

DECEMBER 1974  
VOLUME 5 - NUMBER 6

# Recording engineer producer

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a report, starting on page 35

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



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 VOLUME 5 / NUMBER 6

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*The Cover: Gary Ulmer's MUSIC RECORDERS' console isn't haunted! It does, however, possess the magic of API/ALLISON total automation. Our Holiday greeting from the phantom mixer's hands symbolizes the need for automation today's multi-multi-multi track mix-downs.*

*Concept and Photography:  
 Gary D. Davis and  
 Wayne Yentis.  
 Photograph: Page 41 . . . Tom Hidley  
 by . . . Rick Benson*

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# Letters &

## Late News

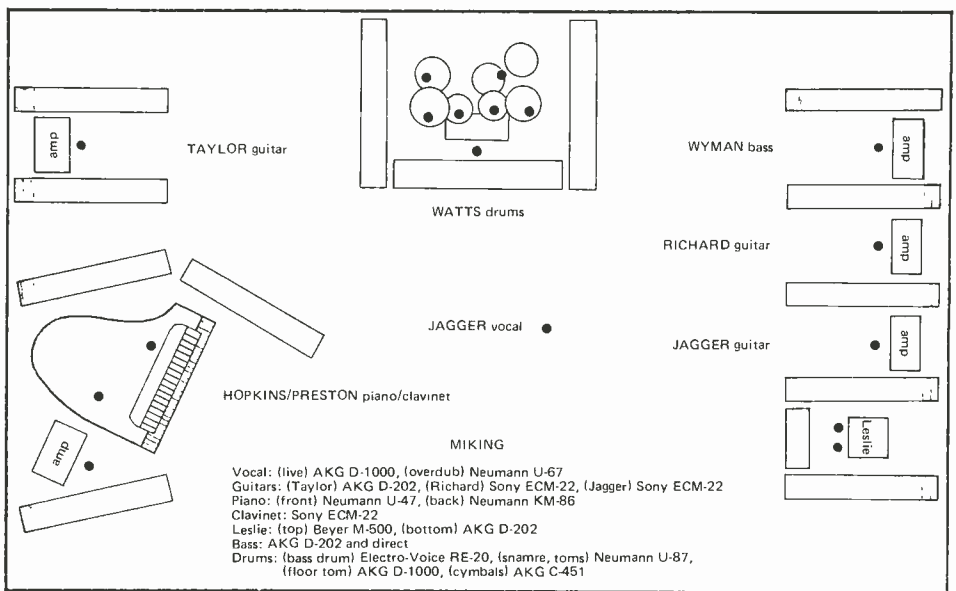
From: **H. GRAEME GOODALL**  
**CHIEF ENGINEER**  
**DYNAMIC SOUNDS**  
**RECORDING**  
**KINGSTON, JAMAICA**

*(this is in response to Paul Laurence's request for a diagram of the studio set-up at Dynamic Sounds for the recording of "Goats Head Soup." Sadly, it arrived after the article and issue had already gone to press, and could not be printed until now.)*

Sorry for the delay, but we have had a fantastic run on our studios recently. Carlton Lee and I have been working flat-out, plus we have been modifying our MCI board with panning amps to accept our new JH-100 series 16-track recorder.

In our control room, we use Altec 604E's in "Big Red" cabinets (Ed: Audio-techniques), mastering lab cross-overs, and a Crown DC 150 amplifier. Andy used our 4 UREI limiters to the extreme, and we also used a Pultec MPQ-1 equalizer and an older tube-type Tektronix compressor outboard. The Stones insisted on using Pioneer headphones, and they proved so successful that we use them exclusively now.

The "Goats Head Soup" album was



recorded over two separate sessions, and although the positioning of the instruments may have been changed (particularly the drums), the miking remained virtually the same. We may have added some D.I. for special effects on occasions, particularly on bass. I guess one of the high points of the sessions was the monumental fire we had in burning all the "out-takes." There must have been a small mountain of tape about 10 feet high and 15 feet across, on which two gallons of

kerosene were used! The Stones tended to work from 5:00 PM to 6:00 AM, and I must say that all of them, Jimmy Miller included, were tremendous to work with, and will always be welcomed back to Jamaica.

Well, I hope this has given you some idea of how the whole thing worked. If at any time you need any more information on this, or any other sessions at Dynamic (including the as-of-yet unreleased Eric Clapton LP), please write us again.

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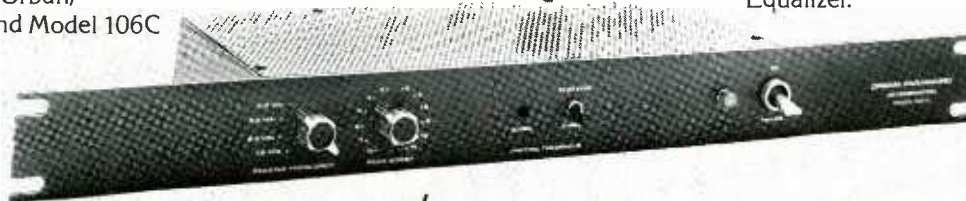
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From: DALE MANQUEN  
THE BURBANK STUDIOS  
BURBANK, CA.

Mr. Polinsky's proposal for eliminating tape bias noise during quiet passages is very interesting, but I would like to point out a few problems. Turning off the high frequency bias during quiet passages would lead to a reduction in noise only if the tape is in the bulk erased or virgin state. Bias noise is generated by both erase and record heads. Since most multi-track masters are built up over many passes, the virginity of the tape would undoubtedly be lost long before a good take was recorded.

An additional problem is that the noise would be controlled in a manner that is very much like a noise gate. The gradual bias decay that is necessary to avoid punch-out thumps would leave a tail of hiss that might be objectionable. The trigger level of the gate would probably be set below the tape noise level since the ear is quite capable of recovering signals in cases where wideband noise actually exceeds the signal level (as at a noisy cocktail party).

The leading edge of a waveform might be lost if the bias rise time is less than instantaneous. The fastest bias turnon time that I have used is 8 msec, which is quite a bit faster than most studio recorders, but would still clip up to 8 cycles of a 1kHz tone in the process of turning on the bias.

Perhaps the most useful area of application for this concept would be the recording of 35mm tracks for sound effects and dialog. In this application, virgin film is used and the quiet passages are indeed dead quiet.

I thank Mr. Polinsky for stimulating my thinking on this topic.

---

*(Ed: Mr. Manquen, a 3M and Ampex alumnus, has only recently joined The Burbank Studios. Prior to the past year of being involved with Ampex's magnetic tape sales, Mr. Manquen had been Product Manager, multi-track products and accessories for Ampex. Before that he had been Project Engineer for 3M-Mincom's Model 56 recorders.)*

---

*Mr. Polinsky's reply:*

In reply to Mr. Manquen's letter about the total kill approach to noise reduction which I suggested in the article, might I first say that his comments indicate that he obviously has worked very closely with recording equipment, bias controls and bias noise because every one of the points he brought out is a potential problem area, and is the basis for further discussion. I must say however that every block diagram in the article was included for illustration of a concept or a direction with which one may improve the dynamic

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range of a magnetic recording. None of the diagrams were meant to be an operating system per-se. To answer his points, in concept, what I had in mind was to reduce the noise on each channel of a multi-channel recorder by quickly fading out the signal *and* bias feeding the record head when the program in that channel falls below a pre-determined level or threshold. This would result in a reproducer noise level equal to virgin tape noise. The first big point here of course is that I failed to mention that the tape is to be bulk degaussed before the session — and that the bias current to the erase head was turned off during the first recording pass; the voltage controlled amplifiers turning on and off both the record *and* erase bias during subsequent passes. Or any combination of the above concept would be valid. Furthermore, thinking in terms of music and orchestration, if the string line is silent until bar 33 and then plays for four bars, it seems to me, that unless the channel and track assignment was changed or unless the musical selection being recorded was re-orchestrated, no matter how many times the music was overdubbed or layered, the silence (at least virgin tape level) obtained between bar 1 and bar 33 where the violins start playing is still a valid amount of noise reduction on that channel of the multi-track tape.

The timing of the bias off is also to be worked out on the bench and in the field because what may sound good on paper or on a block diagram or even with an oscillator on the bench does not always mean it will sound good with actual program, although the bias out fade will be masked partially by other sections of program on other channels. The possible slurring of definition of the sound caused by too slow an attack time of the bias turn on during wanted program results from improper amounts of bias during the wavefront. This is a very real problem — perhaps even the most critical one to solve.

In my concept, two directions which come to mind are (1) to either use a fast attack VCA (as suggested) with control and VCA attack times in micro-seconds or (2) to use a zero-crossing switch system which would switch on the bias (after being told to) after the bias oscillator crossed zero volts and was on the rise of the next wave. Assuming an oscillator frequency of 100kHz, the record channel would then have full bias within about 20 micro-seconds of the turn, on command — or before one fifth of one cycle of the highest audio frequency is passed (20kHz).

In conclusion, if I may reiterate, the concepts and directions offered in the article are to be considered starting points in the studios — not completed systems. In triggering the thoughts from Mr. Manquen I have accomplished what I set out to do with the article. Perhaps this

letter will also shed some more light on noise reduction techniques for the readers — and when the wheels are turning in other directions we will all benefit from any new devices then resulting from the ideas offered by the articles in R-e/p. Most of all I wish to say that no matter how great it looks on the bench, the name of the game is how it sounds in the studio.

Thank you.

From: **DAVID GIBSON,**  
**MANAGING DIRECTOR**  
**COPPERFIELD SOUND**  
**PRODUCTIONS**  
**173 SUSSEX STREET**  
**SYDNEY, AUSTRALIA**

At the present time we are in the throes of expanding our studios and studio facilities, so that we can place the studio on the International Sound Market.

As a result of this we shall be purchasing from either America or England a new Sound Recording Console. We are forced to import a console as there are only two local manufacturers and neither of these makes a World Class Console. However one of these manufacturers has succeeded in having a Forty Seven per cent (47%) import duty placed on all consoles im-

ported into the country.

This particular firm has succeeded in having this import duty placed on every console by claiming that we are only making recordings for A.M. airplay and that they can construct a sound console that meets *Broadcast Specifications*, and that elaborate Equalisation, Echo, Reverberation, Panning and Quadraphonic facilities etc. are not needed as we should be able with good microphones to record precisely what the band plays.

In an effort to overcome this import duty we feel that if we could present published proof of what Overseas Record Producers, Engineers and Publishers feel is necessary to obtain a first class International Sound then we could most possibly defeat this Company and the imposed high import duty.

ED: The letter from Mr. Gibson, aside from the bit of intra-national squabble involved, poses quite a problem in definition:

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Number of	Number of		Number of			
Headphone Channels _____	Echo Channels _____		EQ Channels _____			
Type of EQ: 2 Band <input type="checkbox"/>	Number of		Limiter/Compressor			
3 Band <input type="checkbox"/>	Channels _____		_____			
4 Band <input type="checkbox"/>						
Type of Echo: Spring <input type="checkbox"/>	Is Noise Reduction		Equipment			
Plate <input type="checkbox"/>	necessary? _____		_____			
Live Chamber <input type="checkbox"/>						
Studio Requirements:	Minimum square footage		_____			
	Minimum ceiling height		_____			
	Maximum Number of Musicians		_____			
	Isolation Booth?		_____			

Comments: \_\_\_\_\_

\_\_\_\_\_

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\_\_\_\_\_

\*A 'non-coupon' for those who share with us a lack of enthusiasm for mutilating their magazines. We would appreciate, and do encourage your response using the form as a sequence guide for submitting choices on your letterhead.



The tabulation of your choices from among the several possible parameters which may constitute a "World Class Recording Studio," as listed in the accompanying coupon (or non-coupon\*) will be published in a subsequent issue of R-e/p.

Additionally, we are sure that Mr. Gibson will welcome all comments sent directly to him.

#### ELECTRO SOUND NAMES COCHRAN MARKETING AND SALES VICE PRESIDENT

Robert W. Cochran has joined Electro Sound, Inc., a Division of Viewlex, Inc., as Vice President of Marketing and Sales, it was announced here today by Charles G. Link, Vice President and General Manager of Electro Sound, Inc.

In making the announcement, Mr. Link stated that Mr. Cochran will be responsible for all domestic and foreign product sales programs serving the broadcast, theater and professional recording industries.

Electro Sound produces specialized high-speed audio-tape mastering and duplicating equipment, tape winders and accessories, quality theater sound equipment, precision film transports, and a new line of professional audio tape recorders, serving the professional sound and broadcasting industries worldwide.

Mr. Cochran joins Electro Sound from

CBS Laboratories, Stamford, Conn., a division of Columbia Broadcasting System, Inc., where he was Director of Marketing.

#### MIKE AWARD TO EDGAR VILLCHUR

The highly prized 'Maker Of The Microphone Award' for 1974 has been presented to Edgar Villchur for his creation of the acoustic suspension loudspeaker principle which revolutionized the hi-fi and professional audio worlds by making possible for the first time a wide-response loudspeaker of compact size (often called "bookshelf.") Villchur also formed Acoustic Research, Inc. (AR), renown manufacturer of loudspeakers using his design.



Presenting the trophy is Oliver Berliner, grandson of Emile Berliner, maker of the microphone and inventor of the disc record and player.

The award is presented annually "for an outstanding contribution to the world

of sound."

Some previous winners are Bell System, National Library of Canada, Garrard, Georg Neumann, NARAS, Dr. Harry Olson and Goddard Lieberman.

The trophy will be awarded but 25 times, commemorating the fact that Emile Berliner was only 25 years old when he invented the microphone (telephone transmitter, used in all 'phones throughout the world.)

#### AMPEX / INSTITUTE OF AUDIO RESEARCH ANNOUNCE SERVICE AND MAINTENANCE TRAINING SEMINAR

The Audio-Video System, Division of Ampex Corp. and Institute of Audio Research, Inc. have announced plans for a joint effort in presenting a week long training seminar on service and maintenance of Ampex professional tape recorders. The seminars will be conducted by Ampex personnel at Institute of Audio Research laboratory facilities, 64 University Place in New York. Ampex has found these training seminars to be very effective in meeting what they feel is a commitment to *after-sale* follow up and service. According to Frank Rush of Ampex, the IAR facilities were chosen because the

... continued on page 56

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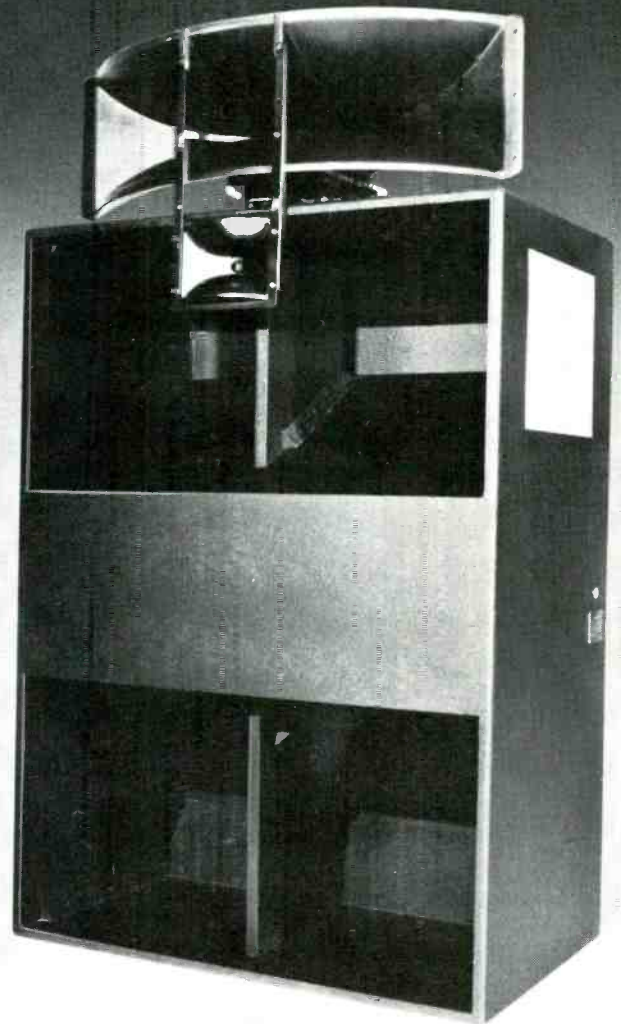


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DEVELOPMENT OF AMPEX "GRANDMASTER" . . . page 13

3M's - SCOTCH "250" HIGH ENERGY MASTERING TAPE . . . page 23

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# THE NEW GENERATION OF HIGH ENERGY RECORDING TAPE:

## DEVELOPMENT OF A NEW MUSIC MASTERING TAPE "GRANDMASTER"

by  
DAVID R. MILLS

Soon after Ampex began to produce the 406/407 products, we realized that a much better audio mastering tape was within our capability and we began to consider how such a tape could be introduced to the audio market. We had deliberately designed the 406/407 product to be totally compatible with the then standard mastering tapes, 3M 206 and 207. However, *compatibility* proved to be difficult to define. We found that most studios selected a tape for its performance advantages, consistency, price, etc., and did not require strict interchangeability - although it certainly simplified operations in those cases where two tape suppliers were being used. It became apparent quickly that studio engineers were receptive to a better mastering tape even if it required a different machine set-up. This convinced us that we should develop a next generation music mastering tape and we started a project - called Grandmaster - which was intended to do this.

### OBJECTIVES FOR A NEXT GENERATION TAPE

The goal of any audio mastering system is the faithful recording, storage and reproduction of sound without changing or losing its quality and without adding anything to it. The magnetic tape is the storage medium on which magnetization patterns are analogs of the sound - the level of magnetization being proportional to the instantaneous sound intensity, and the pattern of changes in magnetization providing the precise time variation necessary to produce accurate audio frequencies when the tape is transported past the playback head. The limits of the tape's performance are the level of output as a boundary condition on the high side and the level of bias noise as a limit on the low side. The total recording capability of the tape is then defined as the region in between these limits. While it is theoretically possible to improve system performance by either increasing the

tape's output capability or by reducing the level of tape noise, in a practical sense, the only option is to increase output while maintaining noise at a low level. Actual recording equipment is itself somewhat noise limited and, while the system noise of good current machines is below the tape noise, it is not low enough such that a significantly lower noise tape could be used. In addition, there appears to be no magnetic material currently available which could lower tape noise significantly without creating other performance problems. In order to improve the storage medium (tape) without making significant changes in the other elements of the system, it is necessary then to increase the tape's capacity for magnetization or, more precisely, its remanence. Also, since the recording process is most effective in the longitudinal direction, it is the longitudinal magnetization which must be increased. When a significant increase in a tape's capacity for magnetization in the longitudinal

direction has been made, the tape will have the capability to record sound at higher levels without distortion and without a noticeable increase in bias noise. If this is the only change in the tape, the increased output will be realized, on any machine, by increasing the record level. The only other adjustments are those required to recalibrate the meters. Unless the machine is limited in record current or output handling capacity, the benefits of such a new tape would be immediately apparent on an existing system.

#### DESIRED ELECTRICAL PROPERTIES

Having reduced the design problem to

that of developing a higher output tape to perform in an otherwise fixed system, our objective then was to define the level of improvement which could be achieved. After an analysis of the existing materials and process technology, we set ourselves the following goals (relative to Ampex 406/407):

1. A 3 to 4 dB improvement in the signal-to-noise ratio.
2. No change (increase) in the bias current requirement.
3. No change in the erasure properties.
4. No change in equalization characteristics.

These goals, when translated to the specific magnetic design requirements,

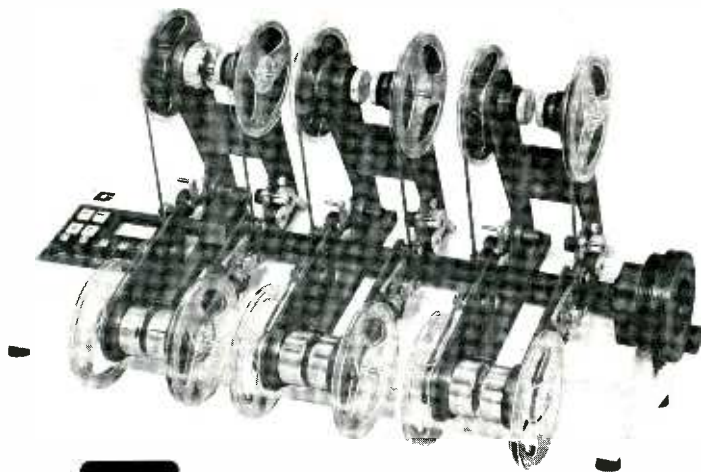
meant that we had to accomplish an increase in the magnetic remanence of the tape from a current value of 1100 Gauss (for 406/407) to a value exceeding 1500 Gauss. This had to be accomplished without degrading any of the other properties which are required and expected in modern recording tapes.

#### HISTORY OF MAGNETIC IMPROVEMENTS

Figure 1 shows the evolution of mastering tape through three generations of development in purely magnetic terms. The hysteresis loop, obtained by subjecting a sample of tape to an oscillating magnetic field and measuring the corresponding change in magnetization, provides a graphic representation of its magnetic recording potential. The loop is bisected horizontally by the zero magnetization axis and vertically by the zero field axis. The greater the vertical extension of the loop, the greater the output potential of the tape. The wider the loop, the more difficult it is to magnetize (and demagnetize) the tape. Specifically, the remanence is defined as the level of magnetization at the point where the loop intersects the vertical axis. The coercivity is the level of field where the loop intersects the horizontal axis. The coercivity is the field necessary to cause significant magnetization changes and this determines the bias current required for optimum recording and, to some extent, the dif-

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DAVID MILLS, 38, is manager of audio tape development at the Ampex Tape Laboratories in Redwood City, Ca.

A native of Indianapolis, Indiana, Mr. Mills earned his degree in chemical engineering from Purdue University. He has been working at research and development in the area of magnetic recording since 1965. The work on Grandmaster tape is an outgrowth of efforts begun in 1972 in conjunction with work on high energy cassette tapes.

Mr. Mills is a member of the advisory board of the International Tape Association, and is a member of the American Institute of Chemical Engineers.



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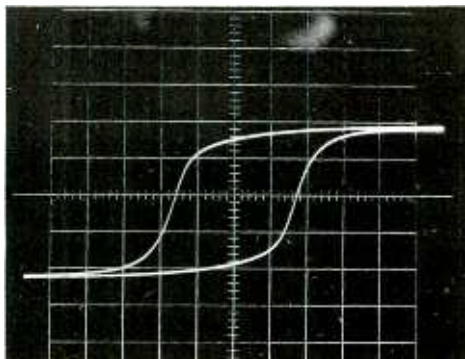
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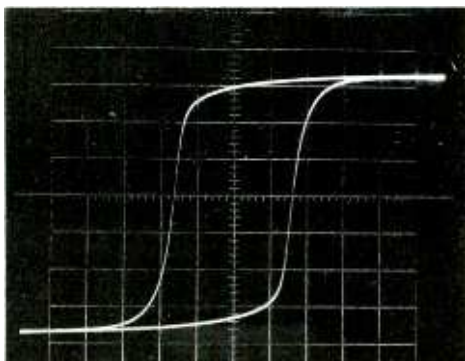
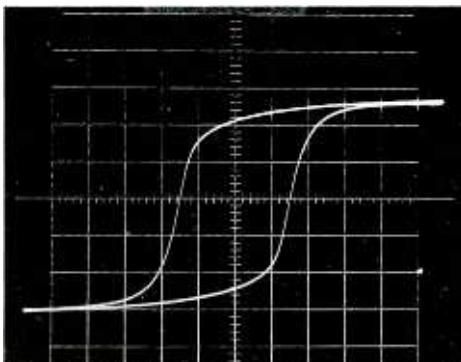
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**FIGURE 1 MAGNETIC PROPERTIES**



**First Generation  
Mastering Tape (1965)**  
MPVC ca. 40%  
Coercivity = 330 Oe.  
Remanence = 850 Gs.  
Squareness = 0.80  
Signal to Noise = 66.0 dB

**Second Generation  
Mastering Tape (1970)**  
MPVC ca. 50%  
Coercivity = 300 Oe.  
Remanence = 1140 Gs.  
Squareness = 0.80  
Signal to Noise = 70.0 dB



**Third Generation  
Mastering Tape (1975)**  
MPVC ca. 60%  
Coercivity = 325 Oe.  
Remanence = 1560 Gs.  
Squareness = 0.91  
Signal to Noise = 74.0 dB

MPVC = Magnetic Pigment Volume Concentration

Illustration 'B'

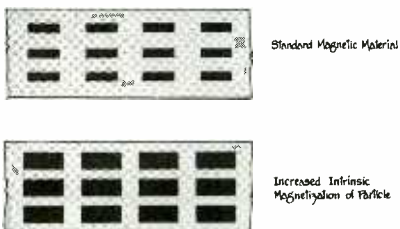


Illustration 'C'

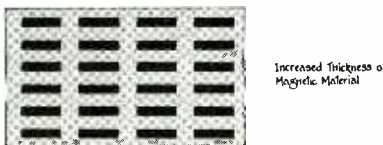
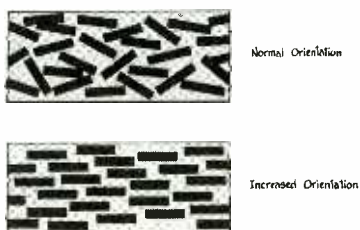


Illustration 'D'



Illustration 'E'



difficulty of erasure. The objective of our development was to raise the remanence significantly without making any change in the coercivity. As the final loop shows, we were also aided by the use of a magnetic material which caused the loop to have high squareness. This is exactly what it implies — the hysteresis loop is extremely rectangular. This gives higher remanence just by virtue of better loop shape, but it has the additional effect of reducing tape distortion at any given output and reducing the difficulty of erasure.

These three curves show the progress, magnetically, from the original mastering tapes to the State-of-the-Art Grandmaster. Remanence and then squareness were greatly increased while coercivity was held constant to maintain machine compatibility.

**METHODS FOR INCREASING THE REMANENCE**

The various methods which are discussed in this Section are illustrated in the accompanying figures.

The remanence of a tape can be increased in the following ways:

1. Use a magnetic material which has a higher intrinsic magnetization than iron oxide.

Illustration 'B'

2. Increase the thickness of the coating (increase amount of magnetic material).

Illustration 'C'

3. Pack more magnetic material into a given tape coating (increase proportion of magnetic material).

Illustration 'D'

4. Increase the amount of magnetic material which is aligned in the preferred direction (increase orientation).

Illustration 'E'

Although these four methods are all valid ways of achieving improved performance, only the last two could be considered in this case. The use of material with higher intrinsic magnetization was ruled out because the bias currents required for the known materials having higher magnetization are beyond the capability of existing machines. The two materials which can be considered in this case, chromium dioxide ( $\text{CrO}_2$ ), and magnetite ( $\text{Fe}_3\text{O}_4$ ), have only marginal improvements in intrinsic magnetization (12–15%) accompanied by serious deficiencies in either chemical stability, coercivity (high bias) and/or cost. It is possible in the future, with appropriate hardware changes, that either or both of these materials might become usable. In this case, however, the material option is restricted to magnetic from oxide ( $\gamma\text{Fe}_2\text{O}_3$ ).

Increasing magnetic coating thickness immediately provides higher remanence potential because more magnetic oxide is present in the vicinity of the head at any



given instant. However, the standard reel configurations make it impossible to increase the oxide thickness significantly without also either reducing the play length or decreasing the base film thickness. The reduction in base film thickness would be accompanied by a corresponding decrease in the physical strength of the tape and by an increase in the susceptibility to print-through. The shortening of the standard tape lengths, while not as potentially detrimental to the tape, is not desirable and was not necessary to achieve the design objective. A future improvement could be envisioned where this approach would be used. Problems might be encountered, however, in ensuring flat response at high frequency if the coating were too thick.

The two techniques utilized for increasing the remanent magnetization capability of the new tape were to increase the volumetric loading of magnetic material in the coating (without increasing thickness) and to increase the level of particle orientation in the longitudinal direction. Increased volumetric loading can be achieved in two ways:

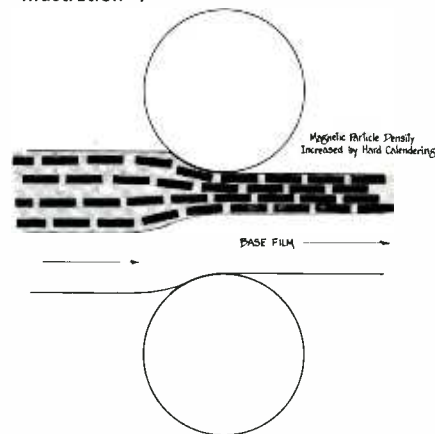
1. Formulate the coating so that (on a volumetric basis) the magnetic material is a larger fraction of the total coating layer. In the formulator's terminology, this means increasing the magnetic pigment volume concentration (MPVC). In the case of the new tape, the MPVC was increased by about 10%. In order to do this,

the binder system, which is the matrix that contains and supports the magnetic oxide, must be strengthened and improved. If this is not done, serious problems of coating durability will develop, giving rise to oxide shed and head clogging as well as storage stability problems. Early binder systems (ca. 1965-1970) were capable of MPVC's in the 35 to 40% range. The class of binders used in the current generation products is capable of MPVC's from 45 to 50% primarily through the use of cross-linking binder components. The Grandmaster product achieves its further increase in MPVC to the 55 to 60% range by improvements in basic binder properties and through the elimination or reduction of additives which contribute neither magnetic nor binder properties to the coating. As an example, the use of a conductive carbon back coating on the tape permits additional magnetic oxide to be put in the magnetic coating since the carbon, which would otherwise have occupied 4 to 8% of the oxide volume, is relocated to the back of the tape. This approach was used to maximize oxide loading in the 406/407 products as well as Grandmaster.

2. Increase the density of the oxide coating by high-pressure calendering. Although the coating is formulated to provide a certain theoretical oxide density, the actual coating contains extensive microscopic voids which cause the magnetic density to be much lower than this

theoretical value. If the dried but uncured coating is passed between a steel roll and a hard, yet compliant roll at high temperature and pressure, a significant densification/thickness reduction takes place which essentially eliminates the coating voids. This permits the application of initial coating thicknesses which would exceed the full-reel limits at the standard length specifications and then employs hard calendering to compact the coating to obtain oxide densification and correct total tape thickness.

Illustration 'F'



#### METHODS FOR INCREASING PARTICLE ORIENTATION

Improved particle orientation can be obtained in several ways:

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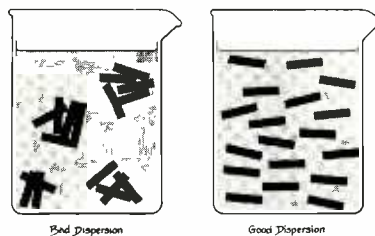
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**PHILLIPS**  
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**SOUND**

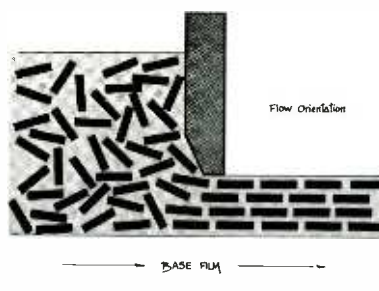
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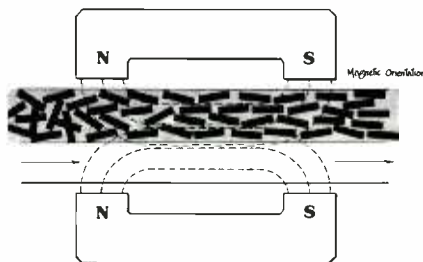
1. Proper dispersion of oxide in the binder system.



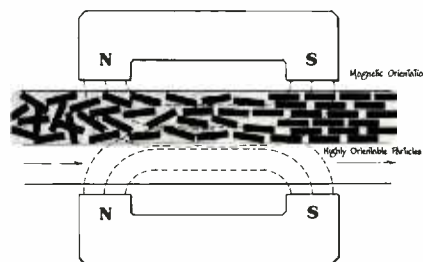
2. Proper adjustment of the rheological characteristics of the fluid coating during application (flow orientation).



3. Passing the coated tape through an appropriate longitudinal magnetic field while the coating is in the fluid state.



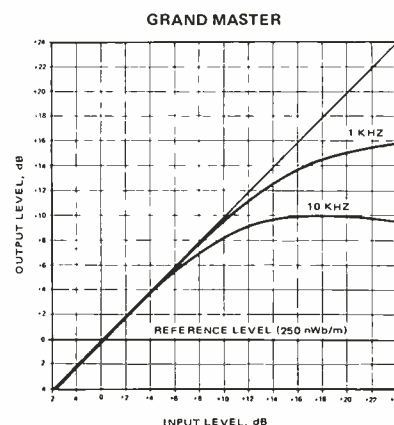
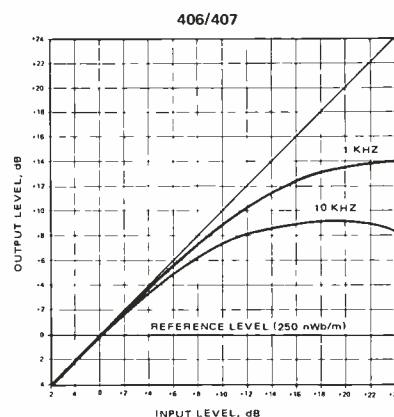
4. Utilization of a "highly-orientable" magnetic oxide particle in the formulation (HOP).



It can be assumed that all commercially available tapes have undergone an optimization phase in which Items 1 through 3 have been carefully established to give maximum tape performance. However,

until recently there were no  $\gamma\text{Fe}_2\text{O}_3$  particles which could be said to fall in the highly-orientable category. Now there are several. By selecting an HOP material, it is possible to increase hysteresis loop squareness (a measure of magnetic orientation) from a typical value of 0.80 to values in excess of 0.90. This has a direct effect on the output sensitivity of a tape but it has an even more significant effect on its distortion properties. This is an improvement which manifests itself as a reduction in third harmonic distortion (compared to current tapes) at any operating level. It permits higher recording levels and lower distortion on the tape at any given recorded level. Ultimately, it greatly extends the useful operating range of the tape since it is the onset of distortion and not the absolute saturation point of a tape which defines its limit of usable output. This is shown in the following input-output curves which clearly reflect the improved linearity and increased output at low and high frequencies of Grandmaster compared with 406/407:

INPUT-OUTPUT CHARACTERISTICS



The farther the output curve follows the 45° line, the lower the distortion characteristics of the tape. Also, higher maximum values result in greater tape headroom or saturation capability. These improvements are a direct result of the increased remanent magnetization potential of the Grandmaster tape and its



excellent particle orientation.

### OVERALL ELECTRICAL PERFORMANCE OF NEW TAPE

Although the design objective in developing this new tape has perhaps been oversimplified into a single variable maximization problem, in fact, many properties were carefully balanced in arriving at the final product. Two sets of curves show the complete audio recording

characteristics of the two generations of mastering tape. These curves depict six recording parameters which change with bias current.

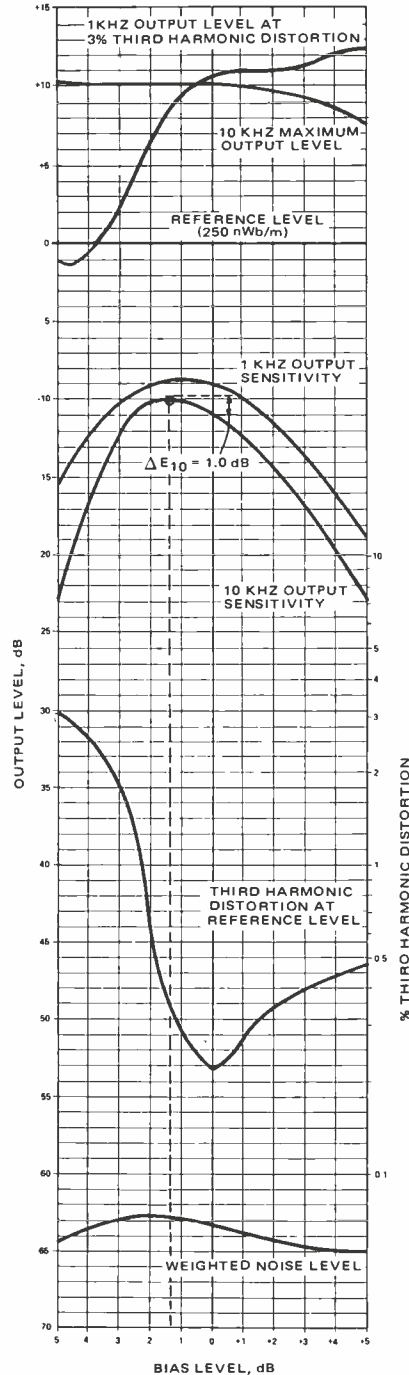
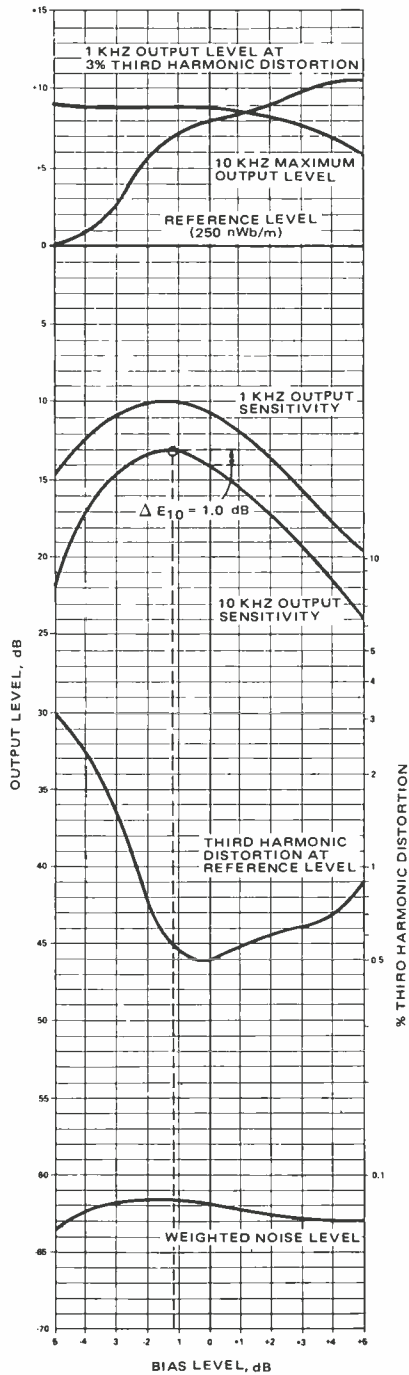
Note that on both tapes, the output sensitivity at low and high frequency reaches a maximum at a given bias setting and falls off at lower or higher settings. Also note that the third harmonic distortion reaches a minimum on both tapes at another bias point and increases if the

bias setting is raised or lowered. Weighted noise remains relatively constant with bias on both tapes. The optimum bias setting is a compromise which balances highest output against lowest distortion and flattest response. The choice, for both tapes, is the point at which the distortion is at its minimum and the output is 1.0 dB below its peak at 10kHz. This optimum point is exactly the same for both tapes and can be arrived at by overbiasing 1.0 dB at 10kHz. Close comparison of the two sets of curves shows the improvements realized in this new tape — increased sensitivity throughout the audio frequencies, low distortion and slightly reduced noise.

## EFFECT OF BIAS ON RECORDING PARAMETERS

406/407

GRAND MASTER



### OPTIMIZATION OF MACHINE SETTINGS FOR THE NEW TAPE

The result of this development is a tape which can provide 4.0 dB of increased signal-to-noise ratio if used properly. Assuming that a machine is set correctly for the current generation of mastering tape (specifically Ampex 406), the following changes should be made:

1. Increase record level 2.0 dB. This increased input level plus the increased sensitivity gives a level on the tape which is 3.0 dB higher than 406.
2. Reduce reproduce level 3.0 dB to adjust for the higher level on the tape. Because of the improved distortion properties of the tape, this higher level on the tape will have the same third harmonic distortion as 406 did at a level 3.0 dB below this point.

Now, without having changed bias, the new tape is being recorded at the same distortion level as before but the apparent noise on playback is 4.0 dB lower than with 406 due to its 1.0 dB lower intrinsic noise and the 3.0 dB lower playback gain.

### CONCLUSION

The design considerations in developing a State-of-the-Art mastering tape have been discussed. The importance of optimizing specific magnetic characteristics to achieve higher output and low noise without increasing bias current requirement was explained. The direct relationship between the key characteristics of the magnetic hysteresis loop and tape electrical parameters was shown. The recording characteristics of the new tape were described and the correct interpretation of input vs. output curves and bias vs. record parameter curves was shown. Finally, the specific machine setup procedure required to utilize the 4.0 dB signal-to-noise improvement of the new tape was detailed.

### ACKNOWLEDGEMENT

The author gratefully acknowledges the major contributions of Robert Brooks, Helge Kristensen and Virgilio Santos to the success of this project.

# PROFESSIONAL MIXERS FROM INTERFACE ELECTRONICS



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

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

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

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

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

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

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

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

**SERIES 300** offers eight track 16 and 24 input fully wired mainframes with power and XLR type input and output connectors, plug-in input modules with nonexclusive pushbutton track selection, panpot, echo

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

**ALL INTERFACE ELECTRONICS** mixers are capable of performance comparable to the finest professional equipment, and insure reliability through the use of plug-in integrated circuits, plug-in modules, conductive plastic sliders, gold plated card and IC connectors, tantalum or computer-grade condensers.

**COMMON SPECIFICATIONS FREQUENCY RESPONSE:**

± 1 db 20—20,000 Hz

**EQUALIZING:**

± 12 db at specified frequencies

**DISTORTION:**

less than 0.1% THD @ 400 Hz, + 3 VU

**NOISE:**

less than 0.6 microvolts equiv. input

**INPUTS:**

**MIKE:** 200 ohms balanced, XLR type connector max. level 0.5 volts RMS max. level 5 volts with int. pad

**LINE:** 10K unbalanced phone plug

**OUTPUTS:**

**TRACK:** approx. 1 volt RMS at zero VU unbalanced, to not less than 600 ohms, XLR connector

**ECHO:** same as track, but phone plug

**ECHO RETURNS:**

1 volt RMS into 5K required, phone plug

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

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

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## 3M's SCOTCH "250" HIGH ENERGY MASTERING TAPE

"Scotch" brand 250 Studio Mastering Tape, introduced first at the Los Angeles Audio Engineering Society Convention in May of 1974, is *at least* the fourth generation mastering tape in a series of studio mastering tapes developed by 3M Company for the professional recording industry.

Like those before it — No. 111, No. 202, and No. 206 — No. 250 embodies another major state-of-the-art advance in studio mastering tapes. From the 66 dB dynamic range of No. 111 to the 78 dB dynamic range of No. 250 are represented many engineering and manufacturing breakthroughs which have enabled 3M to provide the industry standard mastering tape over the years. Each succeeding development has supplanted its 3M predecessor as the industry standard.

For years, No. 111 was referenced on almost every technical data sheet published in the industry. Then in the early 60's, 3M introduced the industry's first low noise mastering tape with what had at that time an incredible 71 dB dynamic range.

Anticipating increasing industry need for greater signal-to-noise and greater dynamic range, 3M in 1970 introduced No. 206. While this tape

had the same weighted NAB noise level as No. 202, the undistorted (3% third harmonic) output level of 206 is +3dB over 202, resulting in a total dynamic range of 74dB.

The latest development is No. 250. A new oxide and new coating techniques have again enabled 3M to advance the state-of-the-art in studio mastering tape. In No. 250, NAB noise drops to -72 dB and undistorted output increases another 3 dB. The net result is a mastering tape with a total dynamic range of 78 dB.

To achieve this increased output requires a greater quantity of magnetic material, hence a heavier coating weight. Achieving this, while at the same time maintaining or improving other electrical and physical properties, was the challenge in manufacturing No. 250 tape.

Simply increasing thickness is not the answer; 3M improved the oxide by making particles more uniform in size and needle shape, and was able to increase the density packing. At the same time, the binder was made stronger and more durable, both to accept the higher-density oxide, and to improve wear and scratch resistance. Both No. 206 and No. 250 feature a controlled wind back treatment to improve uni-

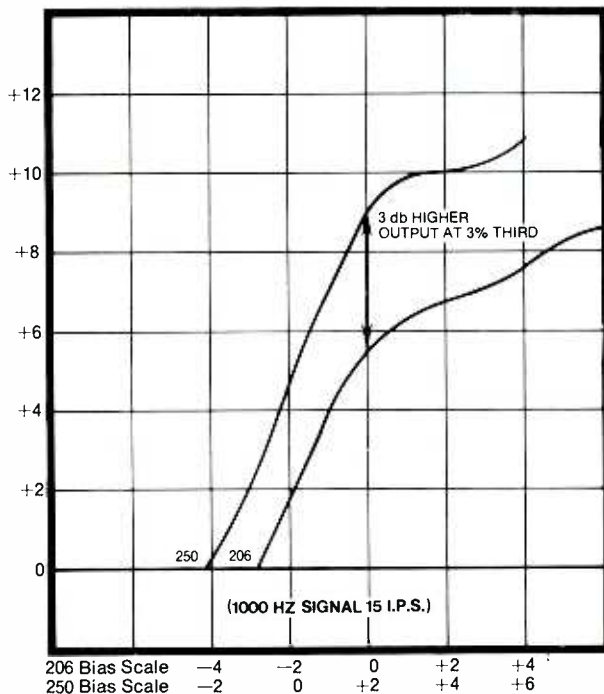
form high speed wind characteristics and reduce cinching and static attraction of dropout-causing contamination. Studio response to the No. 250 tape, according to 3M, has been excellent.

### OPERATIONAL CHARACTERISTICS

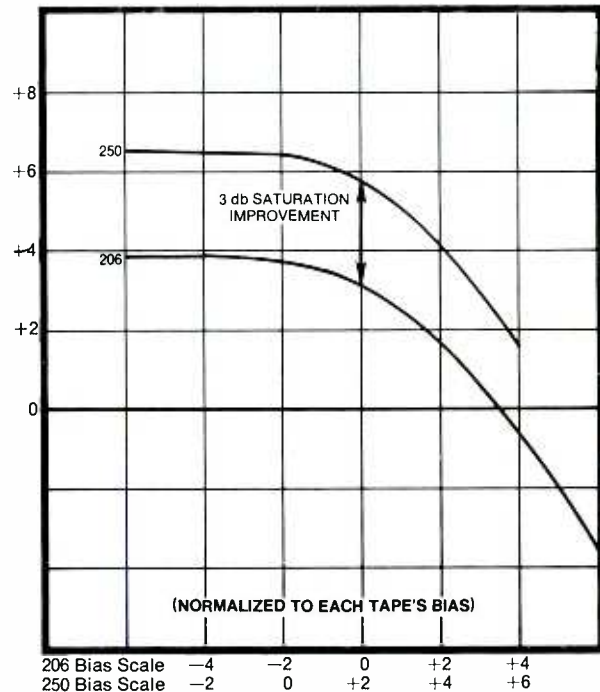
"Scotch" 250 Studio Mastering Tape has the highest S/N ratio of any tape in the "Scotch" line - and quite probably of any line. This extension of the total dynamic range, achieved by lowering the NAB weighted noise level and increasing the level where 3%-third-harmonic distortion, is reached, allows for several operating options, depending upon the recordists' desire for additional headroom or greater signal-to-noise. These options are explained in the accompanying illustration.

Operating with a machine properly set up for "Scotch" 206 Studio Mastering Tape the operator need only adjust bias; equalization settings can remain the same. To achieve the comparative output and saturation curves accompanying this article, bias scale settings are normalized; the 250 setting is 2 dB (20 per cent) higher than that for 206.

OUTPUT AT 3% THIRD ORDER HARMONIC DISTORTION



OUTPUT AT SHORTWAVE LENGTH SATURATION AS A FUNCTION OF BIAS (NORMALIZED TO EACH TAPE'S BIAS)



# Scully Shows You How To Be Perfect Without Paying The Price.

As a professional, you want the finest in a professional recorder. The best sound reproduction possible. Simplicity of operation. Reliability coupled with ease of maintenance. And, you don't want to pay a fortune to get it. In short, you want perfection at a perfect price. You want the new 280-B Recorder/Reproducer.

## Unmatched Performance.

By designing the 280-B electronics around the new high-energy tapes. The S/N ratio is perhaps the best available in any recorder at a comparable price. Up to 72 dB on full track .25" tape at mastering speed. A sharp 68 dB on two-track .25" and four track .50"

The 280-B also features more head room and an increased record level for maximum signal utilizing the high output tapes. And bandwidths are a very flat  $\pm 2$ dB, 30Hz to 18 KHz. It all adds up to greater performance

than you've ever been used to.

## Quick, Simple Operation.

The more sophisticated we've made the 280-B, the simpler we've made it for



you to operate. Our new **Optac**<sup>™</sup> motion sensing system gets a new standard of efficiency in tape motion control. Now you can go from one transport mode to another without touching the Stop button. And enter and leave Record while the

transports in Play. **Optac**<sup>™</sup> and the 280-B's new logic circuitry make the exact moves for you at the right time.

## Easy Maintenance.

New solid state circuitry and mother-daughter board architecture give the 280-B a greater reliability factor. They also make testing, repair and replacement easier. All signal electronics are in slide-out drawers. No more bending down and reaching around. Individual channel modules go in and out easily, too.

If the 280-B sounds too good to be true, wait till you hear it. And wait till you find out the price. We've made it very easy for you to get the best.

For more detailed information and prices on the 280-B, call or write: Scully/Metrotech, 475 Ellis Street, Mountain View, California 94040. (415) 968-8389. TLX 345524.

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# BLUE RIDGE RANGERS

AN INTERVIEW  
WITH  
CREEDENCE'S  
JOHN FOGERTY

BY PAUL LAURENCE

In early 1969, Creedence Clearwater Revival burst upon the music scene with its powerful, earthy brand of music. Drawing liberally from both rhythm & blues and country & western, they sent would-be musicologists scurrying for labels. "Swamp Music," said some, others "Bayou Blues." Said John Fogerty "It's good old rock & roll." Well, whatever it was, a lot of people got the message. From their first release in June 1968 till their official disbanding in April 1972, they sold over 25 million units in America alone, earning 15 gold records in the process. During that time, they were not only America's top band, but phenomenally popular all over the world as well.

Creedence's central figure was composer/lead vocalist/lead guitarist/producer John Fogerty. With brother Tim on rhythm guitar and childhood friends Stu Cook (bass) and Doug Clifford (drums), he not only created a musical genre, but also an unmistakable style of execution that came to be known as "The Creedence Sound."

Two concepts in particular serve to underly their sound. One was their "performance orientation" – they wanted their records to be effectively duplicable in concert. Almost all of their songs at least started as "live-in-the-studio" performances, with little subsequent overdubbing. Their mixes were fairly conservative, and consistent throughout the group's eight albums (10 including repackaging). Not only were the aural aspects of Creedence's records performance-oriented, but the visual aspects as well; as there is little dynamic panning.

The second major concept in their records is the strong emphasis on rhythm. Three years after their last release, Creedence records remain among the most rhythmic ever done. Their so-called *beat* was created in both the arrangement and the mix.

First of all, the basic rhythms. Though they ranged in tempo from languorous ("Feelin' Blue") to positively frenetic ("Ramble Tamble"), there were many common denominators; they were almost invariably in 4/4 time and repetitious. In the arrangement, the basic rhythm was reinforced by a thunderous rhythm guitar/drums backbeat, perfectly complemented by a solid and deliberate on-beat bass. Oftentimes there was a meticulously tight bass/bass drum arrangement as well.

In the mix, these aspects were further inclined toward rhythm (as opposed to melody) by there being a lot of drums (with a prominent bass drum), but only a moderate amount of bass.

Let's now discuss the *sounds* of the individual components. John Fogerty's vocals are natural-sounding, and as a rule, fairly unmodified (though occasionally he used tape

delay, especially with the '50's-styled tunes). His lead and rhythm guitars have a variety of tones, ranging from *clean* on the rockabilly tunes to *dirty* on the blues. All in all, he seems to lean toward the treblier sounds. Not an avid proponent of guitar effects *per se*, he sometimes used tremelo and tape delay.

Tom Fogerty's rhythm guitar is usually moderately into distort and hence fairly *rich*, but not too *bright*.

Stu Cook's bass has a standard complement of tones, with probably little limiting.

Doug Clifford's drums at times have a highly-effective *hollow ponging* sound, with a moderate stereo spread.

John Fogerty's "The Blue Ridge Rangers" is not only interesting in and of itself, but also in its relationship to Creedence's body of work. It pretty much continues "The Creedence Sound," yet at the same time represents a stylistic and attitudinal digression – kind of what Creedence Clearwater Revival might have sounded like in 1953.

"The Blue Ridge Rangers" differs from CCR in the following areas:

1) General Sound. As you have to go out of your way to create leakage on a totally overdubbed record, "The Blue Ridge Rangers" is extremely *clean* (i.e., there is a high degree of track separation and clarity).

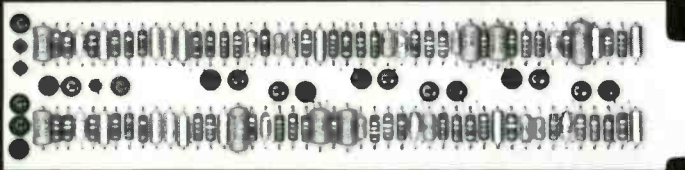
2) Material. Where Creedence leans heavily toward the rock genre, "Rangers" is pretty traditional country & western (though there are definite traces of bluegrass, gospel, and rock & roll). Where John Fogerty penned 80% of Creedence's songs, "The Blue Ridge Rangers" is all *outside* material.

3) Instrumentation. First and foremost, "Rangers" tunes often feature such non-Creedence instruments as pedal steel guitar, fiddle, and banjo. It relies much more heavily upon the acoustic (as opposed to electric) guitar, and a greater percentage of the songs *stay* acoustic than they would on a CCR record. For this album, John Fogerty switched from his Les Paul to "The Guitar of the '50's" – a Fender Telecaster. This is a radical change in guitar sound – Les Pauls are known for their distortion and sustain, Teles for their clarity and *bite*. (As a result, the Telecaster sound and style of playing has come to be known as *chicken scratching*.) Where Creedence's drums often have a *hollow* sound, "Rangers" are rich and full.

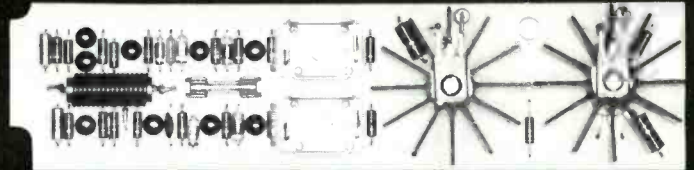
PAUL LAURENCE: John, what were your concepts in putting this album together? Did you say, "I'm going to do a straight C&W record," or did it just happen that most of the tunes that you wanted to do were in that idiom?

JOHN FOGERTY: Well it really seems funny now because country music has . . . . . (continued)

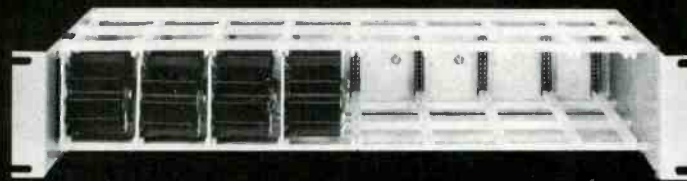
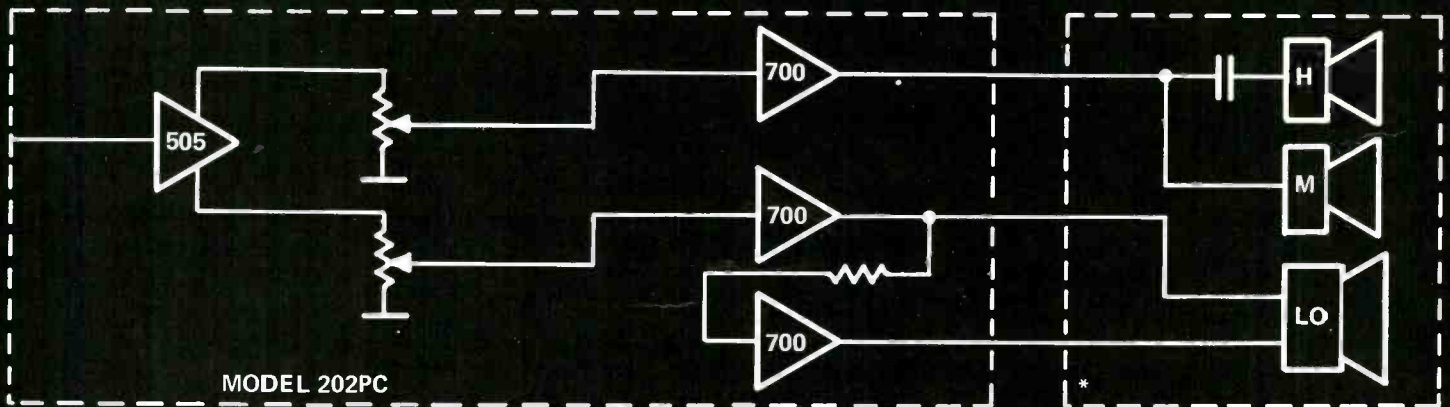
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been so exposed in the last couple of years. At the time I first conceived of the idea about four years ago, it wasn't at all. I thought "Wow, *somebody's* gotta do it." In those days, people would come from country music, but wouldn't show their roots. It seemed like a really novel idea at the time, but now it seems funny that I ever thought it would be so different.

**PAUL LAURENCE:** How did you build your tracks on "The Blue Ridge Rangers"? Was there a particular order that you found best?

**JOHN FOGERTY:** Absolutely. When I first thought of doing an album all by myself, I thought doing the drums first would be the answer – just play the drum part all the way through with no other music and then go from there. I found that once I did that, I was locked into the drum track. You know, there are natural places for a drummer to flourish and do something, and if they're not there, the song really suffers. I found that it was almost impossible to do the right breaks without having some other instruments to play off of.

**PAUL LAURENCE:** I guess "Travelin' Band" would be a good example there.

**JOHN FOGERTY:** Yeah. I couldn't have played that one all by myself – you wouldn't even think that way if you started with drums, 'cause you would've broken everything into 4, 8, or 16. Anyway, I came upon the idea – just a real simpleminded thought progression – of getting a drum machine and playing guitar along with it for the bottom track. They're a lot of fun, but they don't keep perfect time. I don't know why, maybe the electricity fluctuates or something. It used to freak me out – I'd think "God, I'm speedin' up on this thing!" I'm a little out of shape right now, but timing used to be my forte. We finally did an experiment to see how accurate it really was. We recorded the drum machine on tape, and set the machine up to be right matched with itself. Sure enough, after a little while, it was clearly off. We had to measure it at several different places to make sure that the tape wasn't wrong, which it certainly could have been.

**PAUL LAURENCE:** You mean it might have stretched?

**JOHN FOGERTY:** Yeah. That happens, and sometimes the tape machine doesn't run at a constant speed either. These time problems are most crucial when you're overdubbing – if you're playing it live and you're all speeding up and slowing down together, that's okay. But when you're overdubbing, if you start out with a basic track that's all over the place, you'll never be able to match it. Also, I found that you really couldn't syncopate against a machine. It wouldn't move, it

couldn't be budged.

I had to find something simpler, and that was the metronome. It worked okay, but I found that when playing drums against it, it was pretty tough to be into the music. Finally, I decided to do the acoustic guitar first, because you just naturally put things in the right place. Acoustic guitar somehow lends itself to the right kinds of dynamics and syncopations.

**PL:** So you usually did the drums second?

**JF:** Usually. But then there was another problem that sometimes came up. I could practice that drum part until the cows came home, but when I heard it with the other instruments, I might not like what the drummer played. Then I'd have to re-do the drums to fit the other parts. What I ended up doing was putting on a working drum track, and then forgetting them till later. Next I'd do the electric guitar – the central bottom part. He's not playing the lead, but all the "turns" in the song as a Nashville musician would say. He's got a definite territory that he should stay in, and not step on anyone else's part. Once you've got that bottom guitar down, you can see what's going to fit from there. If you happened to have done the piano or bass second, you might have added four extra parts where you really only needed one. That was an idiosyncrasy I found.

(at this point, the "blindfold test" was initiated and THE BLUE RIDGE RANGERS was put on)

#### "BLUE RIDGE MOUNTAIN BLUES"

**JF:** This one here's not very famous at all. It's not even what you'd call a bluegrass standard, like "Foggy Mountain Break-down."

**PL:** I have here in my notes "stereo fiddles."

**JF:** That's true. It's my pseudo-Cajun sound. It was originally supposed to be one part, but both takes were good so I used them together. Also because I practiced that part until my fingers were raw and didn't want to waste it.

**PL:** Guitarists tell me that fiddle is a very difficult instrument to play.

**JF:** If you're a guitarist trying to be a fiddleist like me, it is very difficult. Fiddle players who can really play put what I do to shame. This is just a little fluff that I practiced that I could stick on there at my leisure. I'm amazed by fiddle players – pedal steel players too. You meet some of these old-timers who've been playing for 50 years or something, and they just blow you out the door.

**PL:** How did you first hear this tune?

**JF:** As far as I can determine, it was done

originally by J.E. Mainer and His Mountaineers – I think that's the name. I got really turned on to bluegrass at a certain point, and this one always stuck out. It seemed like a pop hit almost – a really classic song.

#### "SOMEWHERE LISTENING (FOR MY NAME)"

**PL:** This seems to be the most heavily gospel-influenced song on the record.

**JF:** Well, it was done by a gospel group – The Five Blind Boys From Alabama. I found it on an album that I picked up in Europe. I'm not sure if it was a collection that appeared over here or not. Gospel groups are interesting because they don't need a whole lot of background – their voices are the instruments. They were sounding the way they sound today back in the '30's and '40's, which is pretty amazing. I'd never heard this song before that record, and it appealed to me immediately – it was like discovering a long-lost Midnighters hit or an early James Brown record, except a lot better. Putting it together with a bunch of country songs was kind of weird, I guess. I've always had the feeling that there wasn't all that much difference between many kinds of music – you know, bluegrass and strict Nashville music, gospel, rock and roll, old R&B – they draw a lot from the same things.

**PL:** I've always been intrigued by the fact that country & western and rhythm & blues both sprung up in the absence of a written musical heritage. The same general feel, though, went in so many different directions.

**JF:** That kind of music happens when you're out digging in your yard and you start humming to yourself – that is, if you haven't been watching a lot of TV and have jingles going through your head. If you're just left to yourself, the kind of stuff you'll sing or hum will be all there. You don't need a lot of instruments and fancy Busby Berkeley arrangements because it's all melody. This tradition was in the black man's culture with R&B, and the white man's with C&W. A lot of Leadbelly's stuff was work songs, and mountain music is transplanted sailing songs that took root here. I hear a lot of sea shantys in all those different kinds of music – probably a Portuguese sailor in 18-something-or-other brought a certain tune over and it went zip to all those different places.

#### "YOU'RE THE REASON"

**JF:** This was one of those nice simple songs that I always wanted to do. The original version was done by Bobby Edwards, which came out in '57 or '58 – somewhere around there. I used to hear it on the radio a lot – something tells me that it was even a Top 40 hit.

PL: How is your version different?

JF: Well, his was more subtle — it had a Floyd Cramer type of piano tinkling in the background. Also, I think that Bobby Edwards' family backed him on the original.

*"JAMBALAYA (ON THE BAYOU)"*

JF: This, here, sounds like a sea tune to me.

PL: I heard that it was a Cajun song.

JF: Yeah, but who knows where it was before then. Some of the lyrics are in Cajun dialect — I had to get 'em from a book, of course.

PL: Did Hank Williams do this first?

JF: Yeah — he wrote it. Of all the songs on this album, this is probably the most famous except for "Today I Started Loving You Again." I remember, after the concerts, we used to do this one a lot.

PL: As an encore?

JF: No, this was back in the hotel room when we'd be having a bizarro. "Jambalaya" was always a real crowd-pleaser — one of the few country tunes that a lot of people could relate to. Really, the Creedence audience didn't know that much about C&W. When I'd go in the corner and do my steel guitar stuff, most people would say "What the hell is that he's doin' over there?"

PL: Did it have this heavy a backbeat in the original?

JF: No, not at all. You've got to realize that I hear practically everything this way.

PL: How similar is this to the original guitar solo?

JF: Not even close.

To country music, Hank Williams, I suppose, is what Elvis is to rock & roll. He's not the father of it — there were a couple of people ahead of him — but more the popularizer. I think if he'd been three years later, *he* would have been Elvis Presley. It's that close.

PL: Was Elvis someone who influenced you a lot?

JF: Oh yeah. I get mad at him, though, because he keeps failing to live up to what I believe his potential is. See in '55 and '56, Elvis was probably the only white guy known doing that kind of music — he was screaming and freaking out just like guys do today. In retrospect, it turns out to have been a genuine contribution to R&B and country music. He was really doing something — probably didn't even realize it — that was light years ahead of everyone else. He was fully as inventive as someone like Hank Williams, though most people probably wouldn't think of him that way now.

*"SHE THINKS I STILL CARE"*

PL: I always saw this one as expressing a real authentic C&W sentiment.

JF: Yeah. It's called "beer-drinkin' music." Also "crying country-western." I tried to keep this one as simple as the original. It was one of those situations where the arrangement just happened in the studio, rather than me working it out beforehand.

With this song, and also "Please Help Me I'm Falling," the vocal and content are really more important than the music — it's a song you really have to pay attention to to get it.

PL: How many tracks of drums did you take on this record — three?

JF: No, actually I used five most of the time. I'd send each track to a different spot to re-create the way a drum set actually looks. I always used to argue with the engineer — he'd set it up as you look at the drums, and I wanted to do it like I'm playing them — actually sitting behind the kit: snare over here, bass drum a bit right of center, etc. I relate to it that way.

*"CALIFORNIA BLUES  
(BLUE YODEL #4)"*

PL: I really like the way you do this rhythm change here.

JF: It took a long time to figure out. Something just wouldn't fall into place — I was fooling around with it literally for months! It happened on a day Bob Hilburn came for a visit. I went out on the drums and started banging away, and the idea finally crystallized. It starts out as a shuffle kind of thing and ends up in a straight beat — a more solid rock & roll rhythm.

PL: Where did "California Blues" come from?

JF: Jimmie Rodgers wrote it. I heard it first on a Merle Haggard album of Jimmie Rodgers songs.

PL: What horns are you playing here?

JF: There's a trombone, a cornet, soprano sax, and a tenor sax.

PL: Have you been playing them a long time?

JF: No. This pretty much represents the level of my competence. I'm not nearly as familiar with the trombone as I am with the guitar — I don't get much work as a trombone player, you know. Most of the "out of the ordinary" instruments I used on this album I wanted only as fillers, or as points of interest. My favorite sound for brass is the Salvation Army — I love that sound.

PL: This arrangement has sort of a drunken Dixieland sound — you know, the horns all going in different directions.



Maybe even like old BBC radio shows too.

JF: There are more Europeans doing good Dixieland than Americans, believe it or not. Most of the Americans still doing it are really old — I mean, they're the guys who *started* it! I'm talking about Kid Ory, Pops Foster, Lee Armstrong. They brought it to the fore, and really there's been no second or third generation. The people who could have kept it going went to swing music or bebop and lost me totally. It first caught on in Europe in the '40's and '50's I guess, when American Dixieland musicians started touring over there. As a result, there are a lot of younger guys playing Dixie in England, France, and the Scandinavian countries. I have some friends in Denmark who've been in a band together for like 18 or 19 years! They're not shooting for the Top of the Pops or any of that — they don't even relate to that world, which keeps their music pretty distilled. I remember one time the leader confessed to me that Americans do something with rhythm that nobody else can do. He put on a Rolling Stones record — I didn't even know he knew about the Stones — and said "See, they just don't get that same feeling. You can tell they're not Americans." I was really amazed to hear him say that.

*"WORKIN' ON A BUILDING"*

PL: Did you do this vocal intro live?

JF: No, that vocal piece was done separately and spliced in later.

PL: Where'd you find this tune?

JF: I first heard this on a Stanley Bros. record. It was "live" and recorded on not-very-good equipment — it sounds about like something would sound if we recorded it on your cassette machine. It was originally a slave song from the middle 1800's

*continued on page 29*





— somewhere in there. A.P. Carter did a version of it in the 1930's, which he got a copyright on. It's a pretty well-known song.

PL: John, how about you and the banjo? How long have you been flailing away at it?

JF: I started flailing in Australia. I was walking down the street through the pawnshop section, saw a banjo in the window and said "Yeah, it's about time." That was around February 1972. You know, these things are in your head for a long time and finally you decide to take a chance.

PL: How did you approach it — did you take it home and just try to play it, or did you take lessons?

JF: I had a Pete Seeger book there for a while, but that wasn't the sound I wanted. The kind of banjo playing that I really like is called clawhammer, as opposed to Earl Scruggs' style.

PL: Are they tuned differently?

JF: No, they're tuned the same. The way you approach it is different. With clawhammer, your thumb and your forefinger are hitting every time rather than alternating, and you can "flail" with the backs of your fingers. Scruggs kind of borrowed his style from this. As far as I know, real clawhammer is just with your fingers. I used fingerpicks 'cause that was the sound I wanted.

**"PLEASE HELP ME  
I'M FALLING IN LOVE WITH YOU"**

JF: This one was originally done by Hank Locklin, back in the late '50's. It reminds me of the summertime of 1958, when Tom and I always used to play it and "My Baby Left Me" on the jukebox at a little truck stop cafe. I always thought of it as one of the all-time classic bar songs.

**"HAVE THINE OWN WAY, LORD"**

PL: Where did you get this song?

JF: It's a real oldie, from 1907 as a matter of fact. I got it from an album by the Country Gentlemen — really fine singers. This was the first song that I recorded for the album, and purposely did it as straight as I could. To me, it sounded like a really pure campfire ballad type of song. It fit perfectly in my head with the image of "The Blue Ridge Rangers." The sound and the words also fit together — it probably wouldn't work if they were singing about a Boeing 747 or something like that.

Again, you have to realize that when I did this the world wasn't oversaturated with all this country mountain music.

**"I AIN'T NEVER"**

PL: This is the album's most "rock & roll" number.

JF: Well, as a matter of fact, this was a rock & roll hit, I think in 1957.

PL: I never heard of it. Was it a regional hit?

JF: I thought it was a great big hit. It was done by Webb Pierce, who's actually a country artist. I really freaked for him. He had a car like Hank Williams — a big Cadillac with silver dollars in the upholstery. I'm still looking to fine one. This particular song came out when a lot of tunes were crossing over from the country charts. Of course, I didn't know it was a crossover record. Back then, I thought Stonewall Jackson was a big star!

PL: Is this the original vocal arrangement?

JF: Pretty much. If you heard Webb Pierce's record, you might even say that it was pretty gossypelly for a country & western artist.

**"HEARTS OF STONE"**

PL: This is one you probably "Creedenced" a bit.

JF: Yeah, it's really quite different from the original. In the beginning, I was trying to write a song like this one, but could never get one together enough to suit me. I had this basic arrangement going around in my head, which I finally figured out how to adapt to "Hearts Of Stone." It all happened very quickly — from concept to finished product, maybe one of the quickest things I've ever done.

**"TODAY I STARTED  
LOVING YOU AGAIN"**

JF: Merle Haggard wrote this. It's the classic ballad. I don't think they'll improve on it, at least for a few years anyway. To me, it's not a "Country & Western" song — to me it's just a song. This is another one I'd wanted to do for a long time. Originally, I thought Creedence was going to record it, but as it turned out, we never got around to it.

Whenever I hear this track, I always think that there's a whole orchestra playing, not just five instruments. Of all the songs I've ever recorded, this is really one of my favorites — I'm really proud of it.

PL: Creedence was the first group I ever heard to use that heavy a backbeat, with a lot of drums in the mix.

JF: That's true, but the real secret is in how it's played — you can't just turn them up loud and expect it to work. You've got to arrange each guy so the pieces will all fit together. To me, a drum should be a backbeat — drummers are not supposed to be soloists. When your drum sound is right — where the snare sounds like a cannon instead of some guy tapping his knee — you don't need any more. The snare is the "voice" of a drum set, as far as I'm concerned. It's like with a guitar

player, you ask "What does his E chord sound like?" If that's wrong, tell him to forget it. With drums, I don't like a lot of fancy stuff — sticks that glow in the dark and all that. He says it in the commercial — "When they invent electric drumsticks, I'll be out of a gig."

PL: I noticed that for a certain period, starting around the time of the "Green River" or "Willy" albums, you got a very "hollow" kind of drum sound — "Fortunate Son" would be a good specific example. Was that the sound of the kit, or did you do something in particular to get it?

JF: That sound was partially on purpose and partially accidental. The on-purpose part was due to the mike placement, and also the way we muffled the kit. The rest was due to the fact that Doug switched snares — got a great big fat hollow thing because we were having a heck of a time getting the drums to sound the way we wanted. That new snare gave a totally different sound. It was really an ongoing process — something we worked on constantly over a period of time. We were always looking for some way to improve the drum sound.

PL: What was the first record where you used the new snare?

JF: I couldn't pin it down exactly. I know that when we went to do "Green River," it took two whole sessions of nothing but drum tuning before we got down to recording. Doug got his new snare shortly after that.

PL: What would be a song on which you really got the "right" drum sound?

JF: "Feelin' Blue" — each drum had just the right tone.

PL: It seems to me that Stevie Wonder used that intro, and pretty much the entire drum concept of that song on "Superstition." Every time I hear it I say "That's Creedence's arrangement."

JF: Hey, far out! I never quite thought of it that way, but when I first heard that record, I thought it was pretty neat. Maybe that's why.

continued . . .



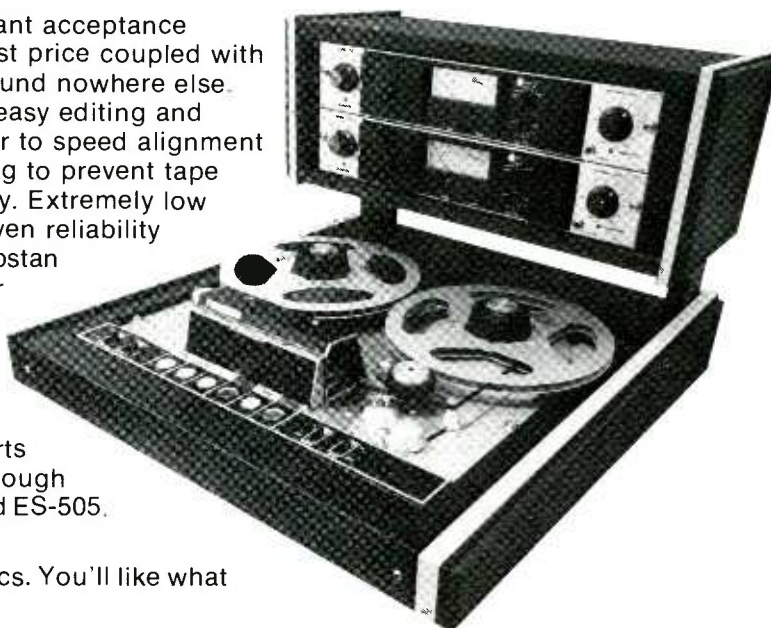
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PL: I was listening to "Susie-Q" the other day, and was a bit shocked to see that nothing was in the middle.

JF: Yeah, that was done on an 8-track machine, but the finished master was 2-track. The engineer wrote on the box "2-track, not stereo." At that time, I had never heard of stereo. This was in 1968! It was because I never had a good enough record player to really hear it. One time by accident, I heard a little bit of the guitar leaking out of the other speaker and I thought "Wow, that's far out. I'm gonna invent a way to be able to move it from left to right." I thought I was a real genius! I sat around for months, literally, inventing this little box with all sorts of jacks, just soldering and wiring away. It was going to be my special gismo — I'd walk into the studio and blow everybody's mind! I was pretty much a hillbilly when it came to that stuff — everybody was 20 years ahead of me. I knew "sound" and I knew intensity for rock & roll records, but I knew nothing about the technical end. This was also because I'd never been in a good studio either. I hear "Susie-Q" now and say "My goodness, there's nothing in the middle!" After that, though, I knew what I was up against. Once I really grasped the meaning of stereo, all the spatial considerations just sort of fell into place. In many ways, though, I still prefer the mono sound — I guess our records show that. As a constant in music, I don't like a lot of gimmickery. I still haven't gotten over the wah-wah pedal or that outer-space organ — what's it called?

PL: Synthesizer?

JF: I'm not into that at all. I've heard a few things that sound like music, but most of it's noise to me.

PL: In your playing, I've noticed that you lean towards E with a lot of 7th's.

JF: Yeah, I lean towards that "freight train massive" sound. It's more "closed," it's bluesier, it's major/minor all mixed up in one. Since it was blues and rock & roll that turned me on first, I wanted to sound that way. I'm sure that if you talked to Pete Seeger or someone like that, he learned to play in C. I learned to play in E — it was about all you could do on the old Stella guitar that you could hardly hold the strings down on. The first rock & roll song I learned on guitar — "Endless Sleep" by Jody Reynolds — was perfect for that. You'd just kind of hit it open and hammer the chord on. I used to play that all the time — probably wore out four sets of strings before I ever went on to the next chord!

Somewhere along in there, I started getting serious about learning lead. Around '59, I went down to Sears with my paper route money and bought a Silvertone on time. It was 88 bucks for the guitar and the amp — with interest, it

probably took a year to pay off. Now I was amplified, and I could really start imitating records.

Like most people, when you start out, you're trying to imitate what it is that made you want to do it in the first place. "Ooby Dooby" by Roy Orbison was a neat E song. "Honey Don't" was a super one — they both had that big walk-down. "Rumble" of course. Back then, all guitar players knew how to play "Rumble" and "Honky Tonk" to be able to play high lead and low rhythm stuff. For 10 years, anytime you'd see a guy who didn't know anything about the guitar, he could find those things.

PL: You were the first player I remember to explore those snarling 7th-y swamp licks, like on "Chooglin'" or "Green River." It wasn't Chuck Berry, even though you used a lot of the same basic shapes.

JF: Yeah, I know what you mean. It was very self-fulfilling for me, because I'd never really heard anyone play that way either. We're in kind of a similar situation today — so much of what's coming out sounds like orchestrated music, not like a guy actually sitting down and playing the guitar. There's still enough room for about 10 more years of playing around with an E7 chord as far as I'm concerned.

PL: Did you consciously attempt to recreate the "sounds" of the records of the 1950's?

JF: I guess I'd have to say yes, because to me, those records were done right. Some of the Sun records, or Chuck Berry . . . . What's the oldest song you can remember?

PL: 1960 I think it was, Rosie & The Originals with . . .

JF: "Angel Baby." You know that had an incredible mistake — two of 'em! I'll tell you, Paul, you missed the good years — the really neat ones. The really important guys were at their zeniths in '56 and '57. It shocks me now to even think about it. Even the nobodys made good records then! Guys who only had one hit, like Johnny & Joe with "Over The Mountain" — that's really a super record! Same with Jerry Lee Lewis, Chuck Berry, and Elvis. Even when Elvis was doing it wrong back then, it was a lot more meaty than the stuff he did wrong later. Ricky Nelson was heavy then — he had James Burton and a great band behind him.

There was a thing that all those guys had in common, which you can relate to '64 and '65 when all the British groups — some of which were really talented, and some of which had no lasting power at all — came to this country. They all had a certain type of energy. The Beatles had the most of it, and the Stones in another way. I used to think that the British groups had better recording techniques or

something — for years I thought that. I go back and listen to them now and it's really not true. The music was simple and well-performed, and Americans got all complicated like we are right now again.

PL: Yeah, it certainly has gotten a lot slicker in the last five years. That's why I thought Creedence was such a healthy thing to come along, right as we were getting into this era — I call it "assembly line production."

JF: Well at the time I really didn't know any better. I still don't, although I have a little bit more expertise. It didn't even occur to me that you could sound any other way. To me the right way was rock & roll, and rock & roll the right way was 1955. That's not just because it was 1955, but because those guys were really happening then and my ears were ready.

To me rock & roll was always something to protect, like an endangered species almost. I used to get mad when I'd hear some guy doing bad rock & roll — it was like a cause to me. If there was a rock & roll club somewhere they shouldn't let that guy in!

PL: I've been listening to your records a lot lately, and I wanted to comment on something you did on "Run Through The Jungle" that was really fairly radical. You treated the tape delay of your guitar like another guitar — it was very up front, and you sent it to the opposite side instead of it being just "behind" the guitar.

JF: Well God dang! — you're really bringing back a lot of memories. I haven't thought about some of these things for three or four years. Creedence did do some things that were fairly radical. I'm not saying that they'd never been done before, but probably never on a hit record before. What I tried to do on "Run Through The Jungle" was create the jungle. You know, it's ultra-quiet there because it's so dense, and yet sounds can reverberate all through it. A wildcat shrieking seems to come from everyplace — you can't look where it came from. Now there's also a dead sound, like in a sound-proof room — you clap your hands and it just dies. That's what I was after in that song — those two different kinds of sounds.

continued . . .





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PL: Speaking of "sounds," one thing I always found fascinating about the Creedence records was the way you used tremelo — that really dark, underwater sound. Did you learn that from listening to records, or did you pretty much explore it on your own?

JF: On my own, mostly. The 1968 Kuston 200 Amp has a variable tremelo/vibrato control. You could have each individually, or you could blend them together, in addition to being able to vary the speed and the depth. I experimented to get that sound just right. Once I found it, I had the settings engraved on the panel so I could go right to it. Speaking of vibratos, one of the neatest ones I've ever heard comes from the little Fender Vibrolux amp, just as it is on the shelf. It really makes the speaker move. I hear crickets when I use it. That used to be one of the malfunctions as well — you turn it on with nothing plugged in and it goes "cheep, cheep, cheep."

PL: What songs did you use the Vibrolux on?

JF: That would be "Grapevine" and "Feelin' Blue." I used the Kuston tremelo sound on "Born On The Bayou" and "Long As I Can See The Light."

PL: Was there an alternate guitar tuning you used with Creedence, like on the acoustic guitars on "Bootleg"?

JF: Yeah, D-tuning.

PL: Is that "open D"?

JF: No, the string relationships are the same as in normal tuning except everything's dropped down a full step. When you play an E chord, it keys out to D. A lot of Creedence records were done this way — "Bad Moon," "Ramble Tamble" . . . It's like what I was talking about earlier. If it sounds like a massive freight train when you're playing in E it sounds even more massive when you drop it down a step.

PL: Did you have a guitar that you kept in that tuning?

JF: After we earned some money, I was able to do that. In the beginning, I had to re-tune. Tuning used to really drive me up the wall — it still does. Tuning for recording especially. I listen to some of the records now, and I'm out of tune as much as anyone.

PL: Are there any specific songs where you hear yourself out of tune?

JF: Oh yeah. My singing's obnoxious.

PL: How about your playing?

JF: "99½." It's just a little wrong all the way through.

PL: Many people think that gives a record a very down-to-earth, real quality.

JF: I was going to say, there are some records that are super because of that. "Midnight Special" is on purpose out of tune and it's really neat that way. It wouldn't be right any other way — it would sound much too clean and pure.

PL: With the Creedence records, didn't you say that you tried to steer clear of equalization and studio effects?

JF: Yeah, I was never really too impressed with all that equipment. I've always felt that the studio can be a help to you, but shouldn't be used to alter the basic sound of whatever it is that you're doing. Hopefully, everything will be sounding right before you record — the studio shouldn't make them sound right. What I relate to when I say this is a live show. I remember, I'd go to see some big group, and they wouldn't sound at all like the record — not even close! It could have been anybody up there for all you knew. Jerry Lee Lewis was a guy who always sounded great live — I thought he had some super piano. It was the way he played — he could make almost any old piano sound that good.

PL: One effect you did use regularly was tape delay on the vocal. Was there a standard '50's delay time?

JF: I don't think so. "Ooby Dooby" for example had a lot because the original had a lot. You pretty much have to match your delay time to the particular song — there's one that's right and all the rest are wrong. I always sang it straight, and put the delay on in the mix to leave as many options open as possible.

I remember, I'd come in to do a mix and blow people's minds by only taking 20 minutes. I didn't do it that way for snob appeal, but because I knew what I wanted to do and that's how long it took. It's only a three-minute song. You hear these stories of guys who spend 13 hours, or three days just mixing one song. Incredible . . .

PL: John, did you ever do any strange things, like sing through a vacuum cleaner for a particular vocal sound?

JF: No, I can't say I've ever done that. Now that you mention it though, I did use to turn on the vacuum cleaner to write songs to. I liked having that constant "vrrrrrr" . . . you could harmonize to it.

PL: Didn't you put an airplane on "Travelin' Band"?

JF: No, but I had the same flash, the same picture you got. That's just our imaginations. Now there's a specific example of really creating something by the way you play. Whenever I hear "Proud Mary," I hear that paddlewheel going around — I'm sure it's that.

PL: Me too — it really goes "slap." Also, C to A is such a good vibesy change,





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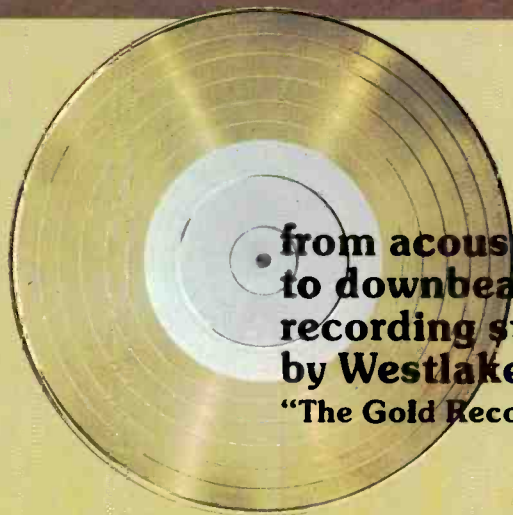
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*perfect for conjuring up that sort of image.*

JF: Well there you go! Glen Campbell told me that was a great mistake – that's country humor. I didn't know what he meant for a long time.

*PL: What did he mean?*

JF: He meant that it was neat, but he called it a mistake. It was his way of saying that I didn't know what I was doing, but that I sure happened onto a good thing. As long as we're talking about things like this, Duck Dunn once told me that I "wasted" "Born On The Bayou" by using it as the B-side!

*PL: You had like seven or eight double-sided hits in a row, didn't you?*

JF: Well, obviously after a couple you've got to figure that I was doing that on purpose.

*PL: It's funny, but Creedence was very successful, but not "commercial" in the bad sense of the word. You really created a niche with a different type of music, that didn't necessarily conform to the guidelines for a "hit single." Like "Born On The Bayou" – I never heard anything like that over AM radio before.*

JF: Yeah, I know what you mean. People always seem to relate to me or the music in a sort of an "of course" way, forgetting that I was a listener and an observer first. Your saying "I never heard anything like that over the radio before" was exactly what I said – I never did either!

*PL: John, let's talk about you as a producer.*

JF: Okay. I don't really think of myself as a producer *per se* – you know, guys who earn their living as producers know much more about it than I do. I wouldn't even try to produce anyone but myself. My knowledge as a producer is only slightly more than enough to do what I want to do.

One thing I will say about producing is that I rarely get off on hearing a record where the producer is the star. This isn't to say that I'm against "production" – certainly when George Martin did it with the Beatles it didn't come off that way. Most modern records are pretty well-produced – certainly way beyond where Creedence was as far as the technical aspects go. Still, there's something unfulfilling about it. I've always thought that he should just be the translator – the guy who's getting the intent of the song across.

*PL: In retrospect, what songs, albums, or whatever do you find the most satisfying?*

JF: I think "Bayou Country" still holds up pretty well. There was really an incredible energy trip going on when we were doing that album. It was equal parts looseness and desperation – we had the happiness and fun of the music with that

desperate feeling of "I ain't goin' back to the carwash!"

*PL: How long did it take to do?*

JF: Not very long at all. We tried it out in two different studios before we went down to Los Angeles and did it at RCA. I guess it took a week.

"Chooglin'" was the hardest song to get – we still never quite got it the way it should have been. It was all live, except for one guitar overdub. "Graveyard Train" was *totally* live – it was the only song we ever did that way. I did that in an isolation booth, just like a real blues cat. Like John Lee Hooker – if the band doesn't follow him, he just keeps right on going. I tried to create that illusion and still have everything hang together.

*PL: Do you do much listening, to records or groups?*

JF: Not much. Basically, I still relate to the radio – you know, car music – even though that particular medium doesn't really do it to me right now. There are a few other guys I know who relate to radio the way I do – the guys in Booker T. & The M.G.'s do, Tony Joe White does. I've always felt that we're all part of one thing, this "fraternity" together.

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Blue Ridge Mountain Blues (traditional)  
Somewhere Listening (For My Name)  
(Archie Brownlee)  
You're The Reason (Fred Henley; Mildred  
Imes; Terry Fell)  
Jambalaya (On The Bayou)  
(Hank Williams)  
She Thinks I Still Care (Royden  
Lipscombe; Steve Duffy)  
California Blues (Blue Yodel #4)  
(Jimmie Rodgers)  
Workin' On A Building (traditional)  
Please Help Me I'm Falling In Love With  
You (Donald Robertson; Hal Blair)  
Have Thine Own Way, Lord (George  
Stebbins; A.A. Pollard)  
I Ain't Never (Mel Tillis; Webb Pierce)  
Hearts Of Stone (Eddie Ray; Rudy  
Jackson)  
Today I Started Loving You Again,  
(Merle Haggard)

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tenor sax, soprano sax, pedal steel  
guitar, fiddle, piano and drums played  
by: John Fogerty  
Production and arrangements:  
John Fogerty  
Engineering: Skip Shimmin (Fantasy  
Studio A, Berkeley) and Russ Gary  
(Wally Heider Studio D, San Francisco)  
Mastering: Fantasy Records  
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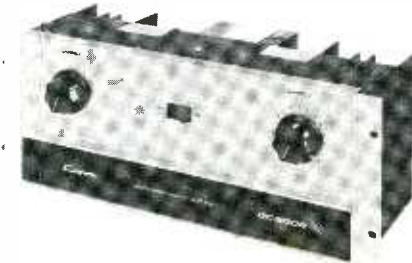
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BY JAY MARK

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While our present success in a highly competitive industry is very gratifying, we have had our share of pitfalls in the growing process. Our location in Philadelphia places us somewhat apart from the nation's recording centers, and, as a result, we have frequently had to find our own answers to problems that arise in normal studio operation. We believe many of these solutions to be quite unique, and we feel the techniques and devices they have spawned have contributed significantly to what has come to be known as the *Philly Sound*. (One of these developments, a small, inexpensive echo delay unit, is presently under consideration as our first entry in the field of professional audio products.)

The following paragraphs represent our views on automated mixing, and we ask the reader to bear in mind that we are still a little new at this, having had our system installed only a few months ago. Perhaps our feelings at this stage can best be likened to those of a child who has just taken his first steps: We like walking around . . . Now it's just a question of how far to go, and in what direction . . .

## REASONS FOR AUTOMATING

As anyone who has spent time behind a mixing desk can verify, a great deal of the bulk of time spent on a mix is consumed by having to coordinate the actions of two or three (or more) pairs of hands so that the right thing gets done at the right time. In an average mix there may be erratic vocal levels to be smoothed out, instrumental solos and fills to be ridden, string and horn arrangements which the producer may decide to punch in and out at various points, etc., etc., etc. Needless to say, all these operations must be performed accurately if the desired mix is to be achieved. Nowadays, with a tendency toward the use of more and more tracks, the problems encountered at the mixing stage can be traumatic, simply because of the increasing number of faders to be ridden and punches to be executed. In a typical 16- or 24-track mix, it may take a couple of hours just to perfect these purely mechanical maneuvers. Then, when

the point is finally reached where everyone executes their particular parts correctly and the mix is recorded, it is not at all uncommon after the playback to have the producer say, "It's perfect . . . All it needs is a pinch more bass." Right? So you bring the bass up, start the machines, and off you go again, fingers flying, trying to get it all down on tape before fatigue sets in. By this time you're already two hours late for dinner, and your wife is one step closer to being convinced that her mother was right after all. Enter automated mixing, and the beginning of the end of scenes like these. With one fell technological swoop, the way is paved for both better mixes and better marriages.

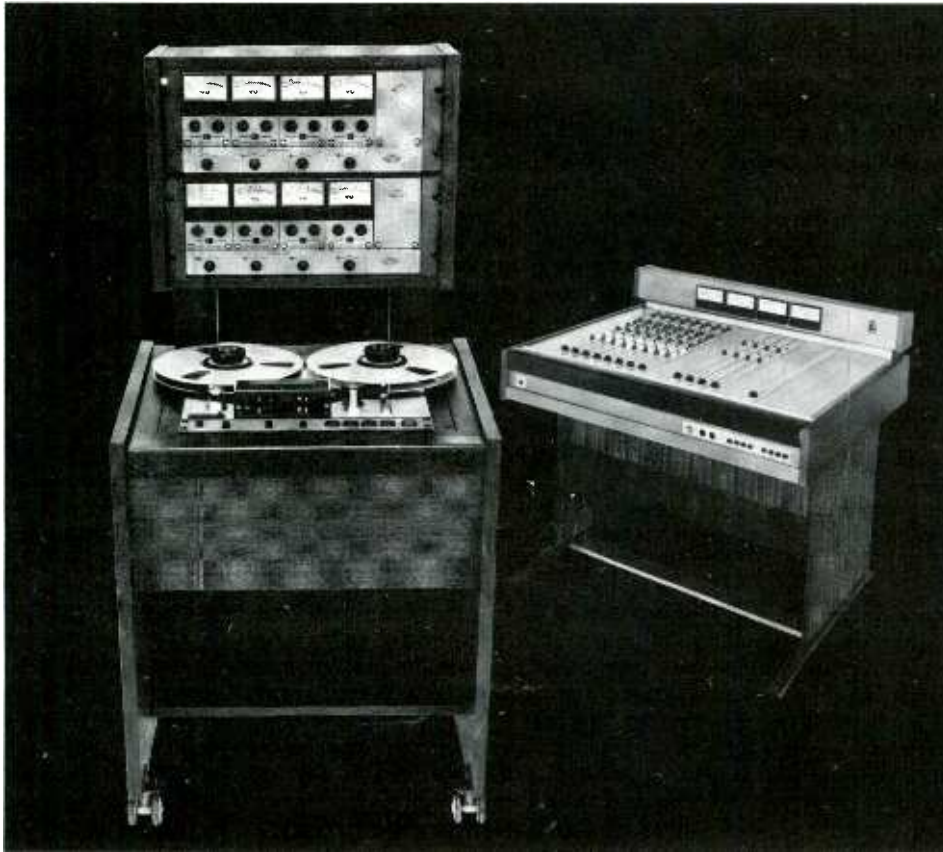
## HARDWARE

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facilities. At present we have elected to automate only those functions we consider essential; namely, the twenty-four level-control faders on each console, and the five remotely-controlled *group masters* provided by the MLH processor. If it is found to be desirable in the future, we can automate more console functions (equalization, echo level, panning, etc.), by installing the necessary voltage-controlled elements associated with these functions. These additional modifications, should they be implemented, will have no effect whatever on any of the tapes mixed on our present system. In other words, tapes mixed with MLH today will always be compatible with tapes mixed any time in the future, regardless of the number of increased functions we decide to automate. This continually expandable feature of the system was one of the primary factors in our decision to purchase MLH. Because of this feature we were able to automate (and consequently have to pay for) only those functions we considered necessary. This point should not be taken lightly, since one of today's fully automated consoles sells for something in the neighborhood of \$150,000 as opposed to \$13,000 for 24 tracks of MLH level-only automation.

### MIXING WITH AUTOMATION

Our approach to an automated mix consists of all the same initial procedures as that of a conventional mix: As the instruments are brought in one at a time the mixer adds the initial EQ and echo to each, and pans the signal to the desired location in the stereo or quad field. As in a conventional mix, the multi-track tape is run as many times as necessary until the mixer obtains a satisfactory overall balance. Included in this initial balance are any level changes the mixer can comfortably perform in real-time, such as riding a solo instrument in the bridge, etc. In the final run-through of this basic mix, the *master write* command is given to the MLH processor, and a permanent record of the mixer's moves as he rides his levels is recorded, in quasi-digital form, on an empty track of the multi-track tape. It is here that we leave conventional mixing procedures behind.

With the initial *data track* thus encoded, the mixer places the processor in the *master read* mode, starts the multi-track tape, and is now able to listen to a hands-free playback of his mix, with each level change reproduced identically by the

processor. At this point the console faders are out of the circuit; all level control is being accomplished by the encoded data stored on the multi-track tape, and the mixer is now free to concentrate on the more delicate aspects of the mix: a couple of words in the second verse that jump out; a piano gliss in the bridge that needs to be brought up, and so on. As each of these desired changes is noted, the mixer returns control of the necessary tracks to the console faders by placing the associated processor channels in the *update* or *write* modes. He can then run the multi-track tape as many times as necessary, each time making as many or as few changes to the mix as he wishes. The significant factor here is that those portions of the mix which have been determined to be correct always remain unchanged, while the portions selected to be refined can be manipulated at will, as many times as necessary, until the desired final mix is achieved. When that point is reached, the mono and stereo (or quad) machines are started and a hands-free first generation mix rolls onto them. Only the fade at the end of the tune need be performed in real time, and even this operation can be programmed, via a group master, if desired. These procedures constitute our basic approach to automated mixing.

### Some Questions and Answers on Sigma Automation

#### WHY HAVE YOU CHOSEN A LEVEL-ONLY SYSTEM?

Three primary considerations went into this decision. First, we believe that upwards of 90% of the manual operations performed in the course of a mix consist of riding levels and punching tracks in and out. The MLH system enables us to automate only these functions, with the option of adding more functions later if we so desire. We felt that with the processor performing all our level changes and punches for us, our hands would be free to take care of the other 10% of the manual operations required in the course of a mix: panning, changing echo levels, etc. To date our theory has held up, and we have found the level-only system to be entirely satisfactory for our present needs. Our second reason concerned scanning time. The general rule is, "The fewer the functions, the faster the scan time," and we did not want to waste valuable scan time on functions like EQ settings, echo level, and panning, which are normally maintained in static positions anyway. The third consideration was cost. As mentioned earlier, the MLH system allows the purchaser to start with a level-only system and update later if he so chooses, without fear of making any of his first automated tapes obsolete. Compare \$9000 for 16 tracks and \$13,000 for 24 tracks of automation

with \$150,000 for a fully automated board. In addition, a single MLH processor can be interfaced with any number of existing consoles at a fraction of the cost of automating a similar number of rooms by building completely automated systems.

#### HAVE YOU IMPLEMENTED THE SYSTEM WITH ANY IDEAS OF YOUR OWN?

We've done a couple of things. The MLH system includes the facility for attaching 5 external faders to the processor. These faders do not come with the unit, but can be anything from 95 cent carbon pots to professional console faders, since their only function is to control low voltage DC rather than audio. With these faders attached to the unit, the mixer has the ability, via small rotary switches on each processor module, to assign any number of console faders to any one of these "group masters." For example, if a 24-track tape has two sets of strings spread over 8 tracks, each of these tracks can be assigned to a specific group master fader, after which all of them can be ridden simultaneously by that fader. This control is AFTER the console faders, so whatever levels and pan positions those 8 string tracks are set to individually on the console, their interrelation will remain unchanged, even though their total overall level is under the control



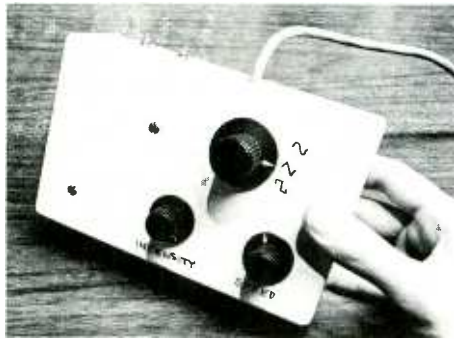
of the single group master fader. Our system uses professional slidewire faders mounted in a small hand-held box. These are attached to the processor by approximately eight feet of cable, thus enabling a producer to sit at his end of the console and ride all the strings and horns (or whatever) as he desires, without ever having to reach across the board or attempt to ride ten faders at once. As an added feature we have installed an illuminated pushbutton switch in series with each of the group masters. This allows any number of tracks (strings and horns, for example) to be assigned to a single group master and subsequently punched in and out at will. These punches, in addition to being easily accomplished via the pushbuttons, are also encoded by the processor, which means that once they've been performed correctly by the mixer (or producer) they need not be attempted again. Rather,



Engineer Don Murray  
in Sigma Studio "B"

the encoded data will execute the punches automatically in all future passes of the multi-track tape.

We have also designed and built a small 0-10 Hz oscillator with sine, square, and triangle waveform outputs. With it we can create stereo vibrato effects by splitting the feed from a given track to two console faders whose levels are then controlled by alternate half-cycles of the oscillator's output. The signals from these two faders are panned left and right respectively, thus creating the desired



stereo effect from a mono source. Our first use of this device was in the Gamble/Huff production of "Enlightenment," a track on the new Billy Paul album. The vibrato effect was used on the strings, synthesizer, vocal background and lead guitar, and can be heard in the intro and release portions of the song.

Another thing we've discovered is that a machine other than the multi-track master can be used as a storage medium for the MLH data. We had an experience on Dave Crawford's production of B.B. King's latest album, "Friends," where there were no open tracks available on one of the tunes on the multi-track master. Faced with the prospect of doing an old style real-time mix (something we don't even discuss in polite conversation

anymore) we decided to try using our 4-track machine to store the data. We were pleased to find that as long as the tapes were started from the same point each time, the slight speed variations between the two machines posed no difficulties in accomplishing the mix. While this method of data storage is admittedly a compromise, it can work admirably in all cases except those requiring extremely tight punches on the order of a tenth of a second or less).

#### DOES AUTOMATION CUT DOWN MIXING TIME?

With the ability to constantly update and improve an existing mix, our original tendency was to "overmix," and, consequently, our first automated mixes took longer than they would have by conventional means. However, as our automated mixing techniques began to develop, we were able to take less and less time to accomplish the same degree of perfection in a given mix. As of right now the time spent on a given mix via automation is about the same as it would be for the same mix performed manually.

#### THEN WHAT'S THE ADVANTAGE OF AUTOMATING, IF THE TIME SPENT IS THE SAME?

The final product. Most real-time mixes were compromises between what you wanted and what you were able to perform. In conventional mixes the desired objective (i.e., the "sound" of the mix) was usually determined fairly early on, with all the remaining time spent in trying to execute the moves necessary to get the desired mix. With automation, all the time spent is constructive time, building a mix and updating it's components as required until the final objective has been achieved. Once you execute a dif-

ficult manouever correctly, it's there, and you never have to go back and spend any more time getting it again.

#### HOW MUCH DO YOU CHARGE FOR THE USE OF MLH?

We don't charge at all, because we want all our clients to be able to use the system, regardless of their budgets. It's good for business, too, because a client now knows he can get his mix, even if he has to do it in stages. If his time runs out and the mix is still incomplete, he can come back in a day or in a month and pick up exactly where he left off, since all the level information pertaining to the mix is stored right there on his tape.

#### WHAT ABOUT ECHO, EQ, AND PANNING? HOW DO YOU STORE THAT INFORMATION?

As mentioned earlier, these functions may be automated in the future if desired. As of right now, however, since these parameters are almost always static, we have developed two systems for storing this information, either of which may be employed, at the mixer's discretion. The first system utilizes a graphic representation of the console face, including all echo and pan pots, cue send pots, master echo send and return pots, and all peripheral equipment such as onboard equalizers, filters and limiters. At the conclusion of the session the recordist notes on one of these sheets the position of all relevant controls. Since the entire console is represented graphically, he does not have to write +2 @ 5 kHz shelving, but instead merely draws a pencil line through the appropriate designations on the chart. Space is provided for notes, such as patches and types of external equipment utilized, and, of course, a block for the final data track

An advertisement for Magnetic Reference Laboratory (MRL). The top half features a black background with white text. The bottom half shows several test tapes of various sizes and formats, including a large 2-inch tape and several smaller 1/4-inch and 3/4-inch tapes. The text is as follows:

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is included. The alternate method for storing this static information is through the use of a cassette machine on which the engineer or recordist lists in a pre-determined sequence the pertinent data. Finally the information, whether in chart or cassette form, is stored in the multi-track tape box for future reference. We tried taking Polaroid pictures of the consoles at one point, but found the necessary detail lacking, so we abandoned the idea in favor of the methods listed above.

**WHAT HAS CLIENT REACTION BEEN TO THE SYSTEM?**

Acceptance of the system has been unanimous and overwhelming. In fact, no one who has mixed with automation will even consider going back to conventional methods. We had a bit of a problem in the beginning, too, because as the mixers and clients got into the system, they insisted on using it whenever a mixing date came up. So you'd have clients backed up for days waiting to mix because there was only one studio which was MLH-equipped. We hadn't even had our first unit for a month when we ordered the second. Now we have two processors and the required interfacing in all three control rooms, so no one has to wait to get automated mixing time. And the producers love it! Example: Tommy Bell called up the other day for a TV track (instrumental track without vocals) of one of the tunes he had recently mixed on the Spinners. In the old days we'd have had to pull out the master mix and try to duplicate the sound as closely as possible, which isn't easy when the tune may have incorporated dozens of subtle level changes and a liberal sprinkling of string and horn punches. But the tune in question had been mixed via Memories Little Helper, so it was just a question of putting the multi-track tape up, reading the echo and EQ settings off the chart and setting them on the console, punching out the vocal tracks, and rolling off a copy. The whole process took about half an hour, and the mix is exactly the same as the record, except without vocals. Mr. Bell was impressed.

Another pleasurable incident concerns Billy Jackson, who just produced a hit called "Trustmaker" by the Tymes. After the single was mixed it was Billy's feeling that MLH played a significant part in helping him get the "right" mix. As a result, when RCA bought the single, one of Billy's stipulations was that he be permitted to mix the remaining tunes for the album at Sigma, using MLH.

And Kenny Gamble, who spends a lot of time in the studio, has made the point more than once that being able to leave a mix half done with the knowledge that he can come back the next day and pick

up where he left off has taken a lot of the weight of mixing off his shoulders.

**WHAT ABOUT PROBLEMS WITH THE SYSTEM? IS IT PERFECT?**

As with any new piece of equipment, especially something as esoteric as a VCA automation system requiring the storage of digital information, there are bound to be a few problems. But all our hassles with the system have been extremely minor, and Paul has been in constant touch with us in our joint efforts to solve them. As we have said, we now have two processors and three studios interfaced, so you can imagine how pleased we are with the overall performance of the system. The only cautionary note regards machine alignment. The tape deck must be aligned as accurately as possible, especially in the areas of high frequency response and azimuth adjustment. The digital information is stored in the form of sine waves at a frequency of around 8 kHz, and the high frequency parameters of the deck must be within professional specs if proper decoding is to take place. Also, good tape with minimum drop-out must be used, and the heads must be kept clean. We feel that any professional recording facility would normally operate within these parameters anyway, so it is our feeling that no problems of major proportions need be anticipated by any-

one considering the system for their installation.

**WHAT ABOUT COMPATIBILITY OF TAPES BETWEEN STUDIOS?**

The only problems which might be encountered in transferring tapes from one MLH-equipped studio to another would be in the duplication of the static parameters of the mix, specifically EQ settings and echo sound, where consoles of different types might have different equalizers and/or different echo chambers. The encoded level information, however, is completely compatible, and would reproduce properly on any MLH system.

**WOULD YOU WANT YOUR SISTER TO MARRY ONE?**

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To sum up, we at Sigma feel that the MLH system is more than just another piece of modern studio equipment. . . . We believe it to be an opportunity for a whole new way of life for the mixer. If there are any further questions on the part of R-e/p readers regarding our use of the system or on the operation of any of its component parts, we would be pleased to provide whatever answers we can. Our address is: Sigma Sound Studios, 212 N. 12th Street, Philadelphia, PA 19107 (215) 561-3660.

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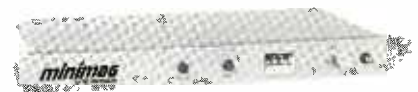


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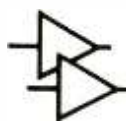


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By PAUL LAURENCE & WAYNE YENTIS

Automated mixing is here. For two years, it was the basket of kittens left on the doorstep of the recording industry, eyed askance by all concerned with sobering comments like "If we feed them, we'll have to keep them." Few, it seems, wanted to get involved.

So it once was with automated mixing. In the last six months however, it has finally risen from the underground to be actively embraced by major artists and producers of many different musical persuasions. Albums like Stevie Wonder's "Fulfillingness' First Finale" (Tamla/Motown), Quincy Jones' "Body Heat" (A&M), and Jim Webb's "Land's End" (Asylum) were all mixed with the aid of an automated programmer.

Hidley



In the vanguard of audio innovation is studio designer Tom Hidley, who traced the evolution of automated mixing to a definite need. "A few years ago, when the industry began to see more than 16 tracks on a single reel of tape — 24 tracks or dual 16 with a synchronizer — this was the beginning of the need for automation. It's a question of logistics. When you're mixing 24-track and bringing back a few effects, you may very well have 30 faders going, which at times can be more than two or even three people can properly handle."

Likewise, computer-aided mixing is the logical extension of all that preceded it. Over the last decade, audio engineering has seen incalculable advances, with not only better reproduction but also many

more options (and hence greater artistic possibilities). With the current state of the art, the artistic expectations engendered by this much freedom can be most fully realized through automated mixing. (Here again is another example of art/generating technology/generating art).

One of the premiere automated mixing rooms is the Westlake Audio showroom in Los Angeles. Designed by Tom Hidley, it features an Automated Processes 3224 console interfaced with an Allison Research ED256 automation programmer. Said Hidley: "When the board first came in about a year ago, we thought of it only as a demonstration device. The more we played with it though, the more we realized how little we really knew about it. Anyone who's been significantly involved in automation will be the first to tell you that we still have a great deal to learn. We've barely scratched the surface of what it can do. It's just so much more than your conventional *level and grouping* board. It remembers input levels, including echo return, grouping submasters, and grand master positions. It remembers echo amplitude and echo return positioning. It remembers all dynamic panning motions and, of course, quad static positioning. I've been in audio for in excess of 20 years, and to me, automated mixing is truly one of the most important developments during that time."

Garry Ulmer, owner and chief engineer at Music Recorders Inc., was the first to have the Allison/Automated system. He echoed Hidley's sentiments in saying "It's a phenomenal development — I get excited every time I work with it! One of the

fantastic things about it is that, for the first time, engineers can actually *listen* to the music. An engineer today is really listening for the moves. He's got to remember as many as 50 changes, in sequence, and still be artistic about it. With a programmer, he can really concentrate on a track, and as a result, catch every little nuance."



Ulmer

How can this *automated mixing* beast do these things then? Basically, through your having *taught* a programmer all the signal modifications you wish to implement during a mixdown, one track at a time. Thus programmed, it will duplicate all of your motions simultaneously for a near-perfect (and ultimately perfect) dubdown. This is a development relative to mixing comparable to what more-than-one-track was to recording. In the same way that multitrack enables you to keep the good and re-do the bad, automated mixing frees you from the burden of having to derive your master mix from one pass of the tape.

Westlake's Automated/Allison currently handles a total of dynamic functions, broken down as follows:

1 level/fader	28
1 L-R pan/module	28
1 F-B pan/module	28
1 echo send/module	28
8 grouping faders	8
1 master fader	1
2 quad panners (joysticks)	2
8 echo return quad pans	8
4 echo return levels	4
4 delay returns	4



Bigsby

Additionally, there is retro-fit capacity for automated EQ.

"The programmer data is very fragile stuff," says Baker Bigsby, one of Westlake's mixers, "in that it can be adversely affected by many different things. First of all, the condition of your tape is important — worn tape may not accept the data. If your machine has any motion problems, that

can have a harmful effect as well. Under any circumstances, because of flanging effects and the other physical factors of tape movement, with sonic machines, your outermost tracks aren't as desirable for storing data as the inner ones. Data tracks can even influence each other if they're too close. The reason that data storage on adjacent tracks is not desirable stems from the same problem that hinders *ping-ponging* of adjacent tracks: when in the sync mode, most tape machines exhibit very poor channel separation between adjacent tracks. Crosstalk increases with frequency, and on some machines approaches unity (or 0 dB) at the frequencies involved in automated mixing. Now this isn't nearly as serious with 16-track as it is with 24, because there's greater distance between the tracks. With 24, we've found that it's best to have at least two tracks in between the

data channels. With all these considerations, you can see where you almost have to start planning for an automated mix at the time of recording."

Now that the equipment is here and working in studios across the country, what effects can we expect on the recording industry as a whole?

A number of things. First, it will have a positive effect on the quality of records. The mixes will be more as the mixers want, and no doubt more artistic as well. There is also the distinct possibility (in the foreseeable future) of going from multitrack master direct to master disc, bypassing intermediate dubdowns and saving at least a generation in recording quality.

Second, there will be a beneficial effect on quadrasonic sound. As automation does away with much of the prohibitive time and patience problems attendant to dubbing 24 tracks down to four, it could very well catalyze that *shift toward quad* we've been hearing so much about. As the industry will be freer to explore the new horizons made possible through automation and quad, it will hopefully be reflected in the awareness and sophistication of the record-buying public.

One of these comparatively-unexplored horizons is the realm of spatial positioning. In a quadrasonically-outfitted room, sound can be localized along two dimensions in the *sound area* defined roughly by the positioning of the four speakers. Through effective use of volume, echo, and panning however, this *sound area* can be made to extend in all directions, far beyond the boundaries of the room, placing the listener in an infinitely large, two-dimensional *universe* of sound.

Producer Ed Michel (of ABC's Impulse line), long a champion of spatial pyrotechnics, predicts a renaissance of aurally-mixed records as the progeny of the automation/quad marriage: "Not only will it make mixing more interesting for us," he says, "but for the audience as well, in that they'll be able to enjoy new sorts of audio sensations. As a start, you can program rapidly changing pan positions, to the point where you can't even distinguish where that track is coming from. You can do all kinds of space changes — like a wah-wah guitar that shoots out at you at a certain point, a high hat cymbal that describes a circle around the room, a clavinet that jumps from speaker to speaker — the possibilities are endless! Everybody's coming around to visual mixing, especially those who're working with quad. And now with automation, you'll never have *not enough hands* to do all the manipulations you want."

Similarly, an automated quad mixdown affords possibilities for not only changing the way a song looks, but how it sounds as well. One way is through panning. Explains Baker Bigsby: "You can program

some very sophisticated panning movements that can actually change the way an instrument is perceived by your ear. For example, you can give a track a strange Leslie'd type of sound by making it oscillate rapidly around a given point. This technique works especially well with electronic sounds, like Fender-Rhodes direct, bass direct, or synthesizers. With automation and quad, everybody's a pioneer — you can do things that really have never been done before. That's because you can take your time and control your mix with infinite care."

Another way in which a track's sound can be changed is an outgrowth of the precision with which you can ride gain. Producer Phil Schier (Quincy Jones, Sergio Mendes, Peggy Lee) explains: "You can take a previously-recorded track and totally *re-orchestrate* it. Suppose for example, that you come into the studio with one of your tapes, and you hear that the drummer was playing something wrong. Instead of the bass drum going dum-DUM-da-dum, you wanted it to go dum-dum-da-DUM. With automation, you can ride your level so precisely that you can really re-accent the beat. By *re-orchestrating* a number of tracks, you can change the song's entire concept!"

Producer John Boylan, (Linda Ronstadt, Rick Nelson, Denny O'Keefe) mixed the first major-act album to be done at Westlake, Brewer and Shipley, "ST11261" (Capitol ST 11261). Likewise, it was his first practical exposure to automation. I asked him to recount his experiences.

"I was one of the first outsiders to actually mix an album there. A few months ago, a friend called me and said that Tom was opening up his showroom. I went down there, liked it, and felt it would be a good place to do the Brewer and Shipley album. The place's only drawback is that it doesn't have live chambers — only EMT's. Otherwise it's perfect."

What problems did you face going in there for the first time?

"In a situation like this, you always face one big problem, namely *Is this new convenience going to offset the trouble it takes to get into it?* In this case it did, and very quickly as a matter of fact. Unfortunately, we had an additional stumbling block. As we hadn't anticipated computer mixing, we didn't have any open tracks for the logic. We toyed with a number of different ideas here. We decided against putting our 16-track tape on a 24-track machine. You gain 8 channels in the process, but lose a little bit from each existing track. This causes your signal-to-noise ratio to go down, and we liked the sound too much to want to mess with it.

"Paul Grupp came up with the idea of running a 4-track simultaneously with the



Boylan

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16 and printing the computer logic on it. We painted arrows on the leader tapes and let 'em roll. It was rather crude, but it worked. This is because the time factor wasn't all that crucial. With the computer scanning as often as it did, it worked out just fine."

How satisfied were you when it was all done?

"Very. We mixed all 10 tunes in 6 days. A significant amount of that was spent learning how to work with the equipment. Discounting the *learning time*, I would say I saved 30-40% of what it would have taken to do it conventionally. I could probably save half the time on all future automated projects.

"Not only that, but it allows a degree of precision that you otherwise couldn't even approach. Automation enables you to fine-tune. You're always as far along as your best mix, which means you don't have to start from scratch if it's not 100% to your liking. Say you mix a tune, take a dub home, and find out that there's too much piano. Well, you can bring it back the next day and re-write that part — it takes 10 minutes! Automation saves a lot of time in situations where a track or tracks need to be ridden, like background vocals. In traditional mixing, you can spend hours getting your vocal balance just right, and often you'll end up by making a slight compromise as it is! In

automated mixing, you never have to compromise.

"It's funny, because there are still many misconceptions about automated mixing. One guy said to me *Doesn't the record sound cold?* I said *Not at all — I mixed it, the programmer just repeated my motions.* Another guy said that he couldn't hear the difference between a programmer-mixed record and a normal one. I said *You're right, neither can I.* That's the beauty of it."

Garry Ulmer encountered similar skepticism.

"I was on Marc Bolan literally for months to do an automated album. The first time he came into the studio for a date, I said *You've got to see this thing work — it's just unbelievable!* He said *Yeah, terrific.* It took me two whole albums with him before we did an automated project, because he wouldn't give me two tracks for the logic — he still really didn't understand what it was all about! I finally laid it on the line and said *Marc, we're doing this record with the programmer.* To accommodate the logic, we had to combine some parts, as he likes to overdub lots of guitars and vocals.

"When we got to the mixdown, he was really flabbergasted, because he finally saw how well it works, and as a result, he gets a better product. I expect he'll want to mix automated from now on."

Ulmer sees an application of automated mixing in the movie and television industries as well.

"It would be a tremendous asset in scoring, because there's such a real and immediate need. In dubbing film, you've got three very different kinds of things to mix — sound effects, dialogue, and music. With a computer, you could work on each separately — do the dialogue, lock it in, then do the music, and then go back and do the sound effects. Because of this, you won't end up by having to dub a scene 50 times to get it right, and you won't have to completely re-do to change one part."

Automated mixing appears to be here to stay. John Boylan predicts that "In a year or so, nobody will be able to afford *not* to mix automated, with costs getting as high as they are. I envision studios having automated consoles, so that when you do the date, you can put down a rough logic right there. For example, when you first record something, the playbacks will sound really good. When you go back to mix a couple of weeks later, you'll say *How come it doesn't sound as good now as it did then?* It's because you can't remember all your settings. But a programmer can! If you could put down a rough logic at the time of recording, your mix would be half done before you even really started."

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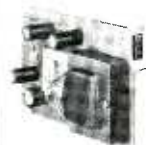
The Model AM-27 is a general purpose audio amplification module suitable for low level microphone preamplification. Its key features are

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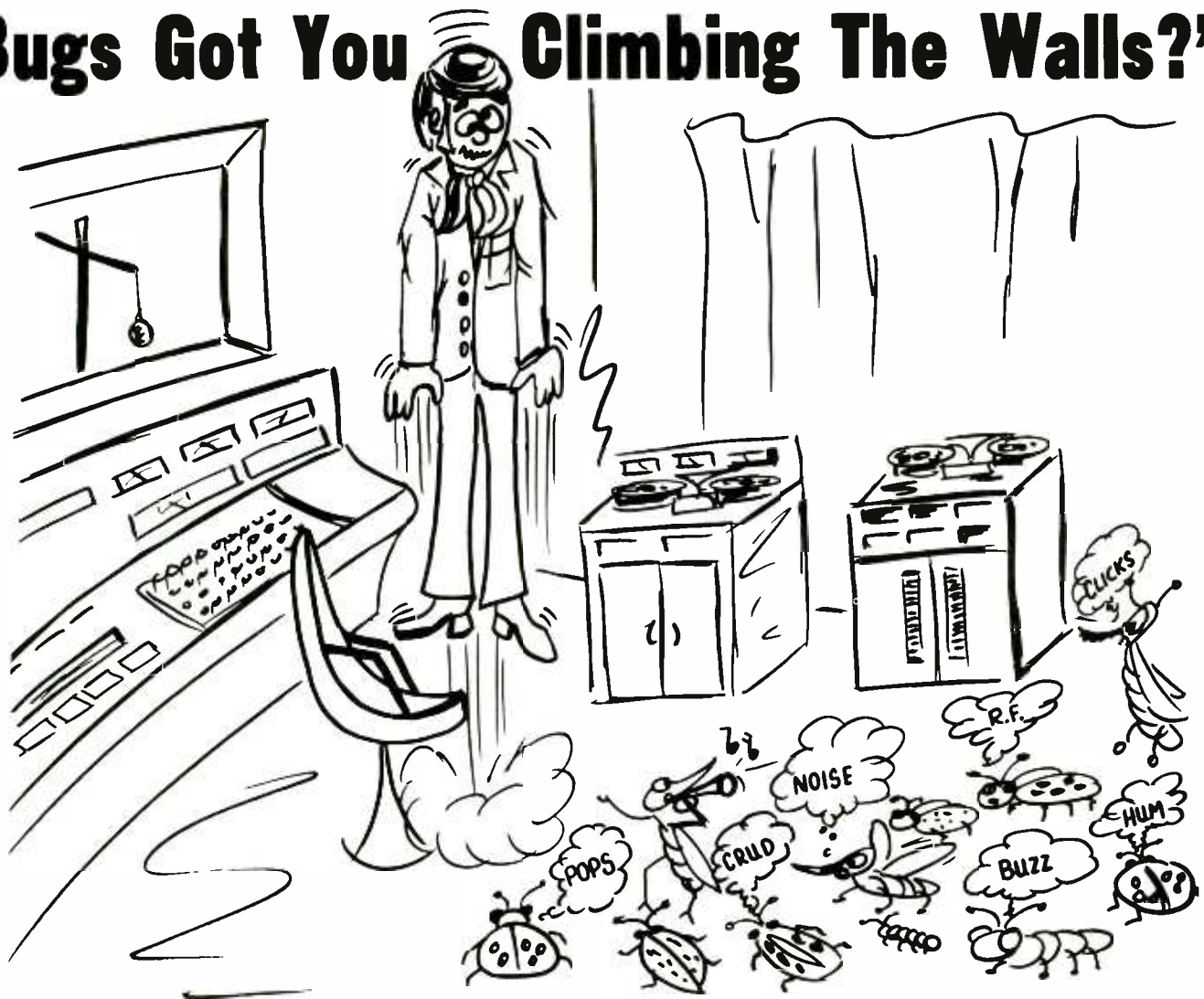
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# The...WHY...WHAT...HOW... of AUTOMATED MIX-DOWN

BY PAUL BUFF  
ALLISON RESEARCH

## WHY?

Whenever the subject of automated mixing comes up, there are invariably a certain number of mixers who ask, "Why do I need automation? I'm pretty happy with the records I've done without it." The real answer to this question lies not in some weakness on the mixer's part, but rather, on the ever increasing level of technical complexity surrounding the audio art. Take a look at what has gone down in the last 15 years alone.

In 1959, a typical control room contained, perhaps, a 12 in, 2 out console, a couple of two tracks and two mono machines. Outboard equipment consisted of a few limiters and equalizers, and a chamber. Sessions were conducted on one of two basis, which were:

1. Straight ahead from mike to stereo or mono master.
2. Tracks were cut from mike to stereo or mono. The master tape was then transferred to a second tape, while the vocal and any sweetening was added, by overdubbing.

In either event, the process was swift and final. You either had a record, or you didn't. There were no reservations such as "We should have had the drums higher." Such thinking was simply unthinkable, as there was no recourse, short of recalling the musicians, arrangers and singers.

Contrast that with today's full blown room. Console = 24 in, 24 out; Machines = 24, 16, 4, 2 and mono. Outboard equipment might include, say, 30 channels of noise reduction and a myriad of limiters, Kepex, phasers, equalizers, delay lines, chambers and whatever else anyone can dream up to modify the sound.

The recording is easy, compared to 1959, but the mixdown process is a whole

new ballgame! My hat goes off to the mixer who can shove 24 tracks of highly intricate audio through today's total chain and make it come out in quad, to the absolute satisfaction of the producer, musicians, singers, record company and the public! And what about 1959's statement "We should have had the drums higher." The chances of our coming back, say a week later, and duplicating the sound, except for the drums, are about as remote and costly as they were in 1959.

What is needed is an interface between the engineer/producer, and his machinery. The sheer number of controls is rapidly approaching the point of exceeding human ability to operate them. When this point is reached, the engineer/producer will have to limit themselves to their physical ability to grab knobs and turn them rapidly, and to remember their settings, unless an adequate interface is employed.

I, for one, like to consider a good mixer as one who has the talent to listen, think and create as opposed to a person of physical dexterity and photographic memory. Automated mixdown can provide the memory and the physical help, thereby freeing the mixer and producer to create.

## AUTOMATION IS A GUY NAMED JOE

O.K. automation doesn't think, listen or create. Just what does it do? It simply remembers and reacts. That's why I don't like the term "computerized mixing". Computers think and make decisions. The audio world is not ready for a machine that thinks! That's the engineer/producer's job.

Think of it this way. Automated mixdown is a guy named Joe. Now Joe

is a remarkable person. He has the ability to remember anything you teach him, for as long as you wish him to remember it. Joe also has the ability to turn knobs and fade faders, without ever getting in your way. Fast? Would you believe that Joe can make a couple of hundred adjustments to your console in the time it takes you to blink an eye?!!!! Joe's a good worker, but he'll never be boss. You see, he's stupid. You have to tell him everything you want done. Why Joe couldn't mix a foghorn solo if you didn't show him how!

O.K. You and Joe sit down to do a mix. You tell Joe to watch, while you do a rough mix. (Joe is WRITING what you do, into his memory.)

Now you can replay the tape and tell Joe to re-do exactly what you just did. (Joe will READ his memory and perform exactly the same adjustments you taught him.) You can sit back and direct all of your attention to listening.

At this point, you might say "Joe, you do everything like I taught you except the panning of the flute and the level of the drums. I'm going to re-do those, so watch what I'm doing." (Joe will WRITE flute panning and drum level, while he READS everything else.)

Again, you can ask Joe to READ everything, and you will hear just what you did on the last pass (the original mix, with the new flute panning and drum level).

After careful listening, you might say "Hey listen Joe, the mix is getting pretty good, except the voice is a little buried. I don't really want to re-write the voice level 'cause the gain riding is good. Why don't you just add 3 dB to the voice level, but keep all the ups and downs I taught

you. Don't change anything else, except on the end I'm going to fade, so remember that."

(Joe is going to modify (UPDATE) his existing memory of the voice level by 3 dB. He will READ his memory on the rest of the parameters, and on the end, he will WRITE the fade into his memory.)

Again, you can replay the tape and ask Joe to READ everything you've taught him, to date.

The process of teaching (WRITING and UPDATING), and listening back (READING), can go on indefinitely until you are totally satisfied with the mix. You need only move those controls which you want to change, while Joe remembers and operates the remainder.

The changes you direct to Joe can be slight or gross, static or dynamic, and can occur over a span of minutes, hours, days or even years. Joe's memory is as permanent as the master tape itself! If you've done a mix, and a week later someone says "We should have had the drums higher," you and Joe can fix it.

To automate a console, then, simply means to give it the ability to remember and re-perform parameter changes, which you program in. TOTAL AUTOMATION refers to the automation of all parameters of the console (Level, echo, panning, E.Q. etc.), while LEVEL AUTOMATION concerns itself with the automation of program levels only. Of course, there are degrees of automation between LEVEL and TOTAL.

### HOW?

In order to give a console the ability to remember and react, it is first necessary to convert the human movement of the controls into an electrical signal, which is suitable for further processing. This is done by means of voltage controlled amplifiers, panners and equalizers. For purposes of simplification, I will limit the

technical discussion to the control of levels, via voltage controlled amplifiers (VCAs).

A VCA can be described as an amplifier whose gain, or loss, is determined by a control voltage applied to its control terminal. Generally, they are structured such that a linear change of control voltage will produce a logarithmically proportional change in gain, or loss. Typical designs exhibit unity gain at zero control volts, with 20 dB attenuation per positive control volt, and 20 dB gain per negative control volt.

State of the art designs can provide control ranges in excess of 100 dB, signal to noise ratios in excess of 100 dB, and distortion which borders on the unmeasurable.

If a fader and a VCA are connected as shown in Fig. 1B, the results are essentially identical to that obtained by the conventional connection shown in Fig. 1A.

However, in Fig. 1B, a variable dc voltage is available at the control input. This voltage is proportional to the gain or loss of the audio through the VCA, and is suitable for further processing.

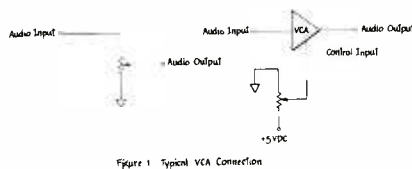


Figure 1 Typical VCA Connection

In looking at Fig. 2, it can be seen that by placing the switch in WRITE position, the sound will be controlled, in real time, by moving the fader. A proportional voltage will be fed to the memory. (It is assumed that one function of memory is available for each automated control on the board).

If the switch is placed in READ position, the audio will be controlled

by the previously written memory, and movement of the fader will have no effect. Notice that in both cases, the voltage fed to the memory is the voltage which is controlling the VCA.

By this connection, the memory is always being fed information which is proportional to what was heard on the last pass. In READ mode, the information is recycled from the output of the memory back to the memory input.

In practice, two or more multi-function memories are used, with READ information being transferred from one to the other, in the manner shown in Fig. 2.

By using multiple memories, it is permissible to make mistakes in mixing, since you always have the memory intact, from the previous pass.

### UPDATE MODE

For situations where it is desirable to take the previously programmed level (with its dynamic changes) and add or subtract level from it, UPDATE mode is by far the easiest method to use.

As can be seen in Fig. 3, UPDATE mode controls the level by means of a summation of voltages from the previous memory, the fader and from a fixed source of voltage.

If you recall, our typical system operates on the basis of 20 dB per volt. If the fader were at its top (0 volts), the control voltage would be equal to the previously programmed voltage (from Memory "A"), minus .75v. Since -.75v causes a gain change of plus 15 dB, the level would appear 15 dB higher than that which was previously programmed.

If the fader were now moved to its -15 dB position, the voltage at its wiper would be +.75v. At this point, the fader voltage would exactly cancel the fixed -.75v, leaving only the voltage from Memory "A". This cancellation point is termed the INDEX POINT. Settings above the INDEX POINT will add level to the previous program while settings below the INDEX POINT will subtract level from the previous program. (Of course, setting the fader right on the INDEX POINT would yield the same results as READ mode, as long as the fader were not moved.)

### THE MEMORY

As discussed in the preceding paragraphs, the memory system is really the heart of an automated mixing system. The basic requirement of the memory mechanism is its ability to store and retrieve all of the dc control voltages produced within the mixing console. Each automated console parameter requires a separately accessible channel, or function, of memory. For instance, the automation of 16 faders would require 16 memory functions. Each function must contain an adequate number of steps to resolve the position of the

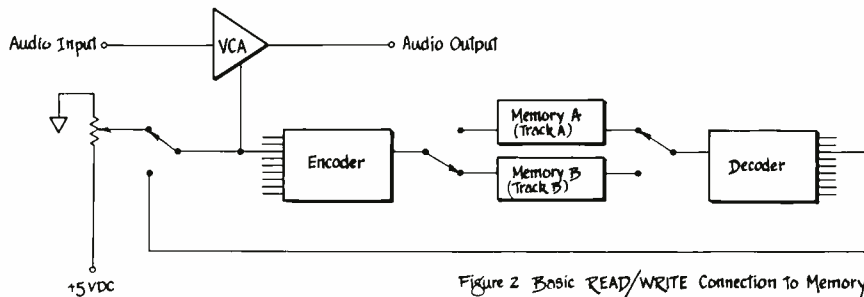


Figure 2 Basic READ/WRITE Connection to Memory

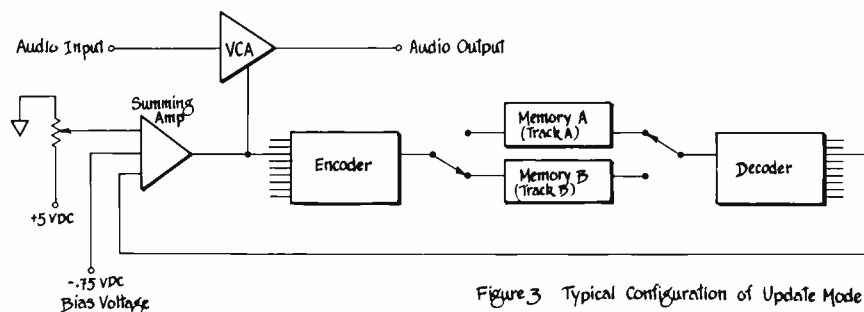


Figure 3 Typical Configuration of Update Mode



fader in an acceptable fashion. (In the Allison Research system, each function is resolved to one of 125 steps, which results in 1/2 dB steps, in terms of fader position).

The master tape itself, is normally used as the actual storage medium for mixing data. The programmer's job, then, is to convert the data into a form suitable for storage on conventional audio tape channels. In actuality, all dc voltages (or "DATA") produced in a mixdown are stored on one channel of tape. Each track of tape used for data storage, then becomes a separate memory, capable of storing data for an entire mix.

As you might guess, each data track contains an awesome amount of information. In a total automation system, there may be in excess of 200 parameters (or functions), each containing 125 steps, and all stored on one track of tape. (Projected Allison Research programmers allow the storage of as many as 1920 such functions on a single track of tape!).

The basic method of storing such massive amounts of information lies in the technique of time sharing. The encoder half, of the programmer sequentially scans all of its inputs, one at a time, and produces one singular output, which contains digitally represented samples of all inputs. Its operation is analogous to the giant rotary switch shown

in figure 4.

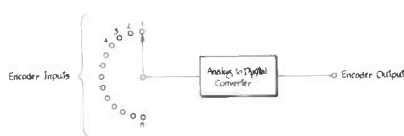


Figure 4 Analogy of the Encoder

The decoder, conversely, is basically similar to the configuration of figure 5.

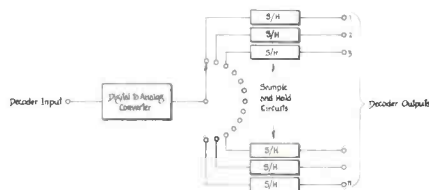


Figure 5 Analogy of the Decoder

Here, the time shared code from the tape is first converted, from its digital form, back to the original analog form. It is then assigned, through the electronic "rotary switch", to individual sample and hold circuits (one per function) then on to the outputs.

As the name implies, the sample and hold circuits are needed to "hold" each sample while the switch is directing samples to the other outputs.

Figure 6 shows the system response to a typical input waveform. Integration is applied to remove the steps.

The time sharing technique may be

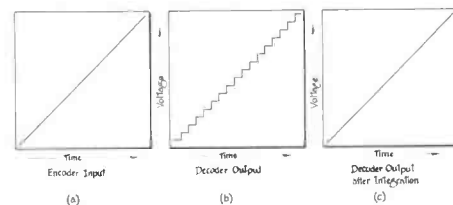


Figure 6 Programmer Response to an Input Voltage Change

more easily understood if you visualize the operation of a standard television system. Here, the camera scans the video field in horizontal sweeps. The video information appears as analog samples on the composite waveform.

In the receiver, a modulated electron beam (within the cathode ray tube) follows the scanning motion of the camera and deposits the corresponding samples on the viewing screen.

The persistence of the screen phosphor acts as a sort of sample and hold device, to maintain brilliance, as the beam scans the remainder of the screen.

Assuming that the scan rate is fast enough, our eyes believe that they are seeing a continuous representation of the video field.

#### PROGRAMMER

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*Continued*

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vice primarily designed for use in automated mixdown systems. It has a basic capacity of up to 256 step variable functions. Peripheral equipment is currently under design which will allow expansion up to as many as 1920 functions. The scan time is 500 microseconds per function, with the total scan time being dependent on the number of functions employed. Extensive protection circuitry is employed to prevent errors during the presence of tape dropouts, splices, level variations and other tape defects. The code, itself, is unique. Digital representation of the analog control voltages is gained by a quinary, rather than binary technique. In the quinary code (an Allison Research proprietary technique) each analog function is represented by 3 bits, which each contain 5 potential states. The quinary system allows for faster scan rates and is more readily expanded than conventional 8 bit binary codes.

**AVAILABLE HARDWARE — TOTAL AUTOMATION**

In addition to the Allison Programmer, hardware currently exists which is capable of producing total automation systems. This list includes voltage controlled amplifiers (VCA's), manufactured by Allison Research, Inc., Automated Pro-

cesses, Inc. and DBX, Inc.

Allison also manufactures a device (VCA2-5A) which is employed as a voltage controlled level/echo and quad panning element.

Automated Processes, Inc. has recently introduced a line of voltage controlled equalizers to complete the hitherto missing link in the chain.

As far as assembling the above hardware, well, this is a job for a console builder. Existing consoles may fairly easily be retrofitted for *level automation*, but *total automation* is another story. Here, the system complexity pretty much rules out "adding parts to your console". In short, *total automation* generally calls for a new console. Automated Processes, Inc. has built and is building such consoles.

**MEMORIES LITTLE HELPER**

For situations where it is desirable to retrofit an existing console for *level automation*, the Allison Research "Memories Little Helper" system may be used.

In this system, the Allison Programmer, VCA's, mode selection circuitry, null indicators, group master circuitry, power supplies and other required circuitry are all contained in a single package which is designed for easy interface to existing consoles.

Although it is possible to connect Memories Little Helper to other console

parameters such as echo send, the system is engineered primarily for control of fader levels.

In a typical installation, the individual fader wires, within the console are cut and re-routed, through differential and buffer amplifiers, to a special connector which is normally mounted on the bottom, or on one side of, the console. The Memories Little Helper is plugged into this connector and is physically located at some point convenient to the console.

The mixing is done on the console faders, which retain the same "feel" as before the installation.

If it is desirable to remove the Memories Little Helper, a "dummy plug" is inserted in the console connector, restoring normal non-automated operation.

As a result of the "quick disconnect" feature, it is feasible for a multi-console studio to put connectors in all of their consoles and move the Memories Little Helper from room to room, as a portable automation system, while maintaining "on the console" mixing.

**A TYPICAL MEMORIES LITTLE HELPER MIXDOWN**

The following paragraphs will be a rundown of a typical mixdown performed on the Memories Little Helper/console.

1. The programmer is patched to 2 non-adjacent tracks of the master tape (these 2 tracks are designated data track A&B). Data tracks will be played to the *sync* position, while the audio tracks are played in normal or play position.

2. The Master Write button is pushed. This places all modules in Write.

3. The mix is *run-down*, in conventional fashion, to establish a rough mix. At this point, the engineer need only concentrate on the basic balance. Intricate level changes may be left for later.

4. When a general mix is established, the tape machine is set to record on data track "A," while the mixer makes whatever level changes he can comfortably handle. The rough mix is now being put to memory.

5. The tape is rewound, Master Read is selected and the data switch is set to decode data track "A." If the tape is now played, the Memory will reproduce the mixing motions it just *learned*. The engineer/producer can simply listen and decide what changes or refinements should be made.

Assume it is decided to raise the drums about 3dB, and dip the horns in the second verse.

6. The drum module is placed in Update mode and the drum fader is set 3dB above the index point. The horn module is also set in Update mode and its fader is put on the index point. The other modules are left in Read mode. The tape machine is set to record on data track "B" and the tape is run. The mixer can now direct his

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entire attention to the horns. When the second verse comes, he can make the *dip* with the horn fader, then return it to the index point for the remainder of the song. The drums are being taken care of, since the fader is set to add 3dB to the previous level.

7. Again, the tape is rewound and **Master Read** is selected. This time the data switch is set to decode track B (the track that was just encoded). Again, the engineer/producer can sit back and listen.

Now, let's assume that they decide to ride gain on the bass, drums, piano and guitar as a block, or group.

8. The corresponding modules are assigned to **Group Master** number one, while the remaining modules are in the groups off position. The **Groups Programmed** switch is set. (All modules are still in **Read** mode.) What this means is that the system will **Read** the previous memory, but will modify the rhythm instruments, as a block, according to the movement of **Group Master** number one. The tape machine is set to record data track "A" and the tape is run, while the mixer rides gain on the rhythm section with **Group Master** one. (The **Group Masters** have an index point so that the engineer knows where he is, relative to the last pass.)

9. Again, the tape is rewound, **Master Read** is selected, data track "A" is selected and **Group Master** one is either set to its index point or the rhythm instruments are assigned to the groups "off" position. As always, the last encoded memory (A), controls the console and the engineer/producer hears a re-creation of the last mix. If more refinements are needed, they are done on the same basis as the above paragraphs, with no limit being placed on the number of permissible passes. Data is alternately stored on tracks A & B. Since the automation is only attached to the faders, the parameters of echo, panning and E.Q., are done in conventional real time fashion.

10. When the mix is entirely satisfactory, the 2 track or 4 track machine is put in record, and as many first generation copies of the mix as needed, may be run.

The mixdown described above, because of space limitations, was pretty basic. In actual mix situations many changes may be simultaneously made, as well as punches and multiple groupings. The pattern of how and when to make changes is entirely up to the engineer/producer.

#### SUMMARY

All in all, console automation, be it **Memories Little Helper** or a totally automated super board, definitely presents the engineer/producer with some new avenues of thinking. Some of these are new ways to produce familiar results, while others are methods of producing results which were previously unobtainable.

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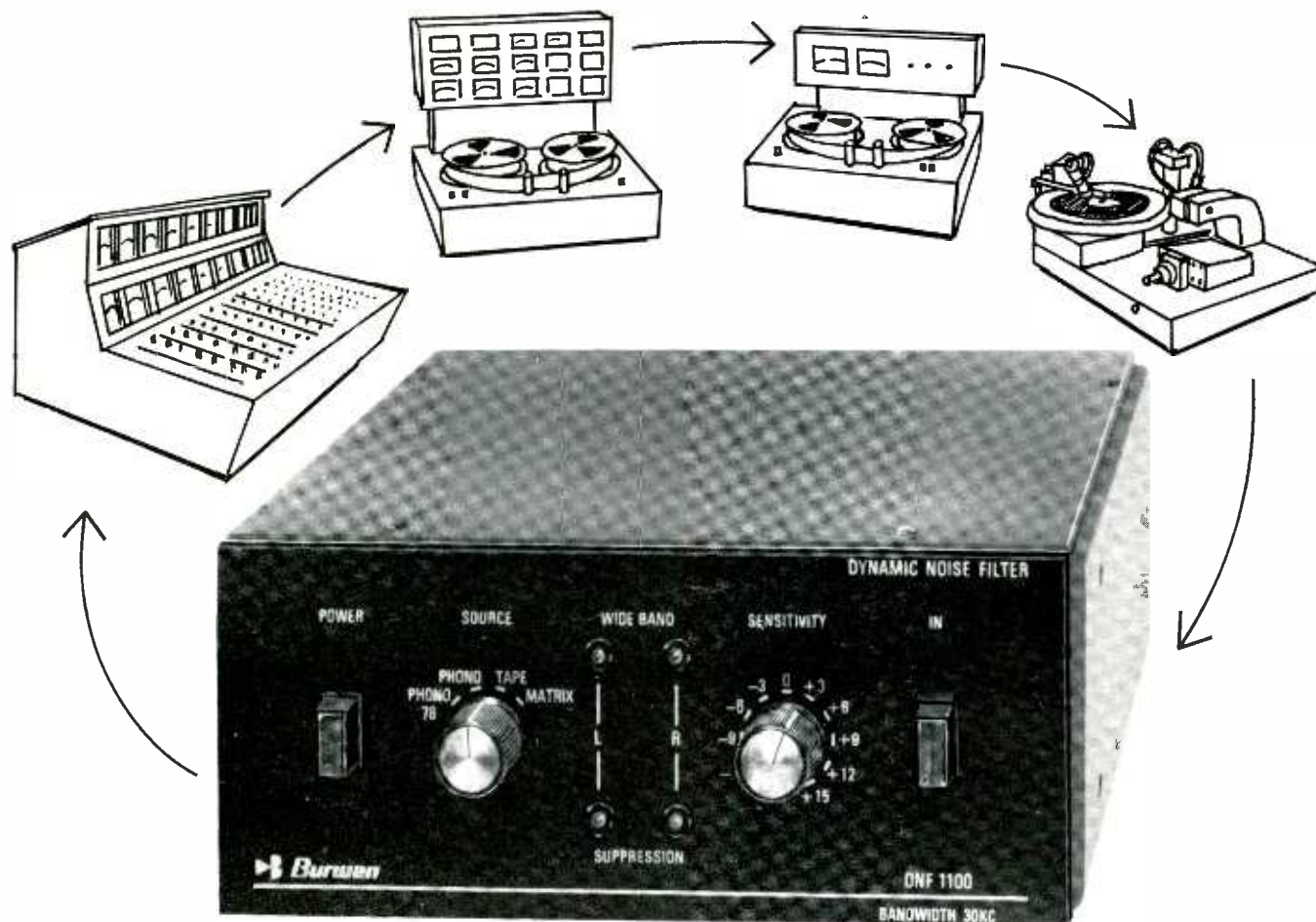
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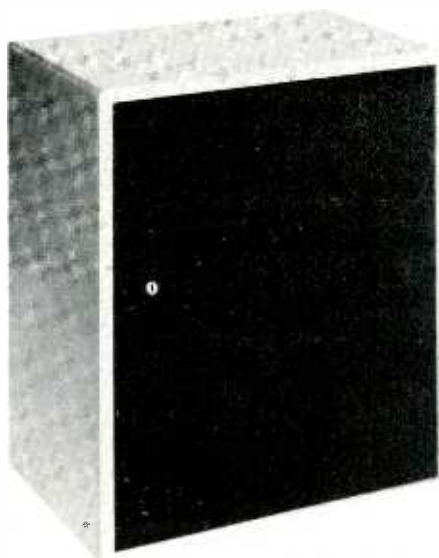
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Circle No. 132


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Calcomp Consumer Products is now introducing the ACT-1, a new low cost audible continuity tester designed to test electrical wiring and electronic circuits without danger to delicate components.

The Calcomp Audible Continuity Tester replaces expensive ohmmeters which require a visual check; it also replaces buzzers and bells, thus eliminating high voltage drain and danger of inductive kickback. Continuity is indicated by a clearly audible tone; the pitch varies according to the amount of resistance (0 to 50 ohms).



The ACT-1 is extremely accurate for static timing of automobile and motorcycle engines. It is also completely safe and reliable for use on sensitive circuits and semiconductors. Probes produce 2.5V when circuit is open, and 6 MA when shorted. Powered by a 9 VDC



## LOOKS CAN BE DECEIVING!

These carts, Fidelipac's original Model 300 of 1956 and one we've just made, may look the same but there's a world of difference. Today's Fidelipac® has:

- High heat, high impact Plexiglas® DR case.
- Welded, leadless hub/reel assembly.
- Low friction polyester faced foam pressure pads.


What hasn't changed is the use of highest quality lubricated polyester tape, positive reel brake action, hand winding, assembly and inspection of all carts as well as the other features that make Fidelipac the standard.

**If you're using or considering buying another brand, don't be deceived . . .** call your Fidelipac Distributor today and see why Fidelipac is the state-of-the-art cartridge, the cartridge with more in use worldwide than all other brands combined.

Fidelipac is a registered trademark of Telepro Industries Incorporated  
Plexiglas is a registered trademark of Rohm and Haas Company

# FIDELIPAC®

3 Olney Ave., Cherry Hill, NJ 08034  
(609) 424-1234

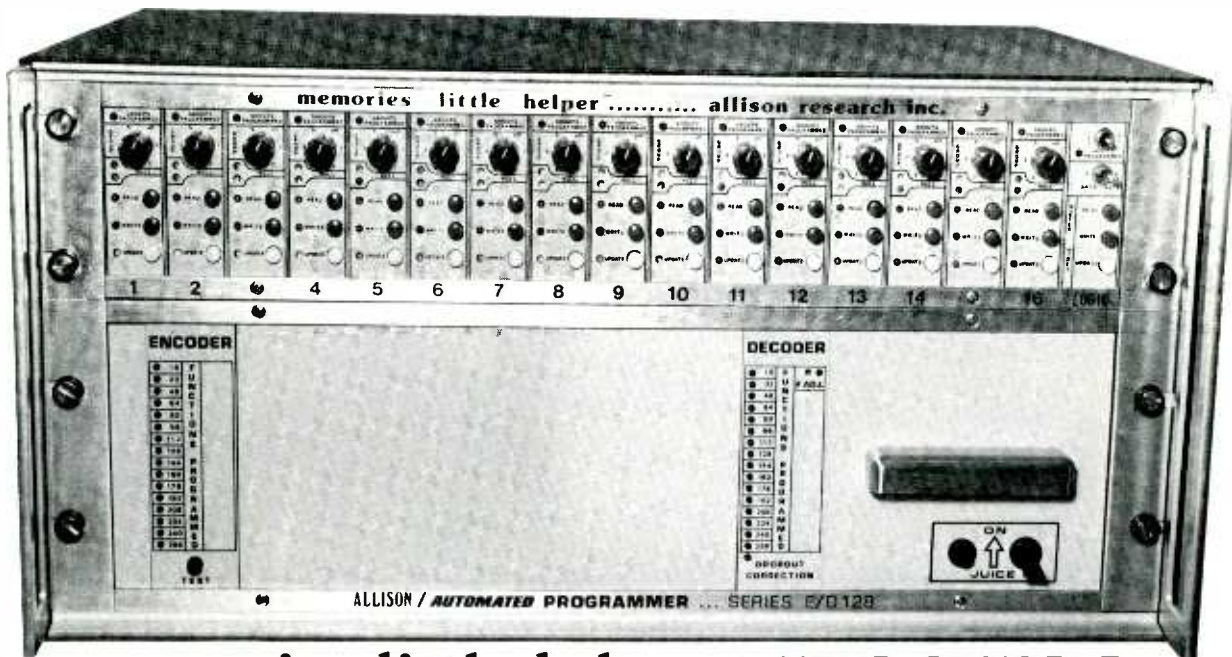


have it your way,

OK. LOOK. TAKE OUT THE STRINGS ON THE SECOND EIGHT OF THE FIRST VERSE, RAISE THE HORNS ON THE "DO DUM DUMS", BRING UP THE VOCAL GROUP ON THE "LA-LA'S" BUT KEEP THEM DOWN ON THE "LU-LU'S". THE LEAD VOICE IS FLAT ON THE FIRST EIGHT OF THE SECOND VERSE, SO TAKE HIM OUT AND BRING UP THE FLUGEL HORN. THE BRIDGE IS WEAK SO LET'S RE-STRUCTURE THE WHOLE MIX AT THE SECOND EIGHTH NOTE OF BAR TWO. YOU KNOW, BASS, GUITAR AND DRUMS UP, STRINGS AND HORNS OUT, AND START PANNING EVERYTHING ELSE IN CIRCLES, BUT WATCH THE "LA-LA'S" AND "LU-LU'S". BY THE WAY, IF YOU DON'T GET IT RIGHT THIS TIME I'M GOING TO HIT YOU WITH THIS WRENCH!!!



or ours!!



**memories little helper + YOUR CONSOLE**  
= AUTOMATED MIXING



**allison research inc**  
**nashville, tennessee**  
**[615] 385-1760**



battery, the unit is extremely compact, measuring 2-3/4" x 1-3/16" x 3-3/4". Weight is 8-1/2 oz. Comes complete with 30 inch probes, battery and alligator clips.

The ACT-1 can be ordered directly from Calcomp Consumer Products on a thirty day trial basis, satisfaction guaranteed or money refunded. Price is \$12.95 postpaid.

**CALCOMP CONSUMER PRODUCTS, INC., 1800 TALBOT WAY, ANAHEIM, CA. 92806.**

Circle No. 136

**P800 "BUFFALO" CONTACT PICKUP FROM GROUP 128, INC.**

A new contact instrument pickup device the size and shape of a five cent coin is announced by Group 128, Inc. The device uses a genuine buffalo nickel in lieu of a lid and is designated the P800 Buffalo Pickup.

The product uses the same proven electret condenser principle which is used in the company's professional quality microphones. Thus, the Buffalo Pickup response when used with acoustic instruments is notably free from the "electric sound" usually encountered with other types of contact pickups, and is similar in frequency range and smoothness to that of a free standing microphone.



The Buffalo Pickup attaches to the instrument by pressure sensitive adhesive tabs which are supplied. The unit can easily be moved or relocated. The pickup has its own power supply which can be attached to the performer's belt or clipped to a mike stand. Power for the unit's preamp comes from a 9-volt transistor radio type battery providing approximately 1,000 hours of operating life.

The P800 Buffalo Pickup is equipped with standard phone jack connector and costs \$99.50 from music and audio stores or the factory. Professional performance Model P800Z with balanced output and XLR-3 connector is also available at \$119.50.

**GROUP 128, INC., 50 SUN STREET, WALTHAM, MASSACHUSETTS 02154.**

Circle No. 137



**dbx ANNOUNCES NEW ECONOMY COMPRESSOR/LIMITER**

A new pair of professional quality single-channel compressor / limiters continuously variable from 1:1 to infinite compression is available from dbx, Incorporated. The new units have a limiting threshold variable from 10 mV to 3 V rms with a pair of LEDs to indicate whether the device is operating below or above threshold.

The illuminated meter has -40 to +20 dB range with adjustable zero reference and is switchable to read input level, output level or gain change functions. A gain control following the compression circuit has a range of -20 to +20 dB. Unit is half rack width and is normally supplied in walnut cabinet, but paired units may be

ordered ganged for standard rack mount in a 3 1/2" panel space.

Model 160 has balanced bridging input and 100 ohms output with Jones barrier strip terminations and operates at line levels up to +24 dBm in and out. Output is balanced and ground loop compensated. Model 160 also has a built-in circuit to suppress turn-on and turn-off transients, and is available at \$300 from dbx professional product dealers. Model 161 is identical except for +18 dBm maximum input and output levels, no transient suppression, and RCA phono jack terminations for convenience in connecting to small studio recording equipment.

Model 161 costs \$250.00  
**dbx, INCORPORATED, 296 NEWTON STREET, WALTHAM, MASS. 02154.**

Circle No. 138

**RESISTANCE TEST UNIT IS POCKET SIZE**

Small enough to be easily hand-held, a new aluminum-housed resistance substitution unit by Phipps & Bird features an 11 million step range in one-ohm steps.



Suitable for circuit design, development, instrument repair and trouble shooting, the Model 236-A uses one-half watt resistors with 1% accuracy tolerance.

Designed with three binding posts (one to ground case), the slide-switch unit provides a range from 1 to 11,111,110 ohms. Its aluminum case, finished in wrinkle blue, measures 4"x6"x1 3/16". Units are available at a list price of \$48. from stock.  
**PHIPPS & BIRD, INC., P.O. BOX 24, RICHMOND, VA 23205.**

Circle No. 139

**GARNER INDUSTRIES INTRODUCES NEW CONTINUOUS-BELT MAGNETIC TAPE ERASER.**

Garner Industries announced the introduction of a continuous-belt magnetic tape erasing machine.

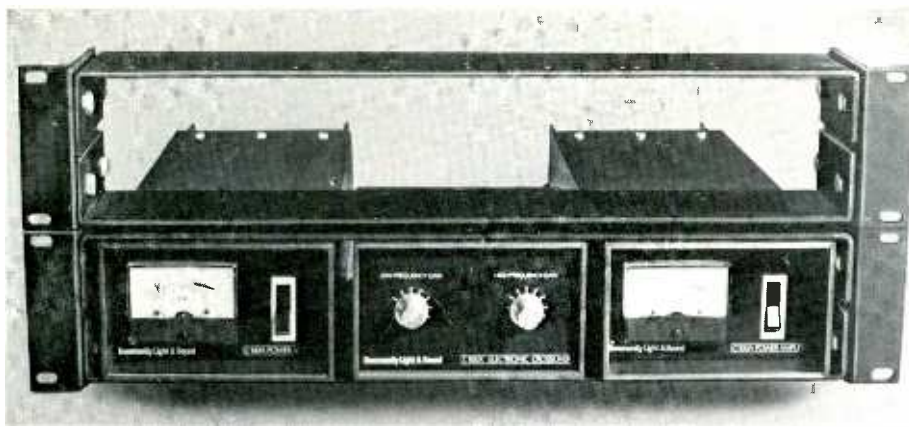
Designated Model 70, the new machine cleanly erases any 7" reel, cartridge or cassette in one pass on the belt. Different kinds of tapes can be intermixed and can be placed on the belt continuously. About 4 seconds is required for tapes to travel the length of the belt and to remove previous recording.



The Model 70 is precision made for high volume erasing of audio, video and data tapes. Dimensions are: 27" long x 5" high x 10" deep. Shipping weight is 75 pounds.

**GARNER INDUSTRIES, 4200 NORTH 48th STREET, LINCOLN, NEBRASKA 68504**

Circle No. 140



**COMMUNITY LIGHT & SOUND INTRODUCES THE C100 SERIES**

A 120 W power amplifier, a four channel mic mixer with three position EQ, a two-way crossover and a pre-amplifier for electronic instruments — all in rugged extruded cases that will stand the most demanding service. This C100 Series from Community is a group of high quality

building blocks that greatly simplify sound system construction. Straightforward design and careful test procedures insure uniform quality and remarkable dependability. Shown above; two C100A power amplifiers flanking a C100X electronic crossover in a 3½" x 19" rack assembly. **COMMUNITY LIGHT & SOUND, INC., 5701 GRAYS AVE., PHILA. PA 19143.**

Circle No. 141

**MODULAR AUDIO INTRODUCES THREE IMPAC AMPLIFIERS**

Three new Impac Amplifiers are now available from Modular Audio Products, a unit of Modular Devices, Inc., Bohemia, New York.

The three new P.C. card amplifiers are the AM-27 Microphone Preamp, the

ABL-27 Bridging Line Amplifier and the AL-27A Line Amplifier. All three utilize the MAP 1731A audio operational amplifier as its active element. Designed for P.C. card rack or individual mounting, these P.C. card amplifiers have wide application in recording studios.

Model AM-27 is a general purpose

professional studio quality noise reduction at a modest price. The dbx 150 series is compatible with all other dbx noise reduction systems. Features include 10dB headroom improvement and 30dB noise reduction. Walnut case is standard, or two units may be ganged for rack mount. RCA phono connections facilitate the interface with semi-professional recorders, mixers, etc. Model 157 is two channel, simultaneous record and play, \$567. Model 152 is two channel, record OR play, \$410. Model 154 is four channel, record OR play, \$646. Available from professional audio dealers or direct from dbx, Incorporated, 296 Newton Street, Waltham, Massachusetts 02154 617/899-8090.

**dbx 157 offers**



**dbx inc.**

Circle No. 143

audio module suitable for low level microphone preamplification. It features transformer coupled input and output, adjustable gain of 25dB to 65dB, low noise and low distortion.



Model ABL-27 is a general purpose audio module designed for amplification of medium to high level (+20dB) signals or wherever it is necessary to bridge a floating or balanced source. Its features include adjustable gain from -7dB to +33dB.

Model AL-27A is a multi-purpose audio amplification module used in line, booster, differential, or combining amplifier configurations. Features include transformer coupled output, adjustable gain/loss up to +47dB and low noise of -125dBm.

**MODULAR AUDIO PRODUCTS, 1385 LAKELAND AVENUE, BOHEMIA, N.Y. 11716**

Circle No. 142

**VERSATILE TURNTABLE PRE-AMP INTRODUCED BY BROADCAST ELECTRONICS**

Broadcast Electronics, Inc. announces the introduction of a new SPOTMASTER turntable pre-amplifier designed for the most discriminating Broadcaster and Sound Man. Designated as the Model BE TMS, this pre-amp provides complete mono, stereo and dual channel capabilities. Its versatility is enhanced by a phase reversal switch on one channel that allows five modes of operation — mono in/mono out, stereo in/mono out, stereo in/stereo out, dual channel mono in/dual channel mono out, and single channel mono in/dual channel mono out.



The BE TMS has an output level switchable between - 10, 0 and +8dBm



into a nominal 600 ohm load. Transformer coupled output is available as an option. Gain of the pre-amp is 54dB at 1kHz and frequency response is  $\pm 2$ dB, 30Hz to 15 kHz (RIAA) NAB. Also featured are channel separation better than 50dB and distortion less than 0.5% at +8dBm.

Spotmaster's BE TMS has front panel controls for power, left and right channel gain, mono/stereo selection and right channel phase reversal.

MARKETING DEPARTMENT, BROADCAST ELECTRONICS, INC., 8810 BROOKVILLE ROAD, SILVER SPRING, MD 20910.

Circle No. 144

### STUDIO QUALITY INSTRUMENT AMPLIFIER FROM BENSON ELECTRONICS

The Howard Roberts signature Model 300 Guitar amplifier is adaptable for use with instruments other than guitar through the Benson exclusive changeable equalizer feature.

The new model 300 was designed by Howard to meet the varying requirements of daily studio work; the open back, tube type design allows for pleasing harmonic distortion with unrestricted speaker cone travel at high volume. It includes built-in reverb, pulse tremolo, output stress control, preamp outputs, built-in distortion unit and changeable equalizers for different instruments.

The Howard Roberts model is constructed of 3/4 inch plywood with heavy gauge tolex covering in a compact 24 x 9



x 20" size. Overall weight of the 300 HR is 75 lbs.

Exclusively distributed by:  
L. D. HEATER COMPANY, 10300 S.W. ALLEN BOULEVARD, BEAVERTON, OREGON 97005

Circle No. 145

### KONTAKT 61 - AEROSOL SPRAY AID DISTRIBUTED BY REGMO DATA

An aerosol spray aid, imported from West Germany is making favorable impact on manufacturers of equipment employing high and low frequency contacts vulnerable to oxidation.

According to the manufacturer, Kontakt 61 is a superior cleaning, lubricating and anti-corrosion agent that reduces mechanical abrasion of all contact surfaces

by several orders of magnitude, thereby immeasurably increasing their service life.



Kontakt 61 is free of silicones and inorganic acids - perfectly safe on all types of plastics, metals and insulating materials. Excellent contact is secured at the points after a Kontakt 61 application.

Kontakt 61 is available in 6 ounce and 16 ounce spray cans and in bulk plastic containers by the liter.

Regmo Data Corporation is the author-

## What You Don't Know Can Hurt You



Amber model 4550 Audio Spectrum Display  
\$1,800 US List

Ever had a great mix ruined by disc skipping problems or tape distortion? With today's recording techniques its easy to create a sound spectrum which can cause problems in tape duplication, disc cutting and other media. And your ears don't always tell you - until its too late.

Now, using the Amber 4550 Audio Spectrum Display, you can find out about these potential problems before they hurt you. And you can determine exactly how much correction is required to solve the problem. You see the full audio spectrum displayed on a real time basis. And there are two digital memories that let you store "before" and "after" information.

You can also use the display to see the effects of equalization, compression and microphone placement. Or if you're mixing for the first time in a new environment use it to give you a fast picture of monitor and tape machine performance.

Ask for a demo today.

#### In stock at:

Audiotechniques, Stamford, Connecticut (203) 359 2312  
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Harvey Radio, New York (212) 575 5000  
Milam Audio, South Pekin, Illinois (309) 348 3112  
Studio Supply, Nashville, Tennessee (615) 327 3075  
Westlake Audio, Los Angeles, California (213) 655 0303

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ized United States distributor of Kontakt 61, and a complete line of protection and insulating spray agents.

REGMO DATA CORPORATION, 6992 OXFORD STREET, MINNEAPOLIS, MINN. 55426.

Circle No. 149

### AMPEX / INSTITUTE OF AUDIO RESEARCH SEMINAR . . . .

*continued from page 11*  
school is progressive and has a very well equipped classroom/laboratory sporting Neve, Dolby and Ampex multitrack equipment. The seminars will begin Monday January 13th and run the entire week. Ampex will provide printed seminar materials. There is no fee but registration is limited. To register individuals should contact Frank Rush at Ampex Corp., Hackensack, N.J. 212-736-6116.

### BOOK REVIEWS

#### YOUR INTRODUCTION TO MUSIC/RECORD COPYRIGHT, CONTRACTS & OTHER BUSINESS + LAW PUBLISHED BY SEVEN ARTS PRESS, INC.

Written by Walter E. Hurst and William Storm Hale, this book contains 74 chapters covering AF of M, BMI, Businessman-Artist Relationships, Copyright Assignment, Copyright for Sound Recordings, Entertainer-Producer Negotiations, Deductions from Gross Royalties, Henry Fox Agency, How Can I Get Money from Record Companies, Income Taxes, Interdependence, Lyricist and the Composer, Lyrics, Lead Sheet, Master Producing Companies, Mechanical License Royalty Due Dates, Music, Music Editors and over four dozen additional topics.

Excellent book for the studio owner/engineer who wants to learn more about his customers' business to better understand and be able to fill his customers' needs. It is also for the customer who may want to expand a love of music, some talent, some money, into a successful business career in the entertainment industry. Talent is not enough, business knowledge is required. This book furnishes an excellent introduction to music/record copyright, contracts and other business + law.

This book may be purchased for \$10 from R-e/p, P.O. Box 2287, Hollywood, CA 90028.

#### MODERN RECORDING TECHNIQUES PUBLISHED BY SAMS

Written by Robert E. Runstein and published by Sams, Modern Recording Techniques introduces the reader to the equipment and controls he will encounter in the modern multitrack recording studio in terms of both the operating techniques currently in use and the roles they play in creating the finished product.

The author has written a descriptive book that fills the information gap between recording engineers, record producers, and recording artists. He covers the techniques of pop music recording as well as all aspects of the recording engineer's job. Both presently employed and aspiring recording engineers will appreciate the practical job information that is given. Producers and recording artists will benefit from familiarity with the techniques and equipment they will be using in the studio.

In Chapter 1 the acoustical, mechanical, electrical, and magnetic transformation of a signal from live performance to reproduction from a disc are outlined. Chapter 2 further develops the physical concepts and terminology used in recording as they pertain to human perception of sound waves. The conversion of sound energy to electrical energy by microphones is the topic of Chapter 3.

The following chapters explain magnetic tape recording, signal-processing equipment, consoles, noise-reduction devices, speakers, and monitoring.

Chapter 9 presents the setup, operation techniques, and procedures used in recording, overdubbing, mixing, and sequencing sessions. Chapter 10 covers techniques for interlocking the speeds of several tape machines. The final three chapters discuss automated mixdown, disc cutting and pressing, and quadraphonic disc systems.

Price: \$9.95 (\$11.95 in Canada)  
HOWARD W. SAMS & CO., INC., 4300 WEST 62ND STREET, INDIANAPOLIS, INDIANA 46206.

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Circle No. 164

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**High Intensity** tuned sound reinforcement systems, including narrow band (5Hz) feedback suppression, detailed regenerative response room equalization  $\pm 1$ dB, <15% articulation loss of consonants. 1000's of customized professional products, all shipped prepaid/insured. **Music & Sound Ltd.**, 11 1/2 Old York Rd., Willow Grove, PA 19090  
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 Inventors / Engineers

**FOR SALE:**  
 2 MCI JH-10 2" Tape Decks (Transports only) Complete with Auto Locators \$1000.00 each  
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**One Way Noise Reduction** (10-14dB) for cutting rooms / tape copies; + monitor equalizers at \$75/channel; + free room equalization with purchase of 1/3 octave filters; + 1000's of state of the art studio products, customized - aligned - calibrated - biased, etc. **Music & Sound Ltd.**, 11 1/2 Old York Rd., Willow Grove, PA 19090. (215) 659-9251.  
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**NEW MODELS: AMPEX AG440C** 2-track; servo capstan motor; **SCULLY 280B**; immediate delivery from stock. Used AG440B's.

**Malaco Recording, Jackson, Miss.**  
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**FOR SALE:** New 14" NAB Ampex aluminum flanges have never been removed from original box. Package of 10 - \$8.00 prepaid. **SOUND INVESTMENT CO.**, POB 338, DUNWOODY, GA. 30338.

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  - 1 Ampex 351 - top plate MCI electronics in Scully portable cases two track stereo 7 1/2-15 ips \$1750.00
  - 1 MCI 16 track tape machine with matching 8 track heads and guides - autolocator - IN CONSOLE 15-30 ips \$12,500.00
- CRITERIA RECORDING STUDIOS**  
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 Inventors / Engineers

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Circle No. 151

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- ★ DUAL EQUALIZED REVERB
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- 8 A301 Dolbys with automatic change over built into rack and power supplies — \$8500
  - 4 A301 Dolbys — Each \$850
  - 1 3M model 64 4-track recorder/reproducer with sync line amp cards 15-30 ips — \$4800
  - 1 3M model 64 2-track recorder/reproducer 7½-15 ips — \$2500
  - 1 3M model 64 full-track recorder/reproducer 7½-15 ips — \$2000
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(213) 466-6452

We have a few competitively priced used Revox A77 decks available. These have been completely reconditioned by Revox, are virtually indistinguishable from new and have the standard Revox 90 day warranty for rebuilt machines. Satisfaction guaranteed. One example is an A77 Dolby for \$675 plus shipping. Please write stating your requirements to ESS1, Box 854, Hicksville, N.Y. 11802 (212) 895-9257

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**FOR SALE:** AMPEX 16-track Master Recorder MM1000. Excellent condition! Non-servo 2½ years old. LOW COST FINANCING AVAILABLE! Assume our low interest loan (if you qualify): \$3500 down and \$368 per month for approx. 31 mo. Will accept \$12000 cash. Reason for sale: going 24 track.

STUDIO WEST (CALIFORNIA)  
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118 Small, Grand Prairie, Texas

Scully 280 Electronics, \$350; Scully 4-Channel Playback Electronics, \$575; Altec Graphic EQ, \$295; Spectra Sonics 22-In/8-out remix console, \$3,950; 1 Dolby M-16, \$7,800.

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JBL 5306 mixer with 5308 expander unit mounted in hardwood case. 14 mike inputs with phantom power, new condition, \$1100.  
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Neumann VMS-66 Lathe — compatible with SAF-74 System — WITH:

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- 1 — VG-1 Stereo Cutting Electronics in Rack
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WITH: Individual channel level sets and pan pots; Monitor select for tape, console, feedback and TT; Stereo/Mono switch; Ganged stereo fader for fades; Individual program and prevue VU's with range; Switch 0 to +12; Miniature scope for phase check (MCD transi-scope 300); Waveforms 401B oscillator;

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*relating recording science-to recording art-to recording equipment*

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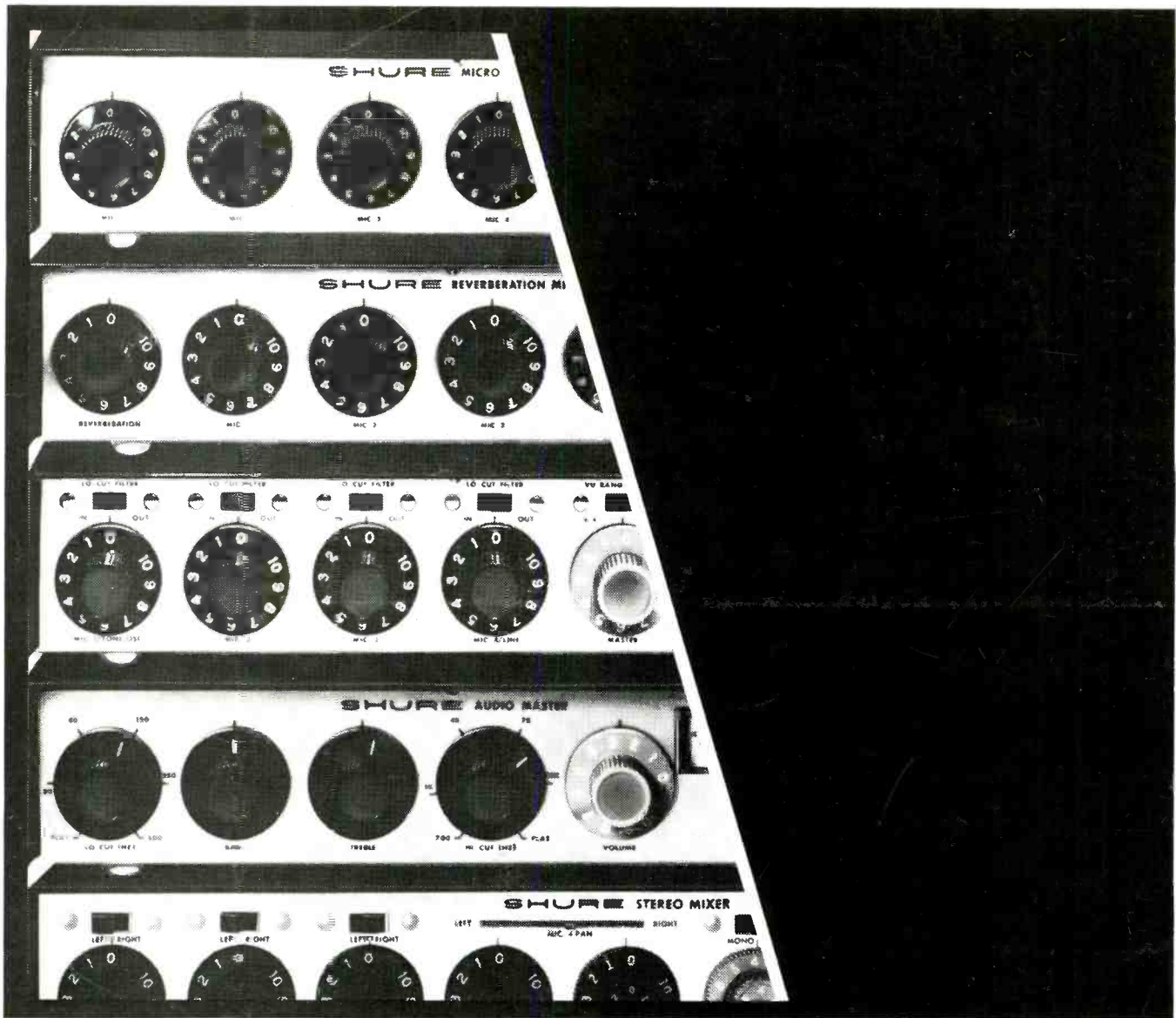
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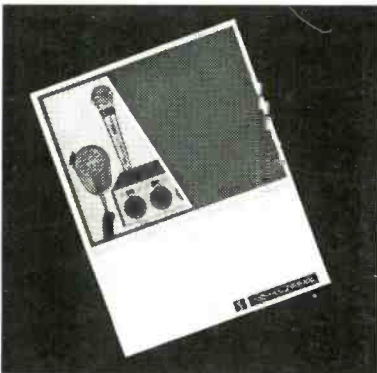
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