January 1988

Recording ENGINEER/PRODUCER

The Applications Magazine for Audio Professionals

AN INTERTEC PUBLICATION

Paisley Park Studios Page 40

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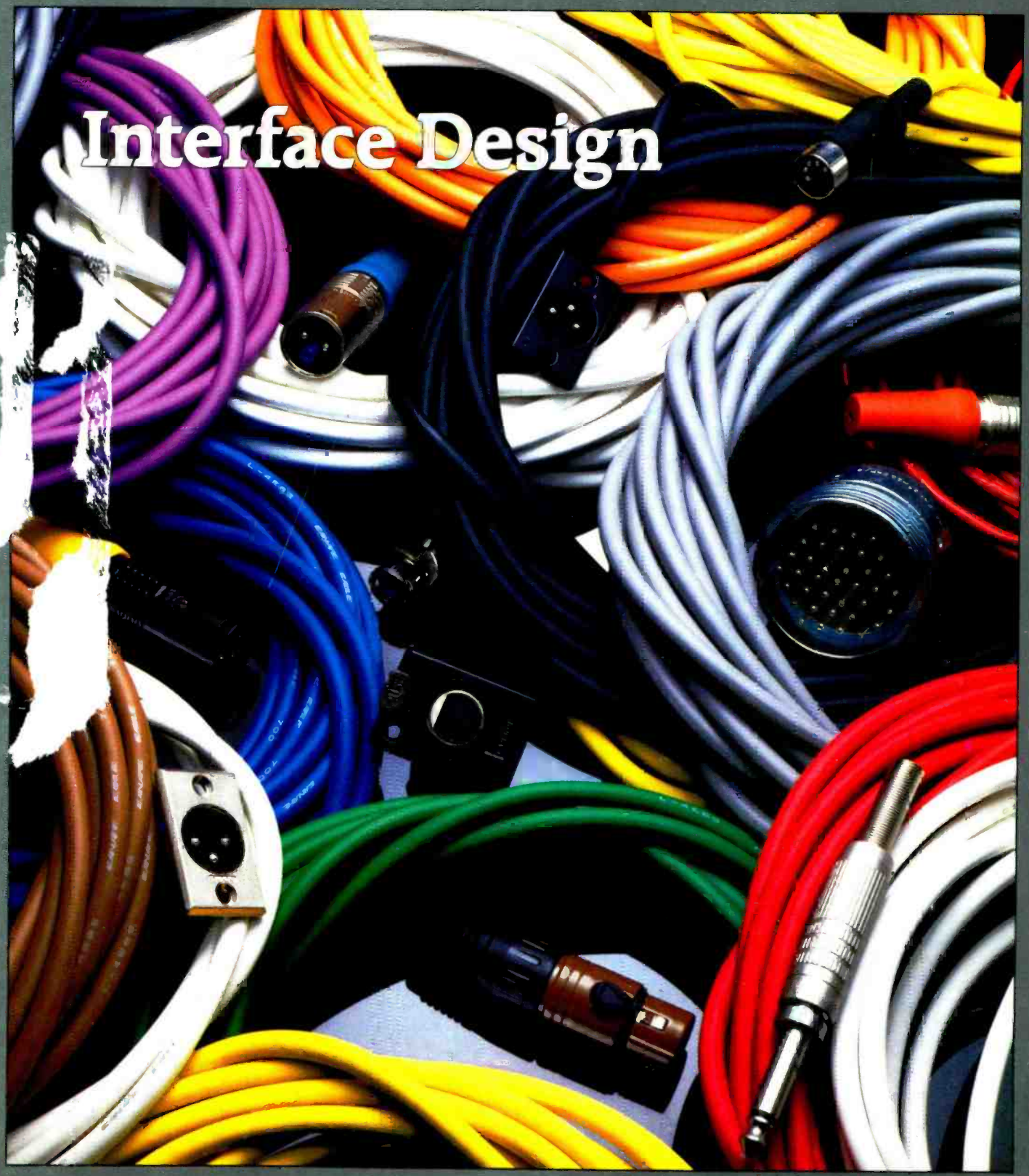

Interface Design

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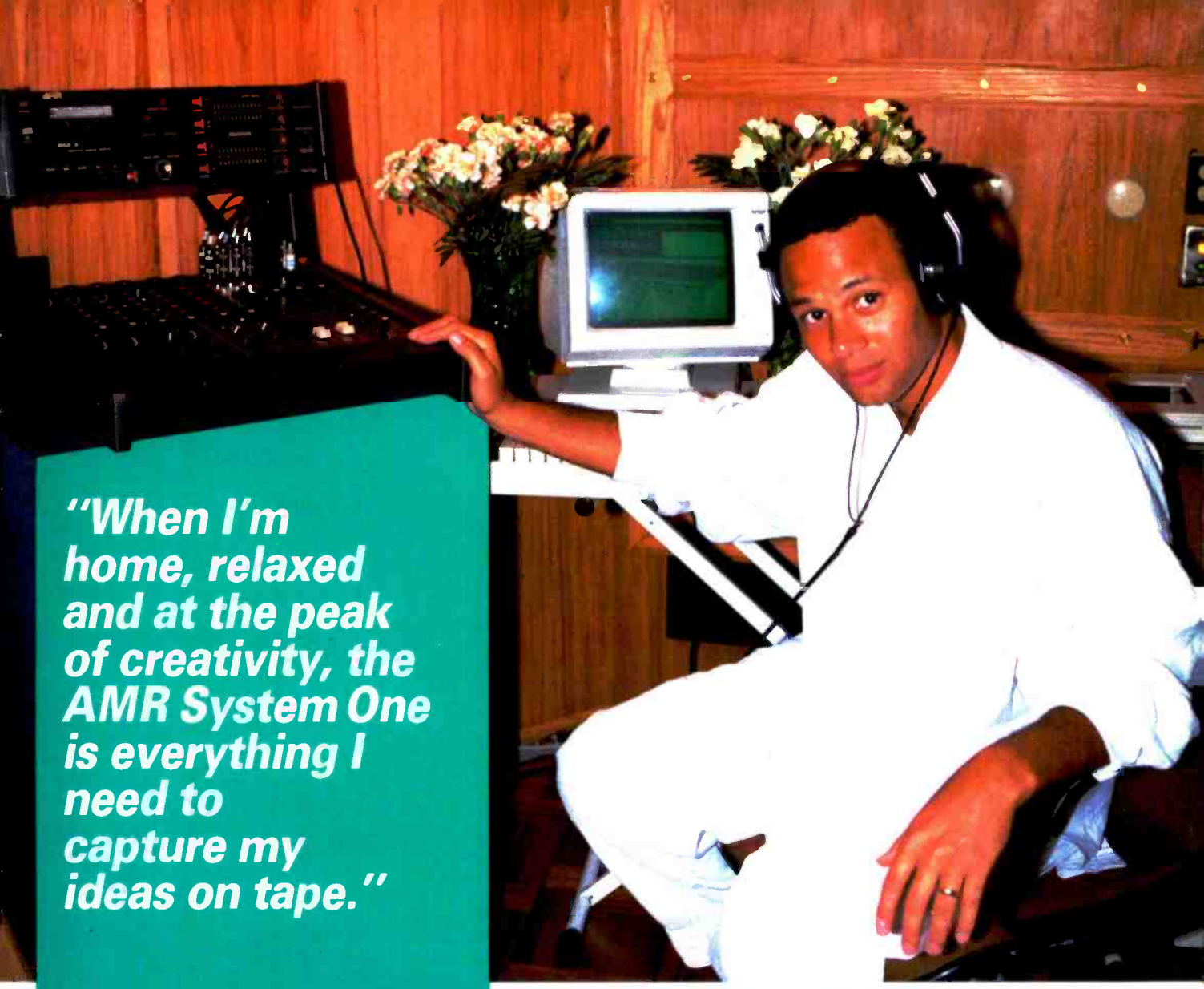

"When I'm home, relaxed and at the peak of creativity, the AMR System One is everything I need to capture my ideas on tape."

NARADA MICHAEL WALDEN

Narada Michael Walden is a world-class drummer, keyboardist, singer, composer and performer. If there's a musical role he can't handle, no one has thought of it yet. As a producer, he's turned out such hits as Aretha Franklin's "Freeway of Love" and Whitney Houston's "How Will I Know" (which he wrote and co-wrote respectively). As a drummer, he's played jazz, fusion, and rock with the likes of John McLaughlin, Jeff Beck, and Weather Report, and R & B with Rick James and Teena Marie.

Narada is an extraordinary musical craftsman. He demands the very best from his music and his equipment. His choice in personal multi-track recording gear is AMR. Naturally.

NARADA MICHAEL WALDEN recent awards:

1986 ASCAP Songwriter of the Year:
"Freeway of Love" Aretha Franklin

1986 ASCAP Song of the Year:
"How Will I Know" Whitney Houston

1986 Billboard's Producer of the Year
1985 Grammy

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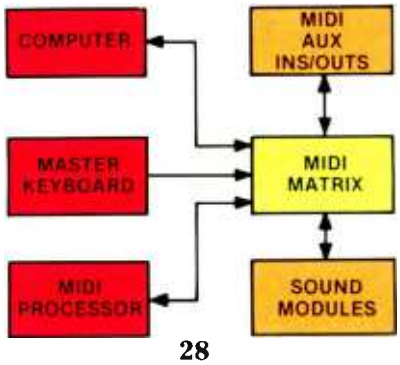

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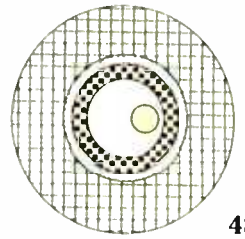
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Departments

On the cover:
◀ The days of using only XLR connectors in a studio are long gone. Today, there are a variety of interface methods available, requiring special knowledge of how to use them properly and to also use them to your best advantage.
Materials courtesy of Canare Cable; photo by Gene Faulkner.

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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."

OTARI

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EDITORIAL

To Be "State of the Art" Or Not

The economics of our industry are getting out of control. Consider these signs:
- In many instances, the advances of technology change what was a 10-year investment into 5-year obsolescence.
- Reduced production budgets often come with increased production demands.
- For most studios and engineers, rates haven't increased significantly in 10 years.

These are not just my thoughts, they are representative comments from many people in the professional audio industry. If we ignore the cause of the problems that these comments represent, will they go away? I don't think so.

Part of the problem seems to lie in the constant push for the "state of the art," combined with an even bigger problem—impulse buying.

In the 1950s, '60s, and '70s, the ideal of being "state of the art" was attainable, at least for a while. But in the late '80s, I'm not so sure this is possible. Technologically, there is so much more happening, and it's happening so quickly, that the state of the art is no longer definable for more than a few months.

In the classic sense, the phrase "state of the art" had an implied time variant. And, in the case of a recording facility, meant it was equipped with the absolute best that money could buy—regardless of any political or social pressures. Being "state of the art" actually meant something in the studio brochure.

Unfortunately, the contemporary connotation of the phrase seems to be more along these lines: *a lot* of money has been spent *recently*, and in selecting how and why it was spent, compromises were made resulting in something less than the classic definition.

As recently as the mid-1960s, a 4-track tape deck was the epitome of professional multitrack recording. At that time there were only one or two manufacturers producing such machines, and although 8-track wasn't too long in coming, the owners of 4-track technology would have a few good years at the top of their markets.

Today, there seems to be at least a half dozen companies competing for market share, representing every conceivable hardware and software product in existence. This competitive environment activates a need for many to prematurely rush marginally new product(s) to the market.

There are many advantages to competition, most notably more product choices at lower prices. But competition can also ignite a marketing frenzy causing, unnecessarily, an uninterrupted redefining of the "state of the art" and creating constant budget pressures for those striving to achieve it.

Are we all at the mercy of this relentless advancement of technology? Is there some underlying human need to respond...purchase a new product simply because we can? The answer is probably yes. But as intelligent beings, we also have the ability to recognize and control our urges. In this instance, technology is the urge. Develop and use it, yes...but manage it we must.

Remember, innovations and new products are introduced to make money first and help end-users second. Under these conditions it is very difficult for consumers (who are still trying to figure out how to use their last purchase) to intelligently investigate and digest the latest creation to hit the streets.

If new technology, in the form of hardware and/or software, is desired *and* purchased by many, but is afforded, understood or used by only a few, what has really been accomplished?

All of us, manufacturers and users alike, should take a serious look at what it is we are trying to accomplish in this business—what is motivating us. Is it profit, creativity, technology, family, friends, or maybe even... *sound?* Perhaps it's an overriding love and concern for professional audio. Whatever the motivation, it is imperative that we all examine our relationship with the industry to see if everything possible is being done to not only further our own goals, but also foster a healthy economic basis for our industry.

Service as an alternative

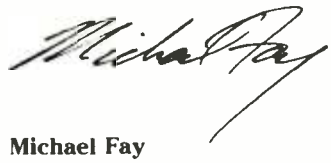
Instead of trying to keep pace with the elusive "state of the art," better business sense dictates taking extra time to carefully evaluate all studio-related hardware needs and purchase only that equipment that is both economically *and* functionally viable. It's better to purchase the best quality you can afford (month-in and month-out) than it is to overextend for a brand name that isn't affordable or is purchased to appeal to the engineers rather than clients.

In six months to a year when new equipment is no longer "state of the art," it will be the service, not the hardware, that will keep your clients coming back. This is true for both manufacturers and studios alike. It seems that many of us see technology as the shortest path to profits. This may be true, but only to a limited extent. As an industry, if we can shift some of the emphasis from technology to service, we would begin to rectify many of the imbalances that are prevalent today, and begin to establish both a positive image and the economic stability that is needed.

For example: Some manufacturers offer shows and clinics to demonstrate *what* their new products can do. This is OK, but providing a service that teaches owners *how* to use their recent purchase would be more useful, would develop better public relations and establish a better image.

In the studio business, extra service could mean driving a client to the airport rather than calling a cab, or showing up at 7 a.m., to be sure that you are ready to roll at exactly 8 a.m. on a project that goes *on-air* at noon.

Service becomes a value-added asset when it's provided above and beyond normal operating procedures—and you'll get something all the "state of the art" technology in the world can't create: customer satisfaction. RE/P



Michael Fay
Editor

I TOSSED MY 421'S AND PUT IN 408'S. THEY'RE GREAT!! ACOUSTICALLY THEY'RE VERY FULL. AESTHETICALLY THEY CLEAN UP THE DRUM SET APPEARANCE.*

Drums, cymbals, brass and woodwind, and even voice applications. The N/D408 and N/D308 instrument mics do it all.

We designed them as instrument mics, but believe it or not we're also getting great response from vocal performers who think they're fantastic.

Actually, the N/D408 and N/D308 represent a radical departure from conventional instrument microphone designs. Both employ N/DYM™ technology, and only the N/D Series mics from Electro-Voice have it. And both offer a pivoting yoke configuration for maximum flexibility in positioning the microphone near the sound source while maintaining optimum pick up angle. They're N/DYM hot, and there is no better mic for live sound reinforcement of instruments.

Try them at your Electro-Voice dealer and in concert. Then let us know what you think.

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To learn more about N/D Series microphones, see your Electro-Voice dealer or write Electro-Voice, Inc., Dept. N, 600 Cecil Street, Buchanan, MI 49107.

**Actual N/D408, 308 user comments are kept on file at the Electro-Voice Corporate headquarters in Buchanan, Michigan.*

LETTERS

Film speed vs. time code

From: Jerry Burling, Hollywood.

I am an engineer in a team in Burbank, CA, that is responsible for preparing the entire output of the National Broadcasting Company for air.

Concerning Larry Blake's article on time code [October issue]: A good way to remember film speed vs. time code is to think of the two of them running side by side. If the film speed is slowed down from 30fps to 29.97fps, then the time code is also going to have to be slowed down to match it.

This is accomplished by dropping frames from the time code from time to time, as Larry mentions in his article. Larry also mentions the fact that some editing and duplication houses accidentally feed the sync pulses to the video tape machine from one sync generator, resulting in non-synchronous time code. The video frame rate and the time code frame rate, on the same tape, do not coincide.

This is a disaster for editors who, later, have to perform work on this tape. Editors, such as the CMX-3400X, will abort the edits when it recognizes that the video and time code are not in sync. This is a terrible problem here at NBC Burbank, where we prepare the entire prime time output for the whole network.

Time is of the essence when it comes to getting things on the air. Any delay, such as the ones mentioned by Larry, can be fatal to any broadcast operation. It is easy to have the video and time code references coming from different sync generators.

Most operators at duplicating and editing houses do not know anything is wrong until the facility "downstream" from them lodges a complaint. Anything anyone can do to eliminate this problem would be greatly appreciated.

R-DAT compromise

From: Laura Taylor, New Orleans

I am very much confused over the issue of R-DAT and the Copycode system. Granted, the DAT is the most significant technological breakthrough in recording since the compact disc, and its uses for recording are invaluable. On the other hand, one of its possible uses is illegal: pirating.

This is a large threat—the darkest cloud looming over DAT's head. If DAT is to become as successful as we wish, this cloud must blow by.

I am a musician, and at this point in my career I don't care if people pay money to hear me; I would pay people to listen. If I were being paid for my music, I wouldn't want people copying it and selling inferior copies at a higher price. DAT eliminated half the problem: The copies are no longer inferior. So now I am losing revenue from the sales of my music.

I am also an engineer. I am a production assistant and DJ at a local radio station, and I also do some home recording and mixing. When it comes to making music in my home, one of the biggest problems is tape hiss. I would love to run out and buy a DAT machine. Aside from being too expensive, I would be going against what I believe in as a musician.

This same indecision is going to tear the music industry apart. I have read opinions on the subject by Jason Berman, president of the RIAA, and by Michael Fay and Frederick J. Ampel [October issue], as well as many others. Both sides put across their points convincingly.

The moral dilemma underlying all this for people like myself is clear: Which side of the industry do we turn our backs on?

Neither. A compromise must reached. The worst thing that could possibly happen is for the music industry to become divided. The record companies and engineers must stand together to find a solution suitable for the whole industry—artists, producers, executives and consumers.

A remedy for this indecision lies out there somewhere. Steps already being taken, such as not including a digital output and using different sampling rates (no high-speed dubbing) are steps in the right direction. These steps, however, must be taken one at a time, as evidenced in previous technologies.

We must learn to walk before we can run. In this way, the music industry will prosper.

Continued on page 78

WHAT YOU DO WITH THE M-600 MIXER IS YOUR BUSINESS.

That's why we've designed it to meet or exceed your most demanding requirements. And made it the easiest, most flexible professional mixing console you'll ever work with.

The M-600 is modular. Which means you can custom configure the console to *your* audio or video production needs. The M-600 lets you choose up to 32 input channels, or you can start with 16 or 24 input channels and expand the board as your needs change. Optional stereo modules can also be added to provide even more line inputs for MIDI instruments and video production convenience.

Installation and wiring is exceptionally easy. The M-600 is the only modular mixer that's available with all the necessary finished cables and installation hardware. And that can eliminate a lot of installation hassles and expense. At the same time, no other mixer at its price gives you multi-pin, computer-type connectors for quieter, more secure connections.

But the real pleasures of the M-600 will only be evident after it's in your studio. Up to 64 stereo or 128 mono inputs can be accessed directly from the top panel. A patch bay can be added for fast, flexible routing. That's convenience.

The M-600 has all the features you'd expect in a professional mixing console. Like balanced insert patch points on all inputs, PGM busses as well as the stereo master buss for increased signal processing capability. Plus sweep-type parametric EQ, balanced inputs and outputs, phantom power, talkback/slate channel and all the audio performance you'll ever need. Without the exorbitant price you don't need.

So check out the M-600 modular mixing console. It's ready for fame when you are.

TASCAM

NEWS

Power Station installs, Pro-DAT groups formed, RE/P R-DAT response

Power Station installs PD, DASH interface

New York's Power Station became the first North American studio to install an interface that resolves compatibility differences between the digital PD and DASH formats.

The PDASH interface, made by Hilton Sound, a London pro audio rental company, facilitates a digital transfer between the formats by master-resolving both PD and DASH machines to its own generated time clock, allowing tapes recorded on one format to be played back on the other.

Besides resolving PD-DASH incompatibility, the interface also allows AMS Audiofile systems to be compatible with PD machines.

"The last thing any studio wants to do is turn away business because the expensive digital multi-track it owns happens to be a different format to the tape the client brings in," said Ed Evans, the Power Station's head of engineering.

Pro-DAT groups formed

The formation of two groups representing professional users who oppose restrictions on R-DAT machines has been announced.

At a press conference Nov. 4 at Westlake Audio in Los Angeles, spokesmen for two groups, Musicians for DAT and Independent Record Labels for DAT, said they were formed to dispel assertions that the record industry proponents of anti-DAT legislation speak for the entire industry.

The groups were formed under the auspices of the Home Recording Rights Coalition, the pro-DAT group representing consumer interests. Initial membership totals about 200 and includes musicians, composers, producers, engineers, studio owners and independent record labels.

Initial plans call for contacting legislators and voicing their opposition to anti-DAT legislation, and seeking additional member support.

Reader card returns total 1,000

RE/P readers have returned more than 1,000 letters to Congress expressing their opposition to anit-DAT legislation pending in Congress.

The cards appeared in the October and November issues and were available at the AES convention in October. The cards, containing a short letter and space for other comments, were returned to *RE/P* for tabulation.

"Obviously, we're thrilled with the total," said Cameron Bishop, group vice president of Intertec Publishing, which publishes *RE/P*. "The combination of the returned cards and the results of our reader survey on R-DAT and Copycode show that the industry is pretty much united on this issue."

The survey results and reader cards will be presented to congressional leaders in early 1988.

News notes

Two British pro-audio companies, **Soundtracs** and **Turbosound,** have been presented with the Queen's Award for Export Achievement, presented once a year to companies that have made outstanding progress in export markets. The companies were among 120 given the award in 1987.

TimeLine has donated three LYNX modules to the Film Composers Laboratory at the Sundance Institute in Utah. The modules were used to synch an Otari MX80 24-track recorder to a Sony U-matic VCR.

Bose Corporation has been named the official supplier of professional sound system equipment for the Olympic Winter Games in Calgary, Alberta, providing sound systems at all 12 venues.

The **DeWolfe Music Library** has won an award of merit at the 10th annual audio-visual competition held by the Society for Technical Communication, for providing music for a health care industry program.

Focusrite has announced contracts to build consoles for the following studios: Master Rock, London; Electric Lady, New York; Sound Castle, Los Angeles; and Royal Recorders, Lake Geneva, WI.

Lorimar, the Los Angeles production company, has purchased 18 **Nagra** tape machines, including 15 IV STCs, two T-Audio TCs and one 4.2.

Solid State Logic has announced contracts for G series consoles to the following studios: Olympic Studios, London; A&M Studios and Summa Music Group, both of Los Angeles.

People

David Ruttenberg has been named central regional sales specialist for Otari.

Gregory B. McVeigh has been named director of marketing, and **Peter T. Kalmen** national sales manager, at QSC Audio Products.

Larry Lamoray has been appointed general manager for Amek/TAC USA.

Jim Gillespie has been named vice president and national sales manager at Interface Technologies.

David Neal has been named marketing manager at DDA.

Steven K. Wenig has been named director of the technical support group at Nakamichi America.

Gary Johnson has been named manager of audio engineering for Electro Sound.

Kevin Dauphinee has been named director of marketing for Digital Audio Research.

Dennis Creamer has been named vice president of finance for the Mitek Group.

Richard A. Antonio has been named the director of sales and customer services for the magnetic tape division of Ampex.

Tom Neidhart has been named director of marketing for consumer and professional audio and video products for BASF.

RE/P

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 viceo 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 - ≤ .009% @ 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

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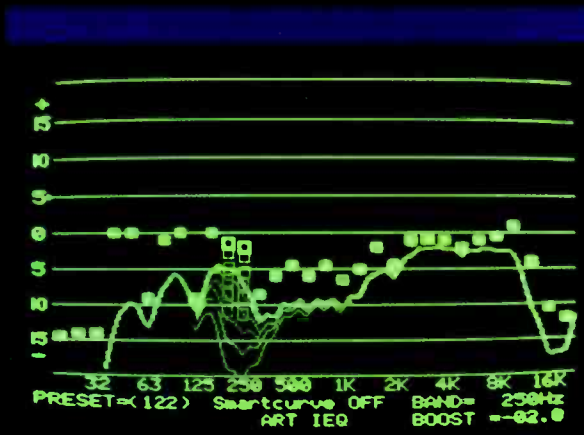
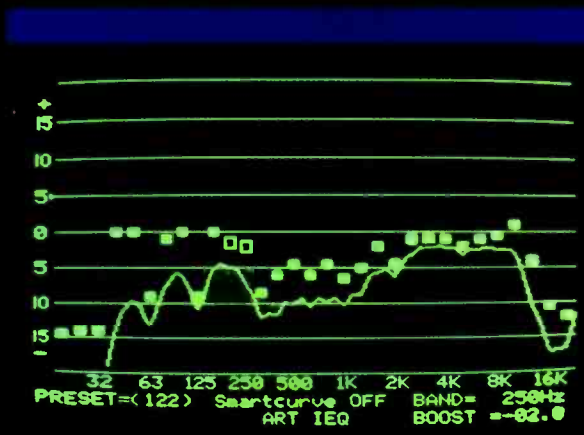


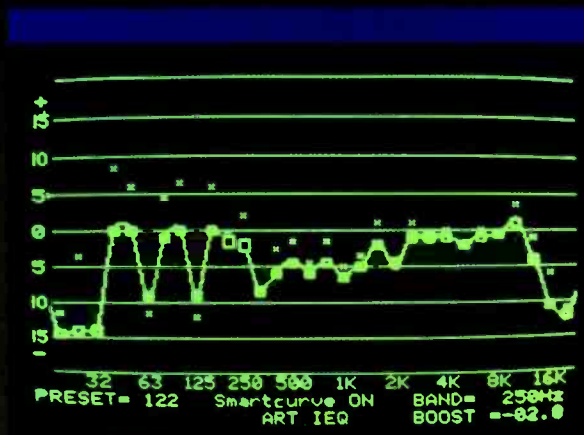
1 See the Sound

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.

SPARS ON-LINE

By Joe Sheets

Breaking the $200K Barrier

An interesting thing happened to me during the 1987 AES Convention in New York. I met a number of engineers and studio owners who had arrived at what I call the $200,000 plateau: the income level achieved from a $100 per hour rate for 2,000 hours booked per year.

The colleagues I conferred with weren't involved in platinum albums or soundtracks for glamorous network TV shows. These people simply had entered the studio business eight or 10 years ago and gained a loyal following of regional advertising and multi-image clients. They work long hours, meet impossible deadlines and supply good services to their clientele. They bought some synthesizers and became skilled at scoring radio spots, multi-image presentations and the occasional non-sync TV commercial. At long last, they could charge $100 per hour for approximately 2,000 billable hours per year, and they felt like kings—for about two years.

Meanwhile, as the recording industry evolved, new technology got very expensive, and clients wanted different capabilities from their favorite studio. It didn't take a genius to foresee the coming wave of new business opportunities offered by audio-for-video production.

Some of the most frequently asked questions at the AES Convention were, "What should studio owners buy in order to fulfill the production client's needs?" and "How can we get above the $200,000 limit of yearly billings per room?" Beyond that, how can income rise to $300K or $400K?

I am familiar with this scenario because I experienced the same situation last year. I set my billing goal for one room to reach $400K per year ($200/hr x 2,000 hrs.). I wrestled with decisions about what to buy. Should I invest in a disk-based recording system? Could I charge $200 an hour for that? Should I buy a new console? Who'll pay $200 an hour just to have a new console? Maybe I should buy a digital tape machine at a cool $180,000. Have you ever tried explaining to budget-conscious advertisers that you'd like to charge significantly more for additional tracks that are extremely quiet?

Certainly, a digital tape machine offers a lot, but many production clients with large purchase orders care about only a few things: where's the talk-back switch, where's the coffee, and don't forget that Federal Express is coming at 5:30.

After much research, my options for market strategies narrowed down to one path. The only new capability that would impress my clients was the ability to do audio-for-video production. Fortunately, as I discovered, it is also something that advertisers are willing to pay for.

Bear in mind that the average cost of production for a 30-second TV spot produced by an advertising agency is between $100,000 and $200,000. Last fall, I engineered a soundtrack for a regional spot that cost almost $500,000. The producers may spend days in video editing houses at rates between $300 and $600 per hour. Audio is one of the last links in the production chain, and when they get to your studio, even at $150 to $200 per hour, they can relax. If you take care of business and consistently produce excellent results on time, you may be able to justify charging twice as much for audio-for-video post-production as you're charging for straight audio production.

Now we understand the additional income that can be made. Next question: What do I buy to get into this new business? I found that the bare minimum includes a video source machine and monitor, a ¼-inch audiotape machine, and a multitrack audio recorder. You also need synchronizers for all three machines, a controller that "talks" to the synchronizers, a time code generator, and last, but perhaps most important of all, some form of "house sync."

The video source machine can be as simple as a ¾-inch videocassette machine, but after the session at your studio you will still need to take your final mix to a video facility and transfer or lay it back to a 1-inch video master tape. Try to be present at the layback. Make yourself an indispensable part of the process and charge accordingly.

The audiotape machines you'll need must be fairly new and capable of being controlled by synchronizers. The number of tracks on your multitrack isn't as important as what to do with them.

The time code generator should be of high quality and compatible with your synchronizers. Some synchronizer companies also make good time code generators and a number of manufacturers build the generator into the synchronizer module itself.

"House sync" is merely a very stable reference frequency that should be distributed to every room that does synchronized work in your facility.

Also, remember that you will need to record time code on videotapes provided by clients. The time code generator and the video deck must both be connected to the same reference (house sync). This guarantees that the frame rate of the video and the frame rate of the generator are the same. This allows the SMPTE time code word to start in the correct portion of the video frame. This alignment is necessary for proper synchronization and is also part of the ANSI/SMPTE specification. Beware of anyone trying to sell you a system that doesn't hook up to house sync.

If you have any doubts about your ground system, you may have problems when SMPTE time code starts flying around your room to various tape machines. It seems that time code just loves to find an audio input to jump into.

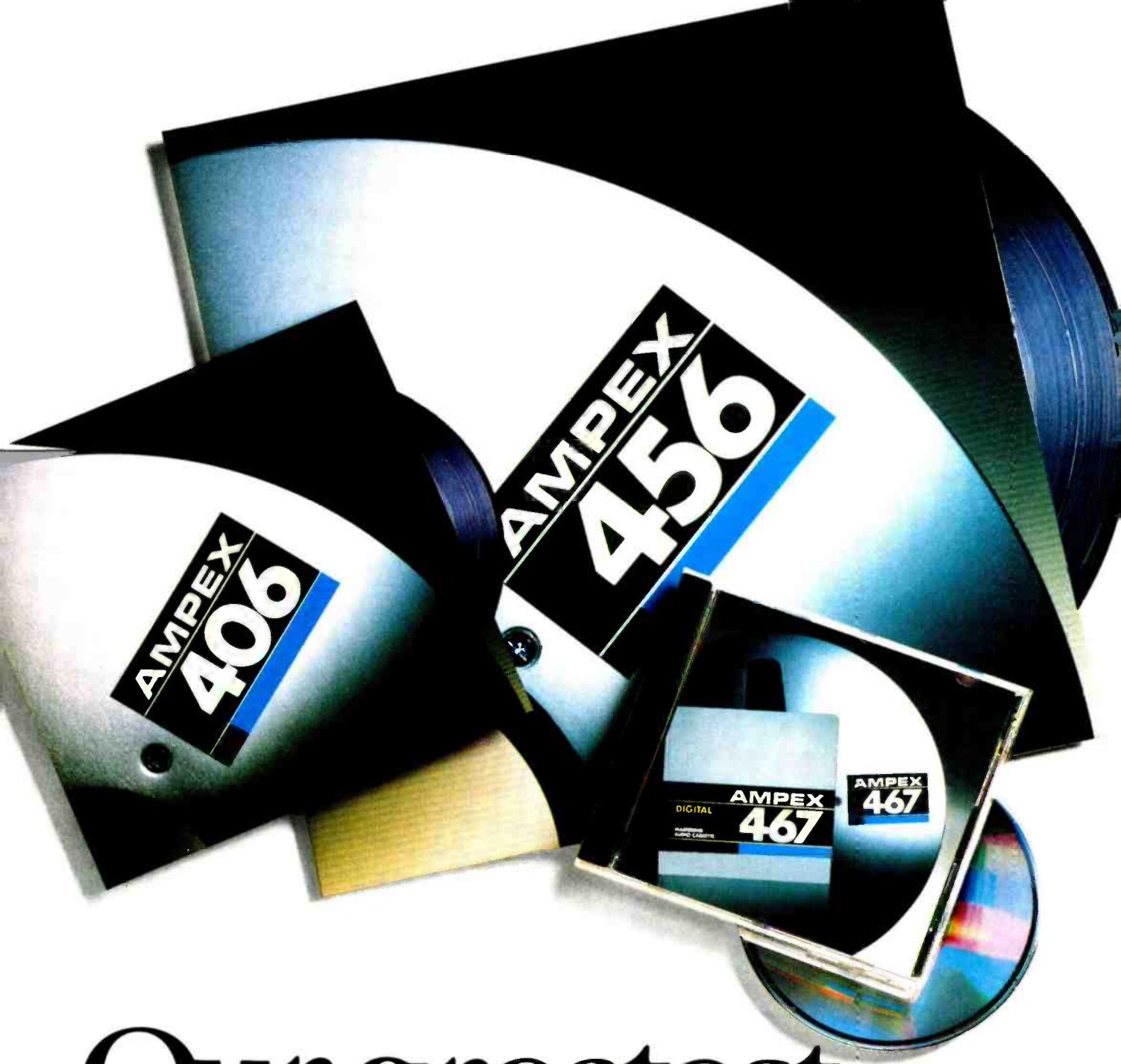
Believe it or not, all of the equipment I've just mentioned will cost between $30,000 and $40,000. It's quite probable that you'll make that investment back in less than half a year, based on the increased volume and the type of business you'll be able to accommodate.

I may have described the transition into audio-for-video as simpler than it actually is. My background included years of production experience, recording every possible commercial imaginable. I bring this up because, before you make the expansion move, you must first be able to record and mix quickly and mix well.

Make no mistake about it—your session overhead will increase in the form of just keeping track of the extra elements while recording and editing to picture. You must have a firm foundation of working experience in the art, science and business of recording in order to prosper at the next plateau: audio-for-video.

RE/P

Joe Sheets is chief recording engineer at Alpha Audio Recording Studios in Richmond, VA, and has been involved in audio for 25 years.



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MANAGING MIDI

By Paul D. Lehrman

More Answers to MIDI

A few issues ago, I did a question-and-answer column talking about some of the more elementary aspects of MIDI, which many otherwise-knowledgeable users do not seem to be completely familiar with. Recently, I spent a couple of weeks in a commercial studio that bills itself as "the MIDI specialists." Although the sessions went very well, the experience made it clear to me that even those who claim to have MIDI down cold still have some gaping holes in their knowledge, especially when it comes to practical applications.

Therefore, a few more questions and answers:

• What is Omni mode good for?

In a word, nothing. Omni mode (or, more accurately, the Omni-On modes) was probably a good idea when MIDI first appeared, so that stage performers who simply wanted to link a couple of keyboards together wouldn't have to worry about which channel each of them was set on to transmit or receive.

But MIDI has gone way beyond that. Now, any device that cannot discriminate among incoming MIDI channels is essentially useless in a studio. If you are stuck with one of these dinosaurs (for example, a pre-MIDI synth with a primitive MIDI "upgrade"), you can still get outboard "filtering" devices that will block out data on all but selected channels.

Unfortunately, some hardware manufacturers insist on considering Omni mode important, which can lead to headaches. For example, there's a well-known instrument that uses a high-capacity external storage device for its sounds, which reverts to Omni mode every time a new sound is loaded. Getting it back to normal involves pushing six buttons and moving three sliders. Yuck.

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

• What are the differences between MIDI interfaces for computers?

There aren't too many, fortunately, but one should be aware of them nonetheless.

Generally, interfaces for the Commodore 64/128 are interchangeable, as are those for the Apple II line (except the IIc, which has no internal slots, so it needs a special interface). There is only one interface available for the Amiga and the Atari has its own.

There essentially is one "standard interface for IBM PCs (and clones), made by a well-known Japanese company, which consists of an external box wired to a card that fits in one of the computer's slots.

The vast majority of MIDI software for these computers uses this interface, and at least one domestic manufacturer makes a system that is functionally equivalent to it. To throw a monkey wrench into the works, however, IBM recently came out with a clever device called "The Music Feature," which combines an 8-voice FM synthesizer and a MIDI interface on one internal card.

Unfortunately, the device is completely incompatible with the aforementioned Japanese system, so no existing software will run with it. However, several software companies are already working on versions of their products that will work with the Music Feature.

The Macintosh is the most complex. Originally, software writers for the Mac used three different "speeds," or clock rates, for the data link between the computer and the interface. The interfaces themselves were set to operate at one or more speeds.

Eventually, things settled down, and 1MHz became the unofficial standard. Most software makers continued to include "switches" in their programs to accommodate the various interfaces out there, but recently programs have appeared that simply assume 1MHz interface. This is bad practice, as there are plenty of early 500kHz or 2MHz interfaces still around and their buyers may resent being forced to scrap them.

As important as clock speed, however, are the features and quality of the interface. Things you may need include multiple input ports (useful if you plan on synching the computer to tape); an internal power supply (interfaces that draw power from the Mac's serial ports have trouble with newer machines); and some kind of switch so that you don't have to rewire your whole studio every time you want to use your modem or printer.

In terms of quality, by which I mean data-handling ability, each manufacturer will invariably insist that its design is perfect. You will find, however, that certain interfaces and certain software programs do not like each other.

• How do I transfer sequences from one program to another?

In a recent column, I discussed MIDI Files, a new data format that will allow files created with one program to be used in another, simply by storing them on a disk and reloading them, or even by sending them through a modem and down a phone line.

But you don't have to wait until MIDI Files become the universal standard to transfer files. If you have two computers, you can simply set one to play while the other records. Make sure that the two computers are running off of a common clock (it's generally a good idea to let the transmitting computer be the master), or else you'll find your carefully quantized notes ending up all over the place.

This is especially necessary if the receiving software does not allow you to record more than one MIDI channel at a time—in which case you will have to do a separate pass for each channel—and if all the passes are not timed to a common source, you will have complete chaos.

It's also a good idea to transfer at a slow tempo. Remember, MIDI data are serial, and there is no such thing as two truly simultaneous events. Therefore, every time you send a MIDI sequence down the line, small timing errors are introduced, which get compounded with every pass. If you send the data slowly, those errors will still be there, but they will be *proportionately* much smaller.

You don't necessarily need two computers to do this: one computer and a hardware sequencer will do the trick as well, or even a sequencer built into a synth. You'll just need to do twice as many passes. Because MIDI is digital, you don't have to worry about generation noise, but again, to maintain the timing, use slow tempos.

More questions, problems, confusions or clever hints you've discovered? Write me and be immortalized in a future column. RE/P

Power Station selects t.c.electronic. Installs 6 TC-2290 sampler/delays

"I love the sound, the ease of operation, and the complete control over all parameters. With the three modulation parameters, speed, depth and waveform on the front panel, and the special key functions to access software T.C. allows fine tuning of parameters that are predetermined in other units.

The combination of dynamic delay and pan modulation allow quite a variety of effects within a single processing device. T.C. was very smart about this. The 2290 does at lot more, and is more affordable than any other unit we've used."

Engineer Don Rodenbach
Power Station N.Y.C.

"I mostly use the sampling... flying in vocal parts is easy and great. I can fly in a whole chorus and verse. Error-free, no glitches, easier and more accurate editing of samples, and storing of edited samples in pre-sets are great features."

Engineer Rob Eaton
Power Station N.Y.C.

A demonstration model of the new TC 2290 was sent to Power Station by Martin Audio. The first engineer to use the 2290 was Don Rodenbach, who was so pleased with the sound, and features of the 2290, as well as "the clarity of the 32 sec. samples," that he bought one for his own rack. His unit then started making the rounds of various sessions at Power Station. Today there are six TC 2290 units at Power Station and no waiting. Each unit has 32 second capability for sampling (and delay), can be looked in perfect synch with a second 2290 for stereo sampling *(The new stereo link update)*, and has Sampling 2 software, along with "Fast Trigger," update.

Sampling 2 Features

1) Multi-layering of samples. Up to 16 samples on top of each other with no degradation of signal, into the same pre-set.
2) Fancy Dancing-samples triggering samples any order, or number, as many times as desired.
3) 32 sec. delay possibility.
4) Crossfade-After the first sample is triggered, a second sample can be triggered, and the first sample will continue to play simultaneously.
5) Note counter for pitchshift of samples.
6) 1 millisecond sample looping and sound on sound possible.

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A Practical Approach to Grounding

By John E. Lanphere

A clean technical ground is the foundation to a distortion-free system in your studio.

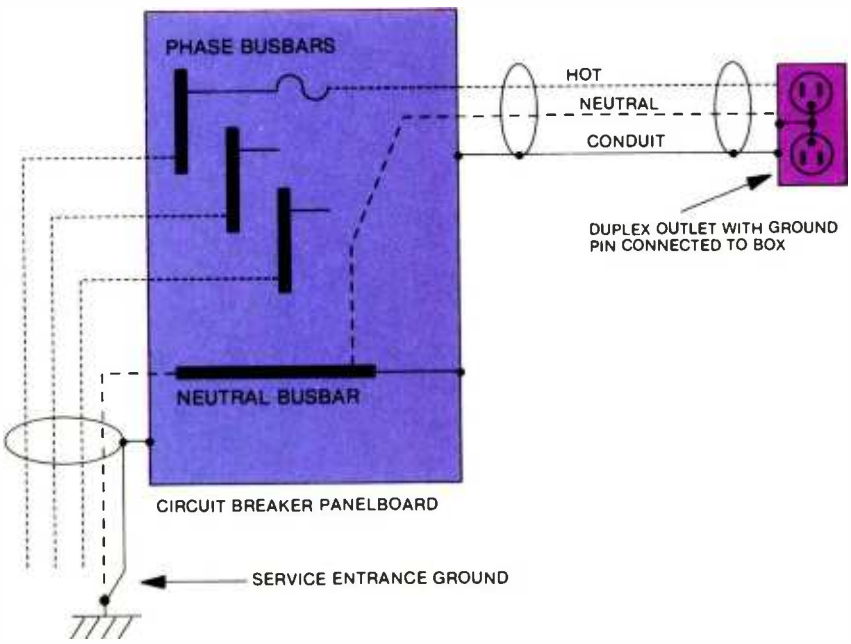

Figure 1. Wiring of the common type of circuit breaker panel. The neutral and the raceway system are connected to ground only at the service entrance location.

Studios need to have systems that are noise-free—a system that does not reveal itself to you or your clients. Systems must be free from interference from stray RF, magnetic or electric fields. Hum, TV sync buzz, dimmer hash, CB radio and miscellaneous other intereference must be rejected as you process and distribute audio signals.

When installing equipment, you may encounter such instructions as "Ground all the shields at one point," or "Make sure everything is well-grounded." A question regarding the details of where and how to make connections to properly ground systems are often answered with, "Just use the green wire in the ac outlet," or "Find a water pipe," or even, "Don't worry, it really doesn't make much difference."

It does make a big difference. A system that is *properly* grounded will most likely have a greater signal-to-noise ratio than one that has been constructed in a haphazard manner.

In addition, if your studio has been grounded with correct techniques, it will usually meet the requirements of the National Electrical Code and all local codes. Thus, it will be safe for everyone who uses the studio.

As we make decisions on how to wire and ground our system, the priorities are: first, a safe system; second, a system that meets the NEC and other codes; and third, a system that is as quiet and interference free as possible.

Rather than present another in-depth

John E. Lanphere is manager of market development for Altec Lansing, Oklahoma City.

article on the theory of grounding, shielding and noise reduction (that is, the reduction of interference from external signals and grounding theory in particular), let's discuss grounding theory as simply as possible and develop a practical strategy for grounding and shielding control that will allow your facility to be both safe and quiet.

The concepts presented here may not be 100% in keeping with the theoretical approaches to grounding and shielding, nor are they 100% in keeping with conventional practice in the field, but they are known to be effective and will meet the requirements of the NEC. It is possible that in some situations they may not work and other grounding schemes may be required. But in every case where I have applied them, they have proven to be highly effective.

The major proponent of the grounding schemes described is Ken Fause. In 1972, I consulted on the design of a large university research facility with five interconnected control rooms. The problems of grounding and shield control in this complex were addressed and subsequently solved by Ken during the installation of the audio and video system.

What and where is ground?

In any electrical system, there must be a point of *zero voltage reference*. A body at zero potential would be an infinite source (sink) of charge. For us, this body is the planet Earth itself. We have come to adopt the term *ground* to indicate this point of zero voltage reference.

OK, the earth is 0V. But, where is a place on earth that is exactly 0.000V? Is it in downtown Tokyo? In Canada? In a parking lot in Los Angeles? Or 500 feet below the desert in Arizona?

The answer is yes to all of the above. If, however, you're talking about a studio in a high-rise building, where is its 0V reference ground? Answering this question will lead you to two important concepts: How do I get ground where I want it, and how do I make the required connection?

A properly grounded system will have less signal-to-noise ratio than one constructed haphazardly.

Connecting the earth

How do you connect to the earth? Just stick a wire in the ground. Unfortunately, it is not that simple. In order to effective-

ly conduct charges to the earth, you need a low-resistance connection. One of the lowest resistance surface materials on the earth is water, so you need to stick the wire in some water.

But what if you are not near the ocean or a lake? Would wet or even moist soil or sand do? OK, but what if the water table is not close to the surface and the soil or sand is very dry most of the time? Sticking a simple wire or even a long metallic rod into the earth may not provide the required low resistance ground connection all of the time.

Over the years, electrical engineers have developed and used many different methods of making suitable connections to the earth. Large fields of interconnected metal rods or wires have been buried in the earth. Chemically treated rods that absorb moisture and, over time, actually increase the effectiveness of the rod-to-ground interface, have been developed and used successfully.

Many of these methods provide low resistance grounds when initially constructed, but the resistivity of the connections increases as the metallic rods rust, oxidize or otherwise deteriorate.

The UFER-type electrode is now a common method that is particularly well-suited to situations where a building has large concrete foundation footings buried in the earth. The concrete foundations contain steel reinforcement rods. The mass of concrete absorbs and holds moisture from the earth and provides a large area of quality interface to the earth. The reinforcement rods are welded together to form a continuous electrode of at least 50 feet in length. The electrode is constructed from No. 4 steel rebar (reinforcement rod) or No. 3/0 bare copper cable. The installation must meet the requirements of NEC 250-81.

The resistance to ground of the electrode should be less than 10Ω. It is normal to measure the resistance at 1.5Ω. The measurement procedure is difficult, but one typical method of measurement is the *fall-of-potential* method described in IEEE Standard No. 142. Fortunately, the whole issue of having a system grounding electrode constructed is the responsibility of the electrical engineer on the project. The EE must make a suitable connection to the earth. You also must communicate with him and let him understand what you need.

Our grounding reference point is now available at the point where the UFER electrode comes out of the concrete. This will usually be connected to the water piping system and the metal building frame, if any exists. It will also be extended to the *master electrical system ground point* located at the ac service entrance. This is the point where ground is the cleanest (free from noise and other foreign voltages) and is first available for our use.

Now, you need to extend this clean ground to the location of your studio equipment.

Getting ground where you need it

The ac power will be delivered to your equipment. Theoretically, the ground goes along with the ac, but you should carefully examine the quality of that ground before you decide to use it. There are two possible problems with the ground that appears at the ground pin of the duplex outlets where your equipment is located.

Assume that the electrical distribution system has been constructed to meet the electrical code, and that metal boxes and conduit are used throughout the system. Wiring to a circuit breaker panelboard consists only of a conductor for the hot side of each phase and a single common neutral conductor.

In order to provide a system that is safe, in case of a breakdown in the insulation between a hot conductor and the raceway (conduit) system, the raceway system is bonded (connected) to the master earth ground at the ac service entrance location. The raceway system will provide a low resistance path to ground for the fault current. The circuit breaker will trip and discontinue the flow of current.

Figure 1 shows the standard wiring arrangement of a duplex outlet connected to a local circuit breaker panel. The only available path to ground from the grounding pin of the duplex outlet is via the conduit system. Every 10 feet there is a compression fitting that joins one piece of conduit to the next. If these fittings become loose or corroded, the resistance of the path to ground may become highly resistive. Such a high resistance path would not be a suitable path to ground for use in grounding the shields of audio cables or low-noise audio equipment.

The only path to ground from the grounding pin of the duplex outlet is via the conduit system.

In the real world, in 2-phase and 3-phase panels the loads are *almost never equally distributed* between all phases. Thus, there is an *unbalanced current* flowing in the neutral conductor, and there will be a voltage drop across the neutral conductor between the circuit breaker panel and on the system at the point of grounding.

This error voltage, that is due to the unbalance of the 3-phase loads, contains voltage components that mirror the cur-

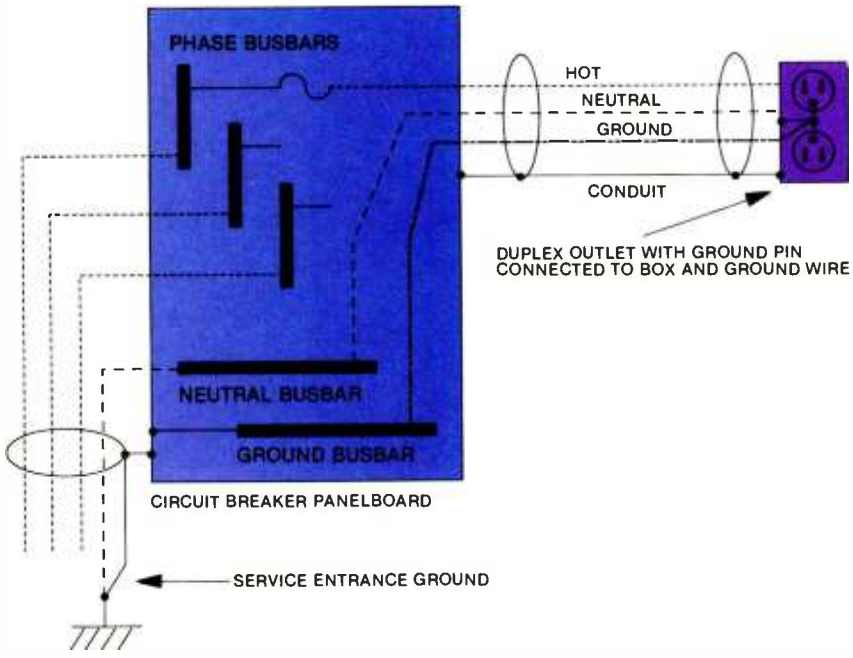

Figure 2. *The bonded-ground scheme is suitable for small systems where there is a reasonable amount of electrical noise present. Each duplex is wired individually to the power panel.*

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rent flow into each device fed from the circuit breaker panel. Unfortunately, this garbage voltage will also be fed into our low-noise audio equipment on the neutral conductor.

If loads such as fluorescent lights, incandescent control room lights on solid-state dimmers or motors are fed from this same circuit breaker panel, then their noise garbage voltages will appear on the phase voltage busbars and can also be fed into our equipment on the hot conductors.

All other circuit breaker panels will have these same problems. The noise and unbalance voltages will be present in each panel, but will be different. If you connect components into outlets fed from different ac power panels, the results might be disastrous.

In talking about a clean ground, two words describe what you need: *isolated* and *independent*. This translates to having individual duplex outlets wired for system use directly from the point where the noise is lowest. That point is at the ac service entrance. Actually, it means that you must have a separate ac circuit breaker panel for your audio and video systems. No loads other than the equipment will be connected to it. No lights, no dimmers, no motors.

Configuring ac power panels

We will discuss two possible schemes for configuring these dedicated ac power panels. The first is suitable for small systems where there is a reasonable amount of electrical noise present. The second is recommended where the electrical noise environment is extremely hostile and for very large systems with many racks filled with equipment.

It is also recommended when audio and/or video patch panels are used and for systems in which the equipment is spread over a large area.

The first of these configurations is called the *bonded-ground scheme*. The wiring details are shown in Figure 2.

A busbar for ground conductors is added to the panelboard. It is electrically bonded to the panelboard enclosure and is thus connected to the service entrance master ground via the raceway (conduit) system. Each duplex outlet is wired individually to the power panel using *three wires*. Yes, three wires.

The green ground wire is connected to a ground busbar installed in, and bonded to, the power panel enclosure. The white (neutral) wire is connected to the neutral busbar. The black (hot) wire is connected to a circuit breaker. As required by the National Electrical Code, the ground pin of the outlet connects to the outlet box, yet there is also a green wire conductor path from the pin to the panelboard ground busbar.

All outlets, either wall outlets or rack outlets, must be fed from this one power panel, or more specifically, from the *same neutral bus*. The more spread out the system is, the more important this requirement is.

If the equipment is rack-mounted, the rack should be connected to the power panel ground busbar using a conductor sized to carry fault current from the largest capacity outlet in the rack. A 10-gauge wire is usually suitable.

The second scheme is called the *isolated-ground scheme*. It is based on an exception allowed in Article 250-74 of the National Electrical Code, which reads:

> **"Exception No. 4:** Where required for the reduction of electrical noise (electromagnetic interference) on the grounding circuit, a receptacle in which the grounding terminal is purposely insulated from the receptacle mounting means may be permitted. The receptacle grounding terminal shall be grounded by an insulated equipment grounding conductor run with the circuit conductors. This grounding conductor shall be permitted to pass through one or more panelboards without connection to the panelboard grounding terminal as permitted in Section 384-27 Exception No. 1, so as to terminate directly at an equipment grounding conductor terminal of the applicable derived system or service.
>
> "Use of an isolated grounding conductor does not relieve the requirement to have the raceway and outlet box grounded."

This is just what you need. Now you can have a wired path from the outlet to the master ground without having to connect it to either the raceway system or the neutral conductor.

The NEC sets the standards for wiring in most locations in the United States. However, the local authorities should be consulted regarding the use of any isolated-grounding scheme. The local approving jurisdiction is the final authority.

The isolated-grounding scheme is detailed in Figure 3. Again, a dedicated ac power panel is set up for the exclusive use of the sound system. The following list explains how each detail of clean technical ground must be handled.

1. Set up one *and only one* panelboard of circuit breakers to serve all the audio and/or video system power requirements. The neutral conductor will be bonded to the master ground at the service entrance. This will be called the *technical power panel*.

2. The raceway system will be bonded to the master ground at the service en-

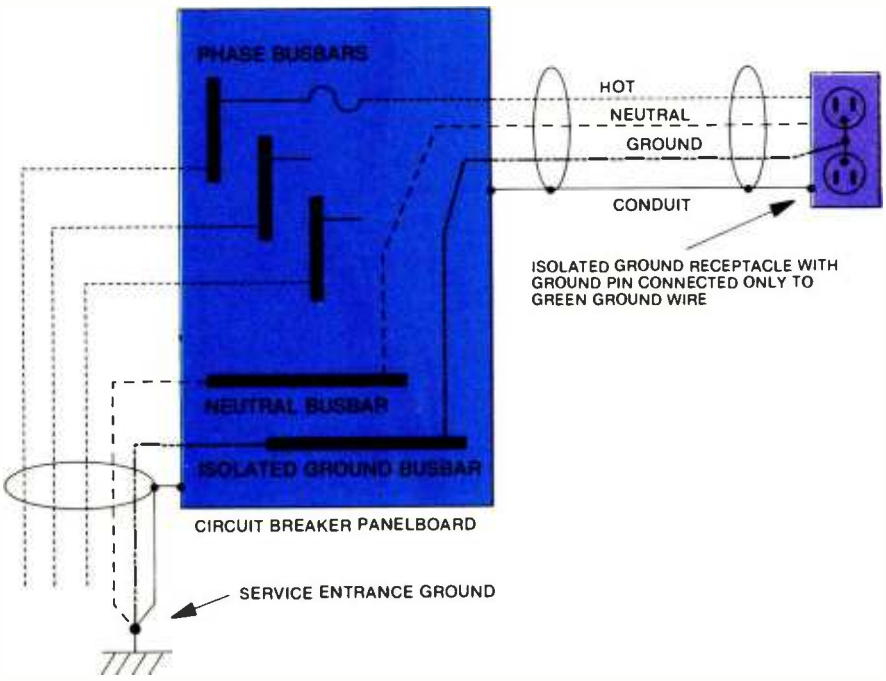

Figure 3. *The isolated-ground scheme is recommended where the electrical noise environment is extremely hostile and for very large systems with many racks of equipment.*

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trance. The raceway system will consist entirely of steel conduits and enclosures.

3. Equip the technical power panel with a ground busbar that is totally isolated from the enclosure, raceway and neutral conductor. It will be connected to the master ground at the service entrance using a No. 4 insulated conductor run with the service conductors or in a conduit by itself. The wire will not connect to any raceway or enclosure. This will be the main *unipoint ground conductor.*

4. All branch circuits and outlets must use the isolated ground (IG) receptacles. (These outlets are easy to identify because they either have a solid orange face or an ivory or brown face with a UL and CSA identifying orange triangle mark.)

5. Each branch circuit outlet shall be wired *individually* from the technical power panel using three 14-gauge conductors. These are the hot (black or other color), neutral (white) and ground (green) conductors.

The use of plugstrips (with or without IG outlet devices) is not recommended. Individually wired outlets assure that every powered device has a direct path to the unipoint ground without noise injected by other outlets.

6. Conduits or raceways carrying system cables to the equipment racks must not connect to or contact the racks. Use insulating fittings as required.

Conduits carrying ac from the technical power panel to the outlets in the rack must not contact the rack. Use insulated bushings and clamps as required. Outlet boxes housing IG duplex outlets must not contact the rack. Use insulated standoffs.

7. In each group of one or more racks, install a copper busbar or plate to act as the isolated ground unipoint for the connection of grounding conductors used within that group of equipment. Use a No. 4 insulated copper conductor to connect this busbar to the ground busbar in the power panel.

Using a tightly attached lug, bond (connect) each rack frame to the rack group unipoint busbar using a No. 12 TW stranded wire.

Bolt all of the racks in the group tightly together or space them completely apart. Casual contact could cause noise problems that will be very difficult to locate.

Under no circumstances should the racks contact the raceway system, the steel structure of the building or even ventilation ducts. (Use isolation as required to maintain this.)

A summary of all the grounding connection is detailed in Figure 3.

Grounding of equipment

Equipment manufacturers have varying degrees of awareness and understanding regarding the issues of grounding and interference rejection. As a result, you will find each uses a slightly different scheme of handling the interconnections of chassis ground, signal common and power supply common within their units. Most commercial products manufactured for use in the United States are now equipped with 3-wire power cords with standard straight blade NEMA 5-15P type plugs. Consumer-type equipment continues to be equipped with 2-wire cords and 2-prong plugs. These are, however, usually keyed so the hot and neutral leads will not be reversed.

It is important from a safety standpoint as well as a noise reduction standpoint to connect each system component to ground in the proper manner. Although the chassis of the unit may have a connection to ground because it is mounted in a grounded metal rack frame, this should not be the primary means of connection of the chassis to ground.

If the unit is removed from the rack for service and held in your hands, it must remain connected to ground to prevent a possible shock hazard. If the unit is plugged into an ac receptacle using a 3-conductor ac power cord with a NEMA 5-15P type plug, then the unmounted chassis would remain grounded. If the ground pin of the plug has been cut off, then there is still danger of shock hazard.

In any piece of equipment, several possibilities exist regarding the internal interconnecting of signal common, writing points labeled "ground" or "shield" and the chassis. For each case, the connecting of the chassis to ground should be handled in a specific manner. There are three configurations worth discussing.

Case 1: The unit has a 3-wire power cord. The green wire of the power cord is connected to the chassis. The signal common is also connected to the chassis and terminals provided for the connection of the shields of external cables are connected to the chassis. The ground connection is through the power cord and no external grounding conductor is required.

Case 2: The unit has a 3-wire power cord. The green wire of the power cord is connected to the chassis. The signal common is brought out to a terminal and is connected by a user-removable strap to the chassis/power cord ground point. In this case, the strap should be removed. The chassis will be grounded through the power cord. A No. 14AWG conductor should be installed between the signal common terminal on the unit to the ground busbar in the rack group in which the unit is mounted. In this manner, the noise signals on the chassis (and shields) do not share a common path to the ground busbar.

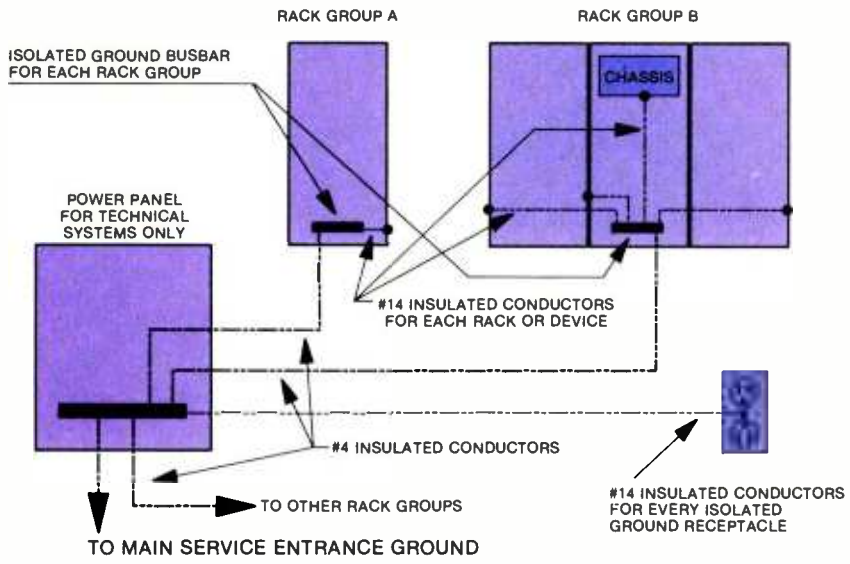

Figure 4. *Isolated-ground connection summary. It is important that the racks either be bolted tightly together or spaced completely apart. Casual contact causes noise problems that are hard to locate.*

Why your next console should be as difficult to hear as it is easy to operate.

The studio is more complex and less forgiving.

Electronic production techniques using MIDI and SMPTE sync require more control than a "wire with gain" can provide. But as functions and components accumulate, the console's signal path has grown more complex, and its audio performance has suffered. On analog recordings, higher levels of crosstalk, noise and intermodulation were an acceptable price for additional control. On digital multitrack, however, these flaws become glaringly obvious.

Crosstalk blurs the stereo image.

Now that digital recorders have virtually eliminated crosstalk, this is an especially annoying problem. *The AMR 24 matches the channel separation performance of digital multitracks* because it employs balanced buses that eliminate crosstalk the same way mic inputs do. This radical design approach takes full advantage of digital's more coherent stereo imaging.

Balanced buses also eliminate the intermodulation that plagues the sound of conventional "virtual ground" mix amps. *The AMR 24's noise floor is constant whether you route one input to a group, or thirty six.* So you can concentrate on the music without distractions from the mixer, even on digital multitrack.

Features shouldn't degrade audio performance.

Automation widens creative possibilities — and narrows the margin for console error. For example, FET mute switches that are "silent" individually can produce audible glitches when grouped. The AMR 24's carefully controlled switching time constants eliminate this problem.

Every circuit in the AMR 24 has been calculated with equally close attention. Each stage has at least 22 dB of headroom; total dynamic range is over 100 dB. Even so, *unused stages are bypassed to produce the shortest effective signal path in every operating mode.*

Perhaps the AMR 24 is a product of extremist engineering. But as we see it, optimum audio performance, not simply a revised layout, is what makes a console automation- and digital-ready.

The feel is familiar, the functions are unprecedented.

The AMR 24 facilitates innovative production techniques within a classically split configuration. Master Input Status switches select mic inputs or line returns on all input channels simultaneously. In its mixdown configuration, the AMR 24 will handle up to 60 tracks, because the 24 Track Select switch changes the monitor returns to line returns normalled to your second 24 track (or to synchronised "virtual tracks" from synthesisers and samplers). The monitor returns have aux buses, solo and mute, plus four bands of EQ and long throw faders, so this flexibility is achieved with no loss of audio quality. For additional effects returns, the Fader Reverse function creates an additional 24 patch points through the cue send faders.

Imaginative design and uncompromising construction give the AMR 24 flexibility and sonic transparency that represent clear achievements: especially clear on digital recordings. For all the facts on this innovative console, send your business card or letterhead to:

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Case 3: The unit has a 2-wire power cord. No green wire exists, and the neutral is not connected to the chassis. The circuit common is directly connected to the chassis. The chassis should be connected to the ground busbar in the rack group using a No. 14AWG conductor.

In some rare instances, the signal common may *not* be connected directly to the chassis, but rather through a small ac bypass capacitor. The signal common appears as the low side of the connectors used to receive or send unbalanced signals into or out of the unit. It would be possible to connect shields to an ungrounded point. Extreme caution should be taken here. Either use some other piece of equipment or install an audio isolation transformer in the input and output circuits. The chassis should be grounded for safety. Shields should be grounded to the chassis and only the transformer should connect to the signal hot and the signal common leads of the unit.

Wiring practices and shield connections

For years, dating back even further than the wiring practices information published by RCA in the 1940s, the recommendation has been made that cables of differing signal levels be grouped and separated from each other. It is common practice to separate cables into groups for speaker lines, line-level lines, microphone lines, video lines and control (non-audio or video) lines. It has been this author's preference to place these groups of cables in an equipment rack, as in the locations shown in Figure 5. This allows maximum separation of differing signal levels.

To every set of rules we try to establish regarding the routing and connecting of cables and shields, there will be exceptions because no one scheme will work in 100% of the systems.

The following rules should be viewed as a set of reliable guidelines for the use and connection of shielded cables.

Rule 1. Always use 2-conductor shielded cable for all audio signal cables. This includes both balanced and unbalanced circuits, microphone- and line-level, and control circuits.

Rule 2. Never run audio, video or control cables in the same circuit with ac wiring. You will probably experience lots of induced hum and it violates the NEC.

Rule 3. Do not run microphone cables in the same conduit with speaker cables. Do not put microphone cables and speaker cables in the same bundle. Try to keep each type grouped and separated from the other by at least six inches.

Rule 4: Connection of cable shields: Two classes of cable circuits exist and must be addressed separately.

Rule 4a: Microphone cables and outlets: For the wiring of microphone outlets and microphone extension cables, connect the shield at both ends of the cable to pin No. 1 of the XLR connector(s). If other types of connectors are used, the same rules apply. Do not connect the cable shield to the shell of an XLR cable connector at either end. Do not connect pin No. 1 XLR connector to the connector shell. Pin No. 1 of an XLR connector should be connected to ground only at the input or output of a pre-amp, mixer, equalizer, amplifier or similar device. For XLR outlets mounted on plates, connect the shell of the connector to the plate.

Rule 4b: On any cable connecting two pieces of equipment, connect the shield at one end only. Connect at the receiving end of transmission.

Rule 5: On video coaxial cables running to outlet jacks mounted on plates, isolate the connector from the plate. The shield should connect to ground only at the input or output of a piece of equipment or a patch panel.

These rules are easy to apply for systems that do not include terminal blocks or patch panel jacks. Details of shield grounding in a simple system are shown in Figure 7a. A system with a patch panel is shown in Figure 7b, and a system with both terminal strips and patch panels is detailed in Figure 7c.

Figures 7a, 7b and 7c clearly show the implementation of the one end only rule. Also shown are the concepts that the shield of input cables connect to the chassis of a device and cable from the output of a device do not connect to the device chassis.

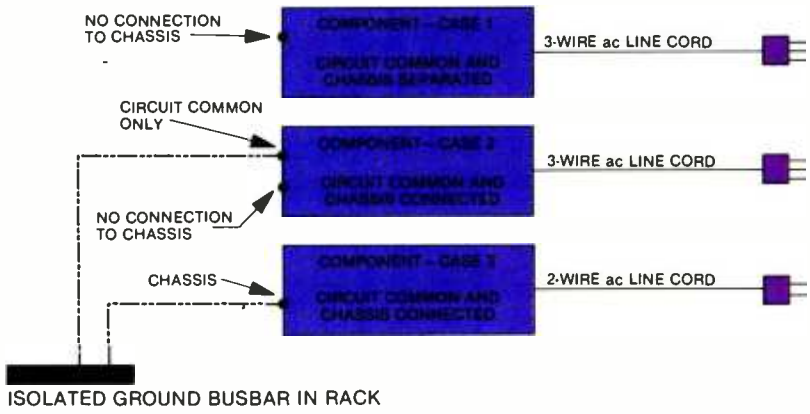

Figure 5. *Insulated 14AWG wire should be used in grounding the equipment chassis. There are several options for interconnecting the chassis and signal common within a piece of equipment.*

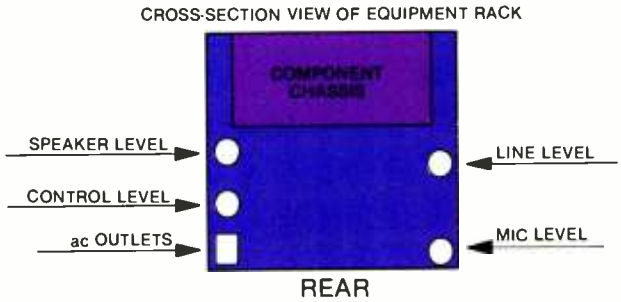

Figure 6. *Cables of differing signal levels can be grouped and separated from each other, then placed in an equipment rack to allow maximum separation of the differing levels.*

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If noise or interference is present in the system, follow logical step-by-step troubleshooting procedures. Start at the loudspeaker end of the system, working back toward the inputs. Isolate each piece of equipment, disconnect inputs, change ground connections, measure and listen. Eventually, you will find the problem and will be able to solve it.

One important rule in troubleshooting: Do not assume that anything is true until you test it or inspect it and verify that it is true. Something as simple as a terminal lug that has been loosely crimped or even crimped over insulation can cause hours of lost time. Assume nothing, and try everything.

Testing for quality of ground

Is it possible to measure the quality of the clean technical ground that appears at the busbars in the system racks? Yes, there are several tests that are easy to do.

Test 1: Unplug all equipment from the outlets fed from the dedicated ac power panel. In the power panel, remove the wire connecting the master service entrance ground from the isolated ground busbar. Measure first with an ac voltmeter, then with an ohmmeter from the isolated ground busbar to the panelboard enclosure (raceway ground). It should be absolutely open with infinite resistance. A few millivolts of induced ac voltage might be present, but the circuit must be open. If this is so, hunt until the offending ground path is found and remove it.

Test 2: Using one of the simple plug-in ac line testers available at any electrical supply house, test every duplex outlet to verify that the outlet is correctly wired. It is surprising to see how many outlets are found with the hot and neutral interchanged, or even worse, the neutral and ground interchanged. The test units will indicate open lines and interchanged lines.

Test 3: Test instruments are available to actually measure the resistance of the path from the ground pin in the duplex outlet to the master service entrance ground. The resistance of the hot lead is not included in the reading. These instruments range in price from about $50 or less to about $600 for highly accurate units. They are commonly used to measure ground path resistance in installation such as in hospitals, where medical electronic equipment is used and the performance of ground fault interrupter circuit breakers must be verified to prove total safety against shock. For our purposes, the ground path resistance must be less than 10Ω. Readings of 1Ω to 1.5Ω are highly desirable.

Writing specifications

The writing of detailed specifications for the entire clean technical power system should be left to the electrical engineer and/or the consultant on the job. This is the domain of the registered professional engineer. You do need, however, to fully inform the EE/consultant about your special requirements.

It is possible to make every system perform better if you pay attention to the way you establish and use ground. As mentioned earlier, the guidelines discussed are just that—guidelines. They are a good starting point for the configuration of your particular system. If some other method works, use it as long as it is safe. REP

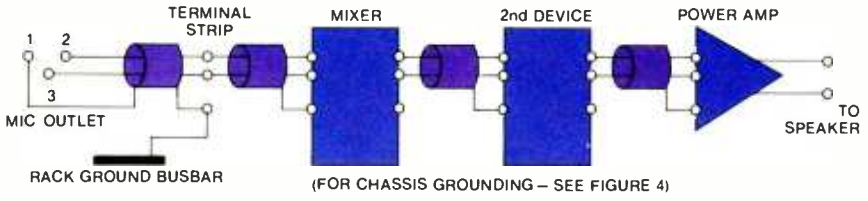

Figure 7a. Shield grounding in a simple system.

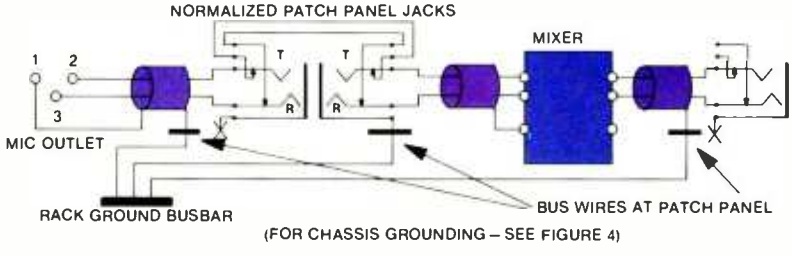

Figure 7b. Shield grounding for patch panel jacks.

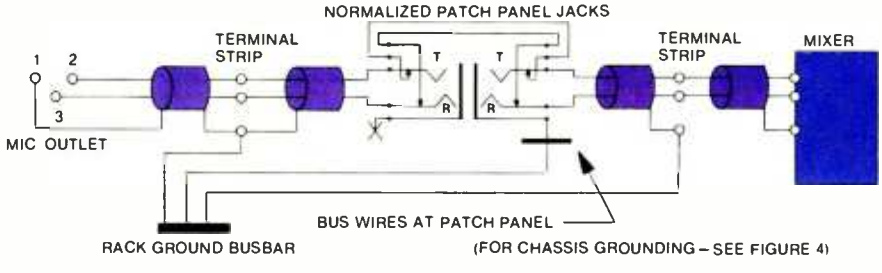

Figure 7c. Shield grounding for systems with terminal strips and patch panel jacks. All of these shield grounding systems illustrate the connection of the shield at one end only.

Author's note: It is recommended that the cables received with microphones or purchased separately for use as microphone extension cables be inspected for the undesirable shell to pin 1 strap. It should be removed if you are using either of the unipoint grounding schemes suggested in this article.

Additional reading

For more rigorous and theoretical discussion on grounding, shielding, noise reduction and, in some cases, alternate opinions on grounding and connection schemes, the following are useful:

Cabot, Richard. "Active Balanced Inputs and Outputs." *Sound & Video Contractor*, March 15, 1986.

"Electronic Systems Wiring and Cabling." *Trompeter Electronics Catalog*,T-15, 1986.

Fause, Ken. "Shielding, Grounding—and Safety." *Recording Engineer/Producer*, June 1978.

Morrison, Ralph. *Grounding and Shielding Techniques in Instrumentation.* John Wiley & Sons, 1967.

National Fire Protection Association. "National Electric Code."

Perkins, Cal. "To Hum or Not to Hum." *Sound & Video Contractor*, March 15, 1986.

"Recommended Wiring and Grounding Practices." *Broadcast & Television Equipment Catalog.* Publication date unknown.

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Interface Design

By Brian Lee and Jeff Blenkinsopp

Wiring considerations for audio, MIDI, SMPTE and ac in the modern recording studio control room.

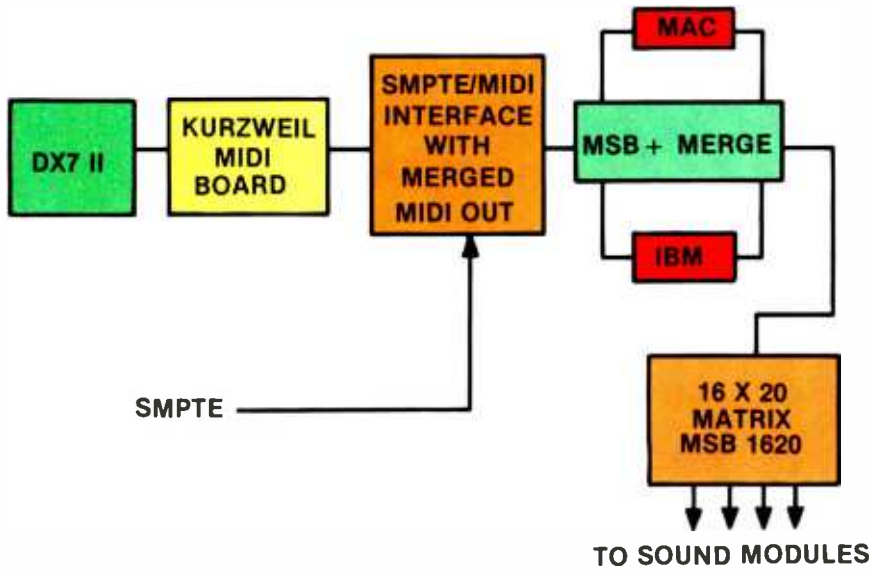

Figure 1. *This MIDI flow chart shows an example of MIDI flow using two controller keyboards—one with lightweight plastic keys and the other with weighted wooden keys. Two computers are featured including one for a sound library and the second for sequencing. A default routing like this will allow clients to get to work immediately and should not have to be changed.*

The present day control room has become more than an audio environment. It is no longer uncommon to find several computers, video feeds and an extensive MIDI setup alongside the traditional tape recorder, compressor and microphones.

For example, MIDI, although still considered the domain of the keyboardist or home recording enthusiast by some, can no longer be ignored by the pro-audio community. It often seems that everything from outboard equipment to consoles is taking advantage of the rapid 31.2kBaud standardized MIDI databus. It is not even unusual to see entire sessions mixed and mastered without tape or microphones.

It is in this environment of rapidly

Brian Lee is co-owner/producer and engineer of The Sync Tank, a post-production scoring studio in Greenwich Village, NY, and is a specialist in SMPTE-MIDI technology used in video/audio post-production. While attending McGill University in Montreal he studied engineering, physics, audio recording and psychoacoustics.

Jeff Blenkinsopp is project engineer at Quantum Sound in New York and consultant for construction of 24/48 track rooms. He is also a free-lance keyboard technician. He has toured with Pink Floyd, The Clash, Vangelis, Ted Nugent and Kansas.

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"We have toured Carvers with the following artists: Softcell, Paul Young, Johnny Mathis, Donna Summers, Howard Jones, Pointer Sisters, Psychedelic Furs, Lee Greenwood, General Public, George Thorogood. This is exclusive of our numerous one-nighters. The consensus of the performers is that the equipment sounds great. They have been amazed by the sound of the amps as well as their size and weight. As for reliability, out of 50 amps we had only one fail in the past year of touring. This is by far the best record we've had with any manufacturer of amplifiers. Sonically, the extra headroom is readily apparent. We, at Manticore unanimously agree that the PM-1.5 is incredible and is the only amp we intend to buy."

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In the Laboratory The Carver PM-1.5 was rigorously tested by Len Feldman for MODERN RECORDING (February 1985). His laboratory test results also prove that the PM-1.5 really delivers. The following quotes from the Lab Report are reprinted with permission of MODERN RECORDING & MUSIC:—

"The first thing we noticed when we began to work with the Carver PM-1.5 was the ease with which the amplifier delivered almost limitless power to speaker loads which we had previously considered to be difficult to drive to loud levels. This is the sort of amplifier that just refuses to quit."

"The amplifier delivered a clean 480 watts per channel into 8-ohm loads with both channels driven for its rated harmonic distortion level of 0.5%. Even at the frequency extreme of 20 Hz. power output for rated THD was 470 watts as against 450 claimed by Carver. Furthermore, at rated power output, distortion decreased to an insignificant 0.015% at mid-frequencies and 0.007% at 20 Hz. When connected to 4-ohm loads, the PM-1.5 delivered 750 watts per channel for rated THD of 0.05%—far more than the 600 watts claimed by Carver. Clearly, when it comes to specs for a professional amplifier, Carver has taken a very conservative approach... All (manufacturer's claims) equaled or exceeded published specifications—usually by a wide margin."

"Carver has managed to deliver a tremendous amount of power in a small lightweight package at a very reasonable cost..."

"For the professional audio engineer or technician who has to move a lot of gear around much of the time and who expects total reliability and circuit protection, come what may, the Carver PM-1.5 represents, in our view, a real winning product. We will probably see it used increasingly by professionals in every area of sound reinforcement."

Now—don't you think you owe it to yourself to hurry over to your local Carver Pro Sound Dealer and *test your own PM-1.5*? Whether you run a megawatt sound company, a struggling bar band, or a recording studio gearing up for digital, the Carver PM-1.5 will pay you. In increased portability and reduced freight costs. In freedom from expensive blown drivers. In sheer sonic excellence.

***Power:** 8 ohms, 450 watts/chan. 20 Hz-20 kHz both channels driven with less than 0.5% THD. 4 ohms, 600 watts/chan. rms 20 Hz-20 kHz both channels driven with less than 0.5% THD. 16 ohms, 300 watts/chan. 20 Hz-20 kHz both channels driven with less than 0.5% THD. 2 ohms, 525 watts/chan. at clipping, 1 kHz, with less than 0.5% THD. Note: 2-ohm specification for information purposes only. Operation at 2 ohms is permissible but not recommended. **IM Distortion:** Less than 0.1% SMPTE. **Frequency Response:** -3 dB at 3 Hz. -3 dB at 80 kHz. **Damping:** 200 at 1 kHz. **Gain:** 26 dB. **Noise:** Better than 115 dB below 450W A-weighted. **Input:** Balanced to ground, XLR or phone. **Impedance:** 15k-ohm each leg, balanced to ground. **Bridging:** 1200W into 8 ohms, 1000W into 16 ohms, accessed through rear-panel recessed switch. **Dimensions:** 19 in. wide, 3½ in. high, 10 15/16 in. deep. Weight: 21 lbs.

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evolving equipment design that the studio owner finds himself budgeting significant capital to install sophisticated video, SMPTE and MIDI setups that will interface correctly with his existing equipment.

The first considerations will be budget and the size of your room. The cost of MIDI interface wiring is close to that of traditional audio wiring. How much square footage you can sacrifice is a more difficult question. A reasonable estimate for a MIDI setup is about 30 square feet for the equipment only. You may even be considering the construction of an entirely separate programming room. Separate rooms are expensive and could involve giving up your office or lounge, but they do have marketing advantages. In fact for a relatively low cost, you can build a sophisticated audio for video post-production room. (See sidebar on page 37.)

The process of breaking down and setting up is going to adversely affect client confidence.

In the case of a programming or preproduction room without a 2-inch machine, you will either have to move the equipment into your main room or use tie lines to get the sound on tape. Tie lines work best when both rooms have a shared machine room and there is some kind of comprehensive communication system included. Moving equipment from room to room may keep your initial capital cost down but will require more effort from your staff in the areas of scheduling and long-term maintenance. In a perfect world you would have a programming room and a completely compatible main room. In the real world you will try to optimize your expenses and get as much use out of each new purchase as possible.

The bottom line in interface design is the *confidence level.* This applies not only to your clients, but to you and your staff as well. We have all experienced the uneasiness and worry that something is going to go wrong during "the big session." When your clients are trying to do something that's *supposed* to work, it is important that it *does* work. MIDI, as one of the most publicized revolutions in our industry, has contributed to a lot of misconceptions, one of which is that MIDI makes everything simpler. Those of us who have spent hours waiting for the latest "thingamagizit" to work know this is not necessarily so. MIDI is, after all, several orders of magnitude more complicated than the latest guitar amp. However, with thought put into what you want to accomplish, and some hints and advice that follow, it can be not only simple but profitable as well.

Ergonomics

Before we break out the soldering iron, there is a considerable amount of homework to do. One of the most common mistakes that we have seen is a headlong rush to plug everything in. This may seem expedient from a business point of view but it often results in doing the right things for the wrong reasons. For example: the triumph of the power outlet location over where the programmer can hear well. The following factors apply whether you are building a new room or upgrading an older one.

- *How many people (not guests) will use the room?*

Will it be a 1-person room, or do you expect a producer, engineer, programmer, assistant and a player. Your clientele is the best clue you have to answer this question. On the average, there might be an outside engineer, an in-house assistant and an in- or out-programmer. It is essential that all of these diversely talented people feel at ease at their individual tasks, and interact with each other comfortably. Individual players and the team effort of a recording session have to be accommodated with equal care if you expect *clients* to use your room with *confidence.*

- *What is each person going to be concerned about?*

The engineer is concerned with level to tape and a good monitor mix. The synth programmer, as sound designer, is concerned with sound factors like velocity, blend, processing, attack and loop length, which require extremely precise monitoring. In many respects the programmer often takes over the front end tasks of the engineer. The player and producer, of course, are also interested in hearing well.

The house assistant engineer is the best person to "guard" the MIDI matrix.

This is a situation that requires a departure from traditional control room design philosophy that says the engineer, who sits in the middle of the console, is the only person in the room who has to hear everything accurately. It is now expedient to have several monitoring positions in the same control room. One of the cheapest and easiest ways to provide extra monitor speakers is simply to buy a high-quality stereo receiver (pre-amp/amp). Generally these have a speaker select switch as well as source selectors such as cassette dubbing and phone preamps, and a separate volume control. If you relabel the front panel tuner to read: VTR OUT, this familiar piece of equipment can be a great convenience.

The bottom line in interface design is the confidence level.

- *Where is each person going to be put?*

Please note that "put" is the active verb. It is important to think this through beforehand, because if your clients decide there could be confusion. Each person has a whole range of tools he or she is familiar with, and to which he or she needs access. Many programmers, for example, are quite proficient at enhancing their sounds with reverbs and choruses.

- *Who is going to operate the MIDI matrix?*

The house assistant engineer is the best person to "guard" the MIDI matrix, and a properly laid out matrix shouldn't have to be changed. (See Figure 1.)

- *Who is going to program the SMPTE-MIDI interface?*

The engineer is a good bet, if he knows how to use it; otherwise the programmer is the best choice. The assistant engineer is another possibility, but, as is often the case with synchronized work, the offsets have to be changed often and this can be a big responsibility.

- *Who controls the computers?*

Both the programmer and the player need access to the computers and their monitor screens. A monitor screen, but not necessarily the keyboard, can be very helpful to the engineer and producer.

Install the people before you install the equipment

We cannot overemphasize the long-term payoffs that can be derived from running that extra cable or setting up an extra monitor.

The people who use your room must

be confident that the room is efficient and reliable and that it is worth the hourly rate. Mechanical conflicts can always be solved but people conflicts are another matter. We suggest some extensive role-playing here.

Before any wiring or construction is started, get everyone into the space to stage various control room layouts and act out a few sessions with imaginary clients. *Hint:* Having some of your actual clients do the acting can be very helpful and is also a great sales strategy. Ask each other questions that come up when you are actually working.

For example, have the keyboard player ask the producer to cue him for the punch and don't forget that the engineer or tape operator will have to see also. Keep in mind the line of sight, lighting, eye contact, glare on visual monitors or instrument displays and where each person will be located. If the assistant engineer/tape op is also going to be keeper of the synth/sampler disk library, does he have to say "excuse me" to the producer every time a new sound or disk is required? What about the latest "gizmit" just rented for an important session? Even the most up-to-date facility will have clients bringing in "the newest thing." What about disk storage? A conservative guess is that you will need several shelves and drawers that are convenient to the programmer and far away from monitors and Hand D-Mag zones.

A common problem we often see is keyboards facing the back wall of the control room. This leads to lots of neck-turning—mirrors are one solution to this problem. If you don't have anyone on your staff who is experienced with MIDI sessions, this may be a good time to hire a consultant.

It is important to use high-quality audio cable for your SMPTE wiring.

Mechanics

Once you have decided on the ideal layout, it is time to begin the search for a way to actualize it. Although many synthesizers are now available in rack form, you will still have to find a place for some type of keyboard stand. There are essentially three choices that follow:

Temporary stands are commercially available in several configurations. The advantage of the temporary stand is that it is cheap and usually adjustable. Be sure to get enough tiers and that it is wide enough for your largest keyboard. The disadvantages are that once set up, the stand is difficult to move, difficult to keep the wiring neat, and if the stand is to be temporarily removed from the room, it has to be completely broken down.

The process of breaking down and setting up is going to adversely affect client confidence, and the time factor involved can become expensive.

Permanent or built-in stands are the most cosmetically attractive. They are also the most reliable in terms of wiring. The disadvantages with a permanent stand are that its difficult to expand and the physical layout of the room may not be suited to the stand.

The rolling stand is usually the best solution from our point of view because, when done properly, they are attractive, reliable, mobile, and can include all the ancillary boxes (DIs, power supplies, MIDI Thrus) in an integrated form.

They are not as practical if you have more than two synthesizers with keyboards. The main disadvantage with rolling stands is that they require a lot of time and money to build properly, and once completed, are difficult to reconfigure.

A word about rack-mounted synthesizers: It is important to get as many displays, disk drives and buttons at eye level as possible. They cannot be treated like a reverb or delay that is set once and left alone for the rest of the session. Most rack-mounted synthesizers have dim, miniscule displays. They also require much concentration on the part of the programmer, as they employ a page method of user friendliness that requires constant attention.

Electro mechanics

Most MIDI equipment is microprocessor based and should be treated as you would a computer. Surge and spike protectors are recommended and relatively easy to buy and install. There is, however, a great deal of variation in the suppression quality of various units on the market, so it is a good idea to speak with the vendor's product engineers to evaluate what it is you are actually buying. Brownouts, or voltage dips, are more difficult to protect against. The cheapest method is to get a "buck and boost" power conditioner, which acts like a compressor for ac. These do not have a battery and will not save your data in the event of a brief failure. Brownout symptoms include: freezing (crashing), random program changes, displays changing mother tongue (English to Japanese) and units that appear to be working correctly but really aren't. It is a good idea after a brownout is detected to power-down and up each piece of equipment. This will re-boot the operating systems of the instruments and outboard gear.

Before investing the $10-20 that may be required to provide clean ac, there are some tips that may save you the expense. First plug everything in, turn everything on and see if you get any of the above symptoms. Frankly, if it works, don't fix it.

Try to get as many displays, disk drives and buttons at eye level as possible.

Next, if you decide that all or some portion of your room will have to be protected, it may be expedient to call the local utility company and ask if there is any construction or other reason why you would be experiencing recurring brownouts. Although the utility company won't guarantee computer quality ac, sometimes they can solve the problem for you. If that fails, there are several smaller uninterruptable power supplies that are on the market.

Start with a power conditioner for the computer and see how it goes. If you determine that it is necessary to condition your entire control room, we advise using a consultant who specializes in high-voltage power supplies and conditioners. This is one place you want to be very careful, as the entire grounding scheme of the studio is also at stake.

Static has never been a welcome element in the recording process, but with all the new equipment it can be even more of a hazard. If you have static problems, take advantage of anti-stat sprays and humidifiers. If you have to buy a huge power supply for the console automation, you can condition the rest of the room for a relatively low cost. If you don't have an automated console, try to provide as much clean power as you can afford. Buy a small uninterruptable supply for the computer and surge-spike protectors for the rest, and then add on additional supplies as needed.

MIDI wiring: choosing a switcher

There are two basic approaches to MIDI wiring. The most primitive approach is to daisychain all the equipment using a few simple Thru boxes. The biggest advantage of this older method is that it is cheap. If you don't need any flexibility or mobility in your system, and

you can get solemn pledges that the cables will not be touched, this can actually work. However, trouble-shooting this type of arrangement is not practical for a commercial studio. The more modern approach is to buy a MIDI matrix or switcher. A MIDI matrix is really a microprocessor-based patchbay. The *smarter* MIDI switchers that include merge and filter functions can be thought of as signal processors for MIDI. They are convenient but not necessary and are more difficult to set up. They can also be confusing to less sophisticated users.

• *Length of MIDI cable runs.*

Once you choose a spot for the MIDI switcher, you can start laying the cable. The assistant engineer's position is often a good spot because only house techs should be allowed to change any of the settings. MIDI cable should be run with much the same care and consideration you would give to audio cable. For longer runs of more than 40 feet, consider using low-loss low capacitance cable.

One of the most common myths is that there is a length restriction of 20 feet. In fact, with good quality shielded twisted-pair, cable runs of up to 50 feet should not be a problem. We have run up to 75 feet of cable with typical 2-core and foil wrap with drain. It is advisable and less expensive to keep your runs as short as possible though, because longer runs can increase the chance of MIDI data errors such as stuck notes. The term MIDI delay is often associated with long cable runs, but this too is a myth. MIDI delay is caused when the signal passes through opto couplers and microprocessors. Delay time varies with operating systems software and the quality of opto-isolators used.

• *Cable interference considerations.*

MIDI cable can cause interference with audio cable and pick up interference, so it is always a good practice to run them separately. In 90% of specific cases it is not a problem to run MIDI and audio cables together. We have even run MIDI and audio through the same multi-core with individually insulated pairs. Even though MIDI uses 4mA current loop to reduce the risk of interference, we recommend avoiding electrically noisy environments. Again, treat MIDI runs as you would audio runs: Good cable will give you good results.

Hint: If MIDI interference is detected on the audio (it only happens when MIDI is being sent), activate the pitch wheel on the transmitting equipment while disconnecting the MIDI cable from the MIDI Out of the transmitting equipment, and then replace. Next, disconnect the MIDI-In from the receiving equipment and repeat this procedure for the rest of the receiving equipment until the problem is localized.

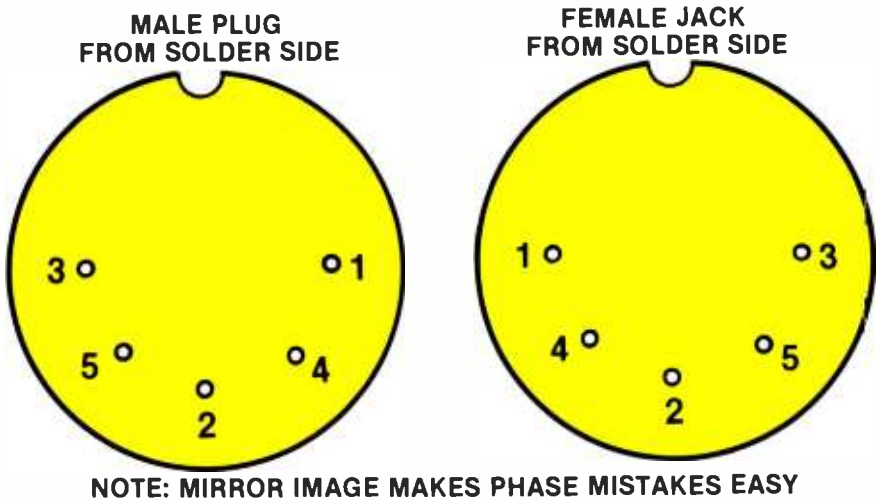


Figure 2.

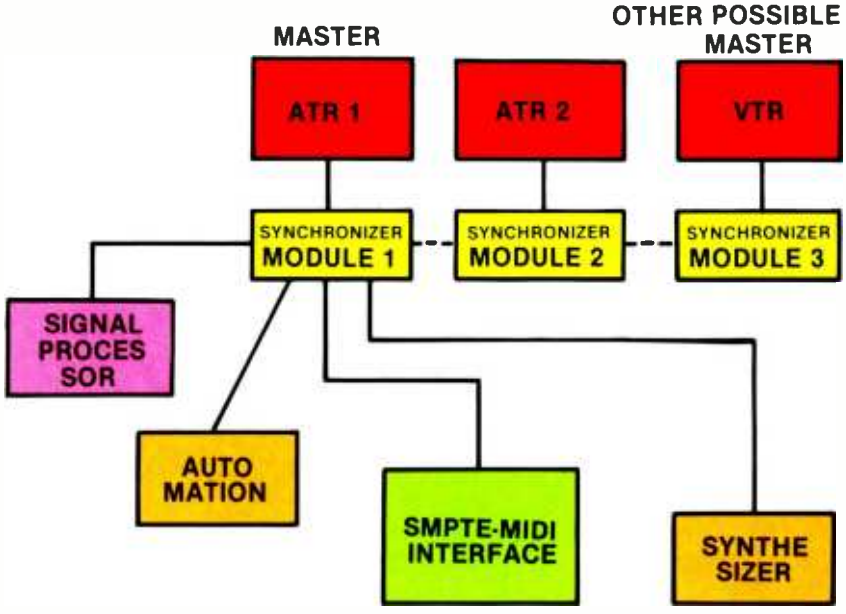


Figure 3.

• *What does MIDI interference sound like?*

Imagine a VCA (5534 type) frying slowly with a lot of digital grit on top.

The MIDI spec calls for the shield to be connected to pin 2 (the center pin) of the 5-pin DIN at each end. That is all; in fact, do not do more. Pins 4 and 5 are for the current loop and pins 1 and 3 should float. (Note that this is different from a DIN SYNC cable.) Do not connect the shield to the case of the DIN plug, because if you do you may start linking up the chassis grounds of your equipment. The DIN plug is not one of the nicest connectors to solder, and the cable clamping systems are far from ideal. You have to take care when clamping the cable that the clamp doesn't touch the shield, as the above problem will result. Also, most plugs and sockets are not numbered on the back. Special care must be taken to make sure pins 4 and 5 are in correct phase with respect to ground. (See Figure 2.) It is a good idea to get an up-to-date copy of the "MIDI Detail Spec" from the International MIDI Association (11857 Hartsock St., North Hollywood, CA; 91607).

A word about SMPTE

The same SMPTE time code is often required in more than one location at the same time. (See Figure 3.) It is important to distribute the signal properly without loading down the source. (Note that most SMPTE inputs and outputs are unbalanced.)

Many studios bring the SMPTE up in the console and then bus it to the rest of the room. This is not the best solution, as SMPTE is a transient high-frequency signal that cross-talks willingly. If you cannot bear the expense of a reasonable quality distribution amplifier, use the gain of a compressor instead (compression bypassed).

As with MIDI, it is important to use high-quality audio cable for your SMPTE wiring. SMPTE should be grounded in the same way as the rest of the audio signals in the control room. If there is any potential between the SMPTE ground and the audio ground (ground loop) you can get SMPTE slewing. One symptom is the SMPTE reader/synchronizer may suddenly jump ahead or behind by hours, even though the reader still says "locked."

Audio wiring

• *Mic pre, Line pre, or DI: What do you plug it into?*

There is not standard output level for synthesizers. They are commonly thought to be −10dB unbalanced, but the actual level can vary radically between different models and even between different patches on the same instrument. Because of a happy coincidence, the actual level, with respect to most consoles, is between the mic and line input levels.

This means that you are often forced to choose between using your line inputs at maximum gain or the mic press padded. The ideal solution is to have a high-quality DI box, with a level control and a ground lift, on the output of each instrument. Using DI boxes will allow you to run balanced cable—possibly saving some work if there are existing mic panels that can be pressed into service—and will save you some grounding problems. This solution may, however, be prohibitively expensive. The best approach is to begin with an experiment. Plug your instruments into your console. If your console has a lot of clean line gain, consider using your line inputs.

One of the most common mistakes is a headlong rush to plug everything in.

In theory, the mic inputs are not intended for an unbalanced input and are more likely to distort due to the lower headroom (above-average keyboard level). In practice, many engineers like the way the mic inputs sound. When you are evaluating your mic (be sure the phantom power is off) and line pre-amps, make sure to try loud and soft patches and pay particular attention to transients. Your ears are the best judge here.

• *Audio wiring: How do you plug in?*

There are generally three basic ways to solve this problem: Plugging directly into the patchbay is the cheapest method. It is also fairly reliable and the most direct path with the fewest connections. However, it is the messiest, requires setup time for each session and a good collection of adapter-cables.

A studio version of the snake and stage box can be a good compromise, especially if the stage box is installed with ¼-inch stereo connectors wired at the box in parallel with XLR-type connectors.

These will eliminate the need for adapter cables and could also be

used for balanced, unbalanced or unbalanced stereo signals including MIDI. This is a medium-priced approach. The setup time is a factor if you have to move the equipment. A variation of this is to have a patchbay located by the synths.

Multi-pin connectors such as DL, Elco and Amphenol can be used to plug all the audio and MIDI inputs and outputs into the console and MIDI matrix instantaneously. They are expensive (the better ones have gold pins) and require much more work to build. The best choice of multi-pin connector is the one you already have on your console.

The best overall wiring method is usually a combination of the above, tailored to your unique circumstances.

If you spend some time on this decision, you will have all the speed and flexibility you need.

Submixers

Another popular option is to have a separate submixer for the MIDI equipment. A mixer for this purpose should have a direct out on each channel and a line trim. Note that this type of mixer will probably only have balanced bus outs and that you may still need a DI for each instrument. The advantage to this arrangement is that, when the programmer is provided with headphones, he can work independently of the rest of the control room. This can be a big time saver and client pleaser. The disadvantage is that it is difficult to get a submixer with signal quality equal to the main console. Although the EQs are not such an important consideration with synthesized sounds, the weakest link theory still holds.

Hint: Hook up a small reverb or multiprocessor for the programmer and provide a console output into the submixer so that the programmer/player etc. can hear the track in the submixer headphones.

• *Audio grounding of MIDI equipment in the control room.*

The instruments should be considered as new pieces of outboard gear. The grounding system in the room should simply be expanded with rack setups. (It's faster to debug the rack in a separate room first.) Some instruments may have to be completely floated (chassis too). Manufacturers all claim to agree on the need for standards with respect to MIDIs but beware. They do not agree on whether the chassis is the audio ground or the power supply ground.

Adding these new types of equipment to a control room is not really more difficult than adding extra outboard gear. In the audio domain it is important to maintain the same grounding scheme, evaluate the actual output levels, plan your cable runs and use good cable. In the MIDI domain, don't short out the MIDI plug casing and watch the phase. In the ac domain some trial and error and research may save you a lot of money.

The important difference is...MIDI equipment is used differently than outboard gear. It is radically changing the way we use control rooms. In the past, a producer would tell an engineer what kind of sound he wanted and individual tasks were clearly defined. Now the producer, programmer and engineer all work together with many overlapping tasks to achieve a common goal. I like to describe this as follows: Under the floor—in the troughs—MIDI is not a big deal. But, above the floor—where the people are—MIDI creates a completely new ergonomic environment. RE/P

Related articles begin on page 36

Photos by John Lombardo

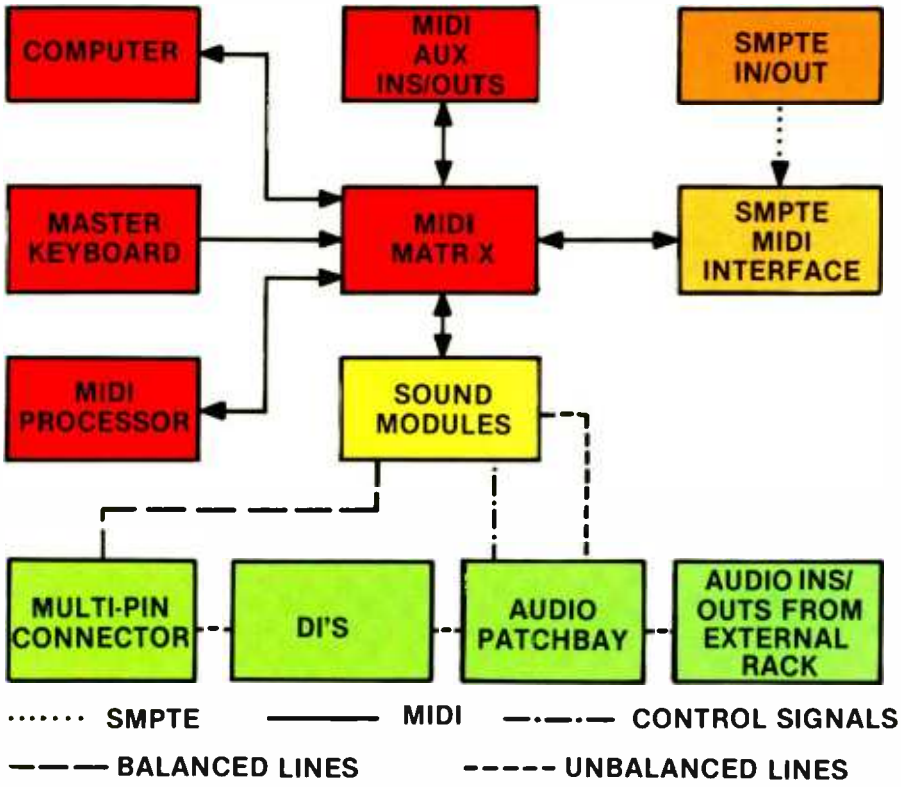


Diagram courtesy of JB Audio

Reggie Lucas' rack equipment list

Synclavier II keyboard, monitor disk drive
Voyetra 8 (2)
Roland SBX 80
Roland piano module
Simmons 4-way active DI
Custom 6-way active DI
JL Cooper MSB 1620 MIDI matrix
Yamaha TX 816
Yamaha MEP 4
Axxess MIDI Mapper
Oberheim DPX-1
IBM PC
Patchbays

Reggie Lucas, writer/producer of "Borderline" by Madonna and "The Closer I Get to You" by Roberta Flack, wanted to be able to work in all of the rooms in his complex, without changing his setup.

In order to address this problem, co-author Jeff Blenkinsopp of JB Audio built him a special rack that incorporates all MIDI, SMPTE, audio and power requirements. All audio outputs have active DIs and come up on the patchbay in the front. They are normalled through the patchbay and come out the back via two 48 pair DL connectors. In this way, any cross patching that Reggie sets up can remain in place when the rack is moved from room to room.

The DL connectors can be plugged directly into the console patchbay of any room in a matter of minutes. The rack does not contain a mixer, because Reggie likes to use the most direct signal path and often patches directly into the multitrack.

A studio owner's perspective

By Joel Greenbaum

As more and more of our clients began showing up for their sessions with MIDI gear, and as more prospective clients began asking for MIDI equipment, we came to realize that this equipment was fast becoming studio standard.

The basic 24-track studio no longer needed just a console, tape recorders, microphones and signal processing; it's also expected to have computers, samplers, synthesizers and other outboard gear (all MIDI). It was clear to us that we needed to provide this new technology to establish a niche in the marketplace and maintain a competitive edge.

We took a hard look at what services were needed in our local area (New York), at what equipment we felt was needed to provide these services, and our available space and the amount of money it would take to get into the game (as well as the amount of revenue we thought it could generate).

We discovered a number of things. From what we could tell, most of the professional studios that were seriously into MIDI (as evidenced by the sheer quantity of equipment listed in their brochures) had not given much thought as to how it would interface in actual sessions.

We heard all kinds of horror stories from disillusioned ex-clients. While other studios had all the latest MIDI gear, there wasn't anyone on staff who knew how to control it.

In fact, instead of their sessions running more efficiently—one of the big selling points of this new technology—their sessions were taking longer and multiplying the frustration factor by tenfold.

It became apparent that a studio that provides a knowledgeable staff and a versatile and sophisticated MIDI setup that works well could potentially capture a sizable chunk of the market.

Purchasing equipment

Deciding what equipment to buy was probably the single most difficult thing we've had to do since opening the studio. Every other day, it seemed, one of the trades would announce the latest and greatest piece of hardware or software. Trouble was, it would render obsolete anything else you might have already purchased or were about to purchase.

From a business point of view, it was frightening. How could we

Joel Greenbaum is the owner of Evergreen Studios, New York.

Evergreen Recording's Studio B.

come up with a complement of equipment that wouldn't become antiquated before we'd even have a chance to wire it up?

Also, what end of the market were we going after? Was it the Fairlight/Synclavier end? The mid level, reflected by such gear as the Akai S900/Yamaha TX-816/E-Mu/IBM/Mac? Or was it the low end, reflected by the likes of the Commodore 64/Casio/Yamaha DX-100?

This is where the advice of consultants Brian Lee and Charleton Pettus was most helpful, especially because they worked in all of the above situations (and combinations thereof).

I decided that the Fairlight/Synclavier route was a bit too esoteric, and the resulting cost factor would be well beyond the reach of most of our clientele, both current and projected. Many of our clients already had certain pieces of hardware in their homes, and it would be most useful to them if all they had to do was bring in their floppy disks.

We thought it best to provide them with equipment that would duplicate some of what they had at home, yet augment it with other hardware/software they might not have.

And of course, we could offer it to them in a system that was designed to be operated and maintained to the standards of a professional studio.

Our clients could, for example, do all or most of their sequencing at home, then come in to use our studio's extensive sampling library and array of synths for voices that they couldn't create at home (or might not want to take the time to). We could then transfer to 24-track if they needed to.

We thought this was a great way to get the arranger/composer/producer out of his home studio and back into our professional facility.

Space considerations

We had a limited amount of space in which to put a new MIDI room, so we took over a room that had housed our shop and my private office, a total of about 150 square feet. Because of the limited amount of space, we were forced to use it scrupulously. I had special keyboard stands built to use as little floor space as possible, and all our rack-mount gear was placed in rollaround racks or individual racks that could be easily moved in while stacked.

All in all, our two keyboard racks and two rollaround racks took up only about 25 square feet of floor space. By housing the equipment this way, we are able to roll it into our 24-track room when needed.

We set the equipment up using the workstation concept. Everything can be controlled from the location of the main keyboard controller (usually the Kurzweil Midiboard) by the programmer/keyboard player. Alternatively, the equipment can be controlled from the console area by the engineer.

We installed a special air conditioning unit that would enable us to always control the environment, something that's very important with computer-dependent equipment. Even though we were only using small monitor speakers, we found it necessary to bring in a consultant (Al Fierstein from Acoustilog) to deal with the acoustics. He helped us with the positioning of the monitors as well as the surface treatments for the room.

It is important that the client be able to get sounds up as quickly as possible. Therefore, we decided to hardware the outputs of the synthesizers/samplers used most often to the line returns of the console so that their voices can immediately be brought up on faders.

We also use two MIDI patchbays, the J.L. Cooper MSB+ and the 16/20. We have written programs into the MIDI patchbays (matrix) so the client can start working quickly with the equipment in a configuration that he is familiar with. They can also change the configuration in a matter of seconds.

For example, the client may want to use either the Kurzweil Midiboard or the DX-7IIFD as the controller. They also might want to use the Mac+ as the sequencere or the IBM as the patch librarian, and vice versa.

If they want to use either of the computers as clock source, they can. Alternatively, they can use the Garfield Masterbeat or even a drum machine as their clock source. There's also an interface for the client's own dedicated synths, sequencers or drum machines, allowing the whole system to be up and rolling in minutes.

The variations are almost endless. The point being, with simple change of programs on MIDI patchbays, clients can be working in any mode they choose almost instantaneously.

Another consideration was the linking up of our MIDI room to our 24-track room. We installed tielines between the two rooms so that once a client had finished sequencing and selecting specific sounds, they would have the op-

tion of transferring all the information to 24-track.

One snafu we ran into was having a console in the MIDI room (a Soundcraft 600) that could only output eight balanced buses at one time (even though it's a 16-bus board, and buses 1-8 are normalled to 9-16). Because the console has 24 direct outputs, we didn't think it would be a problem.

Unfortunately, we discovered that the direct outs are unbalanced, −10, and so we've had to modify them to bring the level up to +4, balanced.

When setting up any new room, even with the planning and collective experience we had, there are always going to be some problems to iron out. This is more the case for a sophisticated MIDI setup. The only way to truly cover all the variables is to run as many different "test" sessions as possible and to deal with the problems as they come up.

In a MIDI studio, it's extremely important to develop certain protocols, especially as it concerns the handling and logging of floppy disks and sound cartridges. Carefully labeling the disks and making backup copies of everything is vital. Keeping track of program disks, song file disks and sampling discs, particularly when you're using 5¼-inch and 3½-inch disks for everything from computers to samplers, can be a challenge.

Educate your staff so they understand that a protective disk should be inserted into any piece of hardware that has a disk drive before it's moved. This precaution will help to prevent the head from getting out of alignment if and when it gets jolted. Preventive measures like this one can save a lot of headaches as well as downtime.

Overhead vs. revenue

Because we were financing a large portion of the equipment, we had to be reasonably certain that the equipment wouldn't be outdated before we had a chance to pay for it. Also, we had to project what sort of studio rates we could command for the whole package and how many hours we could expect to book the new room. Finding a comfortable balance between the monthly overhead and the amount of revenue the new equipment could generate was essential.

From past experience, we realized that we wouldn't necessarily be able to raise our rates just because we had more equipment. Fortunately, the new equipment generates more work for our existing studio because it enables us to do certain kinds of work that we weren't equipped to do.

However, just how much more revenue we can expect from our existing room is difficult to project, so we take the position that any earnings from the MIDI equipment is a windfall.

In general, opening our new MIDI room has created new opportunities at Evergreen. The sessions we book are more diverse and we are scheduling more time. Putting in our new MIDI room definitely presented some unique challenges, and the process was much more difficult than it was for our 24-track room.

However, it does appear to be paying off. We hope to be reaping the benefits for years to come. •

Facility Spotlight:

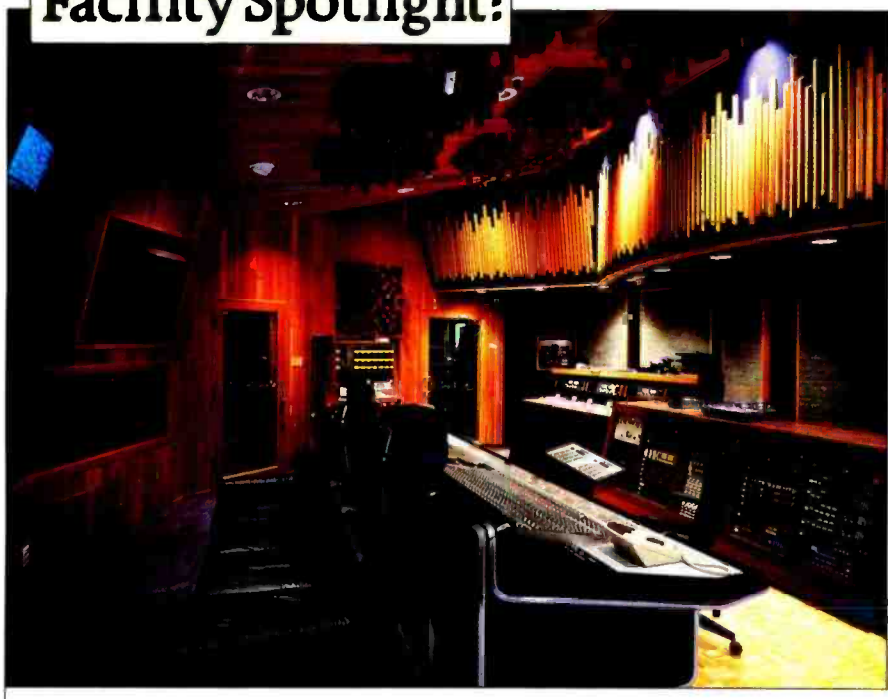


Photo by Bob Prezel

Paisley Park Studios

By Michael Fay

With two studios, a 12,000-square foot production stage, rehearsal hall, and elaborate support facilities, this $10 million complex is truly world-class.

Minneapolis is the home of the World Champion Twins and a truly world-class production facility known as Paisley Park Studios.

Situated on a 9½-acre site in Chanhassen, MN, a suburb or Minneapolis, this $10 million, 53,000-square-foot building houses:

- Two fully equipped 48-track recording studios;
- A 12,000-square-foot production stage with 45-foot high ceilings;
- A rehearsal hall with full lighting and sound reinforcement capabilities;
- A workshop and technical maintenance shop;
- A kitchen;
- Management, administrative and operations offices;
- A 16-car underground parking garage;
- A tape vault;
- An apartment;
- Three loading docks for semi-trailer trucks or remote TV trucks; and
- A central patching area, where all rooms and equipment can be connected as necessary.

Still to come is a video-production studio and a "C" audio control room that connects to the rehearsal hall.

In the recording studios, many innovative systems were incorporated to achieve high-performance listening and recording environments, such as cast-in-place concrete monitor wall, 2D acoustical diffusion and a granite special effects/drum room.

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

Recording studios

Studio A is designed as a "multiple personality" room. Dimensions are approximately 45'x75', broken down into an acoustically live room with granite walls, one wood iso room, a vocal iso booth and a large central room.

The control room contains an SSL 6000E-64 console with 48 mono and eight stereo input modules, for a total of 64 inputs. Each channel includes six assignable sends, 32 input bus assignment and programmable EQ. An Adams Smith synchronizer and event controller is also included. (See sidebar on page 70 for equipment list of Studio A.)

Studio B's dimensions are 45'x55', broken down into one live room, one vocal room and a central room. The room's console is a custom-built DeMideo console, with 36 inputs, 24 output buses and API EQ.

The rehearsal room is designed as a multi-function rehearsal area and a projection room. Measuring 40'x30'x16' with a full lighting pipe grid, the room features a floating wooden dance floor, mirrored wall with dance rail, full curtains, projection screen and projection room. A third studio under construction, Studio C, will be used for rehearsal recording or vocal dubbing for commercials.

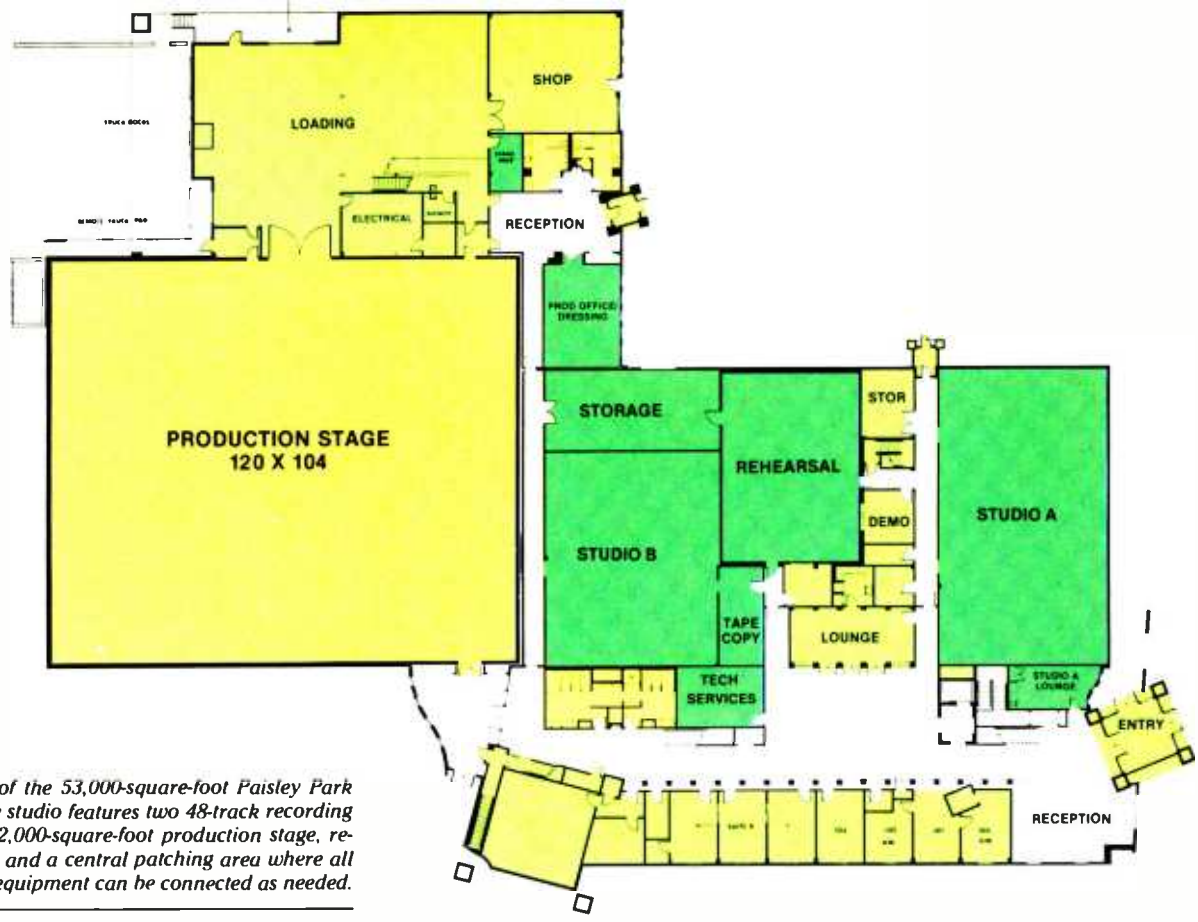
The production stage measures 120'x 102'x45' and has a full sound reinforcement system for live music, film or video productions. The stage is isolated from outside noise and is capable of being acoustically live or dead by using interior treatment and draperies. Stage support areas include three loading docks, a wood and metal shop and a set building area.

Studio design

A few months ago, I had an opportunity to sit down with architect/studio designer Bret Thoeny of Boto Design and ask him to detail some of the unique architecture and acoustic design treatments that went into this project. For Thoeny (pronounced Tay-nee), Paisley Park Studios has been a 2½-year project. Having built Prince's other home studios in Minneapolis, Thoeny was commissioned to find a site near his estate and design a facility where he could produce music, video and film projects.

MF: How did you first get involved with Prince?
BT: Through his manager. I met his manager while working at Westlake Audio. It was around 1980. I was just getting started with my own company when I was asked to do some work on Prince's home studio.

MF: You mentioned Westlake Audio—is that where you learned studio design?
BT: I was going to architecture school and got a job working part-time at Westlake as a draftsman. At the time I knew



Floor plan of the 53,000-square-foot Paisley Park Studios. The studio features two 48-track recording studios, a 12,000-square-foot production stage, rehearsal hall and a central patching area where all rooms and equipment can be connected as needed.

nothing about studio design but became very interested in it because of its innovation and creativity. I was working alongside Glenn Phoenix and C.J. Flynn. The mid to late '70s were a golden time. The industry was changing because multitrack recording was possible. That created a market for the smaller, independent recording studios to exist. Before multitrack, you had to have a large space like an RCA scoring room that would hold any number of musicians, since you had to put them all on tape at the same time. When multitrack became available, you could build a much smaller space and do things in pieces.

MF: Was Tom Hidley there at that time?
BT: No, but much of his influence was still there—he had just left to form Eastlake.

While at Westlake he created a new prototype design like none that had ever been done before...a high-sound pressure reference control room. He designed the speaker and the room. Even though it was crude, it was far better than anything that had been done before.

MF: Do you feel that your designs are heavily influenced by the Hidley design or have you branched out in your own direction?
BT: I've definitely gone my own direction. While I was there I was able to spend a lot of time working alongside Glenn Phoenix. With his guidance, I soon learned to understand the principles of control room design, and once those principles became clear, I had freedom to exercise my own design decisions.

At that time Westlake was developing a new generation monitor system—and along with that system I was able to develop a much better sounding control room than the "compression rooms" that were built in the '70s.

MF: If you didn't profess to the "compression room" theory, what was your design philosophy?
BT: Modern rooms are reflecting what a listening environment should be. There is no longer a reason to use a compression ceiling. The concept was to compress low frequencies at the mix position because of lack of it. Now that isn't necessary because the speakers can deliver the low frequencies. Before, you were compressing the low frequencies (acoustically), causing them to be out of phase and untrue.

The important key these days is to match the control room and the speakers. You have to design a room around the desired sound pressure level of the monitors. Overmonitoring a room with too large of a system won't work, neither will overtrapping (too much trapping removes the room reference). There should be an equilibrium between the size of the room, the trapping, the dispersion of the sound, the desired sound-pressure levels, and the room geometry.

Past projects

MF: How many studios have you worked on?
BT: I've done about 50 rooms for various facilities and this complex is the culmination of all that experience.

MF: How do you integrate new ideas into your designs?
BT: I am conservative. When I get a commission to do a room, I don't think, "Well, this would be great to try." I do it in small increments. I don't risk the client's time and money—you can't.

MF: How did you get involved with the Paisley Park project?
BT: This is a unique situation. They have a total trust in key players. I've been involved with various projects for Prince and have been "adopted" by his management team and given free reign to build the complex as I saw fit. There has actually been very little feedback, and often I had to make management decisions during the construction process.

MF: Why Minneapolis?
BT: Well, Prince grew up here and he feels comfortable here. Minneapolis is his world—he brought success here. His friends and his talent base are here...he wanted to create a production complex for himself and other acts.

Photo by Bret Thoeny

Paisley Park Studios is located on a 9½ acre site in Chanhassen, MN, a suburb of Minneapolis. The structure is a steel frame buidling with an aluminum covering, featuring a thermal enclosure with insulated aluminum panels, double 1-inch thick insulated glass and a poured concrete roof over metal decking for sound control.

MF: I understand this was not the first site selected.
BT: The project started on property in Eden Prairie, which is one community over. Eight versions of the complex had been developed for that site, until it was determined that the site wasn't large enough, there was too much traffic, and visibility was too high.

The decision to move was made after construction grading had begun and construction drawings were complete. Another problem in Eden Prairie was the restrictive building codes and architectural guidelines. The project was moved to Chanhassen, a much younger and more open-minded community. Much of the original design plans for the studios, rehearsal rooms and support areas from the first site were retained. The complex was just expanded—so some of the engineering and design time was saved.

MF: Do you have any tips on site selection?
BT: First look for the obvious things like power lines, railroad tracks, broadcast transmitters or airplane traffic. Here in Minneapolis, we looked for good access in the wintertime—the road we're on is a major highway, so it stays open all the time.

Also important are community services—things like hotels, restaurants and convenience to an airport. These are support systems that are important in site selection.

Prince's involvement

MF: How involved was Prince in the studio equipment selection?
BT: Studio design, very little. Basically, I understood where he had been working and his basic requirements, and took that knowledge and created a world-class recording studio. I tried to expand his workplace from his reference of working in other studios to my understanding of world-class facilities, and bring him a higher level of technology.

MF: Who made the recording equipment selections?
BT: Prince selected the principle pieces. For example, the DeMideo console, which is custom-built, was a direct request. Sunset Sound has one that sounds great, and he wanted that sound, so he commissioned one to be built.

The SSL was a recommendation from an English engineer he was working with on tour. What we have here are two distinctly different recording console eras actually—the basic 990 op-amp of the DeMideo with API EQ, and the total IC world of the SSL. Both give you unique opportunities, and to some degree, a different sound.

MF: Who selected the Westlake SM-1 monitors and why?
BT: I did. The criteria was to have a reference speaker system that could produce very high sound pressure levels. In my opinion, there are no other speakers that can reliably deliver those sound pressure levels. It's a 5-way configuration: dual 18-inch woofer; one 12-inch mid bass; one 2-inch compression driver; one 1-inch compression driver; and a super tweeter.

MF: Do you have the same system in both rooms?
BT: Yes. Both control rooms are identical.

MF: How about the smaller pieces of equipment?
BT: Those pieces were recommendations from Sal Greco, Prince and Susan Rogers.

MF: Are there any live echo chambers?
BT: Not yet. There is one planned; it just hasn't been built.

Isolation

MF: With all these different high-level sound environments side by side, how did you treat the isolation problems?
BT: In many areas I used concrete block. Since I had a chance to design the whole building, I was able to envision the studios and other production areas first. The building shell and support areas were then built around the production rooms. Having that ability made it very easy to solve various acoustic isolation problems without going totally crazy. When you have an existing building, you sometimes have to get into elaborate isolation processes to keep out subway or aircraft noises.

This is a steel-frame building with an aluminum skin that wraps around it. It doesn't offer much sound transmission protection, but it's a cost-effective way to build a shell. Prince wanted a white building. With aluminum paneling, we could get any color, there's no maintenance and it's very weather-resistant.

This is mainly a thermal enclosure with insulated aluminum panels, double 1-inch thick insulated glass, and a poured concrete roof over metal decking for sound control. Inside, the recording studios are completely surrounded by concrete block walls.

MF: Is the production stage surrounded by concrete block as well?
BT: No. The production stage has 10-inch thick solid concrete walls, which are made in a factory on a casting bed 200 feet long. Inside the cast concrete are pre-tensioned cables for reinforcement. When the concrete has set, the walls are cut into 55-foot lengths, each weighing 55,000 pounds.

MF: What makes that type of wall necessary?
BT: Well, it's cost-effective. That's the only way you can build a wall that tall with enough mass to provide sound isolation, and support the steel lighting and rigging truces that span all the way across the room. Two thousand pounds every eight feed, on center—that's the live load you can hang in there.

MF: Is concrete block more cost-effective than poured-in-place concrete?
BT: Yes, but it's still solid concrete because all the cells are totally filled. I do have a poured-in-place concrete on the monitor wall. There is approximately 40,000 pounds of concrete surrounding the big SM-1 playback monitors. And that sits on its own, too. It's a beam. All the monitor weight rests on the 4-square-foot leg of the beam. That's where the weight transfer is. The beam is also isolated from the building.

This type of monitor wall greatly improves the low frequency response and definition of main high-power monitors.

MF: Getting back to the studios, are the control room walls concrete block also?
BT: Yes. The control room walls are decoupled from the studio and control areas. There is a floating inner shell on which the wood framing sits, and the concrete block sits on the structural slab. It doesn't float. If a wall has enough mass, you can't get it accelerated. It takes an amazing amount of sound pressure to get concrete block moving. The mass is the key. With enough mass, there are no resonances or sympathetic vibrations from the walls, which can cause problems.

MF: Is there some sort of damping between the monitors and the beam?
BT: They are rubber-damped. That's necessary. You need a system that can accelerate the air in front of the speaker without having any acceleration going back. That's why you put the mass around it. If either the wall or the speaker cabinet move back as the driver pushes air forward, you're going to get out-of-phase information. For high power monitoring, you just can't build a wood frame wall stiff enough.

MF: Is it safe to say the time and money spent on special acoustic treatment of most control rooms is really necessary to contain, reflect, absorb and diffuse high sound pressure levels from the main monitors—and if you were only using nearfield monitors, that the same degree of treatment wouldn't be necessary?
BT: That's true. For large systems, it's often better to let the low frequencies go through the walls. You can have a much better sounding control room if you can do that. If you can isolate your control room from the outside world with airspace or other wall systems, offices or a hallway, it's much cheaper and is going to sound much better. As soon as you need to contain low frequencies, you start having serious problems with the dispersion of those frequencies.

MF: What is the cubic footage of these control rooms?
BT: They are 600 square feet, with ceiling heights ranging from nine to 12 feet. It's not only volume, it's the reference of the room to the real world. If you are mixing in an anechoic chamber 50 feet wide by 90 feet deep, you would have no reference—totally no reference to a living room, car or any type of playback system. The same can be true of a control room. If it grows, it could, at some point, start to lose its reference to a typical environment such as a living room.

MF: Because the walls are so far away?
BT: Yes, because the reflections off the walls give us clues about space relationships, the way things image and the way we mix.

MF: Is this where the 2D diffusion systems start coming into play?
BT: Right. I have installed "2D Acoustical Soundfield Diffusers" to improve the 2kHz-3kHz (vocal range) imaging and definition at the mix position. These diffuser systems were designed by a computer program written by George Massenburg. His program is based on the Fourier Transform formulas of M.R. Schroeder.
MF: What other acoustic innovations were used?
BT: "Controlled Travel Path" monitoring geometry—it provides a 6dB difference between direct and first-order reflections for improved imaging and localization. And, improved low-frequency geometry eliminates common 60Hz and 125Hz anomalies.

Photo by Bob Prezel

Studio A is described as a "mulitple personality" room. Dimensions are approximately 45'x75', broken down into an acoustically live room with granite walls, one wood iso room, a vocal iso booth and a large central room.

Photo by Bob Prezel

The granite special effects/drum room features the large scale 2D Acoustic Soundfield diffusers on the ceiling of the studio.

MF: How about the other side of the glass—what new trends do you see in the studio?
BT: Dead to live. We've gone from rooms that were acoustically dead in the '70s to fairly live in the late '80s. Now, with some rooms like the granite special effects/drum room here, we're going beyond even the live RCA and Capital rooms.

MF: How is this change in ambience affecting engineers and their techniques?
BT: Engineers are becoming far more sophisticated. The era of very dead rooms came on with the advent of multitrack recording. The original thinking was—all the individual instruments of a band or orchestra could be recorded, then individually reprocessed to the particular desires of the producer. Everything went to tape dry so that reverb, EQ, dynamics or whatever could be controlled and changed in the mix.

But that's changed back now to very sophisticated, large open rooms, operated by knowledgeable engineers using proper microphone selection and technique—to control leakage while capturing a good live sound. Now I'm giving them a challenge, a rock granite diffusion room where they can really have some fun. It really gets unique sounds that you can't achieve by processing.

MF: Why is a granite room different than one finished with wood, plaster or dry wall?
BT: It's the mass again. Dry wall is not generally the best material because it's actually quite soft. It reflects high frequencies and some mids. Plaster is harder, has more mass and reflects highs and lower into the mids.

MF: So as you add more mass you're still reflecting the highs...and the lower end of the spectrum is reflected as well?
BT: Oh yeah. When you've got granite walls with multilayers of dry wall and frame behind it, the wall doesn't act as a diaphragm. It starts kicking back things at 20 cycles. Everything comes back.

MF: If all frequencies are reflected, isn't there a lot of comb filtering in the decay?
BT: We put large-scale 2D Acoustic Soundfield Diffusers (see photo below) on the ceiling, and along with room geometry and limited trapping, were able to achieve a flat RT_{60} reverberation time from 25 to 10kHz.

MF: What is the RT_{60} of the granite room?
BT: It's about 1½ to two seconds.

MF: And the size?
BT: It's about 750 square feet with a very high ceiling, which gives it good volume.

Future projects

MF: What have you learned from doing this room that you'll be able to take to your next project?
BT: Just the performance. So far, everyone working in here tells me the rooms sound great, but I haven't had a chance to go in and do my real time analysis. I examine each room I do and learn where the anomalies are, if any.

MF: It sounds like you don't rely too much on measurements, that you are designing based on experience.
BT: It's a lot of experience. My philosophy of acoustic design is not to create an OK environment and then come back and fix it by putting up panels or closing traps. Having done 50-some rooms over the past 10 years, I'm not at risk having a room that's going to sound bad or have major problems.

But, each situation is unique. I can't take drawings from this studio and plug them in someplace else, because there's always a new set of constraints.

MF: I understand there is a special fire protection system here.
BT: There are no sprinklers in these rooms. Each studio has a halon gas fire suppression system. A 6% halon solution takes away enough oxygen to suffocate a fire but leaves enough to breathe so people can get out. There's both an automatic and manual discharge if needed.

MF: An you don't end up watering the equipment?
BT: Right. There's no damage at all. Nothing.

MF: What special ergonomic considerations were built into the control rooms or studio?
BT: Well, the outboard racks are all connected by umbilicals and can be moved anywhere around the room as needed.

MF: Is the studio open to anyone who can pay the rate?
BT: Anyone—the majority of the work is done by outside clients.

MF: What if there is a conflict in scheduling with Prince. Who gets priority?
BT: Prince has to book time like anyone else. He is very careful about working around the scheduling of other clients.

Photo by Bret Thoeny

Studio A control room above, was designed and constructed with a floating inner shell on which the wood framing sits, and the concrete block sits on the structural slab. Six tons of imported hand-cut and polished Italian marble and Southern cherrywood paneling were also used.

MF: What are the rates?
BT: They range from $125 to $145 for music recording, including a second engineer and effects gear.

Architecture

MF: How would you describe the architectural style of this building?
BT: This is the Venice style, which is the base of my commercial architecture.

MF: Venice, CA?
BT: Right. This is quite progressive architecture in my community, and it's my frame of reference. Prince requested an outstanding building that would make a statement for him—he didn't want a warehouse or an institutional building.

MF: How have the clients responded to this architecture?
BT: They think it's great. Recording studios are becoming more contem-

porary in their physical appearance, to create a total ambience rather than just having a fancy control room in a garage.

We're trying to introduce people to things they haven't seen before—light colors, different fabrics and finish materials, and sky lights for natural effects.

MF: Do skylights or windows present any particular problems in studio design?
BT: It's worst in the control room because it's a reference environment. In studios, it's much more acceptable. As long as the requirements aren't too great, like the client wanted the whole ceiling to open up, you can usually deal with it. But it does affect performance and you have to compensate the best you can.

MF: It appears that this complex was built with an open checkbook. Is that the case?
BT: Let me clarify, there were budgets. For most people, $10 million is an open checkbook, but look at a TV studio, which may cost $50 million, or a motion-picture studio. There were written budgets from day one that were constantly being evaluated and updated because of program changes. Don't forget, this was the 10th design and second location of a 2½-year project.

We had a professional construction management firm that oversaw the building construction and kept track of the program changes and how they reflected the budget. Those budgets went back to management and were approved before we went ahead. There was a system of checks and balances.

Construction manager

MF: Would you elaborate on the roll of the construction manager?
BT: A construction manager works for the owner; he's an agent of the owner and is looking after his interests. You don't get the adversarial situation that you do with a contractor. The construction manager takes the architect's drawings and puts them out to bid, to many different bidders for each division of the building. The building may be divided into 15 to 20 divisions such as metal, glass, electrical or air conditioning. There are usually a minimum of five bids from each division. When the bids come in, he sits down with the architect and the owner's representatives to examine each for cost, quality and the time required to complete the job. Once this evaluation is complete, the construction manager can identify the budget...then his goal is to stay within a few percentiles of that figure.

MF: How is a construction manager selected?
BT: You should interview them. The person who did this job was actually involved with other projects that we had done for Prince.

MF: Was there a different construction manager for the actual studio construction?
BT: That was me. I was both contractor and construction manager for the studios.

MF: Studio construction requires special skills and experience. Were you able to find studio-experienced carpenters in Minneapolis?
BT: I brought three master studio carpenters from Los Angeles and put them in a condominium for 10 months. They stayed here and did the project because they know studio construction, the process, the detailing and the quality that I demand. They were the project foremen, responsible for the supervision of 10 local carpenters and numerous subcontractors. I came back weekly to inspect the job and solve any problems...so that we could get the performance the drawings dictated.

MF: Describe some of the differences between studio construction technique and standard home or office construction.
BT: The key is understanding the finished product. It's the geometry and the angles—there are so many layers to build on top of one another. An office building has an outside skin and some wood studs on the inside, drywall, paint and carpet... that's it.

When you get multiple wall systems, and you have to worry about sound transmission through the walls, you have to have the foresight to know where the final finish is going to be—how many inches past the starting point.

An experienced studio carpenter can solve problems as they arise without having to consult the designer on every last detail. With inexperienced crews, things get left out, holes don't get plugged or layers don't get overlapped. It's important to understand that you're building a watertight enclosure and that each layer adds to the total envelope. We're trying for a sound-tight enclosure. Nothing is soundproof, but the room should be sound-tight.

Wiring design

MF: Who did the wiring design?
BT: Sal Greco. He did the designing, wiring, interfacing and installation.

MF: Is that hospital-grade ac that's being used?

BT: Yes. Each room has its own isolated power.

[At this point, John Dressel joined us to answer some specific questions about the wiring design.]

MF: Is the control room wired balanced or unbalanced?
JD: It's all balanced.

MF: Why?

JD: With a balanced system, we can unbalance it if we need to for a particular situation. Obviously, a lot of outboard gear is unbalanced, which we run into a balanced situation. With balanced lines, everything is much quieter, and it gives you flexibility to change. If you go unbalanced, you don't have a choice; you can't go the other way. You can always unbalance a balanced line, but it's pretty tough to balance an unbalanced line.

Continued on page 70

Fiber-Optics Considerations

By Eric R. Pearson

The cost of fiber optics is decreasing to the point where the audio/video designer may soon be able to consider it as an alternative to copper wire.

All contractors in the audio/video market should consider adding fiber-optic technology to their bag of tricks. And for studio owners, this means that fiber optics may be an integral part of your operation within a few years.

Basically, there are at least four reasons why:

1. Opportunity. There are now, and will be in the future, increasing opportunities for the use of fiber-optic technology in solving audio and video transmission problems.

2. The trend toward decreasing cost of fiber-optic components. This means that there are more situations where optical fiber is the transmission medium of choice solely because of lower cost.

3. The end-user's relative lack of understanding of the performance and cost advantages available by using this rapidly changing and rapidly evolving technology. This lack of understanding means that there is opportunity for designers to create business based on their ability to convince clients of the advantages of fiber optics.

4. The complexity of the technology and the large number of choices for each fiber-optic system. Again, this is an opportunity to create business.

Future growth

The fiber-optic transmission market can be best described as consisting of two major segments: telephone and non-telephone. The non-telephone market had components sales of about $150 million in 1985. This level was expected to grow by about 50% per year through 1988.

In addition, this portion of the market is expected to have a 10-fold growth within the next 10 years, for a total annual market of about $1.52 billion. This is business that does not exist today.

For the design and installation of fiber-optic systems, estimates indicate between $304 million and $529 million in annual business.

For studios, the implications of this market are clear. Costs for all fiber-optic components are decreasing. Fiber, which was $1.50 per meter in 1977 is now 16 cents a meter, and even less in some cases. Cable prices have dropped partly because of decreasing fiber prices, increasing cable manufacturing yields and increasing competition.

Connectors are now as low as $3. Finally, active devices (LED transmitters and detectors) for some applications, such as short distance and moderate bandwidths can be purchased for as little as $2 to $15 a pair. This trend means that there are more applications in which the use of fiber optics can be justified solely on cost.

In many applications, fiber optics can be less expensive than copper wire solutions.

Educating users

Most end-users don't know how to use this technology, and is especially notable in non-telco applications. This lack of knowledge exhibits itself in overspecifying and in choosing components that have a performance and cost higher than alternative fiber products that will meet the needed performance requirements.

An example of the complexity of fiber-optic use is shown in Figure 1, which details the process through which most people go when they start to use fiber optics. In addition, there are a large number of sources for each of the components that you will need in a system. You can see an example of this large number of choices when you consider the variety of connectors, as shown in Figure 2.

Most non-telco users of fiber-optic transmission have fiber optics as a small part of their total work package. Because of this fact, the typical user cannot, will not, and should not spend or invest the amount of time required to identify the components that will be most cost-effective for a particular application.

If you are a studio designer, active in the industry and investing time in keeping up-to-date on the technology, this will help you to present lower-cost solutions to your clients' existing needs.

Fiber optics in A-V applications

There are several major reasons that are most frequently stated when discussing the use of fiber-optic transmission in audio and video applications. In order of declining frequency, the reasons are long distance, repeaterless transmission,

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no noise (or high picture clarity in video application), and low cost.

The other significant characteristics of fiber optics that are mentioned less often include high bandwidth, all-dielectric nature, small size and low weight.

Because many people want to use the latest technology, techno-sizzle has also become a motive. In fact, many users are willing to pay more to use the technology.

In A-V applications, fiber optics is most often used because of the large distances over which it can be used without repeaters. The average distance is at least 16,000 feet. but, with the proper equipment, it can be as high as 75,000. These distances are significantly greater than the often-cited 500 feet to 1,000 feet limit for repeaterless transmission of high-resolution video by coax.

Large manufacturing facilities, for example, have needs for transmission over such long distances. In addition, com-

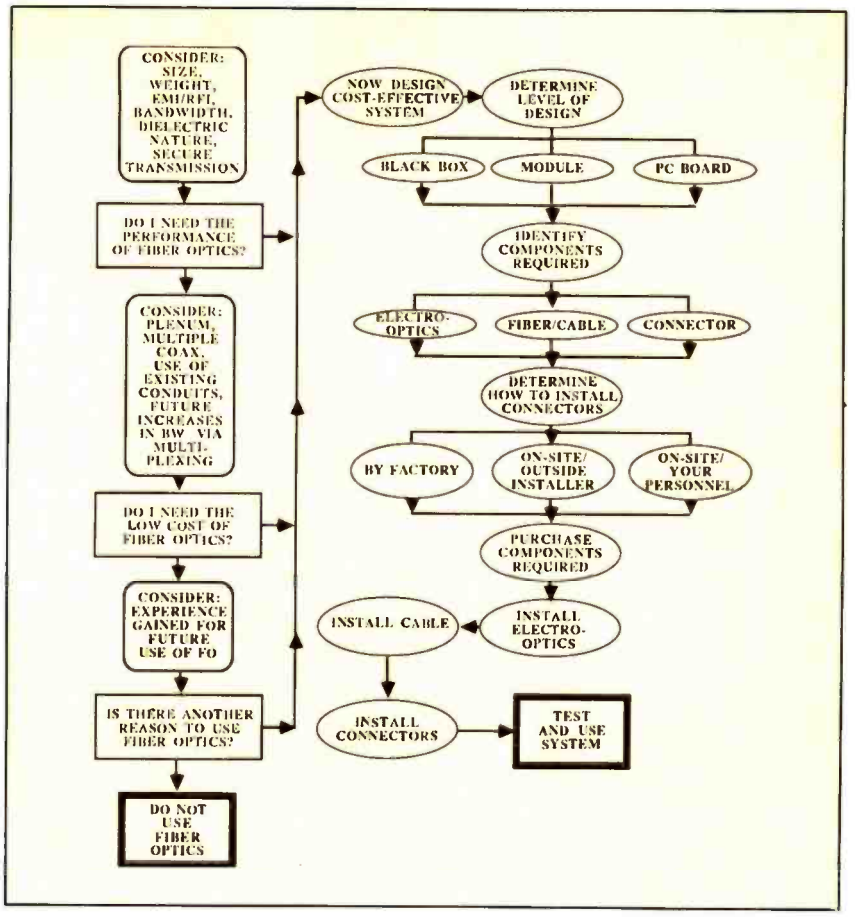
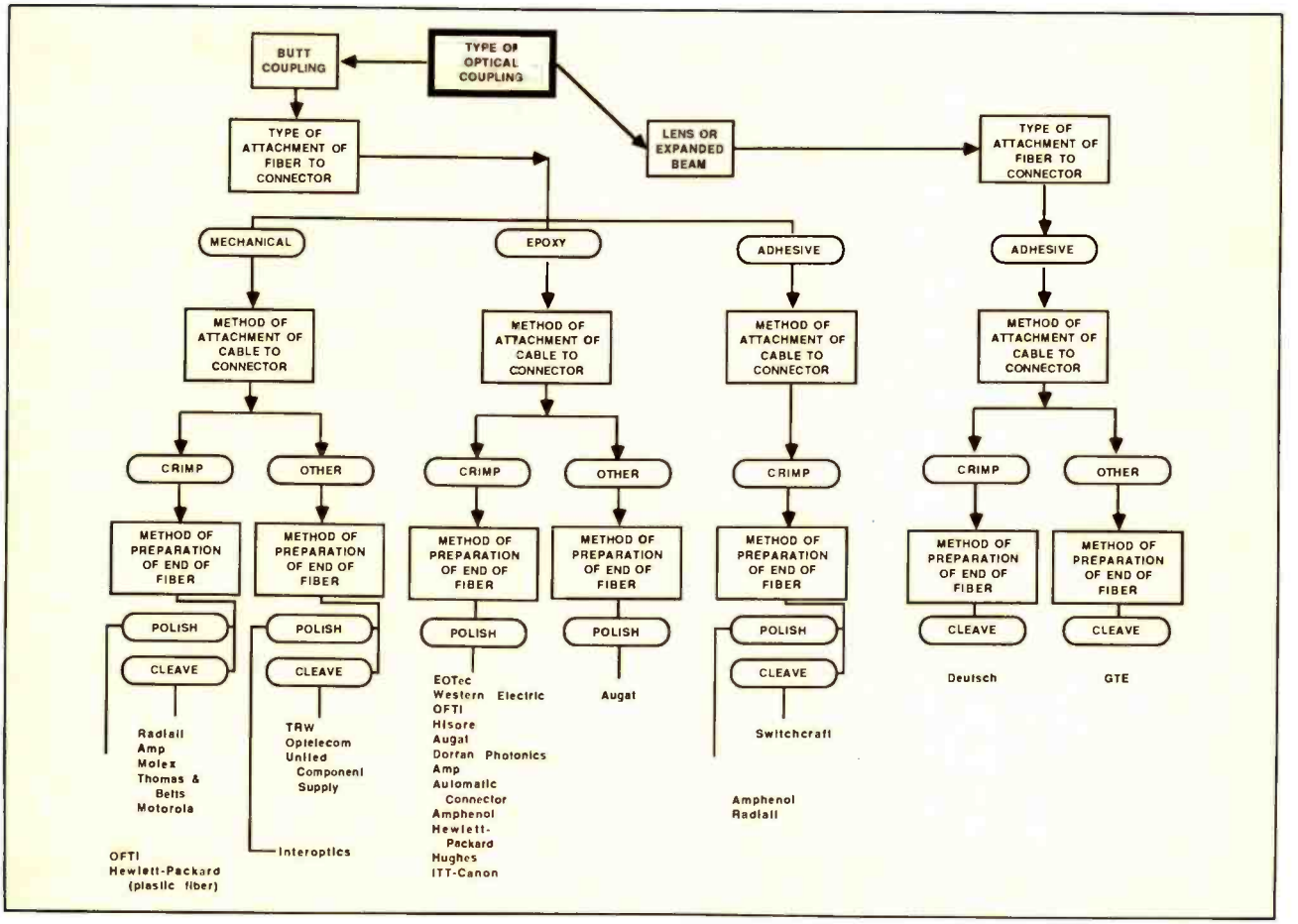


Figure 1. *The decision-making process for the user of fiber optics.*

Figure 2. *Types of installation techniques.*



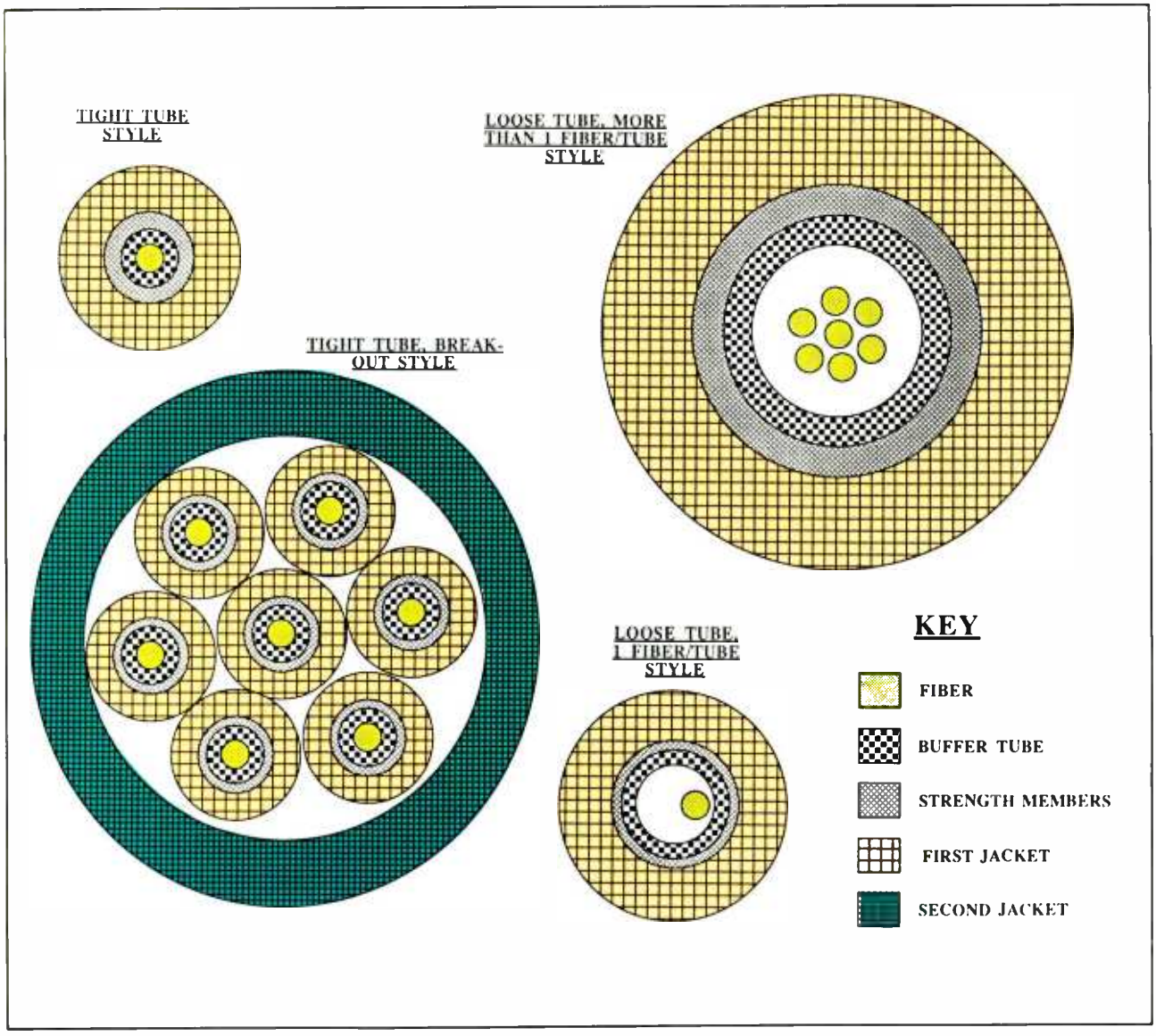


Figure 3. The various types of cable designs.

panies that are using high-resolution video for CAD/CAM applications, surveillance, medical-imaging or teleconferencing are using fiber optics to achieve long transmission distances of high bandwidth signals (50MHz to 300MHz). In some cases, 300MHz signals can be transmitted over several kilometers by fiber, while the coax transmission is limited to a few feet.

Fiber optics is often used for its immunity to EMF, RFI noise pickup. This is especially true in video applications. Remember that fiber optics does not result in simply a decrease in the noise picked up during transmission—it results in a complete elimination of this type of noise.

In one case, a user of computer equipment experienced a reduction in transmission time from as much as 45 minutes to less than two minutes after switching from coax to fiber. (This was a case of digital transmission, but the reduction in transmission time was directly related to the reduction in noise-generated errors.)

Do's and don'ts

For a designer or end-user, it is important to remember that fiber-optic technology is way ahead of the needs of the typical or average user. Most requirements can be satisfied with off-the-shelf and medium-performance components. Another factor is that there is a great deal of competition among component manufacturers and suppliers, allowing for a great deal of shopping around for the best deal.

Remember that fiber optics is basically a digital technology, although analog devices do exist and are reasonably priced. These devices are sometimes amplitude-modulated, although some frequency-modulated devices exist. Some systems used PCM for the transmission of analog signals, as is the case of transmitting low-frequency process control signals.

Optoelectronics

The most important points to remember are that you get what you pay for, most optoelectronics will exceed the needs you have, and the industry is highly competitive.

Getting what you pay for is most significant when you are purchasing video electronics. My experience is that there is a spread of at least six times on the price of optoelectronics for video transmission.

This spread is a result of quality of transmission (5MHz, 10MHz or 20MHz, or standard quality, near-broadcast quality or broadcast quality), and the method of modulation (AM vs. FM).

In most cases, choosing optoelectronics will not be exceptionally difficult. Prices have been relatively stable, but the number of competitors has been increasing faster than the market. Prices can be flexible, depending on the business goals of the supplier.

The main objective for designers is to design and install a system that meets the needs of the client and has the lowest possible cost. This means using the lowest-cost fiber that meets the performance requirements. In most cases, this will be the 50/125 all-glass fiber optimized for use at 850nm.

This fiber has a number of advantages. It is the lowest-cost fiber available. It has a low-signal loss as a function of distance. It has a bandwidth capability that is significantly in excess of most of the needs of the audio/video world. And it is a standard product, for which cables, connectors and optoelectronics are available.

Its one pseudo-disadvantage is that you cannot launch/couple as much light into this fiber as you can into other, more expensive, fibers. However, this disadvantage does not often result in decisions to use higher-cost fibers. The cost premium that you will pay can be significant.

There are certainly some situations in which use of fibers other than the 50/125 is technically necessary or desirable, but that is another article in itself.

Choosing cable

When deciding on the type of specifications that your cable will need to meet, you will need to determine the values for each of the specifications that will be met by your cable(s).

There are many types of cable designs. However, there are four basic types that you will most likely consider:

1. Loose-tube construction with one fiber per tube;
2. Tight-tube construction with one fiber per tube;
3. Breakout cable with one fiber per tube in either loose- or tight-tube construction;
4. Loose-tube construction with more than one fiber per tube.

These four types are shown in Figure 3. In most situations, any of these types of designs will meet the requirements of most typical applications. A decision will be based on total installed cost. To calculate it, you will need to examine the cost of the cable, the cost of the breakout kit/adapter and the labor cost to install the breakout kit/adapter.

Generally, the use of breakout kits with multiple fiber per tube cables will result in the lowest cost possible without any sacrifice in performance. For example, use of a 2-fiber/single-tube cable with a breakout kit will be less expensive than using a zip-cord duplex cable for lengths greater than 820 feet to 1,073 feet.

For situations requiring six fibers, use of a breakout kit will be less expensive at lengths of 220 feet to 285 feet. If you are using plenum cable, the distances are less at which use of a breakout kit are less than those distances given above.

It should be noted that all these considerations apply to cables used in fixed situations. If the cable is to be repeatedly flexed, or unwound and rewound, there will be a different set of considerations.

The use of fiber optics is growing and is rapidly replacing conventional wire in many applications. If you design studios or own one, you should evaluate the possibility of including fiber-optic technology in your arsenal. RE/P

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Electronic Sound Editing: The Dawning of a New Era

By Bob Predovich

Successfully incorporating new editing technology involves combining elements from the past, the present and the future.

I don't hear many of these comments anymore: "Sound is only 5%" or "Don't worry, it's only going through a smaller speaker."

It seems that sound has, more or less, finally arrived on the scene in the television and film industries.

But in the time it took for our industry to elevate sound to a more natural environment, much had changed in the surrounding environment. For the most part, dollars must stretch further while obtaining better value with regard to quality, in less time.

A case in point: Each week, we produce the stereo soundtrack for "Captain Power and the Soldiers of the Future," Landmark Entertainment and Mattel's interactive TV series. There are as many as 1,700 specific synch sound effects in each half-hour program. Yet this feature-film quality soundtrack is produced in only seven days.

It is becoming clear that to properly service, and do justice to, this novel entertainment sensation called sound, new tools and methods are needed. Yet, at the beginning of all our new techniques and technology is the human creative spirit that has been laboring for years with the manual methods of the past, when sound was not nearly as fashionable. It is this wealth of personal experience, combined with new technology, that will be called on to fulfill sound's potential.

In this regard, we must not lose sight of the fact that our greatest pool of talent has been employing these manual editing and mechanical synchronization methods for many decades. And in all those years, there has never been the type of technological revolution sitting at the sound industry's doorstep that there is today.

Now wait a minute. We've had SMPTE time code since the early 1970s. It was first embraced by the video industry as an electronic means of editing picture on videotape that had been done manually for more than two-thirds of a century with film.

Why, then, has it only been in the last few years that video-style editing is recognized as a true alternative, if not a preference, for sophisticated production such as dramatic television and feature film? A discussion of how we went wrong with video editing might help us avoid the same problems when dealing with sound post-production techniques more than 15 years later.

The first error we committed as an industry was to make the running of a video-editing system so much more complicated than a Moviola. This led to "operators" being trained to push the right buttons, adjust the right levels and generally understand everything from chroma phase to the "front and back porch" (there was a time when the latter just referred to part of a house) to be able to properly execute an edit.

Second, the new equipment cost hundreds of thousands of dollars more than film-editing gear. This quickly tarnished the concept as an alternative to the tried and true splicing tape method.

This compounded with the third reason to leave time code-based videotape editing out of fashion with the film world for more than a decade of its existence: inertia. Anyone who has dealt with the film industry realizes just how much it comes into play. And in many respects, there is a good reason.

Why give up things you have become used to until an alternative appears that encompasses the capabilities of the past and provides for new and more efficient means for the future? The problem is that "the capabilities of the past" are quite broad, even if they are not "state of the art."

They include not only the one-to-one contact between the artisan and his creation, but also the practical aspects of cost, functionality and reliability. It is apparent that the replacement of the tools of the past with ones that meet such a tall order has not been an easy achievement.

We've had time code for use in sound production for almost the same length of time as the video industry. Unfortunately, we've encountered similar problems and produced new ones of our own. As well as experiencing the classic conundrums associated with the user interface, the sound industry has suffered from a general lethargy epitomized by the quotes that began this article.

Unlike video editing, there was a lack of concentrated focus in the sound industry on what the new technology could mean. Suffer as it did from the complexity of the process, at least there was always a clear goal perceived in the direction the video industry was taking from day one: to at least recreate that which is possible on film.

This was not the case with sound. Early attempts in the mid 1970s to offer time code technology to sound post-production went somewhat astray. Unlike the broadcast video-editing environment, where high tech was the buzzword of the day, the music recording and film sound industries, used to a much lower level of technological prowess, were asked to embrace technological concepts that unfortunately were riddled with hidden dangers.

It is often said that time code is, at the same time, the biggest blessing and the biggest curse to an unwary sound industry. The shouts of "Is it locked in yet?", 30 seconds after the initiation of play, still reverberate 10 years later in many a sound studio.

An how about the drop frame time code generator I owned in 1982 that dropped frames at the minute mark as well as at the 20-second mark? We all have our own anecdotes.

Just what did this mean to an industry that wasn't sure where it was going from the outset? It clouded things considerably, and confused and disappointed both users and their clients. It also led to a detour that set the industry back even further.

Bob Predovich is vice president and general manager of Master's Workshop, an audio post-production center in Toronto. He is also director of Soundmaster International.

There were so many problems associated with the technical implementation of the processes, let alone the creative, that the industry set out to concentrate on the hardware. The next generation "chase synchronizer" was born, and the race was on to solve what had been the No. 1 priority in user's minds: getting the hardware to work right and be reliable.

Great strides were made. No longer did we have to wear our tape heads reading code at wind speeds. Microprocessors could now relate "tach pulses" to time code.

But hadn't we forgotten something? In videotape editing, they started with the concept that the most important component was the user interface. The "editing system" in the operator's mind was the CRT screen in front of him, and the capabilities that the software embodied in it gave him.

The hardware was not an issue. Intelligent interfaces sat quietly in racks, with a lack of front panel controls, and simply implemented what the operator requested via his control center. The system design concept revolved around the interaction between the operator and his needs, and the hardware was then designed to facilitate it.

Unfortunately, the audio industry, went off on a bit of a tangent. It spent so much time on the synchronizer hardware, and the interaction between machine and machine, that the more important link between the user and overall system took second place. However, that is not to say that the equipment that has evolved is neither excellent nor sophisticated.

In fact, there are many examples of devices that were far ahead of their time when first released. They have proven most useful for the tasks required of them. The problem arises when the inevitable question is asked: With this equipment, can we do what we have been doing for decades in the film world, and do it more efficiently, cost-effectively and with better quality?

I can personally relate to the efforts required to take a device like a chaser synchronizer that had been designed with different criteria, and try to make it into the equivalent of the video industry's I2. My partner, Andy Staffer, and I co-designed an audio-editing system that set out with these ideals. It wasn't long before we realized we had unwittingly become part of a "cart before the horse" syndrome.

I was constantly asking for capabilities that were not thought of in the original synchronizer design. Indeed, they were system-related and inspired by creative needs fueled by our desire to evolve the tried and true film techniques into the 1980s and beyond. We realized that we would have to follow the video editing example and decided to build from scratch an intelligent interface to support, at the machine level, the aspirations and potential available at the user interface.

The key word for our industry is evolution, not revolution for technology's sake alone. The inertia mentioned earlier is incredibly powerful. It is crucial that systems provide a like to the past that will encourage users of traditional hardware to take that first step.

For this reason, I see future technology as an adjunct to, not a replacement for, the systems to which I have alluded. If we are not cautious in our approach, we are liable to make the same mistakes that occurred 15 years ago in video editing. These mistakes have only recently been addressed.

It is crucial that the sound industry not lose sight of the need to link the past, present and future. RE/P

Suzanne Vega at Radio City Music Hall

By David Scheirman

The maturing of a new concert artist and the first use of a new arrayable loudspeaker system.

Suzanne Vega began writing and performing songs at age 16. Signed to A&M records at 25, she made a name for herself with an acoustic guitar. As her career moved from acoustic-music folk clubs to the concert touring circuit, her second album, "Solitude Standing" brought national attention with the breakout single "Luka." Her triumphant hometown concert appearance last October at New York's Radio City Music Hall in October marked both the maturing of a new concert artist and the first hanging use of Eastern Acoustic Works' new KF-850 loudspeaker system in a critical venue.

Sun Sound, Vega's sound company, is based in Northampton, MA, and has been supplying high-quality live-sound systems throughout the Northeast for several years. The company's original large concert system was built around BH-800 bass horns and MH-102 mid/high enclosures from Eastern Acoustic Works, Framingham, MA. In 1985, the company began to examine the various available loudspeaker systems, looking for compact, roadable and arrayable enclosures.

"There really wasn't anything on the market that fit our needs," said Bob Humphreys, Sun Sound's operations manager. "We approached EAW because we were familiar with their horn-loading technology and enclosure-building expertise. Our guys kicked around some ideas with EAW's designer, Kenton Forsythe, and the company agreed to work on developing a new system based on trapezoidal enclosures with dedicated signal processing."

Owner Herb Mayer first took delivery of 24 new KF-850 Virtual Array cabinets during the spring of 1987. An initial field-test of the new system took place in April with regional shows for groups like the S.O.S. Band, Cheap Trick and Vega.

System power amplification

Sun Sound technicians fabricated custom amplifier racks to power the KF-850 system. Model 8001 amplifiers from Crest Audio are used to drive the low-frequency and mid-bass sections of the system; each channel of an 8001 is connected to either four 15-inch or for 18-inch loudspeakers, driving a 2Ω load.

"Our plans are to set things up so that four Crest 8001s will run eight low boxes and the 15-inch sections of eight mid/high boxes," Humphreys noted. "We've been trying out the 8001s this summer with the Suzanne Vega system and they are working out quite well. They are built well electrically, and sound very good."

Carver PM1.5 amplifiers are used to power the 10-inch cone midrange units and 2-inch compression drivers. A pair of RCF L10/750K 10-inch speakers are mated to a single Carver channel, 4Ω load) and four TAD 4001 compression drivers, also a 4Ω load, are driven by a Carver channel. (See Figure 1.)

Heavy-duty, strain-reliefed multi-pair cables with screw-on fittings transfer the amplifier power to the loudspeaker stacks and hanging arrays. Convenient front-panel access is provided for the foam-lined road-case amp racks; quick-release input signal cable connectors and a sturdy-locking ac feeder cable connector make rack hookups quick and easy. High-powered fans are mounted above the Crest 8001 amplifiers for rack cooling.

The KF850 system

EAW's new KF850 Virtual Array system includes compact, trapezoidal enclosures and the MX800 CCEP (closely coupled electronic processor) unit. The KF850 is a tri-amplified, 3-way system loaded with a single 15-inch RCF speaker in a constant coverage horn enclosure. A proprietary RCF L10/750K 10-inch driver is loaded in a constant coverage horn section with a center displacement/phasing plug. A TAD 4001 beryllium-diaphragm compression driver is mounted on a constant coverage high-frequency horn that is positioned in front of the 15-inch LF section. (See Figure 2.)

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

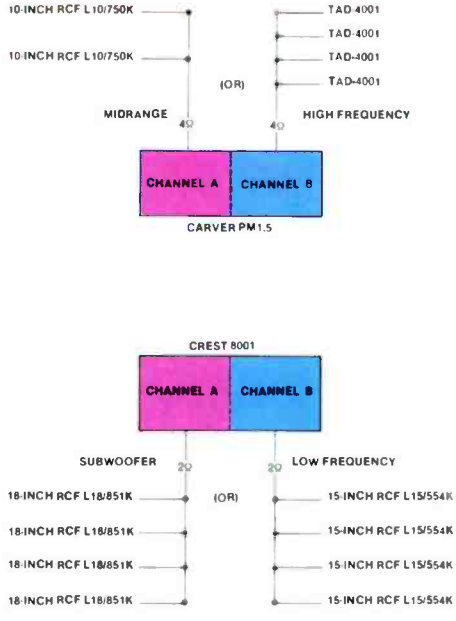

Figure 1. *Power amplifier loads.*

The KF850 enclosure is said by the manufacturer to have a constant coverage characteristic of 55° horizontal by 50° vertical, over the 200Hz to 20,000Hz frequency range. The LF, MF and HF horn subassemblies are designed to couple together so that the three separate components form an effective, phase-coherent system. The matching of the three horn sections into one compact, arrayable box enables system users to assemble large groups of boxes into a well-matched system.

The system's matching subwoofer enclosure, the SB850, contains a pair of matched RCF 18-inch loudspeakers front-mounted in a vented box.

"Direct-radiating subwoofers have been requested by many sound companies," said Kenneth Berger, EAW

Figure 4. *Humphreys pictured next to the lightweight aluminum hanging grid that is used to suspend four KF850 boxes.*

Figure 5. *The four KF850s flown in an overhead center array at Radio City Music Hall.*

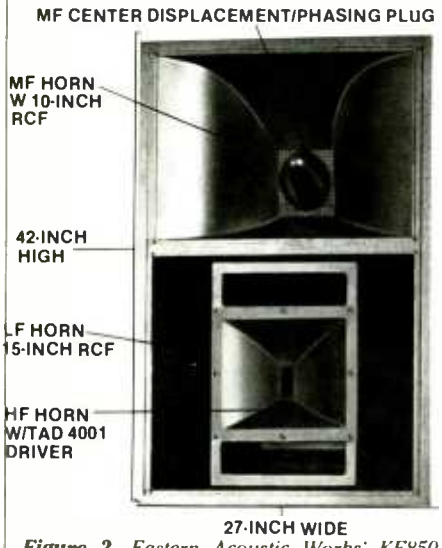

Figure 2. *Eastern Acoustic Works' KF850 front view with grill removed.*

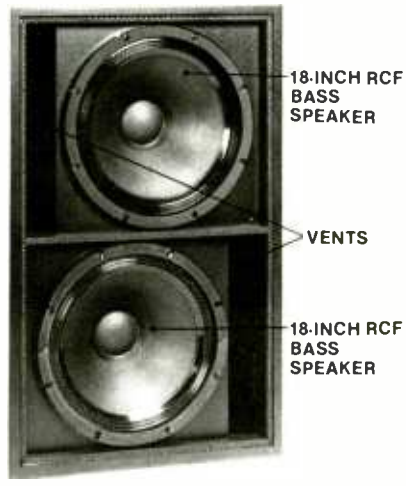

Figure 3. *Eastern Acoustic Works' SB850 subwoofer front view with grill removed.*

president. "We developed the vented-box sub enclosure first, and we are currently experimenting with a folded-horn version as well, for possible introduction in the near future." (See Figure 3.)

Each 850 series enclosure is equipped with dual Cannon EP-type connectors that are wired to an internal barrier strip. Individual banana-plug type test points are also available on the back panel. Heavy vinyl-dipped perforated steel grills protect the front of the box, and optional aircraft-type rigging fittings can be factory-installed. The SB850 subwoofers are trapezoidal in shape like the KF850 full-range boxes, so that the subs can be incorporated into compact arrays. The SB850s feature heavy-duty truck casters, while optional removable dollies are available for the KF850s.

The speaker system is matched to the MX800 electronic processor, which is programmed for the KF850 by a plug-in module. It provides time/phase correction, asymmetrically equalized crossover slopes, subwoofer low-frequency response enhancement and distortion protection.

"We've used the KF850s with both the MX800 and standard crossovers like the Brooke Siren Systems FDS-340," Humphreys said. "To me, the MX800 seems to help the components in this system work together better."

Setting up for Radio City

One of New York's most famous live-performance venues, Radio City Music Hall presented Sun Sound with a unique opportunity to field the KF850 system that Vega had been touring with, while trying out a new hanging grid at the same time. Rigstar Rigging, West Springfield, MA, fabricated an aluminum frame out of 6-inch channel rock. Graded fittings and hardened steel eyebolts offered secure attachment points (See Figure 4.)

"One person can pick up this hanging bar," Humphreys added. "A piece of rigging gear does not have to be heavy to be strong and safe."

K-Link spansets (nylon) and carabiners were used to attach the hanging frame to the KF850 boxes, making use of aircraft-style rigging track. Four of the KF850s were suspended in an overhead center proscenium cluster, using a pair of 1-ton C/M Lodestar chain-motor hoists. (See Figure 5.)

Four SB850 boxes and six KF850 boxes were stacked each at stage left and stage right, in double-high rows of five. A total of 20 boxes were stacked at stage level, offering a substantial stereo left/right speaker system. The 4-box overhead center cluster provided an added spatial dimension in the plush, high-ceiling hall.

To ensure clean, adequate electrical power, Sun Sound technicians brought in a compact, custom-built 100A 3-phase power distribution system. Two 60A cir-

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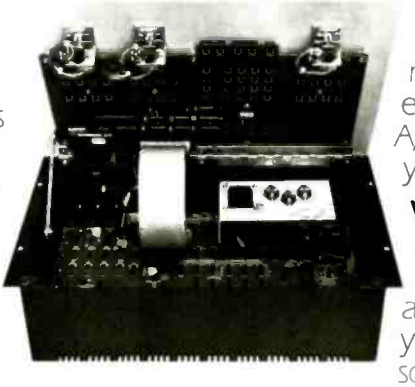

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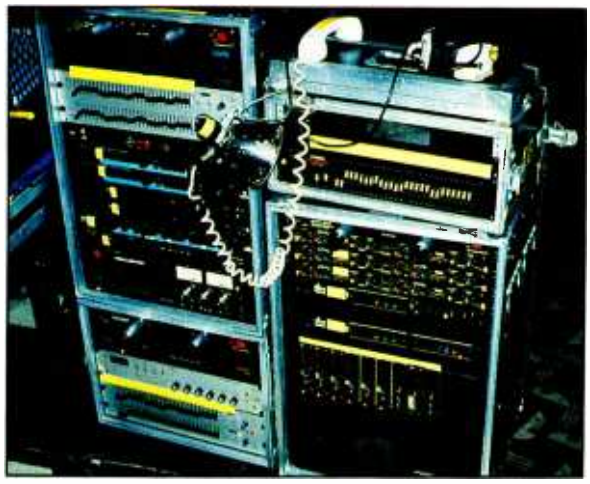

Figure 6. *Sun Sound's house electronics racks included Klark-Teknik and Yamaha graphic equalizers, dbx noise gates and compressor/limiters, and various delays and digital reverbs.*

cuits were dedicated to each amplifier rack, and two 30A circuits were available for stage monitor mixing equipment. An additional pair of 30A circuits with quad boxes was dedicated for on-stage band equipment.

"We also run a separate 30A circuit out to the house mixing position," Humphreys explained. "The Yamaha PM-3000 power supply draws about 8A by itself; then when you put that out on the end of about 250 feet of 10 gauge cable, there is a bit of a predictable voltage drop."

The entire power distribution system, including 125 feet of No. 2 feeder cable for panel tie-in, fits into a 30"x26"x30" road case that rides on its wheels. Sun Sound relies on a Delta-Y transformer to ensure an isolated neutral for the power distribution system, regardless of the environment or electrical hook-up.

Soundmixing gear

A Yamaha PM-3000-40 mixing console was used for the house mix. Robin Danar, the house soundmixer, has been mixing Vega's show since the beginning of the "Solitude Standing" tour. "I've really been enjoying this show," said Danar. "I like music that's intelligent and has some sensitivity. Suzanne's music has some open space in the arrangements, and I think that's good."

Mark Frink of Sun Sound was responsible for setting up the house mixing position for Danar, and mixing the show's opening act. Frink, who is in charge of audio at Dartmouth College's Hopkins Center, enjoyed having a chance to work with the new KF850 system at Radio City Music Hall.

"The company has really gone to great lengths to put together a concert sound system that not only sounds great, but is competitive on the road," Frink said. "The PM-3000 also makes a good soundmixing tool."

Sun Sound's house electronics racks included graphic equalizers from Klark-Teknik and Yamaha, and digital delay and reverb devices from Lexicon, in addition to a Yamaha SPX-90. Channel-insertable noise gates and compressor/limiters from dbx were also available.

The stage monitor system, handled by Sun Sound technician John Gallagher, was centered on a TAC Scorpion 40 x 12 monitor console, set up offstage right. Gallagher combined approximately 32 stage inputs into discrete outputs that were distributed around the stage.

Custom floor slant monitors built by Sun Sound housed JBL 2225 15-inch speakers and a 2420 1-inch compression driver on a 2425 Bi-Radial horn. Sun Sound's sidefill monitors, measuring 45"x22.5"x30", contained a pair of 2225s with one 2445 JBL driver.

"We pretty much sized these things to help out with the truck pack," Frink said. "They fit in well with the amp racks and other cases."

Stage setup

Vega's band includes a drummer, bass guitarist, electric guitarist, keyboardist and a background singer. Although Vega plays an acoustic guitar with electric pickups, the general tone of the show is definitely not folk, but an electric, modern sound. Electronic drum sounds figure heavily in Vega's music; in fact, more than 25% of the 32 stage inputs available to Danar at the house mix position are electronic drum sounds.

The acoustic drum set is picked up with

AKG and Beyer microphones, with a Shure SM-57 on the bottom of the snare drum. A sophisticated electronics rack at the keyboard position provides both a mono program output (passed through a Countryman direct box) and a click track signal that is available for the drummer through the stage monitors. The guitar setup includes a pair of Fender Princeton reverbs picked up with Shure SM-57s, along with an Aphex C unit, Yamaha SPX-90, Alesis Micro-verb and a Korg sampling delay unit. The bass guitarist plays through a Yamaha pre-amp, which features a back-panel XLR direct output connector.

"It's quite an easy stage to set up," Frink said. "The musicians' rigs are well laid-out, and there is not a lot of clutter. We put out only six floor slant monitors, along with the sidefill pair and a drumfill box. It goes together quickly."

Unique, vertical set pieces with back-lighting highlight the stage, one of which hides the bass guitar rig with its two E/V-15L loudspeakers and a Guild-Hartke 4 x 10 cabinet. Because the bass rig is pointed across stage rather than to the front, a 2-piece plexiglass baffle is positioned on that side of the drum set to reduce drum microphone leakage.

Sound of the show

Radio City Music Hall has probably seen nearly every available type of touring sound system in its star-studded history. The curved, high ceiling and multi-tiered rear balconies can present a challenge for portable, 1-day systems and their operating crews. Sun Sound's new KF850 system received favorable nods from the local building crew. One stagehand working the deck said, "If two men can't lift any piece of sound gear, it's not much fun to have it on this stage. This system is smooth."

"What's good about the new system for me is that I can say 'yes' more often."

Robin Danar's well-crafted special effects mixes came across nicely in the sold-out house, and a particularly striking effect was evident on Suzanne's guitar.

"The new Yamaha guitar has a switch, so that you can send strings 1, 2 and 3 to the left and 4, 5, and 6 to the right, or do an even-odd thing," Danar said. "When a room is responding well to a stereo PA system, then it can really sound rich and exciting...not just another guitar."

The sound system was very articulate and seemed quite well-balanced. It complemented the catchy arrangements and moderate volume levels of Suzanne Vega's show. It was refreshing to hear a sound system that enhanced, rather than detracted from, a live concert.

Humphreys added, "what's good about the new system for me...since I'm the one that has to sell it to new clients...is that the KF850s let me say yes more often."

"They ask, 'Is it compact? Lightweight? Does it fly? Do you have subwoofers? Can we use it without subwoofers? Does it pack well in the truck?'...we're saying yes a lot these days."

Photos by David Scheirman

RE/P

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Writing a Business Plan for the Recording Studio

By Sarah S. Coleman

A well-written plan can be more than a loan prerequisite—it can be a management tool as well.

Planning and management are the key ingredients of any successful recording operation today. You need to find out who your clients are, what the clients want, satisfy those wants and do all this while making a profit.

You might think that businesses fail because of undercapitalization or poor management. But according to one counselor with the Small Business Administration, the real reason for business failures is *no* planning. More than half of all new businesses fail within the first two years of operation and more than 90% fail within the first 10 years.

Given these statistics for businesses in general, and adding the highly competitive nature of recording business, a well-written business plan is essential.

Many facility owners or start-up entrepreneurs first hear of business plans when they approach a banker for a loan. Oftentimes, facilities start up and are making ends meet without a business plan. A few years down the road they hit a snag with their cash flow and can't meet payroll, rob Peter to pay Paul and soon realize they need more capital.

The first inclination is to blame the new facility that opened or a heated rate card war.

But the real answer lies in planning. With a business plan, the owner(s) plans on the future of the facility and how it can relate to the industry.

Mark Goodrich, a Small Business Development Center counselor located in Kansas City, MO, says that "most business owners don't like to write or say they don't have time to write a business plan. But what's more important is the *process* of thinking about your business and answering the questions that a business plan forces you to answer."

Most importantly, the business plan is a management tool as well as a financing device for the banker to examine. Although it can take a lot of time to write, it forces you to take a critical, objective and unemotional look at your studio. It will help you communicate your ideas to your staff, prospective partners and investors.

A business plan can be written at any stage in the life of an operation—not only for a start-up facility.

Many entrepreneurs tend to put down business plans because of misconceptions that the plan is merely a selling tool for raising money, and their studio plan has no fatal flaws.

But business plans can identify weaknesses, pinpoint needs, define objectives, and in the case of a start-up venture, help prevent opening a facility that is doomed to failure from the start.

Goodrich recalls one client who had been operating a business for about 18 months and came for assistance. "He wrote a business plan and then he realized that the market was not going to last. He got out of the business by choice before it forced him out."

Whether you plan to write the plan for loan purposes, a management tool, or both, you can follow the basic guideline on page 62.

Writing a business plan

First, give yourself time to write your business plan, perhaps a long weekend or evenings. Don't try to pick it up on your lunch break or in between clients. Give it your undivided attention.

To begin your business plan, start with a simple, short *cover sheet* stating the name of your studio. If you plan on submitting this for a loan proposal, write a separate cover sheet for each bank or capital source you submit to.

The second sheet should provide an *executive summary*, which is really an introduction. Write the summary after you have completed the plan, because once you have finished you may have a better idea of *what* it is you are introducing or proposing regarding your facility.

The summary should include the current position of the facility. List the name, address, principals and the type of facility you are describing. Briefly, in one paragraph, describe the current status of the studio.

The first topic is the *facility description*. Begin by discussing the facility itself. What is the business? Why did you choose the particular location, and how will you run it? Is the business a start-up, expansion, or takeover? Is it a closely-held corporation, sole proprietorship, partnership or corporation? Why will your business be profitable? When did you open? What are the operation's hours?

Also, express your personal objectives and the studio's objectives for being in business and why you will succeed. Why do you want to own the company and what do you see for the company's future?

Secondly, discuss the *services* your

Sarah Coleman is associate editor for *RE/P* magazine.

studio provides. What exactly does your studio do? Detail the services and equipment that you can provide. What are the existing services you have and what are the possibilities for the future? Remember to describe these services in terms that a non-professional can understand.

The *marketing analysis* may be one of the most critical areas of the plan. You should examine and define your target market carefully by asking the question, *who* needs my service and *what* will my service be? What is the market size, what percent of the market can you have and what is the growth potential?

Detail the services you are pursuing: jingles, records, demos, scoring, tape duplication or post-production.

It is vital that you know exactly what your market is. Clients can be defined by geographic location, occupation, sex or any number of conditions. It doesn't matter what the mix is, just as long as you know exactly what it is comprised of. Also, look at the decision-making characteristics of your clients. Why do they choose a studio, and what draws them in? Is it equipment, expertise, location? And finally, how do you intend to attract and keep your clients?

Specific information on the size of your market can be obtained from your Chamber of Commerce, trade publications, marketing and research consultants, audio engineering colleges and schools, and the Federal Census Report.

Your operation ultimately relies on finding your clients and their satisfaction as the main source of revenues. No bookings, no business.

Analyze your competition and their market shares. Look at the consistency of their business. How are the operations similar and dissimilar? What are the strengths, weaknesses and what have you learned from watching their operations? Pick up the good practices of your competitors and avoid their errors.

Finally, detail how your company specifically relates to the market and how it fills specific client needs. Complete this section with a list of your major and secondary clients.

Following your market research, include the *marketing plan*. It should detail specific marketing strategies and promotions for attracting clients. Explain rate card rates, describe advertising, direct mail plans and special promotions for your studio. If you are advertising in publications, detail each one and examine the readership studies. Also, in-

Small Business Development Centers provide assistance

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- *cashflow, working capital*
- *obtaining credit, financing*
- *preparing loan packages*
- *budgeting*
- *new product development*
- *business law*
- *doing business with the government.*
- *advertising/public relations*
- *market feasibility*
- *technology*
- *purchasing decisions*

The management and technical assistance services are provided at no charge and all services are confidential. Call 202-887-5599 for information on a center near you.

Business plan outline for the recording industry

- **COVER SHEET:** Name of facility, names of principles, address and phone number of facility
- **EXECUTIVE SUMMARY**
- **TABLE OF CONTENTS**

I. FACILITY DESCRIPTION
- A. The facility—describe physical space, location and equipment
- B. Strategy for the facility's growth. What are the strengths and weaknesses of the facility
- C. Define personal and facility objectives

II. SERVICES
- A. Description of existing services
- B. Potential of new services
- C. Special equipment

III. MARKET RESEARCH AND EVALUATION
- A. General discussion of the pro audio industry as it relates to your facility
- B. Market size now, five years, 10 years
- C. Market trends
- D. Market segments
- E. Competition's strengths and weaknesses
- F. Estimated market share and sales projections for the next three years
- G. Market shares of other players in the market
- H. How your service applies to the region and industry

IV. MARKETING PLAN
- A. Overall marketing strategy
- B. Rate card structure
- C. Promotion/Advertising/Public Relations strategy and activities
- D. Geographical penetration
- E. Profitability and break-even analysis for the facility
- F. Sales: Targeting methods for prospective clients

V. DEVELOPMENT PLANS
- A. Future equipment additions and projected costs
- B. Prospective markets
- C. Facility upgrades and projected costs
- D. Staff additions and compensation

VI. STUDIO/FACILITY OPERATIONS
- A. Geographical location of facility
- B. What operational advantages do you have
- C. What operations are solely internal
- D. What operations do you depend on outside services
- E. Present capacity for operations

VII. MANAGEMENT TEAM
- A. Key managers, roles and responsibilities
- B. Management compensation and ownership
- C. Staff and responsibilities, future additions
- D. Staff compensation, salary increase plan, bonuses, benefits
- E. Board of directors
- F. Stockholders

VIII. FINANCIAL
- A. Current funding and applications of those funds
- B. Capital equipment list and values
- C. Balance sheet
- D. Break-even analysis
- E. Pro Forma Income Statement
- F. Pro Forma Cash Flow Analysis
- G. Deviation Analysis
- H. Historical Records: previous balance sheets and tax returns (if an existing business)

IX. FUNDS REQUESTED
- A. How much money is needed now
- B. How much money will be needed in five years, 10 years
- C. How will these funds be used—be specific

X. EXHIBITS
- A. Resumes of key managers
- B. Rate card and other promotional materials
- C. Quotes or estimates for equipment and facility upgrades
- D. Photos of facility
- E. Client references
- F. Market studies and articles from trade journals

clude a contingency plan if your business grows faster (or slower) than you anticipate. Name your main competitors and how you will position yourself.

Although many studio owners agree that business comes in by word-of-mouth, this may only be reliable for established studios with quality reputations, but not a wise choice for a new studio. New owners may invest large amounts of money in equipment and room design, but careful studio marketing plays an equally important but often neglected role.

In this industry, there is always a new toy on the block that you probably have on your want list. So the *development section* should be fairly easy to compile. Break this into four sections:

1. *Markets*, new business areas you could pursue.
2. *Hardware*, equipment you will need for these markets.
3. *Facility*, any enhancements to your facility that would be needed.
4. *Staff*, additional personnel that would contribute to pursuing these new markets.

Be realistic and write about things that are possible within the next three to five years.

The studio *operations section* should detail who does what and when. Although no single project is the same as another, attempt to trace the process of your service from securing the client to the finished product.

List the service advantages you have, capacity of operations and your standard costs for producing the service. Include your overhead on estimating the costs.

Because studios are run by people, your *management* and support staff are critical. Describe in detail each member of your staff, their *qualifications* and responsibilities. Design an organizational chart of your staff, and provide plans for staff growth and compensation.

Everything you have written about so far has *financial* implications. Even though you may not be a financial wizard, the heart of your operation lies in the accounting system. It is essential that you understand and control your bookkeeping system, or it will control you. Depending on the size and structure of your studio, you may or may not have an accountant who provides monthly statements. If you are using this as part of a loan proposal, secure an accountant to produce the following financial reports.

The four financial documents you should provide are:

1. *Balance sheet*, a financial position statement at a particular point in time.
2. *Break-even analysis*, report of revenue and expenses.

3. *Income statement*, profit performance and results of operation over a period of time.
4. *Cash flow analysis*, sources and uses of cash.

Also include a sheet of all sources of funding and how those funds are allocated. A capital equipment list should include all equipment, including office furniture, business machines and office supplies with the model number and dollar value.

If you own an existing business, include past (up to three years) historical data, including tax returns, balance sheets and income statements.

If you are planning on submitting your business plan as part of a loan proposal, include a section titled *Funds Requested*. The difference between your business plan and a loan proposal is merely showing the banker that you know what you are doing and you will also be able to make the bank's investment as risk-free as possible.

So, before you venture out with your plan for a loan, do homework on bank loans and be prepared with plenty of questions. Beware of a banker who can't say no but can't provide adequate financing either, or the banker who gives the wrong loan for the right reasons. If you have honestly written the business plan, you now know exactly how much you need, so make sure to get it.

Less than what you think you will need will just make your business more difficult to run. However, listen to your banker's suggestions on other options, but pay careful attention. As owner, you are the only one who knows how much it will take to see you through.

In your loan proposal, clearly state how much funding you are seeking now, how the money will be used, how the money will be paid back, and how much funding you will need five and 10 years from now.

According to one loan officer from a bank, a studio's business plan needs to show that the studio plan can actually be accomplished and has sensible criteria. It needs to show ingredients that allow it to be looked at as a viable business. Management stability and expertise are also examined.

Most first-time loans do need some sort of collateral, he said. The most important question that needs to be answered is the source of repayment, which normally comes from the business operational profits. Collateral is a secondary source of repayment.

The biggest error business owners make in first-time loan applications is incomplete financial documentation. It is important to realize that each loan is analyzed individually, and there really is no such thing as a loan application for a business.

"Ideally, we want the individual to put up as much or more cash than we would in a first-time loan situation," he said.

Include any documents that support your plan under the *exhibits* section. These documents will vary depending on the stage of your operation. A few suggestions are resumes of key staff, quotes or estimates for equipment or studio upgrades, photos of facility, rate card, promotional material, magazine features on the facility, client references and market studies.

After you have completed the outline, write the executive summary, table of contents and design a cover. To complete your plan, have a binding prepared.

Remember, your plan is not chiseled in stone. Your business will change, markets change, new equipment arrives and technology will change as well. Your plan is a management tool in that all the parts of your business are integrated into *one* plan. Each part affects and complements another. When you change or adapt one section, adapt your plan in the other areas it affects.

All the planning in the world won't shield you and your business from a crisis, but it can help you deal with a crisis when it does arise. The best laid plans often change, even for successful studios.

For Target Productions in Boston, one of their secrets to success has been to provide high-quality equipment. The facility opened a video house in October 1986 and then in mid-1987 decided to open an audio suite.

"The industry is driven by what equipment you have and how you can provide the highest quality at the lowest cost," says Peter Fiedler, operations manager.

When they decided to open the audio division, they focused on design and added equipment that is both hi-tech, cost-efficient to operate, and could provide quality and convenience to the client.

"We found the Synclavier was the answer to solving the dilemma. The Synclavier has terrific quality and is a great device because we do a lot of mix-to-pix work. The client has control because they have so many options available to them," he says.

He added that attitude is also important. "Bend over backward to make it more pleasant for the client. Our sound designer, Jeff Largent, has a terrific personality and treats jobs the same whether they take 15 minutes or 15 hours.

Remember...

1. Write clearly and concisely.
2. Don't overdiversify your venture if you are a young facility.
3. Don't have unnamed people on your management team who will join you at a later date.
4. Don't describe technical operations in terms only an engineer can understand.
5. Estimate your potential sales carefully on the basis of your marketing study.
6. Don't make ambiguous statements.
7. Do disclose and discuss current or potential problems.
8. Involve all of your studio's management team in writing the plan.
9. Don't overstate or inflate revenue and accomplishments. Be realistic.
10. Write the plan as an outsider looking in. Avoid the use of "we." "our studio," "I think."

"This is a tough market to break into—a tough nut to crack. If you provide high-quality and innovative thinking, you can corner the market. The guy down the street may be doing the same thing as you, but if you do it with a smile and don't kill too much in the wallet, you can succeed."

Nancy Evans, studio manager for Hyde Street Studios in San Francisco, says service is the most important ingredient for a successful business.

"This is a service-oriented business. The single difference is service and how much you are willing to do. Some clients may want cassettes at 3 a.m. or call three hours before their session and want special equipment that we have to get from Los Angeles.

"It just depends on how far you are willing to go. One client was bringing children, so I rented children's videos and a babysitter. Whatever we can do, we will try to give the best service."

Successful facilities don't just happen. They need the right mix of people, equipment, facility and clients. Use the sources available to make sure you're on the right road to success—accountants, bankers, lawyers, manufacturers, SPARS and other studio owners are a few.

Furthermore, plan and select your ingredients carefully. Because it is those ingredients that will ultimately satisfy your client—making *your* business a success. RE/P

Engineer Interview: Ed Cherney

By Billy Cioffi

The engineer on Ry Cooder's "Get Rhythm" album discusses how to create live ambience in the recording studio.

Ed Cherney

Ed Cherney started his engineering career as Bruce Swieden's second engineer at Chicago's Paragon Studios. There, he worked with Jerry Butler, the Chi-Lites and many other R&B artists.

Because Chicago is a well-known center in the commercial and advertising world for jingle production, Cherney also engineered many such projects. His extensive background in these different recording environments made him uniquely equipped to man the console during Ry Cooder's recording sessions for the album "Get Rhythm."

Cherney is aware of the special emotional characteristics that makes Cooder's music so appealing, but recognizes that the moment must be captured through technical means.

RE/P talked with Ed Cherney while he was mixing the new David Lindley album, which was produced by Linda Ronstadt.

RE/P: *How did you first become involved with Ry?*

EC: Ry was working with George Massenberg. George, luckily for me, got busy. Ritchi Salvado said, "I know this guy, Cherney, you've got to try him out." So Ry called me and we did a Champion Spark Plug commercial together. We got along very well and had a lot of fun.

RE/P: *How does working with Ry differ from other dates you've done?*

EC: Working with him is different, very different. You're working with the "cats." These guys are real musicians and they play. The moment is there and you have to be there with them. It's not like, "Let's get a sound on this," and "Are you ready? Should we record now?" It's more like, you better get that!" When those guys walk in a room, you better get

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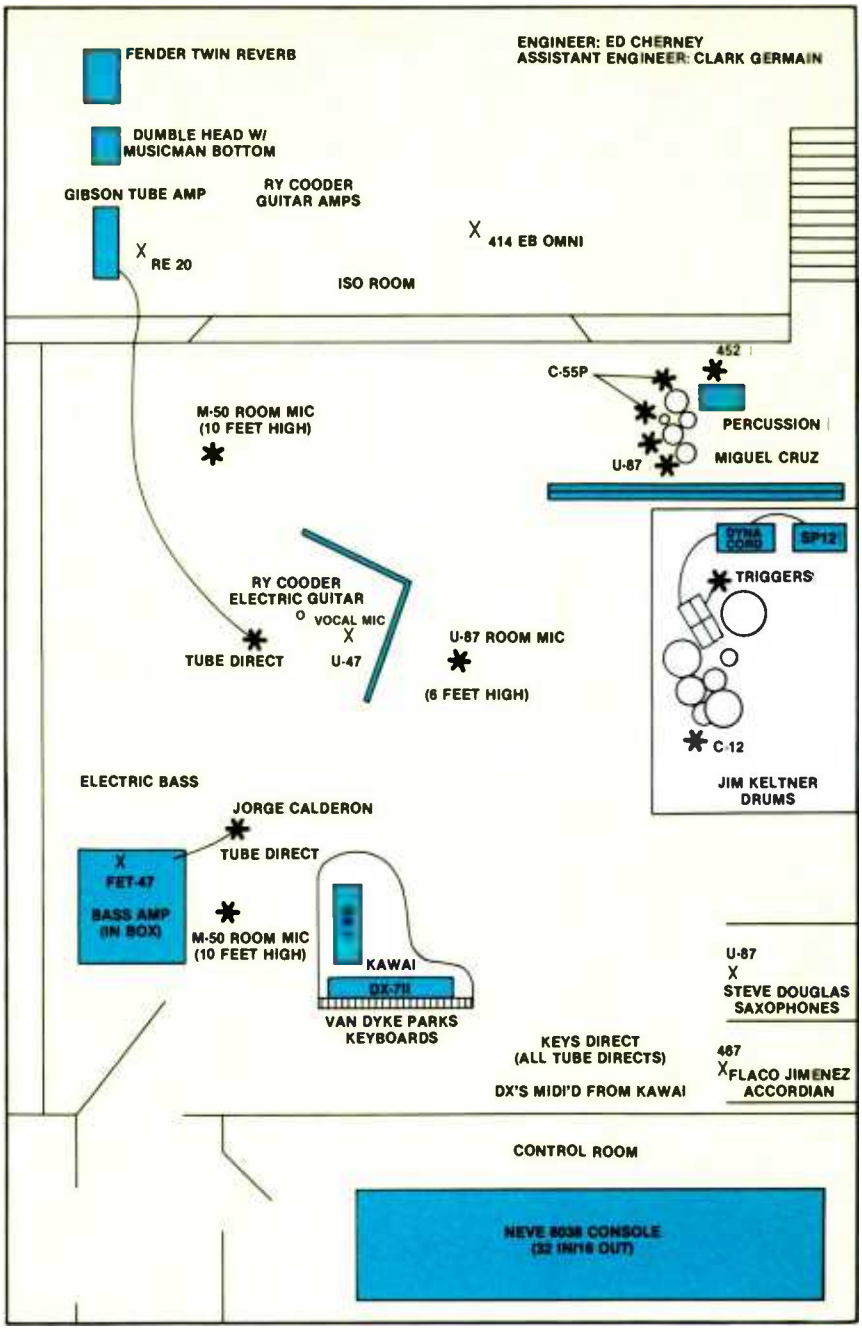


Figure 1. *Studio layout for "Get Rhythm" sessions at Oceanway Studio 2, Los Angeles.*

that tape machine moving and not miss an instant.

RE/P: *In other words, it's like the old days, let's get in, set up and make some records?*

EC: That's exactly right. One of the best things is that Ry takes responsibility with the guys as the band leader. He gets them to play in the mood he wants, without really knowing what it is they are going to be doing. Creating the environment, whether it is fun or fear. It could be cajoling, it could be joking, but these guys never play it the same way twice. It's not like a pop record.

The basic process was like this. He would go out in the studio, we'd get a sound on him, and he would start playing. But not coasting either; it was digging-in playing, and the guys would wander in, sit down and start playing along. The tape machine is rolling, and what you get is about five minutes of incredible excitement. A lot of times it is just unbelievable.

Recording setup

RE/P: *Does he have a pretty preconceived idea of his recording setup and placement?*

EC: You really don't know a lot of the time. For example, when we started the setup, he wasn't exactly sure what he wanted, and he hadn't made a record, other than movie composing, in a long while. We searched for the right setup (see Figure 1). We set up the drums on a platform, miced everything, got the bass

and worked out the isolation.

It is really difficult to get enough separation on everybody but still have it intimate. You've got to be able to hear each other, see each other and feel what's going on. Nothing can get in the way of that—from headphone mix on through—nothing can get in the way of that communication.

Guitar sound

RE/P: *In terms of recording Cooder's big resonant guitar sound, how did you approach that?*

EC: It is very difficult to record. You have to understand where we, as engineers have come from with multitrack recording. For years, the goals have been friendliness—precision—and fastidiousness. I worked as an assistant to Bruce Sweiden and Quincy Jones for years, and on those records, everything had its place sonically.

In the studio, Ry's sound is enormous. You have to be open-minded because it's hard to place that sound in the track. You're not going to be able to place a kick drum, a bass guitar or other instruments the way you normally would on most pop records. With Ry Cooder taking care of business, everything else around him is icing.

It is noisy and it is wide as the Mississippi, and is nearly three-dimensional. He has a very literal idea in his mind of what it should sound like. A lot of time in the studio you imply things. He wants to hear the thing literally. I find it to be very challenging.

"These guys are real musicians, and they play. The moment is there and you have to be there with them."

Ry detunes his guitar, which puts the low strings right in the range of the fundamentals of the bass guitar. It is tricky placing things. In terms of equalization, you don't go to the places that you normally would on a pop record. It's easy to get into the dogma of being an engineer—this is the way it was to be. If it doesn't sound right, Ry says, "Get me something bigger and older, get me the biggest and oldest microphone you've got."

RE/P: *Did Ry use all three amp set-ups at the same time?*

EC: No, he never used more than one at a time. All we did was move the RE-20 into place for whatever amp was being used at the time.

RE/P: *Is that a Kawai acoustic piano or an electric grand that's MIDI'd with the DX-7s?*

EC: It's Ry electric grand with retrofit MIDI.

RE/P: *So as you record are you, in effect, mixing it to his ears and giving him*

Table 1. Microphone assignments for "Get Rhythm" sessions.

Instrument	Microphone
Drum overheads	
left and right	AKG C-12s
Acoustic toms	Shure SM57s
Kick drum	
(2 feet away)	Neumann FET 47
Kick drum	
(inside shell)	AKG D-12
Snare drum top	Sony C-55P
Snare drum bottom	AKG 452 w/ 10dB pad
Hi-hat	Sony C-55P
Room mics (distant)	Neumann M-50
Room mic (close)	Neumann U-87 omni
Dynacord &	
SP-12 triggered drums	Direct
Bass amp	AKG FET 47
Bass direct	Demiter Tube direct
Congas	Neumann U-87s (2)
Timabies	Sony C-55Ps (2)
Triangles, etc.	AKG 452
Cymbals	Neumann U-87
Kawai keyboard	Direct
Yamaha DX-7	Direct
Yamaha DX-7II	Direct
Tenor and bariton sax	Neumann U-87
Accordian	Neumann U-87
Electric guitar:	
Amp close	E-V RE-20
Amp room	AKG 414EB omni
Direct	Tube direct
Vocal (Ry Cooder)	Neumann U-47

a representation of the final outcome? It is, after all, a live blend in the studio itself.
EC: Yes, and I'll tell you something else—we lay down rough mixes in 10 minutes and end up using a lot of the rough mixes on the record. You could never beat them again; everyone was so in tune, the moment was there and we caught it. As an engineer, it makes you sweat, but it's wonderful at the same time.

"Making a record for Ry is based on the sound of old recordings."

***RE/P** Recreating the live ambience in a studio?*
EC: Oh, absolutely! Making a record for Ry is based on the sound of old recordings. We've tried all kinds of different things. There are so many variables in the studio today you can spend forever. In the old days, you might set up a recorder in a hotel room with wooden floors and parallel surfaces, which gave you a certain sound. The performer may have been facing up close to the wall while playing and singing into one mic. It's very hard to get that sound in a studio environment; we are not set up to do that a lot these days.

Main signal path

***RE/P:** What pieces of equipment were used in the main signal path?*
EC: The console was a Neve 8038, the 2-inch machine was an Ampex ATR-124 with Scotch tape (250 @ +3/250 nwbrs).

***RE/P:** And the monitors?*
EC: I used NS-10s; the mains at Oceanway are a custom system and I really don't know what they have up there. I checked some things up top, but worked mostly on the Yamahas.

***RE/P:** Was there any unusual signal processing used during this project?*
EC: Yeah...especially on Ry's guitar and some of the other rhythm instruments we used LA-2s to overdrive the inputs and create odd harmonic distortions. We also did some unusual things on some drum overdubs. Ry and Jim Keltner each have these old Sony 6000 ghetto-blasters they picked up in Japan 10 years ago. The 6000s came with these really horrible mics that must have cost about 99 cents each. We took those mics and hung them over the drums and plugged them into the input of the blasters. These things have this awful limiter inside with about a 100:1 compression ratio, which knocks down the impact of the sound coming in, and then opens up to bring out the harmonics. We used that sound on all of the drum overdubs.

"These guys never play it the same way twice. It's not like a pop record."

***RE/P:** What were the primary responsibilities of your assistant engineer, Clark Germain?*
EC: Mainly, he was responsible for the mic set-ups, loading and operating the tape machine, and patching.

***RE/P:** When you discuss the sessions, with all the barriers and variables, a look of absolute exhilaration comes over your face and into your voice. Something tells me that you love this high-wire musicality.*
EC: I do. It's very interesting. It's quite challenging but there's also a chance to experiment in the context of it all. It is not a job for the timid, certainly, and there is never a dull moment.

It's like the old days—everybody at once—minimum overdubs. Everybody was out there at the same time thrashing around and making great music. It is actually a lot of fun. RE/P

On the Job Training — An Overview

By Rosanne Soifer

Because many studios no longer have time or money to train people, going to school to become an audio engineer is now the norm, rather than the exception.

Photo by Shelly Rusten

Students at the Institute of Audio Research, New York, engage in a recording studio workshop at the Institute's Control Room B.

A few years ago, the process was relatively straightforward if you wanted to become a recording engineer. You found a studio that would let you help out for free, and you would learn as you spent more time there at the facility. Later, as your skills developed, occasional sessions for pay or even a staff position opened up, and you were on your way.

Rosanne Soifer is a New York-based free-lance technical writer

Times have changed, and the situation has changed drastically. Because there are many highly trained people available to work and will take almost any job to get started, facilities of all kinds have been less willing to invest in a full training program for the complete novice. Increasingly, recording schools and college music industry programs use their placement services to find jobs for students that they have trained.

"The days of 'bootstrapping' yourself into the industry are over—you've got to go to school," says Miriam Friedman, dean of the Institute of Audio Research (IAR), New York. Because the state of the art constantly changes, facilities are less willing to take on absolute beginners in technical capacities. The two main reasons are time and money.

"The recording industry has outgrown on-the-job training with studio time at $240 an hour," Friedman says. "Because of economics, facilities are looking for people who are already trained and ready to work. It's no longer a come-hang-out business."

Gofers and generals

There are jobs for beginners, but because of economics it is increasingly rare to find talented self-taught people, says Bruce M. Merley, president and general manager of Clinton Recording in New York. At Clinton, a person in an entry-level job is called a gofer, with a salary range based on experience.

"Gofering is a discipline process where the employee sees a broad view of the studio's operations," he says. "Most people who come here start out as gofers, with the possible exception of maintenance."

A slightly different entry-level job title in a recording studio is general. (In the business world, the equivalent term probably would be administrative assistant.)

"A general first comes in the morning and sets up the room: supplies, mics, tape, etc.," says Kooster McAllister, director of remote operations at the Record Plant, New York. "The next thing they learn is the tape library, or indexing the system. After that they start doing tape copies. All generals are encouraged to observe and help on sessions during their own time."

The situation may be more complicated at facilities that handle broadcast or post-production work. There may be more outlets for untrained people, but there may be less opportunity to move up.

At Editel in New York, for example, people without technical training start out as coordinators. This position is similar to a general, and the title is given to those who work in support services. Everyone who is a general goes through a supervised training program.

"I can only consider people who are decision-makers and can work logically on their own."

Technical employees such as playbacks (equivalent to assistant engineers in recording studios) and editors must have experience.

"Playbacks and editors are already skilled when they are first hired," says David N. Smith, Editel's senior project engineer. "They're even interviewed by other technical people who'll know right away whether the applicant is familiar with the terminology and equipment. What's even more important is the applicant's attitude; they simply cannot be difficult to work with."

While studio operations may seem fairly standardized (taking into account such differences as in what medium the final product will be used), remote situations vary considerably.

"Remote is no place to hire or even attempt to train an inexperienced person, because you have only one chance to get it right," says McAllister. "I can only consider people who are decision-makers and are able to work logically on their own. Remote is also no place to try out an intern or a recent graduate."

Educational programs

The days of making room for the talented newcomer seem to have gone the way of multi-album deals. The "in" (if any) is provided by internships and placement programs at recording schools and colleges. David Smith at Editel remembers when "the education wasn't practical; the students weren't taught either testing or setup techniques."

From all accounts, this has changed, as the schools have incorporated placement offices to find jobs for students after graduation, and internships while they're still in school. Editel's current intern, for example, is a student at Montana State University who works for 12 credits and must turn in a weekly report to his school adviser.

Says the IAR's Friedman, "Our internship program began in the summer of 1984. Before the program was instituted, people who were well trained graduates still had to go through a free internship, which really meant working for nothing. The IAR decided to 'exploit' the industry by giving school credits for the freebies the students were doing. I think we sort of raised the consciousness of on-the-job training. The internship 'legitimized' working for free."

Kevin Henneman, an IAR graduate who is now an institute instructor in digital logic and the design and fundamentals of audio technique, interned at a New York studio that subsequently offered him a job. The internship was a learning experience that allowed him to receive school credit and build a foundation for a career.

"As an intern I worked closely with several people at once," he says. "A cooperative attitude and patience were the most important things I learned, and that you must have a close relationship with your immediate boss.

"Bad attitudes usually mean bad experiences—too much too soon. Your age and experience mean nothing; the faster you learn the faster you'll move up."

Five Towns College, a private college on Long Island, NY, also runs a music intern program for all job categories. According to Susan Faber, program coordinator, "The few times it hasn't worked out are when a student expects too much."

The next step

After graduation, the picture changes. Both Five Towns College and the IAR run placement offices. All incoming jobs are screened first, and no freebies or "salary negotiable" jobs are passed on. And except in a union situation (such as the NABET, ISTSE and IBEW), training and probationary periods are up to the employer.

At Clinton Recording, new employees are on an 8-week probation period, where they are expected to apply the skills they've learned.

"Our training here is very broad-based," Merley says. "You learn from your immediate supervisor or the person you're replacing. The schools may be able to teach the technology but people knowledge is learned on the job."

"When training anyone, dedication and enthusiasm should be taken into account as well as experience," McAllister says. "Don't expect people to read your mind—even if it seems like common sense, it may have to be spelled out." RE/P

Continued from page 47

MF: Is there a central earth ground to which everything is tied?
JD: Each room has a stake—a copper rod, five feet in the soil. Anything that can be connected between the two rooms can be ground-lifted. We are fully prepared to take care of any type of ground-loop problem if there is an individual circumstance.

MF: I noticed there weren't any MIDI tielines on the access panels.
JD: We really haven't gotten into that.

MF: Why?
JD: Well, to this point it's been a lack of time. I think it's something we'll incorporate later.

MF: Do you run video "house-sync" here?
JD: Yes.

MF: Do the audio, video, cue lines, and house-sync all run through separate conduit?
JD: Yes, in every room we have separate steel conduit. Throughout the building, it is the same thing. There are basically three pipes: One is dedicated to audio lines that are low power lines; another for the high power lines such as cue lines; and the third houses the house sync and the dc control lines and such.

One of the parameters of the wiring system is that almost everything is interfaced via DL connectors. It's been set up this way so you can take almost anything anywhere in the building and it would be ready to go. It may not be appropriate, but everything matches from room to room, so we've got incredible flexibility. You don't ever have to worry about things such as changing the pinning—everything's set to go.

MF: What pin is high in your 3-pin XLR connectors?
JD: Pin 2.

[On November 24th I spoke with Sal Greco about other elements of the wiring design.]

MF: What type wire was used in wiring the studios?
SG: We used Gotham Audio mic cable for a majority of the studio runs—it has good shielding properties, is easy to work with and is cost-effective. There are also a few direct mic lines run with Monster cable.

Also, the entire monitor set-up uses Monster cable from the board out, including the 2-track.

MF: Did you do listening tests before selecting the cable?
SG: No, they were selected on the basis of their apparent construction quality, reputation and cost.

MF: What other special things were done during the system interface?
SG: Each studio has several powered, 8-bus q mixers—each musician can have a personal headphone mix.

There are direct boxes built into every mic panel, and a couple of 12-input DI boxes, on umbilicals, for the control room—none are run as parallel inputs; all are independent.

MF: Do they all go through the mic preamps of the consoles?
SG: Yes.

MF: What else?
SG: There are video lines in all rooms, with a video patchbay in each, allowing access to the central patching room; tielines for intercom throughout the building; 80 balanced audio lines run between each room; 25 unshielded control lines available as needed; 180 amps of electrical power for each control room; and a climate-controlled machine room for each studio.

In print, it is very difficult to do justice to a facility of this magnitude and sophistication.

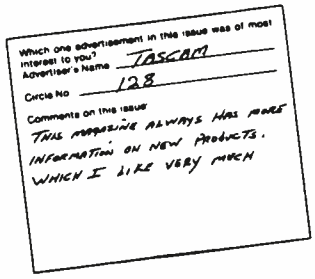
Suffice it to say, I was very impressed with the size, flexibility and the attention to detail that has gone into the development of Paisley Park Studios. Not only has Prince (with the help of many others) built an expensive complex, but he has created a production environment that is truly deserving of the description world-class. REP

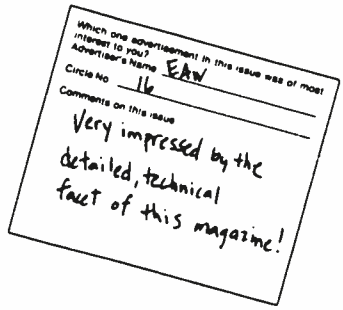
Studio A Equipment List

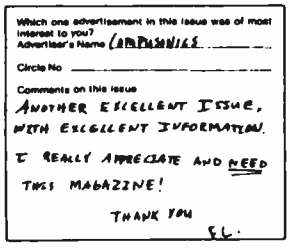
- *Solid State Logic 6056-E automated console with programmable EQ with pan, 3-machine synchronization (48-track lock to picture), event controller and a 6-track film mix capabilities.*
- *Studer: 2 Studer A-800 MkIII 24-track tape machines; 2 Studer A-820 ½-inch 2-tracks with center-track time code; and Studer A-820 ¼-inch 2-track with center-track time code.*
- *Westlake SM-1 5-way monitor system with Crown amplification.*
- *Yamaha NS-10M reference monitors.*
- *Westlake BBSM-4 reference monitors.*
- *AMS: 2 RMX 16 reverbs; 2 DMX 15-80S digital delays/pitch shifters.*
- *Lexicon: 224XL; PCM 41; PCM 42s; PCM 70; Prime Time II.*
- *Yamaha REV-7*
- *EMT: 2 140S plate reverbs.*
- *Yamaha: 2 SPX-90s.*
- *Orban de-esser.*
- *Eventide: H-969 Harmonizer; SP-2016 signal processor.*
- *Quantec QRS.*
- *Dyronics FS-1 Cyclosonic Panner.*
- *Focusrite 8-channel rack EQ.*
- *Pultec: 2 EQs.*
- *GMC: 3 8200 parametric EQs.*
- *Klark-Teknik graphic EQ.*
- *10 Kepex II gates.*
- *Dramer: 3 pair gates.*
- *Dyna-mite gate.*
- *UREI 1178 stereo limiter.*
- *dbx: 4 160X limiters.*
- *Teletronics: 2 LA limiters.*
- *Studer A-725 CD player.*
- *Tascam: 3 122 cassette decks.*
- *Technics Quartz SL-1200 MkII turntable.*
- *Monster Cable: audio interconnect/microphone and loudspeaker cable.*

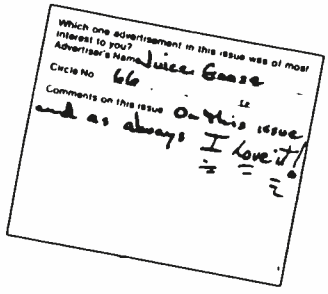
During the past year, 18,889 audio production pros like you subscribed or renewed their subscriptions to RE/P.

With good reason(s).


Which one advertisement in this issue was of most interest to you?
Advertiser's Name TASCAM
Circle No 128
Comments on this issue
THIS MAGAZINE ALWAYS HAS MORE INFORMATION ON NEW PRODUCTS. WHICH I LIKE VERY MUCH


Which one advertisement in this issue was of most interest to you?
Advertiser's Name EAW
Circle No 16
Comments on this issue
Very impressed by the detailed, technical facet of this magazine!


Which one advertisement in this issue was of most interest to you?
Advertiser's Name (illegible)
Circle No
Comments on this issue
ANOTHER EXCELLENT ISSUE, WITH EXCELLENT INFORMATION.
I REALLY APPRECIATE AND NEED THIS MAGAZINE!
THANK YOU
SL.


Which one advertisement in this issue was of most interest to you?
Advertiser's Name Juliet Gauze
Circle No 66
Comments on this issue On this issue and as always I love it!

"Every issue of RE/P is must reading." G.S., Senior Producer.

"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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STUDIO UPDATE

Northeast

Music & Sound Design Studio (Bridgewater, NJ) has opened an audio sweetening facility using New England Digital's Synclavier and Direct-to-Disk recording system. The sweetening room also has a library of 8,000 music selections and 5,000 sound effects, many on compact disc. *1425 Frontier Road, Bridgewater, NJ 08807; 201-560-8444.*

Sound on Sound Recording (New York) has moved to a 3,000-square-foot facility and has upgraded to 24 track. The studio was designed by Benchmark Associates and has four independently floating acoustic areas and a LEDE control room. Equipment includes a Neotek Elite 40-channel mixing console, Sony/MCI JH-24 and Otari MTR-12 tape machines, and an Adams Smith synchronizer. *322 W. 45th St., New York, NY 10036; 212-757-5300.*

Axis Studios (New York), a new studio, has installed a 47-input Amek Angela console with Disk Mix automation and an external patchbay. The studio specializes in keyboard and sampling technology for film scoring, audio for video and music production. *254 W. 54th St., New York, NY 10019; 212-262-3120.*

Roar Productions Recording and Musical Services (Columbia, MD) has installed ED Long MDM-4 close-field monitors for a third monitoring system in its control room. Other equipment adds include an Eventide Harmonizer, ART digital reverbs, Akai S-900 sampler and a Yamaha TX-81Z FM tone generator. *6655-H Dobbin Road, Columbia, MD 21045; 301-596-2600.*

Gateway Studios (Pittsburgh) has added John R. Williams to its staff. With the title of senior audio producer, he is responsible for all audio production and video sweetening for industrial and broadcast video production. *225 Ross St., Pittsburgh, PA 15219; 412-471-7224.*

Trackmaster Audio (Buffalo, NY) has opened a new studio with **Starfields Productions** of Tonawanda, NY. The new facility, called **Studio D/Starfields**, was designed by **D.M. Bellanca** of Audio Task Group and features a mirror image floating control room. Equipment includes an Otari MX70 16-track, Otari MTR-10 ¼-inch and ½-inch 2-track synchronizers, Soundcraft 1600 Producer Series console and a Mac/Performer MIDI studio. Monitors include Westlake with Crest power amps. *1 Franklin Park North, Buffalo, NY 14202; 716-886-6300.*

Presence Studios (East Haven, CT) has upgraded its SL-4000 E series console with G series EQ. The studio is also said to be one of the first to receive the new G series computer system. Currently loaded with 48 input/output/monitor modules, the console will be upgraded to 56 inputs later. *461 Main St., East Haven, CT 06512; 203-467-9038.*

Hillside Sound Studio (Englewood, NJ) has added a Sony 3324 24-track and 3202 2-track digital tape recorders. *102 Hillside Ave., Englewood, NJ 07631; 201-586-3268.*

Group Andre Perry Ltd. (Washington, DC) has purchased a DDA DCM 232 in-line recording console, said to be one of the first U.S. installations. The console will be used for audio for film and video, Synclavier work, voice-over production, and recording and mixing original scores.

Southeast

TDJ Recording Studio (Booneville, MS) has recently opened. Equipment includes an Akai MG1212, Peavey Deca 7000 power amp and a Fostex A-2 recorder. Marty and Debbie Williams are the owners; Danny Ozbirn is the technical adviser and engineer. *Route 3, Box 42, Booneville, MS 38829; 601-728-6339.*

RM Mobile Unit (Atlanta) is a new remote recording service. The 30-foot truck is designed for 24-track location recording, broadcast and audio for video. *3586 Pierce Drive, Atlanta, GA 30341; 404-458-6000.*

Eleven-Eleven Sound Studios (Nashville) has installed a Neve V series 48-input console. *1111 17th Ave. South, Nashville, TN; 615-329-1111.*

Boutwell Recording Studios (Birmingham, AL) has installed a Sony/MCI MXP-3000 36-input automated mixing console, equipped with the ADS-3000 automation data storage system. Other recent purchases include a Yamaha SPX-90 and Valley People Autogate and Leveller. Also, Charles Harnach has joined the staff. *720 23rd St. S, Birmingham, AL 35233; 205-251-8889.*

Middle Tennessee State University (Murfreesboro, TN) has opened its new recording studio facility, Studio B. Equipment includes a Neotek Elite 34-input console equipped with Diskmix Moving Fader automation, Discrete Research Boxer 4 monitors, a Mitsubishi X-80 and Otari MTR-12. The studio also has a Roland MIDI system using an MC-500 sequencer linked by Lynx Time Code modules to an Otari MX-80 24-track. *Box 55, Middle Tennessee State University, Murfreesboro, TN 27132; 615-898-2518.*

Albert's Home Studio (El Paso, TX) has purchased an Otari DTR-900 with overbridge controller, an MTR-90-II with autolocator and an MTR-12-I with interchangeable headstack.

Sound Stage (Nashville) has installed a second SL4056 E series console with Total Recall. *10 Music Circle South, Nashville, TN 37203; 615-256-2676.*

Mastertouch Recording Studio (Nashville) has updated its New England Digital Synclavier II preproduction/scoring room with the addition of a MIDI interface and 112-point patchbay. The patchbay can be linked to the Sony 24-track digital main studio.

Other equipment includes a Yamaha QX-1 8-track sequencer with eight TF-1 modules, Yamaha SPX-90 digital effect processor, a Fostex 3070 compressor/limiter and an MXR 129 pitch/transposer. *2714 Westwood Drive, Nashville, TN 37204; 615-297-2246.*

Midwest

Sound Images (Cincinnati) has added John F. Murray to its staff. He will be engineer/producer for Sound Images' new Studio C. *602 Main St., Cincinnati, OH 45202; 513-241-7475.*

Southern California

Baby'O (Hollywood) has added a Neve 60-input V series console in Studio B, along with a variety of outboard gear. Another Neve console for Studio A is

STUDIO UPDATE

scheduled to be delivered in January. *6525 Sunset Blvd., Hollywood, CA 90028; 213-464-1330.*

Preferred Sound (Woodland Hills) has added a JVC ¾-inch VTR, two TimeLine Lynx modules, an Ampex ATR 104 ¼-inch 4-track recorder, and a Pioneer 25-inch color monitor. *22700 Margarite Drive, Woodland Hills, CA; 818-883-9733.*

Secret Sound L.A. (Woodland Hills) has installed a Solid State Logic 6048 console with Total Recall, event controller and plasma meters. Also added is an Otari MTR90 II as a machine to lock up with a Studer A820, which was also recently purchased. *4836 Queen Victoria Road, Woodland Hills, CA 91364; 818-999-6160.*

Wave Studios (Hollywood) has installed a Sony BVH-3000 1-inch VTR. Construction has also started on a new studio complex, and plans call to add two video sweetening bays with disk-based editing systems. *1956 N. Cahuenga Blvd., Hollywood, CA 90068; 213-466-6141.*

Encore Studios (Burbank) has installed a 56-input Solid State Logic 6000 E series console, with Total Recall, video switching, plasma metering and eight stereo modules. The control has also been enlarged, under the direction of Vincent Van Haaff, to accommodate the console and allow for multiple synthesizer setups. *721 S. Glenwood Place, Burbank, CA 91506; 818-842-8300.*

Northern California

Sound Recording Organization (San Francisco) has announced that Steven Pinsky has been named president of the corporation. He succeeds Luther Greene, who resigned to pursue a career as an independent producer. *1338 Mission St., San Francisco, CA 94103; 415-863-0400.*

Bay Records Studios (Berkeley) has moved from its previous location in Alamedia to Berkeley, at the site of the old Sierra Sound Labs. The studio includes a rebuilt 1,000-square-foot studio room, designed by Randy Sparks of RLS Acoustics for live recording. *1741 Alcatraz Ave., Berkeley, CA 94703; 415-428-2002.*

Music Annex (San Francisco) has added Bob Bradford to its staff as senior mixer. Previous credits include commercials for Coca-Cola and McDonald's, a new "stereo" track for the home video release of "Gone With the Wind" and a new Dolby Stereo mix for "2001: A Space Odyssey." *69 Green St., San Francisco, CA 94111; 415-421-6622.*

Studio C/Custom Recording (Stockton, CA) has upgraded its NED Synclavier II to include polyphonic stereo sampling, music printing, MIDI, SMPTE and release M software. New outboard equipment includes a Quantec QRS Room Simulator and Dolby SR noise reduction for mastering. *2220 Broadridge Way, Stockton, CA 95209; 209-477-5130.*

Northwest

London Bridge Studios (Seattle) has added a Studer A-800 MkIII 24-track recorder. Also, its MIDI pre-production room has added an Apple Macintosh computer with Mark of the Unicorn software. *20021 Ballinger Way A, Seattle, WA 98155; 206-364-1525.*

Spectrum Studios (Portland, OR) has moved into new facilities, containing 20,000-square-feet of space for two divisions. The sound studios division contains four acoustically designed studios and a scoring suite. The systems design division designs audio and video systems for a variety of applications. *1634 SW Adler, Portland, OR; 503-248-0248.*

England

Eel Pie Studios (London) has installed a Soundtracs 32-input Eric console in its main room, to be installed with a Soundtracs CP6800 with MIDI/SMPTE interface for the studio's Synclavier programming suite.

REP

NEW PRODUCTS

SSL G series Master Studio System

The G series is a fully integrated working environment based on Solid State Logic's Master Studio System. The system also contains the company's Studio Computer and new equalization, which are available as product upgrades to existing systems.

Circle (140) on Rapid Facts Card

Sony PCM-2500, -2000 DAT machines

The pro-DAT machines share basic features, but the PCM-2500 is for studio use, while the PCM-2000 is for location recording. Both feature two hours of recording time per cassette, rewind at 180 times playback speed, rapid program search capability, and analog and digital inputs/outputs. The -2000 can also record and play back SMPTE/EBU time code.

Circle (144) on Rapid Facts Card

Otari MX-55 recorder

The ¼-inch compact recorder is available in 15/7.5ips or 7.5/3/75ips speeds, and is designed for recording and audio post. The tape transport features a dc quartz PLL capstan motor and a 7-digit tape timer with a 4-memory locator. Six versions are available.

Circle (126) on Rapid Facts Card

Sennheiser MKH 30 P48U3, MKE 4032 condenser mics

The MKH 30 P48U3 is a figure-eight condenser that uses the same symmetrical capsule design as the cardioid MKH 20. It is designed for M-S recording. The MKE 4032 is designed for stage vocal work and includes a double-screen basket and an all-metal body.

Circle (127) on Rapid Facts Card

3M SX series cassettes

The series comprises three chrome bias cassettes designed for professional audio users. Signal-to-noise ratio is 61dB, and the cassette has a flat frequency response from 0kHz-20kHz. The cassettes are available in 30-, 60- and 90-minute lengths.

Circle (133) on Rapid Facts Card

Studer A727 CD player

The A727 can be used as a table-top unit or mounted in a rack, and includes manual and automatic cuing modes. Also included is an AES/EBU digital output, balanced XLR outputs, and BNC clock input and output jacks for varispeed and synchronized operation.

Circle (137) on Rapid Facts Card

Total Audio Concepts S1200 stereo module

The stereo module fits to TAC's Scorpion console, and is oriented for broadcast and post-production use. The module features two electronically balanced line inputs with an impedance of 10kΩ, and also features 3-band stereo equalization and two stereo aux sends. Gain for both inputs is controlled by the same rotary pot, covering −10dB to +30dB.

Circle (134) on Rapid Facts Card

Fairlight MFX post-production package

A hardware/software upgrade for the Series III, the MFX package is for film and TV audio post-production and uses a custom control console designed for audio post sweetening. Cue-List software serves as the master controller, functioning as a time code-based sequencer capable of initiating any Series III function at a specified time. Events are triggered from the unit's internal clock, or from an external time code source.

Circle (122) on Rapid Facts Card

Fane loudspeaker additions

Ten-inch and 18-inch models have been added to the company's Studio Series co-axial speakers. Said to offer distortion-free, uncolored sound reproduction with wide dispersion characteristics, the speakers are designed for a variety of applications.

Circle (130) on Rapid Facts Card

Southworth Music Systems NuBus cards

Available to OEMs and software developers, the cards are for the Apple Macintosh II and provide 20-bit PCM recording at 192kHz. Using the card, nearly 27 track-minutes of music or 108 minutes of speech can be stored on a standard Macintosh II 40 megabyte hard disk.

Circle (142) on Rapid Facts Card

Optical Disc Corporation CD mastering system

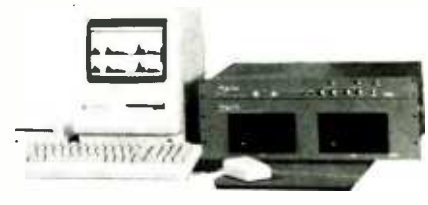
The model 520 uses the non-photoresist process, which uses direct read after write (DRAW) recording to check the master while it is being recorded, eliminating the need for a glass master required for the photoresist process. Size is 52"x31"x60".

Circle (143) on Rapid Facts Card

Howe Technologies 2300A PhaseChaser

The unit detects and corrects interchannel time delays in stereo audio program material, avoiding loss of mono compatibility and poor stereo imaging. Other features include automatic time delay correction, missing channel fill-in capability and polarity reversal correction.

Circle (145) on Rapid Facts Card



Integrated Media Systems Dyaxis system

The Dyaxis is a disk-based digital audio recording and editing system. Using an Apple Macintosh with Maxmix software and the company's audio processor and disk subsystem, users can record sound, editing sound files or create special sound files. Disk capacity options are 72, 160, 320 and 640 mega-

NEW PRODUCTS

bytes, and more than 640 megabytes in 320 megabyte increments.

Circle (141) on Rapid Facts Card

Ensoniq EPS, SQ-80 keyboards

The EPS Performance Sampler and SQ-80 Cross Wave synthesizer are designed for studio and live performance use. Sounds can be loaded into the EPS from disk while allowing all keyboard functions, and the pressure sensitive keyboard also has aftertouch from each individual key. The SQ-80 includes transient attach waves to allow performance expression, including multi-sampled bow, pick, breath and hammer attacks and percussive and synthesized variations. Sound disks from the company's Mirage and ESQ-1 are compatible with the new keyboards.

Circle (146) on Rapid Facts Card

Video Design Pro AudPAD and VidPAD

PAD stands for paper-aided design, and is designed to help people to speed up systems design and who do not have access to a computer-aided design system. For audio and video use, the PADs contain scale drawings of audio and video equipment, plus detailed specs. Each PAD can be copied, cut and pasted-up to make mock-ups or rough drafts.

Circle (147) on Rapid Facts Card

Digidesign Q-Sheet software

A program for the Macintosh, Q-Sheet automates any MIDI device while synchronized to SMPTE time code. Graphic faders, knobs and buttons can be drawn on the screen in any size and configuration, and can be individually assigned to specific functions of a MIDI device. The computer screen can be used to scroll through a cue list or show an automation window. The program is designed to be used for music production and audio for video post-production.

Circle (148) on Rapid Facts Card

Digital Intelligence Systems reference compact discs

The company's reference discs are the CD equivalent to reference LPs, allowing verification of how a disc will sound after it has been duplicated. The discs use a glass substrate with the same dimensions as a pressed CD. Although the service primarily supplies compact discs, CD-ROM reference discs are also available.

Circle (149) on Rapid Facts Card

JBL Control 5 monitor

The two-way system is designed for studio monitoring, sound reinforcement, foreground music, and other applications. The molded enclosure contains a 6½-inch LF loudspeaker and the same 1-inch titanium dome tweeter found in many of the company's larger studio monitors. Power capacity is 175W, and the quoted usable frequency response is below 50Hz to beyond 20kHz.

Circle (150) on Rapid Facts Card

KMD RP500S stereo power amp

The amplifier is designed for sound reinforcement use and features an "auto bias" circuit to ensure temperature stability and no crossover distortion. Two rack spaces high, the amplifier is rated at 250W per channel, has a frequency response of 20Hz to 20kHz and has a slew rate of 30V/μs.

Circle (154) on Rapid Facts Card

Lexicon sampling memory expander for 480L

The expander is designed to be used in the 480L's fourth card slot, and can store a phase-locked, stereo sample of 10.9 seconds or a 21.8 second sample at 48kHz sampling. The addition allows the 480L to easily fly in vocal or instrumental overdubs. Dynamic range is 96dB with a 20Hz-20kHz bandwidth.

Circle (152) on Rapid Facts Card

NEW PRODUCTS

Nagra T-Audio keyboard update

The new keyboard is now standard for all T-Audio time code post-production recorders as of early this year. The keyboard has separate dedicated keys instead of shift key functions, allowing numeric codes or time code values to be entered easily and quickly, the company says.

Circle (155) on Rapid Facts Card

Summit Audio EQP-200 dual program EQ

The unit combines vacuum tubes and solid state technology, which the company says results in a more natural sound than digital signal processing equipment. Features include two independent channels, switch-selectable frequencies, and continuously variable boost and cut. Power is 35W; an electronically balanced input has an input impedance of 40kΩ.

Circle (151) on Rapid Facts Card

Solid Support Industries stackable rack

The modular, stackable rack is designed with eight rack space modules, and can be expanded to accommodate additional equipment as needed. The rack allows MIDI and related rack equipment to be added without having to purchase a new rack with each piece of equipment, the company says. The racks are open at the back and sides, allowing open-air cooling and access to connections.

Circle (153) on Rapid Facts Card

WaveFrame AudioFrame

The AudioFrame is a single-unit digital audio workstation that produces finished tracks completely in the digital domain, the company says. The unit uses a proprietary digital audio bus that allows plug-in modules to communicate digitally. Modules include A/D and D/A conversion, sampling synthesis, studio control processing and memory expansion.

Circle (119) on Rapid Facts Card

Sontec Electronics MEP-250C parametric EQ

The rack-mount unit features low noise audio processing and silent EQ switching. EQ frequency bands are continuously variable from 10Hz-800Hz (low), 120Hz-8,200Hz (mid) and 400Hz-26,000Hz (high), each with a slope of 5-15dB/octave. EQ output waveforms are symmetrical; slew rate is more than 200V/μs.

Circle (162) on Rapid Facts Card

Ashly Audio CG-85 gated limiter/compressor

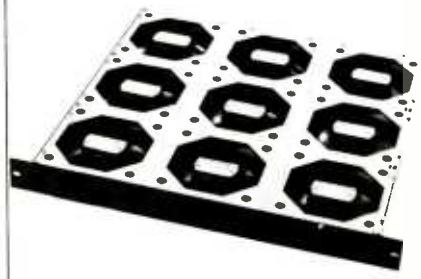
Featuring a new detector section that incorporates a Gated Release feature, the unit monitors the audio signal and interrupts changes in gain during periods of silence. The unit will distinguish between changes in program level and absence of program, according to the company, and will lock the gain at current level and wait for the next audio signal before decided whether to increase or decrease gain.

Circle (163) on Rapid Facts Card

Brainstorm Electronics TB-4 talkback system

The TB-4 is an infrared remote control system designed to interface with an already existing talkback system, allowing communication from other points in the control room other than the console. The receiver is located near the front of the room; the communicator acts like a conventional talkback switch, and is powered by a 9V nicad battery.

Circle (156) on Rapid Facts Card



Central Devices D-4118 cooling module

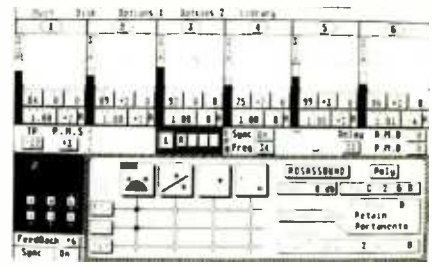
The D-4118 circulates cool air for efficient and safe operation of instruments, PCBs and power supplies installed in standard 19-inch racks. The module contains nine fans, and the user can specify which ones are working. Mounting hardware and adjustable rear brackets are included.

Circle (157) on Rapid Facts Card

Electronic Specialists Power Loss Shutdown

The shutdown device is designed to shut down a computer system if commercial ac power has not been restored and the batteries from an uninterruptible or standby power supply have been discharged. This prevents undesired system startup after a power outage. The device is also available with adjustable ac line dropout voltage level to accommodate brownout protection capabilities of some UPS systems.

Circle (158) on Rapid Facts Card



Steinberg Software SynthWorks DX/TX

The software package runs on the Atari ST and is a patch librarian, voice editor and patch creation program for Yamaha DX and TX synthesizers. Voice Management allows users to maintain 2,100 sounds in 21 user defined categories. The Editor section allows sound and function parameters to be edited directly, and the result is sent in real-time to the synthesizer. Intelligent Sound Creation produces sound working from basic material from existing patches.

Circle (159) on Rapid Facts Card

E-mu Systems hard disk retrofit

The HD Retro is for the Emax and Emax Rack digital sampling systems, which are the first instruments in their class to offer hard disk storage, according to the company. The internal 20 megabyte hard disk drive has a storage capacity of 36 disks of sounds and sequences and has a loading time of three seconds. The disk is preloaded with 30 banks of sounds from the Emax sound library.

Circle (160) on Rapid Facts Card

Turtle Beach Vision II editing software

Vision II software is a visual editing system for IBM compatible computers that uses icons and pull-down menus similar to those of the Macintosh. Wave data are displayed and edited in 16-bit resolution regardless of the

NEW PRODUCTS

resolution of the target sampler, allowing increased accuracy in blending and modifying sounds. Other features include digital equalization, wavetable analysis and modification tools, crossfade looping and variable resolution wave display.

Circle (161) on Rapid Facts Card

Dolby SDU4 surround decoder

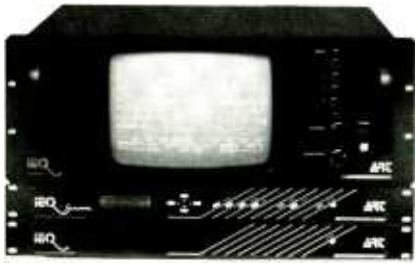
The unit is said to be the first designed for studio installation, and is for reference monitoring of Dolby Stereo or Dolby Surround program material in broadcast, audio-for-video and music recording. Compatibility in mono, convention stereo or fully decoded surround playback mode can be checked; input program material can originate from a stable two-channel source such as videotape, film, or stereo broadcast.

Circle (167) on Rapid Facts Card

Peterson Systems cable protectors

The units are made of Hiperthane and come in black and "traffic" yellow, and protect cables from being run over by vehicles. They are available in 3-foot sections and can be interlocked to any desired length; end "boots" are available to secure the termination of a cable run.

Circle (168) on Rapid Facts Card



ART IEQ ⅓ octave Intelligent Equalizer

The unit provides programmability with 128 memories, each with a user-definable name of up to 16 characters. Features include a 32Hz high-pass filter, ½dB steps on the slider level controls, ISO centers and a 105dB S/N ratio. Pre-programmed EQ settings can be recalled either manually or via a MIDI facility. A rack-mount, 9-inch monochrome video monitor is included.

Circle (164) on Rapid Facts Card

Rubber Dubbers Compu-FX CD system

The system has been designed for sound editing of motion picture and videotape in post-production, and is comprised of four main components: an IBM-PC compatible with a 20 megabyte hard disk; a Sony CDK-006 auto disc loader; 60 compact discs with approximately 5,700 sound effects; and a high resolution dot matrix printer.

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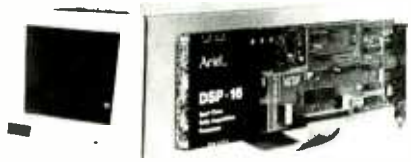

Aeriel SDI interface

The signal-to-disk interface is an enhancement for the DSP-16 Data Acquisition Processor and allows PCs and compatibles to record real-time, full bandwidth data acquisition to disk, as well as signal editing and processing. The SCS-compatible package bypasses the PC bus, and permits direct-to-disk recording and playback of 16-bit data at sampling rates of up to 50kHz on two channels simultaneously.

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BSS Audio DPR-502 dual channel noise gate

The DPR-502 noise gate features Key Level Metering, Auto Attack and ADE modes. Also featured is the bi-directional MIDI analog interface.

The unit features Key Filter, with a variable width response. Auto Attack, designed to monitor input signal information, automatically compensates for variations in rise time.

Circle (171) on Rapid Facts Card

Beyer MCE 81 condenser mic

Designed for live vocal and instrumental use, the MCE 81 features a cardioid polar pattern and a quoted frequency response of 50Hz to 18kHz.

Circle (172) on Rapid Facts Card

Telex HT-400 wireless microphone

The HT-400 microphone series features a 2-channel transmitter.

The transmitter has an RF power out rating of 45mW and line-of-sight operating range of 1,000 feet.

Microphones in the HT-400 series can be ordered with a Telex TE-10 condenser, Shure SM-87 condenser or the Shure SM-58 dynamic head.

Circle (173) on Rapid Facts Card

Korg Sound Sampling collection on Compact Disc

The first volume of the series features a selection of acoustic instruments, including drums, percussion, string bass, violoncello, violin, trumpet, trombone, transverse flute, clarinet and piano.

All instrumental sounds are recorded in mono, allowing the user to connect Channel A of the CD player directly to the audio input of a sampling synthesizer. Channel B can be connected to a mixing console for monitoring flexibility.

Each sound is heard twice at intervals of five seconds, allowing time to adjust threshold levels and then record. Melodic instruments are recorded in scalar steps over at least a two octave range.

Circle (174) on Rapid Facts Card

Symetrix SX201 parametric EQ/pre-amp

The unit is designed to handle low-level and line-level inputs. Three separate parametric EQ bands are provided, with +15dB boost and −30dB cut capability. The balanced line level input matches levels ranging from −10dB to +8dB. Packaged in the "half-rack" size, the units can be used on a tabletop or mounted side by side using an optional mounting kit.

Circle (165) on Rapid Facts Card

Soundtracs CMX series consoles

Based on the CM4400 series consoles, the CMX consoles retain the previous series' features in a new mainframe. Up to 32 inputs may be fitted with or without patchbay, and full metering is provided for 24-track recording. A microprocessor-controlled routing and muting system may be preprogrammed and recalled manually, with patch changes or automated with the company's CMS2 and CMS3 options.

Circle (166) on Rapid Facts Card

Intersonics SDL-4 loudspeaker

The SDL-4 features power cooling and an improved servo drive system.

It is designed for lighweight, compact road use. The product features a quoted output from 125Hz to 35Hz.

Circle (176) on Rapid Facts Card

LETTERS

Continued from page 6

Ambisonics

From: Steve Szajna, Recording Institute of Detroit, East Detroit, MI.

I have just finished going over an article from your August issue by Lowell Cross entitled "Stereo Microphone Evaluations: An Overview of Techniques and Subjective Assessments." This is the second time I have read it and, frankly, it has got me upset.

An extensive portion of this article is given over to the subject of ambisonics, and yet I failed to find where the author gives a sufficient definition of what it does or how it works. There is plenty of space spent on comparing ambisonics to other more commonly known forms of stereo micing and to praising the merits of ambisonics.

I cannot feel anything but cheated by the lack of explanation of this technique, particularly when so much of the rest of the article hinges on understanding what ambisonics is about.

Perhaps in the future, you might include an article that compares the ambisonic technique directly to other stereo micing techniques. It would certainly clear things up for me as well as some other readers, I am sure. In the meantime, I guess I will have to haunt the local library until my head stops hurting.

Lowell Cross offers the following definition:

"Ambisonics" is the name given to a 3-dimensional system of recording with a single (coincident) multi-capsule microphone, for reproduction over loudspeakers surrounding the listener. It is not to be confused with "quadraphonic" recording (now very much out of fashion), which utilizes at least four space microphones. In addition to offering playback in 3-dimensions (left/right, front/back and up/down), the ambisonic technique offers all possible forms of coincident stereo recording as well as monaural compatibility.

Editor's note: *In addition to the sources listed in the bibliography at the end of his August article, Lowell Cross recommends the following sources:*

1. An expanded article by Stanley Lipshitz based on his AES preprint, "Stereo Microphone Techniques...Are the Purists Wrong?", the Journal of the Audio Engineering Society, September 1986;

2. "Performance Assessments of Studio Microphones," parts 1 and 2, by Lowell Cross, RE/P, December 1984 and February, 1985;

3. "New Product Review: the Calrec Soundfield Microphone," (including an in-use test and theory and description abstracted from Calrec literature), by Carson Taylor, RE/P December, 1979.

In addition, anyone wishing to contact Lowell Cross about his experiences with ambisonics may do so in care of the School of Music, University of Iowa, Iowa City, IA 52242; 319-335-1662. RE/P

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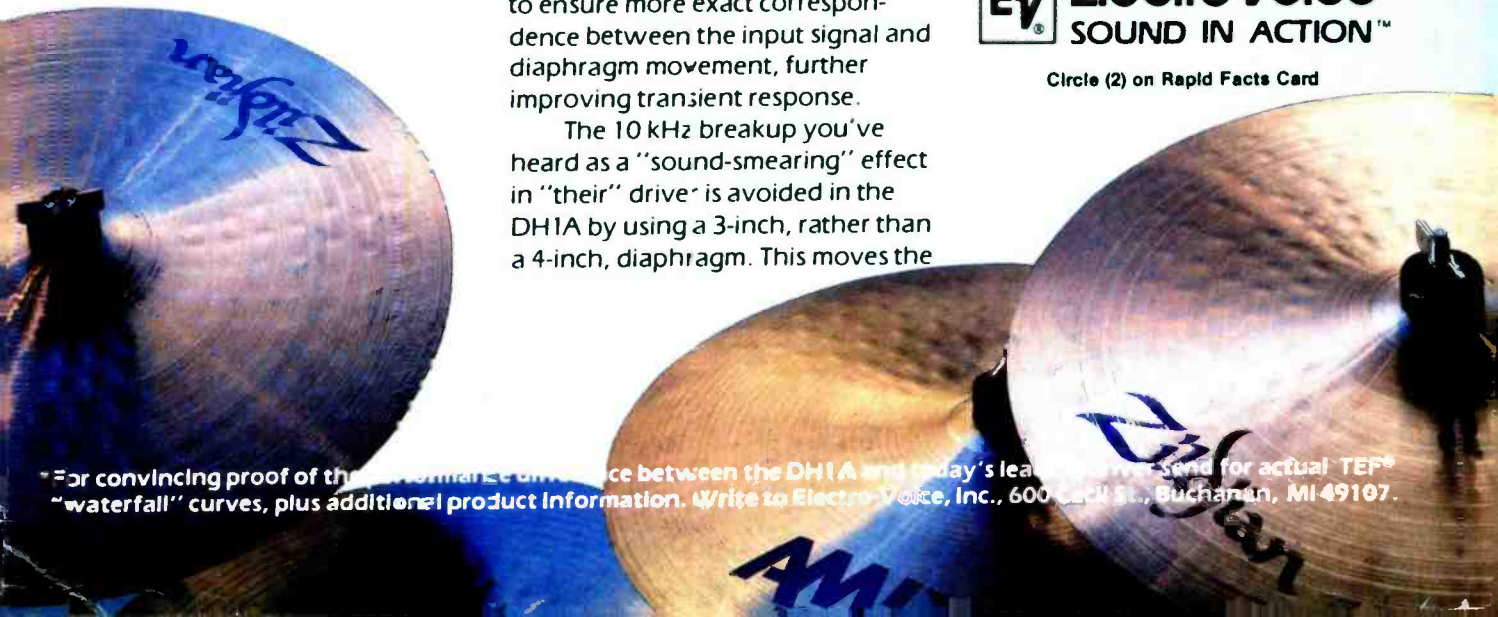

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