SERVING THE CREATIVE AUDIO AND MUSIC ELECTRONICS INDUSTRY

SOUND ARTS

MERCHANDISING JOURNAL

VOL.1 NO.10
NOVEMBER 1978

Matching Impedance

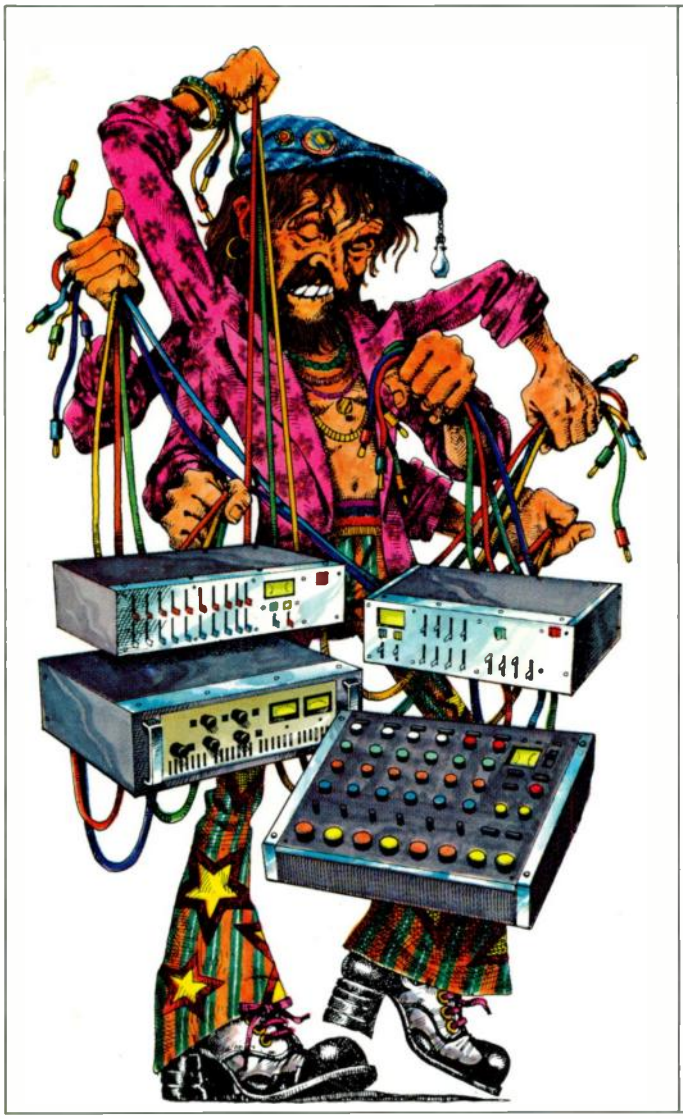
$$Z_{NET} = \frac{4 \times 8}{4+8} = \frac{32}{12} = 2.67 \text{ ohms}$$

Making Money With Four-Track

Solving the Customer's Sound Problems

How to Set Up a Service Department

THE LONG AND THE SHORT OF SOUND REINFORCEMENT.



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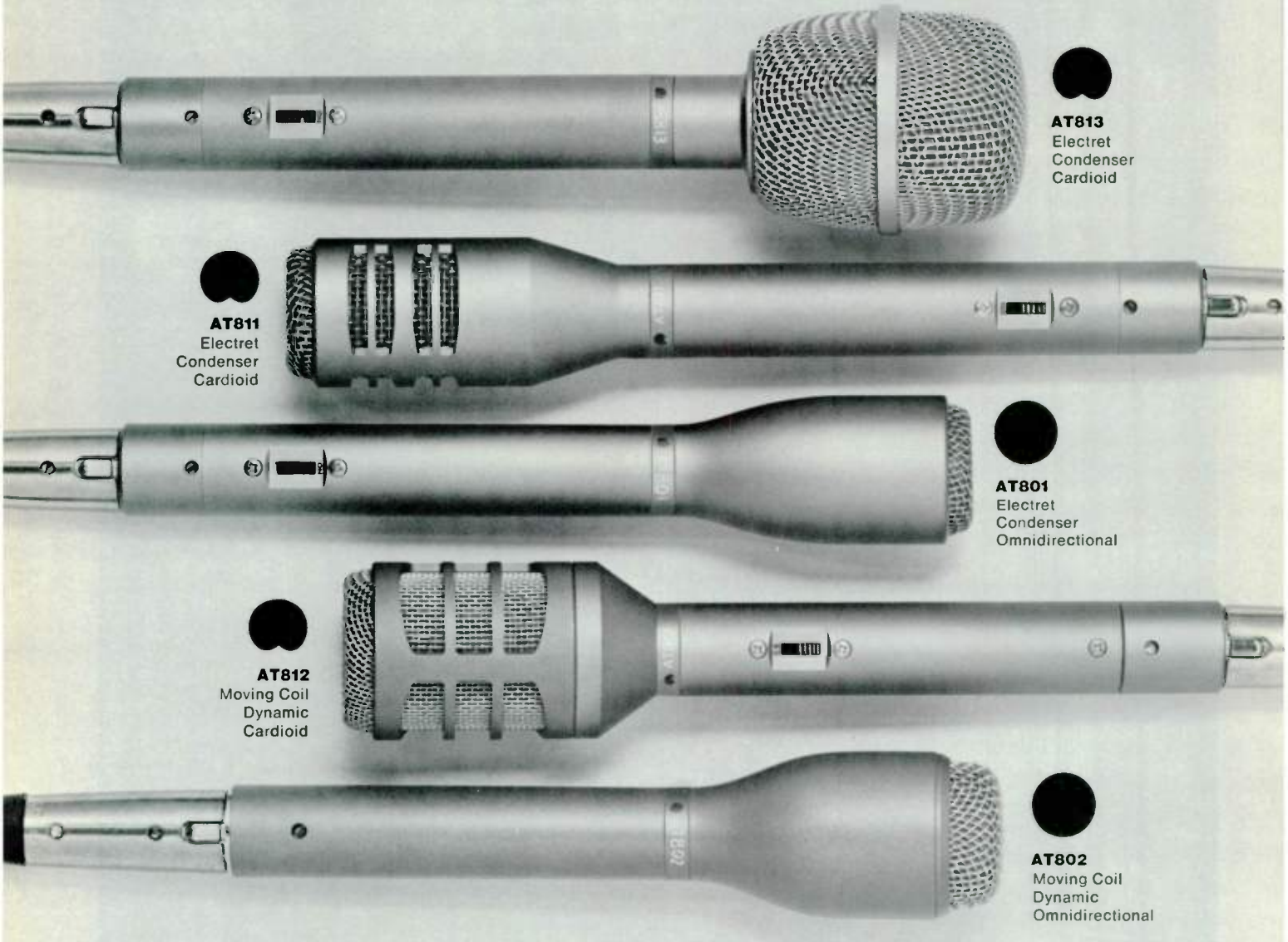
Audio-Technica introduces five new microphones... and a pleasant surprise.



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Take a close look at these new Audio-Technica microphones. Three electret condensers and two dynamics. Plus two clip-on miniature electrets (not shown). All are superbly finished. Carefully thought out in every detail. With the right "heft" and feel. Professional A3M Switchcraft output connectors, of course.

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VOL. 1 NO. 10

SERVING THE CREATIVE AUDIO AND MUSIC ELECTRONICS INDUSTRY

SOUND ARTS

MERCHANDISING JOURNAL

NOVEMBER 1978

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Cover Photo by Doug Hanewinckel

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A LETTER FROM THE EDITOR

As we were dancing to Macho Man (this job does have its lighter moments), my partner raved about his company's planned new products (those lighter moments have their business moments). The new products weren't specified, since my dancing partner was more light-footed than loose-tongued.

The dancing occasion was the Audio Hall of Fame awards presentation and the awards this year went to three men whose names have already become immortal in that they live on beyond their involvement with the companies and products they started. Saul Marantz, Henry Kloss and Rudy Bozak: The names alone bring memories of tubes and garages and the individual forging ahead with genius and insight to the advantage of all of us. Corny? For sure. True? Likewise.

Recent news in the industry is that Tapco has been purchased by Gulton Industries (of which Electro-Voice is an arm) and Pioneer has invested heavily in Phase Linear. Is this the conglomerating of America? Probably not. No doubt any expansion of a company dictates the necessity for an expansion of capital. And solid capital and a solid company base in turn aid retailers who are making commitments

But don't look for a contraction in this industry. There are enough individuals with kernels of concepts to charge ahead in both technology and marketing. Our mail brings information daily on new companies with new products, many of which merit printing. And don't forget the resident geniuses at the larger companies (as my dancing partner's) who can get people excited enough to interrupt Macho Man.

All of this of course has little to do with this *specific* issue of SOUND ARTS. But it has to do with SOUND ARTS in general. It is because of the diversity of products and the talents of product developers that a confused customer wrote to us about his mismatched system. Ralph Morris answers, in "Solving the Customer's Sound Problems," giving aid to retailers in coping with the customer who grabs everything that looks interesting and then can't get it together. Irwin Zucker, in "Impedance Matching," speaks to the sophistication of the industry when he says "Ten years ago you could not have assembled a sophisticated audio system without being very competent at exact impedance matching. . . . Today it's a different story." Impedance matching may be less of a problem in some areas of audio. But it still exists in others and Irwin offers info. New advances don't always supersede the older. Zillion-track, when it comes, can co-exist with simple 4-tracks, as Linda Feldman points out in "Making Money with Four-Track." And to service it all in a competent, sophisticated manner requires a business-like service department, such as John Gattz describes.

There will always be devisers of better soundtraps. This industry contracts and expands at the same time—with equal benefits.

Judith Morrison Lipton

THE ONE-KNOB SQUEEZER.

A compressor/limiter that gives you a free hand.

There are times in the life of every studio operator when an extra hand would make things a lot easier. It's for times like those that dbx designed its new Model 163 compressor/limiter. We call it the "one-knob squeezer" because it has only one control—to adjust the amount of compression desired. As you increase the compression ratio, the 163 automatically increases the output gain to maintain a constant output level. It's quite clearly the easiest-to-use compressor/limiter on the market.

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The 163 is as easy to install as it is to operate. It's light and compact—two may be rack mounted in a 1¾" space—and it interfaces easily with phono connectors.

But the easiest part of this "Over Easy" limiter is its cost. The nationally advertised value of the 163 is $189.* With the money you save on a pair of 163s, you can get two extra hands in the studio. You can hire yourself an assistant.

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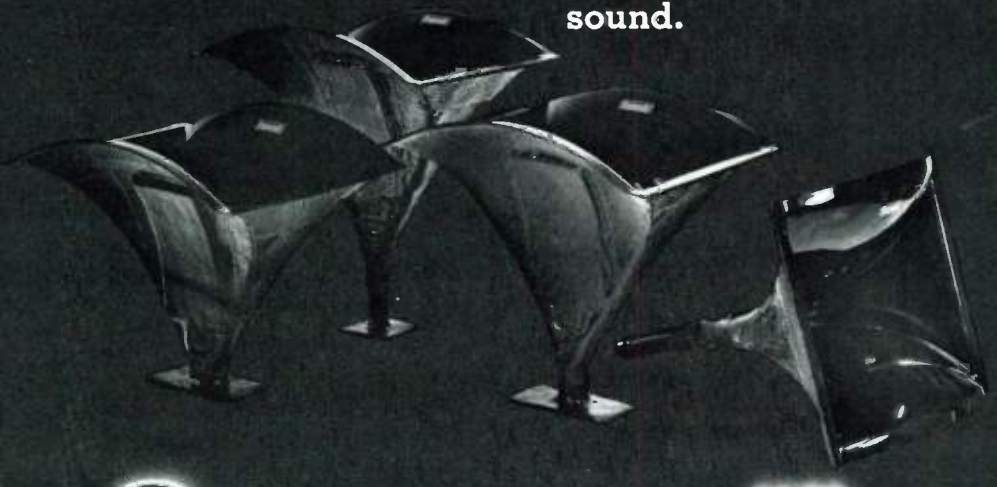

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CIRCLE 89 ON READER SERVICE CARD

WRH

TERMS:

A CONTINUING INDUSTRY GLOSSARY

RECORDING

By Larry Blakely

In further definition of the recording console, we have the following:

Combining Amplifier: This device receives signals such as a number of cue sends and combines them into one signal. For example: If a recording console had 10 input positions with a cue send pot (control) on each input, there would be 10 cue sends. However, there would be only one output on the recording console to feed the headphones. The separate signals from the 10 cue controls are fed to a combining amplifier that adds all the 10 individual signals together and combines them into one. By this method, one or any combination of cue sends could be used, along with the desired amount of signal level from each, thus allowing total flexibility in that you can adjust for (mix) any particular signal levels from each of the console inputs that you desire.

Echo Send: This control adjusts the amount of signal from a particular console input position that is sent to an echo device or chamber. On most all recording consoles there will be such an echo send control on all input positions.

Fold Back: This term is utilized in Europe for what is described above as "Cue Send," in that you fold back (send back) to the headphones of the performers, a desired amount of the signal from any input position or combination of input positions.

Solo Button: This button takes the signal from a given input and routes it directly to the monitor section of the console. For example: If you were doing a mix of a drum set, and position 1 was cymbals, position 2 sock cymbal, position 3 tom toms, position 4 snare, position 5 bass drum; it may take a while to get the certain sound you desire by adjusting the balance (level) of the first five input positions to get the particular sound you want from the trap drums. Let's say you had worked for 15 minutes to get a partic-

ELECTRONIC MUSICAL INSTRUMENTS & ACCESSORIES

By Mike Beigel

Synthesizer Terms (Continued):

Analog Synthesizer: All of the processes involved in tone-generation and modification are performed by analog hardware and methods. At all times, the signals inside the synthesizer are continuous likenesses to the musical sound produced.

Hybrid Synthesizer: Using a combination of digital and analog technologies, the hybrid is an economically beneficial trade-off of the best available current technology. Some of the more advanced polyphonic programmable units are examples of the hybrid approach.

Linear VCA: The ratio of the signal gain to the control voltage is a linear function, so the output voltage is directly proportional to the control voltage.

Polyphonic Synthesizer: A synthesizer capable of producing more than one "note" at a time. A wide variety of devices exists under this general category. So-called "true" polyphonics have two or more "voices" (generally less than ten), each of which has completely independent oscillator sources. So-called "full" polyphonics use organ-like technology supplanted by synthesizer techniques, to allow simultaneous generation of *all* notes on the keyboard, but sacrificing some versatality. There is considerable disagreement about this class of instruments.

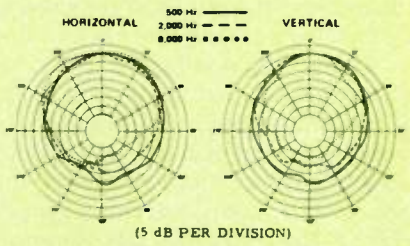
Patchable Synthesizer: Connection between the basic elements of the system can be made by "patch cords" via jacks in the synthesizer unit. The synthesizer can be exclusively configured by patches, or use patch jacks to over-ride pre-existing hard-wired interconnections.

Synthesizer Programmer: A device that stores a set of data corresponding to some of the available control functions for a particular synthesizer. A number of sets of these control programs are stored in the programmer for instantaneous recall by the music-

SOUND REINFORCEMENT

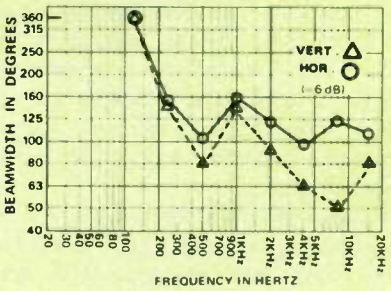
By Glen E. Meyer

Polar Responses: The polar responses of a speaker represent the dispersion of sound by showing the sound pressure level encountered—usually a decrease—as the listener moves to various angles off the speaker axis. Octave or third octave bands of random noise are used to avoid the minor variations which occur with single-frequency measurements. Measurements are usually made in both the horizontal and vertical planes.



Polar Response (3 octave bands)

Dispersion Angle: Accurate system design may be made by referring to the axial frequency response and the polar responses. However, it is convenient to represent the fairly complex and continuous information of the polar responses (which show that a speaker has some output at any angle) with a single dispersion angle. Although no absolute standard exists, dispersion or beamwidth angle in any given octave or third-octave band is often defined as the angle included by the points on the polar response for the responses 6 dB below the on-axis response. Sometimes this beamwidth at different frequency bands is represented in a beam-width versus frequency graph.



Beamwidth vs. Frequency

TERMS: (CONTINUED)

A CONTINUING INDUSTRY GLOSSARY

RECORDING

ular critical mix (balance) for a drum sound. Suddenly it sounds to you like the bass drum input position is distorting. It normally would be necessary to pull down (turn off) all faders with the exception of the bass drum fader so you could hear the bass drum all by itself to determine if there were a problem and to be able to solve such a problem if it existed. Now you have completely destroyed the drum mix (balance) you had spent 15 minutes to achieve. You correct the problem that is causing the distortion and have to balance (mix) the drums all over again. A solo button in this case would allow you to push the solo button on the input position of the bass drum; this input position would be routed directly to the monitor section and instantly all you would hear is the bass drum. It is important to note that this happens without disturbing the mix (balance) that you worked so hard to achieve.

Usually more than one input position can be soloed simultaneously by simply pushing two or more solo buttons at the same time. For example: You have 12 inputs on the recording console; the first five are drums, position 6 bass guitar, position 7 guitar, position 8 organ, position 9 acoustic guitar, position 10 lead vocal, position 11 background vocal, position 12 background vocal.

You have spent much time getting the particular mix (balance) desired and suddenly you realize the drums do not sound right. Instead of destroying the entire mix you had worked a long time to get, simply push the five solo buttons on the drum input positions and instantly you hear the drums all by themselves without disturbing the mix. A solo button feature on consoles provides a fast and efficient way to mix and to be able to spot and correct problems without any unnecessary waste of time.

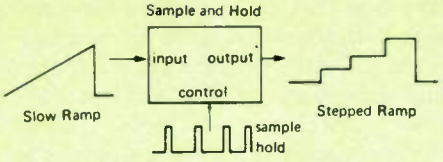
In next month's column we will define and explain a pan-pot, pre-fader, post-fader, and start a look into equalizers.

ELECTRONIC MUSICAL INSTRUMENTS & ACCESSORIES

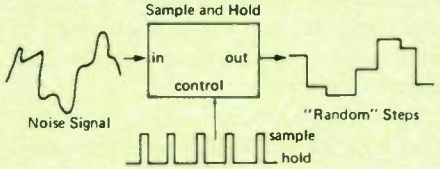
ian. Upon recall, the programmer supplies appropriate control voltages and other signals to the synthesizer elements to re-create the desired "patch." Programs can usually be modified, completely changed, or saved indefinitely.

Sequencer: A device that stores a series of control voltages (or digital equivalents thereof), and "plays them back" to the synthesizer as an alternative to manual (keyboard) control. Sequencers are often used to set up repetitive rhythmic passages on the synthesizer, allowing the musician to play in accompaniment to the "automatic" sequenced passage.

Sample-and-Hold: A processor which, given a "sample" command, follows or acquires the signal voltage at its input. Upon receiving a "Hold" command, the device retains the last voltage sampled. Sample-and-holds are often used with low-frequency oscillators to give a series of ascending or descending control-voltage steps. The "sample" command is given at regular intervals, to produce the "stepped" effect.



The same procedure, used with filtered noise as the input signal, gives a series of "random" steps. The sample-and-hold output signal usually controls a VCO or VCF for interesting "automatic" effects, and may be used to simulate a "sequencer."



Sample-and-hold circuits also serve an important function in digital signal processors, which will be discussed in a later section.

SOUND REINFORCEMENT

Ideally, a speaker's dispersion angle would be nearly the same in every octave band. The best loudspeakers approach this goal, but most general purpose public address designs miss substantially, with their dispersion angle narrowing as frequency increases. In conventional paging system design, the dispersion angle in the octave band where speech energy is greatest (centered at 1,000 Hz) should provide adequate performance. However, the next two octave bands (centered at 2 kHz and 4 kHz) also contribute substantially to the speech intelligibility and under difficult conditions and where the highest quality is desired, listeners should be within the dispersion angle of these bands for the best results.

Dispersion Angle Utilization: Speakers should be aimed to cover the listeners. Viewing from a desired speaker location, what dispersion angle would be needed to adequately cover the listeners without spilling over the walls, floor, and ceiling?

In multiple-speaker, central-cluster installations, it is best practice to have the speakers in close proximity and angled so that the size of their dispersion angles just touch each other. In distributed systems, where speakers are widely spaced, dispersion angles should intersect at ear level.

Horn Stacking: A narrow vertical (up-and-down) dispersion angle is appropriate for long throw applications. Such dispersion may be obtained over a limited but useful frequency range by vertical, lip-to-lip stacking of the horns. In general, each time the number of horns in a vertical stack is doubled, (1) the vertical dispersion angle is halved and (2) the on-axis sound pressure level is doubled (increased by 6 dB). Three dB results from the doubling of the electrical power fed to the entire array and 3 dB is due to confining acoustic output to a narrower vertical angle. Horizontal dispersion is not affected by the vertical stacking.

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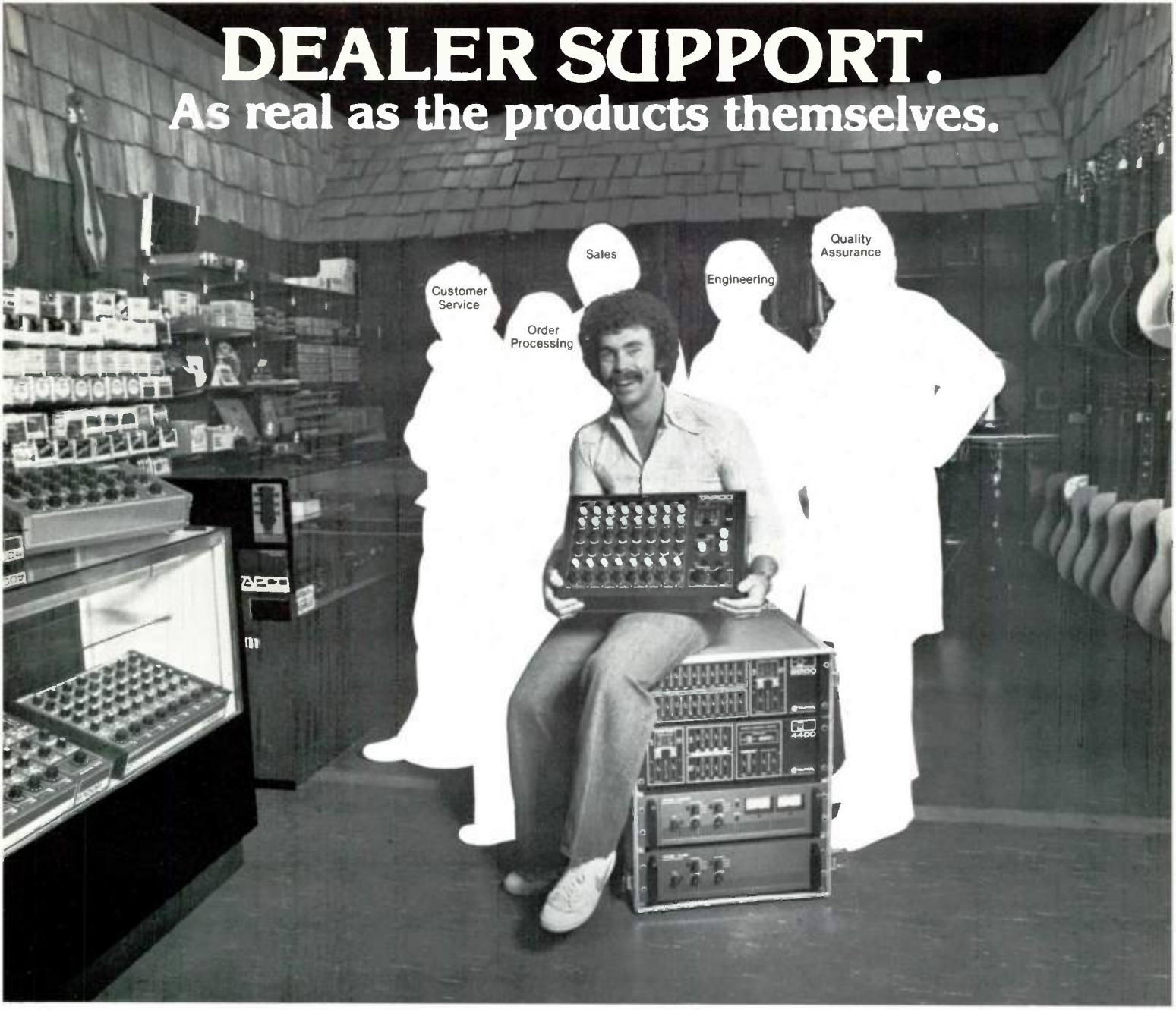

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TROUBLESHOOTERS' BULLETIN

Troubleshooters' Bulletin is designed as an aid to the dealer. Input is invited from both manufacturers and retailers. Share the wealth of your knowledge of repair and maintenance and correction of customer misconceptions. Send your contributions to SOUND ARTS MERCHANDISING JOURNAL, 14 Vanderventer Avenue, Port Washington, New York 11050.

(2)

SOME GUIDELINES ON NOISE

In many instances, one of the first comments made in regard to any type of audio processing equipment is the noise level. Although some designs are better than others, the laws of physics guarantee that any electronic processing equipment will generate a certain amount of noise. What must be remembered is that any mixing console can be made to sound noisy if you work toward that objective.

(3)

I have seen very professional equipment misadjusted to the point that all you could hear was noise in the monitor system. The user should check all of the stage gain adjustments, such as input attenuators, pads, noise gates, channel slider positions, submaster level control settings and master group adjustments, as well as equalization and filters. If there is 20-30 dB of boost in the critical midrange, you can bet that the console is going to sound noisy.

(4)

Adjustments are properly achieved as follows: Using a typical dynamic microphone (preferably one the operator is familiar with), plug it into one of the console's input channels. Make sure at this point that this channel is the only one assigned to the monitor bus. Speak into the mic and adjust the input gain until a normal input level is indicated by the VU meter or LED indicators. If the board is equipped with a noise gate or limiter, adjust the device to the limit mode and adjust the threshold

(5)

as required for 3 dB limiting on peaks. If there is also a noise gate, switch this feature to the bypass mode or you will hear a false indication. Adjust all equalization to an indicated flat position. Likewise, remove all high and low pass filters. Assign the channel output two buses, one and two, or a normal stereo assignment. Make sure the pan pot is in the 12-o'clock position. While observing the bus level indicators, bring up the channel fader until a normal condition is indicated. Assign the monitor to the output bus and then bring up the gain until a

(6)

comfortable level is obtained. Do not touch any of the controls and simply unplug the mic. There should be complete silence if operating in a typical studio control room.

It is easy to see how one can be led astray by playing around with the input gain, equalization and various sub-master level controls. Someone without the proper knowledge can really foul up a very good console by adjusting the controls.

LOTHAR A. KRAUSE, JR.
PEAVEY ELECTRONICS

How can hums and buzzes be avoided in sound reinforcement systems?

Aside from normal equipment and cable failures, hums and buzzes are usually attributable to improper shielding and grounding techniques. Part of the problem evolves from the fact that each manufacturer of professional equipment designs its equipment from the input connectors to the output connectors. Sometimes one manufacturer's grounding scheme may not be directly compatible with another's. Therefore, special procedures must be used to provide proper and consistent grounding between equipment.

By referring to the technical manuals of the equipment involved in the system, it is usually easy to provide proper shielding and grounding between any two pieces in the system. The rub comes in providing a consistent, workable scheme for the entire system.

There are several valid grounding schemes that provide proper grounding and shielding. However, the various methods are not always compatible. Therefore, one system of grounding has to be chosen and maintained throughout the system.

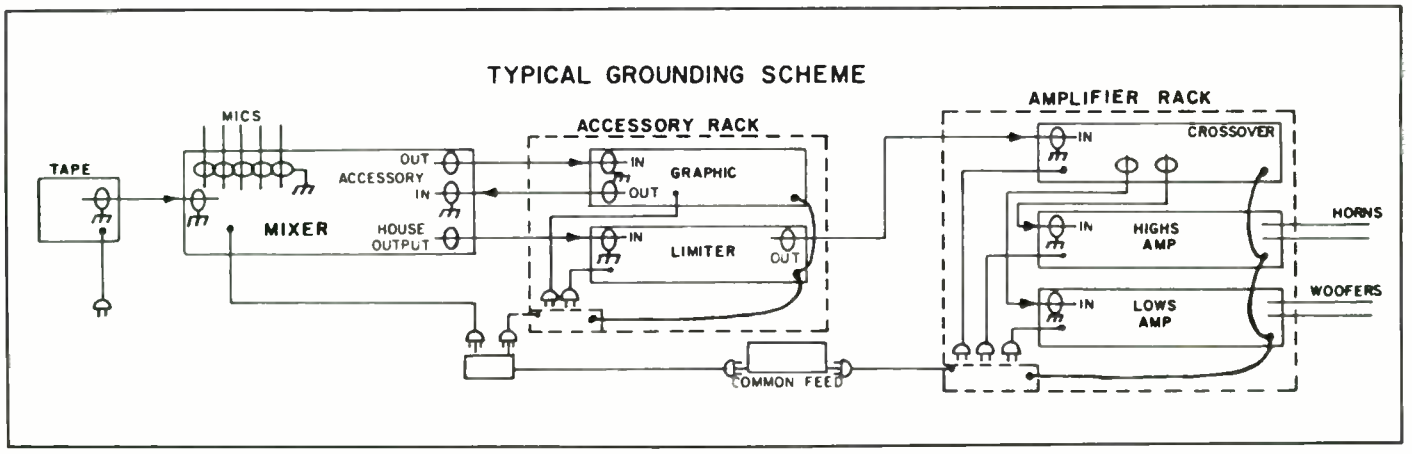
In choosing a grounding system there are three criteria which must be taken into account: 1) The equipment should have an AC (earth or electrical) ground for safety. 2) Signal cables must have proper shielding. 3) There should be no ground loops (more than one ground connection between any two pieces of equipment). So, let's design a grounding system. For AC safety, all equipment chassis should be connected to earth ground (usually with "U" ground pin on the power cord). However, cable shields will connect all chassis together and we violate criterion two and have ground loops. The correct way would be to have all equipment with an earth ground and only have the signal cable shields connected at one end so that they provide shielding of the signal wires, but no inter-equipment grounding. This system is commonly used and works well, but several precautions must be observed.

All AC outlets used must be checked to ensure that they have a good ground. Electrical conduit grounds should not be relied on, especially if the system is spread out all over the auditorium. If the system is a fixed installation, new circuits with grounds may have to be pulled. If it's a portable system, an AC junction box on stage should be built that is capable of powering the entire system including mixers, accessories and amplifiers.

Only one AC ground should be provided to equipment mounted in a common rack. Although most rack mounting rails are conductive, many equipment rack mounting flanges are painted, plated, or anodized and may or may not provide continuity between the chassis and the rack. To ensure proper grounding between the equipment chassis, a heavy ground buss or braid should be fastened between the chassis of each piece of equipment in the rack and then to AC ground. Each "U" ground pin should be isolated from AC ground with an adaptor or in the wiring of the power junction box in the rack.

After all equipment has an AC ground and only one AC ground, the system must be hooked together so that there is proper signal cable shielding, yet no shield connections between equipment. If all of the equipment has balanced inputs and outputs and the system is a permanent installation, it's a simple matter to connect the shield wire to only one piece of equipment (usually the one the signal is going into). However, many of the units used are unbalanced.

When hooking a balanced output to an unbalanced input (or vice-versa), the best procedure would be to use an appropriate bridging transformer. With close attention paid to impedances and phase, the output can be unbalanced by connecting the negative balanced lead to shield at the



output and connecting the positive lead to the unbalanced input with the shield not connected.

In portable systems, the problem is complicated because the special interconnect cables involved may be mixed in with standard mic cables unless some system is devised to simplify hookup. A good way to ensure proper wiring and not have to keep mic cables separated from equipment cables is to use connection panels on equipment racks which incorporate any special wiring required. This way any standard cable can be used to patch equipment together.

With the grounding system, all microphones are grounded to the mixer, so care should be taken in setting up to insulate the mics and stands from ground to prevent ground loops.

If the system designer draws a block diagram of the system with the grounding scheme indicated, the system will be much clearer (ground-wise) than if he just starts connecting the system in a component by component manner without a system plan.

Lawrence Jaffe
Uni-Sync

What would cause a high frequency compression driver to fail?

Destruction of these devices is a major problem, with many possible causes. Some of these might be:

1) wrong crossover point
2) improper crossover slope
3) overpowering
4) underpowering

Underpowering is responsible for about 80 percent of high frequency compression driver failures. Many engineers with less experience reason, for instance, that a 20-watt amplifier could not possibly destroy a driver capable of handling 40 watts. In efforts to pull more sound out of such a system, the amplifier is driven into clipping. This creates a distorted signal (a square wave) that the driver is definitely not designed to accommodate, and thus is permanently damaged.

Blame is commonly attributed to the driver itself—or sometimes to the amplifier, which may also incur damages in this situation. However, the failure is due to misuse.

Marvin Welkowitz
Quantum Audio
New York, NY

By Craig Anderton

For the next few columns I'd like to explain the basic workings of a variety of electronic effects commonly used by musicians. The emphasis will not be so much on theory of operation, but rather on how to apply, use, and sell them for the mutual benefit of the retailer and customer alike.

First, a helpful way to get a perspective on the use of effects is to *view them as solutions to everyday problems encountered by the typical musician*. Therefore, the market for effects consists not only of knowledgeable musicians who are looking for a specific effect they like, but also of musicians who have certain complaints about the "sound." Correctly diagnosing these complaints will often point to an effect as the solution to the perceived problem.

Naturally, different players have different needs, but there are some problems that keep cropping up again and again. For guitarists, two of these are "lack of sustain" and "poor tone." In each of these cases, effects may provide the answer; so let's look at off-the-shelf solutions to these two common complaints. Although we'll be principally talking about guitarists, you will find many of the following corrective measures apply to problems encountered by other musicians as well.

LACK OF SUSTAIN. Effects can help give three distinctive types of sustain. *Preamps* amplify the output of the guitar before feeding a guitar amp; this usually overloads the amplifier, which distorts the guitar's signal and increases the apparent amount of sustain. However, distortion is an integral part of this type of sustain, and generally cannot be eliminated for a "cleaner" sound. In some cases, the amount of pre-amplification is sufficient to create feedback paths between the instrument and amp, producing infinite sustain (but which may or may not be controllable, and which may or may not be desired.

Compression also gives sustain, but does not introduce distortion. A compressor is a variation of the pre-amplifier; its unique feature is that the output of the compressor is pretty much constant in the face of a widely varying input level. Thus, when a note is struck from a guitar, you hear a certain amount of signal; but as the note decays, the gain of the compressor goes *up* to compensate, thus increasing the level of softer notes until they equal louder notes. For example, you can play a bar chord, or a delicate harmonic, and they will both come out at essentially the same level. You may also think of the compressor as "squeezing" the dynamic range of the guitar, thus giving a sustained sound.

Both preamplification and compression bring up the noise level, since both processes involve amplification, and amplification invariably contributes noise. The more amplification, the more noise; so if your preamp has a lot of gain, or if your compressor is set for maximum compression and is straining to amplify a subtle signal, noise will be a part of that overall signal. Noise can be kept to tolerable levels most of the time; however, the guitarist's desire for sustain is often so acute that he'll put up with the noise penalty. One important suggestion is to use the *minimum* amount of compression (or pre-amping) required to give the desired effect. Like any effect, a sledgehammer approach to the controls generally gives sledgehammer results.

A third method of sustain is the *E-Bow*. While I had not planned to mention specific products, this one is unique and offers a sound that is highly coveted by many guitarists. It creates various types of sustain, depending on how you use the device; you can have distorted sustain, clean sustain, and also have the possibility of infinite sustain *with* a high degree of control. However, the E-Bow requires practice and talent for proper utilization, and is not simply a push-the-button type of box. While a player can jump all around the stage when connected to a compressor, the E-Bow does not really allow that luxury. A final problem is that the right hand of the guitarist is no longer used to actually pick strings, but rather to guide the E-Bow over the strings in such a way as to create the desired effects. This means that you can only sustain one string at a time, and that playing at lightning fast speeds is not possible. However, the tone achieved by the E-Bow is exactly what many guitarists are looking for—but if you want to sell them, you'll need someone who can demonstrate the device and really do it justice.

Another method to increase the sustain of a guitar is the fuzz, but that is such a common effect it seems pointless to discuss its operation here. Also, the "Gizmo" looks like a very promising device but I have not yet had the

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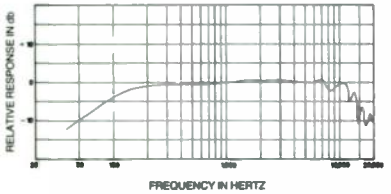

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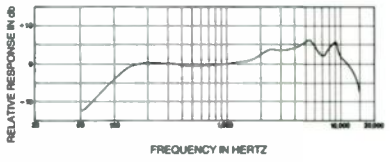

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chance to use one. Finally, I'd like to point out that pickups which claim to increase the sustain of a guitar do not change the sustain *characteristics* of the guitar; they don't do any more than preamping does, *i.e.*, raise the signal level in order to overload a guitar amp or give a fatter sound. Remember, none of these devices except for the E-Bow actually changes the manner in which the strings sustain; rather, they wring out every last bit of sustain possible, given a particular instrument and sustain time inherent in that instrument.

POOR TONE. The most obvious answer to this problem is the graphic equalizer. Graphic equalizers have been around for a while, but earlier models tended to be hum-prone (and expensive to manufacture) due to the technology available at that time; advances in electronics have now made graphic equalizers better *and* less expensive.

The graphic equalizer is literally one of the most universal effects boxes going; it is applicable to response problems in amplifiers, instruments, effects . . . you name it.

A graphic equalizer separates the audio spectrum (i.e. the range of sounds we can hear) into separate bands or slices. Just like a television divides the TV spectrum into a number of different channels, the graphic divides the audio spectrum into a number of different channels. Each channel may then be boosted or lowered, depending on the requirements of the musician.

For example, let's say a bass player lacks "bottom." Using the graphic to boost the bottom range a bit will probably solve that player's problem. Our bassist might also be delighted to find out that boosting the very high end also increases the definition of the notes *without* screwing up the nice fat bottom achieved by boosting the low end. Or, take the keyboard player who complains of a "muddy" electric piano sound. Cutting out some of the midrange will increase the clarity of the instrument, eliminate boominess, and make for a more uniform distribution of sound throughout the audio spectrum. What about a guitarist who feels he or she has a thin sound that lacks punch? This time, a boost in the midrange will often do the trick.

In addition to compensating for problems with instruments, graphics can also help compensate for tonal problems in amplifiers, PA systems, and the like.

One important point is to understand what type of input signal the graphic likes to receive from its source. Some units are designed for hi-fi rigs and require a strong input signal; a lower signal will mean excessive noise. Of course, any effect adds noise, but graphics can make it particularly noticeable. As a general rule, feed the highest signal level you can into the graphic (short of distortion) for the lowest amount of noise.

Graphic equalizers, as already pointed out, are separated into bands; the number of bands indicates the degree of control available with the unit. The more bands in the equalizer, the more options you have for controlling sound. Some equalizers have five or six bands; some have 24 or more. Generally speaking, I feel a simple six-band equalizer is adequate for single instruments (like guitar or bass), since the player is looking for fairly broad changes in tone color. For equalizing more complex program material, a graphic with a larger number of bands is a more likely candidate.

Graphics with 24 or more bands are most useful in precision applications. For example, a recording studio monitor room will not always have an even response because walls, rugs, and other acoustic anomalies will accent certain frequencies and diminish others. A sophisticated graphic can compensate for these differences, thus "tuning" a room for even response (although as with any aspect of the sound arts, there is endless debate over the validity of this technique, the best approach, and so on). Since rooms really have strange responses, sometimes a very flexible graphic instrument is needed.

There are other types of equalizers used in recording studios, but these tend not to exist just yet in "effect box" form. Parametric equalizers, for example, are just starting to filter down into the hands of working musicians, and will probably be very popular six months to a year from now. But our immediate concern is those effects that are available today. Next month, we'll cover more types of effects.

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SOUND REPORT

Solving The Customer's Sound Problems - A Case History

By Ralph Morris

Incongruously mixed in with our mail one day was an unsolicited letter from a consumer who had somehow come upon a copy of SOUND ARTS and who was in equipment trouble. Since the consumer was floundering with a laundry list of problems that could have been solved or prevented by the salesman of his equipment, Ralph Morris has treated the original letter calling for help as a sample—though possible extreme—case to be treated from a retailer-expert stance.

—Editor.

CONSUMER'S LAUNDRY LIST
(printed verbatim)

"Concerning our sound system: We're a local band and don't have a concert system, and can't afford the best. But I would like to know how to get the best results with what we have.

"We are working with two bass reflex cabinets (no name) that hold two JBL bass speakers each (1 cab. per side), 4 Altec high frequency horns multi-cell (bigger than the ones used in Voice of the Theaters), medium priced drivers for power—a BGW 500 for the bass cabinet and two (100 watt) Altec amps for the horns. We use two 8 channel stereo Yamaha mixers (unpowered), a mono JBL crossover, a stereo Soundcraftsman EQ and Roland space echo. We use AKG (D-130?) and Shure SM-58 mikes.

"What I need to know is: Does everything match up ok? Is the EQ ok to use with the Yamaha mixers? Are we losing anything there? How can we get the best drum results? You know that big, deep in-concert type sound? We can't get it quite right. Would a small compressor be of any help? How would you suggest wiring the whole thing up to achieve its full potential? Would you suggest midrange horns and a new crossover? We don't get as much bottom as we should. Our bass cabs. are twice the size of Altecs Voice of the Theaters. The whole thing seems to be lacking something. I know it's hard for you because you've never actually heard it and can't be precise in saying what's what, but you people know what's happening. How can we put it together to do it right? It's biamped now of course. Would running in stereo help?"

SOLVING THE PROBLEM

The situation described above is typical of the problems encountered when someone has assembled some professional quality sound system equipment and the results are less than satisfactory. The problem, of course, is in system design, or audio application engineering, and it is obvious that merely connecting a lot of loudspeakers, amplifiers, crossover, mixer and microphones does not a suitable sound system create.

The components described are of professional quality, and as the writer suggests, something is not right, or the results should be more pleasing to the ear.

The dealer who is confronted with this type of inquiry has to make a decision based on his desire (and ability) to get involved in custom sound system service, as opposed to selling only the most basic P.A. units.

The writer of the letter above has tried to achieve a higher level of sound

system performance then the basic P.A. units offer, by assembling various components of professional quality equipment. This is not a bad idea, but he needs some professional help in analyzing and improving the results. The dealer who desires to engage in this type of service would be advised to employ someone with real training and experience in audio electronics. Another alternative for the dealer who doesn't have a qualified audio technician on his staff is to refer such inquiries to the local supplier of professional audio electronics. This is not always the ideal solution, however, because the local electronics dealer probably doesn't understand the application in this case, which is loud popular music. The loudest thing he may have done in his whole career is the P.A. system in a local church or high school auditorium. If this is the case, he won't be of any help. He might be interested in our problems, professionally, but more than likely he would be totally grossed out at what we intend to do with this equipment.

As the writer suggests, it would be impossible to analyze the system without setting it up and hearing it, but we can go through his questions one at a time and comment on each component of the system.

First of all, I suspect the equalizer. Like the butlers in Agatha Christie novels, equalizers are always to be suspected of the petty crime of adding noise to an otherwise clean signal, if not worse, such as outright distortion, graft, and too sensitive an input for the dynamic range of live music sound reinforcement, and that's a crime against fidelity.

The best way to determine the guilt of offending equalizers is to be sure the built-in "bypass" or "E.Q. out" switch on the equalizer actually results in completely removing the entire equalizer circuitry from the signal path. Sometimes, this can be determined from the schematic or circuit description furnished by the manufacturer. If it does not completely remove the equalizer circuitry (which includes an amplifier), then it is necessary to do the fast repatch routine to actually remove the equalizer from the signal path. The reason for removing the equalizer (or other suspected culprit) from the circuit is so that you can do the A.B. test. "A" with the equalizer in the circuit, and "B" with equalizer out of the circuit. The key word here is *listen*. Listen to the "A" condition, then listen to the "B" condition, with no input signal (system on, normal levels), then with an input signal, say the normal program source, such as with the band playing loudly. However, from the questions, I suspect that a more basic problem exists here. This might be a real mystery, so we should take the questions one at a time and see if we come up with a real clue.

First question: "Does everything match up ok?" Well, that is a tough question, since we don't have all the specifications of the equipment, but the microphones mentioned are of the low impedance type, preferred for professional use. Generally, one can assume that a microphone with an XLR-3 connector (the 3-pin Cannon or Switchcraft) is a low impedance type, and those with screw-on or various configurations of 2-conductors (including phone jack, or guitar cord tips) to be high impedance types.

The professional type, low impedance microphones are preferred because they can be used with relatively long cables (such as a snake cable to the mixer) without losing the high frequency response as much as the high impedance types. The disadvantage (there is no free lunch in audio, either) is that the low impedance types have a very low output voltage, and a transformer (or a new type of solid state circuit) is required at the input of the microphone pre-amp (in the mixer), to step up the voltage for further processing. Eventually, the signal will be sent from the mixer at "line level," which may be arbitrarily set by the manufacturer from .7 to 3.0 or more volts, to the power amplifiers, where the signal will be amplified (in current) to a strength sufficient enough to drive (move) the loudspeakers, and the air by your eardrum.

Okay, so far we assume that the transformers required for these microphones are indeed present and accounted for in the mixer, and we proceed to the equalizer. Our simple A.B. test for E.Q. in, E.Q. out will allow our ears, which are the soundman's basic tool, to evaluate its noise and distortion components.

While we're on the subject of equalizers, let me say that they are not cure-alls for changing low-fi into high-fi. That's alchemy, like turning lead into gold, or a pig's ear into Linda Ronstadt, so don't count on it.

If you use the equalizer for attenuating (turning down) whatever frequencies tend to feed back when the system is operated at high levels, fine. If you turn a lot of the levers up in the "boost" range, then you are using the equalizer as an amplifier (actually, a line amplifier), and you may be overdriving the next component (in this case, the electronic crossover), or at least introducing some noise and distortion to the signal. Always suspect the equalizer. "How can we get the best drum sound?" and "You know that big, deep in-concert type sound" both tell me that the customer doesn't have the bottom end response (40-200 H) that he should be getting with a 500 watt amplifier and a total of four (15 inch?) woofers. Mic the individual drums as closely as possible near the edge of the (top) drum head, for snare and tom toms, and in the front of the bass drum, whether a front skin is fitted or not. The loudspeakers should be located so that they are not behind the front edge of the stage, if possible, so that the system may be turned right up without feedback. I know this isn't possible in a club where the stage really sticks out into the room, and they want the P.A. put "back against the wall." That is one of the cardinal rules of live music sound reinforcement, where the level required to balance the drums and vocals with the electric instruments is going to require turning it right up (that means as far as it goes) without feedback. Well, anyone who has set up a P.A. more than one time can tell you that with the speakers behind the microphones, you can't get it up enough to do your job, no matter what kind of equalizers you may have.

Speaking of cardinal rules, there was a rumor that in the early days of concert sound (talkin' about '67) there was a sound man's "list of secrets" that was supposedly ripped off once from John Judnich, the legendary rock n' roll sound engineer of the sixties. I've never seen that actual list, but I'd bet the rule about never putting the loudspeakers behind the microphones would be on it.

Now, to answer your questions about a small compressor. Why does it

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Ralph Morris is vice president of Tycobrahe Sound Company. He has acted as sound engineer on tour with such artists as Frank Zappa, Stevie Wonder, Fleetwood Mac and Boston.

have to be a small one? No extra room in your equipment rack, huh? Seriously, I did see a neat set-up with two compressors mounted side by side in a standard 19-inch rack; only took about 4½ inches (vertically). It was in an amp rack we built for a keyboard system, which resembles your system quite a lot, having 2 cabinets, each with two 15" woofers, a mid-range horn, and two tweeters, powered by two 300 watt amplifiers, with a similar crossover and equalizer. With those (stereo) compressors set just right, the musician could play a synthesizer through it at a horrendous level, without too much distortion. Of course, it sounded like a square-wave generator, since that's what it was, but that keyboard player was delighted with it, because the compressor is usually a better line amp than an equalizer, and not so noisy. The real advantage, in live sound reinforcement, is that the compressor can be adjusted to provide the correct (read maximum) signal to the crossover (and to the amplifiers) without excessive distortion, and then automatically attenuate (turn down) any signals in excess of that, such as when someone drops a vocal mic.

However, before we suggest a compressor as the answer to the customer's problems, we should get back to our basic sleuthing. How would we wire the whole thing up to achieve its full potential? Perhaps in that question lies the heart of the mystery. The number one son, if this was Charlie Chan in Audio Land, would snap his fingers and say something like: "Gee, Pop, you mean it's a case of good equipment falling into the hands of Ms. Match and the gain robbers?" Could be, Number One Son, if the mixers don't have enough output voltage to drive the equalizer, which would come next in the system, then the crossover, then the power amplifiers, and then the loudspeakers.

I failed to include the echo unit mentioned, maybe subconsciously on purpose, since it's sure to be noisy, if not a source of hum and distortion. I realize some form of artificial echo (as opposed to the natural reverberation characteristics of the room) is desirable for certain vocal sounds, and the cost of electronic digital delay is prohibitive, and the less costly electronic (analog) delay units are noisy. So, if you must, run a separate output from the mixer "cue" or "effects" sends, and bring the output of the echo unit back into the mixer through an unused channel.

Caution: The output of the echo unit will be at "line level," and unless the "return" (input) channel we use has a "line-mic" level switch, we will need a 20 or 30 dB "pad" (another soundman's essential tool) to reduce it to mic level again, for re-introduction to the mixer. That way, we can turn up the return channel slightly when the echo effect is required, and if it is slightly noisy or distorted, it won't be so objectionable because it would never be as loud as the "dry" (untreated) channel. In any case, don't run the mixed output through the echo unit, or everything will be warbled.

The mid-range horns and crossover described should be fine. The crossover frequency isn't mentioned, but I assume it is between 500 Hz and 800 Hz. If the customer wanted to go stereo, you could add another (mono) crossover and a duplicate set of amplifiers, but I wouldn't recommend stereo for live music sound reinforcement. Not only does it require twice as many amplifiers, but it isn't fair to the people on one side of the room (or the other side) to hear one side of a "stereo" mix. Remember, it's only stereo in the middle, and on either side it just sounds like whatever is imaged toward the other side is not loud enough. But we're getting ahead of your questions. "Would it help to run it in stereo?" is actually the last question, but the answer is *no*, anyway, because if it doesn't get it on in mono, it won't do it in stereo, either.

To get back to how it's wired up, I assume that the loudspeakers are wired correctly in *P*arallel for *P*ower (*S*eries for *S*tingy). Another caution: In this case, the amplifier won't mind if the two woofers on either side are connected to one channel of the amplifier, in parallel, even if (hopefully) the loudspeakers are 8 ohms, since this will result in a total load (per channel) of 4 ohms, quite satisfactory.

However, there is a limit to how many loudspeakers can be arranged in a parallel circuit, which will be announced by a hot and sticky amplifier, or at least some blown fuses.

Since the system doesn't seem to have enough "bottom" (bass

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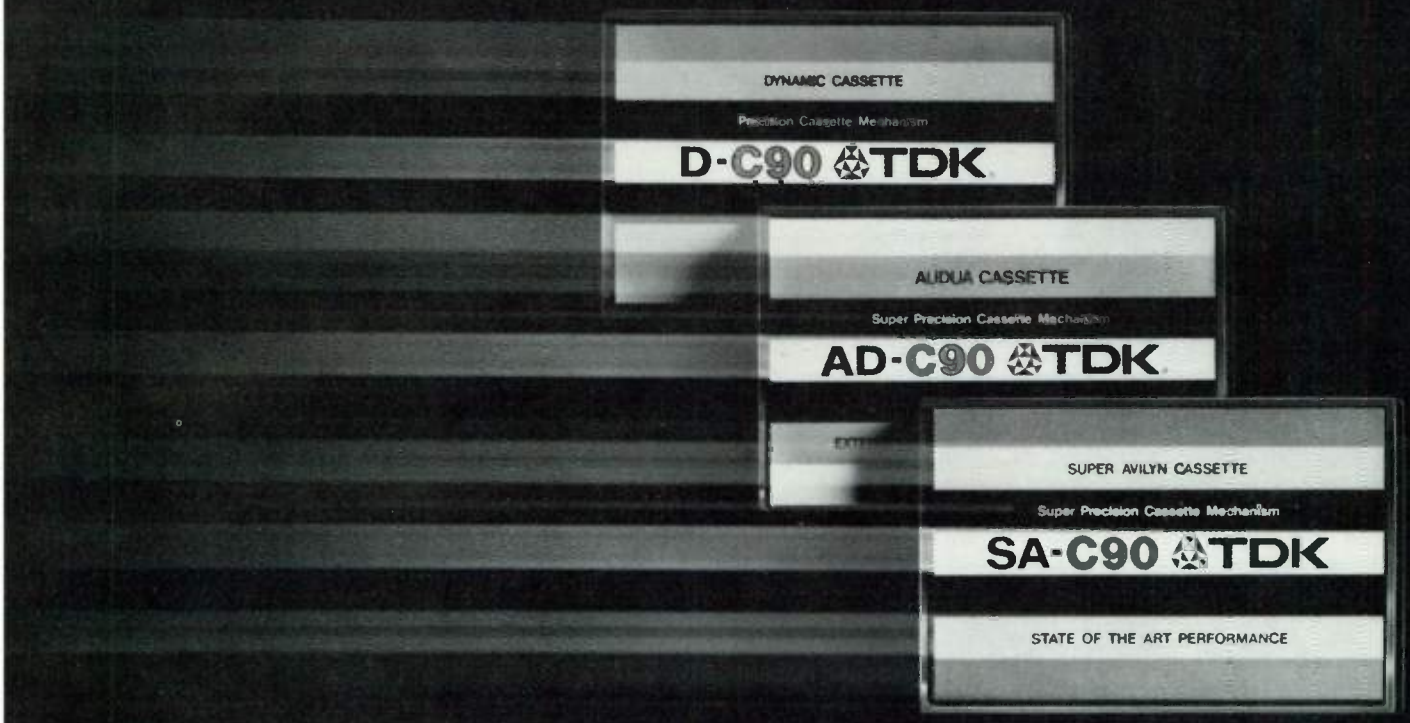

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response), I suspect that the bass reflex enclosures are not correctly tuned (a function of the port area vs. enclosure volume). The manufacturer of the woofers mentioned supplies accurate information regarding the design and construction of bass reflex enclosures for their products.

The reason I wonder about the enclosures is that there should be *tons* of bass with four 15-inch woofers and 500 watts to drive them, even if the enclosure is not tuned exactly right. One more suggestion: Make sure that all the speakers are in-phase, or moving together. (Positive voltage on plus terminal results in forward speaker cone movement). If two (or more) loudspeakers are out of phase, the bass notes will tend to be diminished. You can make this test with an ohmmeter (set on a Resistance scale) or any 1½ volt battery source.

In the description of the speaker systems, "medium price drivers" are mentioned. I'm not sure what that means, but I hope the compression drivers are correctly matched with the midrange horns.

The system is "bi-amped." This is good, for systems which are required to operate at high levels. Bi-amped means using a special crossover to divide the output from the mixer into highs and lows, which are then amplified by separate amplifiers. The reason for this is to prevent total distortion from wiping out the highs when a big bass note takes up all the headroom in a single amplifier system. Here again, you only need the benefits of bi-amping when you need to make it loud. Conventional (not bi-amped) systems with multiple loudspeakers use "high level" crossovers to divide the highs and lows *after* they have been amplified. This is the type crossover found in most home stereo speakers. The relative power output of the amplifiers in a bi-amped system should be about four or five to one, which means that the bass notes need about four or five times as much power as the highs, depending on the efficiency (and power handling capabilities) of the loudspeakers.

There is such a thing as "tri-amped" or four-, or five-way (quint-amped?) systems, in which separate amplifiers are used for bass, mid-bass, low-mid-range, high-mid-range, and highs, but this really isn't necessary, since the higher notes require relatively little power, compared to the bass notes, and only 10 or 20 watts are required for the tweeters of a three-way system whereas 200 or 300 watts is required for the bass notes, so any good amplifier can handle all the upper spectrum (above 800 Hz, for example) without so much IM distortion that the ear could detect. In this case, a "passive" or high-level crossover is required between the mid-range driver and the tweeter. As you can see, the loudspeakers don't appear to be so complex as the electronics part of our equipment, on first examination. However, more mistakes are likely to occur in the application of loudspeakers than all the mixers, equalizers, compressors and other parts of the sound system.

For the second part of this article, we will focus our attention on the loudspeaker, and how to get it loud without too much distortion.

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CIRCLE 87 ON READER SERVICE CARD

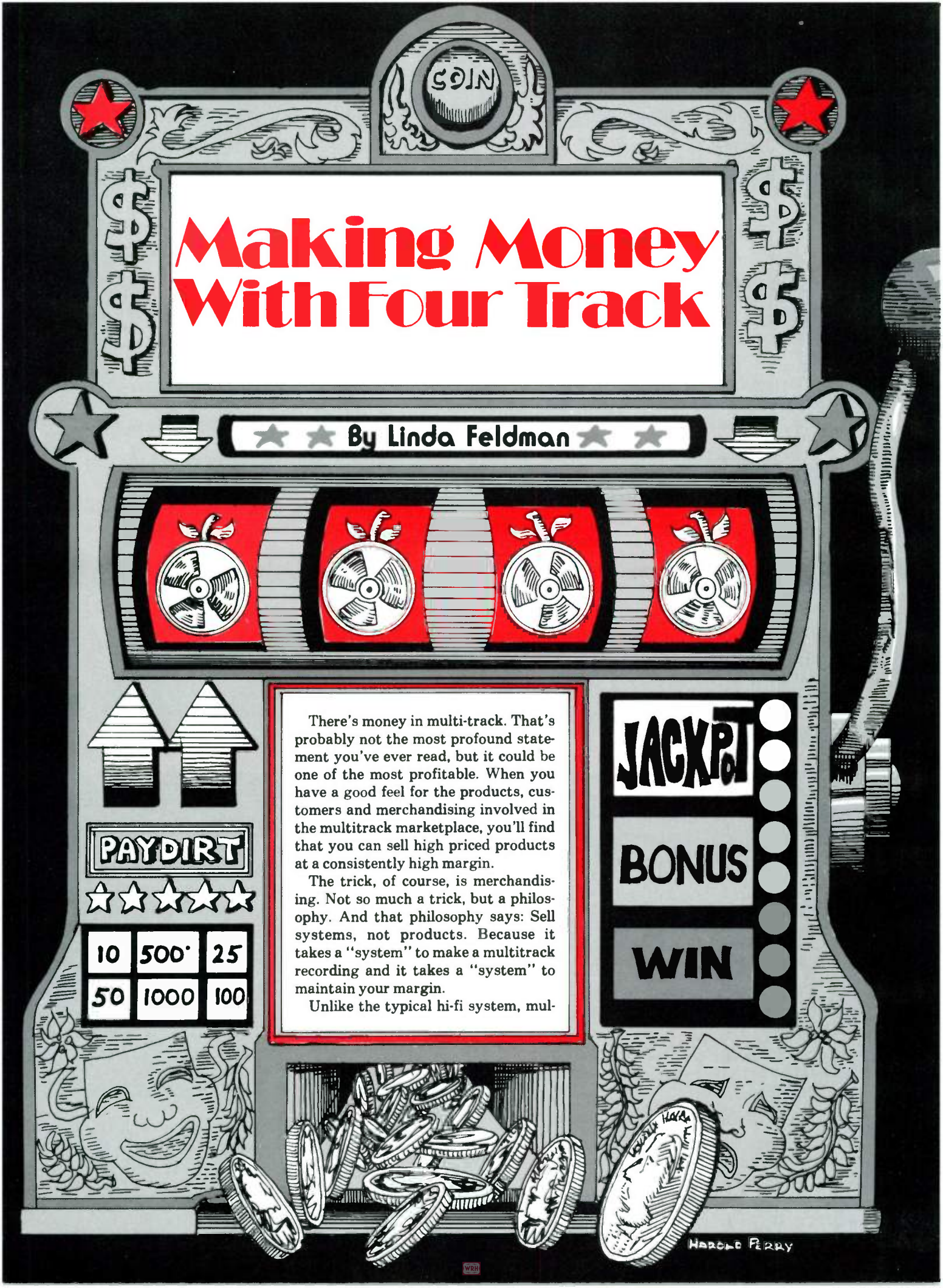
Making Money With Four Track

By Linda Feldman

There's money in multi-track. That's probably not the most profound statement you've ever read, but it could be one of the most profitable. When you have a good feel for the products, customers and merchandising involved in the multitrack marketplace, you'll find that you can sell high priced products at a consistently high margin.

The trick, of course, is merchandising. Not so much a trick, but a philosophy. And that philosophy says: Sell systems, not products. Because it takes a "system" to make a multitrack recording and it takes a "system" to maintain your margin.

Unlike the typical hi-fi system, mul-



ti-track rigs are almost limitless in scope. The product list starts with a 4-track recorder, mixer, and mixdown recorder (usually a ½-track open reel deck). But the list of "necessary" equipment goes on: cassette deck, turntable, power amp, pre amp, loudspeakers, mics, mic cables, mic stands, transformers, cleaning and editing kits, tape, headphones, flight cases for traveling and a host of outboard signal processing products (equalizers, noise reduction units, limiters, phasers, flangers, digital delays, reverb units and lots more).

There are also a few extras like interface charges, interconnect cables and service contracts. Everything can be realistically packaged into a multitrack system. (It's probably a good idea to display a multitrack system, prepackaged, for the beginner, intermediate and "expert.")

The obvious key is that you learn your customer's needs at the time of the sale—which means at the beginning of your supplier-client relationship. You can determine how deep an interest (or need) your customer presents. And how expensive his first (or new) system should be. Some "first" systems might consist of a 4-track, 2 microphones, headphones and some tape. But all of the above mentioned products should be explored. They're applicable. And they're needed. You may even offer some kind of loan or rental program to further whet your customer's appetite.

WHO IS THE CUSTOMER?

To get a better picture of what your customer needs, let's take a look at who your customer is. Most likely, your 4-track customer is a single musician who wants to polish his instrumental skills, or a small combo or band readying a demo tape. But consider the vast opportunities if you look at all the people who may need multitrack equipment: musicians, a novice engineer, old time pro, hobbyist or someone making a living with the gear, audio visual producer, jingle writer/producer, advertising agency, industrial film maker, church, high school, university, disco, local club, bar, restaurant, or broadcaster. The list is endless. Identify your markets.

The 4-track market even extends up to the studio musician who typically works in a 16- or 24-track studio, but needs to work on his own music at home—where the clock and cash register aren't working against him. Some top artists work this way and then have the material transferred over to the master 24-track recorder.

Whoever the person is, the need and final end product tend to be the same. The 4-track customer is someone who must assemble audio tracks and have creative control over the result, then produce top quality fidelity from the equipment that gives him the least trouble and most consistent reliability. Quite simply, multitrack is active and your customer is an audio activist.

HOW TO REACH HIM

An interesting point comes up when, after you've identified your customer, you consider how to get him into your store. Often, he's "self-motivated." He knows he's got to get his music on tape, but doesn't quite know how. He may have a friend who records. Or he may know about multitrack simply from being around others who work with the gear.

But if you're interested in making money from multitrack, you've got to promote. You can check the June and July issues of SOUND ARTS for ideas—particularly on running in-store seminars. Some other ideas you might consider include sending your salesmen (or yourself) on speaking engagements to school and college music classes. You'll find it profitable to send a salesman to the local clubs to visit with the owner and the current band. A field salesman will bring in customers and money. Then, of course, there's advertising. And that's another science altogether. It might really pay off in the long run to contact an expert. Your business is retailing, his is advertising. And bad advertising can do you more harm than no advertising. Begin to advertise systems, if you haven't already.

Once you have a "prospect" in your store, turn him into a customer with useful information—answers to his problems. Sell him the right tools to do the job. For example, if the system you sell will become part of a permanent installation, make sure you discuss a patch bay. It's an interface tool that makes hook-up, tracing problems and rearrangements of cables dramatically easier and faster.

You might make sure your customer knows the difference between a P.A. mic and a studio mic, especially if he's doing outdoor remote recordings. This might be a good chance for you to loan or rent special purpose microphones—with an open eye towards selling them (a rent-buy program). You may know certain mics that are only suitable for one of the jobs: he may not. If you know the mics that work well for both applications, work with that kind of information with your client. Knowing your product lines and letting the customer test the equipment in his environment will increase your profits at a faster growth rate and add credibility to your store.

A final example is showing your customer the real differences between a P.A. board and a studio recording board. Sometimes, you'll run into someone who needs, and can't afford, different boards for two different applications. If your customer thinks the board can do something it can't, you've just lost a repeat customer.

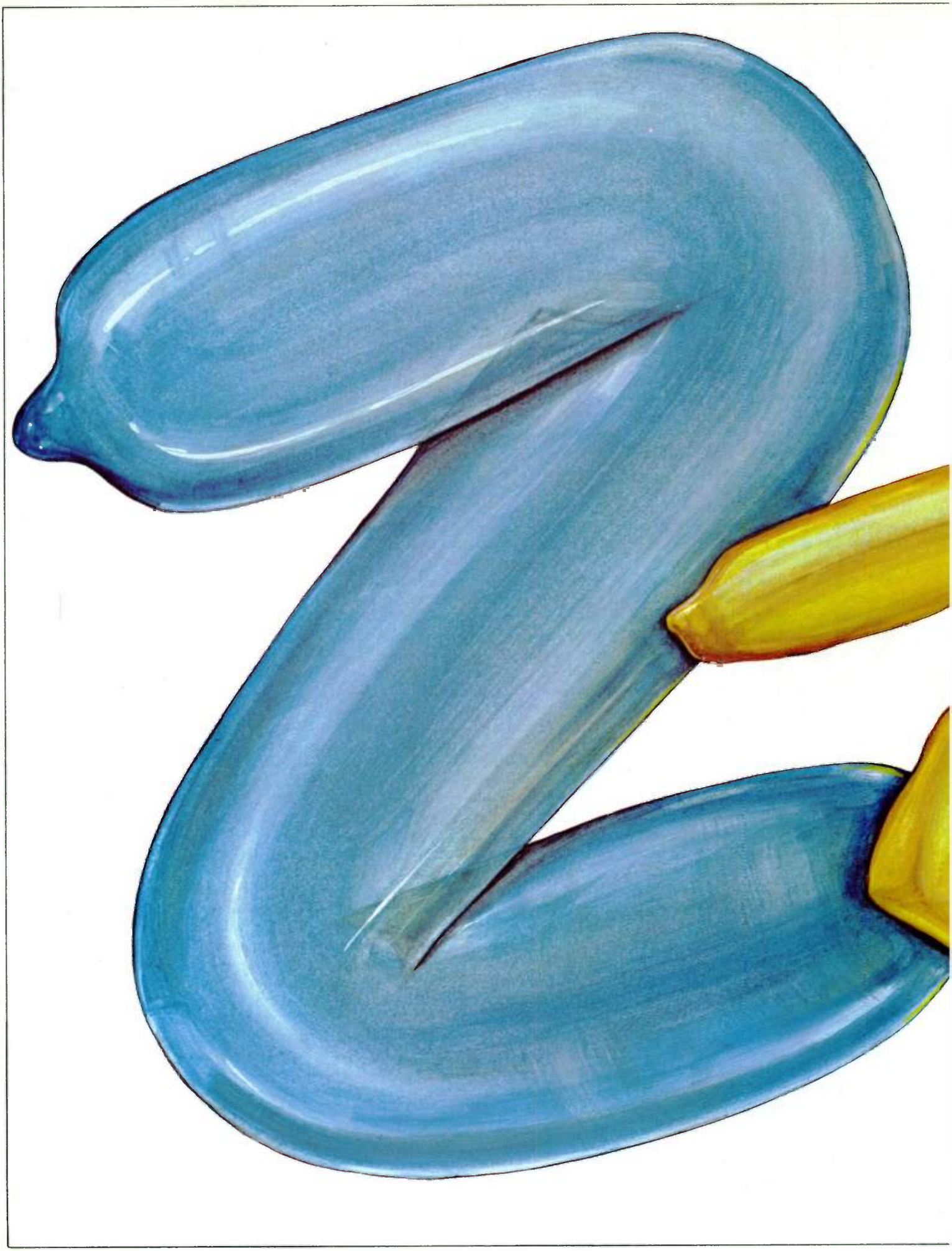
REPEAT BUSINESS

All this helps establish your credibility. At the same time, you're pinning down specific needs and the products that answer those needs. Once you've created a good rapport and established your own credibility, selling items like alignment tapes and test tapes will be far easier. It will also become easier to sell service and/or installation contracts.

By now, you should have a good idea why multitrack products fit a "system" sales approach so perfectly. The clincher is that there's big money in multitrack when you get repeat business. And the "natural" order of things being system-oriented, you'll find that every customer keeps coming back for more and more gear. For example, if he comes back for a roll of tape a week for a full year, you might bring in an additional $500-$800. Then add in extra mics, cables and perishables like cleaning kits and editing kits, and you've made a client out of a customer—which means your sales dollars will keep adding up. Not only will he be back for more gear, but for the next generation of 8-, 16- or 24-track equipment. Don't forget his friends who may wish to go into production.

So the message is: Sell multitrack in systems. Someone once described the tape recorder as the notepad of the future. But as we all know, notepads are useless without pencils and erasers.

Linda Feldman is a recording engineer and the former Training Manager of Teac. She is currently a consultant specializing in professional audio.



IMPEDANCE MATCHING

By Irwin Zucker

The symbol for impedance in electronics shorthand is Z . . . probably because it's the last thing anybody talks about. But it seems there's been a lot of bottom scraping going on, because a lot of confusion seems to exist regarding impedance matching of audio devices. To avoid confusion on your customer's part and to keep your head together concerning impedance, here is a rundown of the basics—both theoretical and practical—for translation to your customers.

A FEW BASICS

What is impedance? Impedance is the total opposition which a circuit offers to alternating current at a particular frequency. Suffice it to say that impedance does change with frequency. As an illustration, the 300-ohm "twin-lead" that connects an antenna to a TV set presents a 300-ohm impedance to high frequency TV signals, but at the relatively low audio frequencies, it's an open circuit.

Impedance, like resistance, is expressed in ohms, but it is more than resistance. Resistance is a term generally associated with DC (direct current) circuits. Purely resistive devices (*e.g.*, resistors) are also present in AC (alternating current) circuits (audio circuits are AC circuits), but impedance is a combination of *resistance* and *reactance*. Reactance is a term associated with AC circuits and refers to the opposition to current flow imposed by capacitive and inductive elements in the circuit. Capacitors and inductors (coils) are frequency sensitive devices. They are what makes impedance a frequency-dependent variable. Capacitive reactance (the opposition imposed by a capacitor) and inductive reactance (the opposition imposed by an inductor) vary in value with the frequency of the signal. But we said we weren't going to worry about frequency, only Z values.

Impedance is the relationship between voltage (E) and current (I). Impedance Z is equal to voltage E divided by current I (Z=E/I). In other words, impedance is a *ratio* of voltage to current. If we have 150 volts and one amp of current in a circuit, the impedance is 150 ohms. Likewise if we have 15 volts and 100 milliamps (100 thousandths of an amp or 1/10 amp), the impedance is 150 ohms.

Why match impedances? By impedance matching we mean making the output impedance of one device exactly equal to the input impedance

of the next device in a circuit. *(When you connect two devices together, such as a mixer and equalizer, they are then part of the same circuit.)* By matching impedances, the maximum amount of power is transferred from one device (stage) to the next.

Why? Remember that Z=E/I. Power (P) is equal to E × I. If Z changes, the values of E and/or I must also change, which means that the value of P must also change. Since the portion of the circuit of concern here is a passive one (*i.e.*, without amplification at that point), the only change in power possible is a loss. Therefore, maximum power is transferred when transfer impedance (or voltage-to-current ratios, if you like) remain constant.

Is impedance matching important? Ten years ago you could not have assembled a sophisticated audio system without being very competent at exact impedance matching. A decade ago it was common practice to design equalizers, filter, and variable attenuators as completely passive in-line devices. In such circuits, impedance mismatches would result in severe losses, rendering the signal so weak that the signal-to-noise ratio would be very poor.

Today it's a different story. Passive devices are rare, if used at all, and virtually no equipment intended for the creative audio marketplace is without gain stages.

So why all the fuss about impedance matching? Actually, no one really requires you to match transfer impedances between major devices. *Impedance watching* might be a better term, since virtually all devices today are designed with a low-Z out, high-Z in impedance coupling.

SOME PRACTICAL STUFF

The one way street: Low-Z out, High-Z in.

If you remember this one basic rule, you won't get in trouble when putting a system together, at least as far as impedance matching goes: *A relatively low output impedance goes into a relatively high input impedance.* (A low-impedance-to-high-impedance ratio of 1:10 is considered standard. Ratios much higher than this usually result in intolerable losses.)

Irwin Zucker is Director of Product Development of musicians' sound equipment and home high fidelity products at Altec Lansing.

The reason for this is that virtually all devices of concern are voltage controlled amplifiers, and can handle relatively large voltages but very little current. Look at Figure 1. Figure 1A shows the condition of equal source and load impedances. Current, voltage, and power are equal and power is maximized. Figure 1B shows a high source impedance and low load impedance. Voltage and power are reduced, but current increases. Figure 1C shows a low source impedance and high load impedance. Current and power are reduced but voltage increases. Conditions A and C are desirable. Condition B will result in excessive noise and distortion and deterioration of frequency response.

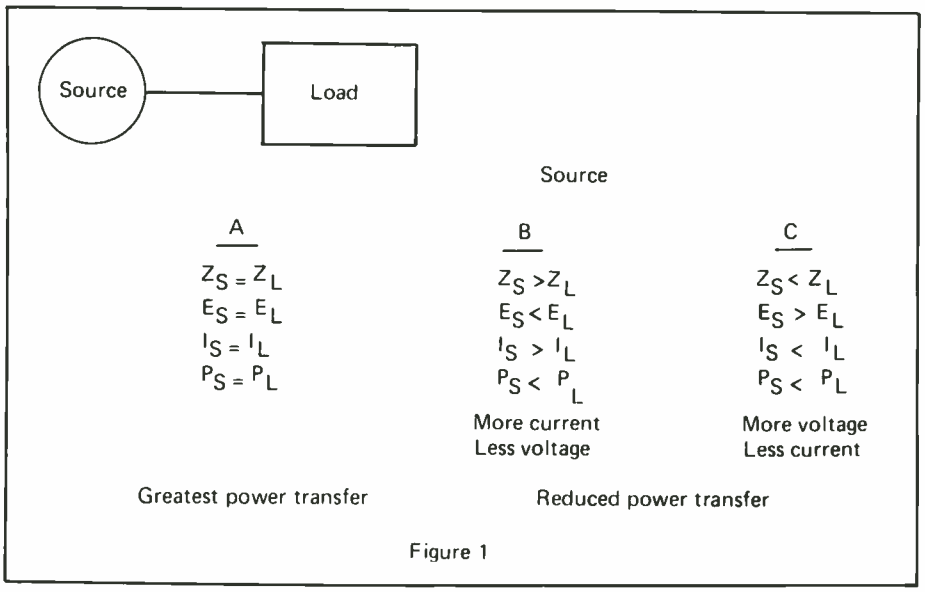


Figure 1

Today's key factors: Output level and input sensitivity vs. transfer impedance. Your primary concern with component matching is simply this: Will there be adequate signal level to drive the next device without requiring large amounts of additional gain creating large amounts of additional noise?

The output level of one device and input sensitivity of the next are dependent on the transfer impedance. A "rated output" is only possible into a certain load impedance. As you move farther away from this ideal load impedance, more and more power is lost during the transfer.

The "variable output" power amp mystery solved. Modern solid state power amplifiers have very low output impedances, usually less than ½ ohm. The Altec 9440A power amp's output impedance, for example, is .1 ohm per channel. It will deliver about 250 watts per channel into 8 ohms, but at 4 ohms power goes up to 450 watts. Why? Because 4 ohms are closer to the .1 ohm output impedance than are 8 ohms; therefore, the greater the power transfer. Output transformerless power amplifiers can't work into extremely low output impedances, however. If load and source impedances were matched, so much power would be developed that heating would be a problem, forcing the output transistors into an unsafe operating range or thermal runaway.

Transformer-coupled power amplifiers, such as tube designs and some solid-state commercial amplifiers, use tapped output transformers to match output impedance to load impedances. In so doing, maximum power can be transferred to a variety of different load impedances.

Power amplifier load impedance. Although some power amplifiers can safely drive 2 ohm loads, 4 ohms are considered the minimum for a safe power amp load. If you want to go below 4 ohms, check with the manufacturer of the amplifier first, if 2 ohm operation is not covered in the operating instructions or specifications.

How do you know what your actual impedance is? Well, if you're only driving one speaker (for the sake of discussion, a speaker system and a speaker will be considered to be the same), it's simple—it's the rated impedance of that speaker. It's when you get more than one speaker on an amplifier (or amplifier channel) that confusion develops. You must know how to calculate net impedances.

To an extent that no other stereo power amp in its price range can equal, the Peavey CS-400 is a totally versatile amplifier.

The CS-400 offers many features in terms of operation, engineering, and concept never before available.

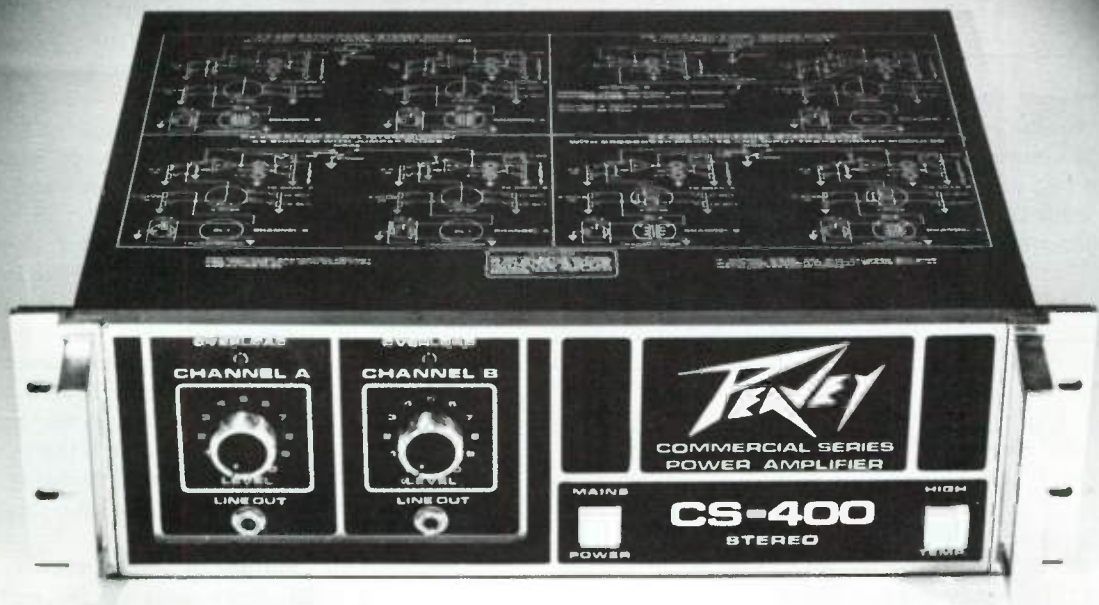
Up front, the CS-400 features a rugged 5.25" x 19" rack mountable chassis with a steel reinforced, die cast panel for beauty and protection. LED overload indicators, level controls, line outputs, high temperature indicator, and lighted mains switch add to the amp's clean, functional design.

Inside, the CS-400 is an uncompromising fusion of modern, solid-state technology and quality components. 200 Watts per channel into 4 Ohms, less than 0.1% total harmonic distortion, with an extremely wide frequency response (+0, -1 dB 5 Hz to 40 kHz @ 1w, 4 Ohms) make some pretty impressive specs.

But there's a lot more to the CS-400 than raw power and impressive specs. What really makes the CS-400 so special is its versatile back panel and patching system that enable such accessories as input transformers, crossover networks, and bi-amping possibilities using small interchangeable plug-in modules. With the CS-400's plug-in module system, our engineers have created a method to *fully utilize* all the performance capability of the amplifier.

Without this unique patch panel, our CS-400 would just be another great amplifier. With it, it'll be another standard for power amplifiers.

Get all the details at one of our selected audio dealers. He'll show you why incredible values are *still* a reality at Peavey.



The Peavey CS-400

Power @ Clipping:
(1.0% THD, 1.0 kHz, 120 VAC Line)
260 Watts RMS into 4 Ohms

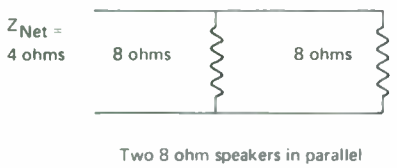
Total Harmonic Distortion:
Less than 0.1% from 20 mW to 200 Watts RMS
20 Hz to 20 kHz into 4 Ohms, typically below 4 Ohms

Intermodulation Distortion:
Less than 0.1% from 10 mW to 200 Watts RMS
into 4 Ohms, typically below .05%

Frequency Response:
+0, -1 dB, 5 Hz to 40 kHz (1 Watt, 4 Ohms)

CIRCLE 71 ON READER SERVICE CARD

For speakers of the same impedance wired in parallel (Figure 2), it's easy: It's the impedance of one speaker divided by the number of speakers. So if you have two 8 ohm speakers in parallel, your net impedance is 4 ohms. Two 4 ohm speakers, 2 ohms; three 8 ohm speakers, 2.67 ohms, and so on.



Two 8 ohm speakers in parallel

Figure 2

For unequal parallel impedances (not recommended with speakers), multiply the impedances together and divide by the sum of the impedances (called the product-over-the-sum method).

$$Z_{Net} = \frac{4 \times 8}{4 + 8} = \frac{32}{12} = 2.67 \text{ ohms}$$

Figure 3

Note that the net imepdance is always lower than the lowest individual impedance in a parallel circuit.

For more than two unequal parallel impedances it's a bit trickier, but still the basic product-over-the-sum. (See Figure 4).
unequal impedance (figures 3 and 4) if at all possible. The current divides unequally, sending more current to the lower impedance speakers, less to the higher impedance speakers, but the Avoid paralleling speakers of voltage is developed across the net impedance, so far more power is delivered to the lower impedance speakers, placing these in jeopardy of failure well before the higher impedance ones (assuming near equal power capacity). Also, your chances are very slim that the sensitivity of three different speakers would be even close, causing an imbalance and just plain bad results. The best rule is to parallel only the same model and the same impedance of speakers.

Microphone Impedance. There are basically two kinds of dynamic mics (the most common) around today: Those with a low impedance voice coil fed directly to an amplifier and those with a low impedance voice coil fed through a step-up transformer to the amplifier. (Condenser mics, both conventional and electret type, have elements with very high output impedances [often in millions of ohms]. They are all equipped with internal step-down transformers, however, to bring them down to a usable [low] impedance. Impedance wise, they handle the same as low Z dynamics.) The first type is referred to as a low impedance mic, the second as high impedance.

Why two kinds and when do you use which? Using high impedance mics—10 K ohms to 50 K ohms (K refers to Kilo, or thousand, so 10 Kilohms = 10,000 ohms)—simplifies amplifier input circuitry, making lower cost mixers possible. Low impedance mics require an input transformer or more advanced circuitry than the high impedance type, and are, consequently, more costly. High impedance mic designs demand limitations on cable length, because the distributed capacitance of the cable increases with cable length. This is the same as putting a capacitor in parallel with the mic's voice coil—it then functions as a low-pass filter.

In other words, high frequencies are lost. The longer the cable, the bigger the capacitor, the greater the loss. Low impedance mics may be used with very long cables without serious losses. (Hundreds of feet are not uncommon in some large outdoor portable reinforcement systems.) If you must use a high impedance console or mixer and have a choice of mic impedance, use a low impedance mic and put a step-up transformer *on the end of the cable at the mixer input.* This way the cable length does not affect response, and gain is not lost due to impedance mismatch. A low impedance mic can be used into a high impedance input without frequency response deterioration, but not vice versa. A low impedance mic will deliver a substantially smaller signal into a high impedance mixer, requiring more gain, and consequently, increasing the noise. Generally speaking, high impedance gear, both mics and mixers, are considered to be inferior equipment to low impedance untis. High Z stuff is never used for professional applications. If given a choice, always go low Z.

Splitting and combining. Splitting (dividing one microphone's signal between more than one mixer input) and combining (summing more than one line level device's outputs into a single input) are often used—and often useful—techniques. If you follow one basic rule you'll never have trouble: *Two* is the maximum—a one-into-two split and a two-into-one combine.

Remember that you are paralleling impedance by splitting and combining, so your impedance lowers, as do your individual signal levels. Splitting or combining with more than two devices per junction will probably raise the noise level into the unacceptable region.

Balanced and unbalanced lines. Generally speaking, systems which are balanced line throughout are rare today in all but permanent installations in public facilities. Recording studios, musician's sound equipment, and home gear are all designed for "direct output" or unbalanced line.

The basic difference is this: Balanced lines have separate lines for signal common and chassis ground. Cable shields are connected to chassis ground, while signal lines are coupled from input to output by transformer (or equivalent ciruitry called "Active

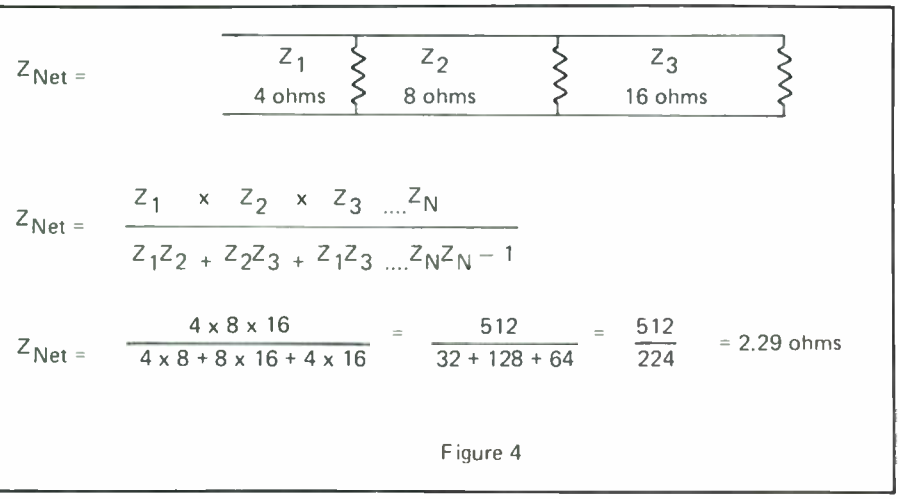
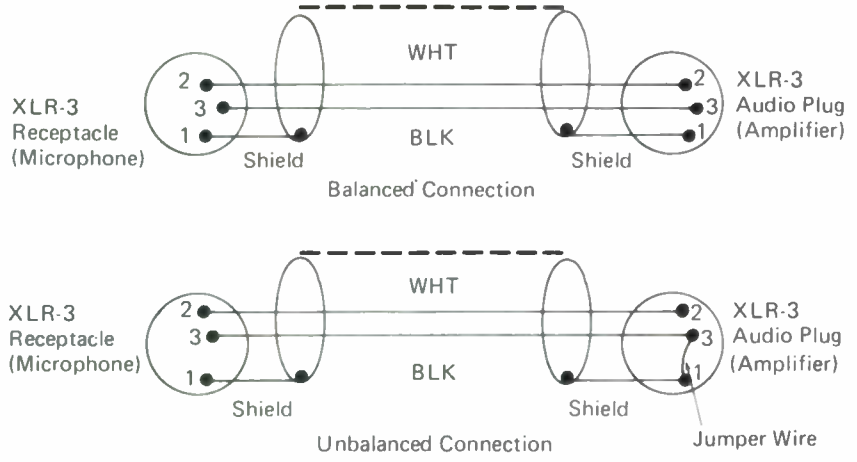


Figure 4

Balanced"). By inducing the signal from the primary side of a transformer to its secondary, direct electrical connection is avoided, keeping the devices isolated. In an unbalanced configuration, the signal common and chassis ground are the same line. The devices are all directly interconnected.

Balanced-line systems are required where long cable runs are necessary to keep noise down. But in relatively concise and simple systems, direct connection is quite acceptable. In addition, all but the finest line transformers will deteriorate low (Below 50 Hz) frequency response.

Microphone inputs should be balanced and transformer isolated. This keeps noise and radio-frequency interference (RFI) to a minimum.

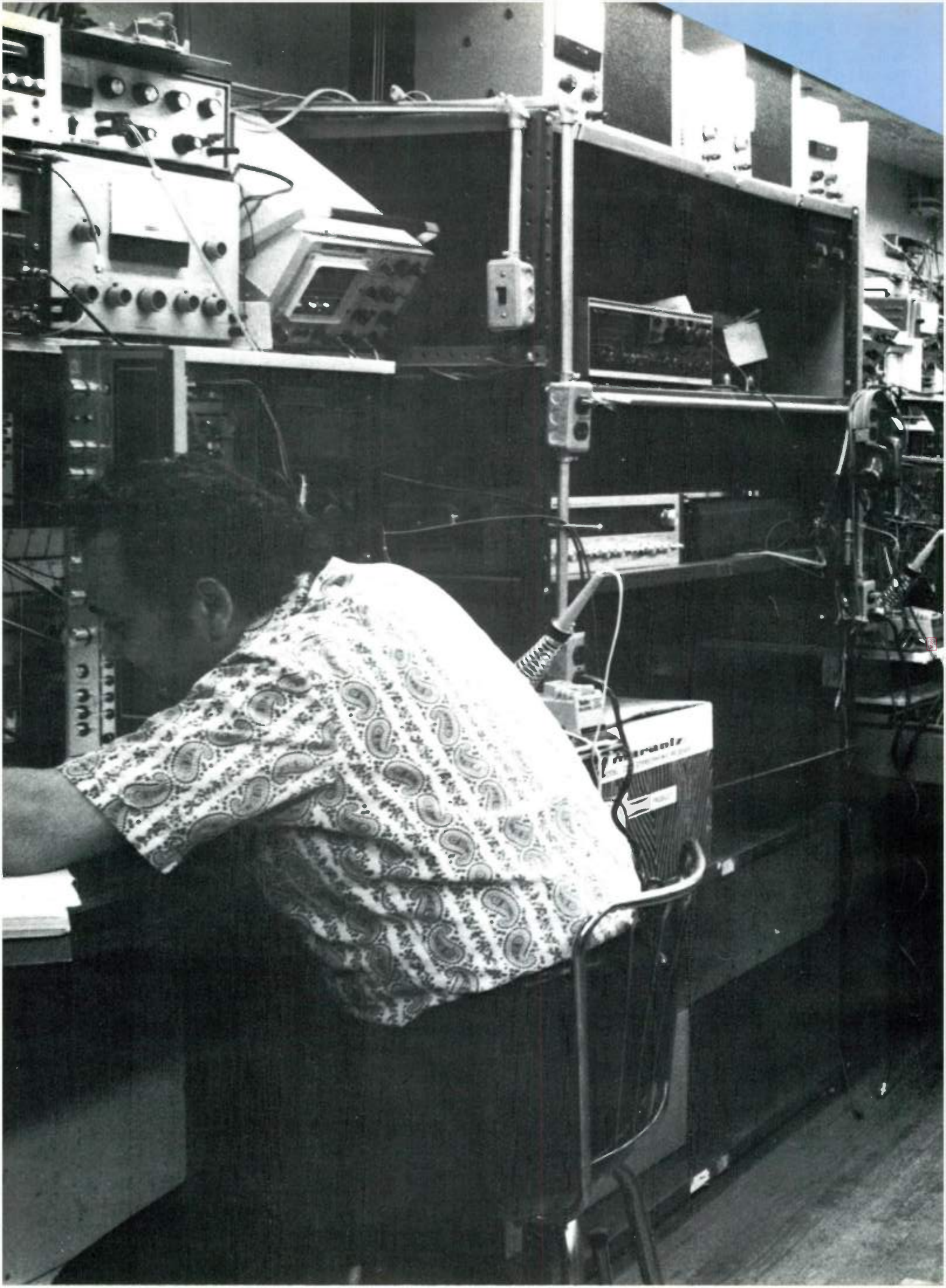


CONNECTIONS FOR BALANCED vs UNBALANCED LINES

Figure 5

A QUICK REVIEW, POINT BY POINT

1. Impedance is a combination of resistance and reactance, and is therefore frequency sensitive.
2. A low impedance output can go into a high impedance input, but not the other way around.
3. Don't use power amplifier loads of less than 4 ohms unless checked out with the amplifier's manufacturer.
4. Two parallel equal impedances are equal to one-half of the value of one of the impedances.
5. Don't parallel speakers of differing impedance or type.
6. Net impedance is always lower than the lowest individual impedance in a parallel circuit.
7. High impedance mics lose high frequency response as cable length gets longer.
8. Given a choice, always use low Z mics and balanced input low Z mixers.
9. Transformer-isolated lines are best for noise-prone large-facility installations. Direct connections (unbalanced transformerless lines) are best for frequency response and are typical of most recording, playback, and musicians' equipment.



SETTING UP A SERVICE DEPARTMENT

PART 1

By John Gatts

The purpose of this article is to share some ideas relating to the process of designing and starting a service department within your retail store.

WHY OPEN A SERVICE DEPARTMENT?

The obvious first step is to decide why a service department is needed. One reason is important above all others: increased profit. The increase in profits as a result of opening a service department should come from two sources: increased gross sales, and direct profit from the department itself. The addition of an in-store service department will increase gross sales due to increased consumer confidence in your store, better technical support of sales, more accurate analysis of the consumer's existing equipment and his future needs, as well as simply creating another reason for the consumer to return to your store. This is not to say that salespeople cannot provide all of these important functions, but that the consumer frequently tends to believe that the service technician is less biased or more knowledgeable in this field.

Profits from the service department itself are an added benefit to the increased sales—*if* the department is efficiently operated and managed. Other desirable aspects of the service department are that it frees valuable sales time otherwise spent in discussing *problems* rather than *purchases*. An in-store service department can also assist sales staff in keeping abreast of rapidly changing technology and can also frequently give a store a significant competitive edge over a non-service oriented store.

PLANNING FOR SERVICE

Once the decision is made to open a service department, planning is in order. The most important aspect of any service department is the people in it. The service business is a people business. Find the people you need as soon as possible and give them the opportunity to share in the planning, organization, and set-up of the department. The number of people required for a service department is directly proportional to the volume of repairs expected. A bench technician with no other duties (*e.g.*, customer service, answering phones, parts ordering, etc.), can produce anywhere from five to fifteen units per day depending on the nature of the repairs encountered. A service supervisor or manager with many other duties besides repair may only turn out two to five units per day. When deciding how many technicians are required, keep that in mind.

Surveying the number of units sent to outside servicers and those returned to manufacturers in the recent past should be a good indicator to determine the approximate volume of repairs that will be required. Also consider those units repaired by your sales staff (fuse changes, rewiring pedals and cables, etc.), as well as the number of customers who left the store with their units to go elsewhere. Contacting the manufacturers or their representatives at this point is in

All photos courtesy Glen Oaks Service Labs, Inc., Bellerose, New York

order—they may be able to give you additional information relating to the service market in your area.

Having decided how many technicians you will require, your next step is finding them. In almost every area of the country, technicians are in short supply, making this step rather difficult. The heart of every service organization is at least one experienced technician. Find this person first. Advertising, spreading the word among your staff and customers, and advising reps and manufacturers that you are looking should generate applicants. Keep in mind that this will be a key position in your organization. Be certain that you hire the person best suited to your needs, and that this person is, in turn, offered a situation that will challenge him, motivate him, and reward him.

If your plans call for a shop of two or more technicians, look for someone with supervisory experience and customer service credentials to fill the supervisor's or manager's position. Customer relations and efficiency are the key to a successful service operation. If your department is to include only one technician, look for these qualities as well as a sound technical background, and be prepared to offer a great deal of support from your accounting and purchasing departments. Once an experienced technician is established in your store, finding others is somewhat easier. The senior technician will thus be able to give on-the-job training to inexperienced people recently out of technical high schools, junior colleges, or college. Work-study programs in such institutions can frequently provide highly motivated young people.

An organizational structure for the service department and associated supporting departments is an essential tool. Define and record the duties and

responsibilities of each position in the service and related departments. Define who does customer service, parts ordering, invoicing of repairs, accounts receivable and payable, etc. The service manager should report either to the sales manager or on an equal basis with the sales manager to the general manager or owner. Sales and service are very tightly related, and a spirit of mutual cooperation and respect is essential for success.

Another important aspect of planning for a service department is budgeting and projections. To accurately assess the performance of the service department, it should be operated as a separate profit center. By this stage you should have an idea of what your volume will be in service.

John Gatts is Combo Products Service Manager of Yamaha International Musical Instrument Division. He previously owned and operated his own service business.

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...**because** the market for the 'professional consumer' is growing so fast and the future holds even greater growth potential.

...**because** it is not enough to educate only the consumer; the retailer, representative, and distributor must be kept aligned with how to productively develop a growing creative audio and musical electronics market.

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Rolandcorp • SAE • Sirius Music • Soundcraftsmen • Sound Workshop • Tapco • Tangent Systems
TEAC Corp. of America/Tascam Series • The VSC Corp. • Unisync • Yamaha International

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Discuss this with your service manager (or prospect), assign an average value for each repair, and determine the gross sales dollars. Next estimate your expenses. Labor, which you can estimate relatively accurately, is almost always the lion's share of expenses. Add rent allocation, advertising, cost of loan for equipment and fixtures, and as many other expenses as can be determined. In short, prepare a P&L statement. Find out *ahead* of the opening what you need to do to maintain a profit picture for the service department. If you plan to arrange financing for equipment, a P&L statement will be a necessity. In addition, your service manager should use this opportunity to become accustomed to generating and interpreting a P&L. Once the projection is complete, be prepared to review and adjust it as circumstances dictate, but try to make

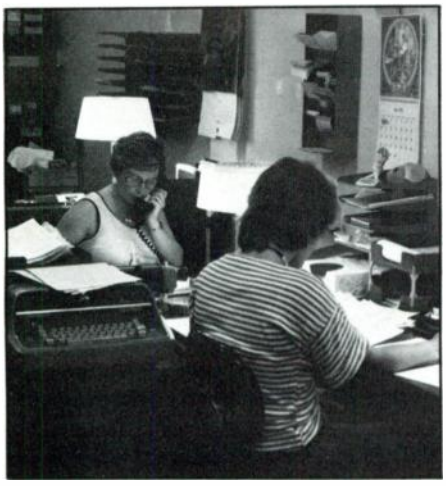
it as realistic as possible at the outset. In the early months of operation, many situations may arise which throw your projections out of kilter. Don't panic—review and reassess. Even after the department has stabilized, don't forget about the P&L. It should be a routine accounting aspect of the business; keep it up and use it.

During this period of planning and projection, survey the manufacturers you deal with and request information on their warranty policies and procedures. Find out what is required to become authorized to perform warranty service. The requirements vary considerably from one manufacturer to another. Be prepared to handle many different forms and procedures. No standardization exists in our industry, and this must be considered as part of the nature of the business. Your district managers and reps will

be very helpful in getting this information to you.

PUTTING THE PLAN INTO EFFECT

At this point you should have a good idea of what you can expect and what the manufacturers expect of you. It is now time to consider the physical aspects of a service department: space, test equipment, and parts. The most important aspect of a service department's location is the customer service area. Put yourself in the position of a customer bringing in an expensive piece of equipment for repair, and base your plans on that concept. You would first want to see an organized and neat receiving area or counter. Post your service rates in a clearly visible and understandable manner. Be sure that your customers are being treated in an understanding, professional manner.



This area for customer service need not be large (a counter can suffice), but must be given great attention. Your service department reputation can and will be directly affected by its appearance. Allow adequate space to easily manage the largest products to be serviced. Usually speaker enclosures cause the most problems, with keyboards a close second. If at all possible, give the customer a view, via a window or open door, of where his expensive unit is going for service. Place some test equipment at the counter so that the customer can demonstrate problems and check his unit after repairs. This saves misunderstanding and prevents frustrating return trips to the service department after the repair.

Next month we will discuss further the layout, equipment needed and actual running of the service department.

The SOUND SH

Well, for those of you who might be wondering, Strings and Things in Memphis is back in business after our fire. We held our Grand Reopening, and I would like to take this opportunity to thank all of you out there who called or sent a postcard when my business burned. I would especially like to thank all the manufacturers and their reps who stood behind us when we needed it—I cannot thank you enough. Now, let's get down to business.

Some of the best import guitars I've seen lately on the electric market are those being made by **Ibanez**. Having abandoned their original approach of copying existing guitar designs, the designers at Ibanez have introduced no fewer than five new series of electric guitars in the last year. One such series that was introduced at the NAMM show in Chicago this year is the Studio Series. The Studio Series is designed for those with a straight ahead approach to rock and roll—simple body design, straighforward control, and hot pickups. The offset body is designed for balance and comfort and features a maple/mahogany or maple/ash construction. The center section of the body is made of maple, as is the neck. The outer sections of the body are made of mahogany or ash (depending on the model) to thicken the tone and reduce overall weight without hurting the sustain. The Studio Series features a new design pickup from Ibanez—the V-2. This pickup is designed with a very tight upper midrange response characteristic. The single volume and tone controls of the ST-100 simplify the operation of the guitar, with the volume control located close to the strings for convenience and easy "violin" effects. The Studio Series also features a long scale (25½") with 24 frets. This new design jumbo fret features a contoured fret crown for buttery string bending.

CIRCLE 1 ON READER SERVICE CARD

Ah, the noble Hammond B-3. Many a musician has gone through the love-hate relationship that comes with owning a "B." Nothing else sounded like them, and nothing else short of a grand piano was any more trouble to move. I am sure that some of you have hernia scars to prove it, too! Until recently, you either suffered the pain and agony of transporting a B-3 or you went without the sound, because nothing else in Christendom sounded like a Hammond.

Well, like the song says, time changes everything. The Traveler portable organ by **Crumar** sounds so much like a B-3 that it would fool Booker T. It retains the Hammond sound and is one of the staples of the keyboard department at Strings and Things. The latest news in relation to this instrument is that it has been updated to include a completely variable synthesizer bass section (the original units had an electric bass voicing that was nice), nine draw bars, independent percussion voicings, LED status indicators, and pitch bend. There are two new models, the T-1

OPPE

By Charlie Lawing

and T-2, both of which have 61-note keyboards. The T-2 is a double manual version. Both of these units should be big sellers if for no other reason than the fact that they are the only thing available short of a Polymoog or a Four-Voice Oberheim that will get an authentic B-3 sound. Each of these units weighs less than 100 lbs with carrying case included.

CIRCLE 2 ON READER SERVICE CARD

More and more of my customers are becoming aware of how much a good sound system is worth; not too long ago it was not uncommon to see rock bands using stacks of Marshalls and a cheap P.A. But it seems like over the past five years, sound reinforcement gear has taken the lion's share of the equipment budget of most of my regular customers. Apart from the basic components such as power amps, mixers and speaker enclosures, no single piece of audio gear has generated as much interest among musicians as the studio delay lines now being marketed by several companies. One such device is the series 440 Delay Line/Flanger by **Loft Modular Devices**, Inc. Some of the effects the unit is capable of producing include: slap-back, loudness enhancement, Doppler, flanging, Leslie-type sounds (with different speaker speeds), vibrato, altering reverb chamber characteristics, tunnel inversions, feedback control, and realistic double and triple tracking with the important pitch and timing variations. The regeneration and internal mixing controls permit variations in depth and dynamics as well as the creation in some cases of additional repeats. Internal mizing also frees the console or P.A. system effects channels. A dual output allows stereo effects and generates stereo synthesis from a mono input. The unit has, along with its three audio jacks, three control

signal jacks for external control of line in/out, external voltage control of delay time, and an internally generated control voltage for "slaving" other units. The manufacturer claims a bandwidth of 18 kHz at 40 msec and a 9 kHz bandwidth (same as most reverb systems) at 80 msec. A noise reduction system (compander) is incorporated for increased dynamic range. The balanced input is capable of accepting signals as high as +18 dBm and the outputs are equipped with discrete line drivers capable of +18 dB into 600 ohms. There is a self-contained power supply for 220 VAC or 110 VAC and the unit is rack-mountable. Suggested list price is $800.

CIRCLE 3 ON READER SERVICE CARD

I wish you all could have seen the looks on my customers' faces when we unveiled the new **Korg** VC-10 Vocoder at our grand reopening. The customers who weren't standing in line for a chance to play it just stood back in disbelief with jaws agape. "What *is* that thing?" they asked over and over. "A Vocoder," I said. "VO-CO-DER; it makes instruments talk." Now this is not an entirely new idea; vocoders have been around for a while, but up until Korg came out with the VC-10, only the big name groups could afford them. The VC-10 represents the first commercially available self-contained vocoder designed for both studio and live performance situations.

The Korg VC-10 "codes" a speech signal (singing or just talking) and mixes it into the tones of the musical source. It literally makes any electronic sound source appear to talk. Unlike other vocoders, which can only "vocode" external sources, Korg's VC-10 has provision for any external electronic source as well as its own built-in polyphonic 32-note keyboard. Some other useful features are a pitch-bending wheel, chorus and vibrato effects, a noise source (for whispering wind, no less!) and a VU meter for accurately balancing the voice with the sound source. Another thing I want to mention is the fact that you do *not* have to sing or talk in key; the vocoder only uses your voice as a trigger and an articulator. However, you can set the VC-10 up to reproduce the pitch of your voice if you so desire.

I have had good luck with Korg synthesizers in the past, especially the little Mini-Korg, in situations that called for something inexpensive and relatively simple to operate, and I think you should know about the newest addition to their line of small synthesizers. The Korg MC-10 is a single-oscillator unit with pitchbend wheel and internal patching capabilities that sells for under $400. Definitely a big boost to the low-end synthesizer market, the MC-10 is even more ideal for a beginner than the Mini-Korg because of the patching capabilities. Korg also has an analog sequencer now available, but enough said about the Korg. The stuff works well for me.

CIRCLE 4 ON READER SERVICE CARD

Guitar synthesizers have been slow to catch on here in the south; most of the players in this area are a little leery of these strange-sounding contraptions, and a lot of them don't want to take the time to learn the concepts involved in synthesis. Be that as it may, Strings and Things had the first guitar syntho rig in this area, and we considered ourselves the local authorities on the subject. Then Jan Lucas from **360 Systems** came along with a 360 Systems Slavedriver-Oberheim-Les Paul rig that completely blew us away! For one thing, Jan had his unit calibrated perfectly, and any false notes and faulty triggering were completely eliminated. Also, the combination of Slavedriver and Oberheim was incredible; the sounds you can get out of an SEM (Synthesizer Expander Module) are both usable and easy to get to. We were finally sold on the Slavedriver. Here was a setup that, at least to my way of thinking, was relatively easy for the average customer to understand.

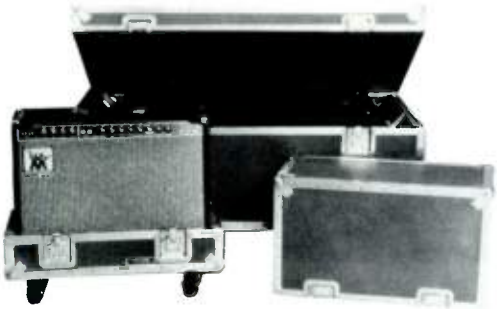
Now 360 Systems has unveiled their completely self-contained guitar synthesizer, the Spectre. The Spectre comes packaged in a Tolex-covered road case with lid and handles, and will fit on top of most any guitar amp. It stands upright so that you can see the control panel from several feet away; you don't have to walk up to it and hover over it to see what's going on. The Spectre has two oscillators, two envelope generators, a four-mode filter, two presettable interval transposers which enable the user to play parallel harmonies with himself, and a number of other features.

Bob Easton, founder of 360 Systems, is a pioneer in the field, and is also one of the most accessible inventors/designers in the business. The Spectre is one helluva good guitar synthesizer, and at a retail price of $1,695 a dealer can do something with it.

If you are interested in this particular area of synthesis, be prepared to do some homework, because it takes a well-prepared demo to really get your point across to a customer. We have been trying to educate the players in this area with synthesizer clinics, workshops and the like, and although sales have been relatively few, interest has steadily increased as a result of our efforts. I feel certain that as more and more artists use the guitar synthesizers on records and in concert, they will be accepted by the customer in a big way. So, if you are beginning to see dollar signs, get in touch with 360 Systems.

CIRCLE 5 ON READER SERVICE CARD

Just a few years ago road cases were not the hottest item on the shelf; now everybody wants them for everything from personal papers to baby grand pianos. There are a number of fairly decent case lines on the market, but **Anvil** cases are my personal favorites. As far as I know, Anvil cases were the first road cases of their kind to be made, and since they "caught on," a lot of similar cases have been marketed. I always recommend Anvil because I feel they are well built. All Anvil cases have heavy steel corners, a 1" aluminum edging, and machine rivets driven every three inches. Also, Anvil cases have hinging that runs the full length of the case, recessed twist-lock hardware, and rock-solid handles. Anvil keeps a larger stock of ready-made cases on hand for those items that are most often sold; however, they will custom-build most any kind of case, large or small, to your specifications. A variety of colors are available both inside and out, and the guitar cases have a king-size accessory compartment with a super-sturdy latch on it that won't fall open in transit.



CIRCLE 6 ON READER SERVICE CARD

Far and away the best new guitar and bass amplifier line I have seen in a long time is the LAB Series by **Norlin**. These solid-state units are built to last inside and out, and they have several features unique in the field. Of course, master volume, reverb, bass and treble controls and a bright switch are all standard fare on most amps,and you will find them on the Lab L5 two-channel unit. Looking a little bit further, however, you will see a control labeled "Frequency" which has a range from 100 Hz to 6.4 kHz. You will notice also that the midrange control, instead of reading "0 to 10" is an active tone control with a cut or boost reading of plus or minus four. This means that you can center the desired frequency with the frequency knob, then cut or boost that frequency with the midrange control. This gives you great tonal flexibility. Another unique feature is the built-in compressor, located just to the left of the master volume, which when engaged will alter the pick attack and/or add sustain or distortion at *very* low levels, as well as prevent any overload distortion. There is yet another tonal variation on the L5, called the multifilter which, in the words of the manufacturer, "emphasizes and rearranges the high harmonics to give them the character of a highly resonant guitar." These amps are little monsters, best response to a new product I have seen in a long time, and they are priced right, too. The L5, with two 12" speakers and 100 watts RMS, lists out at $595.

CIRCLE 7 ON READER SERVICE CARD

By Steve Caraway

DEALER DOSSIER

Leo's Music
Oakland, California

It was back in 1956 that Leo Malliaris started "dabbling" in the selling of used instruments. Along with friend and partner Alec Goldstein, Leo began buying and selling to the point where his garage and living room were full of musical instruments. At that precise moment they decided that they had better open a store. It was a natural evolution that spawned one of the finest dealerships in the San Francisco Bay Area. Now located on Telegraph Avenue in Oakland, Leo's Music services one of the music capitals of the world.

You have a very large operation here; how much floor space do you have?

Malliaris: This is our fourth location and we have 13,000 square feet in this new facility, 10,000 on the main floor and 3,000 upstairs for our drum business. We also have separate warehouses for storage.

How many people are there in your operation, and how are they organized?

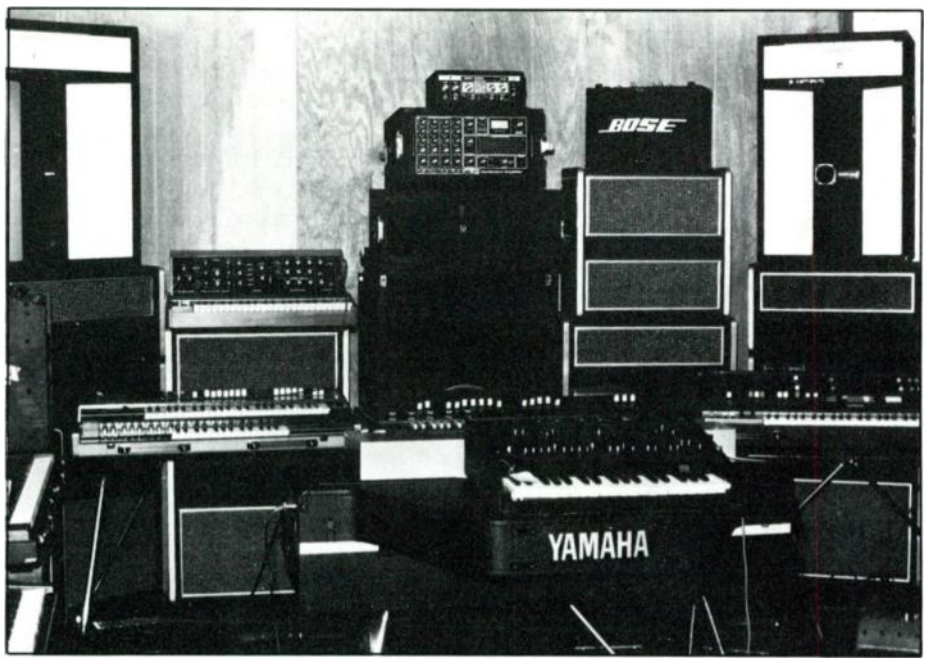
Malliaris: Our store manager is Bill Acton, but each section of the store has its own manager who does the ordering and all; they have a lot of latitude here. I believe I should let each person in each department do his own thing, because he knows more about it than anyone else does. The people who work here are very skilled in their particular areas. We have a total of 13 employees now.

When you first started, it seemed that you were mainly into the musical instrument side of the business, and now you're into the total scope of the business.

Malliaris: Well, "Goldie" was a sax player and so was I, so we just fell into that area. But the market today demands total representation. We're now into sound reinforcement, electronic musical instruments and accessories, and multi-track recording. The main thrust of our business these days seems to be in high end PA systems and their accessories. When I first started, it was a simple PA system that everyone had, just two columns. But today they have graphic equalizers and big boards; it has gotten very sophisticated. That is why you need people in each department who know what they are talking about, such as Doug and Jimmy who run our PA section. It took a long time to get where we're at now.

How do you have your store arranged?

Malliaris: We have a separate drum business upstairs that occupies 3,000 square feet alone. On our main floor we feature an acoustic guitar section with a separate vintage guitar room, several walls covered with electric guitars, a room filled with used amps and a separate floor featuring new amps. Our accessories are displayed in a soundproof room, which allows the customer to try the gadgets without disturbing the rest of the shoppers in the store. Another soundproof room contains our sound reinforcement gear and testing area where we have various mixers patched into the huge speaker and horn display. Our recording gear is in a separate room also to allow better customer demonstration. When a customer comes in looking for an instrument, we don't encourage him to play a long time and loud; but we do allow the customer to take his time and test anything he wants. You know, it's difficult when a guy comes in and starts playing very very loud and you have a half a dozen potential customers there and this guy is blowing you out of the box. That is why we have those separate rooms for demonstrations.

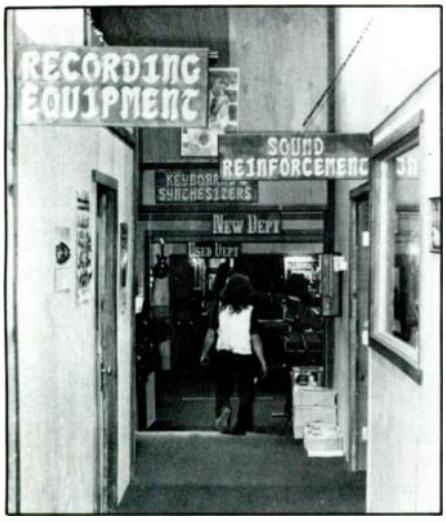


Photos By Steve Caraway

Accessories especially, because you have to play them for a time to see what effects you can get, and you might want to try six different phasers. So we pretty much let them play as long as they want in there. Every store in this business has to contend with volume levels. One guy can ruin a day's business if you don't watch out.

You have so many different lines to choose from, how do you decide what to carry here at Leo's?

Malliaris: There again it's up to each person in his own department. Back when I first started, if you had a Fender or a Gibson franchise, you really had it all. One by one new lines came along and we would simply compare one product to another. It's pretty much the same way now, but someone may call for a certain amp and we have never heard of it. If we get



several calls for that amp, we usually check it out and go through the correct channels to obtain it. Another point is that the guys who work here also work in the field and if they see something that they like, we'll pick it up. Also we deal with a lot of professionals; in fact I would say that 80% of our business is with professionals. By professional I mean the gigging musician. Also, being in the Bay Area, we get many of the bigger groups in here too, like The Grateful Dead, Graham Central Station, Tower of Power, and Journey; even Eric Clapton bought a guitar from us the last time he was through. Many times they'll come in and say, "Hey I saw this piece of gear and you got to have it!" So we'll go out and order whatever it might be. All these things filter in from different areas. We have worked with The Grateful Dead since the sixties and they have been a big help to us.

Do you leave the displays in the various departments up to the folks running a particular section of the store?

Malliaris: Yes, that is left to the people there. As I said, they have a lot of latitude in running their departments. In demonstrating the equipment, the department people will make sure that a particular piece is set up for testing should someone want to try it out. In fact, in our store the sales people are pretty low key, sometimes people probably think we don't want to wait on them. We don't pressure people to buy. Sometimes you can walk into a store and there will be a guy on your shoulder every time you turn around. We don't want that here, so it's pretty low key. Our salespeople work on straight salary and no commission and we're one of the few stores that work it that way. The reason I like it is that they are not as aggressive in making the sale so the customer doesn't feel the pressure. That's the character of our store.

You have a complete service department and a speaker reconing operation.

Malliaris: Yes, for almost everything we handle we have a factory warranty service, except a few lines like TEAC which we send to the manufacturer. It's a good service to offer the customer. For a long time that department operated at a loss and it really was a *service*. I don't think of that department as a money maker though; it's really a convenience thing to have all the service right here on the spot instead of telling the customer to send it somewhere else.

Do you ever hold educational clinics here at the store?

Malliaris: Yes, on occasion. Yamaha just did one not too long ago and TEAC has come in. They do two kinds, one just for the sales staff and the other kind for the customers. The manufacturers offer quite a bit of that, but I don't think I take advantage of it as much as other dealers. I find that sometimes the clinics can get in the way of normal business activities. I have never really been one to advertise and that is what these clinics are in a way. I don't advertise nearly as much as my competitors in the Bay Area do. I guess I have the same attitude about clinics as I do about advertising. I see that it is a good thing, but maybe not for me and the store. We keep no mailing lists for the purpose of advertising. It may be smart to keep mailing lists of everyone who bought something in the store, then we could advertise clinics and it would really help the thing be successful—but I don't do it. My theory is that if you have the equipment here and have a nice store and nice people to deal with, things always work out. I have never been in a position where I had to go out and go after the business. I am not saying I

1979

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don't value the customers, but our system seems to be working pretty well.

So you never advertise?

Malliaris: The only time I have to advertise is when we move. A lot of the companies offer you co-op money; we did an ad with Yamaha when we moved to this location last June. We don't even have a budget set up for advertising. Our best advertising is really word-of-mouth and that's the best kind of advertising there is. I think that if a dealer does want to advertise he should really be consistent with it and run ads all the time. The way I end up doing it is a shot here and a shot there and that really doesn't do anything.

How do you feel about this business in general?

Malliaris: Well, one of the nicest things about this business is dealing with professionals. See, I am a sax player so it's easy for me to identify

with the working musician. Another point here is that it's easier to sell a guitar or bass or whatever to the professional. You can say, "I'll sell you this guitar for $300 and it's a fine deal," and they'll know that it *is* a good deal. The inexperienced musician doesn't recognize a good deal that easily.

What do you see in the business future of Leo's? Can you foresee moving out of your 13,000 square feet here into something bigger?

Malliaris: Yes, absolutely. It takes an awful lot of room to run a business like this. Our PA department can use more room right now, while our multitrack recorder section could easily double in size. All this is because that is the way the business is going these days, into sound reinforcement and multi-track recording.

INDUSTRY UPDATE

Lawrence L. LeKashman, Vice President of Marketing and Sales at Electro-Voice, Inc. died on September 24, 1978. Beginning his career as a radio editor, LeKashman later became manager of advertising and sales promotion at RCA Victor Tube Division. He also was involved with Teledyne/Olson Electronics and Lafayette Radio.

Jim Parks has been promoted to Assistant General Manager, Technics and Home Audio Division of the Panasonic Company. Parks was previously Technics National Sales Manager.

Brian Edney has been named President of Rank Industries America, Inc. to supervise all Rank industrial and consumer products companies in the U.S., including Rank Hi-Fi.

Teledyne Acoustic Research has named **McTaggart** Electronic Sales Team of Grand Island, New York the AR Sales Representative for upstate New York.

Koss Corporation has promoted **David J. McLeod** to National Sales Director. McLeod was previously a regional sales manager. **Norman H. Ream** has been named regional sales manager for the northwest and southwest. **Russell Wells** has been promoted to regional sales manager for New England and the north atlantic.

Bill McPhetridge has been appointed field sales manager for the consumer division of James B. Lansing Sound, Inc. McPhetridge will act as a liaison between reps and dealers in the field and the home office.

J.C. Simmons has been appointed to the newly created position of Marketing Analyst for JBL, to coordinate the company's consumer, professional and international marketing divisions' sales projections and to gather and analyze field data on market trends.

Hammond Industries has announced the appointment of **Sphere Audio** in Brenwood, Tennessee to represent Beyer Professional Products in Georgia, Tennessee, Alabama, North Carolina and South Carolina.

Glenn F. Hersh has been named Director of Communications at B.I.C. Hersh was previously at BASF.

Joseph E. Kotowski has been promoted to Vice President of Marketing at Koss Corporation. He was formerly director of marketing.

Eumig (USA) Inc. has entered the U.S. high fidelity market with the introduction of the Metropolitan CCD cassette deck. Eumig (USA) is headquartered in Great Neck, New York.

Several staff changes have been made by Shure Brothers Inc. **Victor F. Machin**, formerly senior vice president of marketing and manufacturing, has assumed added responsibilities and has been named Executive Vice President of Personnel, Marketing and Manufacturing. **Jams H. Kogen** has been named Executive Vice President of Finance and Engineering. **Meyer Langer** has been named Vice President-Finance. **Bernard W. Jakobs** has been promoted to Director of Engineering and head of the Engineering Division. **Allen R. Groh** has been promoted to Manager, Technical Markets and Product Management. **Michael R. Vehlow** has been named Assistant Sales Manager-Export Sales.

Lloyd W. Meyer has been named CBS Musical Instruments Vice President for Marketing. Meyer most recently was vice president of sales and marketing for the Norlin Music keyboard division. At CBS, Meyer will act as consultant to all operating centers and will have direct responsibility in the management of Gulbransen Organs, Rodgers Organs and CBS Musical Instruments Ltd. of Canada.

Uni-Sync, Inc. has named L.P. Marketing as the Rep of the Year. **Larry Peterson**, President of the firm, accepted the award.

Don McCampbell has been named President of total operations for Musimatic Inc. to oversee total operations of both the manufacturing and service divisions.

Optonica High Fidelity Products has named its top sales representatives of the year. Kimberly Sales of Indianapolis, headed by **Tom Billingsly**, was selected Sales Representative Organization of the Year. The Creative Thinking Award was presented to **Jack D'Angelo** of S.K. Macdonald, Inc., Baltimore.

M. Hohner, Inc. has established a distribution and service center in the Dallas/Fort Worth area. The 12,000 square-foot facility will serve eight southwestern states and Puerto Rico.

US JVC Corp. has made several personnel changes. **Jeffrey Heath** has been promoted to National Sales Administrator, High Fidelity Products Division. **Harold Schiffman** has been named Eastern Regional Sales Manager, High Fidelity Products Division. **Brian Dietz** has been named National Sales Administrator, Home Entertainment Products Division. **Robert Katz** has been named Eastern Regional Sales Manager, Home Entertainment Products Division. **Howard Rosenstein** has been named Midwest Regional Sales Manager, Home Entertainment Products Division.

Advent Corporation has acquired the assets of Continental Fidelity Corporation, manufacturer of Audiomobile.

J. Nardo Associates of White Plains, New York has been named Phase Linear's Rep of the Year.

Advertiser's Index

Think you've heard everything?

The world thought so, too. Then Thomas Edison invented a little thing called a phonograph.

Suddenly sounds could not only be produced. They could be reproduced. And for 100 years, we've been reproducing sounds just about the way Tom did when his music went round and round.

But not any more.

Sony has perfected a new kind of audio recording system for professional use. It's called PCM, which stands for Pulse Code Modulation. And it's part of the digital audio revolution—such a great improvement over conventional analog recording techniques, it's been called the best thing since night baseball.

It's here right now

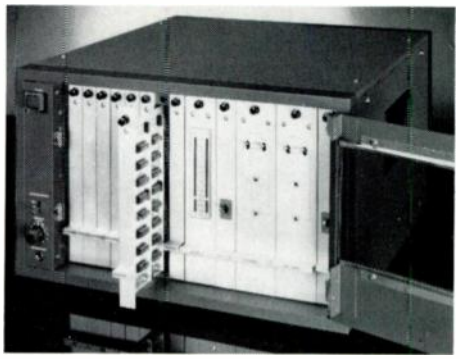
We've taken those last important steps toward making digital audio a practical reality. And the 2-track PCM-1600 we're exhibiting at this fall's AES conference isn't just the most advanced professional digital equipment to come to the marketplace. It's an idea whose time has come.

The perfect master

Used as a Studio Master, the Sony PCM-1600 gives you true digital mastery of audio. Substantially better audio quality than is possible through even the best analog technology. It lets you record separate takes and assemble them. Make generation after generation of laquers with no sound degeneration. And distribute any number of digital masters to, say, foreign affiliates... giving France the same quality you gave England.

And you still haven't heard the best about the PCM-1600.

First, it uses a standard videotape recorder. The same kind of recorder already familiar to broadcasters across the nation. To edit, or to perform a digital-to-digital dub, you use a standard Sony video editing console—and do it all electronically.



Second, some very impressive numbers. Dynamic range greater than 90 dB. Harmonic distortion less than 0.05%. Wow and flutter so low it can't be measured. And absolutely no hint of hiss.

Third, we've solved the problem of dropouts. By introducing an error-correcting code technique originally developed for computers, we've given our PCM-1600 fail-safe signal reproduction. The kind computer applications take for granted.

And finally, Sony PCM equipment is ready to live up to the Sony name. It's rugged. Reliable. Designed to take anything professionals dish out. And once producers and artists hear the difference, conventional analog recording systems just don't sound good enough.

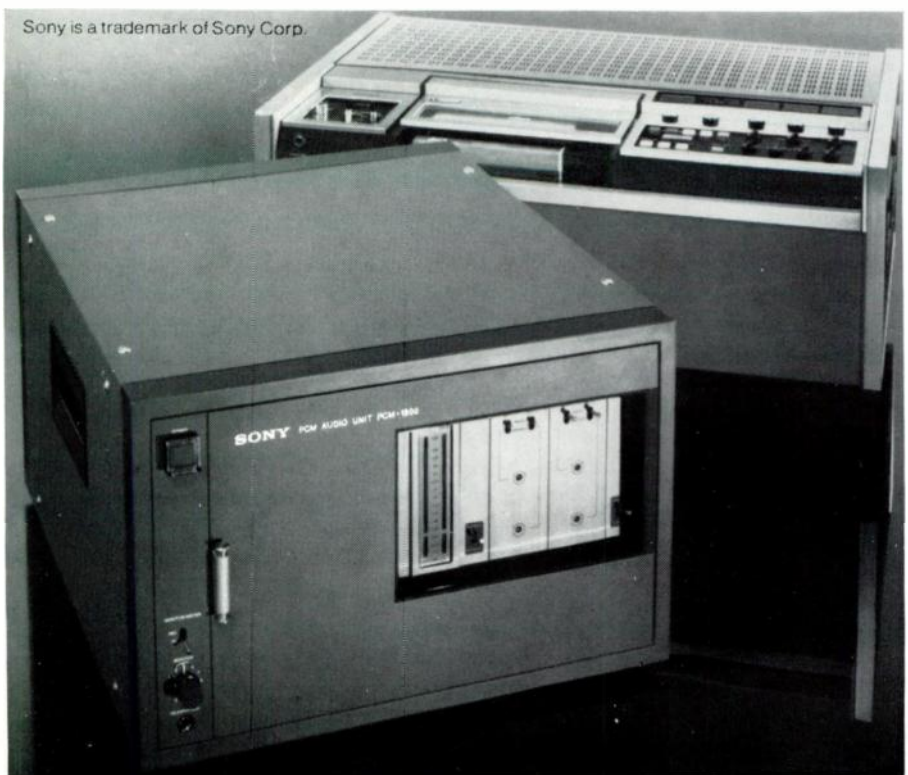
Now you've heard everything

Unless, of course, you haven't heard our PCM-1600 in action. In that case, we'll be glad to demonstrate...and even take your order now for fall and winter deliveries.

If you think you can wait, see our PCM exhibit at the 61st AES Convention, Waldorf Astoria, New York, November 3-6. Have a good look around.

Then have a good listen.

SONY®
DIGITAL AUDIO



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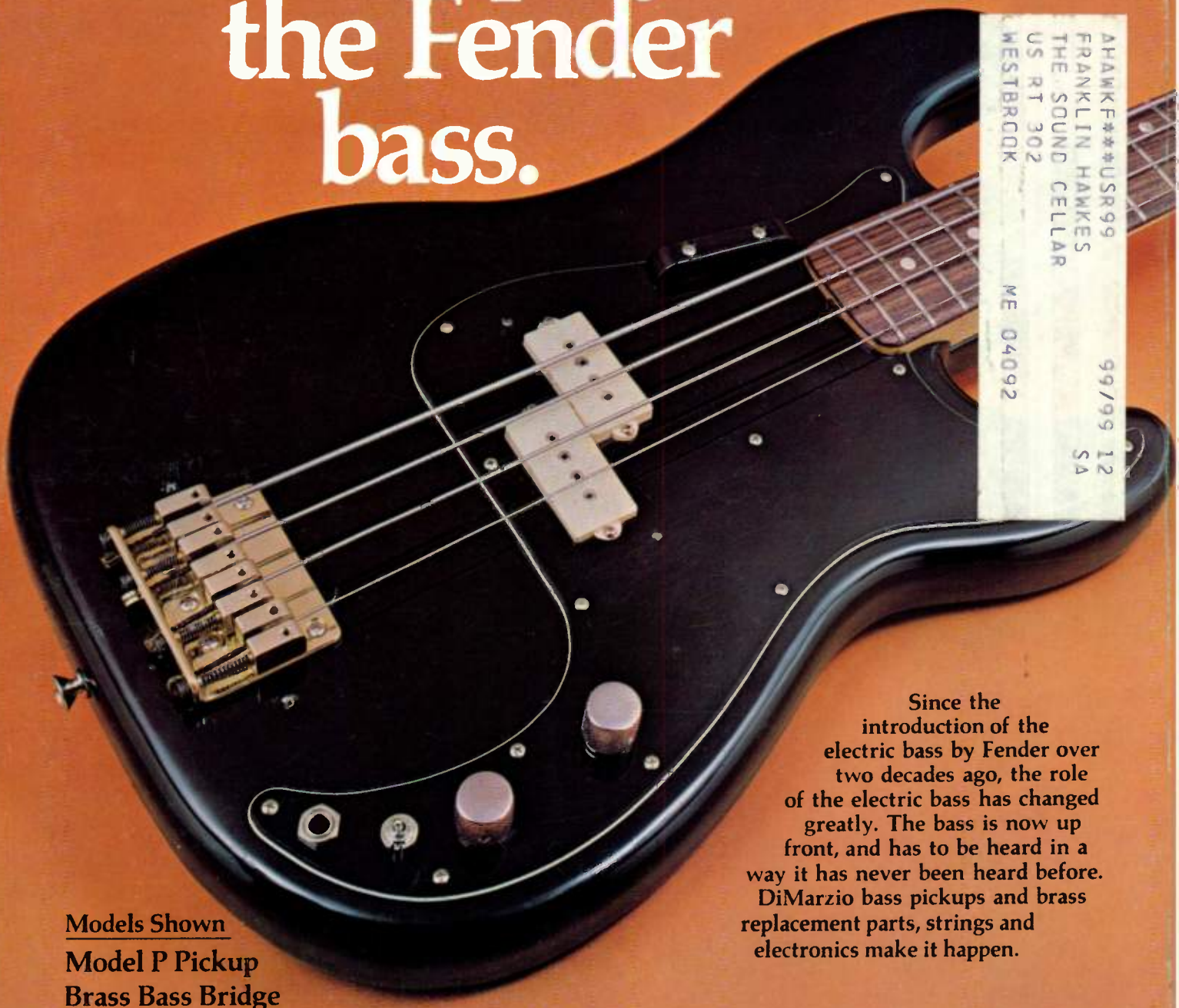
The best news for bass players since the Fender bass.



Since the introduction of the electric bass by Fender over two decades ago, the role of the electric bass has changed greatly. The bass is now up front, and has to be heard in a way it has never been heard before. DiMarzio bass pickups and brass replacement parts, strings and electronics make it happen.

Models Shown

Model P Pickup
Brass Bass Bridge
Bass Strings

For a color catalog, send 75¢ to:

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Musical Instrument Pickups, Inc.
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