February 1985

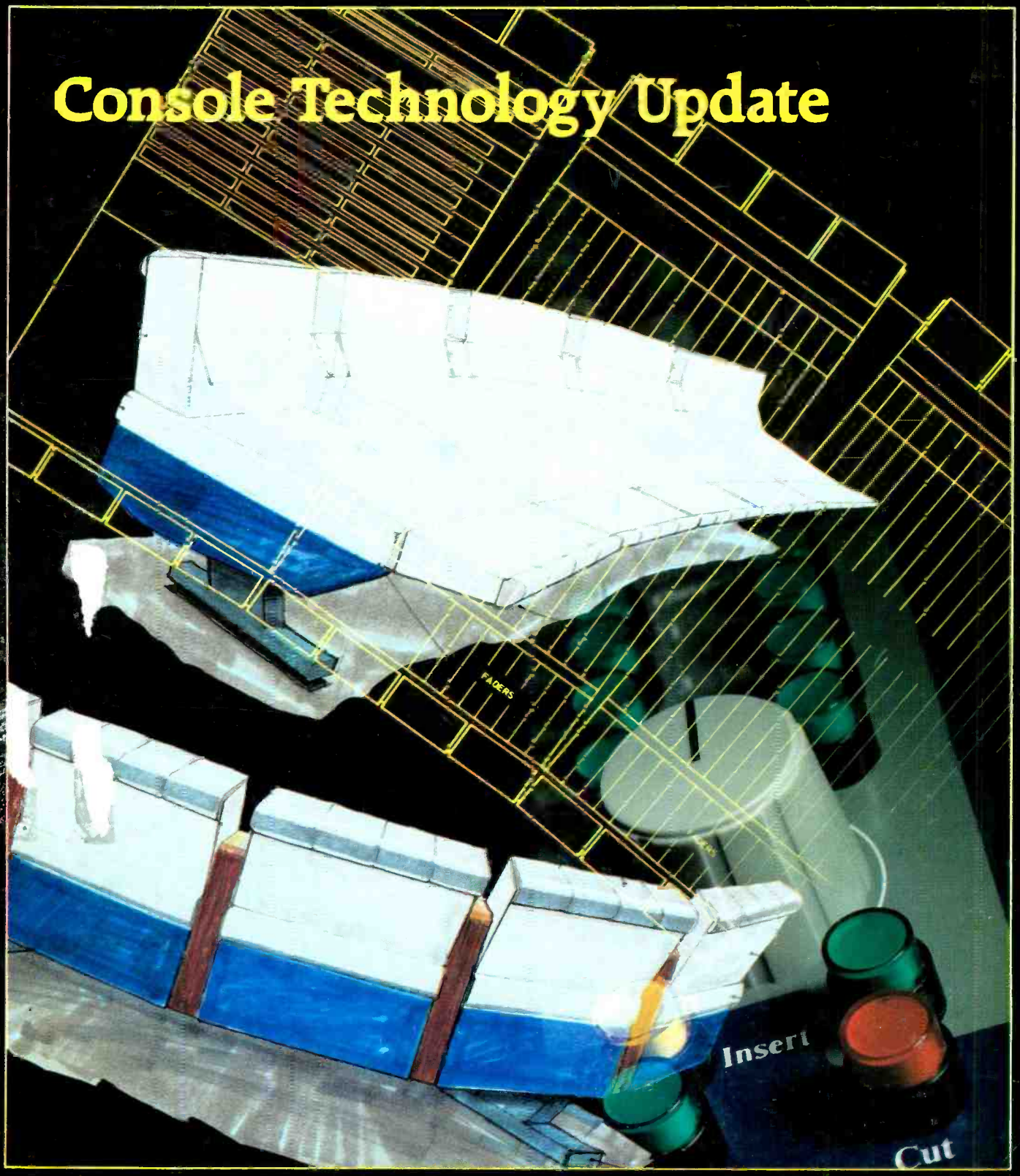
# Recording ENGINEER/PRODUCER

The Applications Magazine for Audio Professionals

$4.00

AN INTERTEC PUBLICATION

## Console Technology Update



# 6. V Series Enhanced Equalization


Freelance recording engineer and producer Mike Bronstein is the choice of established artists like Barry Manilow and talented newcomers D'Molls alike. Working out of Westlake Studios using one of their two Neve V Series 60-input consoles with enhanced EQ, Mike's work is acknowledged as some of L.A.'s best.

"I'm committed to giving my artists the truest sound possible at any given moment in the session. Neve's enhanced EQ is so nice and smooth, so quiet, that it adds brightness without adding noise. If you're boosting 3 dBs at 7K, you're boosting 3 dBs at 7K.

"And the Neve console is so sonically accurate that you now have the flexibility to give your artist, immediately, the things he needs to hear to make every rough mix sound like a finished record. The artist listening can hear every effect, sound or level change in any situation. You can send anything to anywhere at any time."

Enhancements to the Formant Spectrum Equalizer include variable Q on the two mid bands and high and low Q on the upper and lower bands, making it possible to tailor the sound to your precise requirements.

Sound is always tight. There's no unexpected noise, since Q can be switched in and out silently.

The V Series enhanced EQ gives you the most authentic sound possible, when you and your artist insist on it.

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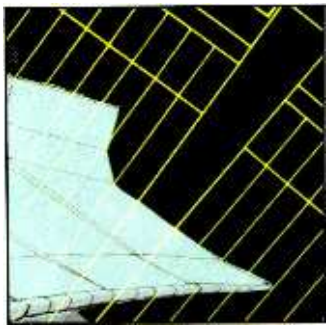




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**◀ On the Cover:**
Artwork courtesy of Focusrite. An artist's rendering of the first Focusrite console 001 scheduled for April delivery to Master Rock Studios, London. For more information on the Focusrite console, see Michael Fay's interview with Rupert Neve of Focusrite on page 50.

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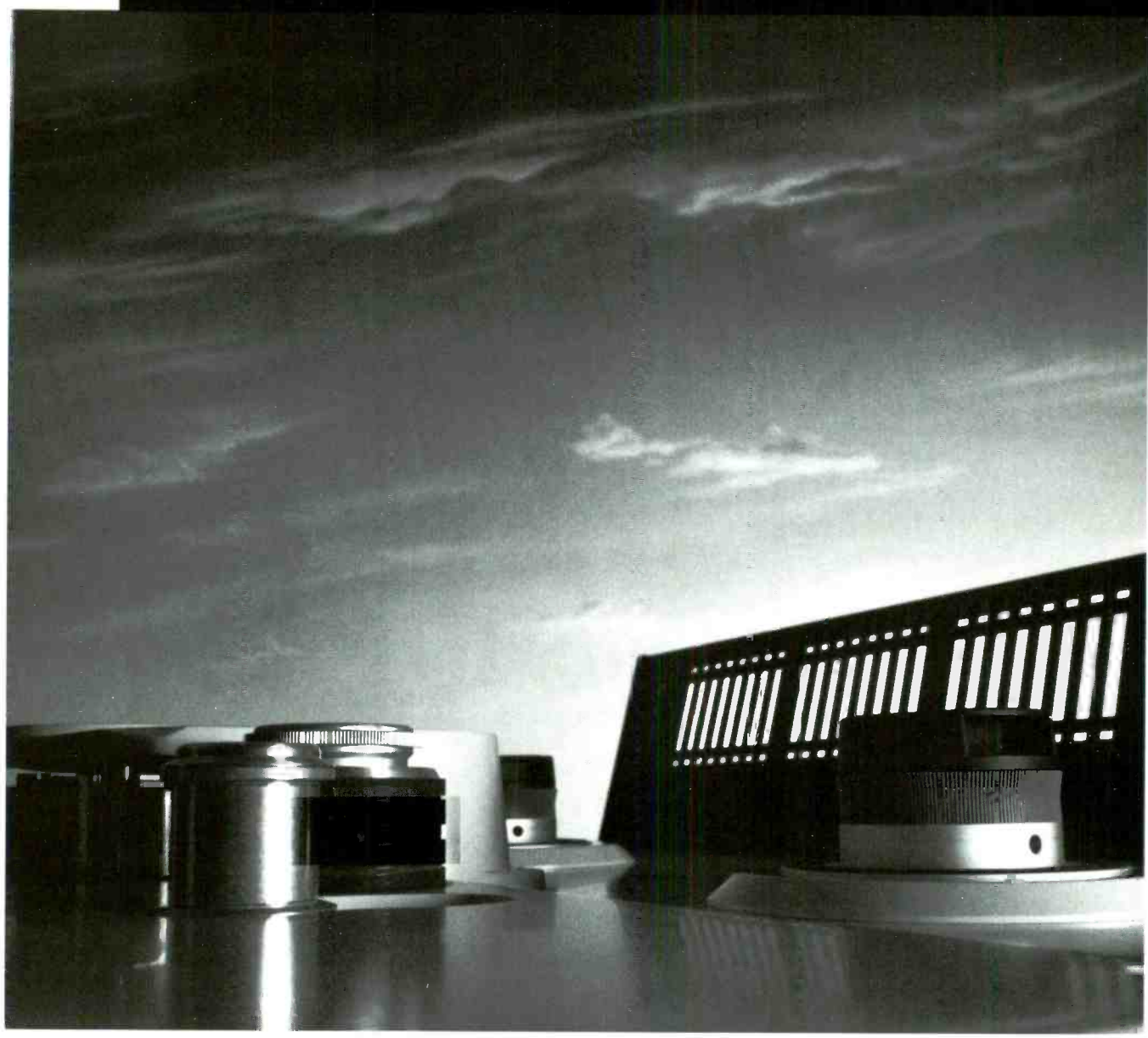



# OTARI'S LANDSCAPE IS BROADER THAN YOU REALIZE...

You probably know us by our audio machines that are used in television, radio, and music recording applications every day, around the world. But it may surprise you to learn that the same company that builds 32 channel digital audio mastering machines also pioneered and developed (with E. I. Dupont de Nemours & Co) the world's only laser-based, high speed video duplicator. And that we also market video and audio tape loaders, and digital audio disk systems.

Our customers also tend to take a broad view. They know that quality products, backed by an engineering support group and a network of regional offices, plus a group of independent sales representatives and dealers who share our commitment to our customers, give them value far beyond initial equipment cost.

So consider the real *cost-of-ownership* in your buy decision. Look for equipment that is less expensive to operate over time and that is designed to support the goals of your business. Realize that when you buy Otari equipment you also "buy" Otari, the company. If you do, we think you'll choose the "Technology You Can Trust."

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# EDITORIAL

## So You Wanna Be An Engineer

This is a test. Please check as many answers as appropriate.

I first became interested in engineering because I:
*A. Didn't want to be a musician all my life.*
*B. Wanted to stay in a field related to music.*
*C. Felt I could do better mixes than those on the radio.*
*D. Thought that with a career in audio I could earn a satisfactory income.*
*E. Thought a potential existed for great success.*
*F. All of the above.*

It wouldn't be a surprise if many of you picked all the above. Professional audio can be an exciting and rewarding career, but it's also one of the most demanding occupations I know. For most, lack of an exciting work environment is not a problem; the difficulty lies in reaping the rewards. The promise of *gold* can be perpetually elusive.

It's time to face a few facts—engineers don't get the credit they deserve. Until they learn to stand up for their just rewards, they will continue to be the unsung and underpaid heroes of modern audio production.

If you haven't already noticed, the engineer is always the first one to arrive in the morning and the last to leave. For those of you who don't have an assistant or intern, *your* start time is at least one hour before the session starts. This is usually not billable time, as it is expected if you want the gig.

When the clients and musicians are ready for lunch they will usually invite you along, but often as not there's work to be done so you won't have time. Now, the people you are working with are usually considerate enough to bring back a sandwich, but it always arrives too late to eat with both hands.

When it comes to breaks, usually the engineer has to "man" the machines for repeated playbacks. Clients don't allow for engineer downtime.

The day is now complete, but the engineer will still be "at it" for at least one more unpaid hour—doing janitorial duty and bookkeeping. Now, it's probably after dark and even if dinner is waiting, it's eaten alone. All you really want to do is sleep—so you can start the cycle again tomorrow.

It often takes 10 years of dedicated effort to become a self-sufficient free-lance studio engineer. Last time I checked, it only took five or six years to get a law degree and around eight to become a doctor. Somewhere along the line, engineers have taken a wrong turn, and it's time to set the course straight. If it takes so much time, experience and dues paying, why does this valuable and creative job pay so poorly? It's the creative carrot. The chance of fame and fortune...or at least the potential exposure to the *famous and fortunate.*

Other than the person paying for the session, the first engineer's job is the most critical. Consider this. Everything that happens before, during and after a recording session has to filter through the engineer. He or she must have total command of the hardware, be the consummate diplomat and interpreter, understand the big picture—be it musical or otherwise—have super-human powers of concentration and endurance, and oftentimes produce the project without appearing to do so. Of course all this is in addition to having great ears, knowing about all the latest audio products and helping the clients' friend who wants to purchase a new stereo system. Give me a break.

If a $50-an-hour musician makes a mistake, you roll back and punch in the corrections. If the copyist or arranger makes a mistake, it's usually caught by a musician or is musically obvious. The producer is paying the bill and is allowed to make mistakes, but, should the engineer lose a "take"... it's a serious problem. Which is why clients don't want just anybody sitting at the console. Lose one too many, and you'll be looking for a new career.

Although $20 an hour translates to $800 a week and $40,000 a year, most engineers don't work 50- or 40-hour weeks. Their net income can be considerably less, making it difficult to raise a family if you're the sole income source, and almost impossible to qualify for a home loan.

Most free-lancers are provided with no medical, dental or life insurance; retirement or profit-sharing; paid time off; and must pay self-employment tax. To provide these benefits for yourself costs about $4,000 to $5,000 a year. Yet the lure to be an "independent" is irresistible.

And being on staff doesn't really solve the problem. There may be financial advantages, but often there are restrictive policies in the company that inhibit your true potential. Again, the thinking is, "There are plenty more where you came from."

Are there any solutions? Consider these options:

**1.** The rates for qualified "first" engineers should be no less than 20% below the base rate of the studio musicians being recorded. As an example, $40 an hour when working with $50-an-hour musicians. A volume discount is appropriate, and 20% is fair.

**2.** When working on an album for major distribution, one point or 10% of the production deal should be negotiated by and for the engineer. If anyone earns it, it's the engineer.

**3.** When working on an album demo, a contract should be signed to guarantee participation if the act gets a deal. A buy-out clause is appropriate (they pay you), in case of conflicts.

**4.** If the job is a staff position, many perks could be negotiated, such as discount studio time, increased production responsibilities, a budget for new equipment (to be used at your discretion), trips to trade shows, published engineering and production credits, and profit-sharing.

**5.** If all else fails, perhaps immediate payment upon completion of a project justifies a discount rate.

The most important thing to remember is this: If you have to settle for something less than the cold, hard cash you deserve, start looking for every possible point of negotiation.

There is one critical point to remember when negotiating. Never, ever, lose your cool, get angry, or show any anxiety while confronting a client or employer. If you do, you've just lost.

Because this is a supply-and-demand situation, most engineers are afraid that if they raise their rates, their clients will call someone else for the job. This may be true, but only to a point. In my experience, a good client recognizes the value of a good engineer and will pay a premium for constancy. You are in a valuable negotiating position.

And what do you do after you've mastered the fine art of engineering? You officially become a producer—what else!

**Michael Fay**
**Editor**

This is the mixing console that will cause a revolution in 24 track studios.

The world's first Dual Mode mixing console.

With the advanced features and performance of a desk you'd expect to cost a great deal more than it actually does, it's a remarkable achievement. Take Dual Mode.

When you record with the TS12, its in-line monitoring means you create a control room mix on the main faders.

In mixdown this becomes the basis for your master mix. Saving time and helping you keep a train of thought as to how the final mix will sound.

Unlike other in-line desks, though, the TS12 also allows true stereo subgrouping on long-throw group faders.

In this mode the routing matrix offers either six stereo groups or four extra auxiliary sends – totalling ten sends – plus four stereo groups.

No other console in the world provides such versatility.

The TS12 is an open-ended investment, with optional disc-based SMPTE automation for faders, mutes, EQ in/out and auxiliary on/off. Again, at the price it's unique.

And fittingly, audio performance is superb.

Recent Soundcraft advances in summing amp technology, and in grounding and decoupling systems, make the TS12 one of the cleanest and quietest consoles ever.

The mic amplifiers, a critical factor in console quality, create less than 0.01% distortion at 10kHz at 70dB of gain. (Easily exceeding 16-bit digital specifications.)

Standard features are impressive, to say the least. Six auxilliary sends, seven stereo line inputs or effects returns, a 'musician friendly' headphone mix, an extensive 19" metal frame patchbay – and the option to create a massive total of 102 inputs.

Quite a line-up.

Attention to detail is equally stringent with modular PCBs, no dual concentrics and a clear, logical layout that belies the sophistication inside.

But the most remarkable feature of the new TS12 is without doubt the price.

We suggest you call us today to find out just how remarkable.

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# THE PRICE.

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TS12

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# LETTERS

## Mic pre-amp, cont.

*From: Todd R. Lockwood, White Crow Audio, Burlington, VT.*

I was surprised to find that the September article on stand-alone mic pre-amps didn't mention the John Hardy M-1, which has been advertised in *RE/P* for awhile now. Based on the ad, we purchased one of the M-1 units, and I have to say, it is one of the finest pieces of gear I have seen from an American audio manufacturer. The workmanship is on the order of a Nagra.

Performance-wise, the M-1 is probably similar to the Jensen unit, since they both use the 990 op-amp in a servo configuration. However, the M-1 has a number of features none of the units tested have, such as elaborate LED meter stacks with both VU and peak modes. Every screw on the Hardy unit is impressive.

Perhaps the Hardy M-1 can be included in future testing.

## Better film sound

*From: Rick Markey, assistant chief engineer, WGAL-TV, Lancaster, PA.*

I enjoyed Larry Blake's comments in his November 1987 "Film Sound Today" column, but if he intends to promote better film sound, the place to start is with the theater owner/operator.

Maybe on the West Coast there are a lot of "first-run" stereo-equipped theaters, but out here in the backwoods of Pennsylvania they are scarcer than unicorn horns! We're blessed with one Dolby-equipped theater in our area. It is a former 70mm wide-screen theater that was split into two smaller theaters. You had better get there early in the run before the print gets scratched and noisy. Everywhere else we have twins, triplexes, quads and mono sound that is usually not loud enough.

It is possible to take a 2-hour drive to Philadelphia and see a clean print on a fairly large screen, hear Dolby stereo and pay a cheaper admission price, but the 4-hour round trip often puts a damper on catching the 7 p.m. show. I would rather see fewer theaters with larger screens and better sound than all these tiny theaters struggling to make a buck.

Stereo sound for home TV viewers is a reality and so is Dolby Surround if you have the money and the space. The only drawback is the small screen, but that is more than compensated for by the lack of rude and noisy patrons.

HDTV is just around the corner. If the movie industry doesn't wise up and do something about the sad state of our theaters, going to the movies will become a thing of the past.

Maybe you should tell the directors and producers to mix their products with living room sound in mind because, as far as I'm concerned, more stereo is heard in the home than the theater. I hope the present trend toward small theaters doesn't continue, because "Star Wars" just isn't the same on a 19-inch screen.

## Wireless mic compatibility

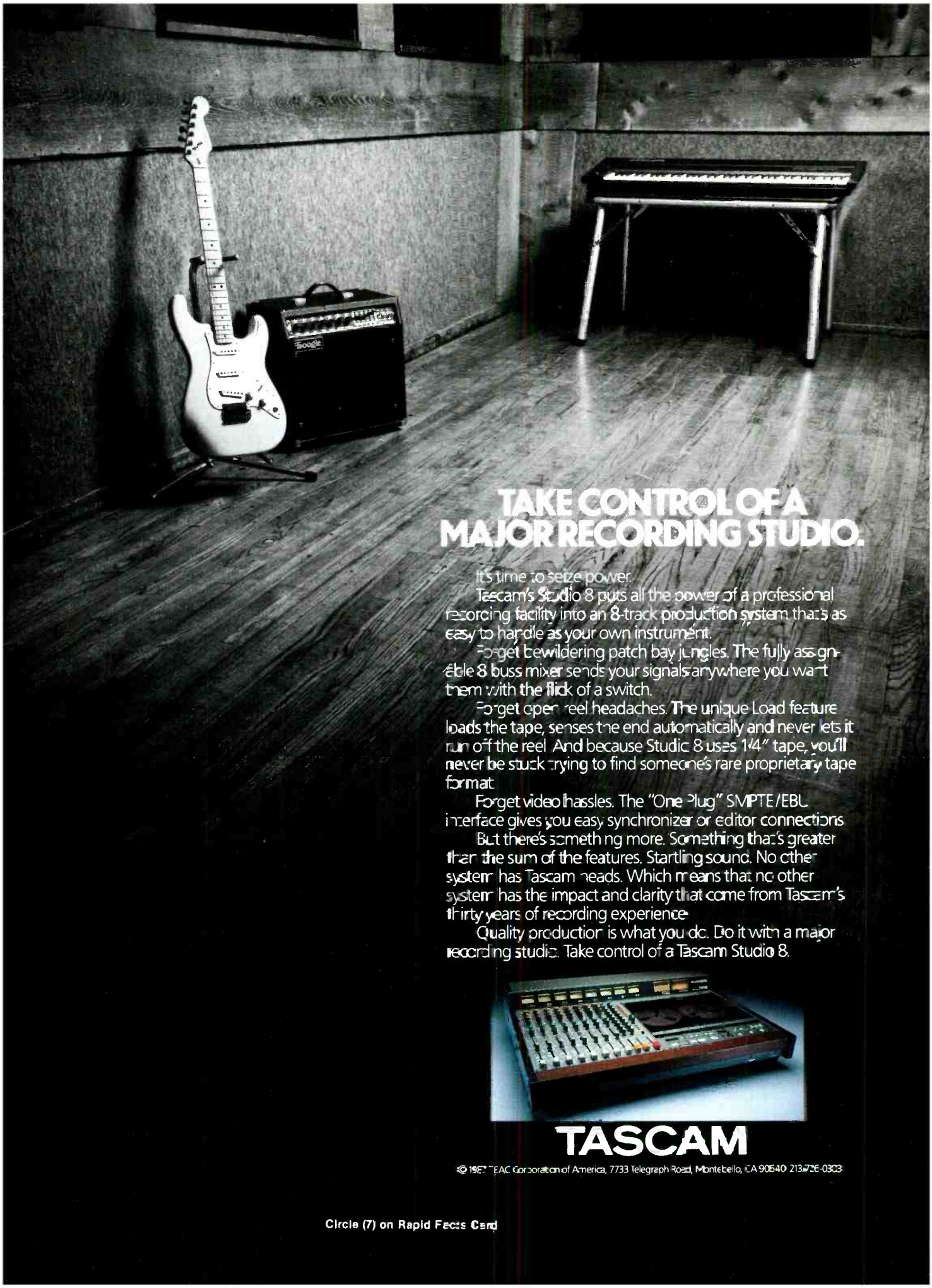
*From: Dale D. Dudley, Dynamic Sound Company, Las Vegas, NV.*

I've just finished reading Ken Fasen's article in the November 1987 issue about wireless microphone compatibility. I knew there were computer programs available to calculate safe frequencies, but I still don't know where to find them. He mentions "public databases" and "computer bulletin boards." The ones I've frequented have no such programs. Could you tell me exactly where I might find such programs?

In addition to owning Dynamic Sound Company, I am the head sound man for the Riviera Hotel in Las Vegas and am forced to use wireless mics extensively. We have 19 wireless mics in use in three different showrooms each evening, nine in my room alone. I must use duplicate frequencies, and luckily the other rooms are more than 1,000 feet away. So far, no problems.

I'm sure that this seat-of-the-pants designing will catch me one of these times (they just asked for another wireless here in my room!), and a computer program to run on my IBM would be a great help.

RE/P



# TAKE CONTROL OF A MAJOR RECORDING STUDIO.

It's time to seize power.

Tascam's Studio 8 puts all the power of a professional recording facility into an 8-track production system that's as easy to handle as your own instrument.

Forget bewildering patch bay jungles. The fully assignable 8 buss mixer sends your signals anywhere you want them with the flick of a switch.

Forget open reel headaches. The unique Load feature loads the tape, senses the end automatically and never lets it run off the reel. And because Studio 8 uses 1/4" tape, you'll never be stuck trying to find someone's rare proprietary tape format.

Forget video hassles. The "One Plug" SMPTE/EBU interface gives you easy synchronizer or editor connections.

But there's something more. Something that's greater than the sum of the features. Startling sound. No other system has Tascam heads. Which means that no other system has the impact and clarity that come from Tascam's thirty years of recording experience.

Quality production is what you do. Do it with a major recording studio. Take control of a Tascam Studio 8.



TASCAM



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# NEWS

### Record Plant sells interest to U.K. company

Record Plant Recording Studios, Los Angeles, has sold 50% of its operation to Chrysalis Group PLC, a U.K.-based records, music and entertainment company. The sale was finalized on Dec. 8.

Chris Stone, former owner, remains as president of the new division, now officially known as "Record Plant, a Chrysalis Group PLC company." Stone said that the move will allow Record Plant to extend into video and film post-production work.

Chrysalis made a similar move in 1974, when it acquired interest in AIR Studios in London, co-owned by George Martin and John Burgess.

### Yamaha opens R&D center

Designed to facilitate communication between itself and its customers, Yamaha's Communication Center in mid-town Manhattan was unveiled in early December, with an opening scheduled early this year.

Comprised of two floors, the center has a showroom open to the public to display the company's line of instruments and pro audio/video products, and an R&D center, available by invitation only.

Acoustically sealed performance areas allow new and prototype products to be tested. Included in the areas are a pro products area and an electronic keyboard center.

### College opens electronic music studio

Said to be one of the world's most sophisticated studio teaching facilities at a university, the Bregman Electronic Music Studio at Dartmouth College in Hanover, NH, features 16 individual computer/keyboard workstations, networked to a New England Digital Synclavier and Direct-to-Disk recorder.

The facility allows students to interact with the host computer, as well as with the professor and other students, allowing more hands-on experience.

According to NED, Synclaviers are installed at more than 50 colleges, universities and music schools around the world.

### News notes

Convention attendance: Both the **Audio Engineering Society** and the **Society of Motion Picture and Television Engineers** have announced attendance records for their fall conventions. A total of 13,266 people attended the 83rd AES Convention on Oct. 16-19 in New York. At the 129th SMPTE Technical Conference and Equipment Exhibit on Oct. 31-Nov. 4 in Los Angeles, attendance was 17,056.

**Aphex Systems** will supply the Compellor compressor/levler/limiter for use at the Summer Olympics in Seoul, South Korea.

RE/P

# NOTHING REFRESHES A MIX LIKE A SIX PACK of MIDIVERB II's


Mixing is no picnic. Especially when you're in the hot seat. Consider the pressure. The fatigue. The late nights. And all the agonizing over what outboard to use on what tracks.

If you've ever sweated out a mix thirsting for more effects, the Alesis MIDIVERB II is pure refreshment. Whether it's the perfect room simulation for the hi-hat, or the perfect chorus texture for a last minute synth overdub, MIDIVERB II delivers. And, at an astonishing $269, it's no wonder pro engineers are using multiple units to strenghten their processing 'front line.

With 16 bit linear PCM, 15K bandwidth, and tons of musical character, MIDIVERB II is the #1 selling signal processor in the business.* That'll only surprise you if you've never used it. Those who have used it love the sound so much they can't resist buying several more. With 99 programs — 50 reverbs, plus choruses, flanges, delays, and innovative special effects — Midiverb II redefines the meaning of cost-effectiveness.

So after today's mix, you deserve something refreshing.

Ask your Alesis dealer to break open a sixpack of MIDIVERB II's. Your next mix could be a picnic.

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**LOS ANGELES**: Alesis Corp. P.O. Box 3908, Los Angeles, CA 90078 **LONDON**: 6, Letchworth Business Center, Avenue One, Letchworth, Hertfordshire SG6 HF

*Based on *Music and Sound Retailer's* monthly survey of 1,200 audio dealers

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# SPARS ON-LINE

**By Shirley Kaye**

# A Healthy Outlook

Since before the birth of rock and roll, musicians have been described variously as stressed out, spaced out, freaked out, way out or burned out. The rigors of the music business surely have taken their toll, and sadly, the casualties are usually seen as the victims of unavoidable circumstances. Modern medicine has created specialized fields for the treatment of athletes, veterans and astronauts—and for those interested, there is the growing field of Performing Arts Medicine.

Space limits a comprehensive study of medical practice devoted to the performing arts, but let's focus on a few points that might benefit those who feel the stress of the music industry.

Modern medicine is just beginning to understand the numerous dangers to both physical and emotional health in the music business. We know a lot about tennis elbow, but what do we know of the damage to the fingers and joints of a percussionist, pianist or string player? Is there more to understand about the degradation of hearing suffered by producers, engineers and vocalists? Is there a danger of damage to the eye's retina from strobes, lasers and high-intensity light shows? What are the emotional effects of spending 8-12 hours a day in darkened rooms without windows—never seeing daylight or feeling the sunshine?

Physical pain plays a part in the life of everyone, but it takes specific forms in the life of a musician. It may be caused by standing or sitting for long hours in a particularly fatiguing position, or from the development of special muscle tissue used for the playing of certain instruments. The results might be sore limbs, aching fingers, stiff necks, leg cramps or what is known as over-use (injury) syndrome.

Over-use syndrome, common to musicians, is characterized by persistent pain and tenderness in the muscles and joint ligaments of the upper limbs as a result of excessive use. In advanced cases there may be decided weakness and loss of response and control in the affected muscle groups.

Over-use syndrome typically appears among tertiary music students when their practice load is increased. In a preliminary study conducted at seven Australian music schools, the minimum prevalence of the condition was found to be 9.3%. In another study at two music schools; where conditions were more controlled, the incidence was found to range from 13% to 21%.

**Physical pain takes specific forms in the life of a musician.**

The factors leading to over-use (injury) syndrome may be affected by the three following points.

1. The genetic factor or some vulnerability that cannot be altered.
2. The technique, which may be influenced by instruction, that improves "energy efficiency."
3. The intensity of practice, which is entirely within our control.

Psychological problems arising from the over-use syndrome appear to occur as a reaction to the condition rather than as a causal factor. How many studio dwellers are really aware of the number of hours they spend sitting in the dimly lit, smoke-filled control room without exposure to the daylight and how that plays a role in mental well-being?

Damage to the extremely sensitive nerve endings used for hearing can occur without warning. High acoustic levels at musical performances can be hazardous to both the audience and the musicians. In the recording studio, engineers and producers may push the playback levels to excrutiating limits in order to identify every nuance and then seriously diminish their ability to listen at normal volumes.

Wind instrument players must be wary of damage to the dental structure or to the sensitive tissues of lips and inner mouth.

Vocalists experience unusual stress and may develop physical problems such as polyps on the vocal chords or emotional problems from the fear of not being able to perform at peak levels.

Long periods of darkness have been found to evoke depression. Debilitating fatigue can come from long hours spent in poorly lit and inadequately ventilated control rooms. In many cases, the emotional side effects are temporarily treated with alcohol, mood-altering drugs or stimulants. The "burnout" can be devastating, halting a promising career dead in the tracks.

We enthusiastically devote our precious time and research to the perfection of the technology, but perhaps it's time we channeled some of our resources to the understanding and improvement of the workplace. Let's investigate the health aspects of studio design, instrument design and the overall environment of the music industry.

In New York, Cleveland, Boston, Chicago, Denver and Miami, there are physicians and clinics ready to treat physical and emotional problems encountered onstage and in the studio. New technology such as computerized thermography is used to measure the body's infrared heat emissions to pinpoint the sources of pain and injury. Let's share the knowledge and raise the health consciousness of the music community. This talent must be nurtured in many ways for continued productivity.

The greatest initial obstacle is our natural resistance to change, and a feeling that there are inherent and unavoidable dangers. Our first step must be a reevaluation of our perceptions of the music business and the cliches we have grown to both love and hate. Since we share the problems, we should also share in the solutions.

As executive director of SPARS, I hope that our organization can be a catalyst in creating a healthier industry. For those interested, we have a list of clinics and doctors who are working on the problems right now. We are prepared to organize and conduct seminars if the request is made, and we welcome your interest and your continued support.

The SPARS office is located at 4300 10th Ave. North, Lake Worth, FL 33461; 305-641-6648. RE/P

Shirley Kaye is the executive director of SPARS.

# Large scale concert sound reinforcement has a smaller future.

# MT-4

## Concert Sound System

## 50,000-Watt Array

### *Manifold Technology™ delivers...twice the output in half the space!*

Concert sound is getting smaller. System size, that is, not tour dollars! In fact, the high-level sound market is stronger than ever. But high transportation and setup costs are forcing lighter, smaller and more efficient speaker systems. While audiences demand better fidelity.

That's why we've made Manifold Technology *systems twice as loud in half the space.* The two-box, 4-way active MT-4 uses 4 (four!) drivers in each bandpass for unequaled acoustic output. Now, your system can be one quarter the size or four times as loud compared to other designs.

The MTA-42 Manifold Technology adapter combines four compression drivers without added distortion. And without the phase cancellations of Y-adapters! That's 4 supertweeter and 4 upper-midrange compression drivers on identical 60° × 40° constant-directivity horns. To complete the MTH-4 "high" box, four DL10X woofers use proprietary phase plugs to provide seamless vocals from 160-1600 Hz. The result is flawless 138-dB midbass at 1 meter!

The MTL-4 "low" box combines four 18-inch woofers in an ultra compact 36″ × 36″ × 30″ cabinet. More efficient than horn-loaded subwoofers, Manifold Technology design prevents woofer "bottoming" even at 40 Hz with 1,500 watts input!

### *High output plus high fidelity*

To produce high-level sound, most concert systems aim many horns at the same seating area Unfortunately, this approach causes peaky frequency response, decreased sensitivity and ragged coverage patterns. With four drivers on each horn, a large-scale MT-4 system has fewer independent sources. For fewer phase-cancellation prob ems. Frequency response is smoother, sensitivity increased, and coverage perfectly constant.

### *A flying system that's second to none*

MT-4 cabinets are optionally equipped with a unique two-point flying system that allows true point-source arrays. Tilt angle adjustment is easy because track positions are pre-engineered for popular array configurations. Trial-and-error guesswork is a thing of the past. Nothing is as easy as an MT-4.

You don't have to wait for the system of the future. It's here now! For a free MT-4 brochure, see your EV Professional Audio Dealer or write: Electro-Voice, Inc., Dept. REP-4, 600 Cecil St., Buchanan, MI 49107.

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EV®

a MARK IV company

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# MANAGING MIDI

By Paul D. Lehrman

# Now Computers Owe Us Something

Reading through a book on computer music written not very long ago by two university professors, I had to chuckle at how far we've come in just the last couple of years. So many of us now take computers for granted that it's instructive, and humbling, to realize that life was not always so easy.

When I first got involved in using computers for musical purposes, the way you did a piece was you went to the campus computer center (no, you didn't have a computer in your home at the time—or even a terminal for that matter) with two or three boxes of punch cards under your arms. One box contained the music language—music was such a low priority in the eyes of data-processing authorities at most universities that they wouldn't even give you a reel of computer tape to store the damn thing on.

The rest of the cards made up your piece, or at least a segment of it. The cards contained individual instructions, like "11 0 17 262 20000," which if you were to be fluent in the medium, had to have the same meaning to you as "play middle C for a half note." You fed the cards into a reader (a terminal? I'm sorry, those are all reserved for the engineering students...), hoping they'd all go through successfully. Then you'd wait.

Some time later, if you didn't make any mistakes, and none of your cards had picked up a particle of dust, you'd get a little printout in your mailbox (if you qualified for a mailbox—if not, you just looked through the general output bin) telling you your piece had compiled. One card out of order or with a creased edge, and you'd get a 40-page core dump that told you absolutely nothing except that you'd wasted another 14 seconds of expensive CPU time.

Assuming all was well, your output would be sent to some device located many miles away known as "the converter," where the digital data would be magically transformed into audio signals on tape. Several days later, assuming the person who operated the converter wasn't on vacation, the audiotape, all 12 seconds of it, would be in your hot little hands. Finally, you'd know that a piece based on the never-repeating random digits of $\pi$ got very boring, very fast.

**We now take computers for granted, but life wasn't always so easy.**

No wonder that computer music was such an esoteric field for so many years—anyone who survived in it had to be equal parts Gandhi and Don Quixote. Developments like new music languages, which used commands like "p4 no d4/e/fs/g" instead of pure number lists, were cause for major celebrations, and composers would spend months coaxing a computer into performing pieces that a third-grade clarinetist could master in a half-hour.

Yes, a lot has changed. But, in some circles, not as much as you might think. Computers still have to deal with numbers, so the use of numbers to describe musical events is still with us. MIDI, of course, is nothing more than a string of numbers, and the parameters that define a synthesizer voice or the bytes that define a sampled sound are also just numbers. Assuming the system you are using to capture a sound or a performance has enough resolution, or bandwidth, numbers can certainly be an accurate, repeatable way of describing music.

But are numbers the best way for human beings to deal with music? To be more specific, are sequencing and editing programs that present lists of numbers and MIDI events the best we can do under the current state of the art?

I think the answer is no. Numbers are great for getting down and dirty with the data, the way an oscilloscope is great for examining what's going on in an analog or digital signal chain. But you wouldn't want to monitor a mix with only a scope, so why would you want to edit a sequence with just a list of numbers in front of you?

Today's microcomputers have graphics, color, touchscreens, mice, light and graphics pens, and a host of other features designed to humanize them, to make them easier and more intuitive to use. Software already exists (although not necessarily on the professional level) that shows music as lines, shapes, colors, objects or in many different ways that work much better as analogues to the musical events themselves than a list of numbers ever can.

Sure, there will always be a need to look at and manipulate pure data, but to consider that as the primary mode of displaying the music makes about as much sense as notating a Beethoven symphony as a series of moment-to-moment frequency spectra. It's accurate, it's reproducible, but no one would ever be able to make any artistic use of it.

Rather than continuing to develop ways of cramming more and more data onto a computer screen, or devising fancier arithmetic functions for making bits of sequences automatically jump through hoops, programmers might do well to concentrate more on looking at novel ways to present musical data in a non-linear, non-numeric fashion, taking advantage of all the new, human qualities today's computers have to offer.

Perhaps as important, while they are designing new interfaces, programmers should take the opportunity to leave their programs as "open" as possible, so that users can do some of the work themselves, configuring and customizing the program to do what they need to do, in a way that makes them feel most comfortable.

After all the years in which we have been slaves to the ways computers think, the machines now owe us something. What that is, is the freedom to work the way *we* think, and to allow us to come up with our own unique ways of doing things. Then computers will become the true tools for creative expression they deserve to be.

RE/P

Paul Lehrman is *RE/P*'s electronic music consulting editor and is a Boston-based electronic musician, producer and free-lance writer.


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# The Integration of Large-Scale Studio Systems

**Just as it is possible to develop an intuitive desktop-simulation environment for the Macintosh—it should also be possible to develop a studio environment for each stage in the studio process.**

By Richard G. Elen

Today the sophistication of recording equipment is growing rapidly, especially where consoles are concerned. They are also becoming larger—and heavier! Yet never before has there been such a golden opportunity for studio hardware designers to bring together the many functions of a recording environment. In this article Richard Elen suggests that not only can these functions be brought together but they can—through proper integration of hardware and software—be simplified—if not internally, then at least operationally.

We are used to the idea of bigger and better recording consoles. The trend toward increased sophistication has been going on for a good many years. There has been a need for greater numbers of input channels and track monitors, obviously, but this is primarily a quantitative rather

Richard G. Elen is a recording engineer and producer specializing in music library material. His company, Creative Technology Associates, specializes in the application of computers in music and communications.


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than qualitative change—it's more of the same. More important have been developments like the digitally controlled analog board, centralized routing and control, assignability, and the incorporation of sophisticated machine control linked to time code via software.

Now a whole host of other developments are presenting themselves, and it looks as though it will be possible, sooner or later, to combine into a single system the requirements for multitrack recording; sequencing and editing systems; the multitrack recorder; and of course, the facilities of a mixing console.

### The recording system

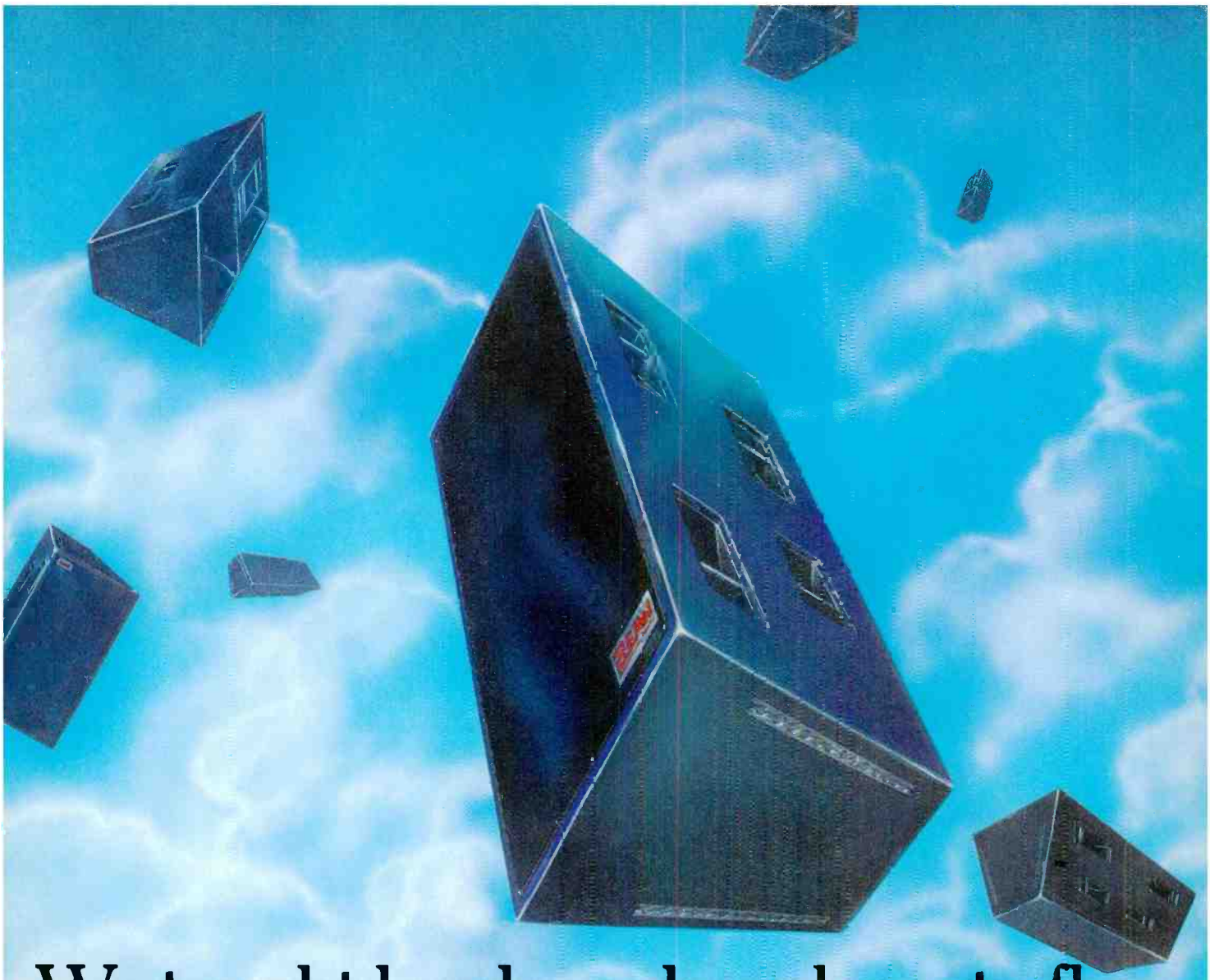
A primary requirement, it seems, is the ability to reorganize the recording system, not into its former hardware components—tape machines, consoles, and so on—but into a new set of functional groups. Fundamentally, these groups consist of a control surface, signal processing, control computer, and storage (whether it be tape, disk memory, or a combination).

Large consoles have always created acoustic problems in the studio. They represent large volumes (generally of sound reflecting substance), they get in the way of the monitors, and they take up a lot of floor space. It is not surprising, then, that the idea of separating the console control surface and the audio processing system emerged.

To begin with, the only element you really need to see in the control room is the control surface, everything else can be banished to the machine room. Indeed, one such room could well house the signal processing, computing and storage requirements of an entire studio complex.

The idea of digitally controlling analog signals was probably first suggested, several years ago, by Richard Swettenham, one of Britain's leading console designers of the '70s. The concept was already gaining ground, although at the time the majority of "remote control" systems required control voltages fed to VCAs. He proposed that the signal processing rack be linked to a control surface by digital signals, not unlike a computer terminal connecting to a mainframe, and would consist of little more than a serial data link between the two units—one in the control room and one in the machine room. When you adjusted a control, the command would be fed down the link and something in the rack was tweaked.

The obvious extension of this idea applied to automation. It made sense to be able to unplug the link between the controls and the rack to insert a computer system that could memorize fader movement, as if manually performed by the



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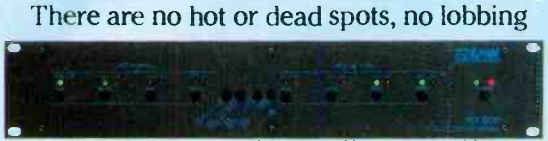

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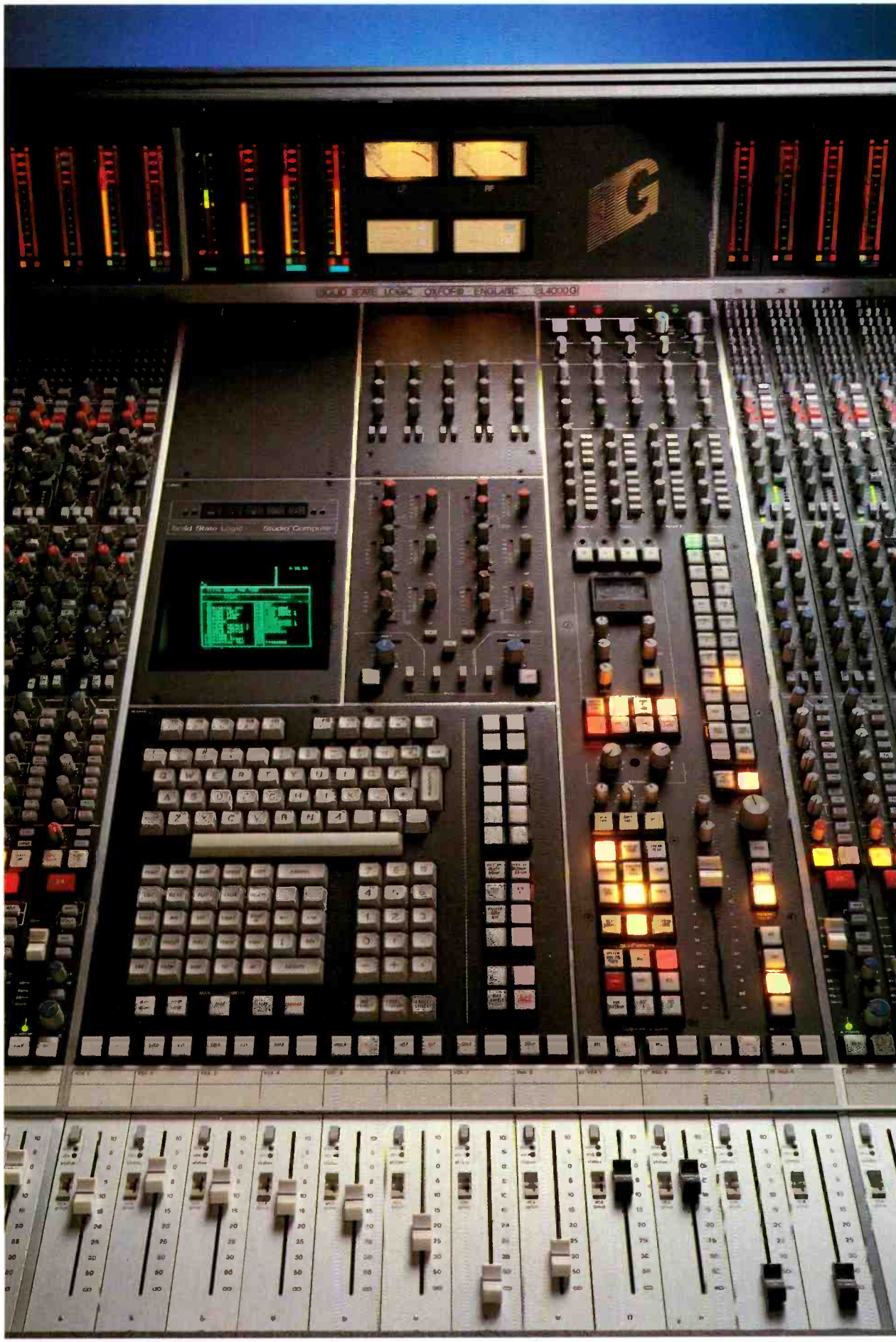

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engineer. If MIDI had been around at the time, it would have been an ideal method of achieving this goal. Indeed, the configuration of many MIDI automation systems resemble this approach.

Consoles with separate control and processing systems were produced in the 1970 s. An installation for Capital Radio in London, based on original designs by Swettenham's Helios Electronics, carried out this scheme although the implementation was perhaps not as elegant as it might have been.

Because of the vast technical requirements of first-generation digital signal processing, and its resulting size and noise, separating the control surface from the processor was a logical move for Neve when it introduced the original DSP console. With a digitally controlled analog console on the other hand, the electronics are small enough to go either inside or outside. Traditionally recording consoles have been self-contained units. SSL, Harrison with the Series Ten and Trident with the Di-An all follow this course. Centralization of facilities in this way brings obvious cost benefits and makes certain aspects of the design easier, but tends to produce the large, heavy consoles referred to earlier.

At the moment, a console with assignability and central control facilities will be less expensive if built as one package, than if split into a control surface and multiple processing racks. But, as digital signal processing becomes more affordable this will change. When we start asking a large-scale studio system to integrate a number of functions—for example recording and editing in addition to mixing—it becomes both undesirable and impractical to try and stick everything into one box in the control room.

When it comes to integrated studio systems—specifically those incorporating digital audio mixing and recording/editing—the engineers at Solid State Logic are already making a name for themselves without having ever introduced a product. Their Digital Studio System is not expected just yet, but their ideas make plenty of sense to a layman (like me, as far as the intricacies of digital audio design are concerned). They recognize that not only must the system be broken down into its functional parts, attention must also be paid to the relative complexity of those parts. Because for different applications, there are different requirements.

Both digital recording and digital mixing systems need signal processing, storage, a front panel, and a control computer. In the case of the recording system, the required storage capacity is large, the front panel is simple, and the signal processing is limited. For a mixing system, the storage requirement is small, the amount of signal processing is great, and the control surface must be relatively complex.

If you throw the two facilities together and integrate them into the same system, you end up needing a lot of everything. This may appear obvious, however it isn't as easy to accomplish as it may seem. There must be sufficient capacity in each area for both applications. Merely providing computing power, storage space and a large control surface does not ensure the capabilities are used efficiently, or that anyone can afford the resulting system.

### Control surfaces

There is a fundamental difference in control surface approach between the systems that have been designed as hard-disk based digital audio workstations like the AudioFile, Lexicon's Opus and Digital Audio Research's Soundstation II, and those which began life as musical instruments such as New England Digital's Synclavier or the CMI from Fairlight. Something that was designed as a musical instrument may not offer the best control surface for a recording system, and certainly not for a mixing console. Fairlight has redressed the balance, in a sense, with the introduction of the MFX system, which centers on both new software and a control surface for a film and video post-production system. The MFX does not need a music keyboard (although you can still use the system for directly musical applications simply by plugging it back in). Also NED has developed it's Direct to Disk recorder as a stand-alone unit.

The disadvantage a sampler-derived system may have is the lack of digital signal processing. There may be some "left over" from the days of using the system as a synthesizer, but most likely there will not be the kind of facilities expected of a mixing console. In particular it's unlikely to have full EQ, and while it will be possible to adjust levels, this may have to be done one channel at a time. Paradoxically, fader adjustments are one of the very few things we do in parallel on a mixing console. Therefore the real problem, and the primary limitation to being all things to all users, lies in the user interfaces of these systems.

### Front panels

Look at the front panel of the Soundstation II or an AudioFile and you will see a panel that is specially designed to do a certain job, in this case to record, edit and play back digital audio.

Look at a Fairlight MFX keyboard and you see a front panel dedicated to post-production. Look at an SSL 4000G console control surface and you see a mixing board with automation, and consider a Synclavier keyboard—it is designed for making music. These are all specialized control surfaces designed to do one group of things well. It may be necessary to make fundamental changes in the control surface to facilitate a new task in an ergonomic, intuitive way. Otherwise you get something that maybe manages to do the job but only slowly and with difficulty.

Designing the control surface of an integrated system is certainly easier if you start by knowing what you ultimately want the system to do—or at least you leave the architecture open.

Apple Computer did this with the Macintosh operating system, for example. Here was a system designed from the ground up to simulate a kind of desktop environment with graphics and input devices. The user interface has its physical (and software) parameters well defined, so that all Mac applications look similar and will have the same basic commands, movements and actions.

Any application that follows the developer's guidelines will work on a current Macintosh, and probably on future ones. Upgrades in the system software will add new facilities to existing applications without changes. Everything is compatible—you can move from one application to the next with ease, and also transfer data if you wish.

Not so in comparison with the IBM PC-compatible environment. Subsystems like GEM and windows are tack-ons, designed to make a rather user-hostile system pretend to be friendly. Because it was not designed from the ground up as an integrated operating system, it is but a pale shadow of the Macintosh, and it is slow. (GEM is even slow on a machine like the Atari ST, which has the same processor as the Mac and should be faster). And there are vast incompatibilities between programs, data and hardware configurations.

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Just as it is possible, with careful thought, to develop an intuitive desktop-simulation environment for the Macintosh, it should be possible in an analogous fashion to develop a studio environment which could, on a largely software-defined control surface, be arranged to provide the optimal facilities for each stage in the studio process.

The hardware behind the user interface would be unobtrusive, and the specifications would be such that programmers could integrate new applications into the overall scheme while retaining the easy-to-use intuitive flavor of the system. Certainly, there would need to be some add-on boxes as well as new display screens, be they are input or output devices.

Different input devices, for example, are suited to different applications. You'll find that music sequencers can benefit from a track-ball, while word-processors suit the keyboard and function keys, drawing programs make good use of the mouse, and paint programs are excellent with a graphics tablet.

Indeed, it can be argued that the Macintosh environment is as good as any for an integrated audio workstation. By being a non-dedicated system, it's not limiting you, which is one of the main complaints with the integrated system approach. The existing integrated systems limit you to the manufacturer's method of sampling, its way of synthesis, approach to mixing and its hard-disk editing software.

An interesting sideline here is what happens when you configure a computer for a particular audio application. When Audio + Design Recording in England started developing their Sound Maestro system for the Atari ST they discovered that one thing you didn't necessarily need was a big knob to play the part of a tape reel when trying to find an edit point.

Instead they provide a graphic display of the amplitude envelope. While playing the section to be edited, you "click" to mark a rough edit point, a second click displays the edit mark, and then (if necessary) you visually fine tune the edit point. Not a rock or roll in earshot, and no need for varispeed. This is a salutary lesson: it is one thing to offer the user familiarity and another to incorporate a special control to emulate something we did on analog tape machines.

So if you don't need imaginary spools on a hard-disk recorder, what do you need on a software-defined mixing console control surface—the so-called virtual console? The control surface of a mixing console is one of the most complicated front panels there is, and nobody to date has tackled the idea of making it software-defined.

Apparently SSL examined the idea of a projected control surface in the course of their work on the Digital Studio System but it proved impractical. It is hardly surprising, that one of the traditional requirements of a mixing console has been a great many controls. But, let us look at that requirement again.

If we don't need imaginary spools, do we need so many imaginary console controls? Possibly not. When using a mixing console we do so in a number of ways. Looking closely, we find that while several operations—like moving the faders—are done in parallel, many more are done serially by adjusting one channel at a time.

### Equalization

This is particularly true of equalization. Either it's adjusted one channel at a time, or two or more channels are adjusted to the same setting. This could be handled by any number of EQ-simulation graphics—allowing the adjustment of a single channel, the ganging together of two or more for simultaneous alteration, or the copying of a setting from one channel to another. The same logic could be applied to dynamic processing and a wide variety of other functions.

The real problem area is the faders, simply because we tend to adjust more than one at a time. But even here, we do not (on a 56-input console) adjust all 56 at once. By and large we never handle more than we can reach at one time (assuming that we aren't using automation), so that puts an upper limit at around a dozen faders. You should be able to control any size mixing session with a dozen faders if, and only if, you can assign "real" faders to "virtual" faders (i.e., physical faders to audio channels) quickly, easily and without confusion.

At worst, the time taken to access a *virtual* fader should be little more than that of reaching for a fader on a conventional console. The performance of such a system can be evaluated without too much difficulty. An average time can be derived for access to a channel fader on a conventional console with the range being from right in front of you to the far end of a 7-foot board. It is difficult to see how it could be faster than that if real faders are involved at all.

Of course, such a system must also be able to deal with subgroups, and automation would be as much an advantage as it usually is. Control surface ergonomics is a subject quite big enough to deserve an article on its own. But hopefully from the above it can be seen that there are several areas worthy of research, when it comes to creating virtual control surfaces.

### Control surface design

The design of a virtual control surface is a primary requirement for a full-scale integrated recording system (as opposed to one aimed at the rather smaller requirements of post-production). Further the control surface should involve as few physical accoutrements as possible, with the vast majority of the work being performed via a graphics interface. The ability to run all the required software on a workstation with add-on peripherals would be a bonus. There is an advantage in using a system designed outside the narrow confines of the audio industry, not least because it does not try to do all the jobs itself.

Many manufacturers produce music software for systems like the Macintosh and, due to the nature of the operating system, they all co-exist within reason. More than any of the other requirements a mixing console would undoubtedly need a more complex control surface. But in many ways, most of those other applications are in place: music and real-time event sequencing, sampling, hard-disk recording and editing.

What I hope for is the development of a software-defined studio environment that can remove the majority of hardware from the control room. This would leave the operator with a compact control system that can access the facilities required with intuitive ease and comfort. The system should be based around a common non-dedicated workstation for which different manufacturers can supply hardware and software combinations to handle the tasks required—for not only those described above, but for sound synthesis as well.

Obviously this article cannot address all the considerations required in the development of integrated digital studio systems. But hopefully it will give the designers of such systems, who know the practical problems involved far better than I, some useful ideas.

RE/P

The Old School, circa 1835, Woodditton

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# Equalizer Trends:

# Digital Filtering

By Paul Tydelski

**A primer on true digital equalization, what it is, how it will impact the recording process and what to expect for your money.**

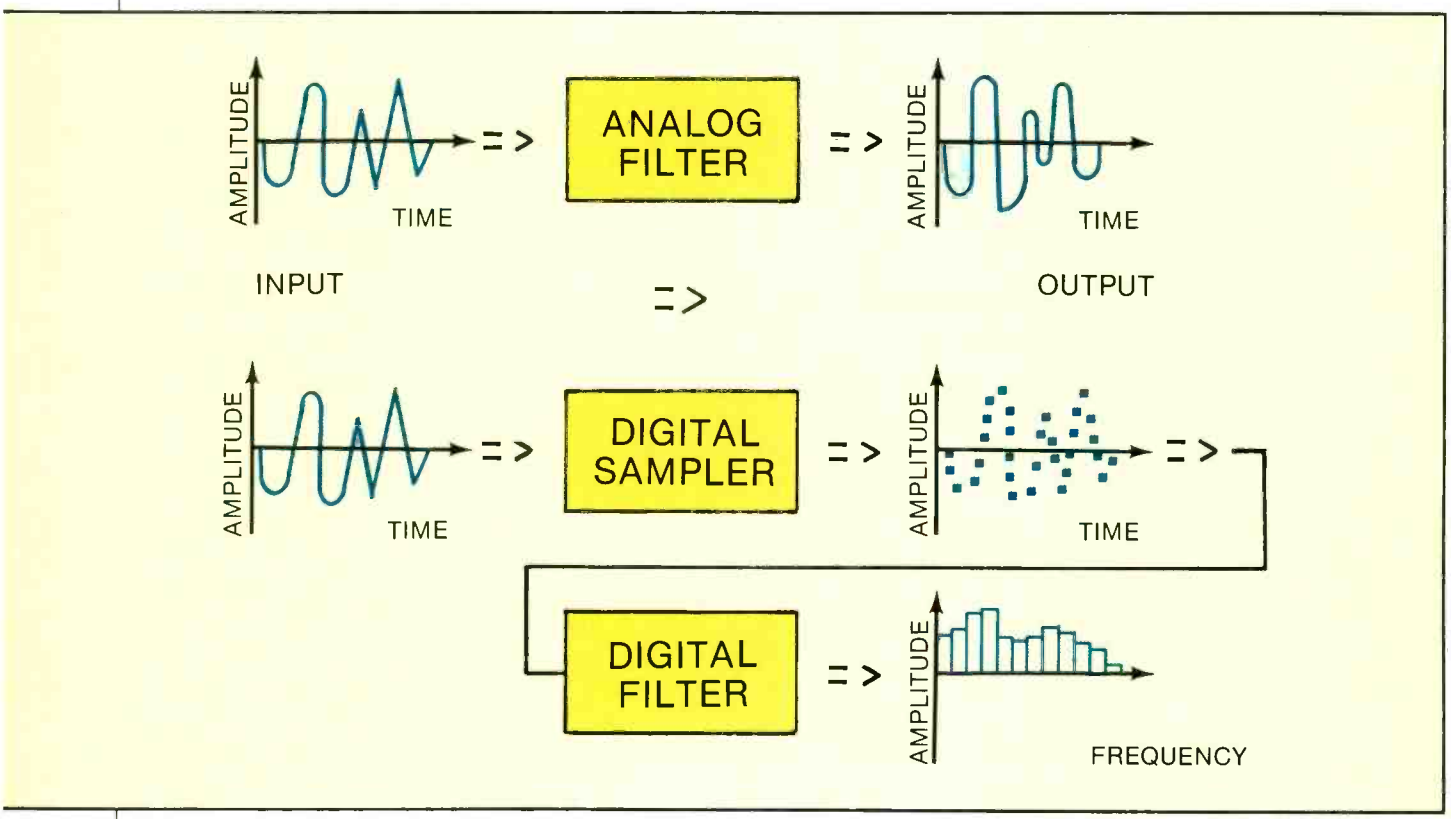


*Figure 1. Black box analogies.*

Recording engineers have been looking for that "special sound," an "infamous space," the ubiquitous "save-me knob" that suddenly unclutters their mids, opens up the highs and brings back the "life and presence" to what many consider a very "dead and dry" procedure.

Of course, there are a number of engineers who still prefer the "fewer knobs the better" approach to recording. With "live to whatever" holding its own in a multitrack world, and the tendency toward digital recording in general, engineers may soon have the use of one more "save-me knob" in their quest for audio perfection.

Paul Tydelski is a technical consultant, engineer and producer in San Diego.

### Digital filtering

The new kid on the block is digital equalization, or digital filtering as it is better known. While offering many exciting options, the digital filter raises some substantial questions. For example, will these new filters provide anything more than the current analog version? Will they be as easy to operate, and offer comparable features? Will they offer greater flexibility? And finally, what will these filters sound like?

Considering that manufacturers will be (or have recently been) introducing these devices to the recording public, this article will focus on the similarities and differences between the two systems.

Through the years, engineers have sought to develop an equalizer/filter that

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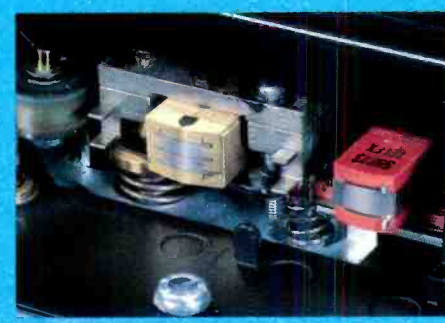

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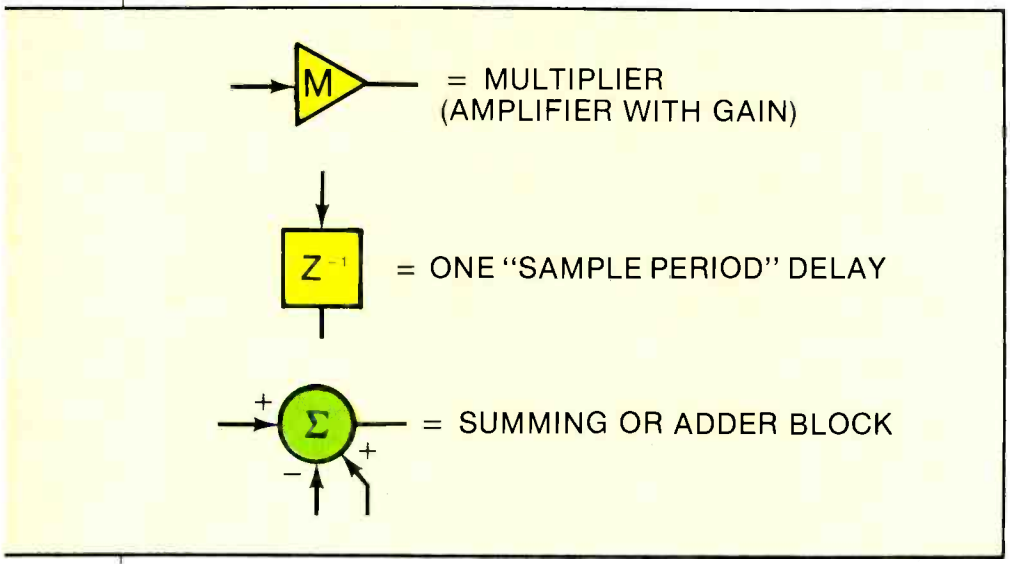


***Figure 2.*** *Building blocks of a digital filter.*

approximates the natural characteristics of a sound, or input signal, without introducing objectionable coloration. Design engineers have been able to "model" filter reponses by computers, thus predicting not only the resultant curve, but also the phase relationships at various frequencies within the filter's range.

In the past, active or passive analog filters have been readily available for studio use, but not until recently with the surge of VLSI designs has a purely digital signal processing package been available to the ordinary user. Granted, these packages exceed the budgets of most studio operations, and therefore are usually found in research areas of large companies and universities or integrated into some of the more expensive digital synthesis systems.

However, with the recent appearance of rack-mount processors having digital filtering capabilities, there will soon be an emphasis on proving the sound quality, flexibility and ease of operation that these devices can offer in everyday studio use.

To recognize the basic differences between analog and digital filters, think of either filter as a "black box" (Figure 1). The analog input to either filter is a "time-varying" signal. After some unique manipulation, the box output becomes a modified copy of the input, be it low- or high-pass, bandpass, band-reject or other response.

### The "time domain"

In analog processing, the structure of the filtering is well understood regarding the use of frequency selective components configured to actively or passively create a response—using time constants, phase responses, etc.—to shape the component-level design. This type of signal is said to be in the "time domain," because there is a continuous signal per unit of time. It should be noted that some current analog filters can be modified using "digital controls." These filters offer real time "slider flexibility of the basic parameters, while maintaining the values of resettability and predictable sonic response. A digital filter allows these parameters to be changed, but in what is known as the "frequency domain."

In order to be processed within the digital filter, the input signal must first be sampled. To accomplish this, the analog signal must pass through an A/D converter to enter the frequency domain. That is, at this stage, the signal is evaluated (at a fixed frequency called the sampling rate) for its amplitude content at each sampling period. Once the conversion takes place, there exists a stream of numbered values configured as an n-bit word (typically a 16-bit word).

This word contains the identity of the input signal, which can now be acted upon to change gain, frequency response or phase. To affect the equalization of such a waveform, the input samples must be introduced as a mathematical equation. (See references listed later.) As well, the desired frequency or phase change must also be expressed as an independent equation.

Stated in its simplest form, each "word" of the input signal is multiplied by something called a transfer function. This function describes the desired frequency or phase response digitally, the result of which is later added to or subtracted from the original signal.

The transfer function is comprised of elements called terms or coefficients. These are a combination of the following building blocks (see Figure 2): a multiplier, a delay stage (sometimes called a "z" transform), and an adder or summer.

Depending on the complexity of the filter, or the number of terms or coefficients in the equation, this multiply-and-add routine could be executed many times. When the transfer function has been executed for one word, the new version of the signal is then sent to the output D/A converter.

The next input sample is then processed. Using this technique, nearly any filter response can be obtained, including those beyond the complexity of any analog type. However, be aware that there is a time limit restriction. For example, choosing a sampling rate of 50kHz, a sampling period of 20$\mu$s separates each input word.

This means that the transfer function of the digital processor must be executed within this 20$\mu$s limit. In the case of the Texas Instruments TMS320 series of digital signal processors, a signal coefficient execution time is 100ns, meaning that nearly 200 operations could be completed in one sampling period.

### Real time filtering

The result of keeping within the specified time limit is real time filtering. This may be executed either automatically by controlling subroutine (as in a patch) or manually with a fader, keyboard or keypad.

At this point, you must be concerned with the operation of such a complex system. How do you actually control these filter changes without having to become a software engineer or a digital signal processing expert? Within this type of equalizer, a microprocessor(s) and software package must be included to enable you to use the process.

Unless you've been fortunate to have worked at a developmental digital workstation, such as those at NASA, Bell Labs, Stanford University and MIT, your closest encounter with a digital device may have been through a rack delay line, programmable reverb or compact disc player. Of course, all these devices are easy to use because the sophisticated processing taking place internally is transparent. But in a stand-alone digital filter, generic process control must be learned, and you should be familiar with some of the basic terms and building blocks of this design.

### Digital filter process

Remember, the digital filter process can be implemented with just the three unique building blocks. In fact, all digital filters can be expressed with various combinations and quantities of these blocks, allowing the designer to create from the simplest to most complex filters.

Figure 3 shows a typical filter flow chart. This one is a second-order filter, sometimes called cannonical, to denote

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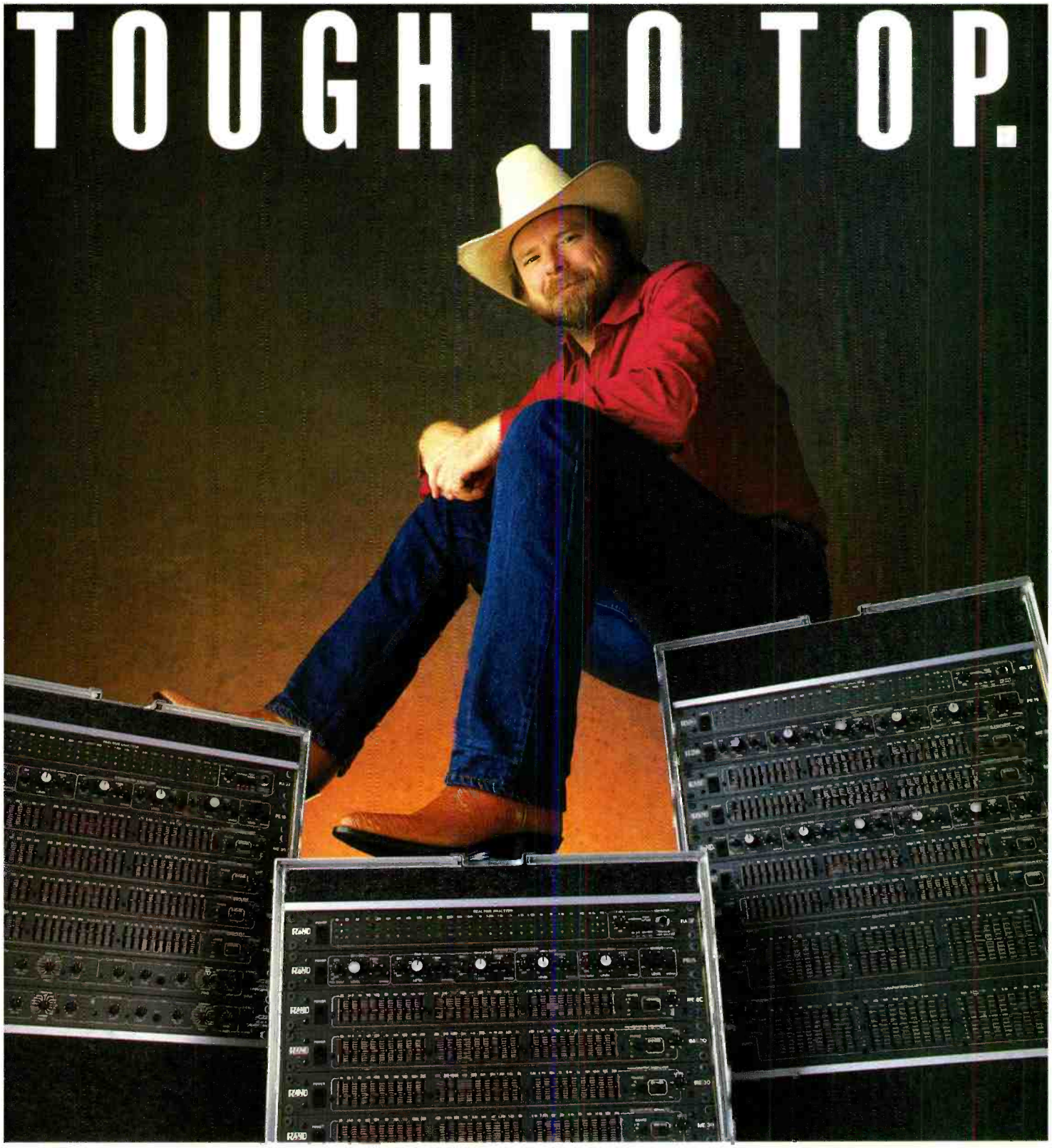

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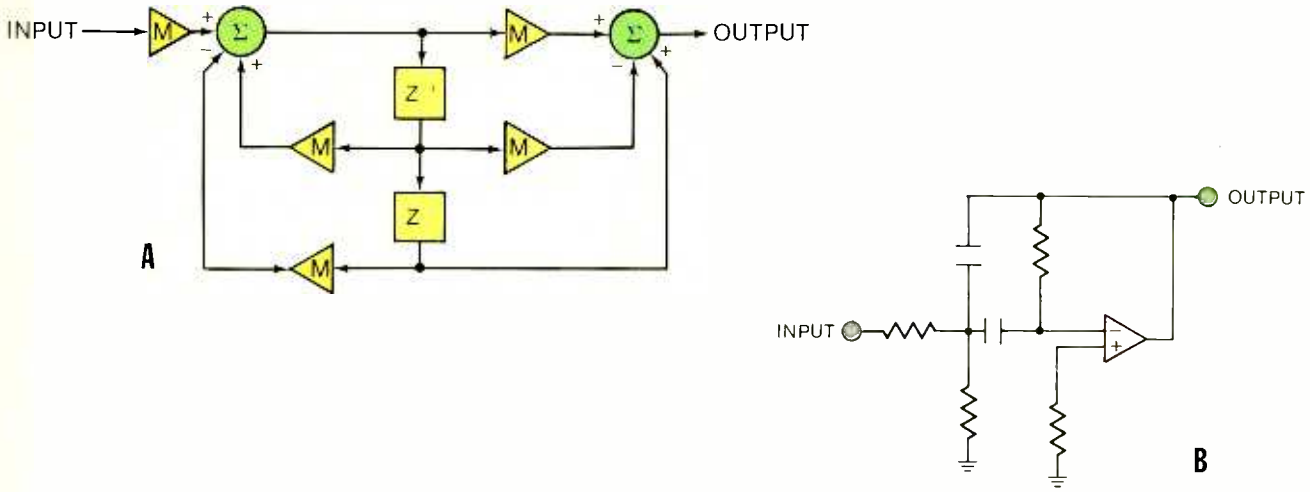



***Figure 3.*** *A: A canonical second-order digital filter. B: A second-order analog filter.*

its established generality. For comparison, a second-order analog filter is shown as well (simply for the sake of architecture).

In digital implementation, there are five multipliers, two delay functions and two summing sections. The multipliers can be thought of as amplifier modules with gain, and the inputs to the summers can be added to or subtracted from the input (hence the use of plus or minus symbols to denote a coefficient's quality).

Also shown are paths from the delay elements, either in a feedforward path to the summing output or in a feedback path back to the input summer. Generally, the feedforward paths are responsible for dips in the response curve, while the feedback paths are responsible for the peaks. (When dealing with "z" transforms, dips = zeroes and peaks = ones.)

### Filter flexibility

To understand this filter's flexibility, you not only need to examine the many ways a signal can travel in its input or modified form but also the degree to which amplitude and phase changes can be made. Within each of the blocks shown, a precalculated value must exist (this includes a "0" value) to allow the implementation of the filter.

Because this filter is very "detailed," the user's task is to select the proper coefficients for a given response, either by external calculation or by some inherent software design feature of the particular item. (See the "Hands On" review of the Quantec QRS/XL in the November 1987 issue—Editor.) To simplify the layout of these filters, manufacturers would include any number of presets, which might include coefficients that describe a particular frequency response, with "Q" and phase characteristics included as well.

This would allow the engineer to select either the on-board response or modify it and save it in memory. This greater flexibility underlines an advantage of digital compared with analog filtering, although the hands-on implementation may not be as easy to understand.

### Response curves

There are some types of response curves an analog filter can only approximate, and others that it can never attain. However, with a digital filter, the implementation may be quite simple. Some which have a flat pass-band with frequency-sensitive phase shifts scattered throughout the filter's response; comb filters; chorusing and flanging effects; reverberant simulators; and probably the most flexible filter design available—the "arbitrary" design.

The implication of the arbitrary filter type is that the user can set up a curve having many peaks, notches and pass-bands scattered non-linearly within its shape. These essential parameters such as frequency, gain, "Q," phase and delay can be calculated with as many building blocks as necessary.

### FIR filter

A very useful device for this purpose is an FIR—finite impulse response—filter. This filter is essentially a multi-tapped digital filter, available as a separate building block. This complex design is often used to recreate the digital reverberation patches used today.

To briefly describe the process, a "snapshot" (called the impulse response) of a particular acoustic space is taken and analyzed by the process known as the FFT (Fast Fourier Transform). What is revealed by this technique is the various frequency and phase anomalies, related delays and decay responses exhibited by that space.

The signal processing package converts these data into usable coefficients that make up the filter's response curve. These data then reside in memory and when selected, as in a typical patch selection, are multiplied digitally by the converted input signal and then reconverted to the output (which now includes the filter response).

For users to design a response such as this would require a knowledge of advanced mathematics, acoustics and certainly a fair chunk of time. Therefore, it is essential that manufacturers include easy-to-use controls, allowing engineers the capability of designing or controlling desired responses efficiently and effectively. If they do, the digital filter could become the hub of much new creativity.

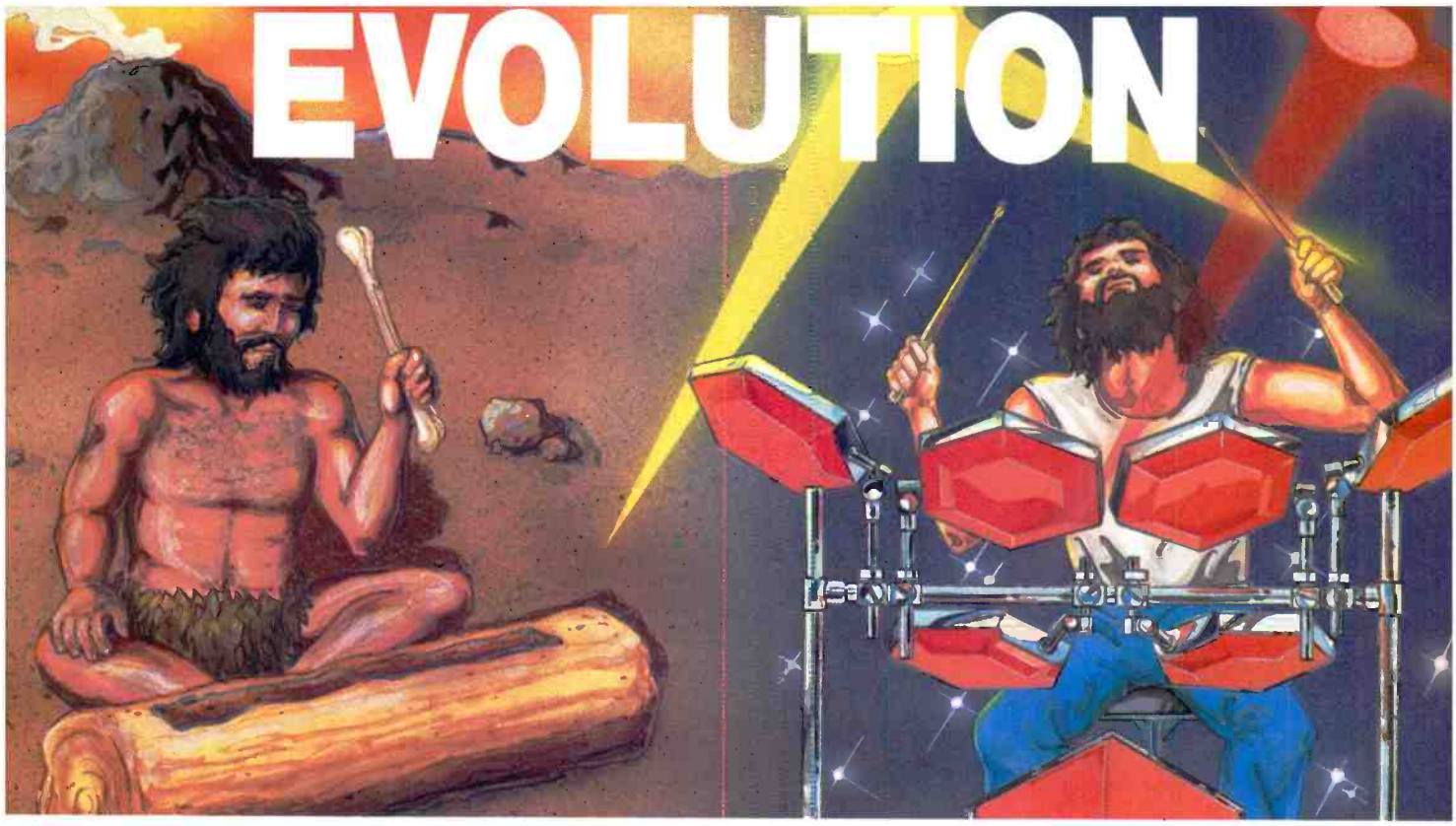
Will the digital filter be usable as a "save-me" device? Only time will tell. However, in terms of its potential use as a creative tool within the studio, aside from the head-to-pencil interface, the digital filter may well have no equal.

RE/P

## *Additional reading*

*If you're interested in further study of this topic, I suggest the following:*

- *"Musical Applications of Microprocessors," by Hal Chamberlain, second edition, published by Hayden Books;*
- *"Principles of Digital Audio," by Ken Pohlmann, published by Sam's and Co.;*
- *F.R. Moore's 2-part series in the Computer Music Journal;*
- *and for you hard-liners: "Theory and Applications of Digital Signal Processing," by Rabiner and Gold, published by Prentice-Hall.*

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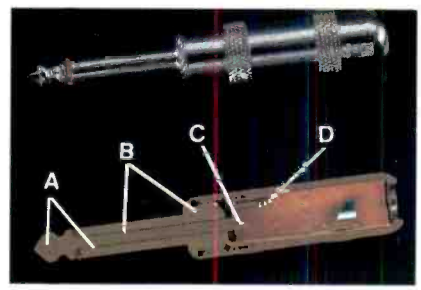


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# Mixing Consoles for Live-Performance Use

By David Scheirman

**The consoles available to today's live soundmixers are more versatile, complex and costly than ever before.**

*Figure 1. House mix position at the 1983 US Festival. Outdoor hazards to console operation can include dust, heat, humidity, water damage, unruly crowds and thrown objects.*

In studio engineering, the mixing console has long been at the very heart of the production process. The console combines a variety of audio signals from different sources and provides the balanced "blend" of these input signals the consumer public listens to.

In the live-sound industry, the console is just as important. Although the end result of a soundmixer's effort does not necessarily get put onto recording tape, the output of a live console does go straight to its own unique storage medium: the collective experience and "group memory" of the listening audience present at the live concert (see Figure 2).

The differences in the amount of time available to create this "live sound product" (as compared to the studio recording process) and the need for portability, struc-

David Scheirman is *RE/P*'s live performance consulting editor and is president of Concert Sound Consultants, Julian, CA.

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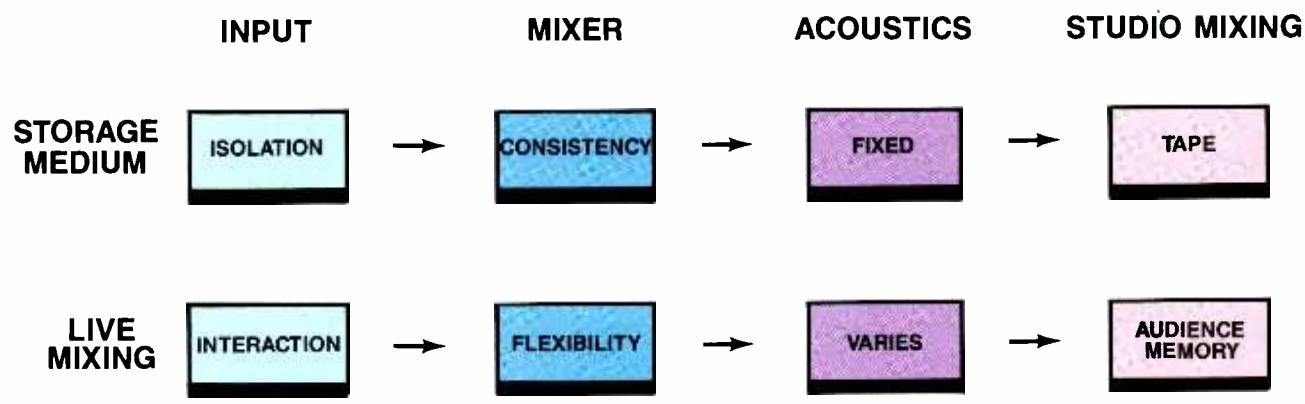


*Figure 2. The differences between studio mixing and live mixing.*

tural integrity and environmental safety mean that most recording studio consoles are not suited for live concert work, and vice versa.

**Environmental hazards**

A live-sound console must function in such a wide variety of environments that the search for circuit components, case and frame materials is never-ending. Live consoles may be unloaded from a thin-skinned tractor-trailer in January in the Canadian Rockies, having traveled overnight in sub-zero temperatures, and then be positioned within 20 feet of a gas-burning space heater in an auditorium. The same consoles may be on the beach at Ft. Lauderdale a week later.

Temperature extremes and the wide range of humidity, along with dust, UV radiation from sunlight and moisture hazards make the successful live-sound reinforcement console a tough unit indeed. Once the ideal parts and materials are chosen, care must be given in terms of construction and manufacturing techniques. Should the frame flex or be rigid? Spot welds or seams? Metal anodization or composite overlay? Computer-ribbon wiring or bundled harnesses?

***Nowhere are the demands on a live-sound console greater than at a large outdoor festival.***

Nowhere are the demands on a live-sound console greater than at a large outdoor concert or festival. Moisture, along with dust from foot traffic and passing vehicles, can cause serious problems. Crowd control is also important; thrown objects and unruly fans can be hazardous.

**Custom vs. off-the-shelf**

Only 20 years ago, there were very few mixing consoles available that were consciously designed for live-concert sound reinforcement use. In the late 1960s, it was common to find small tube-type 6- or 8-input rack-mount mixers ganged together. With cooperation from technicians working in the recording or broadcast fields, a few custom-built live consoles were assembled.

The rise of dedicated touring sound companies serving the growing concert industry helped create a market for live mixing consoles, and started to interest equipment manufacturers. About 1965, a touring group that carried a portable sound system had a limited selection of commercially available PA "heads" that featured four to six inputs. Within seven or eight years, various manufacturers offered flat-panel mixers with meter bridges, usually configured with 16 to 24 inputs. Commercially available mixing consoles have increased in flexibility and complexity since that time, as detailed in Figure 3.

Around 1968-1970, some of the touring sound companies that needed more complex consoles took steps to advance the "state of the art" by designing and building their own devices. Around 1971, Tychobrahe (a California-based PA company) developed a trend setting console for live-sound concert work. By the mid-70s, both the Clair Custom 32x12x2 and the Showco 30-input Superco console were developed. These boards were considered superior to anything available from commercial manufacturers. Both companies designed and built the units in-house, and were produced in limited quantities for the company's use only.

This strategy helped to bring about a quantum leap in live-concert console design because immediate feedback was available from users in the field. The sound company that designed the board built the board, used the board and was able to incorporate improvements relatively immediately.

This process was quite a contrast to the typical loop, with its corresponding time lags, that exists between designer, manufacturer, distributor and end user. Quite simply, the major, aggressive concert sound companies knew more about what they needed than did the existing audio equipment manufacturing companies, and they also had a greater interest in taking a risk on new product development for their own use.

***Many sound companies find that off-the-shelf consoles do not suit their needs.***

By 1983, the sophistication of live-mixing consoles had reached a level that outstripped the manufacturing capabilities of even the major touring sound companies. Starting in mid-1982, Clair and Showco engineers began to collaborate on a cooperative design project that was eventually presented to Harrison Systems for manufacture. Through 1983 and 1984, Harrison built 16 of the new, innovative consoles, dubbed the SM-5.

Offering 16 main monitor mixing buses, 16 group reassign buses and VCA grouping, this console development program once again gave the two primary touring sound companies a competitive edge. A companion house console, the Harrison HM-5, was also constructed.

The development cycle had come full circle: touring sound companies demanded products that didn't exist. When they couldn't find what they needed, they built their own. As manufacturers learned what the new market required, the growing number of commercially available units forced the major players in the game into the development of a custom project (Harrison SM-5) that was so sophisticated that it was best suited for manufacture by an

*Continued on page 36*

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*Table 1. List of tours, sound companies, and house and monitor consoles for Fall/Winter 1987-88.*

## Tour Consoles Fall/Winter 87-88

| Tour | Sound Company | House Console(s) | Monitor Console(s) |
|---|---|---|---|
| Aerosmith | Showco | Harrison HM-5 32 + 16 extender, Yamaha PM-3000, Yamaha DMP-7 | Harrison SM-5 32X16 |
| Baker, Anita | Maryland Sound Industries | Harrison Alive 32, Yamaha 1516 | Yamaha PM-2000-32 x 14 (Windt-modified) |
| Boston | Showco | Harrison HM-5 32 + 16 | Harrison SM-5 32 x 16 |
| Buffett, Jimmy | Sound Image | T.A.C. Scorpion 56-input | (2) T.A.C. Scorpion 30 x 12 |
| Chicago | Audio Techniques | Yamaha PM-3000-40, Soundcraft 500-16 | Yamaha PM-2000-32 x 14 (Windt-modified), Yamaha 1516 |
| Costello, Elvis | Audio Support | T.A.C. Scorpion-32 | T.A.C. Scorpion 40 x 12 |
| Def Leppard | Electrotec | (2) custom Soundcraft Series 4 40 x 16 x 2 | Soundcraft series 4 custom 40 x 24 |
| Diamond, Neil | Stanal Sound | Yamaha PM-3000-40, Soundcraft 800B-24 | Yamaha PM-2000-32 x 14 (Windt-modified), (3) Yamaha 916 |
| Earth, Wind & Fire | Maryland Sound Industries | (2) Yamaha PM-3000-40 | (2) Ramsa WR-S840 x 18 |
| Fleetwood Mac | Clair Bros. | (2) Clair Custom 32 x 12 x 4 | Harrison SM-5 32 x 16 |
| Grateful Dead | Ultrasound | Jim Gamble EX-56 Input | Jim Gamble SC-40 x 16 |
| Heart | Audio Analysts | Soundcraft series 4 40 x 16 x 2 | Soundcraft series 4 (40 x 16) |
| Hiroshima | Linear Sound Systems | Soundcraft series 4 40 x 16 x 2 | T.A.C. Scorpion 30 x 12 |
| Hornsby, Bruce & The Range | Schubert Systems Group | Jim Gamble EX 56-input | Jim Gamble SC-32 x 16 |
| Houston, Whitney | Maryland Sound Industries | Harrison Alive 32-input, Yamaha 1516 | Yamaha PM-2000-32 x 12 (Windt-modified) |
| Kool & The Gang | Eight Day Sound | Soundcraft series 4 40 x 16 x 2 | Soundcraft 800B 32 x 8 |
| Lynyrd Skynyrd | Showco | Harrison HM-5 32 x 16 x 4 | Harrison SM-5 32 x 16 |
| Manilow, Barry | Electrotec | Soundcraft series 4 custom 40 x 16 x 2, Soundcraft custom Electrotec 40 x 8 x 8 x 2 | Soundcraft series 4 custom 40 x 24, custom Soundcraft 40 x 18 |
| Mellencamp John Cougar | Audio Analysts | Soundcraft Series 4 40 x 16 x 2 | Soundcraft Series 4 40 x 16 |
| Motley Crue | Tasco | Midas Pro-5 72 input and 32 input consoles | Midas Pro-5 30 x 10 |
| Murphy, Eddie | See Factor | Midas Pro-5 18 x 4 x 2 | AudioArts M10 24 x 10 |
| Night Ranger | Sound On Stage | Yamaha PM-3000-40 | Jim Gamble SC-32-16 |
| Oak Ridge Boys | Carlo Sound | Harrison Alive 32-input | Soundcraft 800B 32 x 10 |
| Pink Floyd | Maryland Sound Industries | (2) Yamaha PM3000-40, Midas Pro40, custom Quad mixer | Midas Pro40 x 16 (2), Midas Pro5-32 x 10 |
| R.E.M. | Showco | Soundcraft series 4 40 x 16 x 2 | Harrison SM-5 32 x 16 |
| R.E.O. Speedwagon | dB Sound | Soundcraft series 4 40 x 16 x 2 | Soundcraft series 4 40 x 16 |
| Rush | Audio Analysts | Jim Gamble HC-40 x 16 x 2, Yamaha PM3000-40 | Jim Gamble SC-32 x 16 |
| Starship | Sound On Stage | Jim Gamble HC-40 x 16 x 2 | Jim Gamble SC-32 x 16 |
| Turner, Tina | Clair Bros. | (2) Clair custom 32 x 12 x 4 | Harrison SM-5 32 x 16 |
| U2 | Clair Bros. | Yamaha PM-3000-40 | Harrison SM-5 32 x 16 |
| Vega, Suzanne | Sun Sound | Yamaha PM-3000-40 | T.A.C. Scorpion 40 x 12 |
| Waters, Roger | Audio Analysts | Soundcraft series 4, 40 x 16 x 2, Yamaha PM-3000-40 | Ramsa WR-S840 x 18 Jim Gamble SC-32 x 16 |
| Whitesnake | Tasco | Midas Pro5 40 x 8 x 2, Midas Pro5 Q2 x 8 x 2 | Midas Pro5 30 x 10 |
| Zadora, Pia | A-1 Audio | Yamaha PM-3000-40, Yamaha 2404 | Soundcraft 800 40 x 12 |
| Zevon, Warren | dB Sound | Midas Pro40 40 x 12 x 2 | Midas Pro4 30 x 10 |

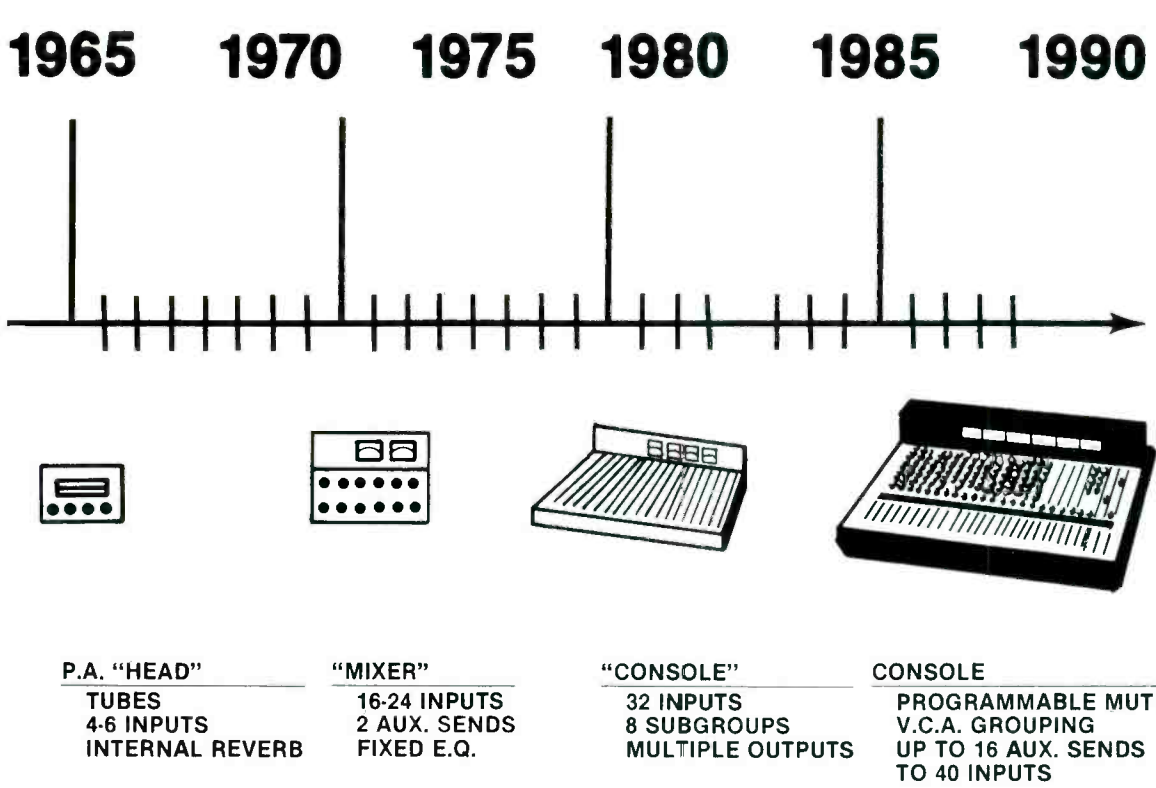


***Figure 3.*** *The development of mixing consoles from commercial manufacturers during the past two decades.*

*Continued from page 32*

established audio console builder.

As of 1988, the competing console manufacturers appear to have a fairly good feel for the touring industry's needs, and are able to supply well-crafted products with the necessary features. The custom vs. off-the-shelf indicator meter seems to be leaning toward the audio equipment manufacturers.

Still, many major touring sound companies find that off-the-shelf consoles do not exactly suit their particular needs. Although the basic frame package and features may fit the bill, certain extra touches or in-house modifications are added to integrate commercially available consoles into touring sound systems.

For example, dB Sound Inc., Des Plaines, IL, requires on-board patchbay facilities and appreciates the new Yamaha PM-3000-40 console, which does not offer onboard patching. The solution?

"Fortunately, we have a sophisticated in-house electronics shop and woodworking facility," says dB Sound's Scott Larson. "When Prince toured Europe recently, we sent over a PM-3000-40 that our shop had custom-modified. An extended frame piece was added onto the right side of the console, with matching exterior finish. A complete jackfield is now available on the console."

***Getting in and out of a complex live console is of primary concern to touring sound companies.***

Getting in and out of a complex live console is of primary concern to touring sound companies, and the addition of multi-pair connectors is a common modification when such connectors are not available through the console manufacturer.

A-1 Audio (Hollywood and Las Vegas, NV) equips its Harrison, Soundcraft and Yamaha consoles with 50-pair interconnect cables. Quick-release connectors manufactured by Amp are used to easily interface the consoles, sub-mixers and outboard equipment racks. Rather than being installed on the console itself, the Amp connectors are sometimes included in an add-on tray that is contained in an extended-back road case. Standard XLR and ¼-inch cables are then available at the console's back panel, and the larger quick-release multi-connectors are available for daily setup and teardown.

**Flexibility and changing needs**

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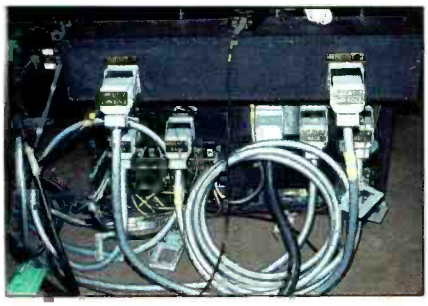

*Figure 4. Many touring sound companies custom-modify commercially available consoles. This photo shows A-1 Audio's multi-pair interconnects installed on a Harrison Alive console.*

*Figure 5. Clair Custom 32x12x2 console.*

console for live sound use has not yet been invented. A mixing console, during the course of a single month in a major sound company's inventory, may function as a front-of-house console for a theater tour, a percussion submixer on a major arena tour, a house-and-monitor console for a new act's club dates and as an auxiliary courtesy console for a headliner's opening act.

This is one reason today's live-mixing console purchasers are examining every available product before ordering any particular make or model in quantity. Will a given console function well in all of the previously mentioned modes? What will its useful life expectancy be as trends and operational patterns change?

**Common consoles used today**

A check on consoles in use for national concert tours during the past three or four months shows that no single manufacturer has a monopoly on the market. In fact, an arbitrary list of 36 recent and current tours, representing the largest touring concert sound companies along with many aggressive smaller companies, shows mixing consoles from many different sources. Out of nine different makes or brands in use, seven currently have the lion's share of the work, with two additional makes seeing action (see Table 1).

***The custom vs. off-the-shelf indicator seems to be leaning toward the audio equipment manufacturers.***

Let's briefly examine who builds these consoles, what they are offering and where they seem to be headed. The consoles that follow are addressed in alphabetical order by manufacturer. For reasons that should be apparent to the reader, no attempt will be made here to subjectively "rate" or compare these devices in terms of performance, price or any other criteria. I have worked with all of these consoles at one time or another, and have had some excellent shows with each, regardless of model. A mixing console cannot produce "good sound" for live concerts by itself; good live sound is a function of the human-machine system, or the given

console and its designated operator working together.

### Clair custom consoles

Designed and built by Clair Bros. Audio for the company's own use, the Clair 32-input board with its folding case has been in use for more than a decade, and has been around the world with many of the entertainment industry's major artists. Clair engineers have updated the console's signal path, and many units have been modified to offer expanded auxiliary and output mix capabilities.

***Mixing consoles can be used in several different functions in a single month.***

The clever packaging and roadworthy frame unit are quite distinctive, and the original, refurbished devices are held in high esteem by Clair road technicians and by the company's clients.

"It is still one of the best-sounding consoles available for live concert work," says Bruce Jackson, soundmixer for Bruce Springsteen and currently touring with Fleetwood Mac.

Clair Bros.' rental stock includes consoles from commercial manufacturers, including Midas and Yamaha. The company has no plans for building more of the folding desks, either for its own use or for sale. See Figure 5.

### Gamble consoles

Designed and hand-crafted by Jim Gamble Associates of Tahoe City, CA, the custom-built Gamble consoles are often requested by live soundmixers interested in a clean, high-quality audio signal path. The original HC-40-24 and SC23-16 units (see Figure 6) were some of the first available with no mic pre-amps or output stage transformers.

The Gamble consoles are built to custom order, and a wide variety of models have been produced to suit different customer needs. Some units have onboard pink noise and spectrum analyzers; others have auxiliary 8-input effects return sections, and stage monitor consoles feature onboard parametric EQ for each mix output.

The new Series EX offers 56 input channels; a total of four have been completed and fielded to date.

*Figure 6. Gamble SC 32x16 console.*

*Figure 7. Harrison HM-5 console.*

*Figure 8. REO house soundmixers [left] Steve Aries and Bud Phillipe at the Midas console.*

*Figure 11. Yamaha PM-3000-40 console.*

*Figure 9. Soundcraft series 4 console.*

*Figure 12. RAMSA WR-S840 console.*

*Figure 10. Amek/TAC Scorpion 56-input twin-frame mixing console.*

assumed by JBL Professional, both engineering and marketing dynamics appear to have stabilized, and Soundcraft is one of the most commonly found makes used in this country.

Appearing on many contract "riders," or specified equipment lists for touring groups that rely on regional sound production, the older 800B and the newer model 8000 (available in 32- and 40-input configurations) are highly versatile.

Major touring sound companies such as Electrotec Productions and Audio Analysts helped to coax Soundcraft Electronics into the large-frame touring console sweepstakes; Electrotec has long relied on unique, custom "blue boards" built by Soundcraft and the first Series 4 units (see Figure 9) to tour North America were brought in by Audio Analysts.

The Series 4 offers programmable mute groups, plenty of auxiliary effects buses and a flexible output section. While relatively large in scale, this specialized console is often seen on major arena tours.

"The big Soundcrafts are a pretty good sound mixing tool for major concerts," says Robert Scovill, currently touring as house soundmixer for Def Leppard with Electrotec Productions. "The mute groups are a real necessity with a major show."

### TAC consoles

Built in England by Total Audio Concepts and distributed in North America by Amek Consoles USA, TAC Scorpions are available in a wide range of input/output configurations. The company will custom-modify units as per customer specification, including the addition of multi-pair connectors and supplying extended-back road cases so that wiring harnesses can stay cabled up.

Extender frames with interlink cables make the Scorpion line an affordable, versatile console option for many sound companies. The stage monitor version is available in 30 and 40 input units that offer 12 discrete output mixes.

TAC's new SR-9000 was introduced in limited quantities this year. Intended to be a high performance sound reinforcement console designed to meet the needs of international touring PA companies, the SR9000 is equipped with 40 input chan-

### Harrison

The Harrison Alive, with 32 inputs on the mainframe and available 16-input extenders, was one of the first available consoles to offer VCA grouping. Primarily a builder of recording and broadcast consoles, Harrison Systems, Nashville, has applied the skills of a studio console company to touring PA work.

The Clair/Showco collaboration that produced the SM-5 and the HM-5 resulted in a group of proprietary consoles not available on the open market; Harrison does offer the HM-4 and SM-4 to retail purchasers, making less-costly sound reinforcement products available that have benefited from the SM-5/HM-5 development program. See Figure 7.

### Midas

Manufactured in England, Midas consoles have been well-known in the live-sound field since the early 1970s. The company introduced one of the industry's first dedicated stage monitor desks, and most units that have been built since are still in service.

Known for strong, heavy frames and long-lasting audio circuitry, the Midas products have penetrated into nearly every phase of the sound reinforcement business in North America.

Available in formats ranging from 24x8 stage desks to massive 40x8x2 units with 32-channel extender frames, the console has many fans, particularly in the English sound community.

In 1986 Midas launched the XL range of consoles, with eight auto mute groups, eight auxiliary sends, and a choice of electronically or transformer-balanced inputs and outputs. See Figure 8.

### Soundcraft

Since North American distribution of the English-built Soundcraft consoles was

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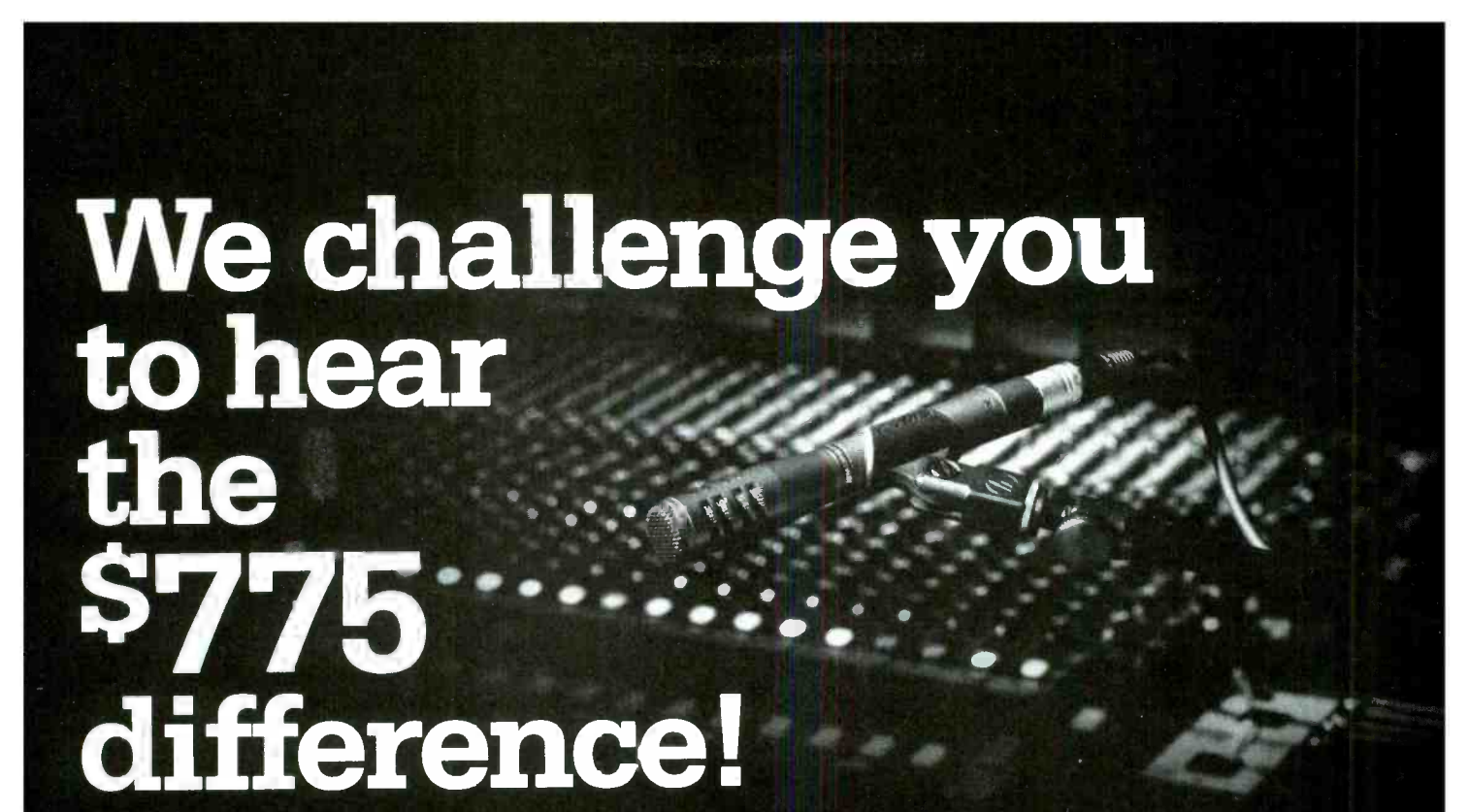

There's nothing better than a $1,000-plus condenser microphone to capture every performance detail. If you can afford it. But what if you can't?

Listen to some very talented musicians and mixers who recently tested the new ATM33R condenser cardioid from Audio-Technica. They told us the sound was almost identical to their big-bucks favorites. They liked the wide dynamic range and uniform off-axis response. The ability to use any standard phantom-power source from 9V to 52V, and the famed *Road Tough* construction were also definite plusses.

After comparing the ATM33R, several testers suggested they could now duplicate their studio sound on the road, where studio condensers were too expensive to risk. Others could see the advantage of four or more ATM33R microphones in a demo studio, at no more investment than one expensive condenser.

Compare the new ATM33R with any other condenser cardioid on the market. At ANY price. Check it for sound quality, ruggedness, and affordability. Whether you are MIDI sampling, cutting demos, or on stage every night, the ATM33R can make a big difference...for far less!

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nels, 16 mono subgroups, 16 auxiliary sends, eight mute groups and eight VCA groups. An onboard patchbay is offered, along with unique features such as a "solo-in-place" circuit that allows a soundmixer to solo up a single input over the main sound system during sound check, overriding the program mix. See Figure 10.

**Yamaha**

The workhorse PM-2000 helped establish Yamaha as a serious contender in the live-sound console field. Building on that market acceptability, the company has found the introduction of its new PM-3000 console (available in 24-, 32- and 40-input versions) to be a success. VCA grouping, programmable mute groups, auxiliary line return input section and a host of other features make the console an industry standard after two years in the field. See Figure 11.

***The rise of dedicated touring sound companies helped the industry create a market for live mixing consoles.***

A less-costly, simpler product is available in the Yamaha PM1800. Yamaha's other console products, including the M1500 series and the new DMP-7 digital 8-input mixer, are often used as submixers.

**Other manufacturers**

Along with the seven makers listed above, two additional brand names found their way onto our arbitrary list of 36 recent and current tours.

The new WR-S840 console from RAMSA (see Figure 12) is currently making the rounds of key sound companies. Its rugged, well-grounded frame will accept either house or monitor mixing modules; in a house version, up to 52 separate mic lines can be accepted. As a monitor board, the format is 40 inputs and 18 discrete outputs, 10 mono bus level controls and 4 pair of concentric stereo controls.

"The frame and circuitry design is flexible enough that we are able to visualize a variety of optional modules to suit different needs," says Steve Woolley of RAMSA/Panasonic.

Engineering design assistance on the WR-S840 series came from John Windt of Windt Audio, well-known in live sound circles for his custom modifications to early Yamaha and Soundcraft products, as touring sound companies sought to interface commercially available products with their own special needs.

Also listed is an AudioArts M10 24x10 (used as a stage monitor console by See Factor). Now know as Wheatstone, these consoles are well-regarded by many regional sound companies and are occasionally seen in use on national tours. Wheatstone consoles have a firm niche in the live theater and fixed-installation field.

***Commercially available mixing consoles have increased in flexibility and complexity.***

While not in use on any of the previously listed 36 tours, devices from Hill, Neotek, Soundtracs and Trident are occasionally seen in use with regional sound systems or as submixers on large tours.

**Looking to the future**

Console products from CADD (Creative

Audio Design & Development, Inc., Quebec, Canada) should be watched. Currently under development specifically to serve the touring industry, a large-frame house and monitor console will be available.

"We're getting significant input from Audio Analysts regarding needed performance and features," says Shane Morris, vice president of engineering. "We feel, as do they, that live touring consoles are a very special category of audio product that requires a tremendous amount of research and development to be truly effective."

DDA, distributed by Klark-Teknik Electronics, is an English electronics manufacturer offering mixing consoles for portable

***Good sound is a function of the human-machine system.***

and fixed-installation use. A new theater-matrix reinforcement console may have applications in the touring sound field.

Several new custom console projects are underway as well; when these consoles come on-line, the live-sound industry may finally have access to onboard signal processing such as noise gates and compressor-limiters built into individual input modules. While several developers in the recording industry are attempting to bring the cost of digital audio technology down, and those efforts may lead to console circuitry that is applicable to the live-sound field, I believe that analog circuitry for live consoles will be with use for years to come, if for no other reason than economics.

It is interesting to note that the name or brand of console manufacturer is perhaps not so important to this special group of users as are such logical characteristics as audio signal integrity, electro-mechanical soundness, true portability and operational features that have been incorporated into the overall console design with ergonomic aspects taken into consideration.

If a soundmixing console targeted at this market is electrically correct, structurally solid and if it appears to represent a good investment, that console should not have difficulties being accepted by a certain percentage of sound reinforcement companies. RE/P

**Editor's note:** The mention of specific products made in this article does not imply an endorsement by the author, *RE/P* or Intertec Publishing. Equipment descriptions are mentioned with reader interest and education in mind.

Photos by David Scheirman.

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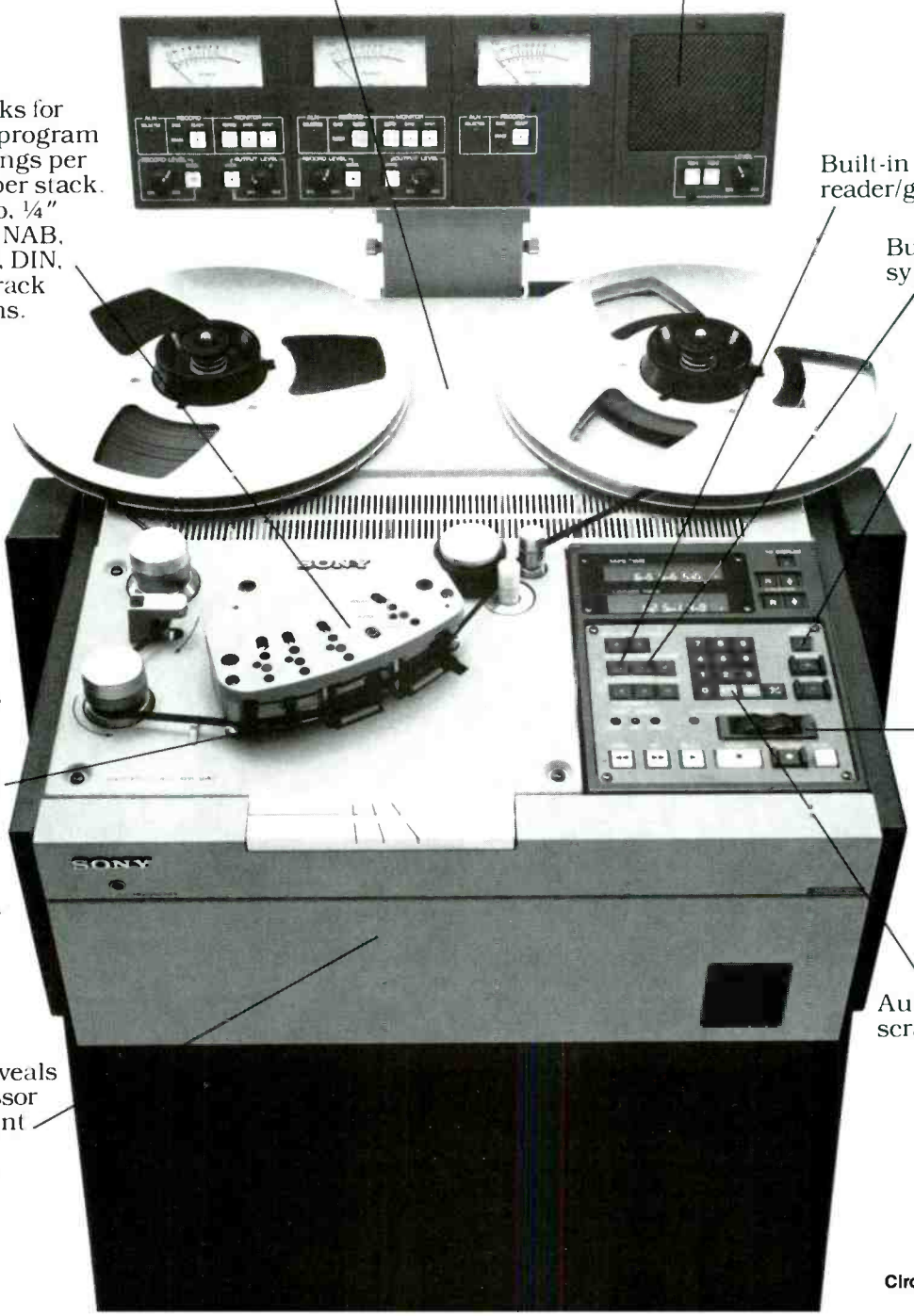


Circle (24) on Rapid Facts Card

# Application Guide for Switch Contact Selection

By Darrell Wilk

**The selection of contact material involves a trade-off between cost and performance, with the environment being critical to its overall reliability.**

There are a number of factors that determine the life of a switch, most of which may be out of your control. For example, where you live, the type of air conditioning system used and the type of contaminants in the air where the equipment is used all determine how long a switch will work.

Dry environments tend to dry out the factory lubricants faster than in more humid environments. If ventilation in a room is poor and people smoke, then airborne contaminants from the smoke will affect switches in that room.

The basic range of a switch's life is between 50,000 and 500,000 cycles, with one cycle equaling one on/off motion.

When selecting a switch, you must take into account the variations in switch contact options, including contact platings, contact shape and a multitude of other switch features. You should consider the maximum and minimum levels that you will be switching, as well as the application environment.

Darrell Wilk is vice president and director of marketing for ITT Schadow, Eden Prairie, MN.

In applications with underloading, proper selection of switch contact plating is critical to the function of the switch, and under stringent environmental conditions, contact shape and plating will also influence switch performance.

The majority of switches used throughout audio consoles use non-shorting (break-before-make) contacts. However, shorting (make-before-break) contacts may result in slightly less-audible transient clicks when used in non-isolated circuits such as PGM on/off, AUX on/off and CH ASSIGN applications. The availability of both BBM and MBB contacts increases the versatility of the switches.

### Contact plating

Compound films result from a chemical reaction of a foreign material with the contact material. Some common films of this type are sulfides, oxides and occasionally chlorides. These metalic chemical compounds are poor electrical conductors.

In normal room temperatures, silver acquires a sulfide tarnish $Ag_2S$ (silver sulfide) by the chemical action of $H_2S$ (hydrogen sulfide) in the presence of moisture. Silver sulfide films that are barely visible can insulate contact spots very effectively. An invisible 1-micro-inch film (see Figure 1) can cause a contact, which should have a resistance of 1mΩ, to actually have a resistance of thousands of ohms.

Partial coverage of the contact interface by films that are broken but not completely removed during contact engagement can result in variations in contact resistance by factors of 10, 100 or 1,000. Thus, high resistance and variable contact resistance are indications of films on the contact.

Gold plating must be used on contacts in applications where low level signal voltages and currents require high reliability. A *noble* metal, gold does not easily react with other substances. In particular, gold does not react with the atmosphere to form oxides or tarnish films.

In this respect, it is unique among metals. In electrical circuits, this is very important, because oxides and sulfide films are contact insulators. The recommended thickness of gold is a minimum of 50 microns to 100 microns with a nickel barrier of 50 microns minimum between the gold and base metal.

Clean metal to metal contact at the interface is required in electrical contacts. A gold surface provides this, even under lower contact pressure and under virtually all environmental conditions. With properly plated gold contacts, the only variables are foreign contaminants such as dust, polymer films or flux.

The selection of contact material involves a trade-off between cost and performance. (Figure 3 provides a general guide.)

### Contact shape/force

Contact force is extremely important as a means of reducing and stabilizing the switch contact resistance, but excessive force can aggravate contact wear and produce wear debris that reduces switch life.

The sliding contact shape includes a

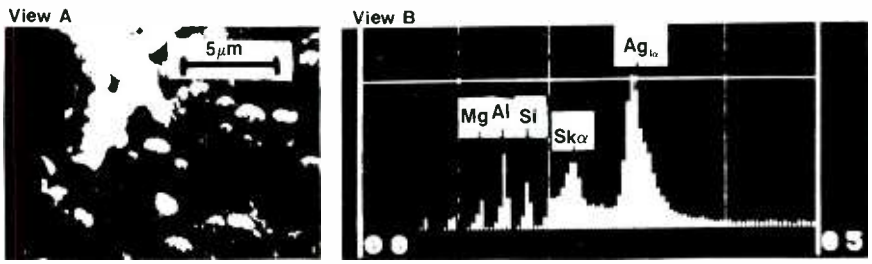


***Figure 1.*** *View A represents a scanning electron image that is characteristic of silver sulfide contamination. View B features an EDAX spectrum that verifies the suface contamination as silver sulfide. The spectrum also shows other surface elements, and acts as a fingerprint. [EDAX is defined as Energy Dispersive X-ray Spectra.]*

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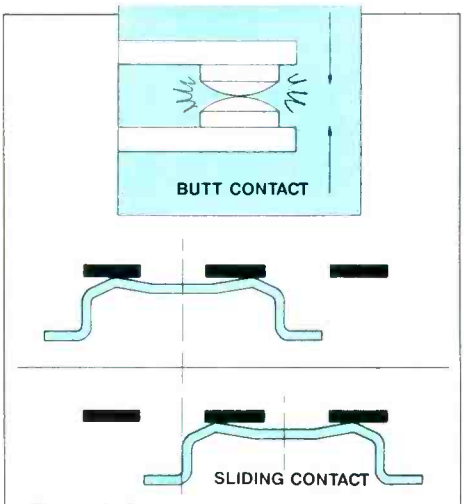



***Figure 2.*** *Representation of butt contact and sliding contact. Note on the sliding contact the chisel edge moving against a fixed flat edge.*

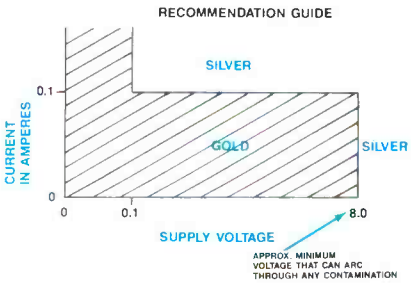



***Figure 3.*** *Recommendation guide for selection of contact material. The shaded area represents the amount of gold required for a given application.*

chisel edge that meets a flat edge with a sliding motion (see Figure 2). This configuration is excellent for cleaning the mating surface of wear debris and surface film in applications where voltage and current levels are high enough to allow silver plating to be used.

Because the surface film is thin, the film can be electrically punctured when voltage is applied to the contacts. The voltage typically required ranges from 2V to 10V, with 5V considered minimum for an unsealed silver contact switch.

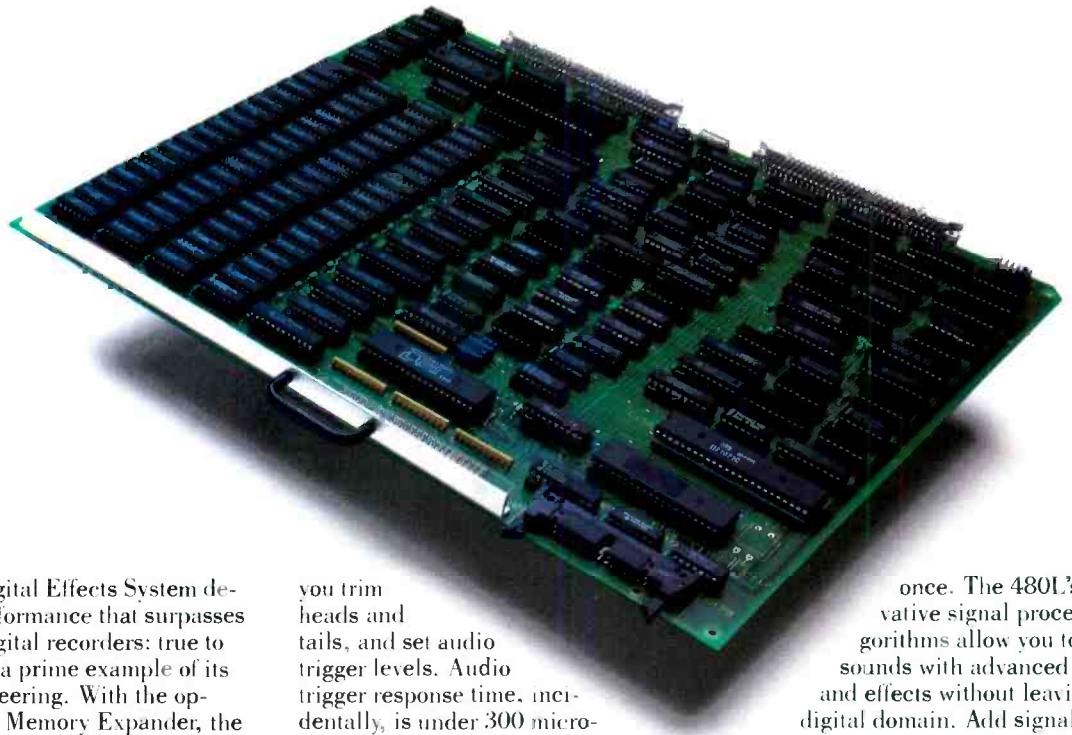
In a typical audio switching application, a dry circuit level between 0.25V to 1V is standard. This application requires film-free gold surface on the contacts.

However, there is a potential problem associated with the level of current in switch contacts. When film covered contacts encounter electrical breakdown due to applied voltage, the final value of resistance of the breakdown path is determined by the current that flows through the contacts (R = E/ I, or, resistance = voltage/current, or, as the current drops, the resistance rises). If the current is small, the final resistance condition can be troublesome, and we should therefore use film-free gold surface contacts in low-level audio circuits.

*Continued on page 66*

# EXPANDING THE SYSTEM

*The 480L Sampling Memory Expander. Accurate sampling in phase-locked stereo: a Lexicon applications brief.*



The 480L Digital Effects System delivers audio performance that surpasses conventional digital recorders: true to life sampling is a prime example of its advanced engineering. With the optional Sampling Memory Expander, the 480L becomes an astonishingly practical way to copy or move several seconds of audio from point A to points B and C.

Until now, "flying in" or "slipping" vocal and instrumental overdubs meant tradeoffs. Two-track tape is clumsy and degrades the signal: DDLs with long memories are better, but not by much. Now, with the 480L's optional Sampling Memory Expander, you can digitally record 10 seconds of true phase-locked stereo or 20 seconds of mono at a 48 kHz sampling rate. 18 bit equivalent A/D conversion produces a typical dynamic range of 98 dB, with a bandwidth of 20 – 20,000 Hz: output doesn't get any closer to input.

If you're using a digital recorder that's Sony 1610 compatible, the Sampling Memory Expander and the 480L's digital I/O interface can reproduce the original performance at any location on tape without leaving the digital domain. Slip syncing, copying and time shifting of audio segments is faster and cleaner than ever before.

You control sample recording, editing, processing and triggering from your work position using the 480L LARC. Varying up to six parameters at once, you trim heads and tails, and set audio trigger levels. Audio trigger response time, incidentally, is under 300 microseconds — virtually instantaneous. Sampling Memory Expander enhancements include Record Trigger to trigger sampling automatically from audio input, Time Variant Record, and sound on sound digital recording in sync with the original sample. Lexicon Dynamic MIDI® lets you assign MIDI controllers to sampling parameters, for new dimensions of real-time or sequenced control.

Sometimes even the most accurate replica isn't exactly what you're looking for: if so, the 480L will take you beyond imitation into creative sampling. Play samples faster or slower (without changing the sampling rate), backwards or forwards, even both at once. The 480L's innovative signal processing algorithms allow you to enhance sounds with advanced reverbs and effects without leaving the digital domain. Add signal processing as you sample, or process a "dry" sample on playback with digital wet-dry mixing.

The 480L digitally integrates sampling and signal processing because it's designed as a comprehensive audio production tool: a system. And sampling is only the first of many directions in which this Digital Effects System can grow. We're continually examining the possibilities, and as your needs develop we'll implement new tools to meet them. Now is the time to call your Lexicon Advanced Products dealer for a demo of the new production techniques the Sampling Memory Expander makes possible.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*Rupert Neve*

# Long Live Analog

By Michael Fay

**Rupert Neve discusses console design and the future of analog technology.**

With all the attention being focused (no pun) on digital these days, it is interesting to note any *priority* given to the advancement of analog technology. I recently had an opportunity to speak with Mr. Rupert Neve about his philosophy of recording console design, his company's recent announcement to build a Focusrite console, and some of his other insights on the role of analog in an ever-demanding digital society.

***MF:** How did the name "Focusrite" come about?*
**RN:** Going back a little bit...when we sold the old company we also sold the name Rupert Neve, all its variations, and all that goes with it. When it came time to form the new company, we had to do something that did not contain the Neve name in any form.

I don't know if it's the same in the states, but in England if you want to form a company in a hurry you can just go to specialists (brokers) where you can buy a pre-formed company, name and all, off the shelf as it were. It's a cheap way to have a company started in 24 hours.

Now these companies have the most outrageous names, because they have to have names that haven't already been used. They have teams of people inventing ridiculous names, with full knowledge that the name doesn't mean anything—because as soon as someone buys one of these companies they will change the name anyway. We expected to do that when we bought the company—we got it all signed up and didn't even ask about the name. When we went to our accountants office, we looked at it and there it was—Focusrite. It was perfectly usable, so we didn't change it...it was just one of those fortuitous things.

***MF:** With all the trends toward digital technology, why did you decide to build yet another analog console?*
**RN:** Well, the demand has been and still is for standards of technical performance, which cannot yet be met by digital. For instance, we've been shown by the golden-eared boys in the industry that they can perceive things happening way outside the band of normal human hearing. These are people who can actually perceive a resonance in excess of 50kHz. There's no digital system that's going to give you that kind of information. Then we have the noise figures. The dynamic range of digital systems is nowhere near as good as the best analog. When you add these parameters together you'll find that at the beginning of the signal path you have to use analog to get the very best performance. Where analog falls down is when you are going to tape, and any other means of delivering your signal from the source to a destination. There, of course, digital comes into its own.

***MF:** Some people might call this the last great analog recording console. Would you agree?*
**RN:** No, not at all. As long as there are musicians about hearing the things they are hearing—there's going to be plenty of room, for those who really are perfectionists, to get something that's really first class in analog terms.

***MF:** I've been told the price of a 64-input Focusrite console is around $400,000. Is that correct?*
**RN:** It is of that order, yes.

***MF:** At those prices how many units do you expect to be able to sell each year?*
**RN:** I find that very hard to answer. We've had a fantastic level of inquiry, and at the moment the question isn't so much how many we can sell, but how many we can make. At the present time we're looking at building a half-dozen or so in 1988.

From there on—if it goes the way it's gone in the past, and if the times are right—it's anybody's guess. I don't think we really want to go for the maximum, I doubt that we're going to expand more than about 30% to 40% per annum.

***MF:** Is each console custom-made?*
**RN:** Well, it is at the moment because my intention is not to make dozens of consoles. We're only building a few of them, and to that extent they tend to be built to the requirements of the individual customers. But obviously, in self-defense, we have to come up with some standard designs—which we have. Now we will make a few changes, provided they can be accommodated within the same physical space.

***MF:** Can you give some idea of what op-*

Michael Fay is editor of *RE/P* magazine.

*tions are available?*
**RN:** It really has to do with the organization of the console. Many people these days have been brought up on the Solid State Logic way of doing things, and they want the console organized in that fashion.

Others are more in the old Neve camp and would want the organization of the console to be that way. We designed our console to be able to go in either direction. There's not too much difference in the organization of the central control panel and things of that sort. People ask for different names for the controls, and a few different facilities, i.e., things such as whether switches should be ons or cuts. Some have asked us to put microphone pre-amps in the studio and control them remotely others feel the cost in doing that isn't justified, and so on.

***MF:** On the cover of this issue we feature an artist's rendering of the first console...when do you expect it to be ready for delivery?*
**RN:** The first console will be delivered in London to Master Rock Studios in April.

***MF:** Will the EQ section be identical to the existing Focusrite modules?*
**RN:** Yes, they will be identical to the 115 model in layout and everything else. The EQ has four sections split into the following: two mid bands, high- and low-frequency shelving bands, and 20db/octave high- and low-pass filters. Each section is independently assignable to four different signal paths—i.e., main channel, monitor, limiter/compressor, or gate—and is all resetable via SMPTE time code. All is done on push-buttons that are logic controlled. That logic can be externally controlled, memorized and reset.

***MF:** Will you describe the mic pre-amp?*
**RN:** It has a transformer input with a single stage of gain utilizing an integrated circuit, (5534) which is optimized, and is pretty well an industry standard. The secret lies in the way it's organized, not in any wonderful new chip or anything.

It combines attenuation and feedback on an 11-position 6dB-per-step switch, which gives a very large degree of headroom and optimizes the noise at each setting. This is followed by a trim that interpolates between the 6dB positions—if it's the remote one.

Now, Master Rock is not actually having the remote one. But the second one, which is going to Electric Lady in New York, does have the separate microphone amplifiers, and they are remotely controlled by a stepped resistor switch on the console, which is implemented through a relay circuit on the balanced line between the microphone pre-amp in the studio and the console input.

***MF:** Does the console come with a Necam-type moving fader automation system?*
**RN:** No, we're not trying to produce our own automation at the present time. We are recommending the George Massenburg automation, and fitting it on these first two consoles.

***MF:** Is the Massenburg an additional charge or is it built into the console's price structure?*
**RN:** The Massenburg is additional.

***MF:** What other total recall type features have been incorporated?*
**RN:** There is a full specification console, which is the one we've been talking about and the highest-price console. This is what Electric Lady is purchasing, and is incorporating all the optional features.

All the assignment switching on the

console (the bus track assignments, aux assignments, the monitor and main path, EQ) and the status of the console can be reset. It's a "smart" reset that follows the mix via SMPTE time code. This is an option and will not be the case on all the consoles.

The Master Rock console has certain limitations of budget and is designed down in terms of the features, but not in terms of the audio performance.

***MF:*** *For those who can't afford a Focusrite board, what would you say are the two or three most critical features to look at when shopping for a mid-priced console ($100,000-$150,000)?*

**RN:** They should be looking at the way in which the signal is handled in the console, and the interface to that console with the outside world. I believe that you need to have transformer isolation at the front end of the console and the main outputs.

Those transformers need to be of extremely high quality. If you don't use transformers, you may be all right in a little home studio, where you're hooking the thing up to some hi-fi gear and it's all unbalanced, but you do run into problems quite frequently and those problems are not always evident. I've had a lot of people tell me that the sound they get from that kind of installation isn't that good, and yet if you take the individual items of equipment and measure them—they are very good. It's really the interface that you need to watch.

And then I think you need to look at things like crosstalk. Crosstalk is any pollution of the wanted signal by an unwanted signal. On many of the lower-cost consoles, crosstalk between channels and between groups is very high.

Let me give you an example of the importance of noise and crosstalk in a circuit. We did some experiments recently whereby a test was set up and played through a loudspeaker. It involved a pink-noise generator (set at any ordinary listening level you like, such as 75dB-80dB) and a discrete 3kHz tone from an oscillator (at the same apparent level just so you have some sort of reference; we know the meters won't be equal).

Now the two are able to be easily heard. Then we reduced the level of the oscillator and warbled the tone back and forth so that it could still be identified. We went on down and down.

At a measured 35dB below the pink-noise level, people could still hear that 3kHz warble tone. Now you tell me what that means in terms of things such as crosstalk and the harmonic content of a signal below the noise level. My point is this—you can still hear crosstalk even though it is 35dB below the noise. Those are the type of things that don't appear in the textbooks.

So, although we pay a lot of attention to noise, we don't pay an awful lot of attention to crosstalk as an industry. Therefore, if you have a console that has a measured signal-to-noise ratio of 90dB, which is considered these days to be a pretty good noise figure, the question has to be asked—"what about crosstalk?" Crosstalk is often overlooked.

These are the reasons why I go all out for almost ridiculous bandwidth, low distortion, low noise, and low crosstalk. All those things add together to make a console that makes a difference. The difference between one of our consoles and one costing half the price is not that hardware looks any different or is even that much more valuable. It's the attention to detail we have to give it in order to attain ultimate performance.

Also you need to look and see what kind of faders are being used. I came across a console the other day where

you could not get the channel to switch off properly. With the fader down at zero there was still some breakthrough. Things like that just ruin the performance of an otherwise good console.

***MF:** Would you say, then, the key differences between a $400,000 and a $100,000-$150,000 console are those points that you just mentioned?*
**RN:** Well another difference is the fact we don't have any signal flowing in switches under the front panel, except through the rotary switches that determine the equalizer frequencies. All other signal handling is done on solid-state switching or relays.

***MF:** What is the bandwidth of the board?*
**RN:** Off the line inputs we have a 1dB loss at 100kHz and it's 3dB down at somewhere around 150kHz-170kHz, so there is a very gentle slope.

This whole question of very wide frequency response is necessary, but it's not necessary unless you're in the high-quality music business. For a broadcaster, it's ridiculous, because the bandwidth and other factors in the chain are going to limit his ability to deliver these figures.

***MF:** What special ergonomic considerations have been incorporated into these consoles?*
**RN:** One of the most important concepts when designing this console was to keep a very familiar layout on the front panel so that engineers who move around a lot from one board to another can quickly feel at home on this system. If a mixer is familiar with the SSL, a Neve, or almost any other system on the market today, he can walk into a studio with a Focusrite and go to work in 10 minutes. We're giving an awful lot of assignability to the console, and lots of flexibility. There is a default condition on almost any point of assignability so that the console operates in a comfortably familiar manner. This is so important with all the free-lance engineers out there today.

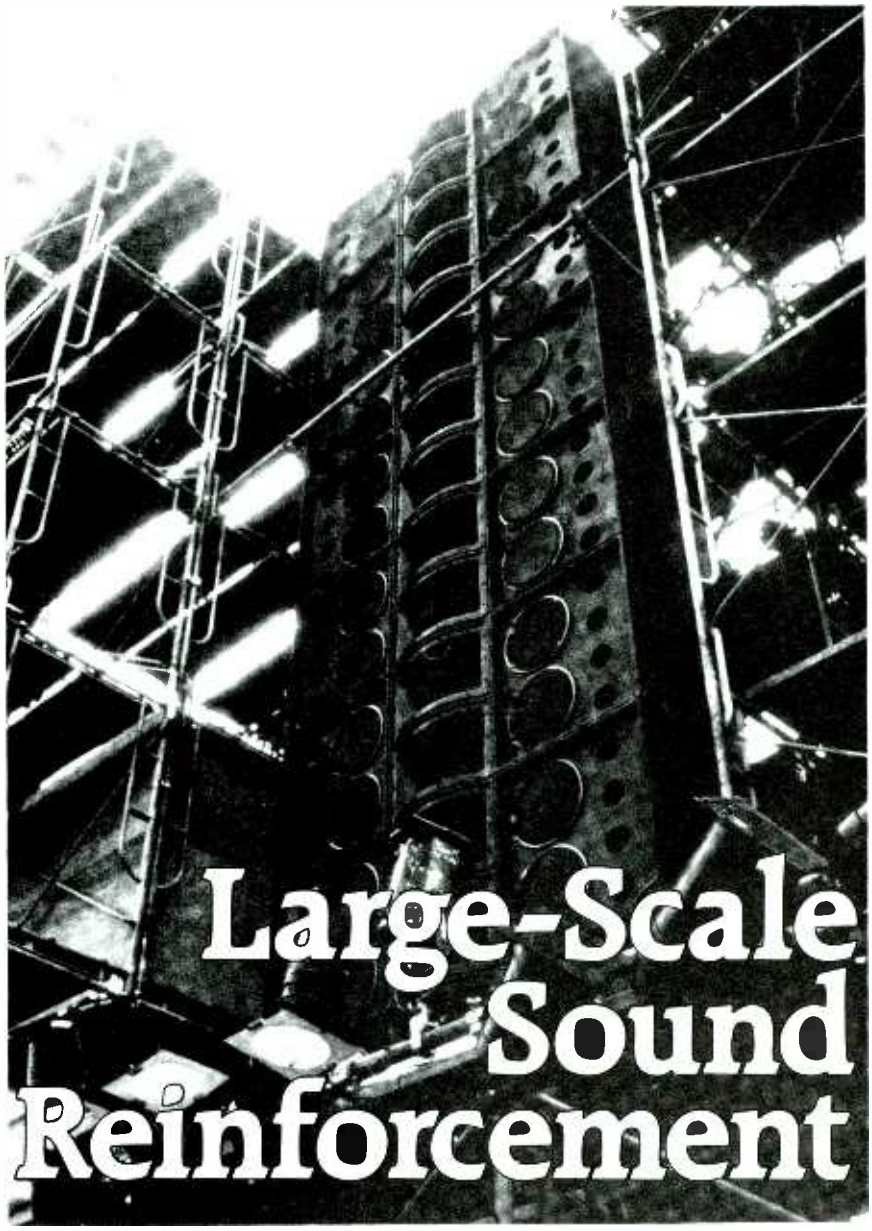
We have people telling us that SSL does it this way and Neve does it that way...we have to try to be independent while at the same time go along with new traditions that have been established in recent years.

How many of you would plop down 2-,3-, $400,000 for a piece of pro-audio gear that no one has ever seen? Not many I'm sure, yet there seems to be a certain mystique surrounding the Focusrite product. Without question Mr. Neve has a reputation for developing superior products and, there is little doubt about his ability to deliver the new console as described. But, I can't help thinking about the uproar caused when any number of other manufacturers introduce new, untested products that promise better specs, sound and all-around performance than ever before.

Is this yet another product that tempts us with features that won't be available for three years? Only time will tell. But this design isn't quite as new as it might seem.

The true heart and soul of any board lays in the input, equalization, and output stages. Mr Neve's console is simply an extension of his microphone pre-amp, equalizer, and dynamics module that has been in production for a few years now. For these reasons, the introduction of a Focusrite console is really no great surprise, but rather an occasion met with much anticipation.

Whatever is said about having yet another high-priced analog console on the market, one thing appears clear...this is not a product in search of a market. On the contrary, the Focusrite console is born of interest and demand. REP



# Large-Scale Sound Reinforcement

By Shozo Kinoshita

**An outdoor Tomita concert in Japan needed a sound reinforcement system that could extend to 600 meters, providing a formidable design challenge.**

Every summer, in the backwoods city of Nagaoka, Japan, a popular fireworks festival takes place along the dry riverbed of the Shinano River. Here the world-famous "sanshakudama" fireworks have become synonymous with the festival. (Sanshakudama literally means fireballs three shakus in size, one shaku equaling .944 feet. One fireball of these fireworks is three shakus in size.)

In one night, 10,000 magnificently colorful fireworks are released, setting off a scene that cannot be matched anywhere. The explosive sounds they emit can be heard echoing off of nearby Mt. Yukyu. This year, in commemoration of the 80th anniversary of Nagaoka's cityhood, the fireworks were accompanied by the dynamic sound production of Isao Tomita's synthesizer.

The area needed to accommodate the sanshakudama fireworks, which, expanded more than 600 meters after exploding, covered roughly one kilometer. The job required a sound system to be able to perform under circumstances that, up until now, had never been tried.

Furthermore, a high-grade system was needed to produce high-quality, natural sound from a multi-orchestrated synthesizer, a solo violin and a shakuhachi (a 5-holed bamboo clarinet), a 250-man taiko core (a taiko is a very large drum used in Japanese festivals) and a 300-person chorus.

Although the task appeared to be overwhelming, the challenge to bring these diverse sounds together in sound reinforcement was too tempting to ignore.

A wide variety of obstacles lay waiting en route, including problems with the amplifier, electric source and speaker cable, causing much frustration.

### Sound system conditions

If Tomita's image of music as "the essence of an epic of the universe" was to be realized, no ordinary sound system would do. Tomita's most basic idea of a surround system was realized using a sound "cloud."

For this concert, the spectators were to be located in two half-spheres on either side of the stage (Figure 1). Also, directly behind the audience were residential areas. Thus, we were not able to situate the speakers to create a surround effect. To compensate for this, six speaker systems were lined up between the Chosei and Oteo bridges, and a sound "cloud" was formed through a phase-controlled, multi-channel sound system. The crowd

Shozo Kinoshita is president of Rey Audio, Miyoshi-cho, Irumagun, Japan.

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But you do care about sonic quality. That's how your own work is judged. It's how you judge ours.

Neotek's reputation for performance is built on outstanding circuit design. It's the reason no other console sound compares.

Our sound is the reason Abbey Road bought their first American made console. The reason you find Neotek credits on the finest classical CDs. Why top mic and synthesizer manufacturers demonstrate on Neotek consoles.

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That's why we work so hard to put our console designs at the leading edge of technology. It puts your sound ahead of all the muddy and fuzzy alternatives.

Great composers write each note carefully on the page. Every passage leads to their vision of the whole. So it is with Neotek's artists of circuit design.

We suspect that Brahms, Beethoven, and Mozart never wrote a schematic.

But if they had....

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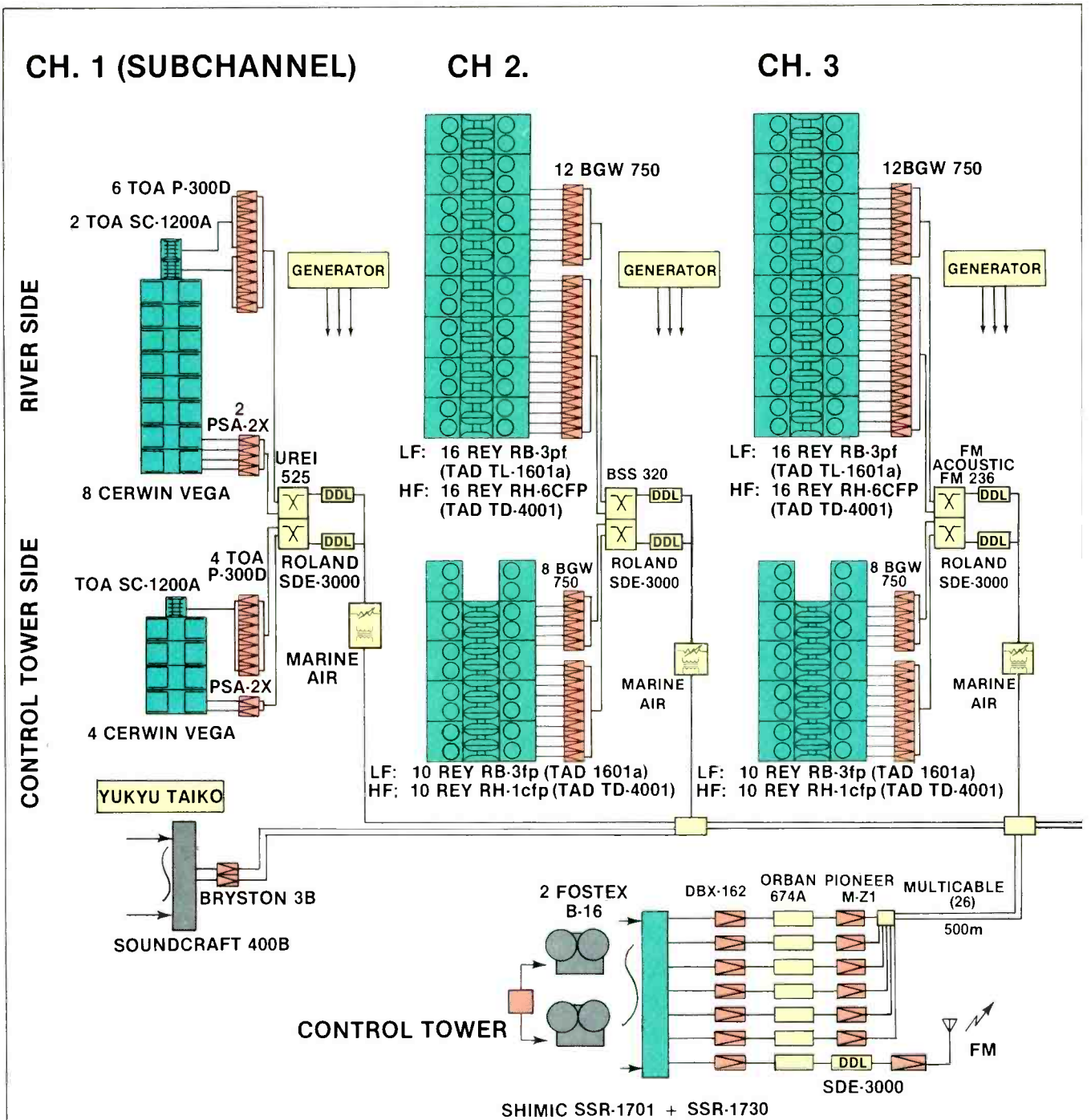



***Figure 3.*** *Block diagram of the sound system.*

was seated on both sides of the river.

After careful consideration, it was decided that the scaffolding for the speakers would be placed near the sports fields and the control tower beyond these fields, even though it would have ideally been best to situate them directly between the two areas for spectators. This was a precaution against the remote chance of flooding in the riverbed. Speakers were lined along a temporary road in the dry riverbed.

Within this, the two extreme channels (1 and 6) were placed near the two bridges so they would correspond with the taikos and the chorus. Here, we were aiming at effectively creating a sense of clear direction and, at the same time, a wide field of sound. The remaining four middle channels (2-5) were located in the central speaker array.

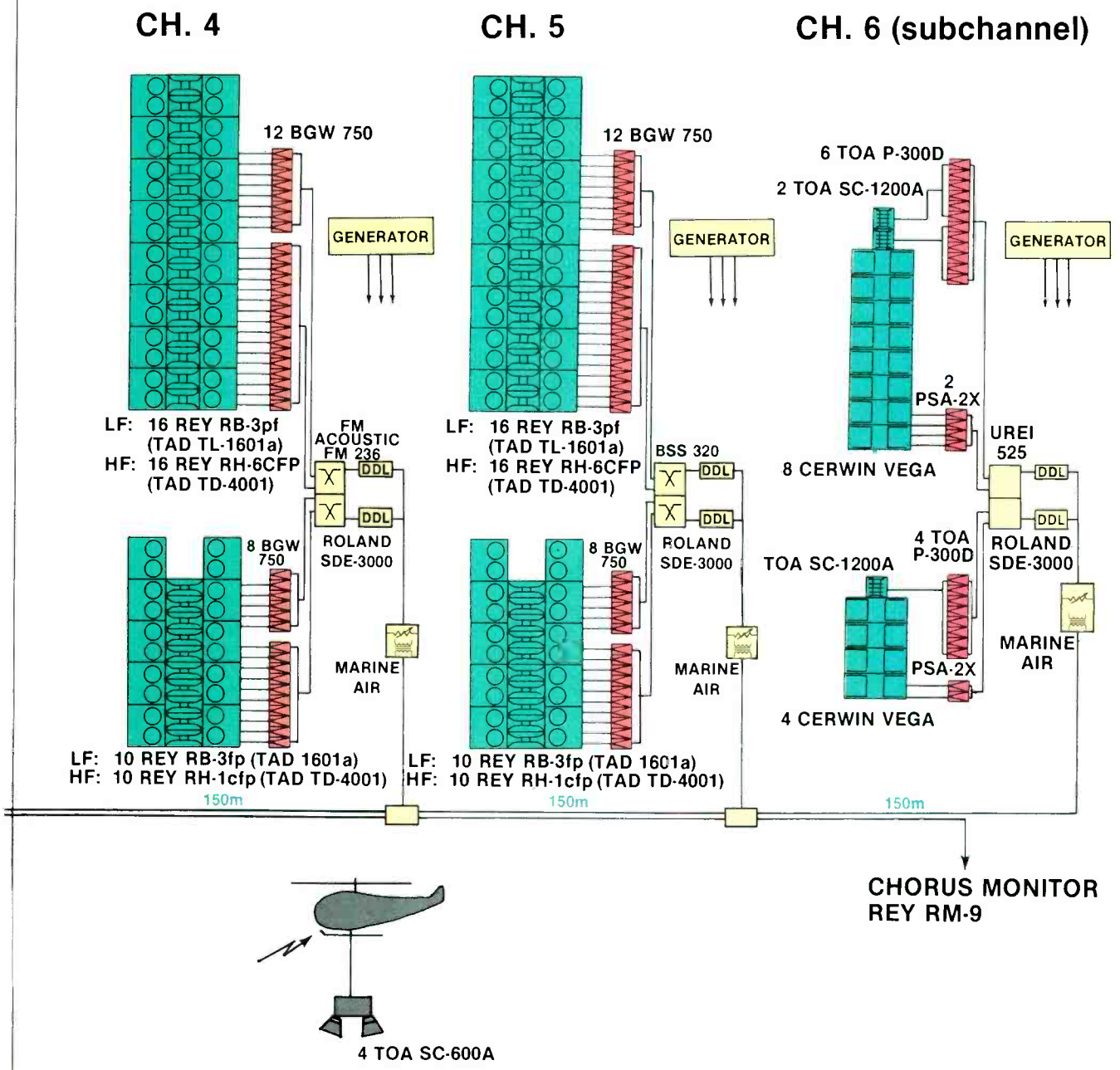
Channels 7 to 12 faced toward both river banks and were situated away from the other two channels (1 and 6). They were joined by a UFO-like helicopter, bringing the total number of channels to 13. This point constitutes a big difference between this concert and other concerts.

Also, in most concerts, an ordinary monophonic dispersion arrangement is used. For this concert, a stereophonic arrangement was used in order to ensure that even the audience seated near the Chosei bridge received a clear sound from channel 1, located one kilometer away at the Oteo bridge.

It would seem that no matter how many speakers were set up, it would be next to impossible to realize the situation we had in mind. The plan called for a standard sound pressure level of 90dB from all channels at the middle-frequency range. For the high sound pressure needed to represent the Big Bang and the rockets, we hoped to reproduce 110dB at the low-frequency range.

### Speaker system selection

For a large-scale sound system such as this one, it was important that the con-




struction of the speaker system be simple and have a high output capacity. A complicated system would not be able to distribute the sounds equally over such a large area and would also cause many problems in terms of setup. Also, for a concert of this magnitude, if we combined different models, unifying the tone quality and capacity of every channel would be difficult.

The use of a low-grade system would weaken the sound quality of the high-grade system. Thus, we decided to use the same model for the entire sound system. For this concert, the Rey Audio 2-way system (TAD unit) was chosen to supply the main channel. This system has displayed a high contrast ability, which allows it to be equally useful at small-scale indoor concerts and large-scale outdoor concerts.

The system separates the direct radiator, model RB-3, incorporating two TAD TL-1601s for low-frequency sounds, and the high-frequency horn type loudspeaker (Rey RH-1 or RH-6 and the TAD TD-400), allowing for high definition. This configuration also allows for sound projection over a wide area.

The low-frequency cabinets, as well as the high-frequency horn cases, are built so that they can endure the pressure of 10 or more low-frequency cabinets. For this particular concert, we piled as many as 16 horns on top of each other.

Another distinct feature of this system is "2-way," which is constructed in order to handle crossover at up to 800Hz. This concert in particular called for a system that could handle everything from low-frequency to super low-frequency sounds. Its performance was astoundingly strong. Moreover, while suppressing box ringing and horn ringing, this system emits a clear and natural tone quality comparable to that of a studio monitor. For these reasons, the Rey Audio system was considered ideal for this concert. From this point, all that remained was how many speakers to use and how to arrange them.

**Preparation experiments**

A sound reinforcement system that can

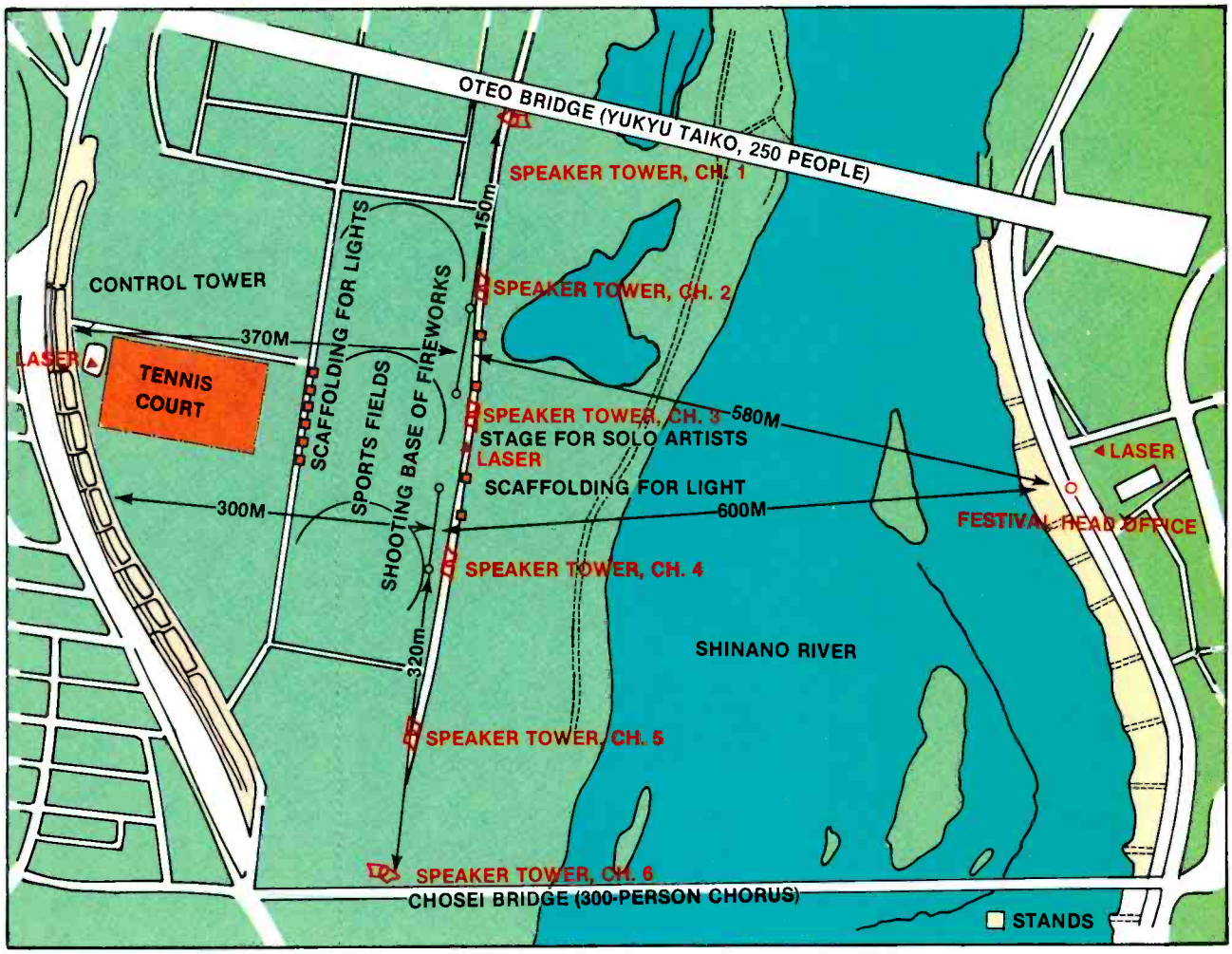



*Figure 1. Layout of the Tomita concert, "The Festival in Nagaoka."*

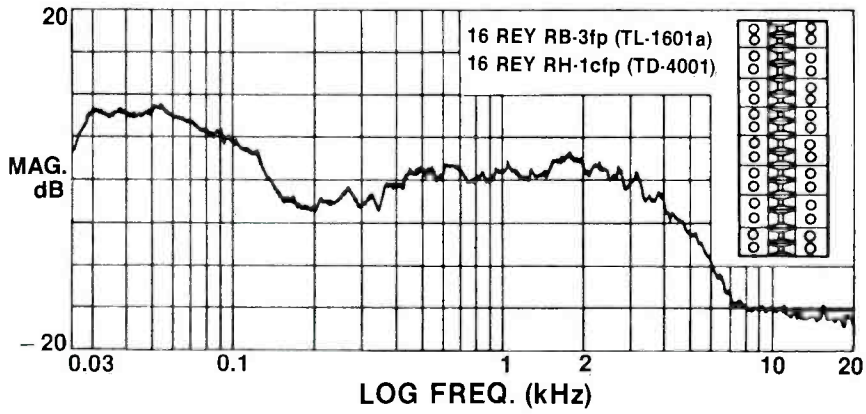


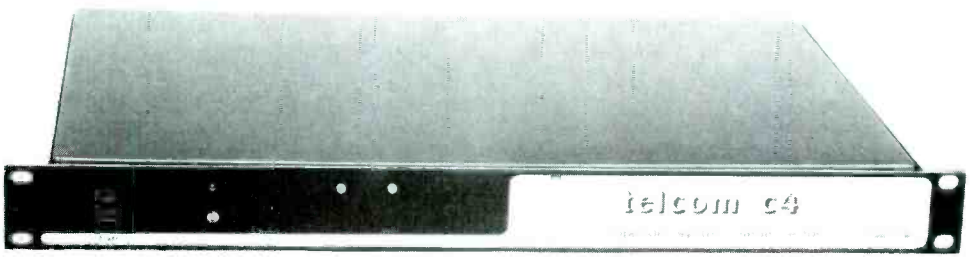

*Figure 2. The frequency response of Ch.3 speaker system at the festival head office. The distance is 600 meters.*

extend 600 meters is, for the most part, non-existent. Needless to say, information concerning such a project is also scarce. While it is possible to design such a system for low frequencies, sounds exceeding middle frequencies, and in particular high-frequency sounds, tend to experience decrement over distance due to air viscosity and heat loss.

Trying to predict the level of decrement is difficult. We performed our testing in a dry riverbed containing ditch reeds, as we thought the decrement would be particularly high in such a setting.

The testing took place in June 1986 at the location of channel 3. Here scaffolding 13 meters high and 13 meters wide was set up. Sixteen RB-3fp + RH-1cfp systems were used to simulate the actual concert conditions. This was all directed at a point further than the opposite river bank. The layout of the speakers, tone quality related matters, maximum sound pressure and actually hearing (how does sound transmitted from 600 meters away actually sound?) were tested. The setting was completed with the addition of the big crane, thus

# The Finest Piece of Quiet

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**Circle (46) on Rapid Facts Card**

*The loudspeaker and electric generator unit. The speaker is TOA's SC-600A.*

simulating the actual concert situation.

From the very beginning, we felt that a vertically arranged speaker tower would best limit the degree of decrement of the middle- and high-frequency sounds, produce a quality sound, as well as transmit an equal sound flow from the Chosei bridge to the Oteo bridge. We were not disappointed. We sandwiched the high-frequency horns with two rows of low-frequency cabinets on either side so that they would match in height and would allow the dispersion angle of the horizontal plane to be controlled so that it would not spread out too far.

As expected, there was a high level of decrement at 600 meters. At a level of over 2.5kHz, the level of decrement was 15dB/octave; over 5kHz, −36db/octave. At levels higher than this, a sudden decrement of sound was indicated. This system, by the way, has a flat response of up to 10kHz and anything higher measured between −18dB and −24dB/octave. The system had enough power to reproduce high frequencies, but at 600 meters even the addition of EQ and a tweeter could not compensate for the loss.

For a source of sound pressure, 100Hz to 10kHz of pink noise was used. At a point immediately in front of the amplifier clip, the sound pressure reached 85.5dB. Depending on the type of music being transmitted, the sound pressure averaged 85dB and maximized at 94dB.

The general feeling toward the results of the tests was that the data taken from the short distances and the listening sensation were not valid measurements. Some sounds in the high-frequency range did not get lost in transmission, but this was not a major concern. What was most impressive to us was that the sound that was produced was so dramatic that it touched us like a wave rolling in from a vast sea of orchestra. Of course, if there was wind on the day of the concert, the sound pressure would fluctuate ±10dB, but this could not be helped.

We were also concerned over whether the equalizer, which had been adjusted in accordance with the test results, would lose some of its naturalness. We would not be satisfied with just any system that could produce only high sound pressure; we were set on displaying a truly high-quality system. The system that we settled on transmitted a quality sound that was comfortable to listen to, and at the same time had a naturalness that left the listener with a startling impression.

### Transmission formula

The control tower was located exactly 350 meters from the center speaker (No. 3). However, because it was impossible to run a cable directly between the two points, we had to use 500 meters of cable. Also, one kilometer of cable was needed between the control tower and channel 6 in order to accommodate distribution to each channel. Because of the limited capacity of the console, direct output was not considered to be possible. We were also forced to situate a relay

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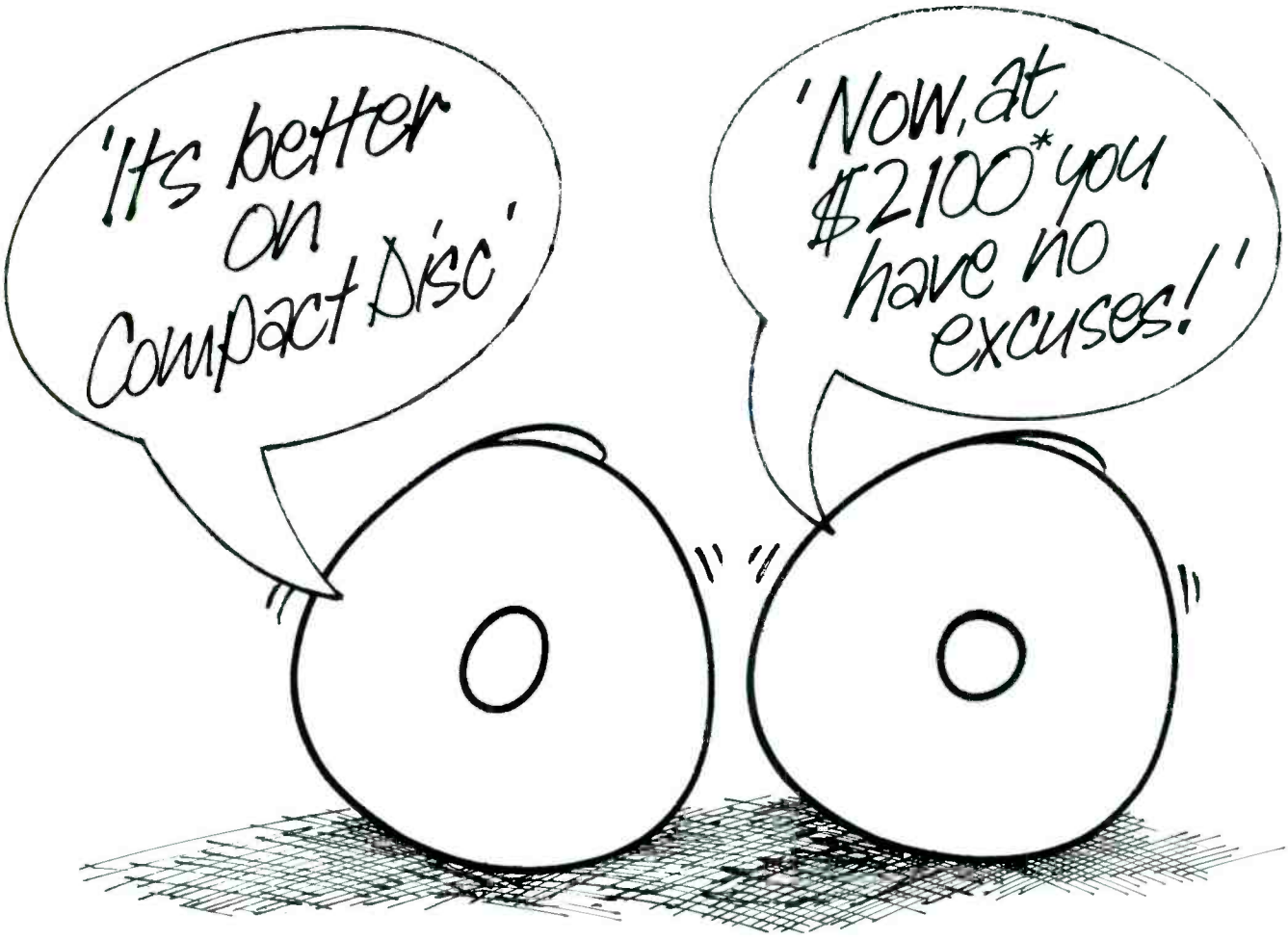


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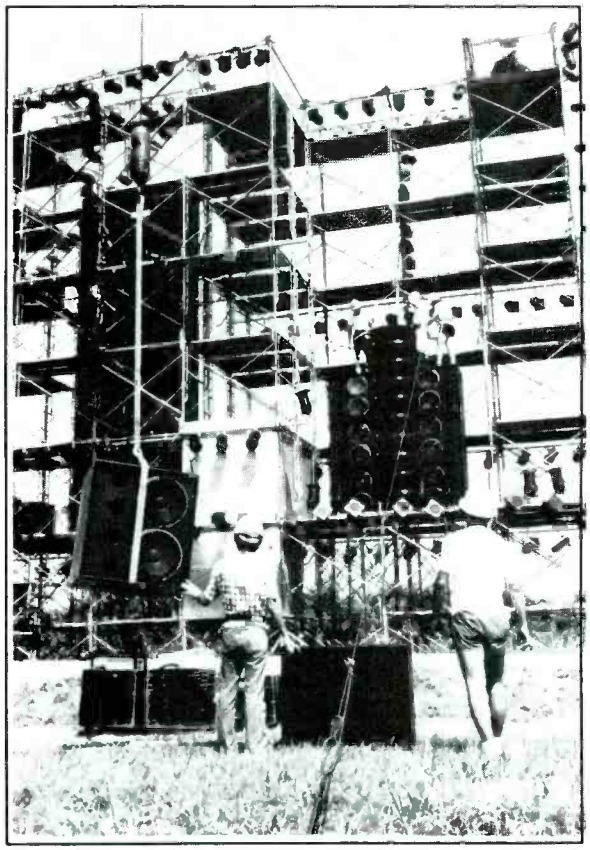

*Setting up the speaker tower.*

amplifier along the cable line, which led to further complications.

The method employed for this concert was as follows. We first stepped up to 10V. Because a stable and efficient power amplifier was at the transmitting end, we were able to accomplish this. A multicable was then connected, and while isolating the receiving end through the use of a line transformer (600Ω:75Ω), we stepped down. Next, through level control, the signal was led through the digital delay, then through the divider, the power amplifiers, and finally into the speakers.

In a comparison study performed between the multicable method and the light communication method (FM and PCM), it was found that the employment of the former did not produce an inferior sound. This is not to say that the light communication method is not a viable system. It has high practical capabilities. However, because of our stability concerns and the number of channels we were using, it was decided to use the highly trustworthy multicable method.

Here, also, the transmitting power amplifier was a source of frustration. A number of potential problems could

*Continued on page 71*

# AMEK AND GML... THE FORMULA

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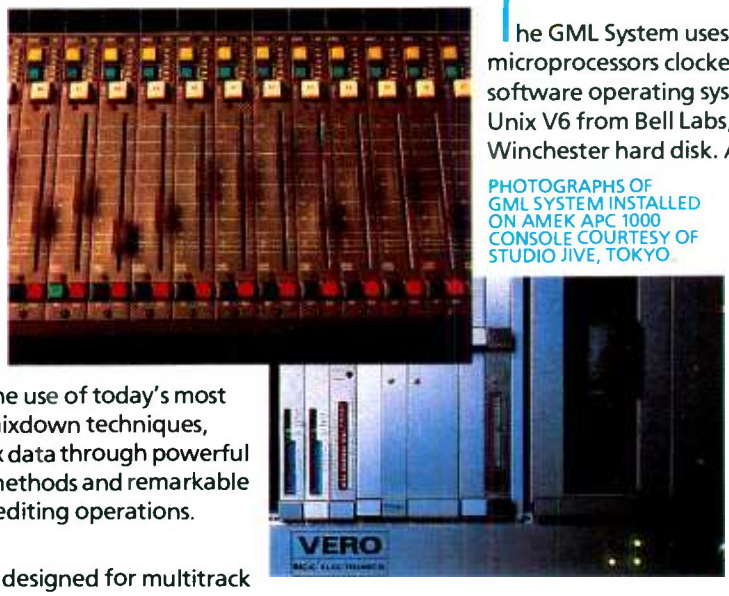
George Massenburg, one of America's most respected recording engineers, designed his system from the engineer's point of view, aiming to enhance professional audio master recording with a unique and innovative approach which more or less transparently follows the engineer's natural workflow.
The GML System facilitates the use of today's most complex and sophisticated mixdown techniques, giving total control of the mix data through powerful easy-to-use data processing methods and remarkable off-line fader and mute mix editing operations.




PHOTOGRAPHS OF GML SYSTEM INSTALLED ON AMEK APC 1000 CONSOLE COURTESY OF STUDIO JIVE, TOKYO

The GML System is purpose designed for multitrack and audio video post production applications, offering an intelligently advanced 'visual-mixing' environment with versatile automatic timecode recognition and programmable timecode 'off set value' commandability in each mix.

GML programmes are divided into two sections. The outer shell is used in normal mixing operations to enable the various write and read modes for each fader, and for initial storage of mixes. The inner shell contains the 'mix editor', which is the command centre for the editing of all data. The GML mix edit utility provides the engineer with the capability of advanced mix editing. The user can selectively modify mix data, merging, splicing, copying, swapping, erasing, inserting and deleting as required. Additionally, data for individual tracks or for a whole mix can be shifted back and forwards in SMPTE-time.

GML also has a simple and flexible subgrouping facility, using 6 dedicated faders as submasters.

The GML System uses two Motorola 68000 series microprocessors clocked at 12.5 MHz with the Idris software operating system, 100% compatible with Unix V6 from Bell Labs, residing on a 40 Megabyte Winchester hard disk. A 1-Megabyte Dynamic RAM memory is provided for the 'mix in progress', with finished mixes stored on the hard disk and later, archived to floppy diskette. Provision is made for the structuring of mixes into directories and subdirectories, so that where a number of producers, engineers or clients use the system their mixes can be kept entirely separate and password-protected.

The system is slaved to SMPTE code and has an internal resolution of 8.33 mS (quarter frame) and can control up to 128 faders and 7 switches per channel to that accuracy. Necam and Solid State Logic fader and Mute data can be converted to the GML format by way of the floppy disk drive input.

Ongoing software development will continue to hone the edge of the GML System, enabling it to remain at the forefront of technical excellence for the foreseeable future.

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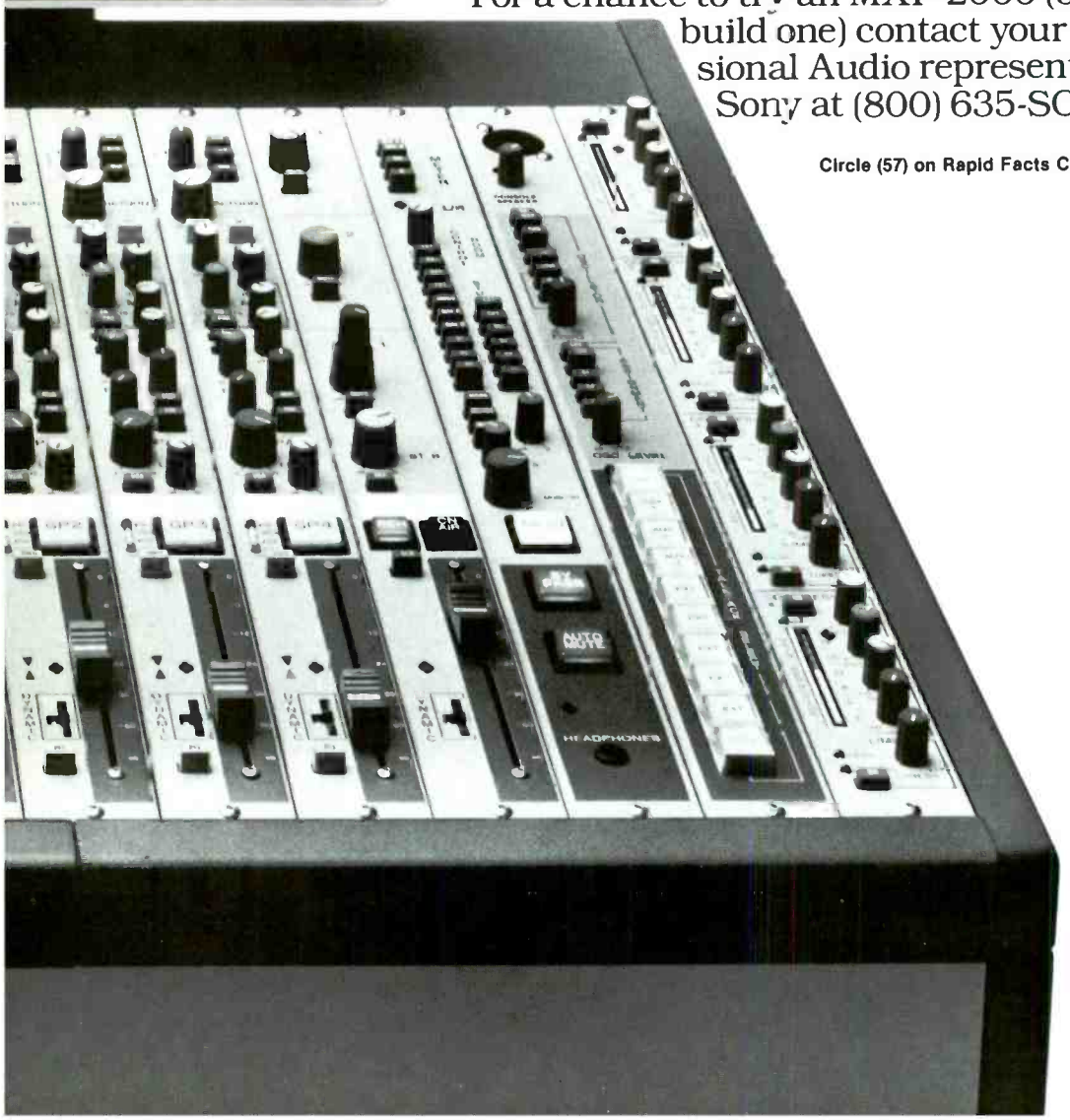


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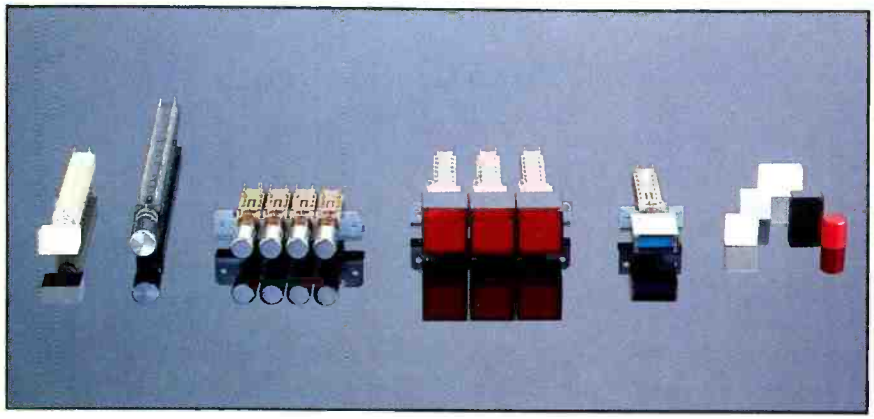


*ITT Schadow F series push-buttons.*

*Continued from page 48*

Switch specifications usually center on the number of operations and the maximum load currents I/M and gives little or no attention to switching low-level currents and voltages or infrequent operations.

There are numerous applications where the total number of switch operations are meaningless. A more important requirement is that the switch contact integrity is assured when the switch is operated infrequently (annually) and maintained over a long period of time (more than five years).

The atmosphere in which the switch is required to operate is critical. Airborne contaminants, such as tars from cigarette smoke, can quickly contaminate the switch contact surfaces, even when the switch appears to be enclosed, but is not totally sealed.

The rate of film growth is greatly accelerated by increasing the sulfide concentration. Typical sulfide sources are paper, cardboard, pasteboard or vulcanized rubber insulation. Water vapor in the air is necessary along with $H_2S$ to tarnish silver.

When selecting a switch, the following points should be considered:

1. Voltage and current to be switched.
2. Atmosphere, storage/usage.
3. Frequency of operation.
4. Contact required on first actuation.
5. Contact plating silver vs. gold.
6. Contact force.
7. Type of contact closure, butt or wipe.
8. Switch designed with overtravel and pretravel zones to point of contact is well outside area of wear debris.

**Troubleshooting**

Determining that you actually have a bad switch is tricky. Most often, a bad switch will show up during the break-in period of the equipment. After that it becomes more difficult to identify a switch that has simply worn out.

You can troubleshoot the switch in question to get an idea of the problem. After getting inside the piece of equipment, spray the switch with the manufacturer-recommended spray. (Contact cleaners/lubricants should not be sprayed into the

switch, despite the apparent short-term results.)

If that seems to solve the problem and the switch again becomes intermittent, the most likely problem is particulate contamination.

If you suspect dried-out lubricant, judiciously spraying a small amount of the original factory's lubricant and exercising the switch a few times can be helpful.

### Field service

The use of gold switch contacts can minimize or overcome field service problems, especially if sealed. Controlling the air flow and air quality in the application, such as filtering and humidifying the air conditioning system, can affect the switch performance and life.

This is especially true in infrequent use applications where there is a high level of air pollutants and particulate contamination such as cigarette ash, hair and dust.

### Fixing a bad switch

If a switch does become intermittent, several factors should be considered before any field service is attempted:

**1.** Particulate contamination is very difficult to remove from a switch in the field. Switch construction, switch mounting location and equipment design/style make a complete cleaning of the switch complex. Often, simply spraying cleaners into the switch moves the contaminant from one area to another, only to cause future problems.

Consult the equipment manufacturer about switch refurbishing if particulate contamination is suspected; many manufacturers will offer a switch refurbishing service. Generally, it is not recommended that you do the job yourself.

**2.** The lubricant can dry out, depending on the application environment and lubricant selected by the switch manufacturer. Indiscriminant spraying of contact cleaners and lubricants into the switch can cause significant performance problems for these reasons: First, these cleaners or lubricants can cause an adverse chemical reaction with the original factory lubricant. Second, the chemicals can leave behind residues that promote moisture retention and corrosion formation in the switch.

It is important to remember that contact performance can only *partially* be controlled by the manufacturer. Electrical and environmental factors in the application also have a significant effect on factors such as switch resistance and life. When making a decision, each particular application should be examined carefully so the proper selection of contact design and contact plating can be made, providing the user with reliable and effective switch performance.

REP

# Studio Scheduling

By Barry C. Sanders

**Effective scheduling is an important key to a studio's survival.**

## *SESSION INFORMATION*

WHO:
Client_____
Artist(s): _____
Musician(s): _____
Producer(s): _____
Engineer(s): _____

SESSION CONTACT:
Name: _____
Address: _____
Phone: _____

Date: _____
Time: _____

Type of Session: _____

Studio: _____

Rate: _____

Notes: _____

Special Equipment: _____

Rental Equipment: _____

Setup requirements: _____

Purchase order number: _____

BILLING CONTACT:
Name: _____
Address: _____
Phone: _____

AUTHORIZATION:
Name: _____
Date: _____

*Above is a suggested form for a Session Information sheet.*

Effective scheduling for a recording studio isn't necessarily an exact science, but learning to do it well is a vital key to survival in the recording business. A studio's profit *does* relate directly to how efficiently its available time is managed.

Ideally, one or two people should coordinate the studio's scheduling procedure. Generally, it is the primary responsibility of the studio manager.

The studio manager should know and understand the rate card, scheduling policies, services and equipment, personnel, idiosyncrasies of regular clients, and how to effectively negotiate with prospective clients. If there is a night studio manager, the two must discuss the status of all scheduling *daily*.

The scheduling process usually starts with an inquiry by a producer or engineer to check dates and times. It is important to get all of the pertinent information in this initial call.

A pre-printed session information sheet can be a handy tool and will ensure that all important information has been written down and is on file. (See example on this page.) This sheet should contain spaces for:

— **Who**: artist, producer, engineer and client.
— **When**: date and time.

Barry Sanders is studio manager for 16th Avenue Sound in Nashville.

— **Contact**: person responsible for approval and payment.
— **Contact address and phone**.
— **What**: type of session (tracking, overdubs, mixing or other).
— **Where**: specific studio room.
— **Rate**: the agreed upon amount.
— **Special equipment**.
— **Setup requirements**.
— **Technical information**.
— **Purchase order number**.
— **Billing information**: (include name and address).

A client's rate is privileged information and is not for public consumption. There are endless reasons why one client pays a different rate than another. A rate or billing code might be an effective way to handle this.

If this is a regular client, most of this background information could be kept on file and filled in after the call. The only information needed from this initial call would be who, what, when, the purchase order number and other technical notes. The necessary information should then be noted on the studio's master calendar.

### The studio calendar

Next to the telephone, the calendar is the most essential tool for scheduling. For studios, an efficient calendar is one in which a full week with hourly breakdowns can be viewed across two pages.

Also, large chart calendars can be useful as a quick reference providing there is enough space in each date box to write important data. One solution is to use a combination of calendars for reference, with one being designated as "master." To avoid confusion when using multiple calendars, follow two strict rules: update additional calendars immediately upon receiving new bookings, and keep the master calendar in one place, such as the studio manager's office or the receptionist's desk for quick reference.

Computers may be used in the same manner instead of a paper calendar. However, most calendar software programs require a dedicated computer to run the software.

Most bookings are either hourly or block. The hourly booking uses specified start and end times. Occasionally, the session actually follows these times. Because it is difficult to accurately anticipate a specific out time, it's a good practice to allow at least one hour between sessions for overtime, equipment teardown and setup for the next session. One hour is the *minimum* time that should be allotted between sessions; if you can allow more, great. Typical sessions do tend to run long, and it is always better to leave a little cushion than to keep the second client waiting.

### Holding studio time

Inevitably, you will get calls from clients asking you to hold studio time while they verify artists' and muscians' schedules. In effect, this "hold" is reserving studio time in advance, and is a common practice. A "hold" or "tentative" booking is something to be careful with because it's not a confirmation and is subject to being easily cancelled or rearranged. However, you need to be able to gauge how firm the hold is if you have another inquiry for the same time.

The key is communication with your prospective clients. The best way to handle the situation is to explain to client "B" that the time desired is currently on hold and that you will check with client "A" for a confirmation or a release of the time. Client "A" has the right of first refusal. Most people understand that you need to carefully schedule time, and as long as you are open and communicate your scheduling situation, most problems can be avoided.

A hold or tentative booking *could* be considered a special service available only to your established clients. However, it's something that you should not allow to be abused. When a client asks a studio to hold time, a confirmation is expected to follow very soon. Each studio must determine its policy on a reasonable time to wait for confirmation. Usually one or two days is appropriate. This time period could shorten considerably if another client shows up with cash in hand for a session during the same time. It could also lengthen, depending on the scale of the project and how far in advance the hold is being placed. If the client is unable to confirm the schedule within your limits, your desire for future work and the amount of time to be booked will guide you in the decision to hold or release the booking.

### Purchase order numbers

For all confirmed sessions, a client should provide a purchase order (P.O.) number as evidence of a commitment. This number is used as a reference on all billings and correspondence and clearly shows an intention to work on the specified dates. Most record labels and publishers use purchase order numbers as a way of tracking studio billings and as an approval for studio time.

Once you receive a number, you can

be relatively sure a budget has been approved for the session, and your bill to the client will not be treated as a surprise. Still, many sessions will be booked verbally without a purchase order number. In this case, use the contact person's name as the reference number on your billings. Having a valid number is not the cure for all billing woes, but it can be helpful in verifying the booking.

For first-time bookings or clients with a tenuous credit history, all bookings should be accompanied by a deposit unless prior arrangements have been made with the studio owner's approval.

Tough decisions must be made when two clients want to book sessions at the same time. Prioritizing your booking decisions is both a deceptively easy and extremely complex operation.

Fortunately, you have several options to explore. If you have all the important information on the initial call, you should have a fair idea of how the sessions will run. If client "A" is working from morning to early evening, is it possible for client "B" to start work in the early evening?

Or perhaps either client could work on the day before or after the time originally planned. Usually, some sort of compromise can be worked out. Once again, this is where communication is invaluable. You don't want to annoy either client with proposals that obviously won't work, so be as creative, helpful and sensitive to their needs as possible. There will be plenty of situations in which there are no other times the clients can work and a decision must be made between the two.

Normally, first-come-first-served is the best place to start. There are other factors that should influence your decision though. Obviously, the bigger project would get preference in the eyes of the studio accountant, but if the times and acts are equal in stature, the first to come up with a valid purchase order number should get the time. You must be *very careful* not to lose a potential client. Think carefully, be as diplomatic as possible, and once you have made a decision, stick with it. Be honest with your clients, and if you can't work out a slot for them, let them know as soon as possible.

**Studio referrals**

At this point, you might want to refer them to another studio, one which you have respect for *and* a reciprocal referral arrangement.

This is important for two reasons. First, you want to demonstrate to your client that you have good judgment and his best interests in mind. Refer the client to a facility that is suitable to their "tracking" and "rate" needs.

Second, by establishing a cooperative relationship with another studio, you may eventually benefit from its overburdened schedule, act as a backup for each others' technical needs and discourage competition with your established accounts. In this situation, the client will appreciate your straightforward attitude and be inclined to call back again.

Always remember that a studio is a *service business*, and you must do everything possible to be available when the client wants to work. If your studio isn't available and you have to refer them elsewhere, you are still servicing the client to the best of your ability, and good clients will recognize this. Sometimes it takes a little jockeying to get the dates just right, but the effort is rewarded through the image and success of the business, and the satisfaction of a job well done.

RE/P

*Continued from page 62*

arise, such as oscillation and increased distortion, when such a large capacitor of cable is connected. Even after the minute warning signals began to diminish, our fears were not put to rest. The solution to this problem was in the non-NFB A class amplifier, M-Z1, supplied by Pioneer. Figure 3 shows the total sound system used at the concert.

### The concert

The concert began on Aug 4, 1986, following two explosive days of fireworks. The sound crew arrived two days before the concert to set up the equipment. Tachibana Audio Laboratory and Kennek Knock directed the operation. I was responsible for advising people on setting up the sound system and taking acoustic measurements. With the giant crane looming overhead and in the midst of vicious heat, desperate preparation took place. I had never before piled speakers as high as we did for this concert.

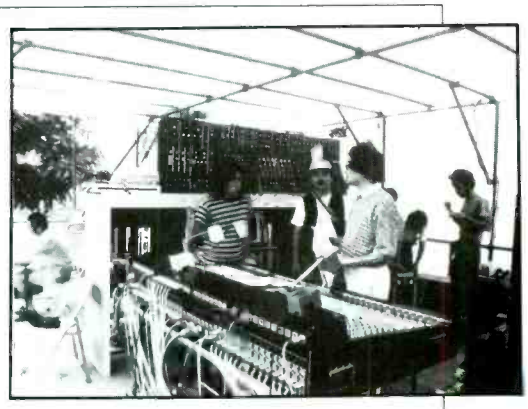
On the morning of Aug. 3, the multicable was set in place. In the afternoon, we did sound adjustments and set the time lag compensator between channels. On the morning of the concert, the sound peculiarities of each channel were checked. Rehearsal took place in the afternoon, and at 7 p.m. the concert began.

It may seem as if everything went along quite smoothly. In reality, due to the fact that we were swallowed up in this wide outdoor arena, we spent much of this time in a very anxious state of mind.

On the day of the concert, due to an approaching typhoon, there was a light drizzle from morning on. However, at about 3 p.m., the planning committee gave the final go-ahead for the concert. By the time the first fireworks were set off, the river bank was bulging at its seams with a crowd of about 120,000 people, all holding umbrellas and making it impossible to move.

At precisely 7 p.m., the concert started, with fireworks, laser beams and lightning. Then the sound "cloud" was formed. The rain strengthened, causing discomfort to the audience, but the sparkling light oozing out from the downfall created a beautiful sight.

The sound, while dispersed, turned out to be favorable. At the time the NASA rocket was launched, the sound pressure level above the river bank reached 119dB. During this unforgettable moment, even the ground shook.



*Inside the control tower*

Putting together a concert of this magnitude presented numerous problems. However, if through such a concert we can get people to overlook generational differences and lose themselves in the splendid sounds the universe has to offer, I feel that it is well worth the effort that went into making this concert a reality.

RE/P

Reprinted with permission from MJ Journal, November 1986. Translated by Mark Caprio.

# Producer Interview: David Holman

By Ralph Jones

**Now concentrating solely on producing, this former engineer discusses analog vs. digital, R-DAT, his latest personal-use studio and artist development.**

In the course of his career, David Holman has experienced the business of music from several angles. From an early stint as a keyboardist (his band was signed to ex-California lieutenant governor Mike Curb's Sidewalk Productions), Holman graduated to manager/chief engineer of a Los Angeles recording studio, then to independent engineer and film dubbing mixer, before rising to his present status as an independent producer.

Along the way, he accumulated credits engineering and co-producing projects for such artists as Olivia Newton-John ("Grease," "Totally Hot," "Xanadu," "Physical" and "Greatest Hits," all certified platinum); Laura Branigan ("Touch"); the Fabulous Thunderbirds (on their self-titled Chrysalis album); the Pointer Sisters (a track for the "USA for Africa" album); and Stevie Nicks (two sides for "Rock a Little"). His film music dubbing credits include "Grease," "Xanadu," "Meatballs," "Wolfen," and "Rad."

As a producer, Holman has shown a tendency toward developing new artists. In addition to established performer Mary MacGreggor, his clients include the King Bees (two albums for RSO records); Los Angeles disc jockey-cum-singer Rick Dees (a track for the "Meatballs" soundtrack); Miguel Cancel of Menudo; World Sitizenz; and Bourgeois Tagg.

On a recent sunny fall day, *RE/P* met with David Holman in his newly completed studio high in the Hollywood hills. An elegant example of Santa Fe-style architecture, the spacious and inviting facility provided a comfortable setting for Holman to reflect on both his career and some of the many issues surrounding contemporary music production.

***RE/P** (Ralph Jones): The "feel" of this studio is very refreshing. It's so bright and airy.*

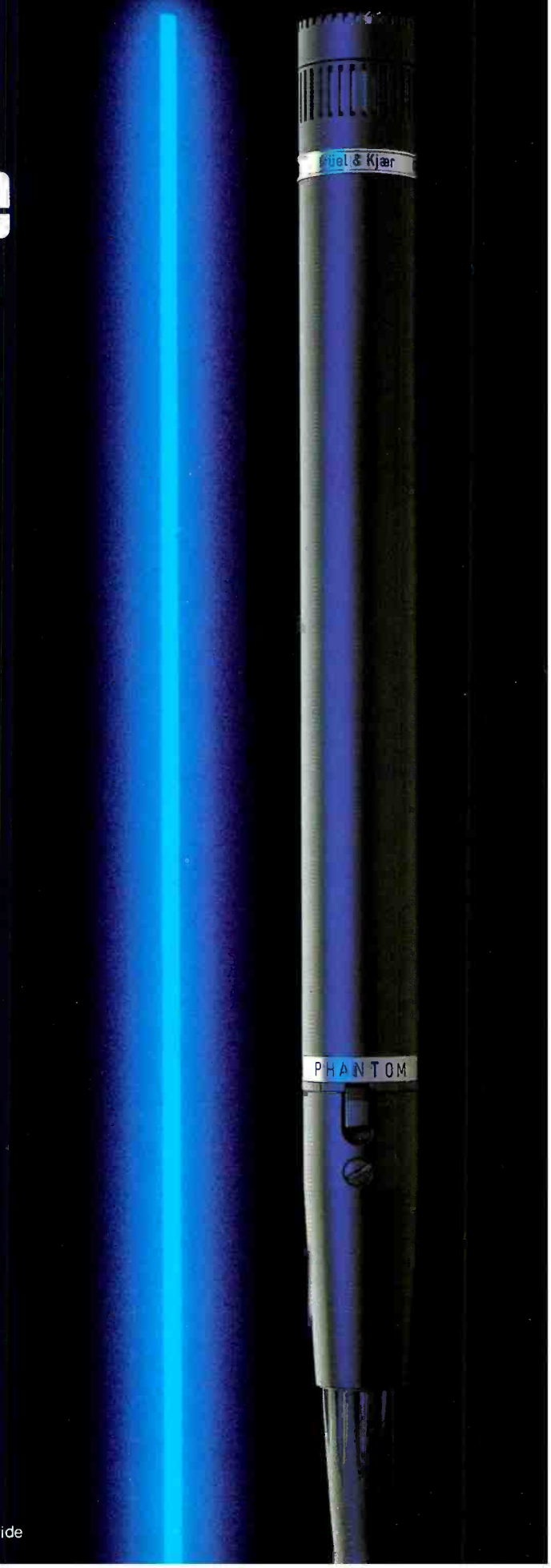
**David Holman:** Yeah, I just *love* to work in here. You can imagine what it's like sitting here day and night, even with all the pressures of this business—especially nowadays, with everybody making very expen-

Ralph Jones is a Los Angeles-based free-lance technical writer, producer/engineer and is a regular contributor to *RE/P*.

# The Brüel & Kjær Cardioid Microphone

THE TYPE 4011 CARDIOID PROFESSIONAL MICROPHONE JOINS THE SERIES 4000 RANGE OF PROFESSIONAL MICROPHONES — THE PRODUCT OF TEN YEARS OF RESEARCH AND DEVELOPMENT BY A TEAM OF DEDICATED SPECIALISTS. THE 4011 IS A PREPOLARIZED CONDENSER-MICROPHONE, WITH A FIRST-ORDER CARDIOID DIRECTIONAL CHARACTERISTIC WHICH COMBINES A FLAT ON-AXIS FREQUENCY RESPONSE WITH A UNIFORMLY SMOOTH OFF-AXIS PHASE AND FREQUENCY RESPONSE. THE TYPE 4011 CAN HANDLE 158dB SPL BEFORE CLIPPING. COUPLED WITH EXTREMELY LOW DISTORTION, THIS GIVES THE TYPE 4011 A SONIC PERFORMANCE UNEQUALLED BY ANY OTHER CARDIOID. THESE DESIGN FEATURES OPEN UP A WIDE RANGE OF APPLICATION POSSIBILITIES.

THE WORK BRÜEL & KJAER'S ENGINEERS HAVE PUT INTO THE DESIGN OF THIS MICROPHONE ENSURES THAT IT WILL NOT BECOME READILY OBSOLETE DUE TO RAPID ADVANCES IN TECHNOLOGY. THE CRAFTSMANSHIP AND MATERIALS INVOLVED IN ITS CONSTRUCTION ARE WHAT MAKE THE DIFFERENCE BETWEEN A GOOD MICROPHONE AND A SUPERB MICROPHONE, AND ALLOW THE 4011 TO BE CALLED, JUSTIFIABLY, A WORK OF ART. ITS TECHNICAL SPECIFICATIONS PAINT AN IMPRESSIVE PICTURE, BUT THERE'S MORE TO IT THAN THAT. PUT THE 4011 TO USE AND YOU'LL FIND THAT, FOR ONCE, WHAT YOU READ TRANSLATES INTO WHAT YOU HEAR.

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## Brüel & Kjær

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sive records. If the record company doesn't like your work, you don't pay for all this equipment! I tried to counteract all that pressure by creating a room that feels good to work in. It's designed for openness, and for being able to move around a bit. We had six guys on a session here yesterday with two synthesizer racks, and it was *still* really comfortable.

I haven't actually finished the room yet, but we were in a panic to get it functioning because financially, this was a *real* burden. As you know, any kind of construction will always have overages. Well, they really nailed me on this one. The city got involved, and we had to put in some extra retaining walls. But we got it up and running, and immediately mixed Gregg Rolie's album, "Rhumba." We had literally just connected everything that morning, and he walked in at two o'clock and started to record. I really was dazed: I'm sitting here with my hands on the board, hoping every time I move a fader that the sound will come out of the speakers. But everybody loves that album, and I think it's one of the best things I've ever done. I worked with Dave Kershenbaum on it. We had just finished Laura Branigan's "Touch," and that would have been mixed here too if the construction had been finished.

***RE/P:*** *Did you do the acoustical design?*
**DH:** Yes. This is the fifth room that I've designed and built. The first two rooms were much more along the lines of conventional recording studios, with traps, double walls, air spaces and angles. The next studio that I got seriously involved in, which was my last personal studio, was basically a garage. In that one, I opted to listen to the room and deal with it as it was, to see if I could make it work. Given the design of the speakers, the way I had set up the sofiting in the front and the way the equipment was put in, I found that there was very little acoustical work to do.

In this studio, I went in a little bit different direction. The room is built primarily for solidity; there's 10-inch thick, highly reinforced concrete all around us. The ceiling is a 3-layer system, and the actual skin is not that thick—it's only plasterboard. But the wood framing is, as my carpenter said, probably enough to do a whole house—that's how much lumber is in there. The framing space lets through some of the low end, and it's a lot cheaper to make than it is to build a hard ceiling and then put a trap in it.

The walls around the control room monitors are filled with 2½ tons of crushed rock, and the open area around the monitors forms a bass wave. The speaker cabinets, by the way, weigh 470 pounds; all the cabinets in this room are double-thickness, to keep them from resonating and becoming part of the sound. The walls are non-parallel, and the ceiling is angled back and up, as opposed to the normal pressure ceilings that some designers are used to using. The beam across the ceiling in the back of the control room is not structural. It's a low frequency wave break that, combined with the structure of the back wall, forms a broadband trap. The only anomaly in the design is the little open area at the entrance to the control room, but I opted for it because of space and elegance. It's always nice to have a little entry area in the room, and it doesn't really affect the sound in the main control area.

When it was completed, this room measured very flat. The wonderful thing about it is that, almost anywhere that you choose to sit, you still hear a consistent sound balance. It's a function of both the acoustical design and the design of the monitors.

I'm not a trained acoustician, but having worked in enough studios and seen all the mistakes that have been made, looking at the blueprints and seeing how it all affects the manufacturing of records—which is all we're really concerned about, after all—this is what I've come up with. Basically, all I'm trying to do with a room nowadays is make it as simple and straightforward as I can. And it seems to work.

***RE/P:*** *The design certainly reflects the contemporary trend toward working mostly in the control room, though you do have a small isolation room.*
**DH:** I put that booth in almost as an afterthought. We were going to isolate all the heat-generating equipment in that area, but I decided at the last minute to make it a little overdub room. We've done guitars and vocals in there, and the sound we've been getting has been phenomenal, but we actually end up doing a lot of vocals in the control room. I just get all the fans quieted down, and we put covers on the tape recorders.

The only drawback is that you can run into acoustical problems, but the communication in the control room is so wonderful. It's instant, and there's no doubt. Of course, you obviously have to work with headphones . . . except that's not even the case! On this thing we did for Olivia Newton-John—it was a video for a live show—she literally grabbed the microphone and stood in the back of the room. We had the monitors almost all the way up, and I was *floored* at the isolation. She started wandering around the room with the microphone, and she was sitting in the weirdest places, yet there was almost no problem.

Of course, that's not only due to the acoustical design; it also depends on the flatness of your monitors. These monitors, and the speakers that I used in my other room are really wonderful-sounding. They were designed for me by Keith Koller, who was one of the partners in the [now defunct] loudspeaker company called Aura. He did my nearfields too; they're becoming very popular around town. I actually have the first pair that he ever built—in fact, I even had his prototypes in here, and we discussed them when he was refining his design. With this nearfield he's given us a speaker that doesn't snap at you, and yet still is bright and pleasant and sounds wonderful.

***RE/P:*** *Tell us about your console.*
**DH:** It's all custom, and entirely hand-built. Bill Gazecki started the design, and did the basic work in consultation with Deann Jensen. There are George Massenburg components in some of the areas—the main combining networks, for instance. The EQ stages are the old Baskin EQ F-2s with some modifications by Dave Baskin and Harvey Rubens. About four years ago, I added 16 inputs and 6 more sends, and it's now up to 18 sends per channel. There's a group muting system, which may become automated in the very near future. No noise on the muting, either; it's all relays, no VCAs in it at all.

Two years ago, Rubens and Baskin installed new fader buffer amplifiers. You can actually drive a set of headphones with their new card—that's how solid it is as far as the kind of energy that it can deliver. They did all kinds of dc servoing, and they added local regulators to improve the speed, the low end and the transient response.

Just the fact that this console is hand-wired gives it an edge over other units with motherboards and circuit card connectors. You see, this board goes out to about 420kHz, which means that you have no phase shift at 20kHz. When people ask me what I'm doing to get ready for digital, I tell them to pick up a couple of my old albums and see if they can find any noise on them. [Chuckles.]

***RE/P:*** *It's a bit late to be just "getting ready for digital," isn't it?*
**DH:** We could get into that, I guess. Some people love digital recorders, and others hate them. For myself, I have stayed primarily with analog. I've worked with the Mitsubishi—which is a very fine digital recorder—and not that much with the Sonys, but I still love the sound of my Stephens multitracks. You know, if you are smart enough, and you want the kind of "grit" and clarity that digital can give you, you can achieve it with an analog recorder.

I am, however, very interested in tapeless digital recording, which is where we're all going. Many companies have now announced hard disk-based recording systems. I've been working with Hybrid Arts on refining its ADAP system, and I think it's an amazing-sounding piece of equipment.

The nice thing about it is what I've been saying all along, which is that there should be a "brain" that can handle as many channels as you want, allowing you to expand the system in blocks—4 channels a block, say. If you're at 32 channels and you want to go up to 36, you just buy another box.

The ideal would be to have a digital medium that did what analog does, which means an incredible amount of resolution, and yet had all the wonderfulness of digital—no noise, accuracy of play every time and so on. It's not going to be for a little while, because the manufacturers are having tremendous problems bringing it up to 18-bit resolution. The cost increases logarithmically, and if the technology is too expensive no one will buy it. After all, the record companies are getting tighter with budgets, and it's a business. We have to be careful.

### R-DAT

***RE/P:*** *While we're on the subject of digital recording, do you have an opinion on the controversy surrounding the CBS copy protection scheme for R-DAT recorders?*

**DH:** Well, even people on our end of the business, who are fighting [the CBS] Copycode because it screws up the sound, have got to understand this problem from a business standpoint. I've been told that one out of every seven or eight records sold is a forgery. Now, to make records and be competitive, I have to buy the equipment that you see here. I have to charge in order to pay for it, and the record company has to give me the money. So, they have to sell my product and make a profit. It will all come to a standstill if the record companies don't make money, and the people who are designing recording equipment simply *have* to come to grips with that.

***RE/P:*** *But R-DAT is inherently a much more intelligent medium than vinyl records or cassette. Don't you think that there ought to be greater potential for sophisticated, clean, smart schemes that would protect against any form of copying, without ruining the quality of master recordings in the process?*

**DH:** Absolutely. By comparison, vinyl is almost impossible to protect. I'm sure that there are better ways to do it. But at least somebody's doing *something.* I don't know if it's the right thing, but the industry had damned well better standardize on something pretty quickly, because DAT machines are starting to roll out into the U.S. market right now.

Counterfeiting is a very difficult problem—not just for the recording industry, but for all the retail areas. Let me give you an example. When I was working on the original "Grease" soundtrack album, the same label [RSO Records] was doing "Sgt. Pepper" with the Bee Gees. They shipped, I think, 3 million units of that album, sold 2 million and got 2 million back from the retailers. A million copies of that record were forgeries. Now, the record company at that time was paying 42 cents per record to have it put into the marketplace, and they also paid 42 cents apiece to take back the unsold units. They got killed!

They showed me a real pressing next to a forged one and, I tell you, I'm in the business, but I had a hard time knowing which was the copy. It was like looking at forged money: I wouldn't know. They had not printed some of the numbers on the spine of the record jacket, and if you looked closely at the printing quality, it was a little different. But if a counterfeiter was really careful and skillful, I could see how they might not be detected.

Now, with CDs, it's a little trickier. After all, it's pretty tough to set up for copying; the equipment and facilities are very expensive. So, if the CD is going to be the dominant medium, then we're not going to have any problems. But now that DAT is

coming out, here we go again!

***RE/P:*** *What about the debate over the use of samplers to "steal" sounds from existing recordings for reuse in new tracks? That seems to be a somewhat similar issue. Does it concern you?*

**DH:** Well, if I leave the drums out in front for four bars or start off a tune with an incredible snare sound at the head, I *do* feel a bit odd about it. I know damned well that I'm going to find it in every sampling library in Hollywood! [Laughs.]

On the other hand, I've worked with groups that have wanted to use, say, a snare sound from someone else's record. We'd take it off a CD and put it in the PPG Wave synthesizer, and they'd find that it didn't sound like they thought it would. Your mind can play tricks on you, you know. "If it sounded great on that record, why doesn't it on this?" Well, it's a *different record.* So, what I usually end up doing is using the original as maybe a concept for a sound, then coming up with something that's better and a little more unique.

I listen to a lot of records, comparing what I've done with what others are doing, and I wish more people would start thinking about this. I mean, when they grow up and they want to be creative and make the kind of records that will succeed, that's when they need to come up with sounds that beat everybody else's! There's *no way* that I would use somebody else's drum sound on my tracks. If you're making serious records, you have to go for a unique sound that's basically your own.

Some time ago, I went to Michael Botts and borrowed a snare drum. We recorded 300 or 400 snare hits on a Sony ¾-inch and transferred them into my PPG system, and I have used almost all of them in one form or another. We'll feed them into my living room, for example—which has a vaulted ceiling and a beautiful decay—and build our own sounds. I find that a lot more creative, more refreshing and much more honest. Besides, then the sound is mine; I'm not stealing it from someone else.

I would rather be a forerunner than a follower. After all, once it's completed, your record isn't even released for anywhere from six to 18 months. By that time, if you sampled someone else's snare, it's an antique sound. So, I've always pushed unique things. And usually, when my records get out, they're either ahead of their time or they hit the mark.

### Artist development

***RE/P:*** *It seems that finding new sounds would be one part of creating a unique "identity" for the artist.*

**DH:** It certainly is, and that's extremely important if you want to make a record that's going to do something for the artist. For example, I had Rick Nelson's kids, Mathew and Gunnar, in here yesterday. They're good-looking young men who are on the verge of doing something, and they want to do heavy metal. They look great and, because of that name, they're in incredible demand from MTV and record companies.

But the name can work against them too. Our biggest problem will be making them believable, because the family name pretty much guarantees them a record deal and some airplay. But we can't let that influence us. The record still has to *sound* incredible (my credibility is at stake, as well), and the songs have *got* to be good. So, we're talking about the great records that are already out there—the Def Leppards, the Mollie Hatchets and all the rest.

We definitely want to listen to those records and see what made them successful. But then, we have to come up with something new that works for the Nelsons. Otherwise, what good is it? The reason the labels and the public are going to want them is that we're going to come up with a sound that is unique. At the same time, we're going to make sure that it fits in the pocket of that kind of music.

Now, on the Nelson project, we're going to be doing a lot of searching. But they're young, and they really have ideas. You can take that . . . mold it and shape it. The worst is when you get artists that just come in and sing, then go home. As long as you get a good sound on their vocal and give them a good headphone mix, they're happy. I've been very fortunate in that the people I've been working with have had strong personal convictions.

***RE/P:*** *It must be very rewarding to work with new, young artists. Do you perhaps find them more enthusiastic or less jaded than music industry veterans?*

**DH:** Well, this is only conjecture on my part, but some of the young people that I'm dealing with don't yet have all the responsibilities that come with success—and that may account, in part, for the enthusiasm and creativity that they show. Their one goal in life is to be great at what they want to do. They come up with these sounds, or they're great players, and that's *all* that they do. So, they bring a tremendous amount of energy to the project, and new ideas that I may never have thought of. And I'll let them go, because if it's wrong, I can redo the whole thing if I have to. But what if it's better than I would've done, or it's taken me in a new direction? That's the only way that I feel I'm going to progress.

***RE/P:*** *Where do you find material if you're working with an artist who doesn't write?*

**DH:** I have a few publishers and songwriters that I work with, and my manager, Paul Palmer, is always beating the bushes for material. I may look for writers in other groups, depending on what type of act I'm working with. But if you're looking for pop rock 'n' roll, you go to the publishers. Co-producing with David Kershenbaum has been great in this regard, because he has a real strong line to publishers around town.

I also find not only writers, but also new artists, through the young A&R guys that I deal with. They'll present you with acts, and a lot of times they won't even know what they've got! The talent I'm hearing on demo tapes lately is amazing. For example, there's this kid, John Andrew Parks III, who's a country & western artist. Now, I'm not that much into country, but he's written a couple of things that, if done properly, will really make a mark on records. He's combined the technical aspect of making records with country & western to produce a whole new concept, and it *really* perks your ears. It's fresh, real, believable, and exciting to listen to.

***RE/P:*** *Let's talk a bit about your background. How did you come to be a producer?*

**DH:** My beginnings were in music; getting into engineering and production was basically a fluke. I studied classical piano when I was very young, and started playing in rock 'n' roll bands when I was 14 years old. Finally, in the late '60s, the group that I was in disbanded because our record didn't make it, and I needed a job. I ended up as the manager and chief engineer of a recording studio—knowing absolutely nothing about *anything,* other than having played in studios as a musician. I spent about seven years taking that studio from a small yearly income to a solid business. Along the way, I built two small consoles, did a lot of construction and did all the engineering.

During that period, and for some time after, I did very little playing other than with a couple of groups that I was producing. I was doing two or three sessions a day, getting only a couple of hours of sleep a night, working seven days a week, and hardly *talking* to anybody. It was nuts! Finally, about eight or nine years ago, I was driving to a little studio that I had out in Century City to finish up some work. It was 4 a.m., and I had a session at 9 a.m. with Elmer Bernstein. All of a sudden, I realized that I had been working for about five days without sleep, and I was hallucinating.

At that point, it finally dawned on me that I was doing something wrong. So I doubled my rate and lost half my clients, but *still* was working more than most human beings. Around that time, I met John Farrar, who was producing Olivia Newton-John. We really hit it off, started working together, and had a pretty good run of about seven or eight years—and they were exciting years for me. But after that, I had to move off into producing, because I was getting . . . not tired of engineering, exactly, but I felt that I had gone as far as I could go in that area.

Even when I was working primarily as an

engineer, I did a fair amount of producing. I did King Bees, Mary MacGreggor, a track with Rick Dees for the film "Meatballs," and a number of independent acts. It really gave me a taste for producing. But I was acting as an engineer/producer, and I found out that I really shouldn't do that. Now, I have Ray Leonard doing almost all the engineering, and I just supervise him. So the musical aspect is becoming much more important to me again—looking for songs, spending more time with the artists, searching for the identity and the musical sound. A producer is basically just an organizer of energy, and I have a talent for it. I just want to keep my talents and energies focused where they'll do the most good.

***RE/P:*** *What about your current work? Is there anything else that distracts you from focusing purely on production?*
**DH:** The thing that I find myself doing a lot of nowadays is sitting in front of computers. I spend a lot of time with the PPG Wave synthesizer and the Hybrid Arts ADAP system, which runs on an Atari. Right now, I'm looking for people to take over those jobs, because it's getting to the point where I'm juggling too much. But it's hard, because I'm very proficient with PPG, and not many other people are. It's not a system that's used all that much—which is a primary reason why I use it. The sounds that I can get are completely unique; nobody else makes these kinds of noises.

As you know, it's not only how things sound but also how the functions work—how you are made to be when you work with the equipment. It actually influences you as a creative entity, and the PPG is a powerful influencer. The majority of the drum tracks that we've been doing have been out of the PPG, and I'm not even tracking them. The PPG just runs in sync with the mix and spits everything out, which is an incredible production method. It takes care of not having fader automation, because I can do it in the computer. I can even change drum sounds in the chorus, or the B sections, or whatever I want.

***RE/P:*** *Having so extensive a background in engineering, how do you direct Ray Leonard's work? Do you tend to say, "Peak it a little at 4.5kHz," for example?*
**DH:** No, I'm trying to stay away from that! [Laughs.] Every once in a while, much to my chagrin, I find myself slipping. But all I usually say to Ray might be, "You're doing the vocals too bright. I like the clarity, but the 'esses' are just zinging." Then it's up to him to figure it out and, if he's having problems, to come to me. I don't want to stifle Ray—or anyone else, for that matter. They have to be able to come forward with their ideas, because the only way that they're going to be happy is by being creative.

You want to find out what people's abilities are, too. If you don't, then it's just a losing proposition. Everybody has to take their responsibilities, and if they screw up, so be it. They're just humans. Now, if it gets to a point where someone is doing too much of that, then you have to make a change. But, on the other hand, you've got to know how to deal with motivation when you're making records.

That's really what I'm finding to be the most intriguing aspect of making records—motivating people. Because, primarily, you should be able to produce the best record that you can without even touching anything or doing much at all. If everything's going great, there's no reason to say a thing. But every once in a while, you can just feel that things are going off track, and all you've got to do is go out there and nudge it very gently. If you're good at it, and you work at it, then you can do that without causing a lot of commotion. And, make great records. RE/P

# Facility Spotlight:

# Windmill Lane Studio

By Paul D. Lehrman

**A look at the recording industry in Ireland that is now experiencing changes comparable to those that hit England when the Beatles took off.**

*"Bono, I'll trip through your wires any day!"*
*"San Francisco loves U2!"*
*"Bono, I saw you at Croker. You drove in and nearly went over my foot."*
*—graffiti outside Windmill Lane Studio*

The recording scene in Ireland is hot. Thanks to the overwhelming success of U2, one of the few Irish bands that has stayed in its home country after achieving international success, the local recording industry is experiencing changes comparable to those that hit England when the Beatles took off. Nowhere else are those changes being felt more than at Windmill Lane Recording Studios, the audio arm of a full-service multimedia production house in downtown Dublin.

"It's been very much a parallel development between ourselves and the band," says Brian Masterson, managing director of Windmill Lane Recording. "We opened in 1979, and in 1980 they did their first demos here. Since then, they've either recorded or mixed everything here, except for one video, but that was post-produced in our video facility."

The Windmill Lane complex is located in a tightly-bunched group of old buildings surrounding a courtyard in an old section of Dublin by the River Liffey. The building it occupies is a former granary, with 3-foot thick stone walls to support the tons of grain it once h and the heavy blades of, yes, a w ll.

Inside, many of the wa have been left in their original stat maintaining the old industrial ambien e, but are offset by parquet floors, Macintosh SE computers, blue-tinted windows and laser sculptures that remind the visitor that we are indeed in the 1980s.

The company began as a film-editing house in the mid-'70s. After a few years, one of the partners, Ja nes Morris, a former bass player, decided to get into audio recording. Masterson, a free-lance engineer with experience in Ireland and abroad, was asked to join the team, and thought that the only way it would be worthwhile was if the facility could be aimed toward an international clientele.

Paul Lehrman is *RE/P*'s electronic music consulting editor and a Boston-based free-lance writer, electronic musician, synthesist and producer.

"I wanted to attract acts from other countries and also get Irish bands back recording here, not in London," he said.

**Windmill's first studio**

The original studio was designed by John Storyk, who installed an MCI console and tape decks and JBL monitors. By 1983, the studio was ready for a major rehab, and London designer Andy Munro was called in.

"A large part of what we were doing was classical and traditional music," says Masterson, "and the hornloaded drivers [in JBLs] were just not suitable for that."

Munro installed his own Softdome monitors, and the change was so successful that the company then asked him to redesign a second studio they had just bought across town.

Meanwhile, Masterson was phasing out the MCI gear. The tape deck went first, replaced by an Otari MTR-90, and then in 1984 an SSL board was brought in, which immediately increased the European client list.

The following year, a Studer A800 multitrack arrived. It became the primary machine, while the Otari became a "floater," which still spends most of its time in the main studio, now known as Studio 1.

*Windmill Lane Studio One.*

With the foreigners crowding the Studio 1 schedule, local artists have been welcomed at Studio 2, which features a Soundcraft TS24 console with Audio Kinetics Mastermix automation, and another A800 24-track.

The studio does not own any professional-level digital recording gear yet, although they do a lot of digital work.

**Digital recording**

"We'll hire in a PCM-1610 or 1630 when we need it," says Masterson, "or we'll use our F1 with Audio + Designs Coincident Time correction modification, and no pre-emphasis, so we can transfer to 1610 easily." Recently a Sony PCM 3324 was brought in for a live event, a 3-day festival honoring Sean O'Riada, an early 20th century composer and arranger who is considered the father of "modern" Irish music.

"Up 'til his time, it was considered sacrilege to change the traditional tunes, or add parts, or even just to harmonize them," Masterson explains. "He orchestrated the music, and integrated some of it into film scores, and brought it into the 20th Century." The festival consisted of two orchestral concerts (one conducted by Elmer Bernstein), a reenactment of a rehearsal of O'Riada's own original 17-piece ensemble, and a new high-energy traditional band formed by the outstanding Irish musician Donal Lunny.

"It was the first digital multitrack done in Ireland," says Masterson. "Eventually it will be a video and four or five CDs."

Although Masterson is obviously enthusiastic about digital, he is reluctant to commit fully to it until the industry gets out of what he calls the "multiple-format mess." Instead, he says, "We're committed to Dolby SR, which is a good alternative. If there was just one digital standard, SR would have a much harder job. But we're a little upset with Dolby, because we're having a hard time getting it into all of our studios.

"We have three different Dolby racks of three different vintages, so we can't just get one set of cards. They seem not to be making it available to enough people." A ½-inch Studer A820 equipped with the new system is currently the favorite machine for mastering.

Because the Irish market is still relatively small, Studio 1 is much more a "general-purpose" room than might be found among new facilities in the UK or the United States. It's big enough to house about 50 musicians. Masterson explained that it is not too big for rock, or too small for an orchestra.

"We're different from studios in the United States and UK in that we work with many traditional acts, not only from Ireland, but from Brittany, Sweden, Spain, etc., and with classical musicians as well. We don't put people into booths when they come in. We're very concerned with mic placement, because we're doing so much with unamplified instruments."

Last year the company took over a bit of the courtyard parking lot and extended the studio by putting in an additional live room (also designed by Andy Munro) behind the main one. So far it's used mostly for drums, and a Hammond B3 with Leslie lives there.

**Studio 3: computerized production**

But the studio looks forward too, and in that regard recently put in a computerized pre- and post-production room known as Studio 3. Although it is still not completely finished, it already houses a Fairlight CMI Series III and a wealth of MIDI gear like a Yamaha, TX816 rack, PPG Wave, Fairlight Voicetracker, Roland Super Jupiter, Oberheim Xpander and Matrix-6R, E-Mu SP-12 and Emulator II with the CD-ROM sample library, and Boske SM-9 time code converter.

The board is a Soundcraft TS12, and the monitors are custom designs by Andy Munro. Although the Fairlight currently acts as a controller and sequencer for the entire room, the company has just acquired a number of Macintosh computers for office tasks, and one of them is slated for Studio 3. Responsibility for the room has recently been taken over by Dennis Woods and John Donnelly, two musicians/producers/programmers who previously ran their own successful production service in Dublin.

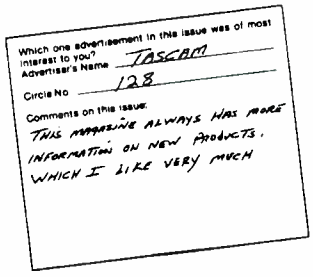
"My thoughts are that with the right people involved, Studio 3 will be very successful," says Masterson. "Especially in terms of composing to picture, the levels of investment and expertise we provide are far beyond those normally realized by the home musician.

"On the other hand, we welcome the idea that musicians can sequence and arrange material in their home environment, and then use Studio 3 to get the benefit of the more extensive sound sources. At Windmill we have always believed that our strength was our own people, and the expertise and en-

*The new live room in Studio One designed by Andy Munro.*

# During the past year, 18,889 audio production pros like you subscribed or renewed their subscriptions to RE/P.

# With good reason(s).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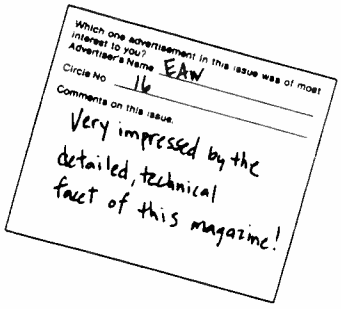
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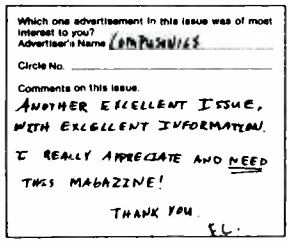
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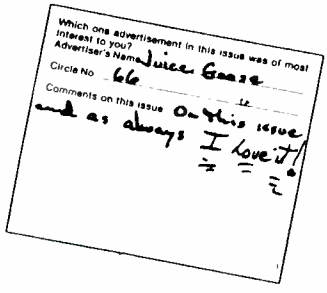
THANK YOU.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Comments on this issue On this issue and as always I love it!

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"Your columns and advertisements are a constant source of information on new and improved equipment and procedures." C.V., Engineer

"The *Interconnecting Audio* article should be required reading for anyone with two or more pieces of gear." J.H., Production Manager

"RE/P's AES Show Directory was the most useful I've seen in any magazine!" F.W., Director

"Excellent articles on compressors, digital recording, microphones, studio wiring--everything!" K.V., Audio Engineer

"I especially appreciate your staying on the cutting edge of the digital technological advancements in the sound recording field." W.H., Sound Consultant

"RE/P is the only magazine I read cover to cover as soon as it arrives." R.G., Engineer/Musician

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thusiasm they bring to each project. Somehow with the coming of synthesizer technology, which allows so much to be realized, it becomes the people who make the difference between a good studio and a bad one."

The new room will be tied in closely with Windmill Lane's video facility. Windmill Lane Pictures, the original company, moved into video post-production in the late '70s, and bought their first computerized editor in 1977. They now have five edit suites, a wealth of special effects and film-transfer equipment, and film editing rooms as well. Masterson claims they handle 90% of the entire country's post-production work. Both Studio 1 and Studio 3 are tied into the video system through a Q-Lock synchronizer, and audio and video tie lines.

### Audio for video

Again looking toward the future, a search is currently under way for an appropriate hard-disk recording and editing system that can integrate conventional music and film and video technologies, according to Masterson.

"It would offer great advantages in terms of speed and ultimate audio quality. But it's sometimes hard to convince film and video editors about how noise builds up through multiple generations, and that the lack of good transient attacks can really spoil a brilliant picture.

"We're presently looking at the AMS Audio File as a possibility, but Fairlight is also promising some interesting things for the world of TV and film post-production, so we'll just have to wait and see," he said.

Windmill Lane Pictures is an all-Ampex house, with all of the controlling and interfacing equipment custom-designed by technical director Jim Butler. PAL and 24fps film are also used exclusively in the facility.

"We don't use NTSC equipment here, we can have all of those transfers done in London," Masterson said.

One unexpected advantage of having the audio and video under the same roof has been that Jim Butler and Andy Munro have been able to work together, and have decided to join forces as a design team, with Munro and his staff handling the architectural and design details, and Butler doing the technical specifications.

"Unlike the audio industry," says Masterson, "there have been no real specialist designers for video installations." The new company, Windmill Munro Design, has offices in Dublin and London, and is now working on projects in England, Los Angeles and Istanbul.

However things shape up for Windmill Lane's various ventures in years to come, there's no denying that the formula so far has been successful, and the studio has been able to develop a very respectable reputation. In recent years, Windmill Lane has been host to Def Leppard, Howard Jones, UB40, Van Morrison, and Moving Hearts, as well as local superstars Planxty and the Chieftains. Even Kate Bush came over for a while when she was doing her "Hounds of Love" album.

"She wanted the influence of local musicians, so she went to some of the seshuns [traditional music] in the local pubs, and she ended up using some of the players, overdubbing them here," says Masterson.

Politically, Ireland has lived for centuries under the shadow of its powerful British neighbor. Likewise, the recording industry has been perceived as something of an offshoot of the British scene, similar perhaps to some views of the Canadian recording scene relative to the United States.

Windmill Lane, of course, is trying hard to change that, by attracting clients from outside Ireland and England. Masterson feels that one thing working in the studio's favor is that, despite the success, the staff at Windmill Lane and the local music community as well have yet to develop a jaded attitude.

"We still get excited about work coming over," he says. "We keep our tech standards high and we also try harder, and that thrills the clients. We did an Elmer Bernstein [scoring] session, and the orchestra was so interested in what they were doing—asking questions, making suggestions—that it made Bernstein feel very special.

### Recording in Ireland

"Ireland is a good place for bands to come and relax. They arrive all hyper, and after three or four days they calm down. They can go around the corner and drink the best Guinness in the world, and not be bothered by fans, the way they would be almost anywhere else. The only band that can't do that is U2," he laughs.

"The least flattering reason British acts come here is because they're tax exiles," he adds, "but we're pleased anyway, because there are lots of other places they could go."

One of the problems in attracting international business has been overcoming Ireland's image as a backward country. "We've got nearly 20 percent unemployment," he says, "and the roads are still not good. In any other country, you look at a map and can estimate how long it will take you to get from one place to another, but here it depends on the time of day, or if there's a market going on, or whether there's a football game!

"But telecommunications has gotten much better in the last four years. It used to be that the only place out of the country you could dial direct to was London, but now you can direct-dial anywhere in the world from any phone in Ireland."

### The band: U2

And of course, there's U2, which has its corporate offices on the premises, and is still a big part of the studio's business.

"The last couple of albums they've


Photo by Paul Lehrman

*The graffiti outside Windmill Lane, Dublin, Ireland.*

recorded in a big house in the country they've got, and at Edge's home in Dublin, but they still do some of the basics and all of their overdubbing and mixing here.

"The first time they recorded outside, they rented the gear from Effanel in New York, but for the last album Edge bought an Amek board and we rented them one of our 24-tracks and provided all the technical backup."

But to the public, this is still where U2 lives, and so the outside walls (especially that of Studio 3, which as it happens is the room the band is in least often) are covered with graffiti paying homage to the band.

"One day I was walking in the car park," recalls Masterson, "and a Volkswagen Van drove up, and these two teenage girls got out. That's not so odd, but then their father got out, carrying a huge ladder, which he put up against the building so they could climb up and paint their message on the wall higher than everybody else's."

If the height of the graffiti on the outside is any measure of a studio's success, then Windmill Lane certainly stands tall.

RE/P

## Studio Specifications

### Studio One

***Design**: John Storyk, Sugarloaf View*
***Console**: SSL 4000E 48-input, with Total Recall*
***Tape machines**: Studer A800 (III), Otari MTR-90 (II), Studer A820 ½-inch, Otari MTR-10 ¼-inch, Sony PCM-701*
***Outboard equipment**: AMS, Lexicon, Sony, TC Electronics, Eventide, dbx, Urei, Yamaha*
***Piano**: Steinway 7-foot grand*
***Accommodates**: 50+ musicians. Separate purpose-built live room*

### Studio Two

***Console:** Soundcraft TS24 36-input with Audio Kinetics Mastermix automation*
***Tape machines**: Studer A800 (III), Otari MTR-12 ¼-inch, Sony PCM-701*
***Outboard equipment**: same as Studio One*
***Piano**: Yamaha 7-foot grand*
***Accommodates**: 20 musicians*

### Studio Three

***Console**: Soundcraft TS12 40-input, custom modified for computer-music operation*
***Tape machines**: Otari MTR-90 (II), Otari MTR-10 ¼-inch, Sony PCM-701*
***Outboard equipment**: Lexicon, bel, Yamaha, Drawmer, TC Electronics, etc.*
***Piano**: Steinway 7-foot grand*
***Main monitors** (all studios): 3-way custom-designed with electronic crossover; midrange and tweeter by Andy Munro.*

# STUDIO UPDATE

## Northeast

**Chung King Studios** (New York) has taken delivery of a Neve V60 console with Necam 96 moving fader automation.

**Pro Audio Recording** (Wheaton, MD) has named Mark Greenhouse as studio manager, handling bookings, project planning, correspondence and promotions. *12255 Veirs Mill Road, Wheaton, MD 20906; 301-946-7364.*

**Victory East** (Philadelphia), a new studio, has opened as an extension of Kajem Recording, Gladwyne, PA, now called Victory West. Victory East offers 24-track music recording, original jingle production and audio synchronization to video. The studio features a 24-track room with a Sony 3036 console, a 16-track MIDI room and an 8-track room. *201 St. James Place, Philadelphia, PA 19106; 215-923-9999.*

**Sound on Sound Recording** (New York) has added an Otari MTR-90 MkII 24-track recorder, to complement its Neotek Elite console. *211 W. 45th St., New York, NY 10036; 212-757-5300.*

**Power Play Studios** (Long Island City, NY) has added a Solid State Logic SL-4000 E series console with 48 input modules, Total Recall function memorization and Studio Computer fader automation. *37-20 30th St., Long Island City, NY 10101; 718-729-1780.*

**Pheasant Hill Farm** (South Hamilton, MA), has added a Valley People Gatex noise gate. *13 Essex St., South Hamilton, MA 01982.*

**Minot Sound Studios** (White Plains, NY) has installed a Harrison MR-2 console with 56 inputs and Audio Kinetics Mastermix automation. *19 S. Broadway, White Plains, NY 10601; 914-428-8080.*

**Audio Recording Studios** (Cleveland) has added a Sony MXP-3000 consoles with ADS-3000 automation. *601 Rockwell Ave., Cleveland, OH 44114; 216-771-5112.*

**Production Masters** (Pittsburgh) has added Victor Van Rees as sales manager. *321 1st Ave., Pittsburgh, PA 15222; 412-281-8500.*

**Transcom Digital Studios** (New York) has named Elisabeth Lawrence as director of sales and client services. *902 Broadway, New York, NY 10010; 212-529-1000.*

## Southeast

**Crosstown Recorders** (Memphis, TN) has taken delivery of a Neve 8232 series console with an Audio Kinetics Mastermix automation system. *435 N. Cleveland, Memphis, TN 38104; 901-276-8742.*

## Midwest

**Acme Audio and Recording Co.** (Chicago) has added 34 Nakamichi BX-300s to its duplication division. *3821 N. Southport, Chicago, IL 60613; 312-477-7333.*

## Southern California

**Devonshire Studios** (North Hollywood) has completed a major renovation of its studios, to provide audio-for-video post-production. Equipment upgrades include a Neve 56-input 8128 console with Necam 96 automation; Sony and RCA 1-inch video machines; five Sony BVU-850 VCRs; five Adams-Smith 2600 synchronizers; and two Emulator II digital samplers, with Macintosh SE interfaces running Sound Designer and Q-Sheet software by Digidesign. *10729 Magnolia Blvd., North Hollywood, CA 91601.*

**Modern Sound and Videofilm** (Hollywood) has taken delivery of seven CMX CASS 1E Computer-aided Sound Sweetening Systems.

**LA fx** (Sherman Oaks) is a new company providing outboard effects rentals and maintenance modification services to studios in the Los Angeles area. Dan Vicari and Kevin Leonard are the owners. *4502 Cedros Ave., Sherman Oaks, CA 91403; 818-501-0691.*

**Universal Studios** (Universal City) has promoted Norman Rice to the position of vice president and studio manager of Universal Studios Florida, currently under construction in Orlando. He will oversee construction of the new studio, which is scheduled to open this summer. *100 Universal City Plaza, Universal City, CA 91608; 818-777-2701.*

**Golden Goose** (Costa Mesa, CA) has reopened with a new console of in-house design. The 40-in/40-out board uses Spectra Sonics' 1010 modules with API 550 and UREI EQ. The control room and studio also have new electronic and acoustic treatment. *2074 Pomona Ave., Costa Mesa, CA 92627; 714-548-3694.*

## Northern California

**One Pass** (San Francisco) has appointed David Angress as vice president of sales and marketing, and will head up a staff of six in the client services department. *One China Basin Building, San Francisco, CA 94107; 415-777-5777.*

**Independent Sound** (San Francisco) has added optical disk storage to its New England Digital Synclavier. *2032 Scott St., San Francisco, CA 94115; 415-929-8085.*

**Different Fur Recording** (San Francisco) has added a Sony R-DAT machine, a Lexicon 480L and a second Yamaha SPX-90. *3470 19th St., San Francisco, CA 94110; 415-864-1967.*

## Northwest

**John Raymond Audio Productions** (Reno, NV) is a new studio catering to radio advertising. Control room equipment includes a Tascam M208 board, Dokorder 7700 4-track recorder, Teac A-7300 2-track recorder, and Sennheiser MD409 U-3 mics. *421 Hill St. Ste 6, Reno, NV 89501; 702-322-6611.*

## Canada

**Comfort Sound Recording Studio** (Toronto) has added a Yamaha digital reverb and digital delay, two Rane EQs and four Countryman Isomax microphones to its mobile unit. *26 Soho St., Suite 390, Toronto, Ontario M5T 127; 416-593-7992.*

## England

**Abbey Road Studios** (London) has upgraded its Studio 3 by adding a 64-channel Calrec UA8000 console with TASC automation. Sam Toyashima has also designed a new studio and control room. *3 Abbey Road, London NW8 9AY; 01-286 1161.*

## Spain

**EXA Studios** (Madrid, Spain) has added an AMS AudioFile, to be used for film effects work, and music, dialogue and effects for advertising. *Agastia 20, Madrid, 27, Spain; 267 52 22.*

RE/P

Send studio news, including openings, equipment additions, renovations and personnel changes, to Studio Update, **RE/P**, Box 12901, Overland Park, KS 66212.

# NEW PRODUCTS

### Bose Acoustimass professional powered speaker system

Designed for a variety of professional sound applications, the system is a 2-way, 7-driver amplified and equalized system in an injection-molded enclosure. Requiring no external amplification or equalization, the unit achieves 122dB SPL at one meter and operates between 55Hz and 18kHz. The unit measures 16"x22"x23" and weighs 70 pounds.

**Circle (100) on Rapid Facts Card**

### Eventide H3000 ultra-harmonizer

A "reinvention" of the Harmonizer, unit has several new features, including the stereo pitch change, diatonic pitch change, high-end signal processing capabilities and total MIDI programmability. Specs include 16-bit resolution at 44.1kHz sampling, 5Hz to 20kHz frequency response and a >92dB S/N ratio, A weighted.

**Circle (101) on Rapid Facts Card**

### InfoVision "Computerize Your Business" videotape

Designed to aid both computer owners and people considering purchasing a computer for business use, the 1-hour videotape is a general overview and is not a sales device for any particular brand. Among the topics covered are common pitfalls in computerization; how to get the most for your computer dollar; and a step-by-step plan for computerization.

**Circle (102) on Rapid Facts Card**

### Forte Music mentor MIDI network controller

The Mentor system serves as a central controller/programmer in a MIDI-based music system, acting as an intelligent link betwen performance devices and sound modules or other accessories. The status of the network can be memorized, with each slave device configured independently for individual parameters.

**Circle (103) on Rapid Facts Card**

### Baccus Software Systems TX802 graphic editing system

To be used with the Yamaha TX802 FM tone generator, IBM PC-compatible software features voice editing and performance editing capabilities, plus complete remote control. The mouse-based system uses icons, graphic control panels, multiple overlapping windows and pop-up menus. The voicing editor is also compatible with the DX-7II.

**Circle (104) on Rapid Facts Card**

### Topaz Escort power conditioner

The "Super-Quiet" version of the company's Escort series, the unit features audible noise level of 40dB and is designed to be used where low audible noise is a primary consideration. Constant regulation is maintained within +3% to −6% of nominal rated voltage for fluctuations as large as +15% to −35% of nominal. Response time is 16ms.

**Circle (105) on Rapid Facts Card**

### McKenzie Acoustics Professional series loudspeakers

Previously available only in the United Kingdom, the series is designed for live and recording applications and features four models. C12-100 GP is for high-power general purpose, lead guitar and disco applications; C12-100 BS is a high-power LF unit for bass guitar; C15-150 BS is for high-power bass guitar and LF multi-speaker systems; and C15-200 BS is for very high-power bass.

**Circle (106) on Rapid Facts Card**

### Adams-Smith 2600 A-V editing addition

C:Sound audio-graphic editing is now a standard feature for the model 2600 audio-for-video editor. Located on the main screen of the unit's Editor, the C:Sound uses techniques similar to video slow motion and still-frame to capture sync and record edit points. Up to four hours of sound may be digitally sampled on any of four separate audio channels;

# NEW PRODUCTS

the waveform envelope of any two channels can be displayed simultaneously.

Circle (107) on Rapid Facts Card

### Software upgrades for AKG ADR 68K reverb

Two software upgrades are available for the digital reverb and effects system. V3.07 replaces V3.00 and features improvements to the sound quality of the Hall and Room reverb programs. V4.0 includes the V3.07 additions and also expands the audio memory, permitting 32 seconds of sampling.

Circle (108) on Rapid Facts Card

### Hanson Software production budget software

The Music Production Package is designed to streamline and simplify the preparation of pre-production and production budgets. To be used with an Apple Macintosh, the software is comprised of a set of customized templates compatible with ForeThought's FileMaker Plus database program, including budget worksheet, budget proposal, studio call list and actual expenses.

Circle (109) on Rapid Facts Card

### Caig Laboratories Cramolin anti-oxidizing solution

The spray is designed to clean, preserve and lubricate metal contacts and connectors, including gold. In addition to cleaning, the spray forms a protective molecular layer that maintains conductivity, which does not occur when using Freon TF cleaners, the company says.

Circle (110) on Rapid Facts Card

### HM Electronics 50 series wireless mics

The series features a new RF link, the company's NRX-II noise reduction system, mic-mute and power switch lockouts, and operator-selectable RF frequency selection on the body pack system. The system is comprised of a 2-channel body pack, a newly designed handheld and a 2-channel switching diversity receiver.

Circle (111) on Rapid Facts Card

### Tannoy PBM 6.5 monitor

Designed for live and studio use, the PBM 6.5 measures 11⅞"x8"x8½" and has a frequency response of 57Hz to 20kHz. Recommended power is 100W RMS into 8Ω, with a sensitivity of 90dB (1W at 1m).

Circle (112) on Rapid Facts Card

### Soundcraft FAME automation

Standing for faders, auxiliaries, mutes and equalizers, FAME automation is for the TS12 console. SMPTE/EBU time code-based, the system uses a 68000 16-bit microprocessor for flexibility and speed. Features include real time switching of three auxiliary send on/offs, channel cut and EQ in/out. Up to 10 complete mixes can be stored in a standard 3.5-inch disk.

Circle (113) on Rapid Facts Card

### Full Compass Systems remote headphone mixer

Studio Psychologist is a remote control studio headphone mixer that allows individuals to adjust their own studio headphone cue mix. Individuals wear a beltpack mix control unit; mixing is done in a rack-mount card rack unit using digital attenuators, with line level inputs coming from a recorder line out or console outputs. Up to 32 inputs and outputs may be configured.

Circle (116) on Rapid Facts Card

### Techron software catalog for TEF 12

The catalog details 14 software programs that are exclusively used with the TEF system 12 acoustic analyzer, which the company says makes the system suitable for testing any audio environment. Programs detailed include Easy TEF, for running common TDS measurements; Workbench, providing four common instruments for bend and field testing of sound systems and electronic equipment; and 3-D Reverb, which generates $RT_{60}$ times from 3-D TEF measurements.

Circle (117) on Rapid Facts Card

RE/P

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**WANTED:** Rare audio, video and/or film on Barbra Streisand for use in *authorized* compilations. Write Karen Swenson, c/o Martin Erlichman Productions, 1040 North Las Palmas, Los Angeles, CA 90038; Phone (213) 461-3466. Please describe format and quality. 02-88-2t

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**NEVE 48 INPUT 8108**
**G.M.L. AUTOMATION**
**$175,000**
The best sounding Neve since Rupert, equipped with Massenburg automation. The world's finest moving fader mixing system: $175,000. Cash. May split or consider partial terms. Also for sale: Studer Mk II (Transformer) 32.5 k, Q-log 3 machines $2500. The above combo has recorded over 30 gold and platinum records. Call Buddy King, Soundcastle Studios (213) 665-5201.



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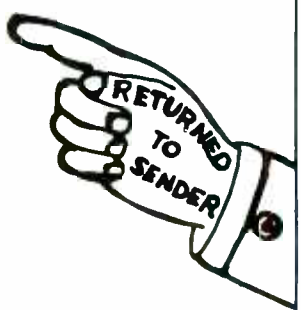


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# THE IEQ WITH Smartcurve™

## Not Just Another Programmable Equalizer With MIDI™

The IEQ with Smartcurve™ is a programmable, high performance graphic equalizer that includes a video output. For those who wish to enjoy the video output of the IEQ, ART makes the IEQ Video Monitor.* Smartcurve™, proprietary software developed by ART gives you instant actual frequency response as easy as the push of a button.

The IEQ Family consists of both the 2/3 octave and the 1/3 octave graphic equalizers. Both types come in two varieties, Controllers and Satellites. A Controller is a self-contained programmable intelligent graphic equalizer capable of controlling 15 satellites at once. IEQ Satellites are exactly the same unit except the front panel controls are eliminated.

**IEQ Model Specifications:**
**Controller & Satellite**
- 128 battery backed presets
- MIDI
- Frequency Response 20Hz-20kHz ± 0.5dB
- THD - ≤ 0.09% @ 1kHz, 0dBM typical
- Dynamic Range - ≥ 100dB typical
- Balanced inputs and outputs

***IEQ Video Monitor Features**
- 19" rack mountable
- NTSC compatible monochrome monitor
- 4 Selectable inputs
- Standard RCA jacks for easy connections

*It Has To Be A Work Of . . .*

ART

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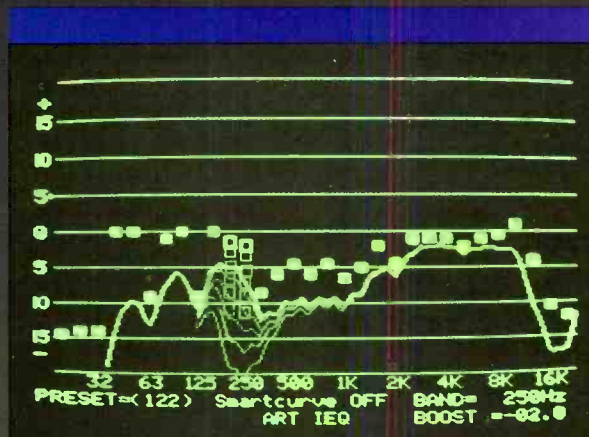
FAX (716) 436-3942

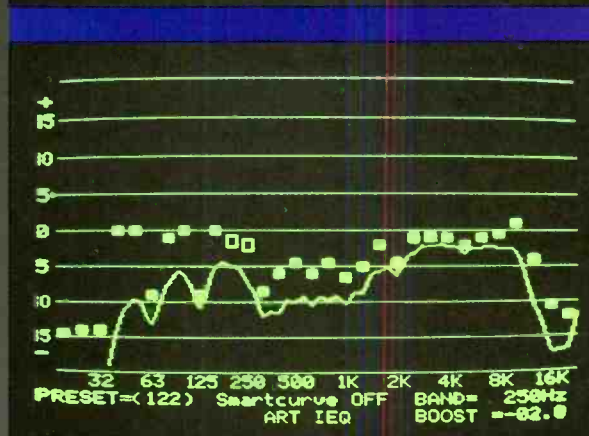
*For more information see your local dealer.*

**Circle (2) on Rapid Facts Card**



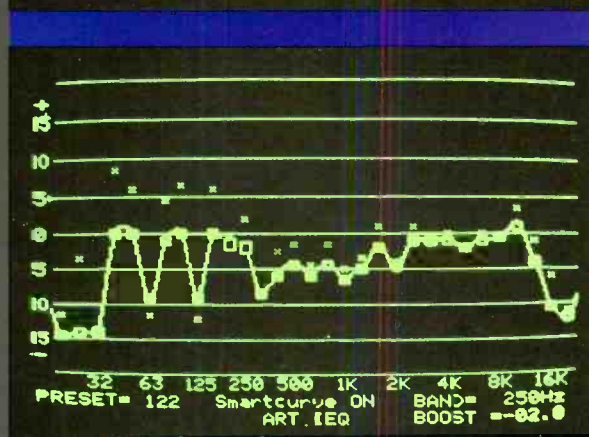

## 1 See the Sound

This is a video output of the IEQ as the unit is being adjusted. The sliders can be moved ± 15dB in 1/2dB steps to get the exact response you need. With the simple push of a button, complex equalization can be done in seconds with incredible accuracy.



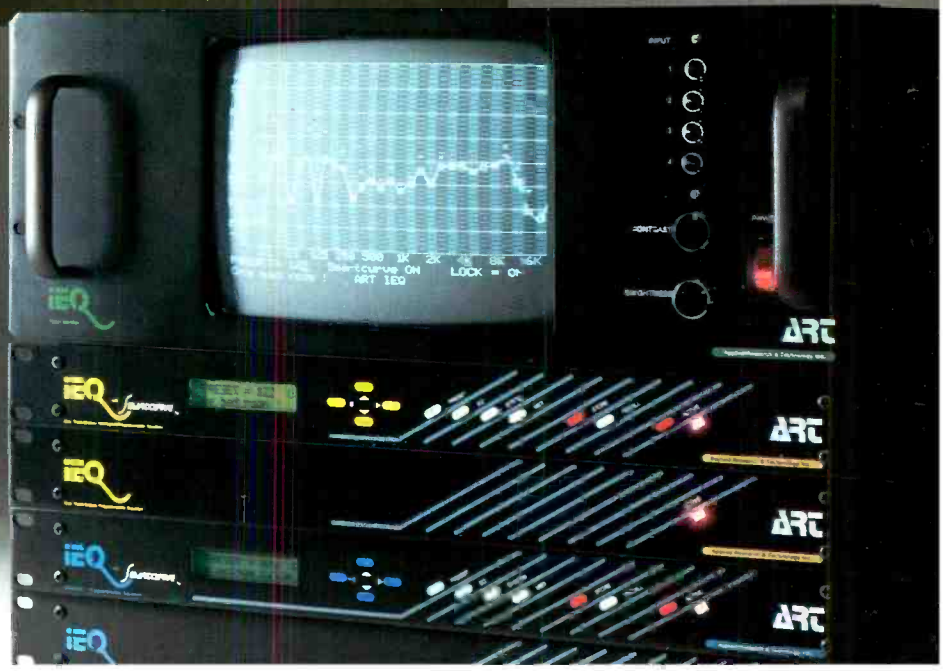

## 2 Hear the Sound

The power of the IEQ readily becomes apparent as the video display plots the frequency response due to the slider settings. The IEQ offers high quality constant "Q" equalization. The video graphic display shows the correlation between the sliders and the frequency response.



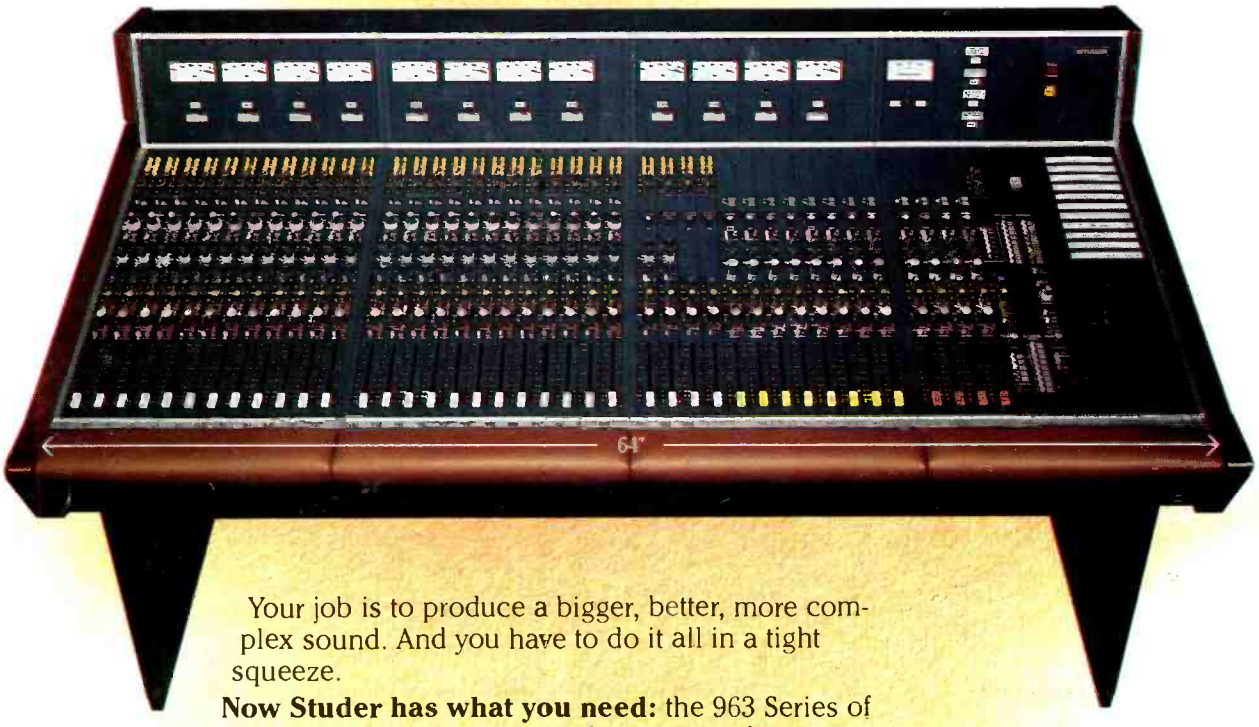

## 3 Perfect Sound

Turn Smartcurve™ on and perfect equalization is at your fingertips. Note the difference between the second frame (Smartcurve™ OFF) and this frame. The position of the sliders represent the actual frequency response of the EQ. Interaction between bands is virtually eliminated. Incredible. Just think, now when you adjust the EQ you get exactly what you need. The "perfect" EQ? Let your eyes and ears decide.



# Not-So-Big News

## The news is out. Studer's new 963 is big on features, performance and reliability. And not-so-big on size.




Your job is to produce a bigger, better, more complex sound. And you have to do it all in a tight squeeze.

**Now Studer has what you need:** the 963 Series of compact production consoles. A 963 is ideal for video post-production, video editing, broadcast production, EFP vehicles, smaller recording studios–anyplace where quality and reliability are critical but space is at a premium.

**Based on a standard 30 mm module width,** the 963 is available in configurations from 16 to 40 inputs. A 28 input console, with 28 direct outputs plus 4 stereo subgroups and 2 stereo masters, is barely more than 5 feet long. A 40 input console, is barely more than 6 feet long.

**Standard features** on the 963 include balanced insert points, direct outputs, a bantam jack patch bay, and external mute interface for video switchers. A wide variety of module options lets you custom configure your 963 for practically any specialized application.

**When it comes to audio performance,** the 963 goes head-to-head with the bulkiest of the big-name boards. Noise levels are digital compatible in "real world" conditions with many open faders. Studer engineers gave special attention to mix bus design and reference grounding to assure consistently superior specifications regardless of frame size. For extra reliability, solid state switching is used in all critical audio paths.

As with all Studer products, the 963 is manufactured and assembled to the highest standards of Swiss craftsmanship.

**For more information,** call your nearest Studer representative. Find out how the 963 can give you big console capabilities in a not-so-big package.

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