BROADCAST ENGINEERING

April 1983/$3

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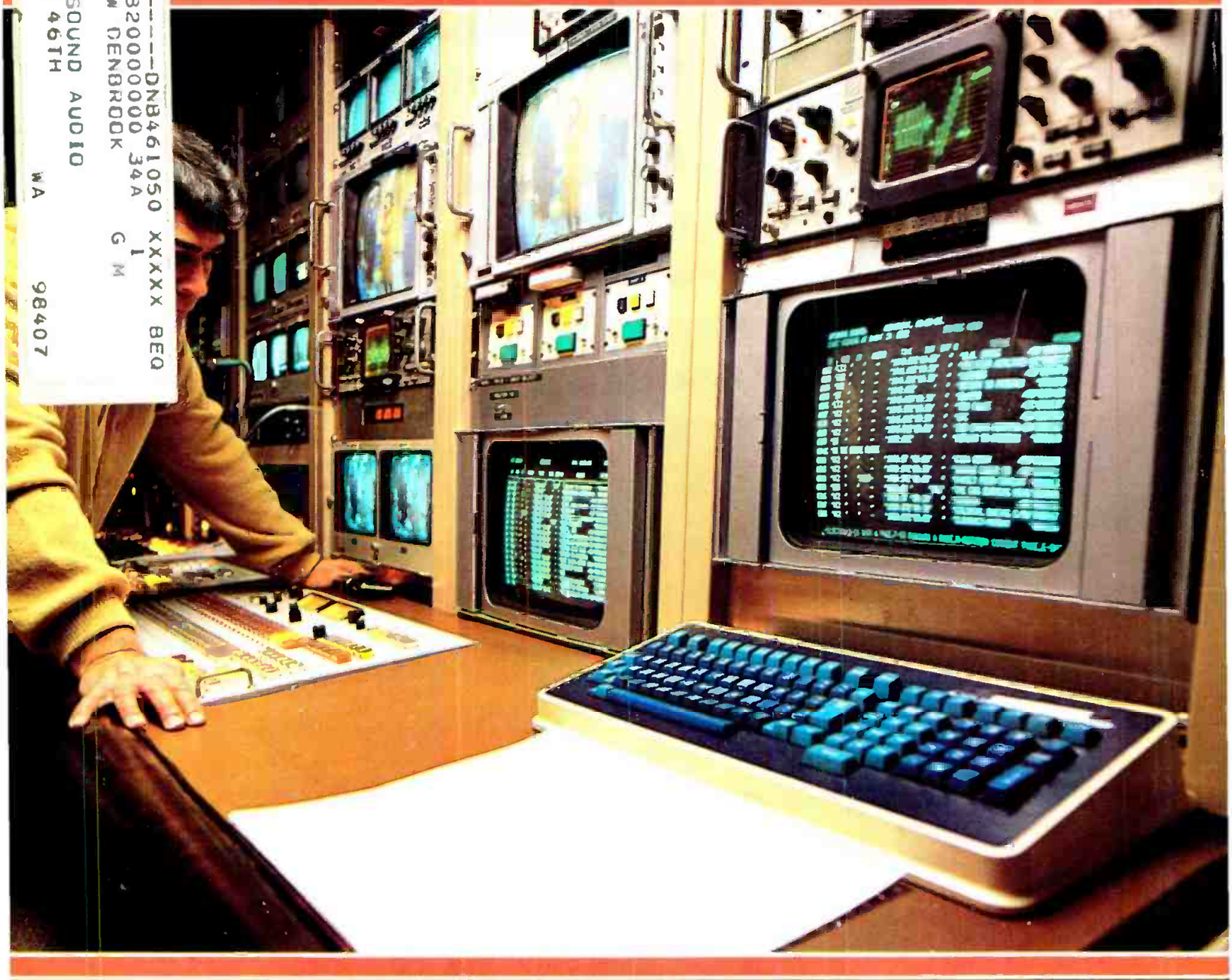

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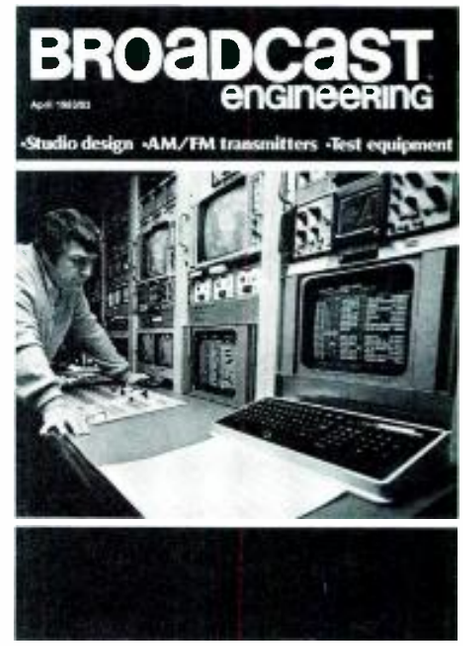
BROADCAST engineering

The journal of broadcast technology

April 1983 • Volume 25 • No. 4



THE COVER shows the control automation system at WISH-TV 8, Indianapolis, IN, with Charlie Clark at the controls. An article describing the upgrading of the station including new equipment and station layout, "Case Study: WISH-TV 8 Update," is presented in this issue (page 16). The author is John Demshock, WISH chief engineer. Cover photo is provided courtesy of Jamie McMahan, Data Communications Corporation.

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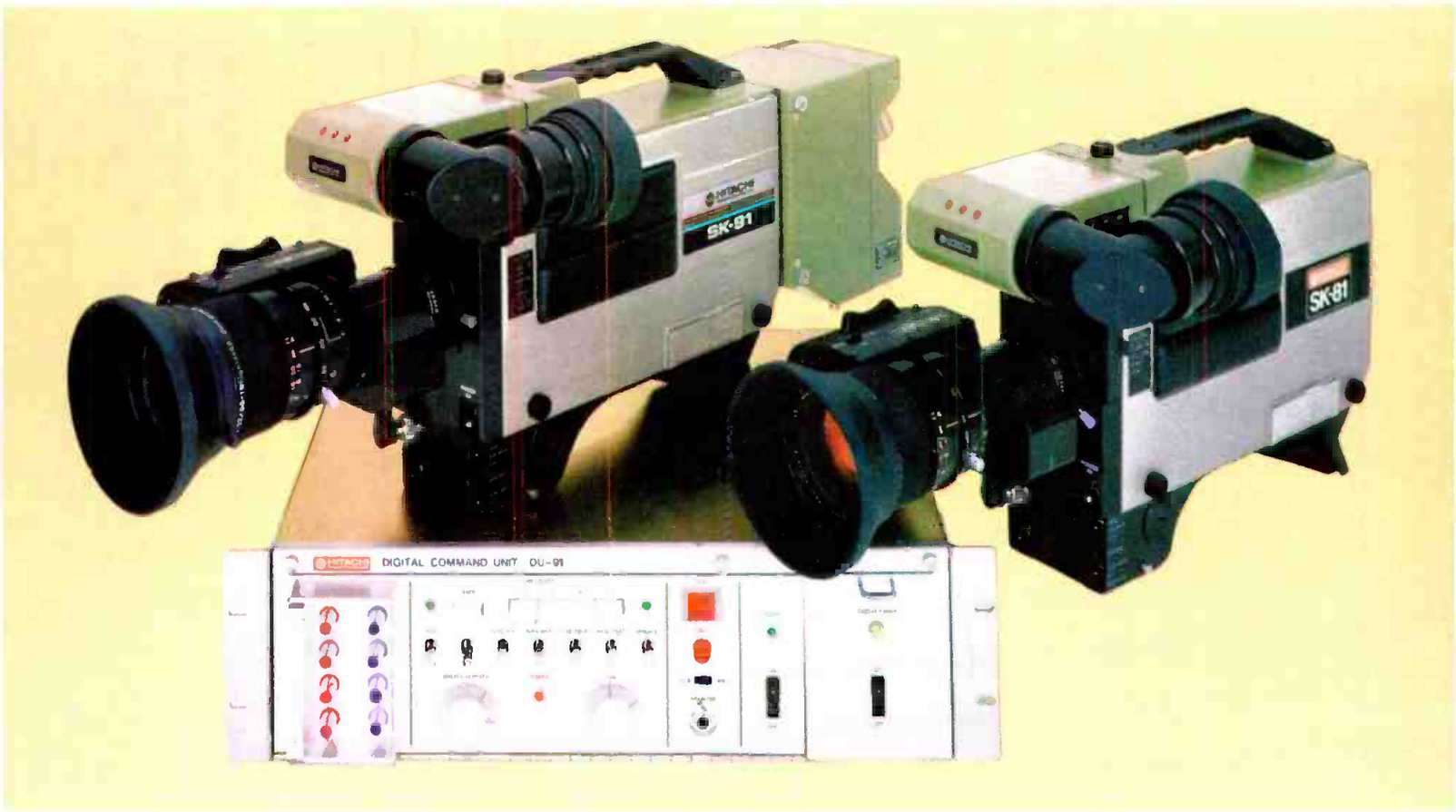

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BROADCAST ENGINEERING is edited for corporate management, engineers/technicians and other station management personnel at commercial and educational radio and TV stations, teleproduction studios, recording studios, CATV and CCTV facilities and government agencies. Qualified persons also include consulting engineers and dealer/distributors of broadcast equipment.

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FCC update

April 1983

Harry C. Martin, partner, Reddy, Begley & Martin, Washington, DC

Reallocation policies dropped

In another deregulatory move, the commission has eliminated its Berwick Doctrine and Suburban Community Policy, under which the commission attempted to ascertain whether a broadcast applicant intended to serve its specified suburban community or a nearby, larger central city. Also eliminated was the De Facto Reallocation Policy, which required a hearing when it appeared that a TV or FM applicant was attempting to remove, *de facto*, a channel assigned to a particular community to some other, larger community.

The commission found that these policies imposed costly and difficult burdens on applicants and the FCC, thereby slowing down the establishment of new stations.

These changes are effective immediately. Berwick, Suburban Community and De Facto reallocation issues will be deleted from all hearings now in progress. However, applicants proposing to serve a suburban community still will have to prove that the community is separate and distinct, and in need of a broadcast transmission service, in order to win a Section 307(b) preference in a comparative hearing.

In the same Report and Order, the commission eliminated its 10- and 15-mile rules under which Berwick and De Facto reallocation issues have arisen. Previously, those rules permitted TV and FM applicants to specify communities not listed on the Table of Assignments if such communities were within 10 (Class A FM) or 15 (Class B/C FM and TV) miles of a community so listed. This rule change, like the policy changes discussed previously, will serve to eliminate hearing issues dealing with whether a central city or its suburb best deserves a new station.

The commission rejected a suggestion by Commissioner Stephen Sharp that the Section 307(b) term "community" be redefined to encompass an entire metropolitan area. (This would be another way to eliminate community comparison issues.) The FCC said that such a redefinition would be handled in a further rulemaking to be initiated later this year.

Amendment for AM coverage requirement proposed

The commission has adopted another Notice of Proposed Rulemaking in which it is seeking to delete the requirement in Section 73.24(j) of the rules that AM broadcast stations place a 25mV/m signal over a community's business district.

The 25mV/m business district coverage standard, and the related requirement that residential areas receive a 5mV/m signal, are intended to guarantee that the principal community served by an AM facility receives premium reception service. The basis for requiring higher signal levels over business areas is found in the propagation characteristics of frequencies used by AM stations. Because AM signals are susceptible to "noise" caused by electric equipment and are absorbed by large steel-girdered buildings, a higher signal level generally is necessary in high density areas.

In proposing its rule change, the commission said that the vast majority of AM grants today are for small communities that have neither large buildings nor the extent of manmade noise prevalent in industrial cities. Another reason given for the proposed change is that business and factory areas are not easily defined and often are not concentrated in one central area. Growth patterns in many American cities, the commission said, have given rise to extensive suburban retail areas that have replaced declining central business districts. Under these circumstances, the rule could be interpreted to require 25mV/m signal coverage over every business area—even in cities in which such areas are widely scattered.

In a related matter, the commission is proposing to eliminate Section 73.151(a) (3) of the rules. This requires permittees of directional AM facilities, in connection with their covering license applications, to take field strength measurements to determine that their 25mV/m contours cover the main business district and that their 5mV/m and nighttime interference-free contours encompass the city of license. The commission said these requirements are needlessly burdensome, because Section 73.24(j) presently requires a showing from applicants that their specified contours will cover the community of license. Further, the rule section in question applies only to directional AM facilities. The absence of a similar requirement with respect to nondirectional AM facilities has resulted in no significant public interest problems, the commission said.

Inquiry initiated on technical regulation

The commission has initiated a sweeping inquiry on the efficacy of its existing technical regulations. The inquiry will seek to identify those technical rules that have outlived their usefulness. Behind this initiative is the FCC's belief that technological innovation has reached a level at which rigid regulatory constraints needlessly stifle the development of improved telecommunications services.

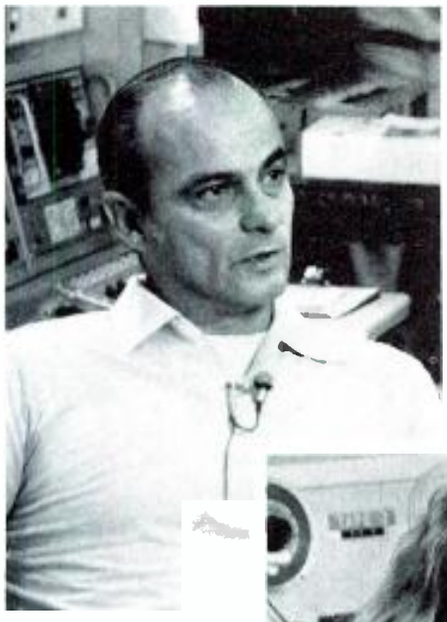
In the broadcasting area, the commission said increased competition and diversity have created an environment in which revision of technical quality regulations is possible and desirable. Market forces have created incentives that may be better than regulation in ensuring high quality technical performance.

One of the major thrusts of the inquiry is in the area of interference control. Present rules limit transmitter output power and effective radiated power (ERP). Although power-related limits appear to be essential, the commission said it believes it may be possible to change or simplify them. For instance, transmitter output power limits may not be needed at all. ERP is a more direct means of controlling interference potential.

Still less constraining, the commission said, would be direct regulation of coverage areas and field strengths—as opposed to the present system that regulates power and antenna height. Under the new concept, any combination of ERP and tower height (or antenna directivity) might be permitted if calculated field strengths at established boundaries did not exceed a specified limit.

In the same proceeding, the commission proposed deletion of its transmission quality standards for broadcast equipment. The FCC said competition among broadcasters probably is sufficient to ensure high picture and sound quality. It asked for comments on the impact that elimination of these and other quality control regulations would have on broadcasting.

Our story; THEIR WORDS.



CHARLES

TRUMBULL

SCOLIS

STEVENS

Pictured are tv station personnel in Tucson, Arizona, and San Francisco and Los Angeles, California. All were photographed during location videotaping sessions for a *new* Grass Valley Group presentation on M200 Modular Automation operation.

On the tape Roy Trumbull of KRON-TV in San Francisco, Marian Stevens at KCOP-TV in Los Angeles, and Catherine Scolis and Harry Charles of KGUN-TV in Tucson (and others not pictured) were questioned about their station operations, how M200 Automation has affected them, and their views on automated tv broadcasting generally.

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Satellite update

By John Kinik, satellite correspondent

Earth terminal technology

The major trend in C-Band satellite earth terminal technology today is toward the use of dual-beam antennas in order to receive two adjacent satellites with a single antenna. When Hughes' Galaxy 1 satellite goes into operation alongside RCA's Satcom 3R this June, most existing receive antennas will be retrofitted with dual-beam kits that will add the second satellite feed at an additional antenna cost ranging from $700 to $1500 (depending on the antenna type) and at an almost insignificant penalty to the performance of a normal single-beam antenna. This technique is possible because the focusing properties of a parabolic reflector are only slightly compromised if the antenna is aimed at the midpoint between the two satellites and the two feeds are placed on either side of the physical center axis of the reflector.

The new requirement to look at more than one satellite with one antenna also brings into the picture the *multibeam* antenna, which, with a single reflector and multiple feeds, can receive signals from all satellites in the North American orbital arc. The need for multibeam antennas increases as the number of satellites carrying programming increases, and cable operators and broadcasters find it a worthwhile trade-off to install a single, larger antenna instead of a new antenna for each new satellite.

Antenna location

Another C-Band technology trend is the integration of the Low Noise Amplifier (LNA) with the downconverter into a Low Noise Converter (LNC) mounted at the antenna feed. The converted output signal may be transmitted over a much longer and lower grade coaxial cable between the downconverter and demodulator, because a much higher loss is acceptable after conversion. By comparison, the conventional receiver design, with only the LNA at the feed, does not allow a separation distance greater than 150 feet without incurring significant cable costs from the antenna to the downconverter. More freedom in locating antennas makes installation easier, particularly when trying to avoid antenna blockage by trees and buildings, or when antenna shielding by buildings or natural terrain is desirable either for local microwave interference reasons or aesthetic considerations.

Lowering the threshold

A significant development in C-Band receiver technology is the use of *threshold extension* techniques to lower the "effective" threshold in carrier-to-noise (C/N) ratio to 8dB or less. Until 1980, conventional receivers exhibited impulse noise threshold points of approximately 10dB, and threshold extension was an expensive technique. The low cost receivers developed by entrepreneurs in the past few years for the private earth terminal market use extremely low cost components to achieve lower thresholds. The method used reduces the instantaneous receive bandwidth by means of a dynamic tracking filter concept based on phase-locked loop demodulator techniques. One innovative receiver manufacturer has developed a method for further reducing threshold by filtering out impulse noise *sparklies* with digital processing circuitry.

A combination of threshold extension and impulse noise filtering makes possible an acceptable receive signal with an antenna as small as 4 feet in diameter. Although this is an extreme example, the techniques described are important for a more typical case in which a 10-foot diameter antenna could replace a 15-foot diameter antenna. It is important to note that lowering the C/N threshold does nothing for the delivered video signal-to-noise (S/N) ratio, because S/N is directly related to C/N. The lower the C/N, the lower the S/N. However, the most disturbing degradation to the viewer, the pulse noise occurring below threshold, can be more easily avoided with the new technology.

Better equipment, lower prices

In a typically competitive market, the products get better and the prices drop. This is true for computers, and it is equally true for earth terminal equipment. C-Band earth terminals have dropped in price from the $10,000 level in 1979 to the $3000 level today, for equivalent performance. Low cost terminals (with 8- to 10-foot antenna) can be configured for less than $2000, and this figure could drop to the $1000 level within the next few years as offshore suppliers enter the competition. The new Ku-Band Direct Broadcast Satellite (DBS) technology will also tend to force C-Band terminal prices downward as private terminal suppliers try to attract customers reluctant to buy C-Band terminals in favor of waiting for DBS. With the type of intense competition that will occur in the next few years, it is not difficult to visualize an earth terminal *per channel cost* of $500 being attained by 1987. Not bad when one considers that the same channel cost was roughly $50,000 in 1972 and $5000 in 1979.

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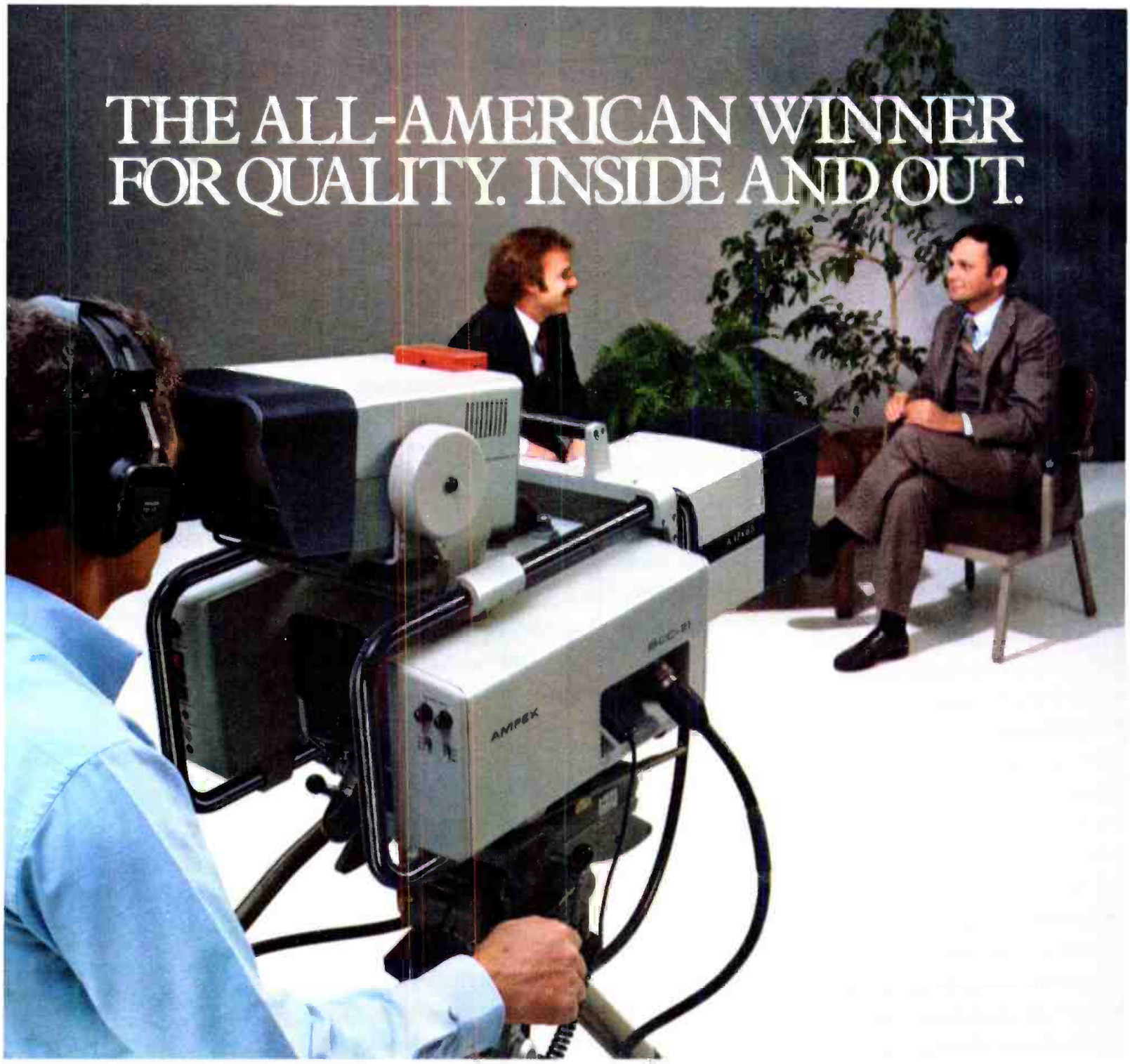

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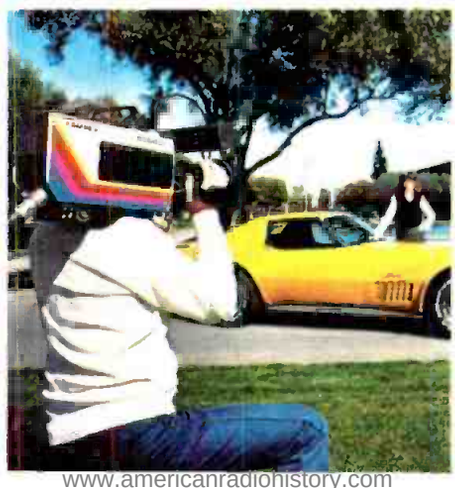

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SETTING THE FASHION IN BROADCAST VIDEO

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It's getting crowded backstage

Guest editorial by Richard A. Rudman, chairman, SBE National Frequency Coordinating Committee

If Part 73 governs the on-stage part of our business, Part 74 surely rules backstage. Just like an elaborate play, broadcasting requires a lot of backstage help. Part 74 controls the audio and video that makes much of our radio and TV programming possible.

Unfortunately, the FCC has not allowed for interference-free growth in this vital area. The type of terrain, existence of new stations and new programming services mean that in many markets no more aural STLs will fit comfortably. There may be constant 2-way interference, and Channel *X*'s ENG van may light up on top of Channel *Y*'s video STL. Current FCC rules do not allow TV ENG prime use of any microwave spectrum. Mobile microwave must either share on a coequal basis to fixed links or use only channels on a secondary relationship to fixed.

Backstage managing

In 1976, Bob O'Connor of CBS set up meetings in major markets to discuss the impact of FCC changes to portions of Part 74 affecting dispatch and aural remote pickup. We believed after the CBS meeting that the FCC's attempts to deal with the situation needed adjustments to meet the needs of Southern California broadcasters.

Those of us in large markets live on the twin cutting edges of grief and technology. With this in mind, it is not hard to see why those of us in Southern California decided to form an active local coordination group. In the spirit of enlightened self-interest, the Southern California Frequency Coordinating Committee was formed. After more than six years, we have the following items to show for our efforts:

- a waiver that let us split the N1 and S Channels in our region on a coordinated basis to allow a significant increase in the number of people who can use 450-451MHz and 455-456MHz;
- a monthly newsletter with a nationwide mailing to more than 450 broadcast engineers, consultants and equipment manufacturers;
- operational ground rules for ENG truck crews for day-to-day and special operations;
- a comprehensive Part 74 database for a multicounty region covering more than 200,000 square miles; and
- many, many broadcast engineers who now know each other on a first name basis and know it is possible to talk problems out before they become too serious.

What's in it for you?

The Society of Broadcast Engineers has identified local frequency coordination as an ongoing chapter project. Of the 75 SBE chapters, 54 are already involved in coordination or are working with other groups.

With AM stations looking for high quality STLs for stereo or improved mono, more stations doing live radio and TV news, and more stations conducting field operations far from home, you might begin to see what is in it for you.

At the recent SBE board of directors meeting, SBE frequency coordinators said that their biggest Part 74 problem was interference from broadcasters coming in for special programming such as election coverage or sporting events. Networks were perceived as prime offenders. The SBE National Committee has representatives from ABC, CBS and NBC. All three network representatives are sensitive to this problem. In the Southern California region, we have worked on this problem for several years and have made significant progress. Based on our experience, we have suggested some ways to change the perception on a national level.

The SBE has compiled an accurate list of frequency coordinators and the regions they are able to coordinate. Once this list is circulated among operations people throughout the country, we believe interference from our fellow broadcasters will diminish.

To reduce such problems to an even lower level, a *Truck Level Awareness* campaign has to be mounted. There is a need to educate every person on every field crew that the simple act of keying a hand-held transceiver on an uncoordinated channel can blow a fellow broadcaster off the air.

In March, in Washington, DC, the SBE and FCC conducted the first-ever "tutorial" meeting for regulatory and non-regulatory personnel on how broadcasters use microwaves in their day-to-day operations and on some of the things that leaders in our industry are doing to make the most of what we have.

On April 14, in Las Vegas, the day after NAB-'83, the first National Broadcast Frequency Coordinating Committee meeting will be held. It will bring together

Your opinions on our editorial, on other critical issues facing broadcasters, or on the views of our authors is welcome. Address comments to The Editor, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212.

The Ampex ATR-800 is built to last.

Others talk about audio "workhorses". But only Ampex has been manufacturing reliable professional audio recorders since 1947. Recorders that can take everything you can dish out day after day.

The Ampex ATR-800 continues our tradition by offering you unmatched editing ease, complete interfacing capabilities with a variety of peripherals (synchronizers, editors, etc.), a rugged cast transport that maintains tape path alignment, standard built-in features without an accompanying premium price tag, and a full range of accessories for all kinds of applications. And, as with all Ampex audio recorders, you get our worldwide sales and service support to keep your workhorse racing along.

Try the ATR-800. Another winning audio workhorse from Ampex.

OUR WORKHORSES DON'T DIE YOUNG.

For details, contact your nearest Ampex dealer, or write Willie Scullion, National Sales Mgr., Ampex Corporation, Audio-Video Systems Division, 401 Broadway, Redwood City, CA 94063.

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many of the 54 local coordinators that SBE has identified to discuss how we can best meet the needs of our industry.

We must all work to raise broadcast management awareness on Part 74 matters. When a broadcast engineer asks for extra funds to install cavity filters, circulators and reject loads on transmitting equipment; wants to purchase a truck identifier for TV microwave; or even wants some time to attend a monthly coordination meeting, the requests should be evaluated as investments in an insurance policy.

Based on our experience in South California, the SBE believes coordinating committee activity also enhances professional development. We have initiated many engineers into the mysteries of aural and visual STLs, spectrum-efficient amplitude-compandored sideband dispatch, 800MHz trunked dispatch systems, high quality narrowband audio remote pickup techniques, interference tracking and spectrum analysis techniques, to name a few general topics. If any of the preceding items seem unfamiliar to you, and your station is involved in Part 74, you have gaps in your technical education.

If, like many of us, you learned about Part 74 through trial and error, the level of current activity has made this learning process as professionally unwise today as setting up a rifle range in a playground.

Are we going to be upstaged?

Other services are hungry for what little Part 74 spectrum we have. In the case of land mobile interests (the 2-way radio industry), there is an organized lobbying campaign to denigrate the broadcast service. We are portrayed as wasteful spectrum users. Although they point most often to Part 74 FM, VHF and UHF channels when talking about our "wasteful" tendencies, our Part 74 holdings have not escaped their notice.

The grandfathered aural STL band (942-947.5MHz) has been in jeopardy for a decade. We may be forced to relocate aural STL refugees elsewhere on a 5-year timetable. Unfortunately the FCC has not come up with a viable "elsewhere."

The FCC has already allowed cable systems to obtain 13GHz channels on a shared basis with broadcast. The FCC Docket 82-334 would have us share all broadcast microwave spectrum from 947MHz-40GHz. If we do not convince the FCC that such sharing may create chaos in all services involved, things could become interesting, indeed. We must coordinate at the local level to make such shared spectrum slices work. This must include bringing cable systems into our regional coordinating committees.

On the theory that we can defend our use of valuable spectrum and adopt more spectrum-efficient techniques, local coordinators must support a national broadcast spectrum policy best called, "Use It Or Lose It."

There may still be time to solve our internal and external problems concerning Part 74. If we don't, some of us may have to exit the theater.

Editor's note:
Rudman, who is also engineering manager, KFWB, Los Angeles, CA, wants to clarify this address as being founded on the position of the National Frequency Coordinating Committee. Thus, it does not necessarily represent the views of KFWB or the Westinghouse Broadcasting Company.

Spec Book supplement

The following information is offered as an update to the 1982 *Spec Book* issue. This information includes additions, corrections and deletions to data in *Spec Book*.

EDITING CONTROLLERS

Datatron

- The Vanguard editing equipment is capable of operation with control track pulses as the timing reference. When used with SMPTE equipment and code, the accuracy is 0 frames. Readers are included; generators are optional. Editing decisions may be stored on various media, including paper tape and magnetic disc. Three additional sources beyond VTRs may be interfaced with the editing system. All 1- and ¾-inch and most 2- and ½-inch VTRs, as well as a majority of production video switchers and audio mixers, may be interfaced.

TURNTABLES

Broadcast Electronics

- The QRK Custom II is not available.
- The QRK 16SA is now the 16C. Indication of operating speed is determined by position of the speed change lever.
- The QRK 12C is available as a 3-speed (12C3) or 2-speed (12C2) unit.
- Rumble ratings for the QRK Galaxy model should be – 50dB, per NAB specs.

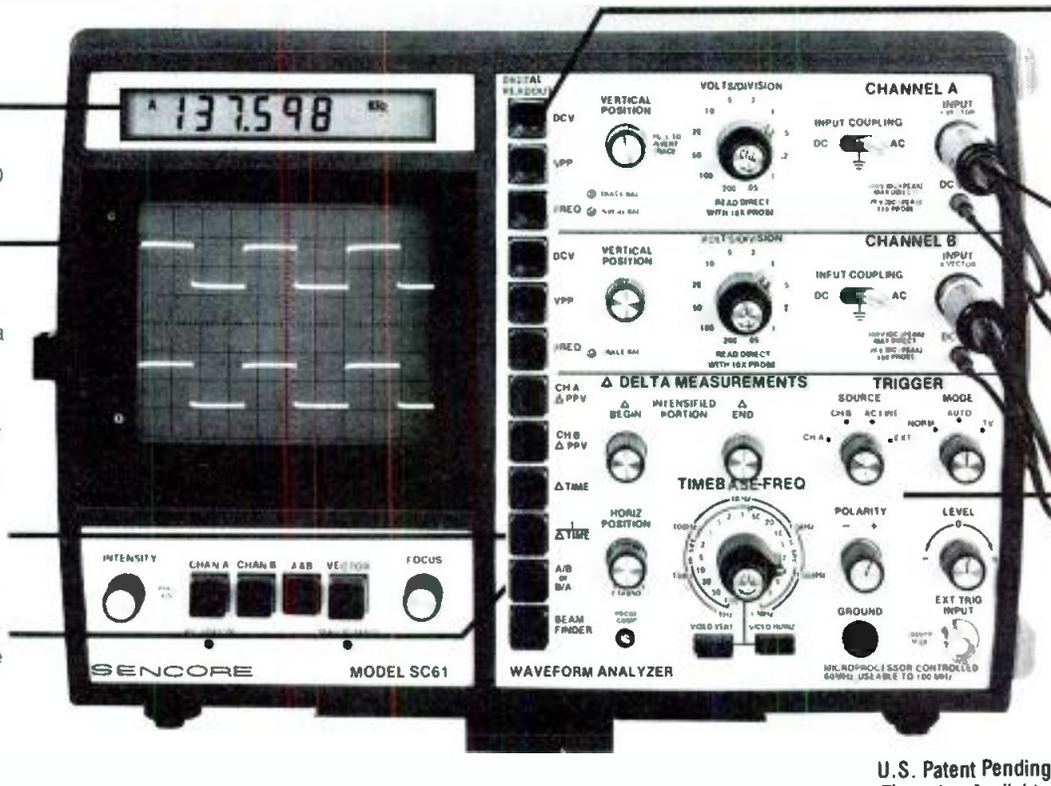
Double Your Troubleshooting and Testing Productivity . . . Or Your Money Back!

Six-digit readout: Automatically tracks every CRT test. We call it digital autotracking. It's patent pending.

Bright dual-trace CRT: 60 MHz (– 3 dB); 100 MHz (– 12 dB).

Delta PPV, Time, Freq: Measure any part of a waveform for PPV, time or frequency using Delta measurements. Just dial in the waveform section you want to measure and push.

Simplify Freq ratio tests: Automatically compare input/output ratio of multiply/divide stages from 1:1 to 1:999,999 with the push of a button.



Autotracking DCV, PPV, Freq: Measure DCV to .5%; PPV to 2%; freq. to .001%. Just push a button for either Channel A or B.

One probe input: One probe input per channel for all measurements - digital and scope - with 5 mV to 2000 V measuring range. (2 lo-cap probes provided.)

Super sync: ECL provides rock-solid sync trigger circuits with only 4 controls; includes TV sync separators for video work.

U.S. Patent Pending
Financing Available

The first scope with push button digital readout. If you use general purpose oscilloscopes for troubleshooting or testing, we can double your present productivity with the SC61 Waveform Analyzer, the first instrument to turn every conventional scope measurement into an automatic digital readout.

No more graticule counting. *Connect only one probe* to view any waveform to 100 MHz. Then, just push a button to read DCV, PPV, frequency and time — automatically!

There are no graticules to count or calculations to make, which speeds every measurement.

The digital readout is from 10 to 10,000 times more accurate as well.

Plus you have everything you want to know about a test point, at the push of a button, which speeds troubleshooting tremendously.

A special Delta function even lets you intensify parts of a waveform and digitally measure the PPV, time or frequency for just that waveform section.

And it's neat. No more tangled leads, piles of probes or dangling cords. The SC61 is an entire test station in one unit.

The one and only. There are other scopes with digital readout, but none of them completely automate every conventional scope measurement so you can automatically analyze any waveform without counting one single graticule. Totally automatic waveform analyzing at the push of a button. It will make all the difference in your productivity.

Double your productivity. When we say the SC61 will double your productivity, we're being conservative. We've seen cases of three, four, even ten time increases in productivity with this first-of-its-kind, automated oscilloscope. Every situation is different, however, so try the SC61 and judge for yourself. Here's our offer.

Money back guarantee. If the SC61 does not at least double your productivity during the first thirty days, you may return it for a full refund, including freight both ways.

Call today. Get the entire SC61 Waveform Analyzer story. Call toll-free today, and ask for our eight page color brochure. It could be the most productive call you make this year!

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Circle (12) for information
Circle (131) for demonstration

Case study:
WISH-TV 8 update

By John Demshock, chief engineer, WISH-TV 8, Indianapolis, IN

The WISH-TV 8 facilities.

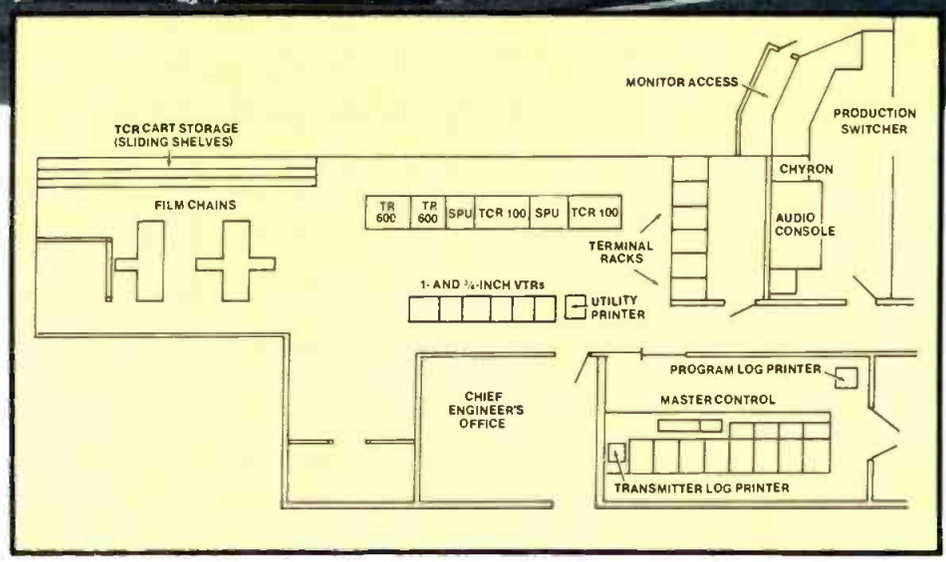

Figure 1. WISH-TV engineering facilities floorplan.

My role as chief engineer of a station in a highly aggressive market has changed drastically from one of crisis management at the start to one of actually controlling the engineering operation, particularly in view of the ambitious plans of our station's management. This was possible through a lot of hard work and the progressive attitude of our parent organization, the Corinthian Broadcasting Corporation. Today, given the tools we have to work with, comparatively it's like being in a candy store.

Our position is best illustrated by the upheaval we experienced during remodeling, and the opportunities the company seized during the interim that enhanced our engineering operation and service to the station. New equipment was being readied for installation that would help streamline our operation. The decision to automate master control was made during this crucial period. From that time on, the mood in engineering has been to carefully heed the latest technological developments in television, because they *might* be the solutions for future demands.

Much of the credit of Corinthian's future thinking goes to Art Biggs, vice president of Engineering. His ideas do not reflect status quo, but match the pace set by new programming, news services and broadcast needs that are constantly being set before us.

Chaos

It was a dubious honor, however, being brought in as chief in February 1981. When I walked in the door, it was similar to walking into a diamond-in-the-rough, and I mean *rough*. The control room, tape and production control areas were torn apart. The previous chief had left during the first stages of remodeling. After an initial shock period, I was able to gain a certain amount of composure by reminding myself of the equipment already in-house as well as the equipment to come. Being associated with Corinthian Broadcasting in different capacities over the past few years, I was aware of its philosophy toward engineering, and I was reasonably confident that it would carry the philosophy through here at WISH. Simply put, the plan of attack is to fully use technology in order to meet increasing demands made to engineering for more and better products.

At the time remodeling began, evidence of this philosophy had begun to show through several equipment purchases, including Grass Valley switching systems for master control, production and routing; RCA TK-47 cameras with auto setup for studio use; a new RCA transmitter with TFT remote control and auto logging; two new RCA TR-600 tape machines; and an ADM custom 36-input production audio board.

The new equipment having not been installed turned out to be a blessing in disguise, because the existing studio installations had to be undone com-

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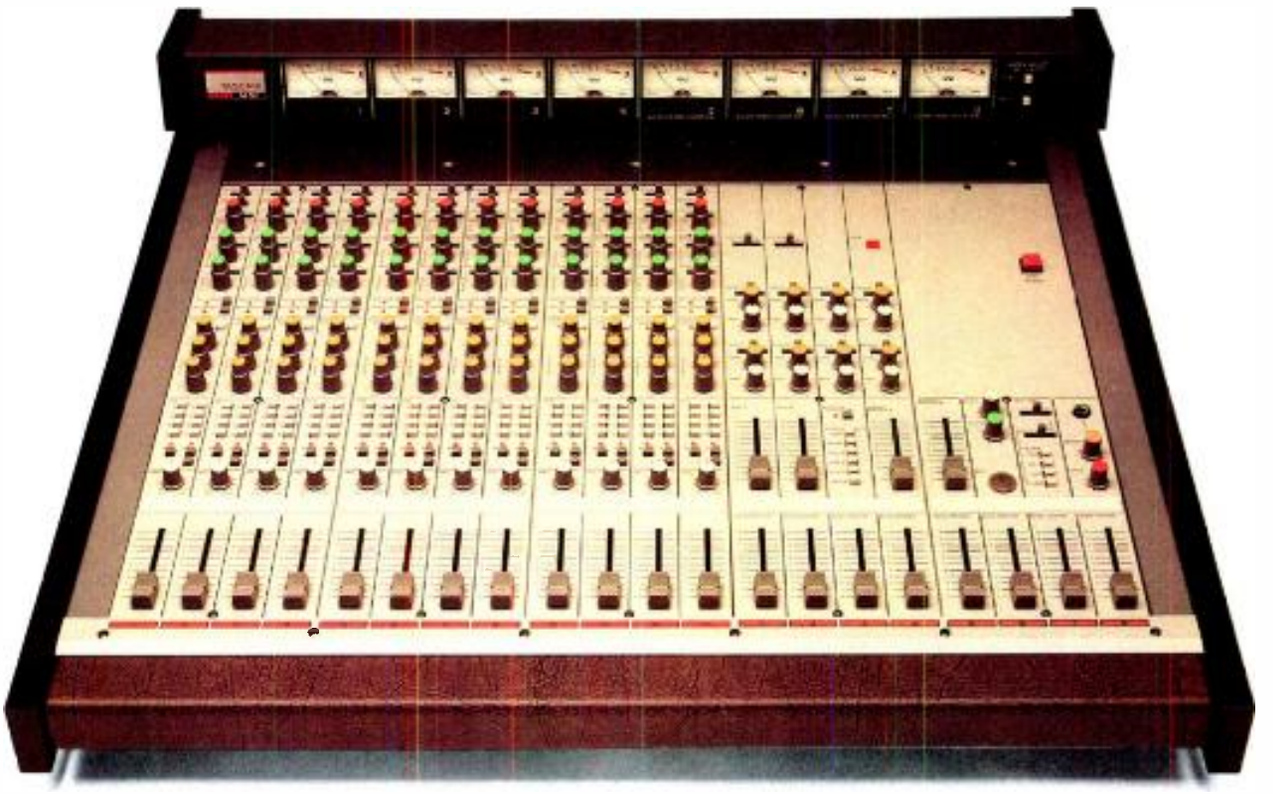

WE JUST MADE HIGH PERFORMANCE STANDARD EQUIPMENT.

TASCAM's M-50 is the compact 12x8x8 mixing console audio production professionals have been looking for. With its multiple inputs per channel, plus assignable submixes and monitor sections, you get the flexibility to get the job done in all production modes—record, overdub and remix or assembly.

By including direct boxes to accept instrument inputs, phono pre-amps for replaying effects library or reference disks and stereo solo "in place" permitting monitoring of individual channels or whole portions of a mix, you get what you need. High performance functions as standard equipment.

The M-50 is reliable and fast, with extremely flexible signal routing. A valuable asset to the ad agency production room, the small video production/post-production company, the multi-media production facility, and in many other applications.

Because the M-50 includes Solo and PFL, multiple auxiliary mixes, plus balanced and unbalanced inputs and outputs, it is also well suited to final film assembly, small club P.A., and broadcast with clean feeds provided.

TASCAM's extensive design and manufacturing experience in professional recording equipment made it possible to create the M-50. Compact and affordable, this modular 8-track mixer is within the reach of any serious professional.

For additional information, see your TASCAM dealer, or write TASCAM Production Products, 7733 Telegraph Road, Montebello, CA 90640, (213) 726-0303.

TASCAM
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DESIGNED BY POPULAR COMPLAINT.

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TEK 110-S FRAME SYNCHRONIZER

A frame synchronizer from Tektronix that sets a new standard of comparison.

Now. Authentic reproduction from any signal source. The Tek 110-S is the frame synchronizer with 10-bit resolution and accuracy. Performance that's every bit Tektronix! You get highest signal quality with correct SCH phase from any source. Resulting in the least signal degradation of any frame synchronizer on the market today.

Ten-bit digital circuitry offers digital signal processing with negligible quantizing errors. This 10-bit capability lets you cascade multiple units and depend on the 110-S for unexcelled performance. With four passes through the 110-S your signal is still better than with one pass through an 8-bit synchronizer. *Including quantizing effects,* the 110-S has the following specifications:

1% Diff Gain
1° Diff Phase
60dB Signal-to-Noise
1% Freq Response
0.5% 2T K-Factor

Compare these values to other frame synchronizers which omit quantizing effects from their specifications.

Noise performance unmatched. Signals can be tracked to low signal/noise ratios, such as those encountered during ENG Microwave fades. Or the operator can select field freeze or black. Adaptive clamping prevents streaking while quickly responding to hot switches.

Accurate color framing. With the adaptive decoder or optional four-field memory, field 1 to field 3 conversions can be accomplished without introducing 140 nanosecond picture shifts. With four-field memory (one complete color frame), accurate color framing can be obtained without decoder artifacts.

Accurate RS-170A timing. With the 110-S's 10-bit digitizer and full memory, your original sync and burst can be passed with the signal. Or you may choose to insert a new digitally generated sync and burst with RS-170A timing.

Front loaded interchangeable boards. Internal diagnostics allow you to quickly identify any impending problems. Circuit boards are calibrated individually so you can change boards quickly, minimizing downtime.

Processing amplifier with remote control provides adjustments for signal level, set-up, chroma gain and hue. Other controls such as field/frame freeze are also provided on the remote control.

The 110-S is built in our tradition of reliability, excellence and long-term value. And backed by a worldwide service network and proven technical support.

Call your nearest Tektronix Field Office (listed in major-city directories) for more information. Or call 1-800-547-1512 for descriptive literature. (In Oregon, 1-800-452-1877).

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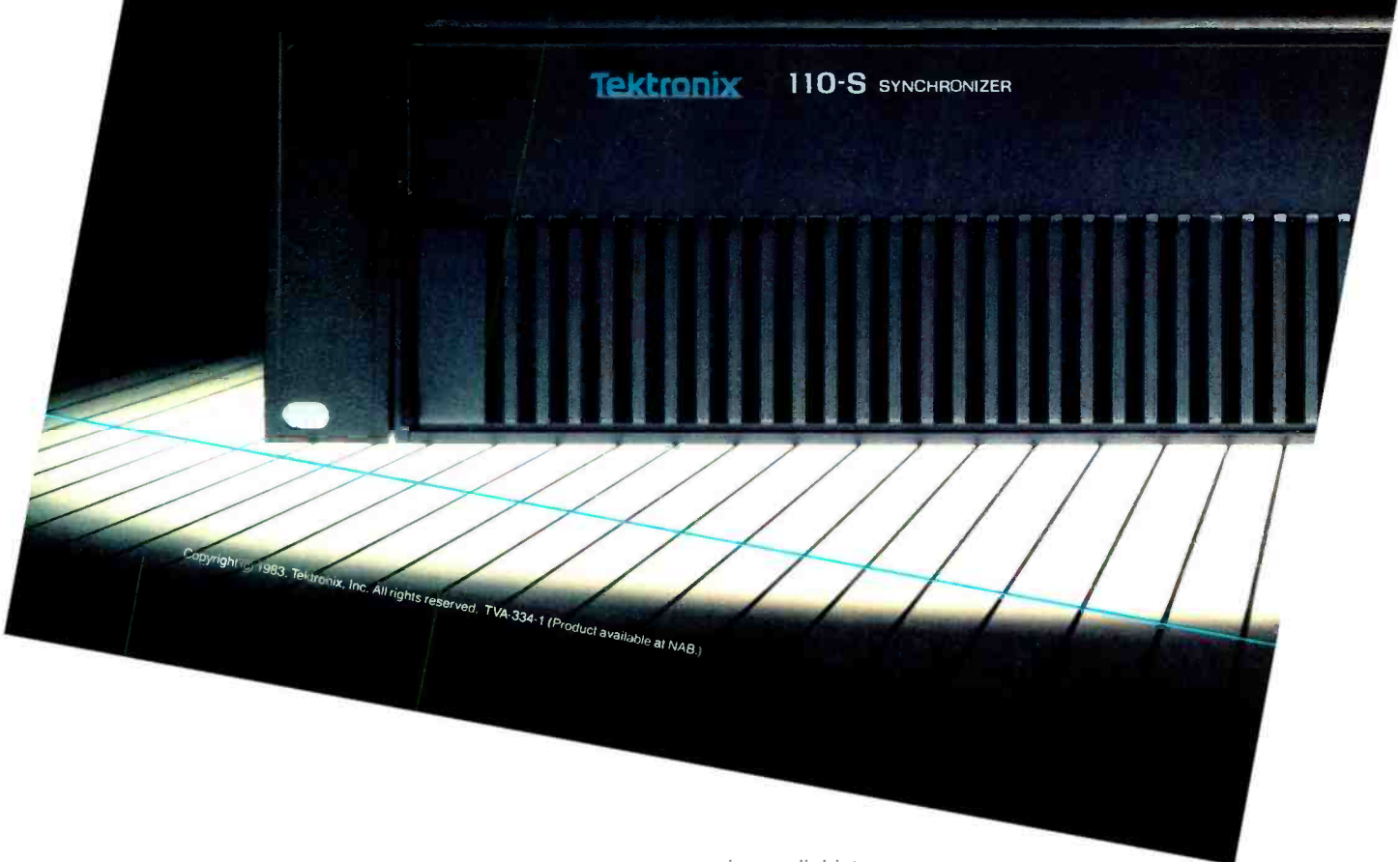

Continued from page 16

pletely to accomplish remodeling. About midway through the cleanup, it became obvious that short-range production and programming goals would be impossible to meet, even with our existing new equipment. These plans included the production of an hour-long late news block; extensive use of *Live Eye* reports from the field; and rumors of an hour-long local show, complete with remotes, adjacent to the hour-long early news. These plans could not have been timed better for the engineering department, because the remodeling project allowed us to tailor the operation to these increased production requirements.

Early steps

The first steps had really already been taken. The selection of an automatic logger for the transmitter remote control, along with cameras that could be set up automatically, were definite advantages. We also realized that master control automation could be implemented faster with the installation of our new switcher. We chose Data Communication Corporation's BIAS Master Control Automation (MCA), a sister product that interfaced with the BIAS Traffic System that had already been in place for several years. The system opened all kinds of new avenues to us but, at this point, I was happy to design a control room that could be efficiently operated by one person under most conditions. Automated switching, automated setup of studio cameras, automatic transmitter logging and automatic program logging gave us what we needed to meet our immediate demands without having to add staff members.

One of the unique features of the BIAS MCA system was that we had only one company to deal with for our traffic and switcher automation. The same computer for our MCA area served the sales and traffic department and left us the option of adding other software packages for other departments, with the luxury of programming our own ad hoc applications.

The engineering staff at this point was running flat out just to keep the station on the air. I still don't know how they kept us looking as good as we did while contending with the obstacle course on the floor, an old Visual switcher, camera controls mounted above and behind the master control operator, no monitoring to speak of, and, because of the remodeling, no assurance that something that was in one place yesterday would be in the same place tomorrow. When the announcement of the purchase of an automation system was made, it was met with some apprehension, although a lot less than I expected, and a great deal of curiosity. The fact that we would have a new Grass Valley switcher and an automation system at the same time seemed like heaven, especially when we looked around at our existing circumstances.

Advantages in remodeling

Another advantage of the remodeling then came into play. We were able to practice on the new switcher *before* we put it on-line. The operators had a chance to become familiar with it at their own pace. This eliminated the need to learn an automation system and a switcher at the same time. We

WISH's *Live Eye* news, on location.

Jack Parker, news photographer, sets up his truck for a live feed.

The WISH-TV automation system cuts on-air errors and improves billing. Charlie Clark (at the keyboard) demonstrates the log generating capabilities of the WISH automation system, while the author looks on.

TEK 1910 DIGITAL TEST SIGNAL GENERATOR/INSERTER

WORKING HARD FOR YOUR SIGNAL QUALITY

The new digital generator that lets you access and configure the vertical interval any way you want it.

Now. Four external VITS inputs. Non-volatile memory. And 39 test signals. All wrapped up in one test signal generator with all-digital family features. The new 1910 from Tektronix gives you the most access offered to the vertical interval—for inserting and configuring the location of test signals, Teletext, closed captioning, source ID and more. No other generator gives you that kind of capability.

Plus, the proven performance of the leading family of digital test signal generators. With the 1910, Tektronix has combined its 1900 Series Transmitter, NTC7 and Studio Test Sets in one highly capable unit. You get a full signal complement, with the accuracy and stability of 10-bit digital signal generation. The digital code for each signal is stored in replaceable PROMs so your 1910 won't become obsolete.

Its RS232 control port adds even more versatility to the 1910 by providing a means for automatic control from such devices as the Tektronix 1980 ANSWER Automatic Video Measurement Set, with added flexibility for programming VITS and VIRS in either field on lines 10 through 20, signal matrixing, VITS sequencing, redefining signal selection in the front panel or remote control unit—and more.

Solid support completes the package. The 1910 comes with a worldwide service network and proven technical support, plus the Tektronix reputation for reliability, excellence and long-term value.

Contact your nearest Tektronix Field Office (listed in major city directories) for more information. Or call 1-800-547-1512 for descriptive literature. (In Oregon, 1-800-452-1877.)

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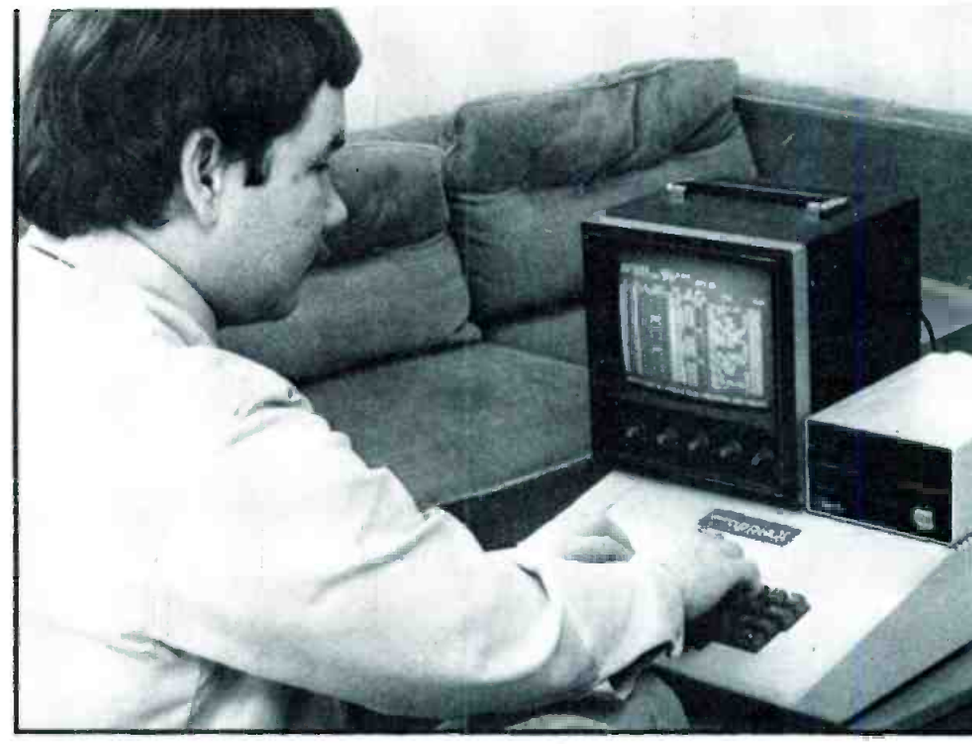
WISH-TV equipment list

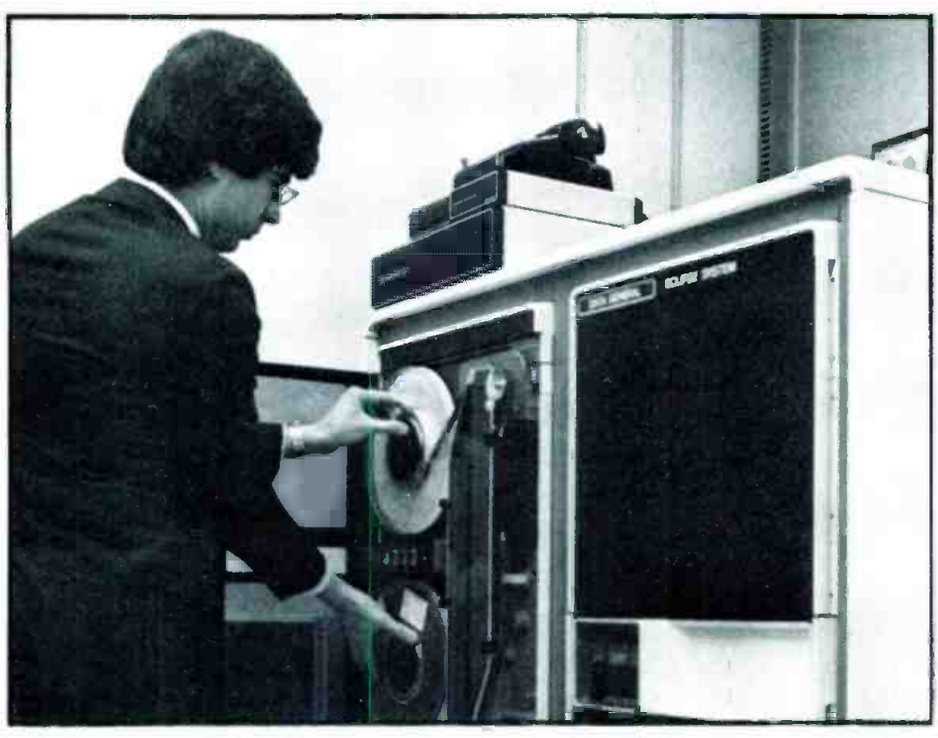
- RCA TT-25 FH parallel transmitters
- TFT remote control system with model 7640 telescan
- M/A-COM microwave equipment
- Grass Valley 1600-7K, 1600-4S and 400 series switching systems
- BIAS Master Control Automation (MCA)
- Lenco pulse and video generation and distribution equipment
- RCA TK-47 studio cameras with auto setup
- ADM 36-input audio console
- RCA TCR 100A cart machines
- RCA TR 600 quad VTRs
- Sony BVH 2000 1-inch VTRs
- Sony BVW-3 Betacams
- Ikegami, Tektronix and Videotek monitoring



An Apple II computer at home lets the author communicate with the WISH facilities.

had hoped to wait until the automation system arrived before putting the new MC switcher on-line, but the old Visual didn't make it. We couldn't wait. As it turned out, everything worked out well, because training on the system was relatively easy and was done during periods of network operation. Because we knew it was coming, installation of the system proved to be relatively simple.

When terminal equipment was installed, rack space was left to hold the computer; switcher interface and machine control junctions were made on punch block immediately behind the interface frame area. This design allowed for easy paralleling of machine controls to the computer. The switcher electronics were located in the rack immediately adjacent, to provide easy access to it. The switcher-computer interface was accomplished by a cable that simply paralleled the switcher push-buttons with the computer interface frame. No modifications to the switcher were necessary. In almost no time, we were off and running with a control room that was an example of the use of computers and microprocessors in on-air operation. It was a thrill the first time I was in there for a break as we were going into the evening newscast. The computer was running and logging the break, the transmitter log printer was dutifully spitting out readings, and the MC operator was recalling camera setup for studio-A lighting conditions out of the TK-47's memory.



Bill Redpath, assistant financial manager, prepares a tape transfer for backup of accounting data.

Maintenance

Because our staff size is limited, during the remodeling effort we opted for some things that might save maintenance time as well. Simplicity of system design was the rule for most applications, resulting in limited patching and an easy-to-use labeling system. All cables are labeled with Thomas and Betts wraparound stickers that indicate the source and destination of the wiring. There was no need for a reference manual, as numerical coding was not used. All equipment power was run overhead, as much as possible, to help prevent spikes. And, probably most importantly, the master control equipment racks were sealed with panels and back

Continued on page 26

TEK TELEVISION PRODUCTS

WORKING HARD FOR YOUR SIGNAL QUALITY

A completely automated audio analyzer package and advanced portable scopes to simplify your job.

Now. Four new products from Tektronix deliver more capability and performance than ever before. **SG 5010 Programmable 160 kHz Oscillator/AA5001 Programmable Distortion Analyzer.** Two new members in our TM 5000 family of modular, IEEE-488 compatible instruments. The SG 5010 is the first oscillator to offer both GPIB programmability benefits and less than 0.001% (−100 dB) total harmonic distortion. Plus all the standard IMD test signals and high level, fully balanced, fully floating output. Together, the SG 5010 and AA 5001 make a completely automated audio analysis system with the highest performance available today. Fully automatic even when the oscillator and analyzer are separated, by yards or by miles.

2236 100 MHz Portable Oscilloscope. Measurements that had taken three or four instruments can now be done with one: the 2236 with integrated counter/timer/digital multimeter. It's a whole measurement system packed in a portable scope that's lightweight, versatile and easy to use. Priced-right performance for tasks from circuit continuity testing to gated frequency, time and event counting. Standard features include TV field and TV line triggering.

2445 150 MHz Portable Oscilloscope. The new industry standard with more performance for the dollar than you've ever seen before. Four-channel capability. Auto level "hands-off" triggering. Standard Δ time and delay sweep. 1 ns/div sweep speed. Overdrive aberration of only 0.5%. Extensive CRT readout. Plus more. And state-of-the-art microprocessor design keeps the 2445 simple to operate. It's everything that a portable scope should be and the only one that is.

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It takes a very tough tape to withstand edit after edit through today's VTR equipment and still deliver a crisp, clean playback image.

And tough is exactly what new Scotch® 480 one-inch video tape is.

A special coating formulation on Scotch 480 means you no longer have to worry about problems like stiction.

In fact, during computer editing, 3M lab tests have shown 480 is capable of delivering over *1,000 edits from the same preroll point,* with no significant reduction in playback quality.

And in today's tough video production environment, that kind of durability can mean a lot.

Scotch 480 is further proof of why 3M is the leader in professional use video tape. And why we sell more one-inch tape for professional use than all other manufacturers put together.

For a free brochure on new Scotch 480 call 1-800-328-1684 (1-800-792-1072 in Minnesota). And find out more about the tape that's as tough as today's editing equipment.

Magnetic Audio/Video Products Division/3M.

NEW SCOTCH 480 1" VIDEO TAPE. LASER TESTED FOR CONSISTENCY.

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3M hears you...

3M

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Continued from page 22

doors, and 55° air, filtered hy a moving roll and an electrostatic collector, was pumped in. In the equipment area, the backs and tops of the racks were sealed, and the entire area was supplied with the same air feed. This provided for a walk-in access area for all terminal equipment, as well as ready access to the audio console. The entire terminal area can be accessed without opening individual doors, and can be neatly isolated by keeping the entry door closed.

We finished the major part of the remodeling effort just in time to confront another challenge. We were in need of a satellite receive system in order to receive news and programming feeds. Scientific-Atlanta had just introduced a micro-controlled receive system that allowed simple and quick changes of transponder number and antenna position. That was added to the complement of computerized tools already possessed by the MC operator. Two additional ENG microwave trucks were also needed, along with an additional receive system to meet programming and news objectives. We opted for M/A-COM MA 2-MX systems to provide simple and efficient use in the field. This selection helped ease the dilemma of manpower for ENG microwave units.

The plan was to make these units easy to set up and functional so that their operation could he performed by the news photographer assigned to the truck. We did not have the manpower necessary to send an engineer along. This is obviously asking a lot of our photographers. It's usually hard enough just to get the story on tape, and now a live shot was added to the list of things to do. After some initial failures, we have worked out a system that allows us to do an average of 20 news remotes per week during the summer months when lighting conditions are most advantageous. This includes nightly weather remotes from *Stan's Weather Van*.

Adding to the excitement was that the hour-long local live show leading into the early news subsequently became a reality. Two adjacent 1-hour live shows complete with live action from our remotes and auxiliary feeds kept us on our toes, but we managed the transition without expanding our workforce. We are expecting new developments that will demand more from us in the coming months and, thanks to automation in our master control, we will be up to the task.

The computer transition

Also, during the course of this year, the computer that had been installed to handle traffic and master control has become more fully used. Presently, BIAS has supplied us with several additional applications packages, in-

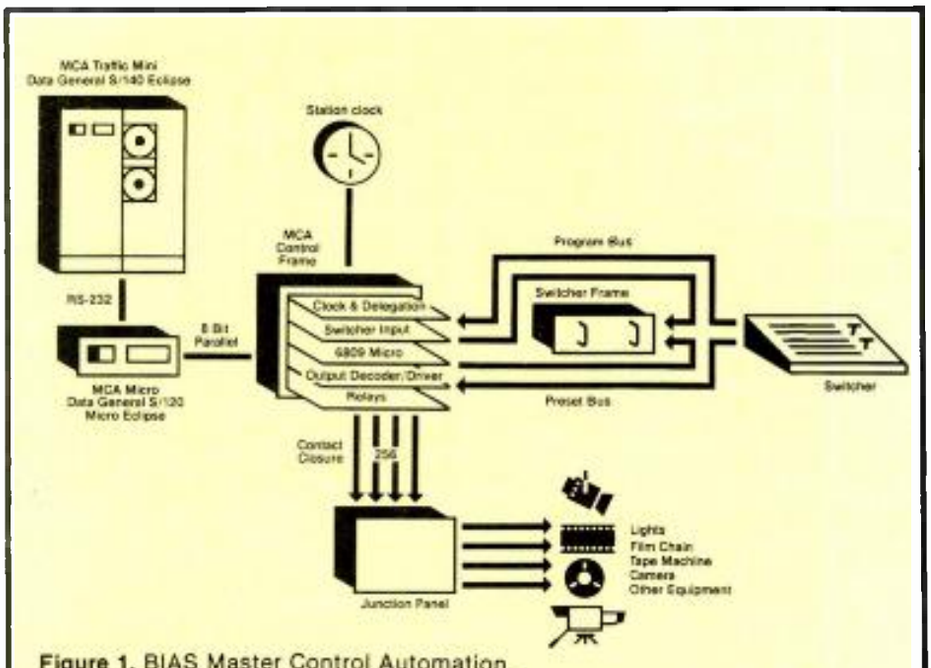


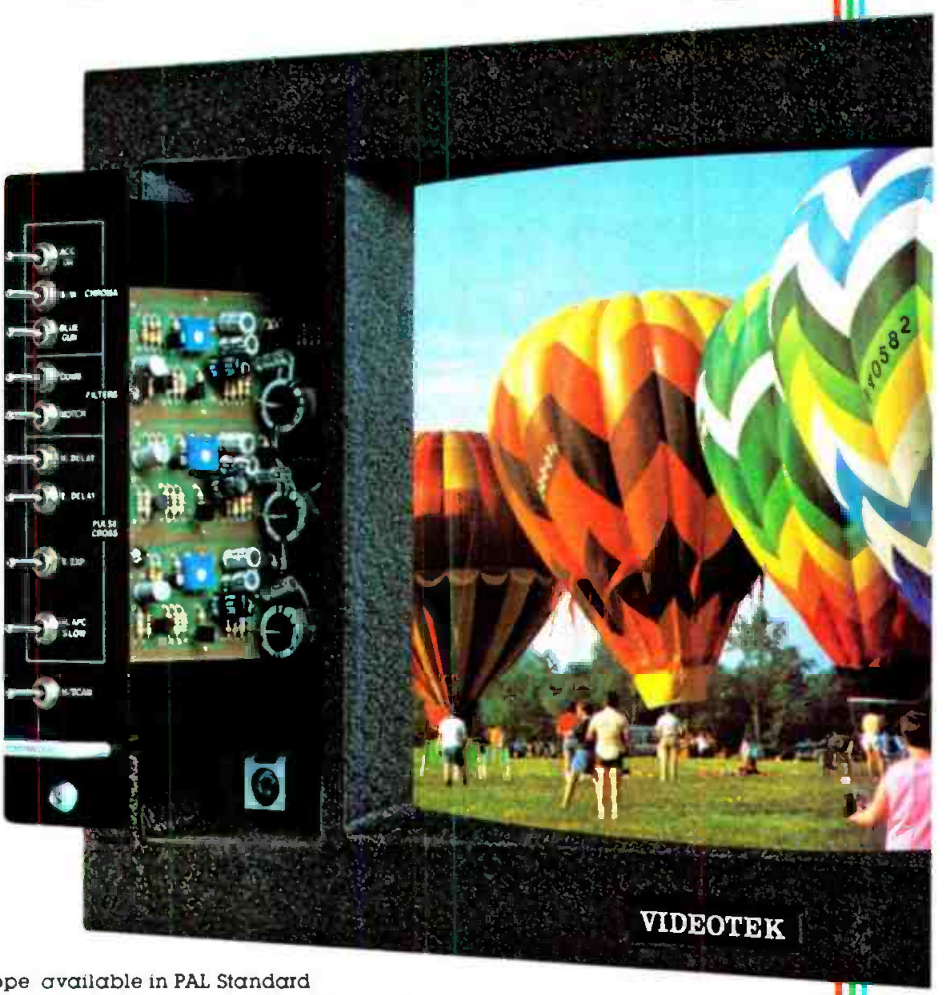
Figure 1. BIAS Master Control Automation.

The staff from Data Communications Corporation was on hand at the SMPTE-'82/New York convention to describe the BIAS Master Control Automation (MCA) system (Figure 1). This product extends computerization to the TV station's engineer for machine controls and all on-air switcher activity. After receiving the program log formatted with the *events* with machine assignments, the MCA performs all subsequent controls.

PROGRESS

...the new High Resolution Studio12A

Videotek's commitment to progress has resulted in the most versatile RGB/NTSC 12" broadcast color monitor on the market today. The Studio 12A employs an advanced fine-pitch CRT for 43% better resolution; Set-up Controls are now secured in an easy-access Slide-out Drawer; and Switchable Comb Filter, Notch Filter, and Analog RGB Inputs have been added to an already-impressive list of standard features found on monitors costing twice as much: High Voltage Regulation, A-B Split Screen, Selective H-AFC, ACC Defeat, Preset Controls, Pulse Cross, Underscan, and more.



TSM-5A Waveform Monitor / VSM-5A Vectorscope available in PAL Standard

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VIDEOTEK INC.

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cluding word processing, general ledger, accounts payable, feature film inventory and amortization and supercomp.....all on one system. By means of terminals distributed throughout the building, these additions allowed other departments to share in the increased productivity that engineering had already enjoyed. The programming department uses its terminal for feature film and as a means of input to the traffic system for program-related input. This eliminates some paperwork and decreases the workload in traffic.

We were concerned at that time that if we did not take advantage of the latest technology it might be difficult to catch up later because of the rapid changes taking place in the information age. In order to gain a better understanding of computers, which are becoming an integral part of our business, I purchased an Apple II personal computer. I have taken some liberties in extending automation on the computer at WISH to my home or any other remote location. The system's dial-up modem allows me to access its activities through my Apple II personal computer and a special communications software package. At any time, I can monitor on-air status or use the station's word processing package for reports or memos.

Because we are on-the-air 24 hours daily, transmitter maintenance requires switching from one side to the other of our parallel FH transmitters while we are on-the-air. Of course the name of the game is to do this at the most opportune time. Dial-up access to the on-air log from the transmitter site provides the needed information about when to switch with minimal disruption.

An example of the benefits of the marriage of my microcomputer with the station's host computer is illustrated by what happened recently. Once, at 5 a.m., the phone rang with the startling news that "the computer won't work." Instead of driving to work, I signed on with my Apple II and examined the problem. A wrong log date had been accessed, and this proved to be the culprit. A quick fix was all it took to remedy the situation. Still in my pajamas, I went back to bed.

When the phone prohibits me from getting any paperwork done, I can spend an afternoon at home with the Apple composing memos, etc., on the station computer. The secretary then calls them up on her terminal, corrects them and prints them out on her letter-quality printer.

Things to come

Past progress has been at a rapid pace, but. 1983 is off to an exciting start as well. Our tape room was in need of a means to record the ever-increasing production schedule, as well as satellite-provided syndicated programming. The replacement of two old quads with three Sony BVH-2000s provided the remedy for the two-few-machine blues. Use of the auxiliary events system provided in the MCA allows us to control these machines for delay and production purposes automatically and independently from on-air operations. The command for record, for instance, is entered on the log at the appropriate time, and the computer rolls the selected machine.

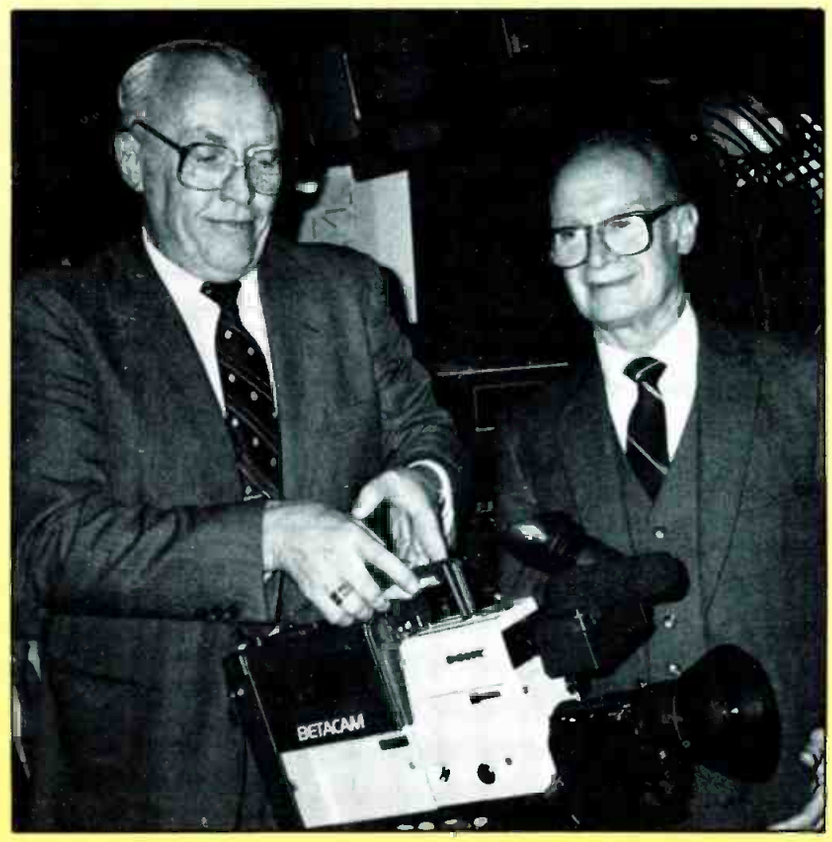
The workload that our news photographers are under is also heing addressed this year. The purchase of Sony Betacams dramatically reduces equipment weight while offering superb quality. The absence of old familiar cables to the VTR has not saddened anyone in maintenance or news. Although a standard has not been developed in this area, we believe that it is to our advantage, as well as the viewers' to use such a dramatic improvement in the area of ENG.

Additional enhancements for the future include automatic control of the studio cameras by the MCA system to allow unattended setup and automatic scene recall for each show we produce. The addition of bar code readers for our two cart machines, as well as the possibility of wand readers for the reel-to-reel machines, have been discussed. Computer access to an electronic still-store would eliminate slide errors, and the possibility of newsroom automation is never too far away.

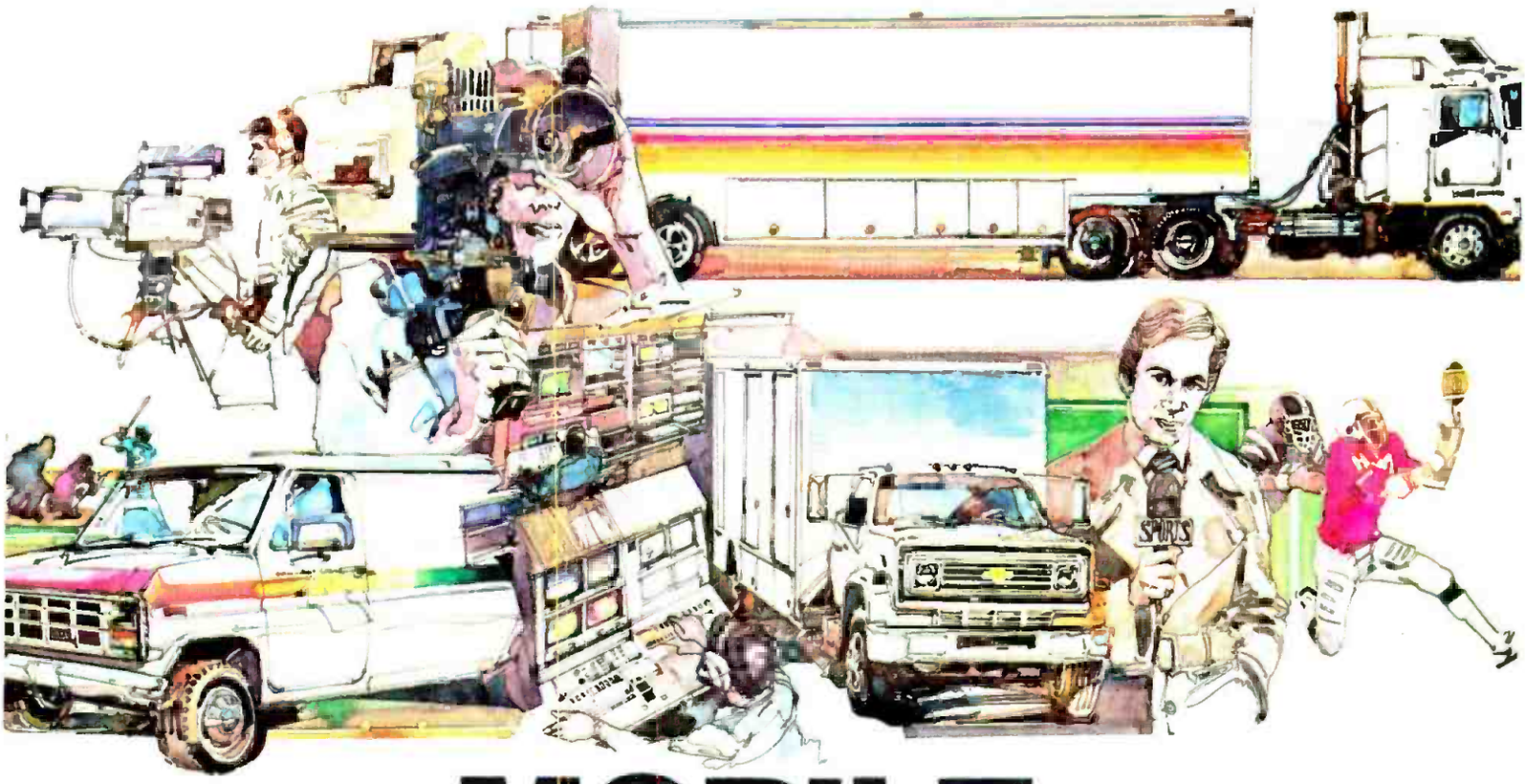
We are certainly not perfect, but the impact that new technology and automation have made at WISH has helped us offer the services necessary to not only survive, but also to advance in such a competitive environment. |:-)))|

Acknowledgement

The assistance of Jamie McMahan of Data Communications Corporation and Trish O'Leary of the Strayton Corporation in the preparation of this article and providing photos is recognized.



At the SMPTE-'82/New York convention, Art Biggs (right), Corinthian Broadcasting, appeared before the press with Neil Vander Dussen and Sony's ½-inch Betacam video recorder/camera system. This system is one of the innovations to be incorporated in the remodeling of WISH, one of Corinthian's six stations. An interview with Biggs concerning his selection of the Betacam appeared in the January 1983 issue of BE, pages 48-50.



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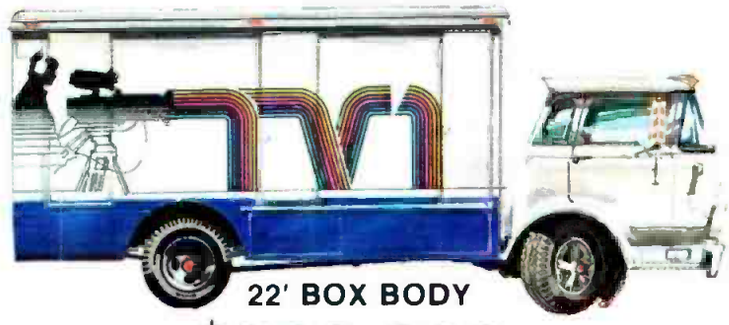

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MOBILE UNITS ENGINEERED AND BUILT TO YOUR REQUIRMENTS

Although the market for test equipment is rapidly expanding, not *every* piece of equipment is practical for *every* station. By keeping actual needs and resources in mind, broadcast engineers can choose the best-suited equipment for their particular stations.

Test equipment: Know your needs

By Gary A. Breed, chief engineer, WCBU-FM/WTVP-TV, Peoria, IL

Choosing test equipment is getting to be as tough a job for the broadcast engineer as choosing studio equipment. With a growing variety of equipment, new models seem to be introduced almost daily, at every level of complexity as well as the entire range of the price spectrum. Making a decision on the purchase of test gear for your AM, FM or TV station can be made easier if approached from a systematic evaluation of your station's needs and resources.

The decision process

In the simplest terms, the process of decision-making occurs in three question-and-answer steps:

- Do you really need the equipment?
- Do you know how to make good use of it?
- Can you afford it?

These steps are fundamental, but certainly are not always easy to follow. *Management*, *Programming*, *News* and *Sales* all have their questions for *Engineering* when it comes to the quality of the product, whether it is the on-air signal, or the ENG or production output. The pressure is on engineering to have the facts on the station's technical quality, as well as the ability to maintain the equipment in the most reliable condition. It is the engineer's job to watch over his department's contribution to the success of the station, which may mean saving money by doing without a helpful, but not essential, piece of test equipment. Alternatively, it also may mean spending a substantial chunk of money to purchase a piece of test equipment that makes it possible to improve the quality and competitive position of the station.

Before looking at specific examples of situations that might arise at AM, FM or TV stations, we should go over the three steps of decision-making in more detail. First, is the equipment really needed? Does your station require a specific test function to provide maintenance support, quality evaluation or enhanced reliability? Is the need a response to a technical problem or to input from any number of outside influences from within or outside of the station? Beware of an argument that begins, "If we had this new gadget, we could..."; it's a sure sign that the *real need* may require some further examination. Balance the value of time savings, new capabilities and the current inventory of test equipment before deciding if a piece of new gear is needed.

Second, do you have the expertise available (talent *and* time) to make the equipment worthwhile to have on hand? I have seen situations in which the only engineer who knew how to properly use an advanced piece of equipment took on a new job, leaving behind an expensive unit that just gathered dust because the successor chose *not* to learn to use it, being quite satisfied with the other equipment available. So, remember that it is not always the equipment that makes the repair or evaluation possible, but the ability of the user to get the most (or least) out of that piece of equipment.

And third, can your station afford a new test unit that you want? Sometimes the answer is that the station *cannot afford to be without it!* More often, when the proposed purchase involves something other than the most basic test gear, there needs to be an evaluation of the cost factor of

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test equipment. If equipment is needed for a specific job that is urgently in need of attention, but that is not particularly common, it may pay to rent the necessary equipment. On the other hand, it might be advisable to call in a factory service technician or a consultant to do a job, rather than to purchase equipment that might not be used again for a long time.

The hard decisions, though, are for *optional* equipment, not absolutely necessary for the survival of the station, but having significant value to the quality, reliability or efficiency of the station. This type of purchase must eventually be *paid back* through better use of available manpower, less downtime or an improved competitive position. All equipment purchases, whether test equipment or otherwise, must be treated as *investments* by a station; as such, it must provide a payback, whether or not that payback can really be measured in terms of dollars. Engineering and management need to have serious and honest communications to determine the affordability of a new piece of test equipment.

Some examples

Let us apply the principles outlined previously to the situation of AM, FM or TV stations that are contemplating the purchase of some of the interesting new pieces of equipment available recently on the market.

AM stations. Let's suppose that the chief engineer at an AM station wants to get a common point in-line impedance bridge. *Is it needed?* If he has a simple 2-tower array, it is probable that such a unit is not needed. Only an array with a history of instability would need such an impedance bridge. I would rather see that the instability is remedied; but, in a large array, that may not be possible.

Is the staff capable of using it? In this case, the unit is pretty easy to use, but the temptation could be to do more than adjust the common point tuning! Would this piece of equipment encourage the person of marginal competence with directional arrays to tamper with an array that requires no adjustment?

Finally, *is the value worth the price? Will an FCC citation be avoided? Will it help track down trends in a troublesome array that might allow it to be fixed once and for all? Does the profitability of the station allow its purchase?*

FM stations. Another chief engineer wants to get a field intensity meter to answer questions he has been plagued with from the sales staff regarding the signal strength of the station throughout its coverage area. Assuming that the problem is judged to need a solution, the equipment is needed. But, *does the engineer have time to go out and do numerous field measurements? Can the person sent out to do the measurements be trusted to use the meter correctly?*

What about cost? Maybe renting the meter would be a better choice. If the station is part of a group, purchase and subsequent sharing of a unit might be wise. In the case outlined here, a serious consideration is calling in an outside resource to run the measurements. The price could be quite a bit less than a new meter, and the need for the measurements could be better met by the credibility of an outside expert.

TV stations. Two pieces of equipment that might be considered by engineering managers today are a sophisticated, microprocessor-based remote control and monitoring system and automatic video test equipment. *What are the needs?* Perhaps the engineering staff has been trimmed or the facility expanded, and more work needs to be done by fewer engineers. Maybe an older transmitter needs closer watching than can be done by someone with other duties besides manning the remote control point. *Has there been trouble with production material that has been shipped out-of-house that would have been caught by that test set?* In the effort to increase the profits of the production facility, *is the enhanced technical capability a good sales tool?*

Making good use of sophisticated equipment often takes more time than anticipated. *Is your station ready to send someone to school, if necessary, to properly operate and maintain that automatic video test package?* Remember, these new gadgets also become equipment added to your maintenance and repair responsibility! *Can that aspect be handled? Is the initial reason for getting the equipment circumvented by the attention that the equipment requires once it is placed in operation?*

Costs have to be evaluated in terms of eventual payback. Lost business or transmitter downtime is pretty good justification, if they are improved by the new gear. It is also quite common for stations with excellent profitability to have the policy that they will stay one step ahead of the competition by providing the best facilities to all departments, including engineering. The engineer who gets most of the things he wants needs to be especially careful not to abuse the trust he has been given to select equipment wisely.

Your "wish list"

The following are some of the more important pieces of equipment that might require careful consideration before they are purchased for use at your station.

AM stations:
- common point in-line bridge
- impedance bridge and oscillator/receiver

FM stations:
- field intensity meter
- wattmeter and dummy load
- VHF impedance measuring equipment

TV stations:
- microprocessor-based remote control and status monitoring system
- video noise meter
- automatic video test system
- VHF or UHF impedance measuring equipment
- field intensity meter
- logic analyzer
- digital storage oscilloscope

All stations:
- spectrum analyzer—RF or audio
- multifunction audio analyzer
- microwave power meter
- time-domain reflectometer
- small computer or large programmable calculator
- portable equipment to replace or complement existing bench equipment
- precision sound level meter
- calibration standards

These are not complete lists, just some of the test equipment that may not be essential to a particular station, but certainly could be considered by many stations as additions to their *tools of the trade.*

Many of the items on the previous list would make life a lot easier on the engineering staff, if they had them available when they needed them.

It is the job of the chief engineer to carefully decide on the needs, the usage and the financial impact that the purchase of one of these pieces of equipment would have at his station. Making the decision is only partly technical. It is mainly a decision made by the chief engineer as part of the management team that has the overall goal of making his station as successful as possible.

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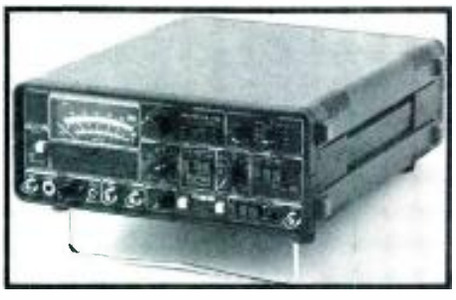
New test equipment at NAB-'83

By Carl Bentz, technical editor; Bill Rhodes, editorial director; and Rhonda L. Wickham, managing editor

In late January, manufacturers who were scheduled to be exhibitors at NAB-'83/Las Vegas were invited to submit materials on new test equipment to be introduced at the show. Entries for this listing were accepted until Feb. 23.

Being busy preparing for the show, not all exhibitors of test equipment took time to respond to our questionnaire. However, for those who did respond, the following excerpts give an idea of what NAB-'83 has to offer.

A Reader Service Number is included so that you may request further details on each product. For other new equipment at the show, watch for our NAB-'83 show replay in June.



Amber Electro Design 3501

AMBER ELECTRO DESIGN

Model 3501 audio distortion/noise measuring system. Harmonic measurements are possible down to −102dB, 0.0008%, with noise capabilities to less than −120dBm. Internal generator produces +30dBm signals into a 600Ω load over a range of 10Hz to 100kHz. Optional intermodulation distortion and rechargeable battery pack are available for this portable unit.

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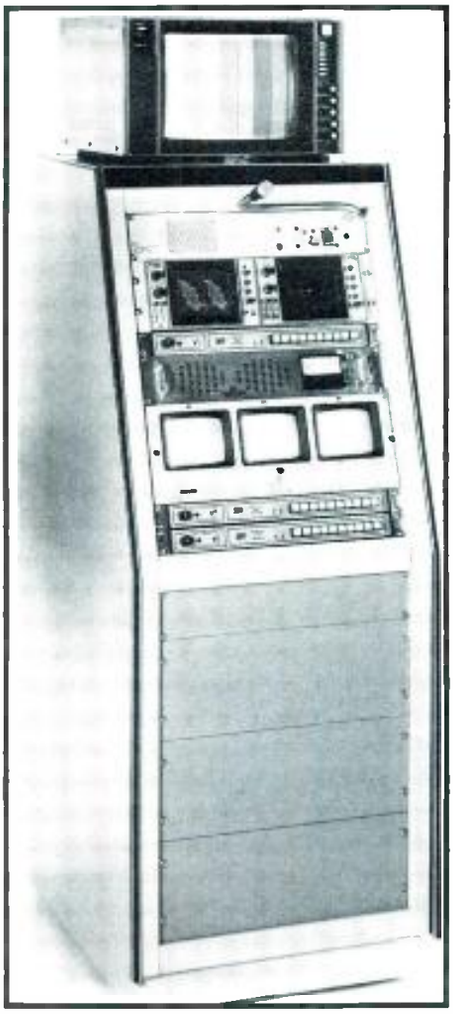

Broadcast Systems VTM-1000

BROADCAST SYSTEMS

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Broadcast Systems VTC-1

VTC-1 studio/video test system. A mobile video test system for broadcast studio maintenance and monitoring includes a color monitor, waveform and vector monitoring, a video noise meter, test signal generator and videoscope.

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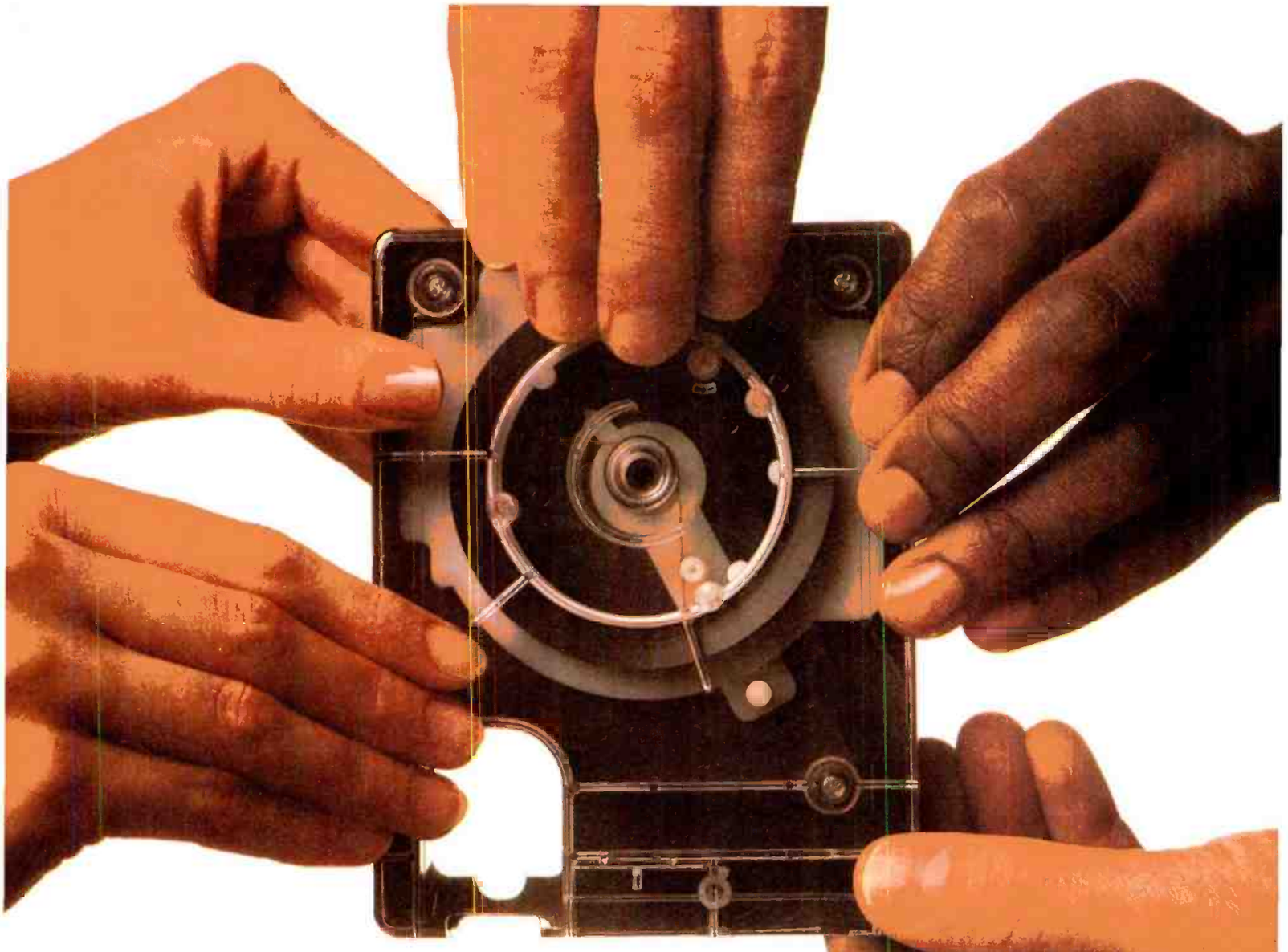
BJ-240A and BJ-200 prewired audio jack panel systems. The two systems include 24 and 26 normal-



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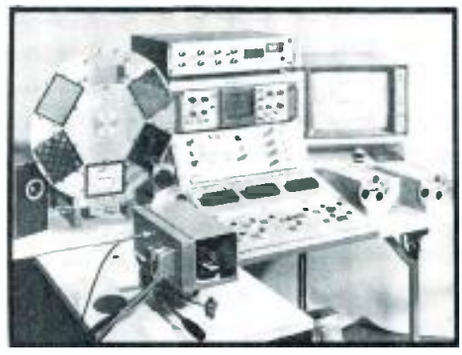
BROADCAST VIDEO SYSTEMS

Introduced at NAB-'83 were the Electronic Visuals Ltd. EV4040A waveform monitor and EV4020A vector monitor, distributed in the United States and Canada by BVS. Details of the -A models of these test monitors were not available at press time.

Circle (301) on Reply Card



EEV P4225

EEV

P4225 TV camera tube test system. This equipment allows a check of camera tube quality on delivery and during the operational life of the tube. Interchangeable head assemblies accommodate 30mm, 1- and ⅔-inch tube sizes with front or rear access to focus/deflection equipment.

Circle (306) on Reply Card

Eastman Kodak color monitor analyzer

EASTMAN KODAK

Color monitor analyzer. The Eastman Kodak color monitor analyzer combines a signal generator and photometer. Telecine operators use a probe to read relative brightness between white and gray patches generated by the unit. The monitor is then adjusted for optimum conditions.

Circle (307) on Reply Card

Telecine Analysis Film (TAF). Adjustment of subcarrier balance and gain centering on the telecine is aided with the TAF. Negative, print or interpositive materials in 16mm or 35mm formats contain an 8-color bar chart and a 6-step gray scale, surrounded by a neutral density area.

Circle (308) on Reply Card

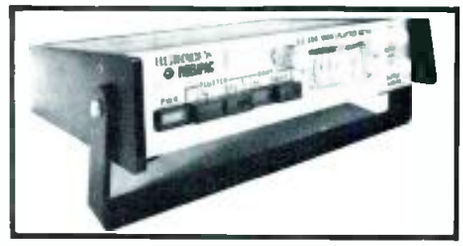
EVENTIDE CLOCKWORKS

APX252 real time audio analyzer. For use with Apple II and Apple II Plus computers, this system provides a display with 48-element resolution on a color video monitor. Levels from −20dBV to +14dBV into the 10kΩ unbalanced input are applied to 31 2-pole filters from 20Hz to 20kHz on ISO centers.

Circle (309) on Reply Card

Specsystem 2.0 software. An optional accessory to the APX252 analyzer, the Specsystem software allows measurements of RT60 reverb time and decay curve plots. Three-dimensional plots of frequency vs. amplitude vs. time are drawn on an Apple HIRES screen.

Circle (310) on Reply Card

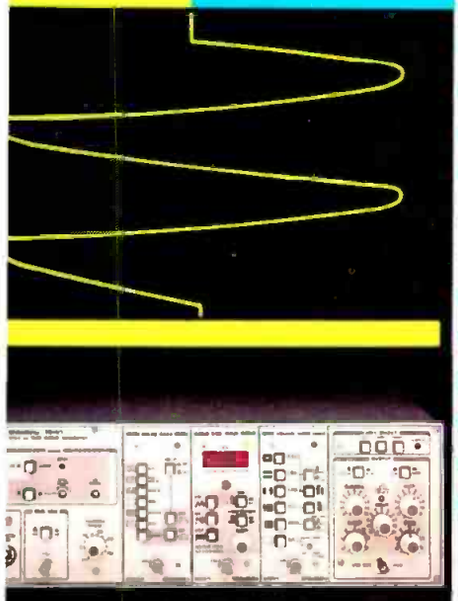


Fidelipac 65-390

FIDELIPAC

Model 65-390 wow-and-flutter meter. Measurement of wow and flutter from any recording or reproducing system may be taken with the 65-390 meter. The internal reference oscillator (3.15kHz) and weighting filter sense speed instabilities with calibration standard signal sources designed for wow-and-flutter testing.

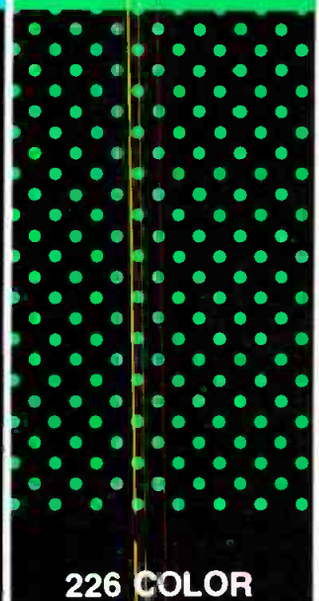
Circle (311) on Reply Card



TG-7 TEST SIGNAL GENERATOR

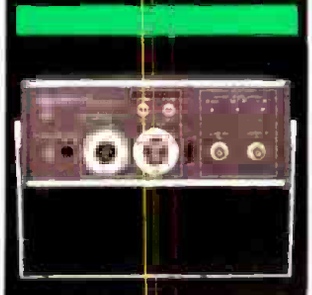
The TG-7 TEST SIGNAL GENERATOR is a unique system which contains a total of 48 different signals and functions and may also be completely automated with the optional IEEE-488 interface bus. Because of its modular design, you may select the perfect configuration for your facility and then expand at any time. Its special features are . . .

- A main frame with sync generator, color lock, gen lock with the VBS or sync with color burst.
- Chroma phase may be varied 360°
- Signals may be remote controlled by using the optional IEEE-488 interface bus.
- Seven modules are available: LINEARITY, SIN², COLOR BAR (10 signals), SINE WAVE, SQUARE WAVE, NOISE TEST, and a VITS Generator.
- Complete drives system (VBS), Sync, Black Burst, Sub Carrier, Burst Flag, and Blanking - Stability of ± 5Hz
- Output amplifier with R-Y, B-Y modulator is built into the main frame and allows variations of the Brust, Luminance, Chroma, Sync, and pedestal level, available in NTSC and PAL.



226 COLOR BAR GENERATOR

The 226 is a COLOR BAR GENERATOR designed for use as a testing and adjustment device for ENG applications. The unit contains split field color bars and a programmable prom to generate station identification as well as a 1 KHz oscillator and a odBm output signal at 600 ohms. The 226 may be operated on both AC or DC power and it is available in NTSC only.

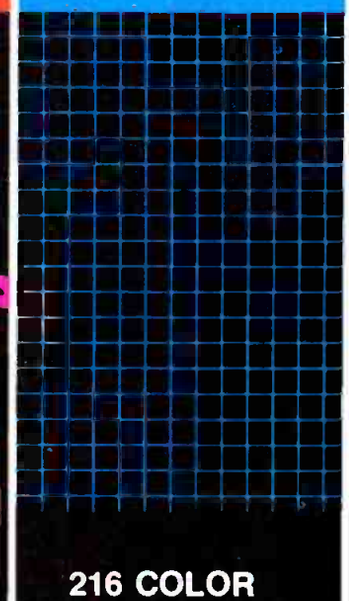


CB53A1 COLOR BAR GENERATOR CHARACTER GENERATOR

The CB5 3A1 combines a COLOR BAR GENERATOR and CHARACTER GENERATOR in one versatile instrument you can take right into the field for remotes and on-location shooting. It generates SMPTE and Y/REF color bars, plus red bar, black burst, multiburst, cross-hatch and dot signals. Standard NTSC sync signals and the gen-lock function are built in.

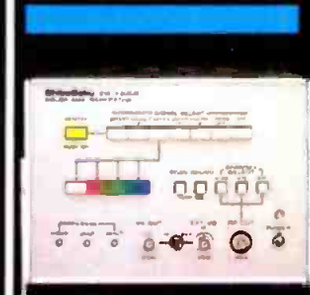
You can insert character information into each signal using a special keyboard with Random Access Memory that retains the signals even if your power is lost. The CB53A1 gives you a total of 31 character spaces on 2 lines.

- Black burst output.
- Selectable black or white background, four characters.
- External or internal switching for video and audio signals.
- Output range of +8 dBm ∼-50 dBm for 400 Hz and 1 kHz audio signals.
- RF signal on USA channels 3,4 and 6.
- AC-DC operation.
- Available in NTSC.



216 COLOR BAR GENERATOR

The 216 COLOR BAR GENERATOR is adaptable to all video service applications. It contains 2 color bar signals, Red, Green, Blue, & White Rasters, and 4 cross hatch & dot patterns. With this versatile instrument, you may obtain a video output as well as use the unit as a TV channel modulator with an internal or external video signal (2 VHF, 1 UHF). For audio, a one KHz signal is generated internally and modulated to form an RF signal.
The 216 is available in NTSC, PAL B, M, N, and SECAM.



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Circle (26) on Reply Card

GRASS VALLEY GROUP

Model 3259 phase meter. Establishing and maintaining a constant subcarrier/horizontal phase relationship(SC/H) is made simpler with the GVG 3258 phase meter for NTSC TV systems. Recently added to the line is the 3259 meter, designed for use in PAL systems. These two units may be used in place of a waveform monitor or oscilloscope and vectorscope for such phasing problems. Front panel switches allow selection of a reference (A or B video or external reference); A or B input for measurement; and SC/H or time base error modes. Seven-segment indicators display numerical values as well as alpha characters to prompt the operator in correct readings.

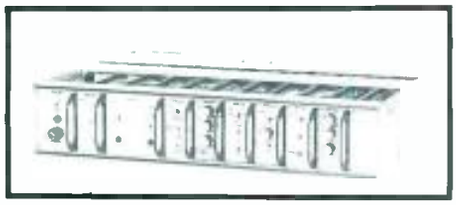
Circle (312) on Reply Card

HM Electronics PAL system

HM ELECTRONICS

Precision Audio Link systems (PAL). The PAL equipment is a wireless system capable of processing and transmitting audio information for remote acoustic measurements. The system handles an audio bandwidth of 20Hz-20kHz ± 2dB and uses an FM carrier in the 150-174MHz range.

Circle (313) on Reply Card



Lenco 300-312T

LENCO ELECTRONICS DIV.

Model 300-312T video test set. The 3½-inch rack panel includes power supply, RS-170A sync generator, color bars, bar dot, multiburst, sweep, stairstep, pulse bar, window, flat field and blackburst signals. Sync generator outputs and dual outputs from each test are available.

Circle (314) on Reply Card

Lenco PVS-430

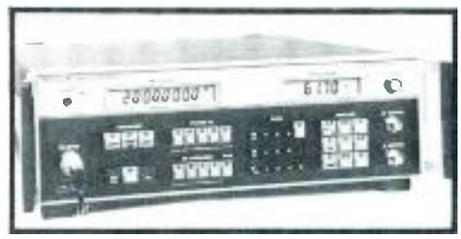
PVS-430 videoscope. The videoscope gives a graphic representation of the SC/H phase relationship between a video signal and a reference signal. Output from the unit is displayed on a standard video monitor. The equipment allows quick certification of a studio SC/H phasing condition.

Circle (315) on Reply Card

Lenco VNM-428B

VNM-428 video noise meter. Noise may be measured at any point from peak sync tip to peak white video. The noise value is given on a front panel LED display.

Circle (316) on Reply Card



Marconi 2305 modulation meter

MARCONI INSTRUMENTS

Model 2305 modulation meter. FM and PM deviation or AM depth of modulation may be measured on carriers from 0.5MHz-2GHz. Automatic or manual tuning is possible. The GPIB-programmable equipment also provides frequency response and power measurements, as well as optional distortion and noise figures.

Circle (317) on Reply Card

Minolta Color Analyzer II

MINOLTA CORPORATION METER DIV.

Color analyzer. Four white standard/reference memory channels and four CRT matrix characteristic memory channels in the Minolta TV-Color Analyzer II make the unit adaptable to different monitors and different studios' operations. Primary analyzer and chroma modes are available.

Circle (318) on Reply Card

J. Osawa VS-1000N

J. OSAWA & COMPANY LTD.

Model VS-1000N sync/test signal generator. The VS-1000N includes four standard signal sources: sync generator, color bars, linearity and convergence. Multiburst and sweep or pulse and bar are factory-installed options. Capable of RS-170A, the unit will gen-lock with 10Hz or optional 1Hz accuracy of the subcarrier.

Circle (319) on Reply Card

SG-1000N dual sync generator. Two independent generators are included in the SG-1000N, using 1Hz accuracy of subcarrier as the standard. Meeting RS-170A, the dual configuration allows switch-over from one unit to the other in case of failure (auto switching is optional.) Field reference and blackburst are standard outputs.

Circle (320) on Reply Card

PHILIPS TEST & MEASURING INSTRUMENTS

PM5631 programmable color pat-

Continued on page 42

Studer Re-States the Art

With the new A810, Studer makes a quantum leap forward in audio recorder technology. Quite simply, it re-states the art of analog audio recording

By combining traditional Swiss craftsmanship with the latest microprocessor control systems, Studer has engineered an audio recorder with unprecedented capabilities. All transport functions are totally microprocessor controlled, and all *four* tape speeds (3 75 to 30 ips) are front-panel selectable. The digital readout gives real time indication (+ or − in hrs, min, and sec) at all speeds, including vari-speed A zero locate and one autolocate position are always at hand

That's only the beginning. The A810 also provides three "soft keys" which may be user programmed for a variety of operating features It's your choice Three more locate positions Start locate Pause Fader start Tape dump Remote ready. Time code enable. You can program your A810 for one specialized application, then re-program it later for another use

There's more Electronic alignment of audio parameters (bias, level, EQ) is accomplished via digital pad networks. (Trimpots have been eliminated) After programming alignments into the A810's memory, you simply push a button to re-align when switching tape formulations

The A810 also introduces a new generation of audio electronics with your choice of either transformerless or transformer-balanced in out cards Both offer advanced phase compensation circuits for unprecedented phase linearity The new transport control servo system responds quickly runs cool, and offers four spooling speeds

Everything so far is standard As an option, the A810 offers time-coincident SMPTE code on a center track between stereo audio channels Separate time code heads ensure audio/code crosstalk rejection of better than 90 dB, while an internal digital delay automatically compensates for the time offset at all speeds Code and audio always come out together just like on your 4-track Except you only pay for ¼" tape

If you d like computer control of all these functions simply order the optional serial interface. It's compatible with RS232 RS422, and RS422-modified busses

More features, standard and optional, are available We suggest you contact your Studer representative for details Granted we've packed a lot into one small package, but ultimately you ll find that the Studer A810 is the most versatile most practical, most *useable* audio recorder you can buy

The Swiss wouldn't have it any other way

STUDER REVOX

Studer Revox America, Inc. • 1425 Elm Hill Pike, Nashville, TN 37210 (615) 254-5651
Offices: Los Angeles (213) 780-4234 • New York (212) 255-4462 • Dallas (214) 760-8647 • Canada: Studer Revox Canada, Ltd.
Circle (27) on Reply Card

Why ABC Sports selected Panasonic

ABC Sports demands uncompromising picture quality. Mt. Everest demands absolute portability. Panasonic Recam delivers both.

That's why Recam was the natural choice for ABC's "American Sportsman" to capture all the beauty and danger of the U.S. expedition scaling Mt. Everest this Spring. John Wilcox, executive producer of "American Sportsman", said it best: "Recam's picture quality is as good as one inch...the 3-tube Plumbicon® camera and M-Format recorder give us the opportunity to shoot broadcast quality pictures in any location."

And perhaps no location is as demanding as Mt. Everest. As the expedition ascends the mountain, ABC will capture it all on Panasonic half-inch video equipment. Recam

Recam to climb Mt. Everest.

recorder/cameras will transmit pictures via microwave to a base station specially outfitted with two Panasonic AU-300 source decks, an AU-A70 editing controller, an AS-6100 switcher and another AU-300 for mastering. These high-quality Recam pictures will then be beamed via satellite to the U.S.

But this is just the beginning. Recam's picture quality and portability will be used by ABC Sports for future remote locations whenever the going gets rough.

Look into Recam for yourself and see why it's becoming the choice of demanding professionals whatever their EFP needs.

Panasonic
AUDIO-VIDEO SYSTEMS DIVISION

Circle (28) on Reply Card

Continued from page 38

tern generator. NTSC and PAL test signals are available from PM5631 models. Manual front panel- or computer-GPIB-selected patterns include color bars, checker boards, gray scales, staircases, ramps, VITS and VIRS.

Circle (321) on Reply Card

PM5630 TV signal generator. With sync meeting RS-170A requirements, the PM5630 provides composite sync, composite blanking, H/V drive, color flag, subcarrier and burst on parallel outputs. A gen-locking sync generator is included, as well as signal generators for color bars, PLUGE and other tests. NTSC and PAL systems are available.

Circle (322) on Reply Card

PM5634 sync test generator. This instrument tests the lock-in range of a video device accepting external sync drive inputs. Horizontal line rate and subcarrier frequency are variable in discrete steps around the nominal values. Availability is for the NTSC and PAL.

Circle (323) on Reply Card

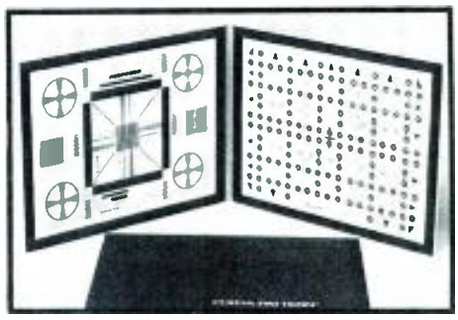
PM5651 VITS generator/inserter. NTC-7 VITS or EBU ITS are generated and inserted into the video signal by the PM5651 equipment. Incoming VITS may be stripped if desired. Source IDs are possible, as an option.

Circle (324) on Reply Card

POLARAD ELECTRONICS

632-B1 spectrum analyzer. Monitor, service and test procedures may use the Polarad 632B-1 spectrum analyzer. A frequency coverage range from 100kHz-2GHz handles broadcast radio and television, CATV, CB and other communications requirements, as well as distortion or noise measurements.

Circle (325) on Reply Card



Porta-Pattern 020-10

PORTA-PATTERN

020 series duochart test system. The duochart test systems include the 020-10 resolution/linearity charts, 020-12 multiburst/flesh tone reference and 020-11 registration/log gray scale charts. The test patterns are mounted in hinged-to-fold packaging and include a vinyl carrying/storage case.

Circle (326) on Reply Card

Other test products to be introduced at the show include: the 001-44 11-step log gray scale chart; the 001-45 BBC #62P color bar chart; the 016-10 high resolution color calibration test chart system; the 017-10 waterproof test chart; and the 021-10 pocket test chart system.

Circle (327) on Reply Card

QSI Demod 105

QSI SYSTEMS

Demod 105. A varactor-tuned modulator, the Demod 105 tunes 105 standard broadcast, midband and superband channels. Replacement sync and burst may be selected. A front panel speaker and 600Ω balanced audio are available, as is optional remote control.

Circle (491) on Reply Card

QSI BG200 display

BG200 series color bar generator. Three models fall in the BG200 series. The BG200 includes full-field color bars with 1kHz, 600Ω balanced tone output. The BG208 adds a positional, 8-character ID. The BG216 includes a 16-character ID. ID characters are field-programmable.

Circle (492) on Reply Card

CB-9000V series video identifier/color bar generators. During test periods, the CB-9000V series provides test color bars and tones. Color bars are dropped for live feeds and the ID information is transferred automatically to the vertical interval of the live video.

Circle (328) on Reply Card

ROHDE & SCHWARZ

DZF TV data distortion meter. Useful in teletext, Ceefax, Oracle and Didon-Antiope technologies, the DZF system provides a quality assessment of videotex signals. Eye height, half-eye height and videotex amplitude measurements are quickly made. Modification is required, to measure data at different bit rates, such as station ID coding and dual-sound coding.

Circle (329) on Reply Card

LFM2 group-delay measuring set. The generator/indicator set of the LFM 2 determines group delay and absolute delay of active and passive 2-port networks. For television it may appropriately be used to check systems and TV links. The frequency span is 0.1MHz (expandable to 1GHz with the Rohde & Schwarz MUF2).

Circle (330) on Reply Card

UPSF 2 video noise meter. Dual-standard measurement capabilities of the UPSF2 may allow fully automatic measurements in NTSC and PAL systems. The video response is 40Hz-

Switchable waveform/vectorscope

One of the products reported to be of high interest again this year at NAB-'83/Las Vegas is a color signal monitor, from Broadcast Video Systems, which is switchable between waveform and vector displays. Boasting full broadcast specifications, the compact unit features half-rack width and 5¼-inch height and is available in NTSC or PAL.

Satellite Radio Receiving Equipment. Microdyne has it all.

Whether you want to install a complete new system or simply expand your existing one — Microdyne can meet your needs with our complete line of standard and proven satellite radio equipment.

We start with a full line of electronics with conversion at the antenna or in your building. You can optimize the system to your needs and budget. SCPC program channel demodulators are fully tuneable to all radio channels with a front panel switch. Subcarrier demultiplexers are available.

Microdyne offers a full line of satellite antennas — featuring the precision and lifetime durability of molded fiberglass construction; the simplicity and selectivity of a prime focus feed design.

Where parabolic antennas won't work — in areas of high microwave interference — we offer our highly selective conical horn antenna — an industry exclusive.

Microdyne products are characterized by exceptional standards of performance and reliability. We stand behind these products with our exclusive 48 hour service policy. Our service depots provide 48 hour turn around on all returned equipment.

There is no company more qualified to meet your needs for satellite radio equipment. We provide both downlink and up-link equipment; complete turnkey installation or individual components. We have thousands of satellite terminals installed throughout the world. We have the experience, the hardware and an uncompromising commitment to excellence.

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Circle (29) on Reply Card

10MHz. Chroma-noise (AM and ΘM) from videotape is measured along with video level. An IEEE bus is available, along with autoranging from 0-80dB.

Circle (331) on Reply Card

TEKTRONIX

1980 ANSWER Option 04 software. When the Option 04 is installed in the base 1980 system, the ANSWER equipment provides automatic monitoring of baseband video signals for standard FCC, NTC-7 and RS-170A measurements. Real values are compared to user-defined limits, with alarm messages printed on out-of-tolerance conditions.

Circle (332) on Reply Card

Tektronix 1910

1910 digital test generator. Improving upon the model 1900 of several years ago, the TEK 1910 generator and VITS inserter includes 10-bit word generation. The unit is compatible through RS-232 with the ANSWER system. VITS rotation allows programming of VITS to sequence in a single line (10-20) and matrixing of up to 16 signals into any of three user-defined matrices.

Circle (333) on Reply Card

Other new test equipment includes: the 2235 and 2236 portable 100MHz oscilloscopes (2236 includes CTM multimeter); the 2445 portable 150MHz oscilloscope; and the 2465 portable 300MHz oscilloscope.

Circle (334) on Reply Card

TELEVISION EQUIPMENT ASSOCIATES

MK II color monitor comparitor. Made by IRT (West Germany), the MK II comparator is based on a recommended world standard of D6500°K. The operator adjusts the monitor screen and gain controls so that the kine white balance will match the comparator in high and low light areas.

Circle (335) on Reply Card

VGE 1032 zone plate generator. Use of the zone plate test signal generator allows frequency response of a TV system to be tested in the horizontal, vertical and temporal dimensions simultaneously. Produced by VG Electronics Ltd. under license from the BBC, two systems are available for 625- and 525-line TV use.

Circle (336) on Reply Card

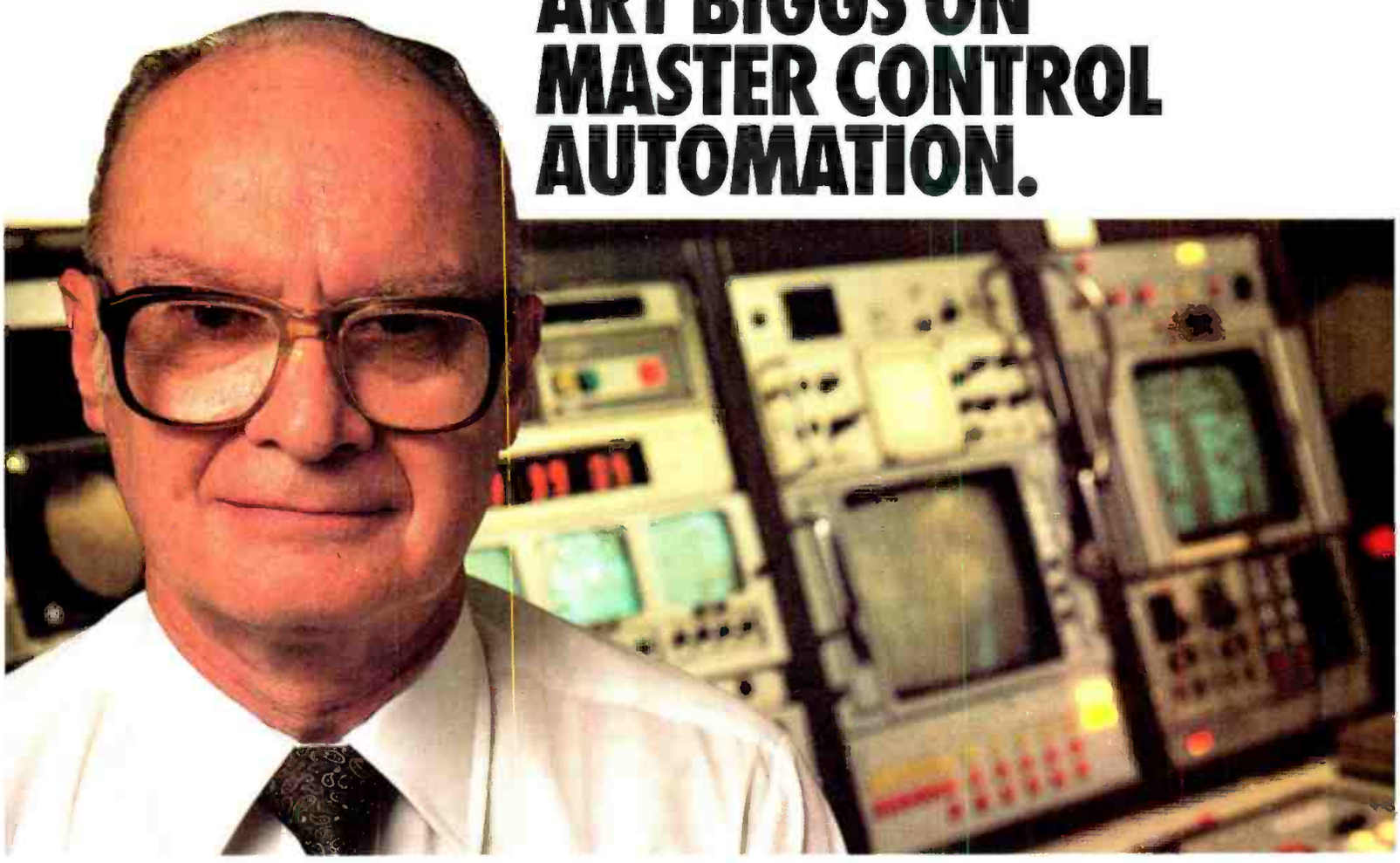
Tentel L2-H20-CBD

TENTEL

Tentelometers. Two models of the Tentelometer gauge series handle tension measurements for 1-inch C Format and ¼- or ½-inch reel-to-reel. The T2-H20-CBD gauge is designed for Sony BVH and Ampex VPR machines, using ball-bearing rollers to reduce tape drag. The T2-L20-A gauge is intended for use with audio recorders, providing measurements to 20 ounces full-scale.

Circle (338) on Reply Card

ART BIGGS ON MASTER CONTROL AUTOMATION.



In the 1950's, two broadcasting engineers in Tulsa built a small, crude, mechanical device to automate station breaks. One of those engineers, Art Biggs, is now Vice President, Engineering, Corinthian Broadcasting—and his interest in master control automation remains strong. The respected, 34-year veteran of the industry works with the engineering staffs of all six Corinthian stations, of which two—WISH-TV, Indianapolis, and KXTV, Sacramento—are now using DCC Master Control Automation.

EVEN FORMER SKEPTICS LIKE IT

"At first, some of the engineering staff were enthusiastic, some were skeptical. But within three weeks after it was released to them, they did their first total day's operation on the MCA system. And now, even the most skeptical depend upon it."

CREATES TOGETHERNESS

"MCA brings the traffic department and technical department closer together. This makes everything go more smoothly for everyone."

GIVES MORE CONTROL

"I think some engineers are afraid that with MCA, they'll be giving control of their operation to a machine and be a robot, sitting there, watching it. Actually, the exact opposite is true. Even the most vocal of our engineers who opposed the idea have found that MCA frees them from so many nitty-gritty, demanding, split-second, button pushers, that they have more time to learn what all the machine can do and can do even more than they could before. Now, if you take it away from them for some reason, there's a lot of yelling to get it back. They've learned they didn't relinquish control—they gained a tool that gives them greater control."

WHO NEEDS IT?

"How do you know if you need MCA? If the chief engineer is constantly trouble-shooting switching errors or one engineer is a total slave to switcher buttons, MCA can certainly help. It also liberates personnel from many manual chores, such as log-keeping, to make their time more productive."

FOR BIAS OR NON-BIAS SYSTEMS

"All of our stations are on the BIAS traffic system from DCC, so by using the DCC MCA, we're dealing with one manufacturer, one computer, and one system that embraces the master control operation, the traffic operation, the financial operation, word processing, film inventory. One source for everything."

For a free brochure on how DCC Master Control Automation can interface with your on-air switcher and traffic system, write DCC Marketing.

dcc

BROADCAST DIVISION
DATA COMMUNICATIONS CORPORATION
3000 Directors Row, Memphis, Tennessee 38131, 901-345-3544

Circle (31) on Reply Card

Head protrusion gauge. Measurement of head protrusion in microns or ten thousandths-of-an-inch are possible with a universal video head protrusion gauge. Mounting on virtually any Beta VHS or U-Matic deck, including ½-inch VHS and Beta VRC equipment, is suggested.

Circle (339) on Reply Card

TOWNSEND ASSOCIATES

IR-500 impedance plotter. Manufactured by Olektron Corporation, the IR-500 allows measurements of VSWR, impedance and admittance of transmission lines and antenna systems. Covering the 54-890MHz spectrum, the system uses a resolver and sampling head for operation with X-Y oscilloscopes and sweep generators. The display of measurements on the oscilloscope screen are referenced to a Smith Chart overlay on the scope.

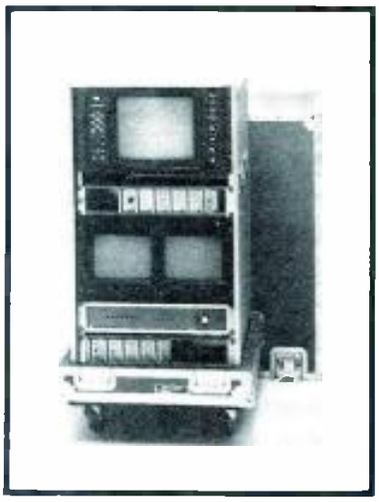
Circle (337) on Reply Card

Transport cases

Transporting test equipment can also be an important factor in making measurements. Responding for our call on *What's New at NAB-'83,* Anvil Cases unveiled for us some of its transport cases for the video and TV markets that they expect to have on hand at the show in Las Vegas.

Anvil offers a full line of EIA rack-mount cases for any and all rack-mountable components, designs particularly useful in the field when fast setup anc teardown is essential. At the show will be the company's extensive line of standard case designs plus details on custom design work.

These and other cases at NAB-'83 will be covered in our June wrap-up issue.



Anvil rack-mountable case

UREI

Model 200 X-Y recorder mainframe. After a cooperative effort by UREI and Hewlett Packard, the 200 chart recorder uses UREI plug-in modules for automatic response plotting, impedance measurements and frequency/amplitude measurements. Applications of the 200 test system cover a wide variety of audio equipment checks.

Circle (490) on Reply Card

Model 21 mic preamp warble generator. In addition to providing a +18Vdc phantom supply, the model 21 offers 20dB or 40dB gain selection as a preamp. A 5Hz sine wave output signal is available when the unit is incorporated with the model 200 test system.

Circle (340) on Reply Card

Built into every LGT low power TV transmitter is a feature nobody else can offer: 25 years of TV transmitter experience. In 98 countries. That's why LGT is the big name in low and medium power transmitters.

Experience the design. All our transmitters are solid state. Built to full broadcast equipment standards for year after year of reliable service. External diagnostic lights let you know what's going on internally. And the plug-in chips and transistors, as well as the replaceable modules, make the transmitter extremely easy to service.

Experience the support. What's behind our transmitters is just as impressive as what's inside them. A complete stock of both parts and test equipment. A team of field-test and application engineers. All available where needed, when needed. And to make sure your transmitter gets off to a good start, *we'll send an engineer to your station to commission it.*

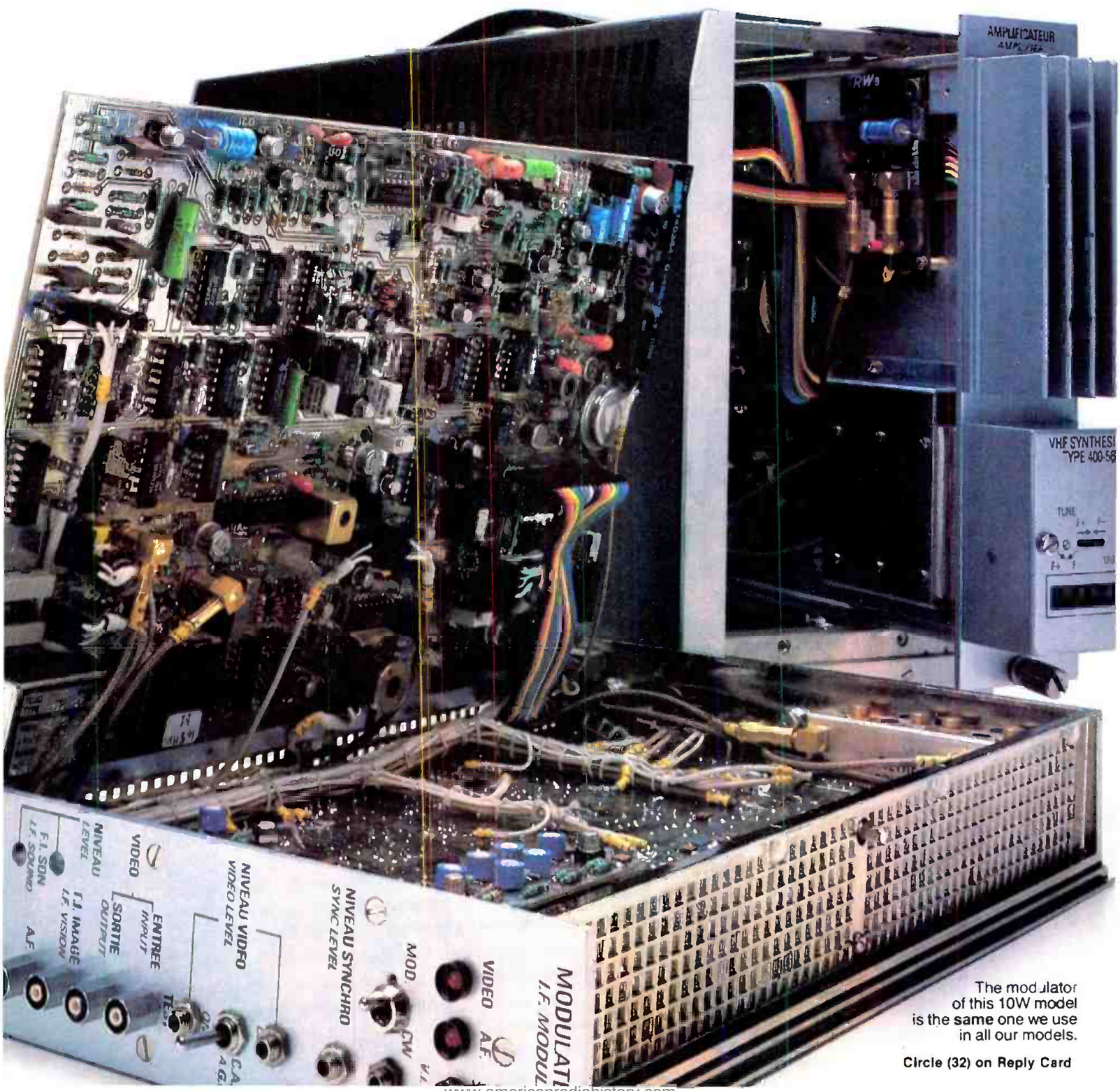
Experience the confidence. All around the world, LGT spells "peace of mind." If you're looking for a trouble-free transmitter that will still be pouring out strong signals years from now, LGT fits the description to the letter.

For more information on the LGT experience, contact Thomson-LGT, Division of Thomson-CSF Broadcast, Inc., 37 Brownhouse Road, Stamford, CT 06902. Tel. (203) 965-7131. TWX (710) 474-3346.

THOMSON-LGT
Division of Thomson-CSF Broadcast, Inc.

Thomson-LGT Low Power TV Transmitters.

Experience our experience.



The modulator of this 10W model is the **same** one we use in all our models.

Circle (32) on Reply Card

- Silver Jubilee
  April 1983
- WFRD—99.3 FM
  WDCR—1340 AM
- 1000W AM
  3000W FM stereo
- Hanover, NH

Case study:

Studio 5 at WDCR/WFRD

By Brad Carpenter, engineering consultant, Cambridge, MA

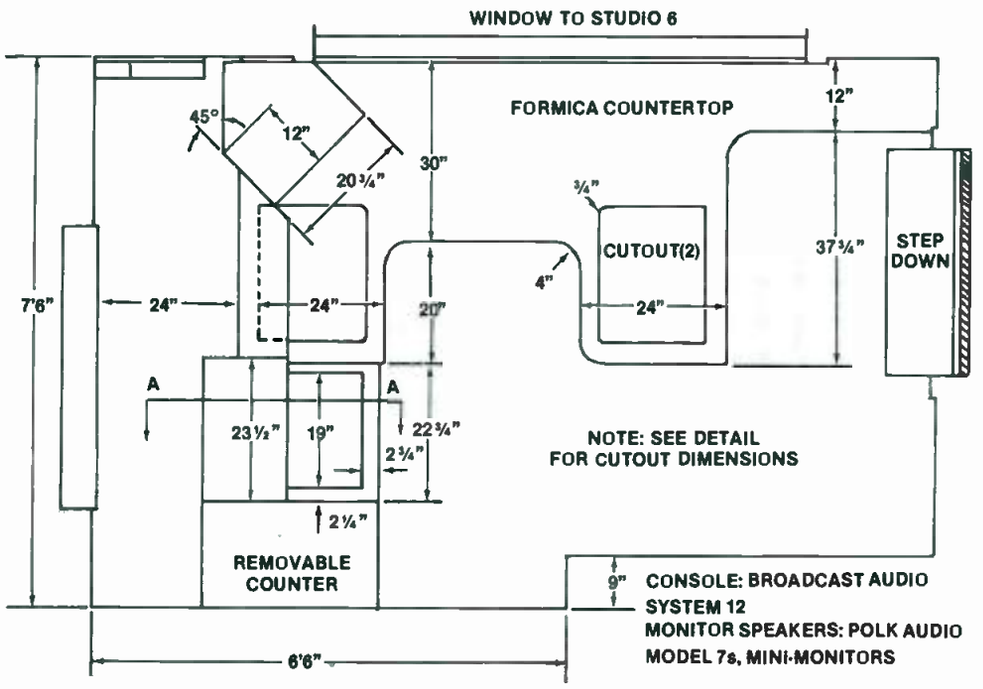


Figure 1. Floor plan for Studio 5.

WDCR is a 25-year-old commercial station that is operated nearly exclusively by students of Dartmouth College. The 1kW AM signal at 1340kHz covers the upper Connecticut River Valley in New Hampshire and Vermont and operates year round, 18 hours a day. The companion FM station, WFRD at 99.3, went on the air in 1976.

History

In 1958, WDCR started broadcasting with a Gates BC-1T transmitter and Gatesman console in Studio 3x. This equipment was used until 1982 when Studio 5 was put on the air, and again more recently when a Nautel transmitter was installed. When I became involved at the stations in 1978, Studio 3x had long been a problem to maintain; the console badly needed replacement. The question was how to do it cost-effectively and without sacrificing reliability. Some of us believed that replacing the console as a drop-in operation was the simplest and cheapest method, while others believed that, because the wiring would have to be replaced anyway, it would be best to start from scratch. WFRD was put on-the-air out of Studio 7, which was totally student designed and built over a period of 1½ years. Although the console was initially satisfactory, it soon became a maintenance nightmare. It was built from modular components, wired and mounted by the student engineers, who spent little time documenting their work.

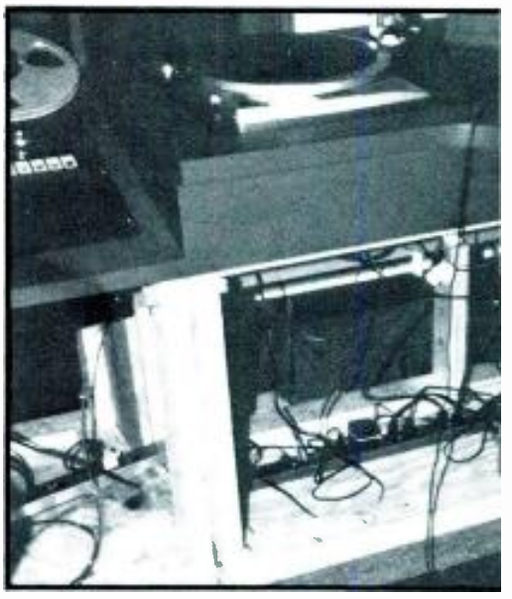
The critics of the new studio plan cited Studio 7 as an example that it was too big a project to use the start-from-scratch approach. My reply was that it was an example of how not to start from scratch and that we had certainly learned from that endeavor. Meanwhile, the problems in Studio 3x festered.

Ned Roos (a subsequent technical director) and I visited many stations in the Boston area to gather ideas on new equipment, studio layout and wiring practices. We also wanted to determine if it would be possible to have an outsider come in and build a complete studio for a reasonable fee. We found that not only is it expensive to do it that way, but that most stations have the resources to design and construct their own facilities, perhaps with some installation help and design consultation.

Redesign

Once we stopped considering rebuilding Studio 3x, we set out to use an empty room that had been designated as a studio when WFRD was built, but that had not been built for lack of funds. It was a small room, just less than 7.5' x 11.5'. We enlisted the help of Lindsay Collins, consulting engineer, of Collins and Vanni Associates, Bradford, NH, to oversee the design processes. As a result of discussions with Collins and another acoustical consultant, I rebuilt the existing raised floor to eliminate the drum effect caused by unsupported 2" x 10" joists. Stiffening these joists and adding insulation and a layered floor created a solid base for the furniture.

The next step was selecting a console. WDCR's programming is music-oriented, played in about equal proportions from carts and from records; this requires a medium-sized console with modest flexibility. We chose the Broadcast Audio System 12 with 10 input modules because of its many convenient features—such as three inputs per channel and interchangeable



The cabinet panels are quickly removable to reveal the patch bay and hidden circuitry.

Continued on page 52

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K3230 and K3231 join our family of high efficiency klystrons.

- Power output 32 kW
- Efficiency 40% minimum
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– 470 to 860 MHz in one tube and no beryllium oxide ceramics.

K3270 BCD up to 15 kW power output
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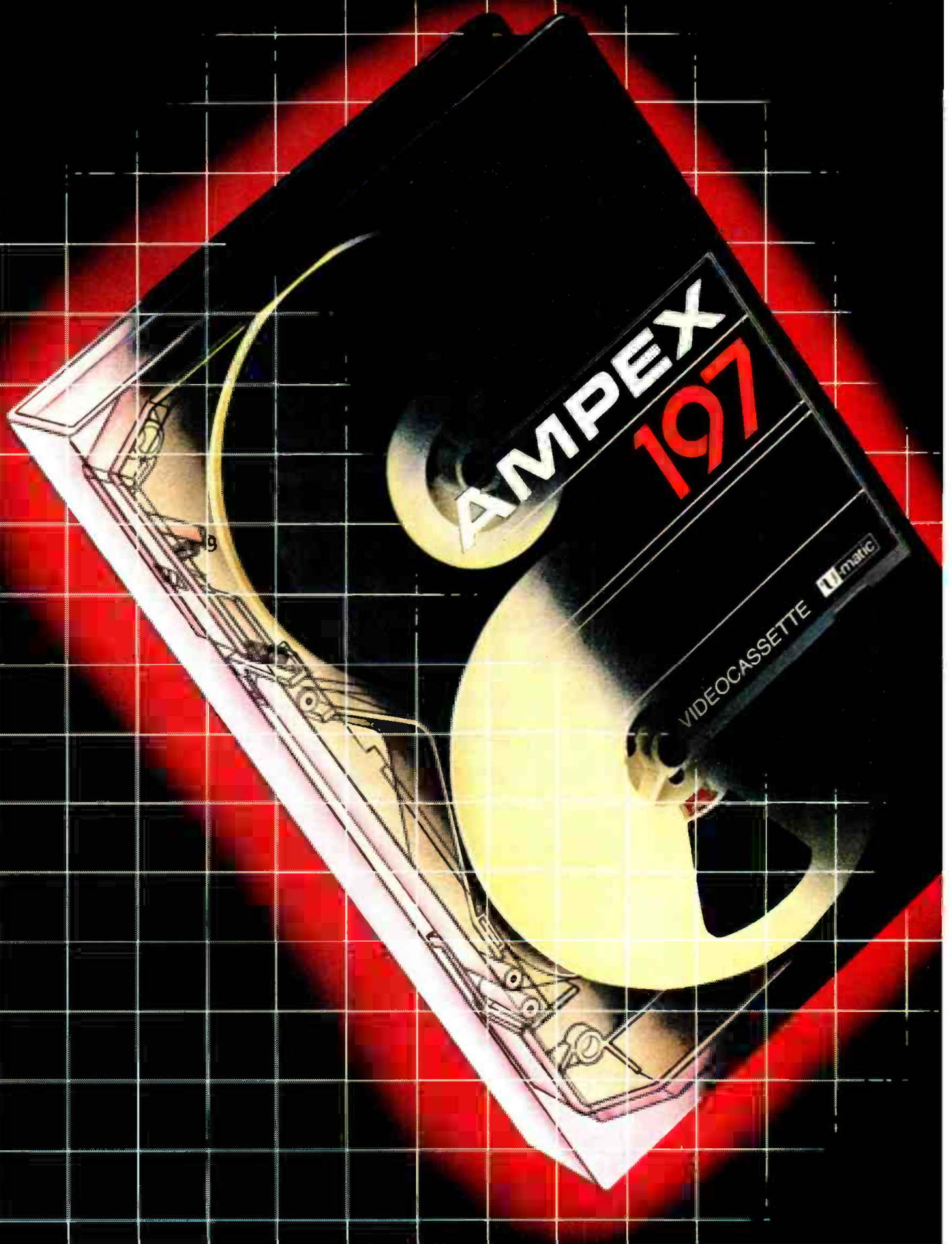
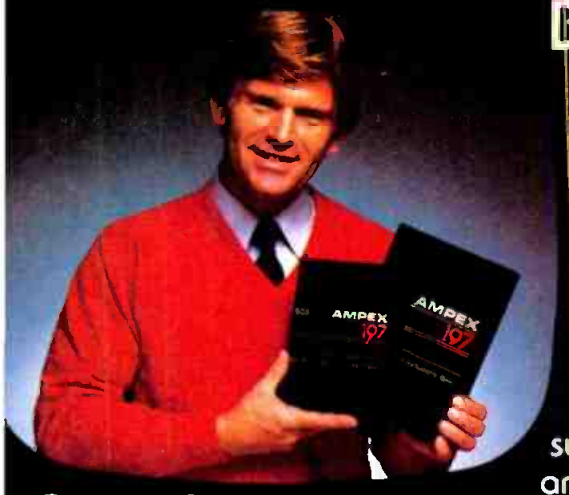
Circle (33) on Reply Card

EEV4a

Introducing Ampex 197, that's broadcast-



the new ¾" videocassette quality in every way.



Broadcast-quality color & sharpness.

The new Ampex ¾" videocassette has been designed with nothing less than perfection as its goal.

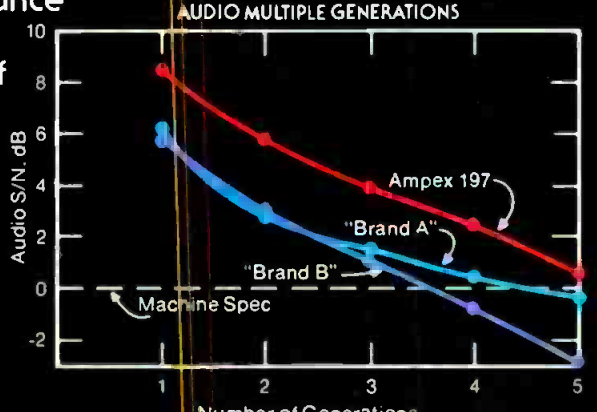
Its superb chrominance and luminance performance makes it ideal to meet the stringent demands of broadcast applications such as electronic news gathering, electronic field production and on-line editing.

And the tape in Ampex 197 has been especially formulated to optimize the performance of the Sony BVU series of recorders.

Broadcast-quality sound.

Ampex award-winning sound has been an industry leader for a quarter of a century. Now Ampex 197 brings this award-winning expertise to video.

Ampex 197 offers superior signal-to-noise and low distortion characteristics. This translates into crisper, cleaner audio performance under heavy editing conditions and multiple generation dubbing. It also delivers excellent stereo fidelity when used for music recording.

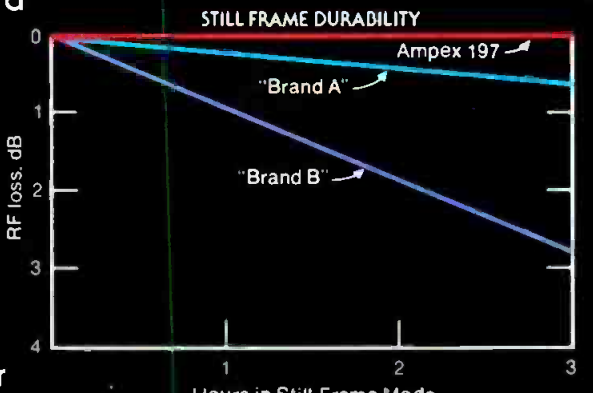


Even after five generations, Ampex 197's audio signal-to-noise ratio exceeds the BVU series machine specifications.

Broadcast-quality reliability.

This new ¾" videocassette is a blend of the finest broadcast materials and Ampex's unique technical expertise. In blind field testing, Ampex 197 got the highest marks from broadcast professionals for its picture quality, stability, and durability.

In laboratory trials, Ampex 197 held up in the still-frame mode for three full hours and showed no dropout increase or RF loss.



Laboratory tests proved that Ampex 197 held up for three full hours with no RF loss.

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Quality worth broadcasting.

Circle (34) on Reply Card

Continued from page 48

mic/line modules. It has three independent stereo output buses, plus stereo cueing and a mono output driver that is selectable from any of the other buses. There had been much discussion about whether to look for rotary or linear faders, but once the operators were familiar with the new system, there were no complaints.

Although the programming was drifting toward more exclusive use of carts, turntables were viewed as an item not to be skimped on. All of our turntables had been of the idler wheel/rim-drive type, and we were becoming increasingly dissatisfied with their performance. The Technics SL-1015 was chosen because it is a self-contained direct-drive turntable system of the highest caliber—important because it would be the primary reproducer. Yet it is still less expensive than a cartridge player.

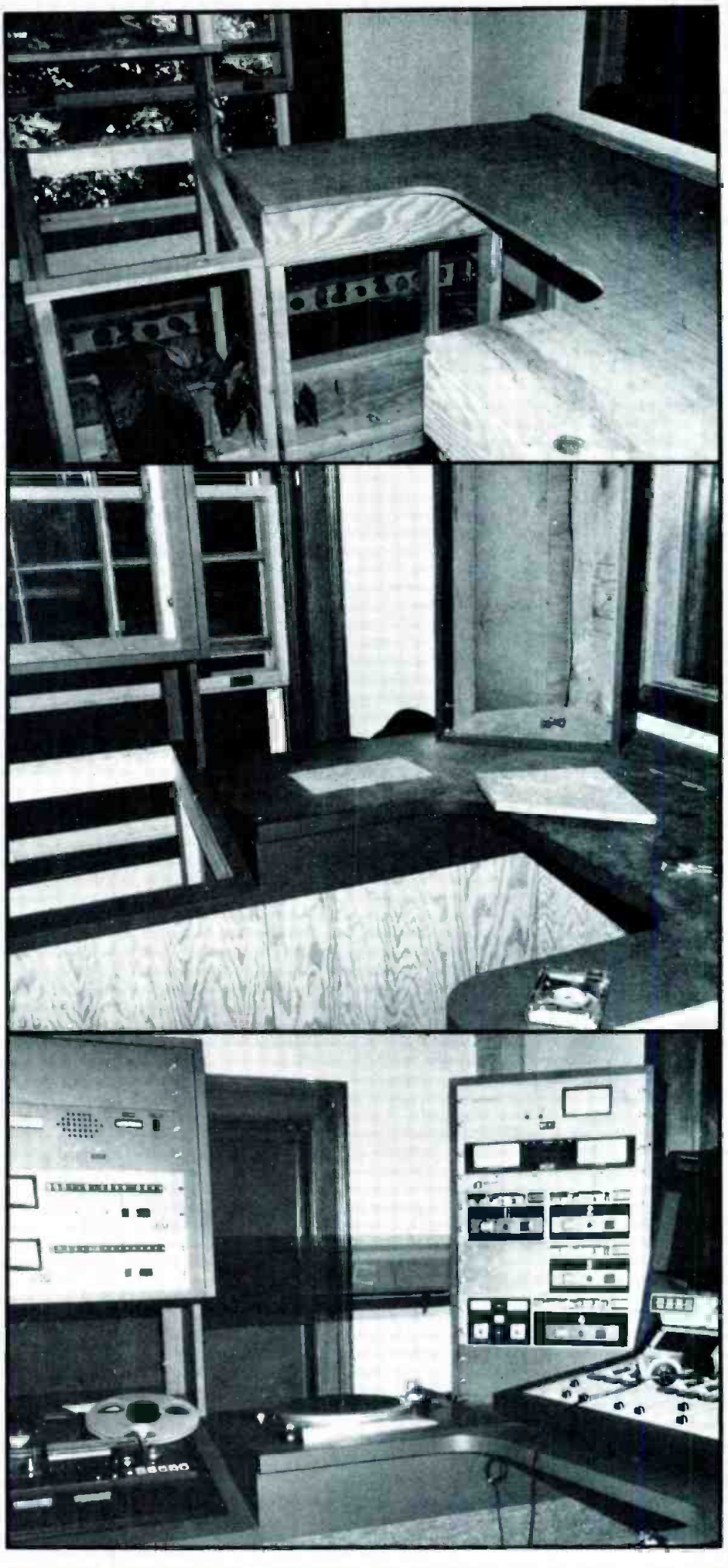
The cart machines we used are considered an industry standard: the ITC SP. We considered using a triple-decker as we do in Studio 7, but we needed at least four players (we had five in Studio 3x). We installed one record/play machine for taping network feeds as the fourth deck. The individual decks afford better overall reliability and maintainability.

Belar modulation meters were installed as part of a separate project, and the AMM-3 was chosen partly for its provisions for multiple remote meters. An NAD 3020 amplifier was used with Polk Audio model 7 speakers because of their high quality sound at consumer equipment prices. Possible problems of reliability (we've had none) were offset by the fact that they could be serviced locally by a stereo dealer if necessary.

Cabinetry

After looking at modular furniture components, it quickly became clear that the existing space was too small for all-purpose furniture, so I set about designing custom cabinetry around the chosen equipment. The key features of the design are that all faces of the base are removable, and that everything is easily reached by the operator or technician. The basic construction uses 2" x 4"s and ¾-inch plywood in an open frame with a thick countertop. Side panels are covered with the same carpet as the flooring, and they latch on. Rack space is provided underneath for all related equipment, including the patch bays, which are thereby hidden from normal view. The SL-1015 turntable bases are set into the counter and isolated on the sides with a thin layer of felt.

Finding a contractor/carpenter took a bit of searching, but it was well



This series, taken during the studio renovation, shows how construction on Studio 5 progressed.

The Bosch BCN family. Type "B" master quality– generation to generation.

The superior quality of Bosch 1-inch Type "B" videotape recording has always been accepted by tele-production professionals.

That superiority has made Type "B" the preferred tape mastering system—the videotape equivalent of film negative.

No matter what the ultimate distribution format—2-inch, 1-inch Type "C," U-matic—the quality is better when "B" is the master. Here's why.

Quality is inherent in the design.

The Bosch BCN family was designed for the stringent demands of 625-line systems. So it has a very comfortable performance reserve in 525-line NTSC systems.

High head-to-tape speed gives BCN recorders a leg up in signal-to-noise ratio.

And superior head-to-tape contact yields cumulative chroma noise advantages. So the BCN gives clean pictures even after the most complex post production, with low sensitivity to dropouts.

With the BCN, even a sixth or seventh generation tape is broadcastable!

Start with film or tape.

If your production is shot on film, you can retain a lot more fidelity if you transfer to Type "B" before duplicating in any format.

If your production is shot on tape, you get a head start on quality if you record and post produce on Type "B."

Generation to generation.

BCN 21. At only 17 pounds it's highly portable. With all the quality inherent in the Type "B" 1-inch format.

Models for all requirements.

The Bosch BCN family includes 1-inch recorders for every requirement.

For field production, the super compact BCN 21 weighs only 17 pounds.

The BCN 41 is ideal for mobile units. It's compact, too, at less than 150 pounds.

The BCN 51, perfect for studio use, has a built-in time base corrector and sophisticated monitoring capabilities.

With our digital store option you can have superb slow motion, step motion, and stills, plus fast visible search.

You can go further with videotape still storage, quad splits, quad freeze, and mirror effects. Plus long play versions.

And all BCN models, including the portable BCN 21, have identical performance specifications. With absolute tape interchangeability from system to system.

Why not the best?

Top production facilities across the country—and the world—are moving to Type "B" mastering. Because better "B" masters don't cost any more than "C" masters. So why compromise?

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BCN 51. The world's preferred 1-inch videotape mastering system.

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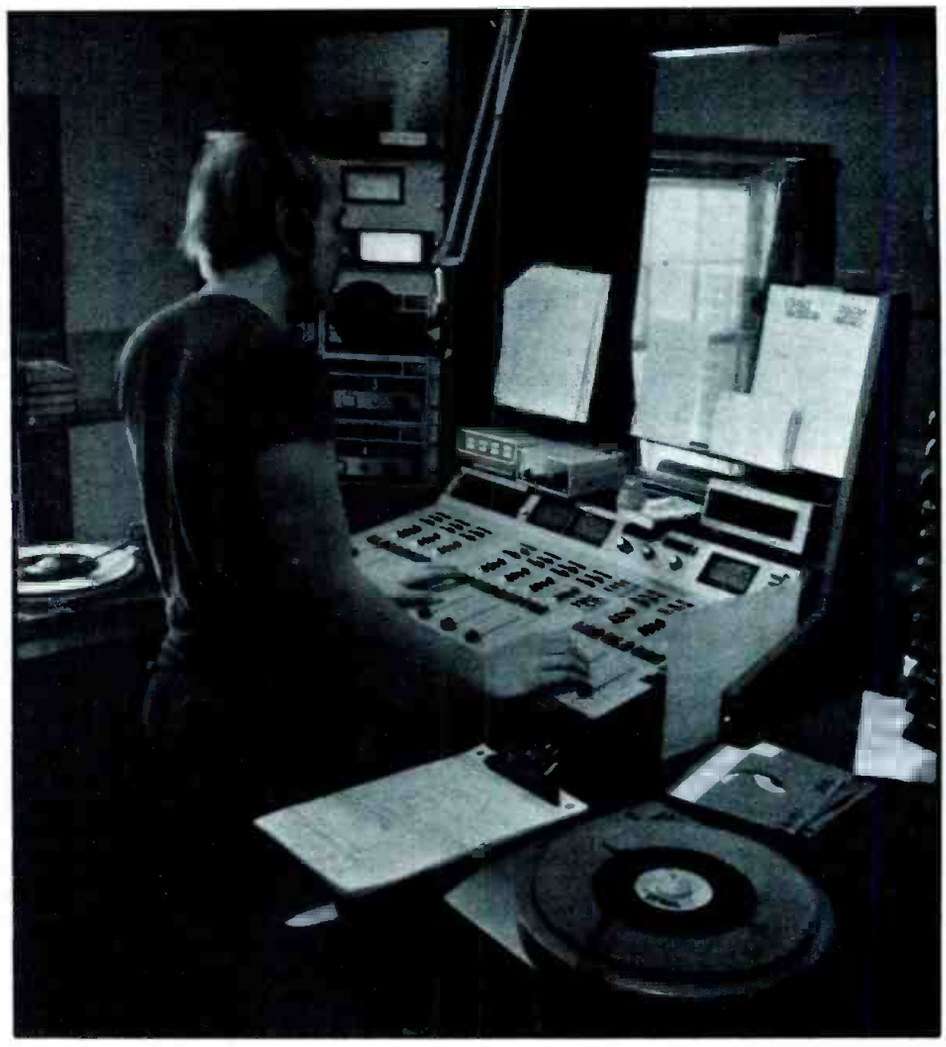

Bob Gray, program director at WDCR, checks out the system's operation.

worth the effort to find one who, from the start, was truly concerned with the quality of the construction and precision that we required. It took about a week for the cabinets to be built and finished.

The wiring design concept was simple: Bring as much as possible out through patch bays, and use a consistent grounding procedure. We extended the jackfields out onto punch-down blocks, with the top row of jacks being normalled to the bottom; the source was on top, destination below. All cable shields were grounded at the destination end only.

A 2-inch copper strap ground system was added to all the studios. We ran six 12-pair cables into our master control room; all audio and control connections were made on these cables. Microphone and control cables were run to adjacent Studio 6, which acts as the news booth and all-purpose studio, and a custom remote control panel for the console was installed there.

One of the problems encountered when students were building Studio 7 was a time limitation; they were required to be on-the-air by a certain date. When we started this project, we decided *not* to set a deadline. A student organization can perhaps better afford this type of decision than an operation with higher overhead, but it allowed us to do things correctly and carefully. The total equipment cost was about $28,000, but all the labor of the students involved was free; otherwise, the total cost of construction could have been much higher.

In the near future, Studio 3x will be stripped and rebuilt to be identical to Studio 5. WFRD will then use *that* as the main air studio, allowing Studio 7 to be refitted as a production studio. Other recent purchases include two Otari 5050B reel-to-reel decks.

About the author:

Brad Carpenter *graduated from Dartmouth College in June 1982, with a major in engineering sciences. His specialization was radio, although that is not part of the Dartmouth curriculum. He served as technical director for the WDCR/WFRD stations in 1980. Joel Margolese of WDCR/WFRD asked him to prepare this article as a result of his design and construction work on Studio 5.*

He is currently working for WRKO in Boston as a temporary engineer helping to design and install its new facilities, including 10 studios with Pacific Recorder consoles. His plans are to do graduate work in architecture.

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SMPTE TV Conference replay

By Bill Rhodes, editorial director; and Carl Bentz, technical editor

- Feb. 4-5, 1983
- Westin St. Francis Hotel San Francisco, CA
- 700 registered attendees
- 26 exhibitors
- 5000 square feet of displays
- 33 technical papers

The 17th Annual SMPTE Television Conference was built around its theme, "Pictures of the Future," but history may record it as the *user-friendly* conference. Unexpectedly, the conference brought together a broad spectrum of speakers who stressed the integration of computers into broadcast controls. As a result, attendees heard more about user-friendly computers than ever before at a broadcast conference.

THE PRESS MEETING

For members of the press, the Winter SMPTE Conference began with its traditional press meeting. This year Toni Roth, SMPTE vice president for Educational Affairs, served as host.

The purpose of this early meeting is to give members of the press advance notice of the scope and content of the conference. Also if any last minute surprises are scheduled, this is the time for SMPTE to unveil them.

Short addresses to the press were given by the following SMPTE officers and members of the conference arrangements committee: Leonard F. Coleman, president; Roland J. Zavada, Engineering vice president; L. Merle Thomas, vice president for TV Affairs; and Glen Pensinger, general arrangements chairman.

Also on hand to greet the press were Charles Anderson, former SMPTE president; Mary Connolly, editorial/program coordinator; Lynette Robinson, executive secretary; Jeffrey Friedman, editor of the *SMPTE Journal*; Alex Alden, manager of engineering services; and Barry Detweiler, TV engineer.

By the end of the press meeting, two conclusions could be drawn: Attendees could look forward to a fine

Get-together lunch

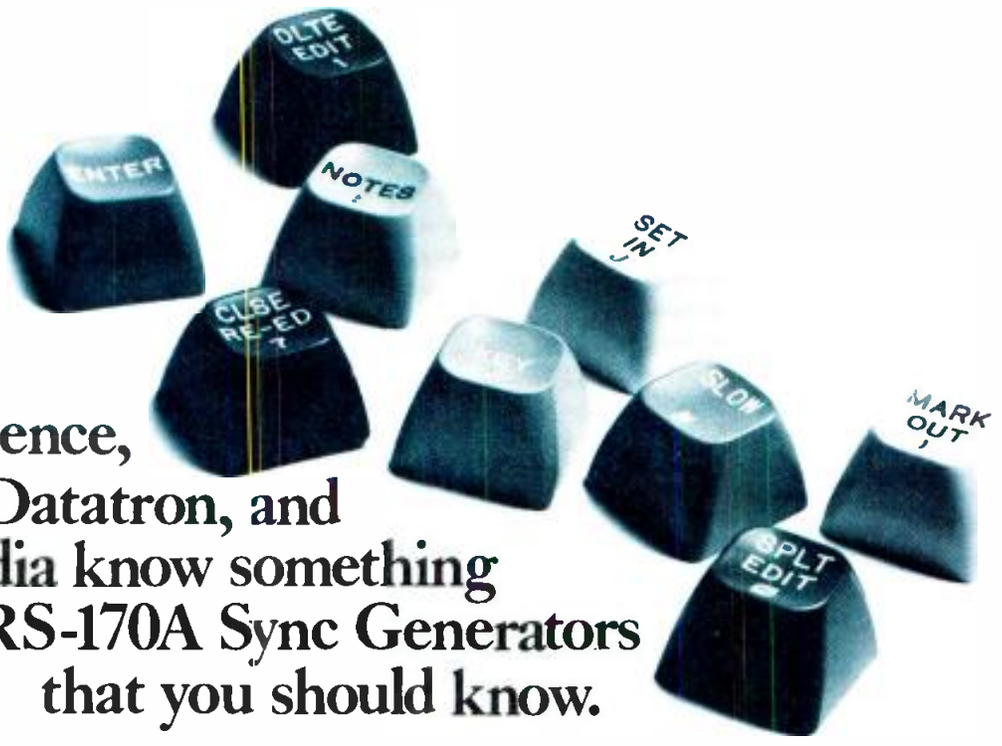
The lunch address by Boris Townsend focused on TV technological advances.

One of the highlights of the conference was a delightful address by Dr. Boris Townsend, head, Engineering Services, IBA, England, at the get-together lunch. Townsend directed his remarks toward the quantum leaps being seen in TV technological advances, but he addressed the group with a gift for wit and humor that kept attendees thoroughly entertained, often in stitches.

Referring to the opportunity of addressing such an esteemed group as the SMPTE attendees, he said that it was a challenge that "only the intelligent would reject." On a more serious note, he went on to address the future language of television, with concern about bandwidth constraints, crosstalk and channel capacity; the increasing quality of the TV picture, with DBS and HDTV looming on the horizon; the rapid growth in solid-state chip technology, especially the falling price of chips with increased usage; and, again humorously, the ZIP (Zero cost of Information Processor).

Some of the elements of technology that future broadcasters and manufacturers should pay attention to, according to Dr. Townsend, are uniform world transmission; smart receivers that automatically adjust to the transmission standard being received; and modular systems for easy service/replacement. In accepting the challenges of the future, Dr. Townsend seemed to be calling for wisdom and flexibility, noting that "an idea is not responsible for the people who believe in it."

Who's Pulsing the Editors?



Convergence, CMX, Datatron, and Videomedia know something about RS-170A Sync Generators that you should know.

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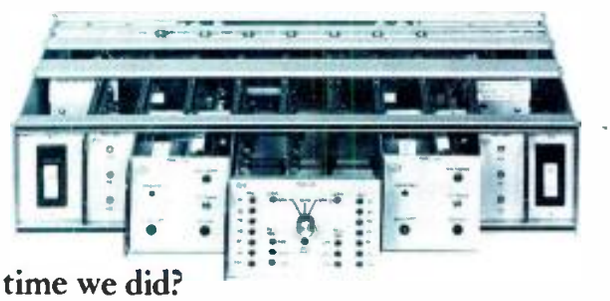
The complete dual sync system consists of a dual power supply frame, two RS-170A Generators, and an Automatic Changeover. The Automatic Changeover meters each generator pulse and DC voltage for fault indication. The PMG-312 offers chrominance subcarrier with an accuracy of .35Hz stability over a one year period. Subcarrier to horizontal phase relationship is maintained in reference to line 10, RS-170A. Black burst is optional. Professional broadcast quality at very attractive prices. Two year parts and labor warranty.



These manufacturers of editing systems know who's pulsing the system and now so do you. Is Lenco pulsing your editing equipment? Don't you think it is time we did?

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Booth activity at the SMPTE Winter Conference was brisk even though the technical sessions were heavily attended.
Photos: Donna Foster-Roizen. Courtesy of SMPTE.

selection of retrospective and forward-looking papers and there would not probably be any surprises at the convention.

As you may recall, the last time this conference was held in San Francisco, it made history with demonstrations of a digital TV studio at KPIX. This year's convention did not make history, but it was an excellent conference, nevertheless.

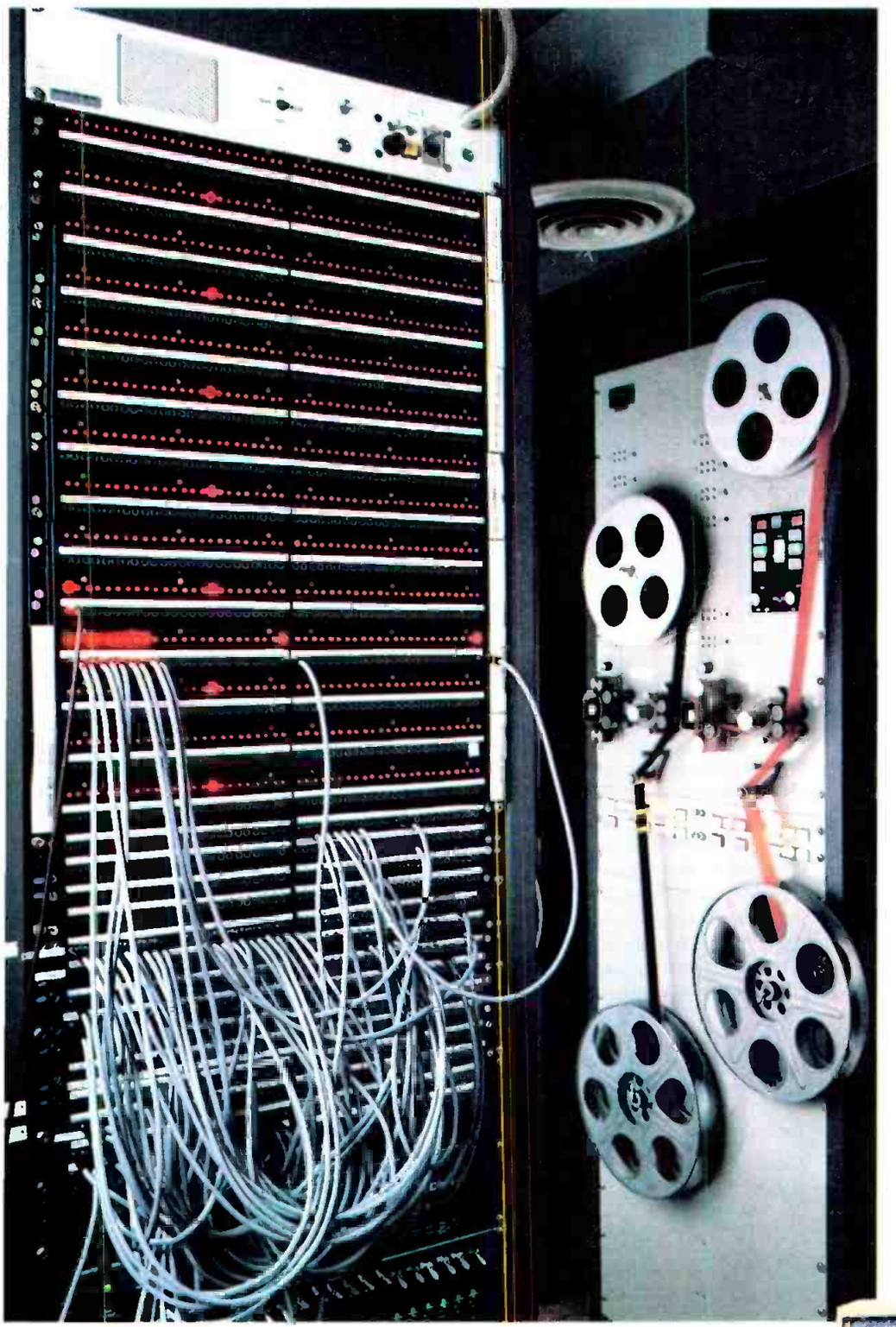
THE TECHNICAL SESSIONS

In keeping with the theme of this year's convention, "Pictures of the Future," the Program Committee, chaired by David Fibush, scheduled four sessions, each lasting half of a day. These covered *generating, manipulating, recording* and *programming* the video picture. A listing of the papers and authors is provided in a sidebar to illustrate the scope of the overall program. (See page 60.)

The conference proceedings, published in book form, were targeted for release in March. Copies may be ordered* from the SMPTE and were

*See the previously mentioned sidebar on page 60.

With state-of-the-art technology in their recording studios, Lucasfilm Ltd. didn't settle for do it yourself jackfields.



Lucasfilm's special effects in sight and sound have become the hallmarks of the STAR WARS saga. To achieve those other-world sound effects takes a lot of patching, switching, and mixing.

When Lucasfilm's audio patching requirements called for a unique and complex design to provide high-quality audio throughout its complex, Chief Audio Engineer Tom Holman selected ADC to manufacture jackfields to fit those requirements. All Tom had to do was plug them in, and the jackfields were ready to go—guaranteed and pretested—eliminating the hours of wiring, testing, and correcting that do-it-yourself jackfields often require. ADC custom and standard jackfields can save as much as 50% of the cost of do-it-yourself jackfields.

In addition, we offer more than 240 configurations in ¼" or Bantam jacks, wire wrap or solder terminations, variable cable lengths, plus a variety of normalling configurations and types of terminations (including our revolutionary new "punch-down" connectors, introduced at this year's NAB). We inspect and computer-test every circuit to make sure it lives up to spec. That's why we can offer a five-year warranty on every unit.

Best of all, we can have any of our standard jackfields on their way to you in only two to four weeks. And that's a promise we can deliver. For information about ADC's standard or custom jackfields, write ADC, 4900 West 78th Street, Minneapolis, MN 55435. Or call our toll-free hotline—1-800-328-6188. In Minnesota, call (612) 835-6800.

ADC

(Above) ADC custom jackfields form an integral part of Lucasfilm's state-of-the-art audio technology.

(Right) Tom Holman, Chief Audio Engineer for Lucasfilm Ltd., selected ADC for responsiveness, quality, and reliability.

Circle (40) on Reply Card

Photos: Donna Foster-Rolzen. Courtesy of SMPTE.

Stephen Kerman (left) of Tektronix and Robert Daines of Custom Video Systems chaired the session on TV graphics and special effects.

David Fibush (left) of Ampex and Thomas Mehrens of Sony chaired the session on the future of videotape formats.

Roy Trumbull (left) and S. Merrill Weiss chaired the session, "Programming the Picture," and delivered individual papers as well.

Technical sessions

GENERATING THE PICTURES

Session chairman: Gerry Brill, Ampex.
"New Chrominance Components for Multiplexed Component Video Signals in HDTV Systems," Charles Rhodes, Scientific-Atlanta, Atlanta, GA.
"The HDTV Camera—Fighting the Resolution/Noise Battle," Dr. Ulrich H. Reimers, Robert Bosch GmbH, West Germany.
"A High Definition Still-Frame TV System," Glen Southworth, Colorado Video Labs, Boulder, CO.
"Extended Definition Television with High Picture Quality," Dr. B. Wendland, Univ. of Dortmund, Dortmund, West Germany.
"Today's Photographic Imaging Technology for Tomorrow's HDTV System," Richard Schafer, et al, Eastman Kodak, Rochester, NY.
"Compatible Systems for High Fidelity Television," Richard N. Jackson, Philips Research Labs, Surrey, UK; and Dr. M. Annegarn, Philips Research Labs, Eindhoven, The Netherlands.
"Switching and Distribution of High Resolution RGB Video Signals," Patric L. Lewis and Lee V. Good, Ames Research Center, Moffett Field, CA.

MANIPULATING THE PICTURES

Session chairman: Steve Kerman, Tektronix.
Vice chairman: Bob Daines, Custom Video Systems.
"Arithmetic Control Algorithms for Digital Video Effects," Jim Blecksmith, Grass Valley Group, Grass Valley, CA.
"Technical Director's Interface to Digital Video Effects," Richard Dienhart, NEC, Elk Grove Village, IL.
"The Computer-controlled Frame Buffer as a Production Tool," Tom Klimek and Herman Towles, Jr., Computer Creations, South Bend, IN.
"Computer Graphics Animation," Peter Black, Xiphias, Santa Monica, CA.
"Menu-Driven User Interfaces for Videographics," Richard Shoup, Aurora Systems, San Francisco, CA.
"Tools for Interactive Picture Processing Systems," Alan Bridges, Via Video, Cupertino, CA.
"Digital Special Effects," Lance Williams, NYIT, Old Westbury, NY.
"Graphical Digits," Richard Taylor, Quantel Ltd., Berkshire, UK.

RECORDING THE PICTURES

Session chairman: David Fibush, Ampex.
Vice chairman: Tom Mehrens, Sony.
"The Type C Format—A Moving Target," William Carpenter, Ampex, Redwood City, CA.
"A Second Generation of Type C 1-inch VTR," H. Tanimura and Y. Fujiwara, Sony Video Products, San Jose, CA.
"Analog Components, Multiplexed Components and Digital Components—Friends or Foes?" John Baldwin, IBA, Winchester, Hants, England.
"An Introduction to Analog Components Recording Technique," Koichi Sadashige, Matsushita Electric, Secaucus, NJ.
"Digital Video Recording: New Results in Channel Coding and Error Protection," Juergen K. R. Heitmann, Robert Bosch GmbH, Darmstadt, West Germany.
"8-9 Block Code: A dc-free Channel Code for Digital Magnetic Recording," H. Yoshida, Y. Hashimoto and T. Shimada, Sony, Kanagawa-Ken, Japan.
"Design Criteria for the New Broadcast Video Recording System Employing ½-inch VHS Cassette Tape," I. Arimura and Koichi Sadashige, Matsushita Electric, Secaucus, NJ.

PROGRAMMING THE PICTURES

Session chairman: Merrill Weiss, KPIX-TV.
Vice chairman: Roy Trumbull, KRON-TV.
"How Not To Be Frightened by Microprocessors," E. Stanley Busby, Ampex, Redwood City, CA.
"Sharing the Software Development Load Between User and Manufacturer," Larry Seehorn, Control Video, Campbell, CA.
"Microprocessor Control Achieves Design Flexibility for Video Production Switchers," Howard P. Butler and David C. White, Grass Valley Group, Grass Valley, CA.
"Diagnostics for a Microprocessor-based Videotape Recorder," M. Glen Rose and Gary Warren, Ampex, Redwood City, CA.
"Product Growth Through Software," Bernard Hurley, RCA, Camden, NJ.
"A Microprocessor-based Camera Remote Control Unit," John A. Grey, RCA, Camden, NJ.
"An Intelligent Time Peripheral for Computer-based Videotape Editing Systems," Mike Racelo, EECO, Santa Ana, CA.
"Digital Diagnostics—How Much Should the Patient Tell," Roy Trumbull, KRON-TV, San Francisco, CA.
"Rolling Your Own—Customized Microcomputers for Custom Applications," Merrill Weiss, KPIX-TV, San Francisco, CA.
"The Evolution of a Comprehensive Computer Support System for the TV Operation," John Anderson and Michael Tooms, Protel Computer Systems, Wokingham, UK.

TOWNSEND

The Television Transmission Specialists

Running a straight course keeps Townsend a step or two ahead of the competition.

The many opportunities in television have attracted several of today's largest corporations into our industry from a variety of backgrounds. Since the beginning, Townsend Associates has been dedicated to the design, development, and manufacture of television transmission equipment exclusively. It's not a sideline with us. And we're not someone else's subsidiary. From transmitters to components, everything we develop and produce is mainstream to the transmission of television.

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High Power UHF & VHF Television Transmission

FIRST solid state exciter.

FIRST to employ emergency klystron multiplex circuitry for UHF.

Low Power UHF And VHF Transmission Systems

FIRST manufacturer of High Power transmitters for L.P.T.V.

FIRST integrated antenna and amplifier transmission system for low power UHF.

Satellite Rebroadcast Systems

FIRST transmitter manufacturer to introduce satellite system concept through a cooperative effort with a TVRO manufacturer.

FIRST to have a complete line of transmitters for satellite rebroadcast systems. We design and build rebroadcasting systems for UHF and VHF and each is available in either low or high power configurations.

Multipoint Distribution Service (MDS) And ITFS

FIRST 100% solid state transmitters in both 10 watt and 100 watt.

FIRST with intermod free external diplexing of the aural and visual carriers.

Custom Engineering

FIRST and only manufacturer with hardware and the know-how to up-power all major brands of T.V. transmitters.

Major Components

FIRST
solid state pulser.

FIRST
to introduce external cavity klystrons.

FIRST
to provide a regulated and adjustable power supply...PERVEAC.

FIRST
to manufacture and employ plug in vacuum contactors for T.V. transmitters.

The R & D Group Our "FIRST" Team,

The many transmission innovations developed by the Townsend R & D group have often involved technologies borrowed from other fields. Their singular purpose is to find ways to measurably raise the state-of-the-art in just one field...television transmission.

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Circle (41) on Reply Card

Richard Dienhart of NEC America discussed the technical director's interface to digital video effects, with special emphasis on automation of digital effects.

to be available for purchase at NAB-'83/Las Vegas.

Overall, the papers this year provided an excellent balance by covering the state-of-the-art and future trends in each subtopic addressed: picture generation, manipulation, recording and programming. As mentioned, the proceedings should be available before this report on the conference is off the press. You can read the full papers there, but the following are a few comments of note that will not appear in the book:

• Charles Rhodes, long identified with Tektronix but now with Scientific-Atlanta, presented a new luminance equation and addressed a question foremost in the minds of many: Should a new video signal standard be developed that perpetuates the present situation?

• A number of papers considered video pictures of high quality, but many authors took issue with HDTV as a designation for this newly developing technology. Other recommendations included *High Quality, Higher Definition, Extended Definition* and *High Resolution*. But regardless of what it is called, higher quality video pictures are in our future, and the SMPTE provides the setting for this advancing technology to flourish.

• As observed in the outline of papers, attendees saw a lot of emphasis on graphics generation and animation. We first began to see papers on these techniques at SMPTE about four years ago, and they are always fascinating to sit through. Of special note is the dramatic way that authors now combine displays of slides, still-stores and videotape to bring out the power of modern electronic videographic systems.

In his paper, Richard Taylor of Quantel explored the power of the Quantel Paint Box with its capability of electronically mixing paints as in traditional brush artwork. He finished his paper with a videotape of picture manipulation that brought out other Quantel equipment capabilities.

• Throughout the videographics papers, there was a common theme that authors stressed in various ways. Dick Shoup of Aurora Systems may have brought this point out most clearly: The graphics system is just a tool, and the system must know who is the boss. All stressed the crucial role of the creative person at the controls.

• Dick Dienhart of NEC chiefly addressed the interfacing to digital video effects systems, with special emphasis on automation. He also mentioned other aspects of technology assuming their roles in broadcasting, including bubble memories, voice-operation of equipment and remote control techniques.

• With the advent of the M Format equipment, Koichi Sadashige of Matsushita pointed out that there is a definite trend for professional and consumer equipment to grow closer together in performance.

• The most significant report at the meeting may well be the address presented jointly by Robert McAll, chairman of the SMPTE Working Group on Digital Control; and M. J. Stickler, chairman of the EBU Ad Hoc Group for Control. They reviewed the

Continued on page 66

Take a close look at Harris SX Series solid-state AM transmitters...

When you add up all the benefits, the choice is clear.

Available in 1 kW, 2.5 kW and 5 kW, the field-proven Harris SX Series transmitter is packed with advanced technology to bring you the utmost in operational efficiency and performance. Compare overall specifications with any competitive transmitter.

MAXIMUM OVERALL EFFICIENCY

MOSFETs (Metal Oxide Semiconductor Field Effect Transistors) in the modulator and PA stages give you significant benefits over older bipolar transistor and tube technology. For example, MOSFETs incorporated into the Harris design result in higher overall efficiency — typically 70% or better.

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PDM Harris' patented Polyphase Pulse Duration Modulation is a highly efficient 4-phase system. The audio input is sampled four times during each PDM cycle. Your listeners will notice the marked improvement in audio quality.

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Here is your centrally located monitoring point for a vast number of useful operating parameters — all right up front — all at fingertip command.

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Harris is the only transmitter manufacturer with extensive AM Stereo experience. That's a plus, as special consideration is given to incidental phase modulation...audio input to RF envelope output phase linearity...and RF channel phase response.

DIRECT POWER SAVINGS

SX Series transmitters save you up to 46% more power than other transmitters currently in use. A definite edge when there's a premium on every kilowatt consumed.

So add up all these benefits. Today you simply can't afford to be without a Harris SX transmitter. For more information, contact Harris Corporation, Broadcast Division, P.O. Box 4290, Quincy, Illinois 62305-4290. 217-222-8200.

HARRIS

Circle (42) on Reply Card

THE STATE-OF-THE-ART IN ROUTING

There are a number of people in a number of places who claim they're state-of-the-art. But let's face it, the state-of-the-art in routing switchers hasn't changed significantly in years.

Until now. Because 3M is introducing a whole new approach to switching technology. And starting today, you can look to Minnesota for the true state-of-the-art.

Our Series H Switching Systems utilize hybrid integrated circuitry, a technology developed in the aerospace and medical industries.

The results are the best performance specs in the business. Reliability is improved and maintenance is reduced.

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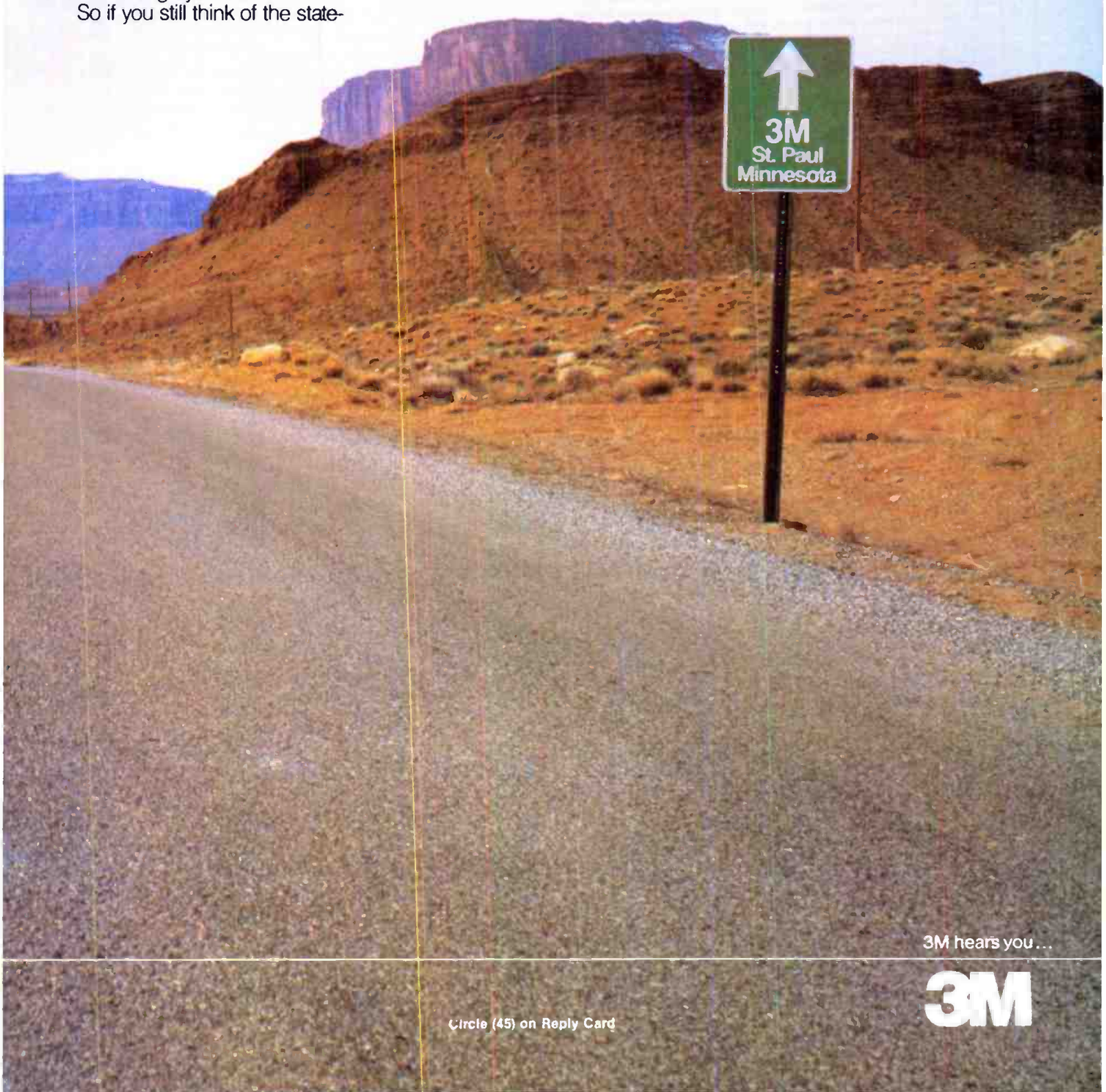
And thanks to miniaturization, there's at least a 300% increase in crosspoints-per-rack-unit. What used to take up an entire room can now fit in a closet.

Best of all, we offer all these advantages at a price that's actually comparable to the price of conventional switching systems.

So if you still think of the state-of-the-art in terms of yesterday's technology, stop by our booth at the NAB or call us toll-free at 1-800-328-1684. In Minnesota, call toll-free 1-800-792-1072. Outside the continental U.S., call International Operations collect at 1-612-736-2549. We'll give you a whole new sense of direction.



3M hears you...

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Circle (45) on Reply Card

Continued from page 62

history of the extensive SMPTE/EBU efforts to evolve a serial digital control (interface) for TV and related equipment and presented a digest of the standard being recommended. A formal release is reported in an accompanying sidebar (at right). Also, a series of articles and special notices are being planned to aid in the adoption of the standard into new hardware.

- The award for the most humorous paper at the conference goes to Stan Busby for telling us how *not* to be frightened by microprocessors. He cranked his paper out on a home computer/word processor to emphasize the modern trend in "writing" an address.
- The most unique session, the last, saw the session chairmen serving both as chairmen and as principal speakers. Roy Trumbull of KRON touched on a subject dear to most engineers: diagnostics and maintenance, with special attention to digital equipment. Merrill Weiss of KPIX outlined the unique system he has developed at KPIX for computer control of station functions. The main thrust of his message was for engineers to do their design planning thoroughly so that manufacturers could build special equipment needed

Standards agreement reached on remote control of broadcast TV equipment

The SMPTE Working Group for Remote Control of Broadcast Television Equipment (T14.10), under the chairmanship of Robert McAll, met with the European Broadcasting Union (EBU) Ad Hoc Group on Remote Control, under the chairmanship of Michael J. Stickler, during the recent SMPTE Television Conference. During this meeting, the combined groups finalized and achieved agreement on two additional documents concerned with message architecture and interconnection between units.

These two new documents will complement the two previously agreed upon standards: Electrical and Mechanical Characteristics for Digital Control Interface, ANSI/SMPTE 207M; and Supervisory Protocol for Digital Control Interface, RP 113, published in the September 1982 *SMPTE Journal*.

The combined set of standards will constitute the general specifications for a real time remote control system for broadcast equipment used by the TV and radio industries. The newly developed documents have been submitted to the Committee on Television Video Technology, under the chairmanship of David Horowitz, for formal letter ballot.

Stickler further reported that functionally identical documents will simultaneously be submitted by the EBU Ad Hoc Group to its parent committee G-5 on Production Systems Engineering for acceptance. These joint actions are the preliminary steps to international agreement and standardization.

Continued on page 70

New Gould portable video monitor/ oscilloscope lets you select by number any line of composite video.

Meet our new OS3350/5. It's the first-ever NTSC 525-line waveform monitor, complete picture monitor, and 40 MHz oscilloscope combined in a single, portable package.

Through an onboard time-base generator, it lets you examine each of the composite video signal's 525 lines—one at a time. PAL plug-in available.

Or you can display complete pictures, highlighting any line selected for inspection to show the relationship between waveform and picture.

And finally, our OS3350/5 functions as a general-purpose 40 MHz, 5mV/cm dual-trace scope.

Our compact monitor/oscilloscope is suited for testing and troubleshooting TV, CATV, CCTV, video recorder/playback and other equipment in mobile TV, microwave repeater, broadcast station, institutional, military, plant and production-line applications.

For more information, contact Gould Inc., Instruments Division, 35129 Curtis Boulevard, Eastlake, OH 44094. Phone 800/321-3035.

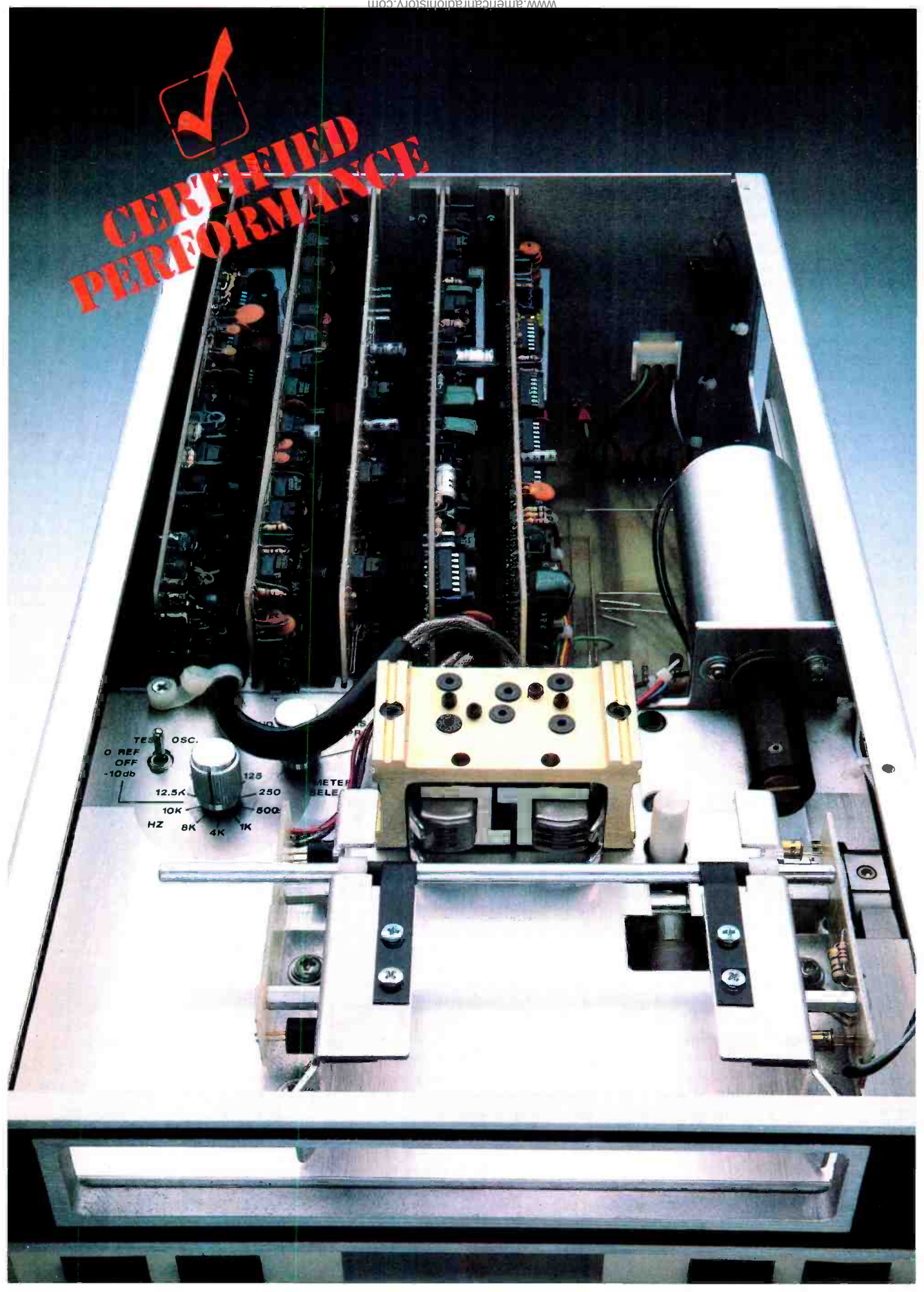
GOULD

Electronics & Electrical Products

Circle (47) on Reply Card

Gould's monitor/oscilloscope can display a complete picture with a bright line indicating the line under examination.

Or it can look at a video signal line-by-line.



TAKE A CLOSE LOOK AT THE NEW PRIMUS™ CART MACHINES.

Introducing the PRIMUS (pree-mŭs) cartridge recording/reproduction system from Ramko Research.

These new cart machines are engineered to be demonstrably and dramatically better than any other cart machines in the industry. They deliver signal-to-noise, distortion and frequency response specifications that are unrivaled. They set a new standard for the lowest wow and flutter. They're built rugged throughout to guarantee adherence to specifications.

COMPARE THESE SPECIFICATIONS: YOU BE THE JUDGE.

roller is engaged by an adjustable air-dampened solenoid with a Teflon-coated plunger for friction-free, quiet operation. Optical sensors start the motor when a cart is inserted. This not only eliminated start-up wow, but it means there are no mechanical switches to break or jam. Bearings have a longer life too because the motor doesn't need to run continuously. A crystal-controlled, brushless D.C. servo motor insures timing accuracy to within 0.05%. The minimal motor heat is kept away from your tapes by a high traction, ceramic capstan. Tape speeds (7.5 & 15 ips) are field selectable.

With PRIMUS, you have three cue tones with sharp, error-free digital sensing. Solidstate bar graph meters and dynamic noise reduction are standard. An automatic 4½ digit timer is optional. All electronics are on plug-in modules and rear panel connectors are quick disconnect type.

In summary, the PRIMUS cart machines have been engineered to be the most sophisticated broadcast reproduction system you can buy for under $3.000.

sistently repeatable, accurate electronic phase alignment. A front panel phase meter and internal diagnostics are added for operating ease.

PhaseMaster works flawlessly with any cartridge and eliminates the compromise of unreliable and inconsistent electromechanical schemes. The trade-offs imposed by noise-inducing and non-compatible matrixing approaches are now history. Complex, inexact cross-correlation techniques have been discarded. With PhaseMaster you're positively guaranteed compatibility with all your previously recorded carts. Here's a cart machine truly ready for superior FM & AM Stereo applications — a machine that rivals the performance of an open reel recorder.

	PRIMUS™	ITC RP SERIES	AUDICORD #126	BE SERIES 3230
Signal-to-Noise Ratio:	-60 dB	-50 dB	-47 dB	-52 dB
Distortion (System):	0.9%	2.0%	1.0%	2.0%
Frequency Response: 50 Hz - 15 kHz	±1.5 dB	±2.0 dB	±2.0 dB	±2.0 dB
Wow & Flutter:	0.095%	0.2%	0.15%	0.15%
Price:	$2,550	$2,610	$1,975	$2,450

All measurements referenced to 160 nWb/m, distortion is THD @ 1 kHz.
All models are R/P stereo, priced with three cue tones.
All prices are based on latest available manufacturers' information 3/83.

	PhaseMaster	TOMCAT	ITC SERIES 99B	ATR-800* (Reel-to-Reel)
Signal-to-Noise Ratio:	-65 dB	-59 dB	-55 dB	-60 dB
Distortion (System):	0.9%	0.9%	0.8%	3.3%
Frequency Response:	40 Hz - 15 kHz ±1.5 dB	40 Hz - 15 kHz +.5, -1.0 dB	31.5 Hz - 15 kHz ±1.0 dB	40 Hz - 15 kHz ±2.0 dB
Wow & Flutter:	0.08%	0.09%	0.15%	0.06%
Real-time Phase Correction:	locks to ±0° @ 15 kHz	none	none	none
Price:	$3,850	$5,280	$5,330	$6,230

All measurements referenced to 250 nWb/m, distortion is THD @ 1 kHz.
All models are R/P stereo, priced with three cue tones (excepting ATR-800).
*measurements referenced to 370 nWb/m.

A CLOSER LOOK AT BETTER ENGINEERING

Mono or Stereo, R/P or playback, here are more reasons why the PRIMUS cart machines are the industry's most advanced.

The PRIMUS transport deck is ⅝" thick cast alloy for superior stability. It's covered with stainless steel for wear resistance and EMI shielding. The machined headmount allows easy and precise adjustments. In addition, the heads are internally illuminated for cleaning and inspection. For smoother insertion and withdrawal and to prevent distortion, carts are securely held at the edges by spring-loaded rollers, rather than friction springs. To prevent tape skew, pinchroller parallellism is adjustable with the motor running. The pinch

COMPARE THE PHASEMASTER™: YOU'RE THE JUDGE AGAIN.

If you're in the market for the ultimate Stereo phase-correcting cart machine, look to our PhaseMaster, the broadcaster's premier phase-correcting, stereo cart machine.

The PhaseMaster has all the features as PRIMUS plus, the advantages of con-

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Whether you invest in PRIMUS or PhaseMaster, you'll receive a two year warranty* and a *Certified Performance Gold Card* that instantly puts you in contact with our Technical Assistance Department over our toll-free hotline.

To put PRIMUS or PhaseMaster to task call (800) 821-2545 or contact your nearest Ramko Research sales representative or distributor. Ask about our two week free trial.

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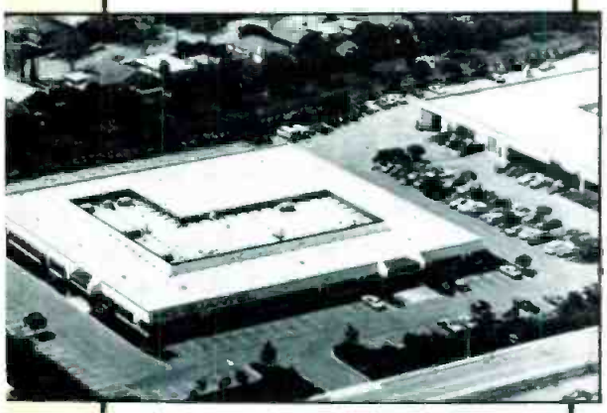
Circle (48) on Reply Card

Continued from page 66

MCI/Quantel expands



MCI/Quantel announced at the SMPTE conference that it has expanded its operations into a new 21,000-square-foot facility in Palo Alto, CA. In the process, it has combined its previously separate headquarters and manufacturing group and increased available floor space by 50%.

The new facility, located at 3290 West Bayshore Road, also includes an additional 21,000-square-feet for future expansion. An important feature of the building is a central signal distribution system. Designed by George Hamilton, MCI/Quantel's director of engineering, the system feeds controlled video signals to all manufacturing test stations, field-service work stations, demonstration rooms and classrooms.

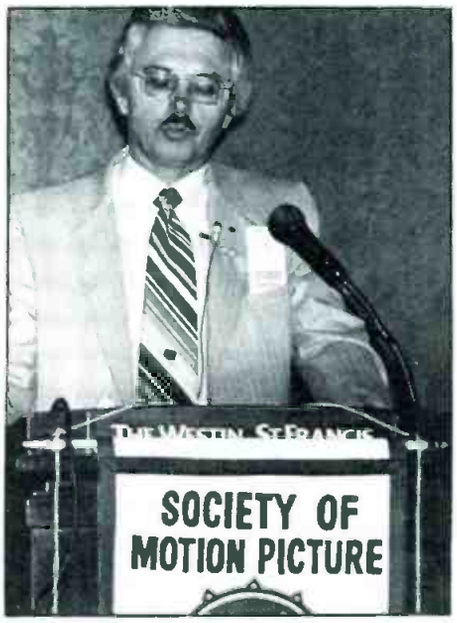
The building has also been equipped with a burn-in area in which the company's sophisticated electronic broadcasting equipment can be tested over a range of temperatures. Dedicated product demonstration rooms and classrooms will enable the company to increase its already heavy schedule of customer training courses.

Digital video products currently being manufactured by MCI/Quantel in Palo Alto include the DFS 1550 TBC/synchronizer, the DFS 1750 frame-store synchronizer, the DPE 5000/SP production effects system and peripheral equipment such as switching devices.

Moderator Robert Daines (kneeling) gives last minute instructions to speakers of the session concerning TV graphics and special effects.

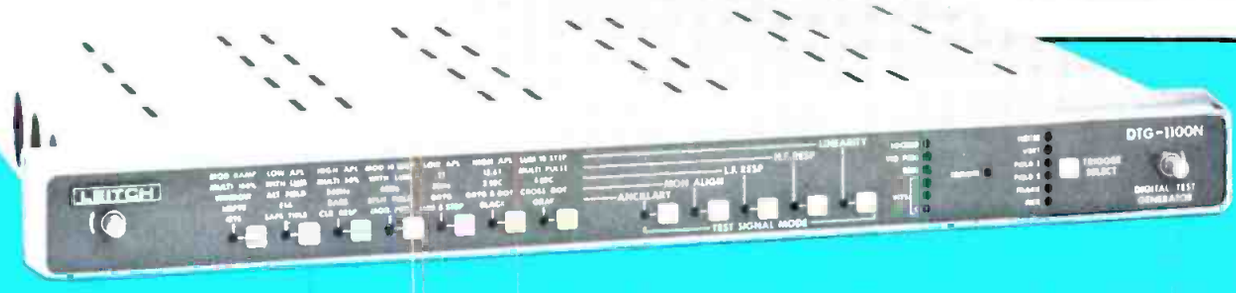
Glen Southworth (left), one of the early speakers, discusses some of the historical work in HDTV with Bill Rhodes, **BE** editorial director.

Photos: Donna Foster Roizen. Courtesy of SMPTE.



Robert McAll (left) and M. J. Stickler brought attendees up-to-date on the status of serial digital control of TV and related equipment.

Digital Test Generator



Price/Performance at its Peak

If cost effectiveness of your equipment dollar is as important to you as state-of-the-art technology, then you cannot afford to ignore the DTG-1100N.

In just one rack unit you get 35 computer generated, precision video test signals and microprocessor controlled signal selection.

The user-friendly front panel menu and status indicators let you look and select... easy as 1-2-3!

Full remote control is also available.

NEW FOR NAB '83

The VIP-1101N Vertical Interval Processor is a sophisticated, versatile companion for the DTG-1100N Digital Test Generator. It is a stand-alone unit featuring a digital sync generator which always maintains RS170A in the digitally generated black output. Microprocessor control with digital read-out allows insertion/deletion of VIT signals or data in lines 10 to 21 of either field. The unit is scheduled to be shown at NAB '83. Don't miss it!

LEITCH

Circle (49) on Reply Card

Engineering Committee meetings

A number of important SMPTE Engineering Committee meetings sponsored by the society took place during the conference. The purpose of the committees is to aid the development and maintenance of engineering standards and practices for the TV arts. The 17 committees that met during the conference were as follows:

- Subgroup on Camera/Recorder System Design
- Subgroup on Camera/Recorder Interface
- Working Group on Camera/Recorder Component Analog
- Working Group on Digital Video Standards
- HDTV Subgroup #2—Psychophysics
- HDTV Subgroup #4—Equipment
- Working Group on Digital Tape Recording
- Study Group on Digital Tape Recording
- Study Group on Digital Television
- HDTV Subgroup #1—Production
- HDTV Subgroup #3—Distribution
- Study Group on Digital Studio Implementation
- Working Group on Time and Control
- TV Technology Committee
- Study Group on High Definition Television
- Standards Committee
- Working Group on Digital Control of TV Studio Equipment

Progress resulting from these meetings will be included in our *Associations* department as the SMPTE issues formal statements.

Photo: Donna Foster-Roizen. Courtesy of SMPTE.

Stanley Busby of Ampex: *Don't let microprocessors frighten you.*

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■ State-of-the-art technology. ■ High gain, for simpler transmitters.
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TH 298: 3 kW • TH 369: 5 kW • TH 399: 12 kW • TH 374: 30 kW.
■ Specially designed, proven RF line-circuit assemblies, matched to the tubes.

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John Baldwin of the IBA: *Analog/multiplexed/digital components—friends or foes?*

Richard Shoup of Aurora Systems: *Menu-driven user interfaces for videographics.*

Charles Rhodes of Scientific-Atlanta: *New chrominance and luminance components.*

Boris Townsend of the IBA: *In the next decade...chips of biological complexity.*

Photos: Donna Foster-Roizen. Courtesy of SMPTE.

during implementation. "And if you do it right, everyone gains," he said.

• With all the emphasis on computers in the broadcast environment, it was not unexpected that the most-used term to emerge from this convention was user-*friendly*. This term was liberally bandied about to express the responsiveness of computers as a tool, an aid to broadcasters for control functions.

OTHER ACTION

Not all the action during the SMPTE meetings takes place in the formal exhibits and in the sessions. There is typically added action in hospitality suites, as noted elsewhere for Via Video, Quantel and RCA.

For members of the press, this year's SMPTE meeting provided a special added attraction: a tour of the Ampex Museum of Magnetic Recording. Because of a flight delay, the **BE** staff did not get to join the press for this special occasion. But we did arrive, hours late, to receive a special showing by George Boardman, Ampex, and Peter Hammar, curator of the museum. A short article on this unique museum appeared in the March 1983 issue of **Broadcast Engineering.**

FINAL NOTE

Next year's SMPTE Winter TV Conference is scheduled for Montreal, Canada, with dates to be announced. In 1985, it will return to the St. Francis Hotel in San Francisco. |:-)))|

SMPTE exhibits

The equipment exhibition associated with the Winter SMPTE conference for television enjoyed heavy traffic even during the technical papers. In all, 26 manufacturers or representatives displayed innovative equipment, including those using hospitality suites.

• **ADDA** provided demonstrations of multigeneration graphics building with the ESPC still-processor. The recently introduced AC-20 dual-channel TBC caught attention as well, with its added digital production effects.

• **Adams-Smith** displayed its versatile time code generator/reader equipment, the 2600 series. Capabilities include SMPTE and EBU longitudinal and VITC time codes and interfacing auxiliaries.

• Several videotape-related items of particular interest in the **AMPEX** exhibit caught the attention of conferees. The HPE-1CN editor ("N" for news) now includes the capability for interfacing to a variety of ½-inch, ¾-inch and 1-inch VTRs. Among the 3-play VTRs interconnected was the ARC-40, the studio compatible ½-inch VCR that complements the ARC-10/FPC-10 VCR system, along with the VPR 3 and a ¾-inch U Format system. At several points during the technical papers, an ARC-10/FPC-10 recorder/camera was being used to document the presentations.

• Master Control Automation was the theme of **Data Communi-**

Continued

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We're 20 years old and we're proud of it.

In switchers, digital effects, and automation, we have led the way.

We put the star in switchers.

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And we continue to write the rules on automation.

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Circle (52) on Reply Card

cations Corporation's booth. DCC's BIAS package manages on-air switching, machine delegation and control, as well as provides FCC logs and business reports. (See an application of BIAS at WISH-TV, on page 16 of this issue.)

• **Broadcast Marketing Associates** demonstrated the Lake Systems Corporation program automation equipment. The La-Kart broadcast software package is capable of controlling up to 30 machines, with U, M and C Formats all possible, and with broadcast LPTV and CATV applications suggested.

• **Cinema Products** used an Ikegami EC-35 camera equipped with a wide-angle anamorphic prime lens to display a widescreen picture. A modified Barco TV projector was used in the demonstration. Cinema Products also promoted the Starnet Teleconferencing services of Starcast Services.

• **Control Video Corporation,** known for its Sequencer commercial insertion system for satellite-relayed programming applications, stressed its latest system, the Lightfinger editing controller. Besides allowing access to the system software with a keyboard, the monitor's CRT screen allows interactive operator control, using infrared technology.

• **Fortel** presented three systems: the Y-688[32] total error corrector for color under VCR equipment; the C-YIQ[32] TBC processor for component-based video recorder systems; and the Digibloc synchronizer, a 2-frame system that includes remote control capability.

• Providing tape was the main thrust at the **Fuji Photo Film** exhibit. On display were 2-, 1-, ¾-and ½-inch M, Beta or VHS Format tape materials. An improved color signal-to-noise ratio is claimed for the Fuji tape formulation with BERIDOX oxide materials.

• **Fujinon** provided a glimpse at a lens being suggested for HDTV applications. Designed for use with microprocessor-controlled cameras, the 1300-TVL high resolution capable lens includes a compact RGB pattern projector for rapid camera adjustment.

• The **Grass Valley Group** multibooth display included the 300/Mark II digital video effects production system; automation and digital control with the modular M200 system; the 3258 digital SC/H phase meter; a 3280 digital audio multiplex/demultiplex system; and the 3291 fiber-optic data transmission units.

• The SK-110 TV camera drew attention at the **Hitachi** exhibit. The advanced computer control system tracks and adjusts 31 parameters within the camera. A complex system, containing up to 96 of the cameras, could be aligned within two minutes.

• **MCI/Quantel** showed its DLS6030 digital still-store library system, capable of recording and manipulating images, alongside its SP system. The SP equipment allows manipulation of live video images in custom or catalog moves. Within the quieter environs of the suite, Quantel's Paint Box intrigued by-invitation-only visitors. Staff artists demonstrated the innovative unit.

• **Merlin Engineering Works** displayed its ME-278 digital frame audio delay unit for lip sync restoration. One of its ME-258

Continued

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Table I.
SMPTE exhibitors

For information from exhibitors at the Winter SMPTE TV Conference, the following Reader Service Numbers are provided for your convenience.

ADDA Corporation .....(365)	Hitachi Denshi (America) ....(376)
Adams-Smith .....(366)	MCI/Quantel .....(377)
Ampex Corporation .....(367)	Merlin Engineering Works ...(378)
Broadcast Marketing Associates .....(368)	NEC America .....(379)
Cinema Products Corporation .....(*)	Philips Television Systems ..(380)
Control Video Corporation ..(369)	Precision Echo .....(381)
Data Communications Corporation .....(370)	RCA Broadcast Systems ....(382)
Fortel .....(371)	Sony Corporation .....(383)
Frezzolini Electronics .....(372)	3M Company .....(384)
Fuji Photo Film USA .....(373)	Tentel Corporation .....(385)
Fujinon .....(374)	Thomson-CSF .....(386)
Grass Valley Group .....(375)	Via Video .....(387)
	Videomedia .....(388)
	Vital Industries .....(389)

*For more information, contact: Cinema Products Corporation, 2037 Granville Ave., Los Angeles, CA 90025.

ultrawideband VTR units provided the source of an HDTV demonstration tape on the video monitor. The VTR, with a 10MHz bandwidth, played the material developed by **Compact Video** and presented via satellite at the Fall '81 SMPTE convention in Los Angeles. (See **BE**, January 1982, page 84.)

• Digital effects, with trajectory, multimove and the exclusive (optional) bubble memory, are featured in the E-Flex from **NEC**. Video from the TT-7000 series VTR allowed an impressive demonstration of the E-Flex system capabilities.

• Introduced at the NAB-'82 show, the **Philips Television Systems** LDK-6 camera presented its true colors at SMPTE-'83 on the LDH-6200 color monitor. The camera system includes individual microprocessors in its various components to maintain stable camera operation. Also at SMPTE-'83, the highly portable LDK-14LS camera caught its own share of attention.

• **Precision Echo** featured the SQ-1 digital image compression and manipulation equipment. A single-channel system, the SQ-1 allows compression, positioning, horizontal inversion, border effects and more.

• Video component recording with the Betacam brought many to the **Sony** display. Once there, the conferees also found the digital post-correction BVX-30 unit, as well as the BVW-10, BVU-820 and BVH-2000 machines, featuring digital bus control capabilities.

• **Tentel** presented the Tentelometer tension gauge equipment for diagnosis and setup of 1-inch C Format, as well as U, VHS and Beta Format, VCRs. The TSH gauges for ½-inch Beta or VHS and ¾-inch U Format machines demonstrated determination of sources of tape edge damage and tape path errors.

• The eye-catching capability of the Graphics V system from **Thomson-CSF** included the Vidifont character generator/graphics system. Composition, text-editing and animation effects provide artistic freedom with a multiplane frame store for special effects graphics manipulations.

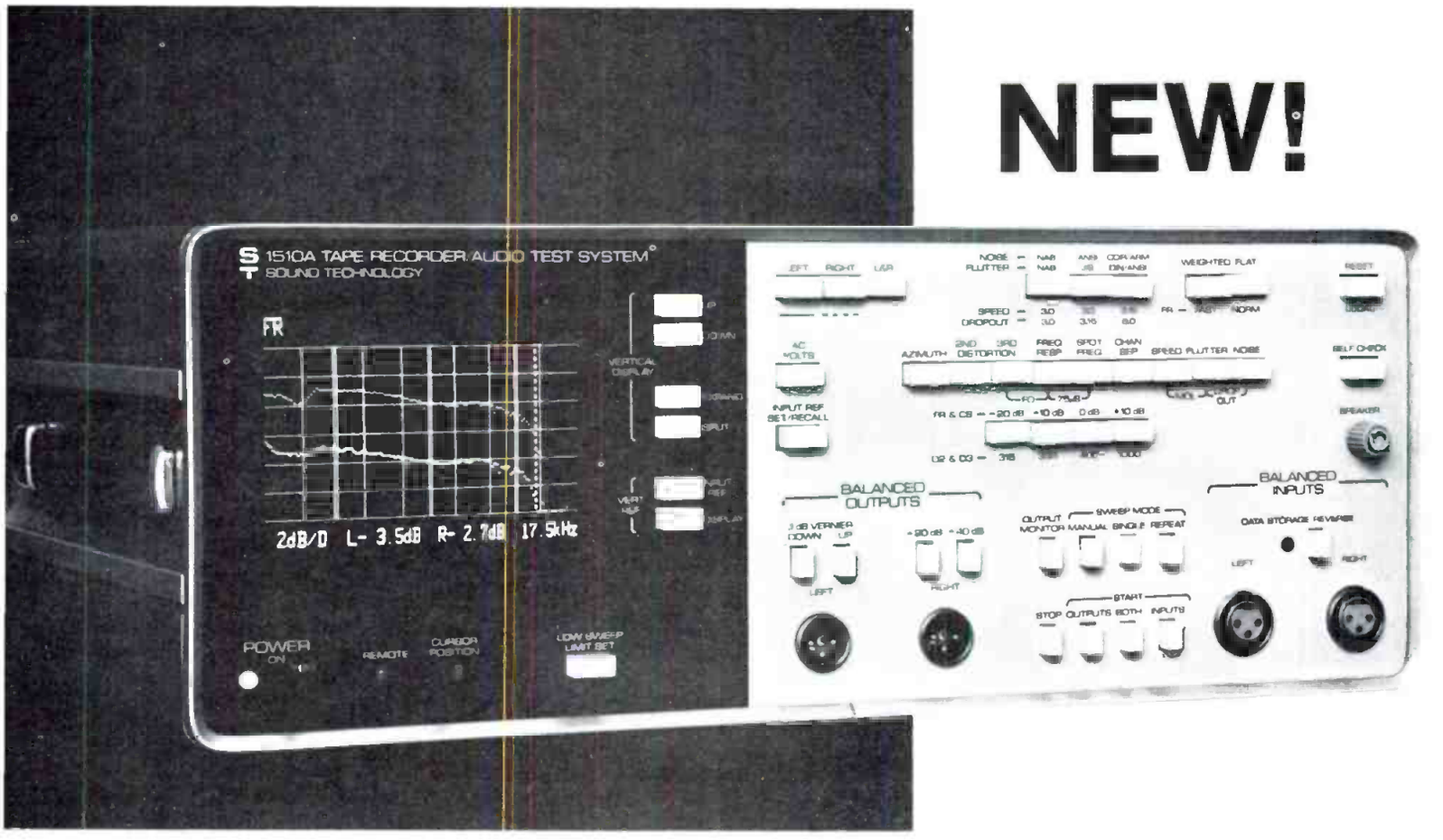
• The **NEC** TT-8000 1-inch C Format VTR shown by the **3M Company** included some cosmetic changes from the equipment introduced at NAB-'82 and several internal improvements. The performance of the machine remains high quality. Along with the VTR, 3M displayed the 40X routing switcher with microprocessor control.

• **Videomedia's** Eagle series edit controllers include Z80 distributed intelligence similar to the well-known Z6000 series. The Z80 chip also finds use in the VCM-200 master control automation system (and VCM-201 remote sequencer units) and the Q-Star serial transport automation and remote equipment (upgradable to a VCM-200). The STC-1 and STC-2 systems provide highly flexible remote control via a twisted pair based on Z80 processor technology.

• A digitally controlled production switching system, the 250P/N from **Vital Industries,** incorporates an RS422 interface proposed by SMPTE standards work. The small switcher joins the Vital line of innovative products highlighted by the SqueeZoom effects system.

• Other products evident at the show, but not in the exhibit halls, included the **RCA** Hawkeye video recording camera (VRC) and a universal recorder by **Frezzolini**, the FOC-1, for VRC operation with many current ENG cameras. **Via Video** presented its System One electronic graphics system with a digitizing camera, graphics tablet and friendly software system.

NEW!



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DESIGNED FOR THE BROADCASTER

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Here's a small sample of the varied jobs the 1510A will perform for you:

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- Automated production testing using GPIB option
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- Evaluation of audio quality for VTR's
- Verify threshold points on compressor/limiters using compression ratio test
- Thoroughly evaluate and certify magnetic film and audio tape
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- Frequency Response; ± 0.1 dB
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- Phasing
- 2nd and 3rd Harmonic distortion vs. level
- Spectral and composite noise
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- Compression ratio
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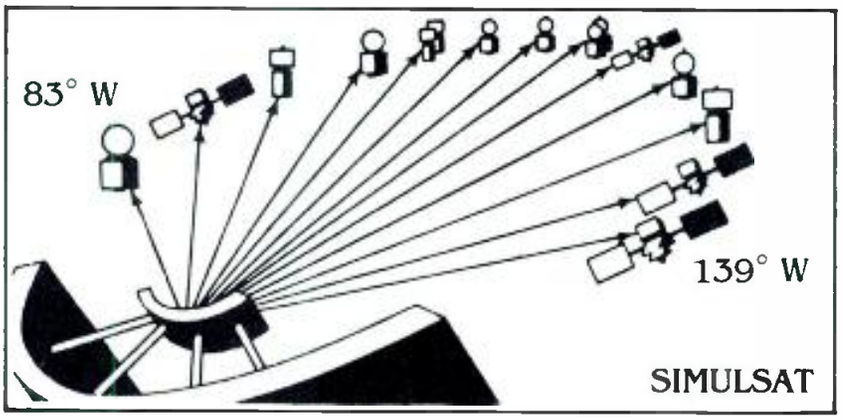

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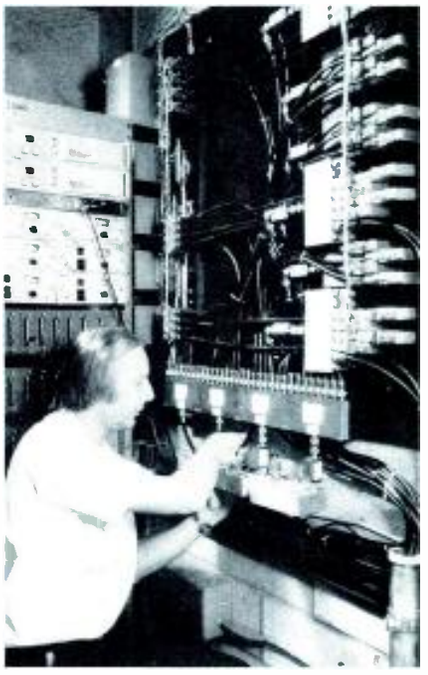

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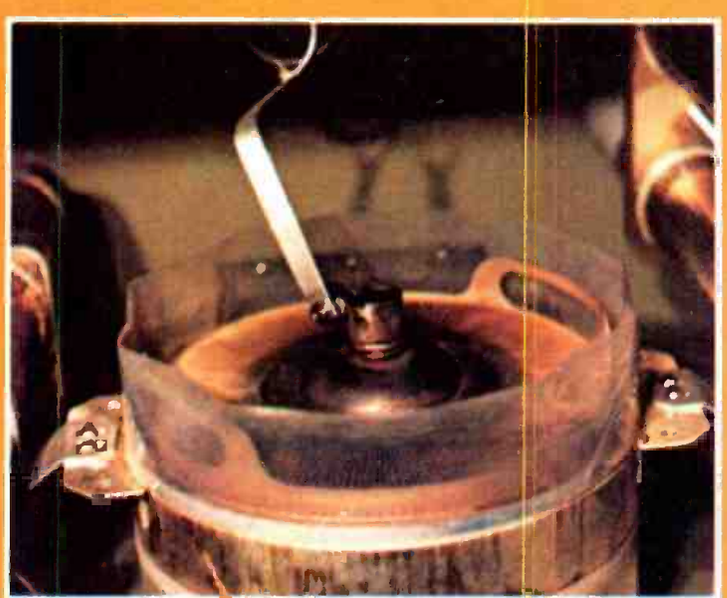
Improving tube life in high power transmitters

By David P. Hebert, chief engineer, KONA-AM/FM, Tri-Cities, Washington

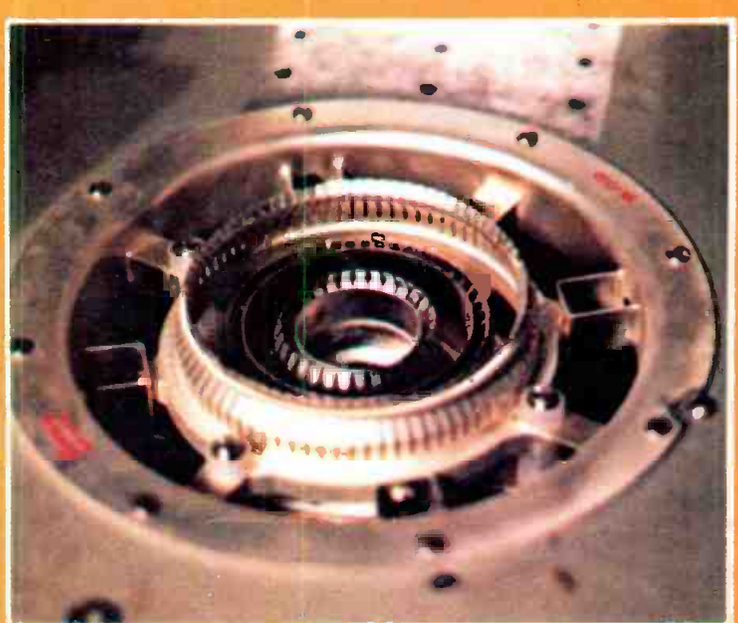
Soon after the installation in 1980 at my station of a recently manufactured 25kW FM transmitter, I became aware of a problem with premature tube failure. Through my experiences, I found causes of shortened tube life and modifications that could correct the problem. These may prove helpful to other stations that have encountered a similar problem.

When the McMartin BF25K transmitter was originally designed, a 3CX20,000A7 zero-bias triode was chosen as the power amplifier. This was a sound decision by the manufacturer, because the tube dissipates about 8kW of heat when operating at a power output level of 25kW. Manufacturers, eager to ensure adequate amplifier headroom, found the choice of this tube to be nearly perfect.

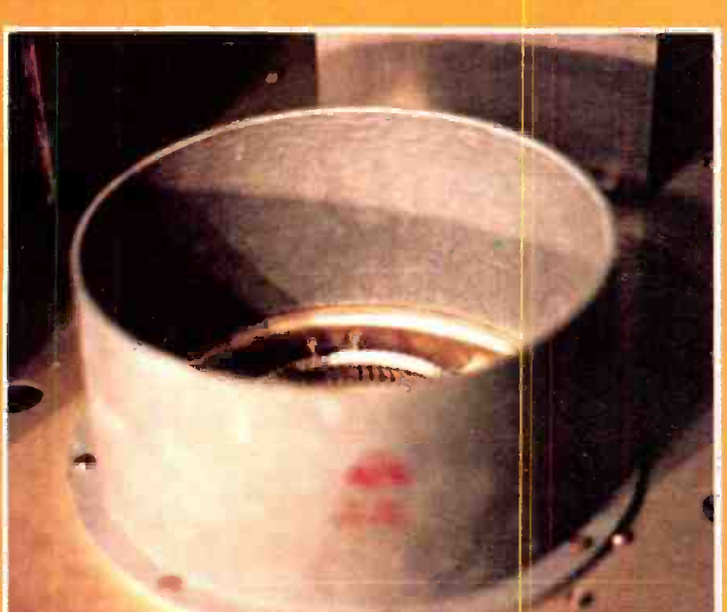
Continued on page 84



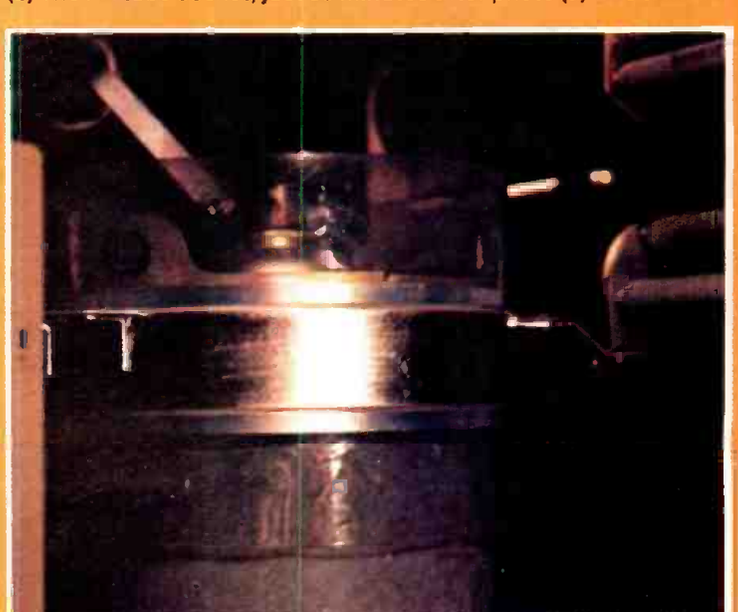
(a) Just before modification. Note discoloration of tube, which had less than 2000 hours on it.



(b) The PA tube socket, just 30 minutes after photo (a) was taken.



(c) The new EIMAC type SK-1306 chimney in place.



(d) The completed project.

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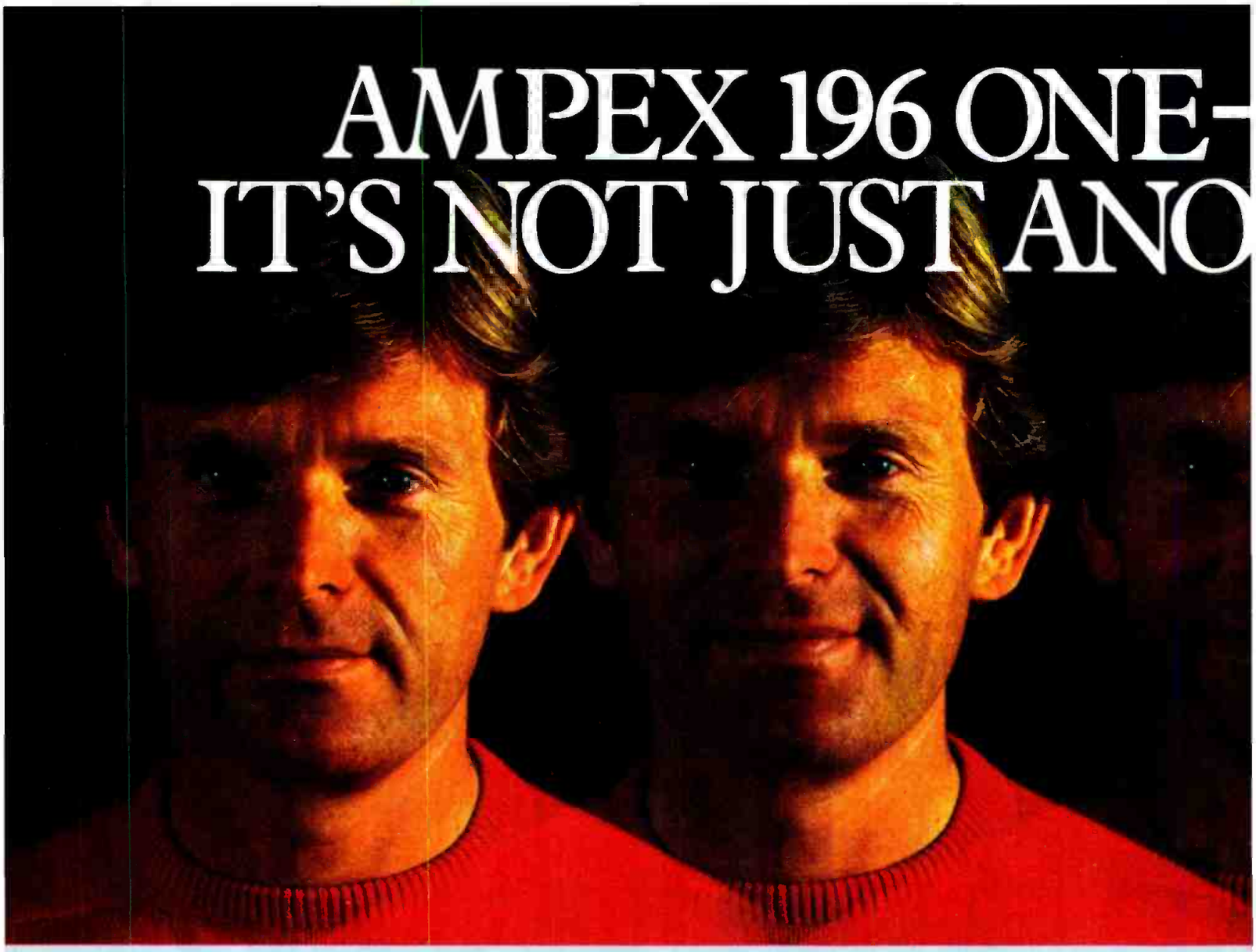

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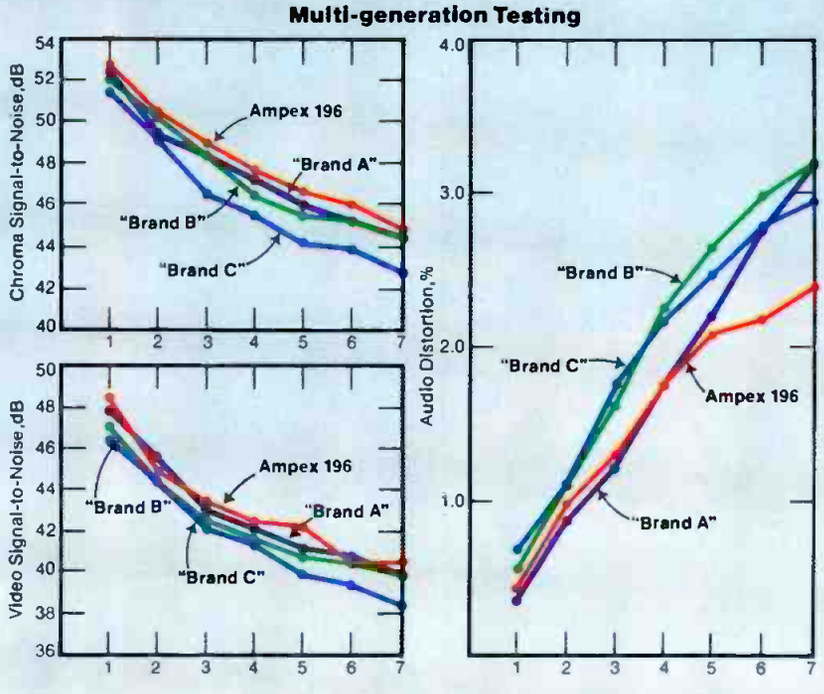
Multi-generation Testing



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Continued from page 81

Design maximums of 8kV and 5A on the plate were easy limitations to meet.

Almost immediately after installation, I became aware of the premature tube failure. Informal study revealed other transmitters in the area that also had this problem, but no clear pattern could be determined as to tube life vs. operating power level, or even frequency. I found that the same transmitter in other situations would not necessarily deliver better tube life when operated at a lower transmitter power output, while in other circumstances it would sometimes deliver better tube life when operated higher than 25kW. Clearly, no pattern could be found.

My study continued as to the apparent cause of tube failure after 3000-4000h. From what I could determine, the failure was caused by severe distortion of the grid caused by heat; however, the exact cause of the heat seems to be a matter of disagreement.

Back to basics

I concluded that there were six basic items that could characteristically contribute to poor tube life. They are the following:

Improper tube filament voltage. Filament voltage would seem to be the greatest contributing factor in the early death of many transmitting tubes. The 3CX20,000A7 is specified to operate with a filament voltage of 6.3V and 160A of current. Operation above these levels cannot be tolerated for long. Therefore, the importance of an iron-vane voltmeter cannot be overstressed. Measuring the filament voltage at the tube is a must (especially when it is fed from a voltage regulator with a non-sinusoidal waveform output), and care must be taken to ensure the mechanical integrity of all mechanical connections in the filament circuit. Full 25kW output should be obtainable with a filament voltage of slightly more than 6.05V for a new tube.

Excessive RF drive. Because autopsies from discarded tubes indicate overheating of the grid structure, this would be a natural item to suspect. However, the three tubes in the series (the 3CX10,000, 3CX15,000 and the 3CX20,000) all share the same common grid structure and ratings. It is important to remember that the grid does not actually dissipate all the drive to it, when operated in a grounded-grid circuit, but rather only a small part. Therefore, the 500W rating of the grid would seem adequate, as published specifications for this tube indicate a drive requirement of about 1700W when operated at the rated power level. EIMAC, the manufacturer of these tubes, has concluded that problems encountered in tube life are usually the result of excessive RF drive.

Improper tuning. Certainly, for efficient transfer of power from the cathode to the plate and then to the antenna, proper stage tuning is paramount. Because the grid is electrically in series with the plate circuit, any operating mismatch in the plate circuit will reflect to the grid, resulting in increased grid structure heating. Most transmitters of the BF25K type use a cathode current meter, and one can arrive at the grid current by subtracting the plate current from the cathode current. This figure should approximate the original tuneup values for the particular transmitter in question. Generally, the tube will be properly tuned when proper power can be obtained with minimum drive from the preceding stage.

Reduced air flow. Typical air flow around the tube should normally run at least 1600cfm. As the tube is producing about 90,000 BTUs of heat, it is important to provide both a fresh constant supply of cool, clean air and a means of removing the heated air as fast as possible. An exhaust fan rated at least 2000cfm, along with an efficiently designed exhaust duct, is a cost-effective purchase. With an outside temperature of 75°F, a thermometer should show an exhaust temperature of about 145° to 175° in the hottest portion of the exhaust port. Overheating of the tube can sometimes result in damage to the tube stem seals and resultant internal damage to the tube.

Spurious emission. A grounded-grid amplifier is intolerant of spurious activity, and will reflect spurious action unfavorably to the grid circuit. My experience has shown that the most frequent source for spurs will be the exciter, but other causes should not be ruled out. There could be high harmonic activity (anything much higher that 30dB below carrier, measured before the harmonic or low-pass filter), defective harmonic trap, excessive antenna VSWR, improper tuning, intermodulation products from nearby transmitters or objects, or an artifact somewhere in the transmitter itself.

Tube socket damage. Incomplete or inadequate physical contact with any part of the tube can be counterproductive. With the circuit considerations of high filament current and low grid circuit impedance, secure contact is important. The fragile finger stock inside the tube socket may become bent, broken or tarnished and will show signs of stress (especially when the tube is changed often). But one can be too careful and not fully insert the tube into the socket to avoid socket damage, resulting in no contact at all to the grid ring. This also results in arcing to the tube and possible damage.

The modification

My studies revealed that the problem of short tube life can be corrected by replacing the 3CX20,000 with the physically smaller 3CX15,000, provided, of course, that none of the previously mentioned problems exist. The electrical ratings of both tubes are identical, according to EIMAC published specifications. Communications with the FCC indicated that this modification is considered acceptable as a Class II permissive change, as defined in Section 2.1001 (b) (1) of the commission's rules. After the procedure, a proof-of-performance should be made to demonstrate compliance with the technical requirements of Section 73.317. The replacement modification is relatively simple and can be done by one person in less than three hours.

Before modification

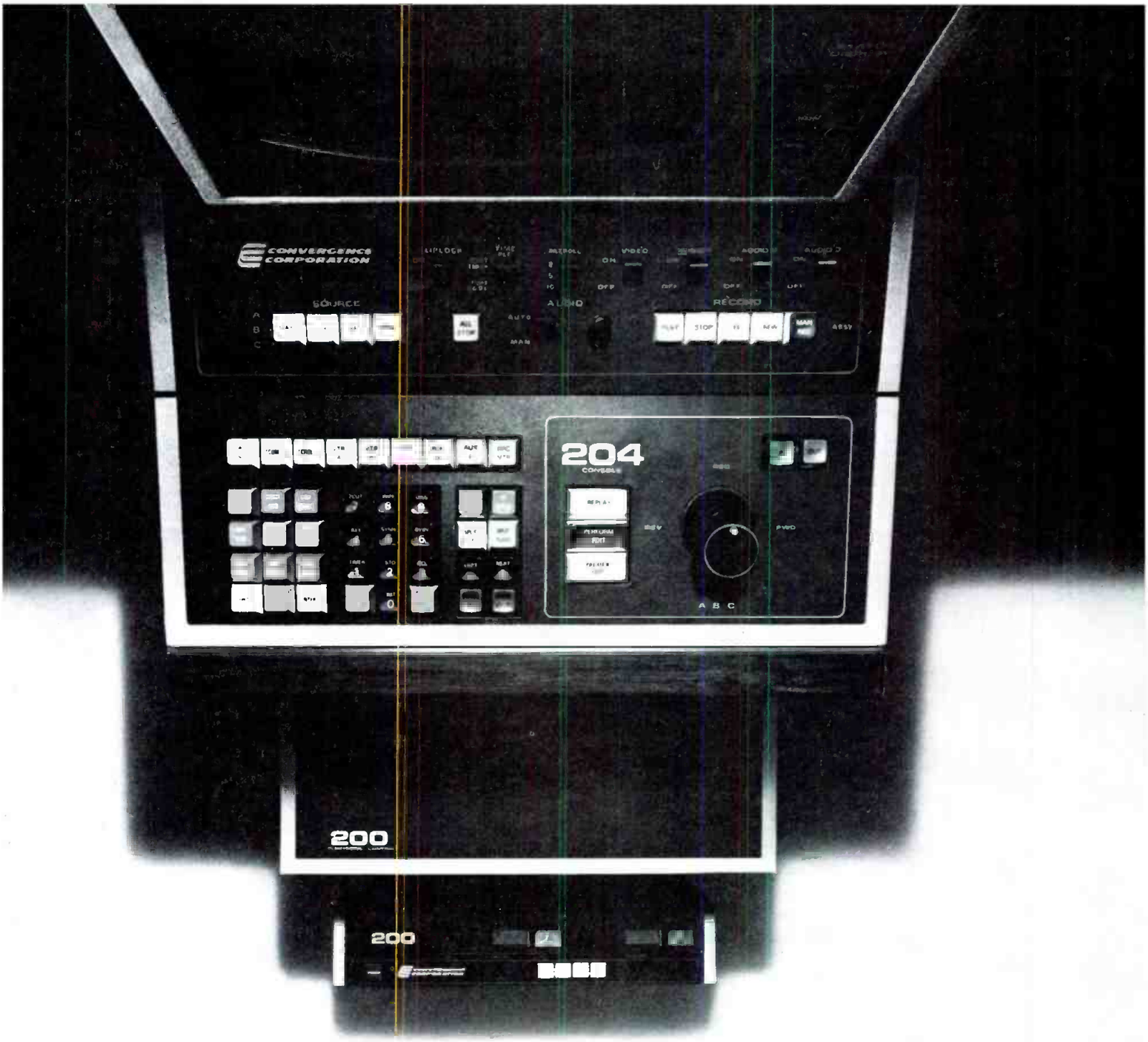
Before attempting to make a modification such as the one described in this discussion, the following steps are recommended.

•Be sure the transmitter is running properly, and is not suffering from any of the conditions described previously. In most cases, if there is something basically sick about the transmitter, modifying the transmitter will not be a cure.

• Before the modification, I installed an in-line wattmeter between the driver and the final stage. This was possible because a short piece of 1⅝-inch rigid line runs between the two stages. Not all transmitters use a 50Ω feed, as was the case in my modifications. I have found this helpful in recording the amount of drive required by the PA, and also ensuring the good match to the driver stage. I can also be certain that the drive actually delivered to the PA tube is within specs. An added bonus is that monitoring the RF drive to the PA is a good check of the preceding tube stages and is a helpful diagnostic aid.

• Be sure of all meter indications. If you know that the plate current, cathode current and power output meters are accurate to begin with, then you have a pretty good handle as to what's going on in the PA cavity.

The modification will require a good 3CX15,000A7, an EIMAC type SK-1306 chimney, a new plate blocker and two new RF connection straps to attach from the smaller plate blocker to the tuning and loading comonents. It should be possible to accomplish the entire modification for about



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$2300 (somewhat less if you use a rebuilt tube).

After modification

It is too early to be conclusive, but our initial results are encouraging. The first modification, which was done by factory personnel, has produced about 11,000 hours within the originally installed 3CX15,000A7 (this is more than three times the best life of any preceding 3CX20,000 before the modification.) The tube is still capable of more than 25kW output.

I am encouraged by the initial efforts. During the spring, I performed a similar modification to another transmitter in the general area. This particular modification was not initially as successful, because the tube used had some problems of its own, and there were other problems within the transmitter of which I was not aware. However, this later proved to be a satisfactory step, after the limitations were cured. This modification has been successfully performed by other engineers having similar difficulties. I am sure they have found their efforts as worthwhile as I have.

To those who may doubt the similarities that exist between the two tubes, I say that, in the first case, little retuning was required after the procedure was completed.

As with all good things, the tube finally came to the end of its life after 12,000 hours. The decision was made to remove the tube early to allow Econco Broadcast Service to autopsy the tube while it still had something inside to examine.

The tube was still producing full 25kW when removed. The only symptom noticed was increased drive requirements. Exhaust air was not unusually hot and, upon removal, the anode fins were not excessively discolored. Engineers at Econco determined that the tube had simply come to the end of its useful life, and there was nothing unusual about the failure of this particular tube. So it is believed that this experiment was successful and the decision was made to continue with the 3CX15,000 in the future.

John Sullivan, Econco service technician, believes that the problem with the 3CX20,000 is one of poor heat distribution. Whereas the 15,000 showed a relatively evenly spread heat discoloration on the heat exchanger fins, the 20,000 tube was highly discolored toward the center, and appeared as new toward the edges.

Acknowledgements

In conclusion, I would like to acknowledge the help of Dick Johnson, Brian Locke, Charlie Goodrich, Dick Dennis and Bill Abbot of McMartin Industries for their help in these projects.

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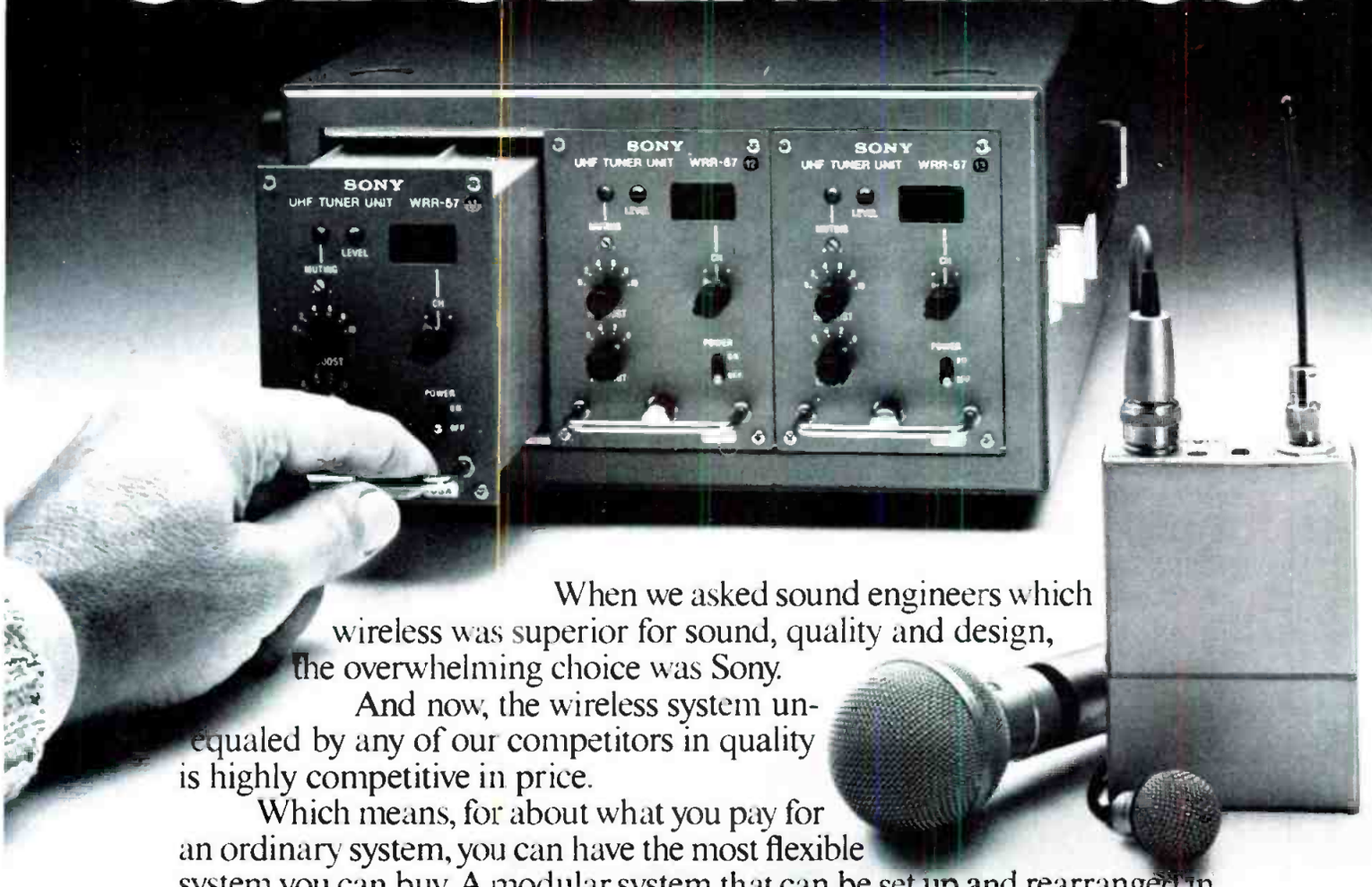

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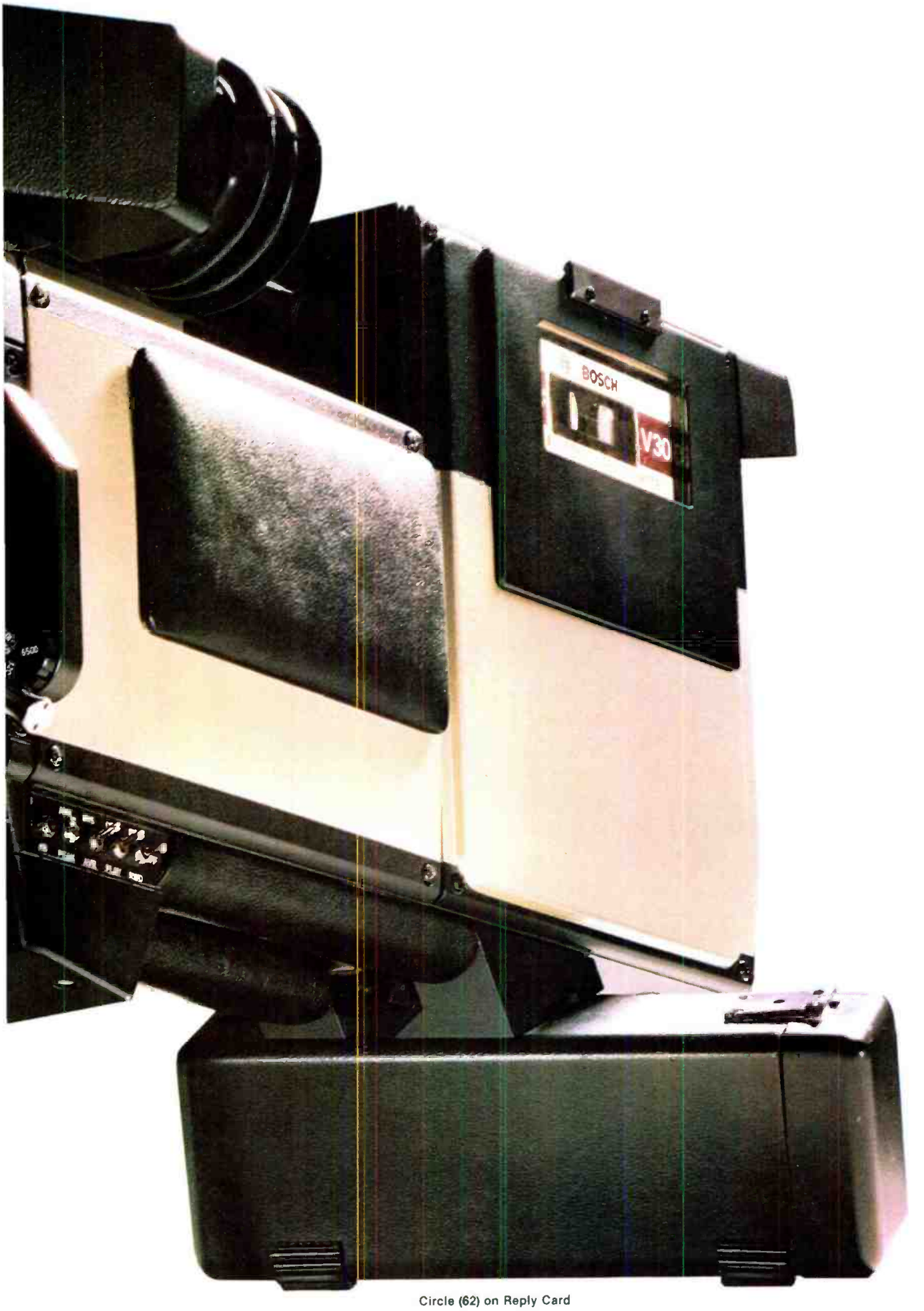

Circle (62) on Reply Card

AM/FM transmitter update

By Donald L. Markley, facilities editor, D. L. Markley & Associates, Consulting Engineers, Peoria, IL

Transmitter manufacturers update their systems with new models and innovations as new technologies become available. We asked the author to take a look at some of the changes expected at NAB-'83/Las Vegas in AM/FM transmitters. He agreed to do so, and included some trends in antennas and TV transmitters that he uncovered along the way.

As part of the report preparations, **BE** mailed inquiry forms to NAB-'83/Las Vegas exhibitors requesting data on new AM/FM transmitter systems to be introduced at the show. Updates on these latest transmitters are included herein, for those manufacturers who returned our forms. For those who did not, look for their data in the June issue of **BE**.

A sidebar included here, prepared from the **BE** files, lists manufacturing sources of AM/FM transmitters. Complete data on the companies' products may be obtained by using the Reader Service Numbers in Table I. In a second sidebar, **BE** has included tables of performance data on selected transmitters. Similar information can be obtained from the manufacturers' data sheets for other models of interest.

The transmitting equipment and antenna systems to be shown at NAB-'83/Las Vegas do not contain any major or revolutionary changes in the area of the transmitters themselves. Instead, a continued improvement in existing models is being shown by most manufacturers, with only a few new models actually being demonstrated.

One major antenna system to be shown this year offers a great deal of promise. This is the new slotted waveguide antenna system offered by Harris Corporation. The UHF slotted waveguide antenna, the Wavestar, is currently available in either a cardioid or peanut-shaped pattern and will soon be available in an omnidirectional antenna. The antenna provides the broadcaster with a horizontally polarized signal with the advantages of extreme simplicity in the antenna itself, as well as a rugged construction. The antenna basically consists of slots cut into a piece of waveguide. Power dividing and matching is simple and straightforward. The primary advantage of a waveguide antenna of this type is the same as the primary advantage of waveguide used for transmission line: It is fairly rugged and extremely immune to burnout. It should be interesting to follow the development and use of this antenna.

The other Harris contribution to the transmitting area at NAB is a slightly improved version of its UHF transmitting line identified as the E series. This series of UHF transmitters incorporates a new SAW filter and variable output coupling on the klystrons for improved efficiency. Some other minor corrections complete the changes found in this new model.

The SX series of AM transmitters will be shown again. Harris now assures buyers that the 5kW version will be available within 30-45 days after NAB. The engineering test units are in the field in operation at the present time. 1kW and 2.5kW SX series transmitters have been shipped for several months.

Two manufacturers are demonstrating new FM exciters and stereo generators this year: Singer Broadcasting Products and Harris Corporation. The Singer system is a 30W direct FM exciter with digital AFC. The audio path is without transformers, and the system uses a phase-locked FET oscillator. The stereo generator also uses no transformers in the audio stages. It uses a matrix system to generate the stereo signals. The new Harris FM exciter is identified as the model MX-15. The com-

Table I.
Transmitter manufacturers

The following is a list of manufacturers of radio broadcast transmitters. Included are sources of AM broadcast and HF shortwave systems, as well as FM broadcast. AM and HF systems cover the general spectrum from 535kHz-30MHz, while the FM models are designed for 88-108MHz (Band II) operation. Reader Service Numbers are included for your convenience in receiving information about the equipment.

Bayly Engineering Ltd. ..... (364)	Nautel Maine ..... (352)
Broadcast Electronics ..... (341)	QEI Corporation ..... (353)
CSI Electronics ..... (342)	RCA Broadcast Systems .... (354)
Continental Electronics Mfg. (343)	Rohde & Schwarz GmbH .... (355)
Eddystone Radio Ltd. ..... (485)	Rohde & Schwarz Sales Company ..... (356)
Elcom-Bauer ..... (344)	CN Rood BV ..... (357)
Harris Broadcast Products .. (345)	Scientific Radio Systems .... (358)
LPB ..... (346)	Singer Broadcast Products .. (359)
Larcan Communications Equipment ..... (347)	Solid Electronics Labs ..... (360)
Marconi Communications Systems Ltd. ..... (348)	TTC/Wilkinson ..... (361)
Marconi Electronics ..... (349)	Tesla ..... (486)
McMartin Industries ..... (350)	Thomson-CSF/Radio & TV Department ..... (362)
NEC America ..... (351)	Versa Count Engineering .... (363)

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bination of stereo generator and exciter offers signal-to-noise ratios for monaural of 80dB with IM distortion of 0.2% or less. The new generation stereo generator offers separation of up to 60dB at midband.

Continental Electronics is not demonstrating any new products at the show this year, but is returning with a complete line of broadcasting equipment as in the past. As well as its line of FM and AM transmitters for domestic use, Continental has an extensive line of high power medium-wave and shortwave transmitters for the international market.

Larcan Communications Equipment is showing three new FM transmitters. These are available at 10kW, 15kW and 20kW power levels. Larcan has followed a lead first made by RCA in its VHF transmitter line and then by Broadcast Electronics and Harris in their FM transmitter lines. This mode of design calls for all solid-state, broadbanded amplifiers up to the final amplifier stage. There is a great deal to be said for the simplicity of replacement parts and simplicity of operation that accompanies this type of broadbanded design. All three of these Larcan transmitters use a single final amplifier tube.

Singer Broadcasting Products is showing three new transmitters in its line. These include 3kW and 25kW systems, both of which use two tubes. In accordance with the heritage of this product line, the transmitters use grounded grid power amplifiers for output stages. The 3kW also uses a grounded grid IPA. Singer's third system is a new 5kW AM transmitter with solid-state low level circuitry. However, Singer still uses a vacuum tube as a final amplifier and uses high level modulation.

Rohde and Schwarz is showing two new TV test transmitters with rather limited applicability for the average broadcaster in the United States. However, these units are worth mentioning for the quality of construction and performance that one has come to expect from Rohde and Schwarz. The units are tunable from 25-1000MHz and generate a series of test patterns from internal waveform synthesizers.

Several other manufacturers are showing basically the same equipment that they have brought to the convention in past years. Nautel is showing its solid-state transmitter. This unit is available in 1kW, 2.5kW, 5kW and 10kW sizes and is totally solid-state. To the best of my knowledge, the 10kW unit is the only 10kW solid-state transmitter available in the market at the present time. Some of the 10kW units have been sold in Canada, and transmitters at the lower power levels have been

40 to 1

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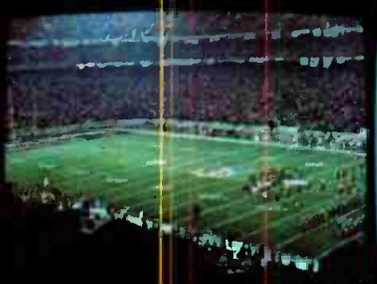

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delivered in the United States.

McMartin is demonstrating its previous product line without significant changes from prior conventions.

Wilkinson, now under the auspices of Television Technology Corporation, offers the same broad line of equipment that it demonstrated before the change in corporate ownership.

Townsend is again placing emphasis on its Perveac control system for use with 55kW klystron amplifiers. This unit is claimed to permit simple control of the beam operating parameters to optimize transmitter performance and efficiency. The company is also showing its solid-state anode pulser for use with all UHF klystron transmitters.

CSI will demonstrate its basic line of transmitters. These units are known for their simple design and construction, which results in an economical price structure.

Low power AM and FM transmitters are primarily being manufactured by Radio Systems and Low Power Broadcasting. These units are not significantly changed from last year.

In summary, it seems that the push in UHF transmitters is still toward improvement of overall operating efficiency, using couplers and improved pulser systems.

In FM, the state-of-the-art seems tc dictate the use of single-tube transmitter designs with limited use of multiple-tube designs in new FM transmitting systems. AM transmitters are progressing toward totally solid-state designs, with power levels up to 5kW currently available from three manufacturers and up to 10kW available from one manufacturer. There still seems to be a significant market for vacuum-tube type transmitters. It does not seem that this market is going to end in the near future, primarily because of the somewhat lower comparative price of such equipment.

Selected equipment specifications

Performance specifications for AM and FM broadcast transmitters are given in Tables I(a), I(b), I(c), I(d), I(e), II(a) and II(b). The information in these listings, taken from the 1982 **Broadcast Engineering** *Spec Book*, was derived from the manufacturers' specification/data sheets. Although these tables are offered for comparison purposes, we suggest that interested individuals contact manufacturers for the most recent, updated data on their products.

Table I(a).
Transmitter, amplitude modulation

The RF output impedance is 50Ω. Audio signals applied to the transmitter are approximately +10dBm for 100% modulation, 600Ω balanced. Additional model numbers and their associated power levels of transmitters with similar performance specifications are given.

Manufacturer	CCA (Singer)		Continental Electronics		
Model Number	AM-2500D	AM50000D	316F	315R-1	317C-2
Power Output Level	3kW	55kW	10.6kW	5.5kW	60kW
Frecuency Stability (±)	5Hz	5Hz	5Hz	5Hz	5Hz
Carrier Shift	3%, at 100%	3%, at 100%	<3%, at 100%	<2%	1% at 100%
Modulation Capability	125%	125%	125%	125%	125%
AF Response (± dB/Hz)	1.5/50-10k	1.5/50-10k	1.5/20-10k	1/20-10k	0.3, −0.8/10-15k
Harmonic Distortion	2.5%	3%, 90% modulated	<3%	<2%, at 5kW	<2.5%, 95% modulated
AM Noise Figure	−45dB	−55dB	−60dB	−63dB	−60dB
Power Consumption	10kW	140kW	28.4kW	13kVA	60% efficient
Final Amplifier	(2)4-1000A	4CX35000C	(2)4CX10000	3CX3000F7	(2)4CX35000C
Modulator Final	(2)4-1000A	(2)4CX15000A	Solid-state	3CX3000F7	(2)3CX3000A1
Drivers	Tube type	Tube type	Solid-state	Solid-state	Tube type
Other Models	AM-1000D 1.2kW	.....	315F 5.5kW	314R-1 1.1kW	.....

Table I(b).
Transmitter, amplitude modulation

Manufacturer	CSI Electronics Inc.		Elcom-Bauer		Harris Broadcast
Model Number	T-1-A	T-10-A	701B	710	SX-1
Power Output Level	1.1kW	12kW	1.1kW	12kW	1.1kW
Frequency Stability (±)	10Hz	10Hz	5Hz	5Hz	10Hz synthesizer
Carrier Shift		.....	3% at 100%	2% at 100%	2% at 100%
Modulation Capability	100%	100%	125%	125%	125%
AF Response (± dB/Hz)	1.5/50-10k	1.5/50-10k	1.5/50-10k	1/50-10k	1/20-12.5k
Harmonic Distortion	2.5%	2.5%	2.5%	2%	<1.5%
AM Noise Figure	−55dB	−55dB	−55dB	−60dB	−60dB
Power Consumption	3.75kW	27kW	4.15kW	27kW	1.8kW typical
Final Amplifier	(2)7527A	3CX10000A3	(2)4-500A	4CX15000Z	High power
Modulator Final	(2)7527A	(2)4CX3000A	(2)4-500A	(2)4CX5000A	MOS FET
Drivers	Tube type	Tube type	Solid-state	Solid-state	Devices
Other Models	T-3-A 3.3kW	T-25-A 30kW	705C 6kW	715C 15kW	SX-2.5 2.5kW
	T-5-A 6kW	T-50-A 55kW	.....	....	.....

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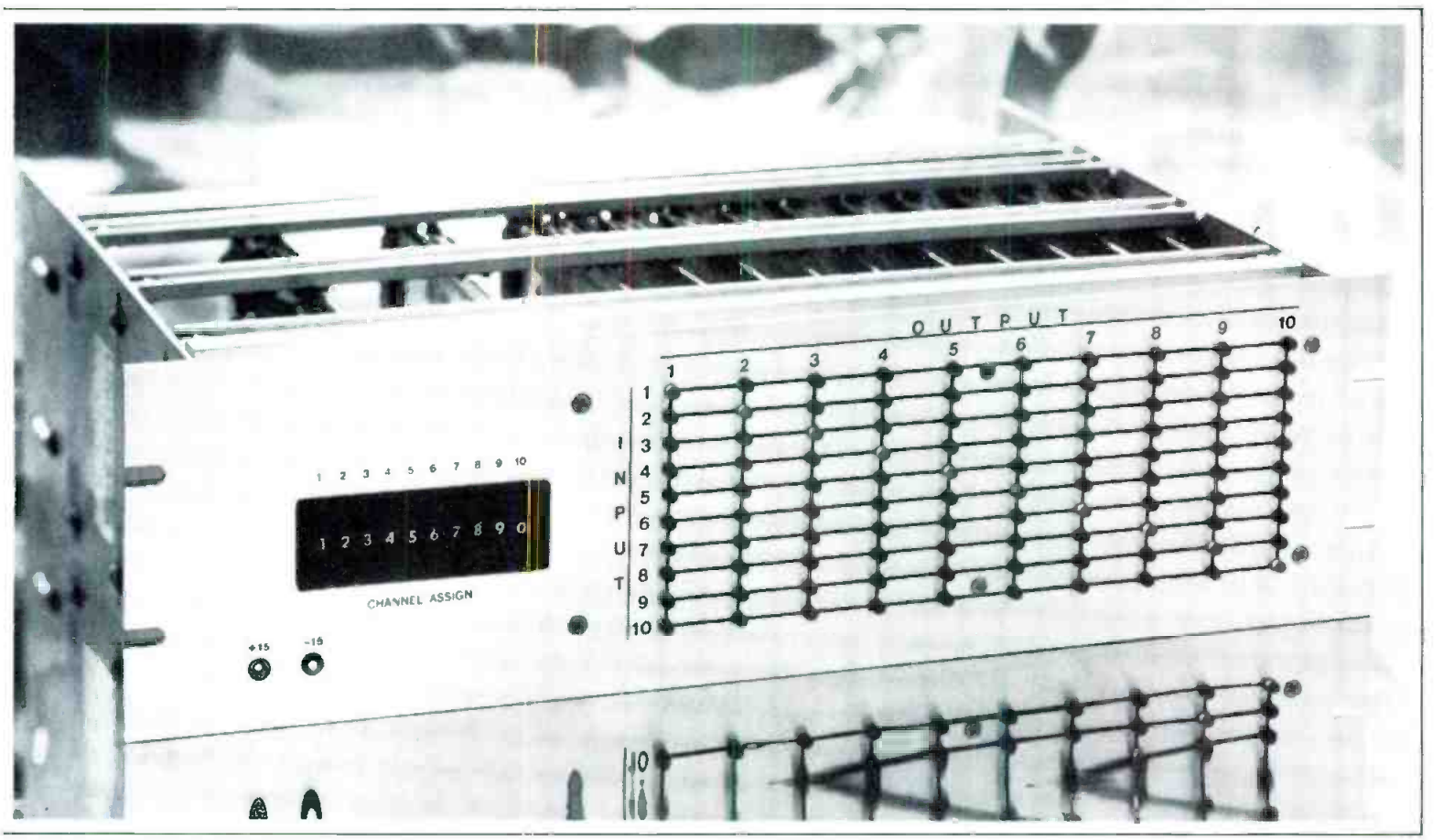

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Table I(c).
Transmitter, amplitude modulation

Manufacturer	Harris Broadcast			LPB	
Model Number	MW-10B	MW-50B	VP-100A	TX2-20	AM-250
Power Output Level	10kW	50kW	100kW	2-20W	25-27W
Frequency Stability (±)	<20Hz	20Hz	5Hz	0.0003%	10Hz
Carrier Shift	<2% at 95%	<2% at 100%	<5% at 100%	<2% at 100%	<2% at 100%
Modulation Capability	125%	125%	100% continuous	125%	125%
AF Response (± dB/Hz)	1/20-10k	1.5/20-12.5k	1/40-10k	1.5/20-15k	1.5/20-15k
Harmonic Distortion	2% at 95%	<3% at 95%	<3% at 95%	1.5% max at 85%	2% max, 95%
AM Noise Figure	– 60dB	– 60dB	– 55dB	– 55dB max	– 55dB max
Power Consumption	28kW	110kW	215kW	90W	2.4kW
Final Amplifier	3CX15000H3	4CX35000C	4CX100,000C	Solid-state	Solid-state
Modulator Final	4CX15000A	4CX35000C	4CX100,000C	Solid-state	Solid-state
Drivers	Solid-state	Tube type	Tube type	Solid-state	Solid-state
Other Models	MW-5B 5kW	.....	.....	TX2-30-TIS	AM-50 55W
	.....	.....	.....	.....	AM-100 110W
	.....	.....	.....	.....	AM-150 165W

Table I(d).
Transmitter, amplitude modulation

Manufacturer	Marconi Communications		McMartin Industries		RCA Broadcast
Model Number	B6034	B6026	BA-5K	BA-50K	BTA-5SS
Power Output Level	50kW	750kW	6kW	50kW	5kW
Frequency Stability (±)	10Hz	10Hz	5Hz	5Hz	3.5Hz
Carrier Shift	4% at 100%	5% at 100%	3% at 100%	2% at 100%	1.5% at 100%
Modu ation Capability	125%	100%	125%	125%	125%
AF Response (± dB/Hz)	1.5/30-10k	1/60-7.5k	1/10-10k	1.5/40-10k	1/20-12k
Harmonic Distortion	3% at 90%	3% at 95%	2.5% at 100%	2% at 95%	3% at 95%
AM Noise Figure	– 59dB	– 60dB	– 60dB	– 63dB	– 60dB
Power Consumption	117kW	1,170kW	3.5kW	106.99kVA	11.4kW
Final Amplifier	(2)4CX35000C	(3)VCP2002	(4)4-1000A	(2)4CX20000A	Solid-state
Modulator Final	(2)4CX1500B	(2)VCP2002	(4)4-1000A	(2)4CX20000A	Solid-state
Drivers	Solid-state	Tube type	Solid-state	Solid-state	Solid-state
Other Models	.....	B6021 500kW	BA-1K 1kW	BA-5K2 5.5kW	.....
	.....	.....	BA-2.5K 3kW	BA-10K 11kW	.....

Continued on page 100

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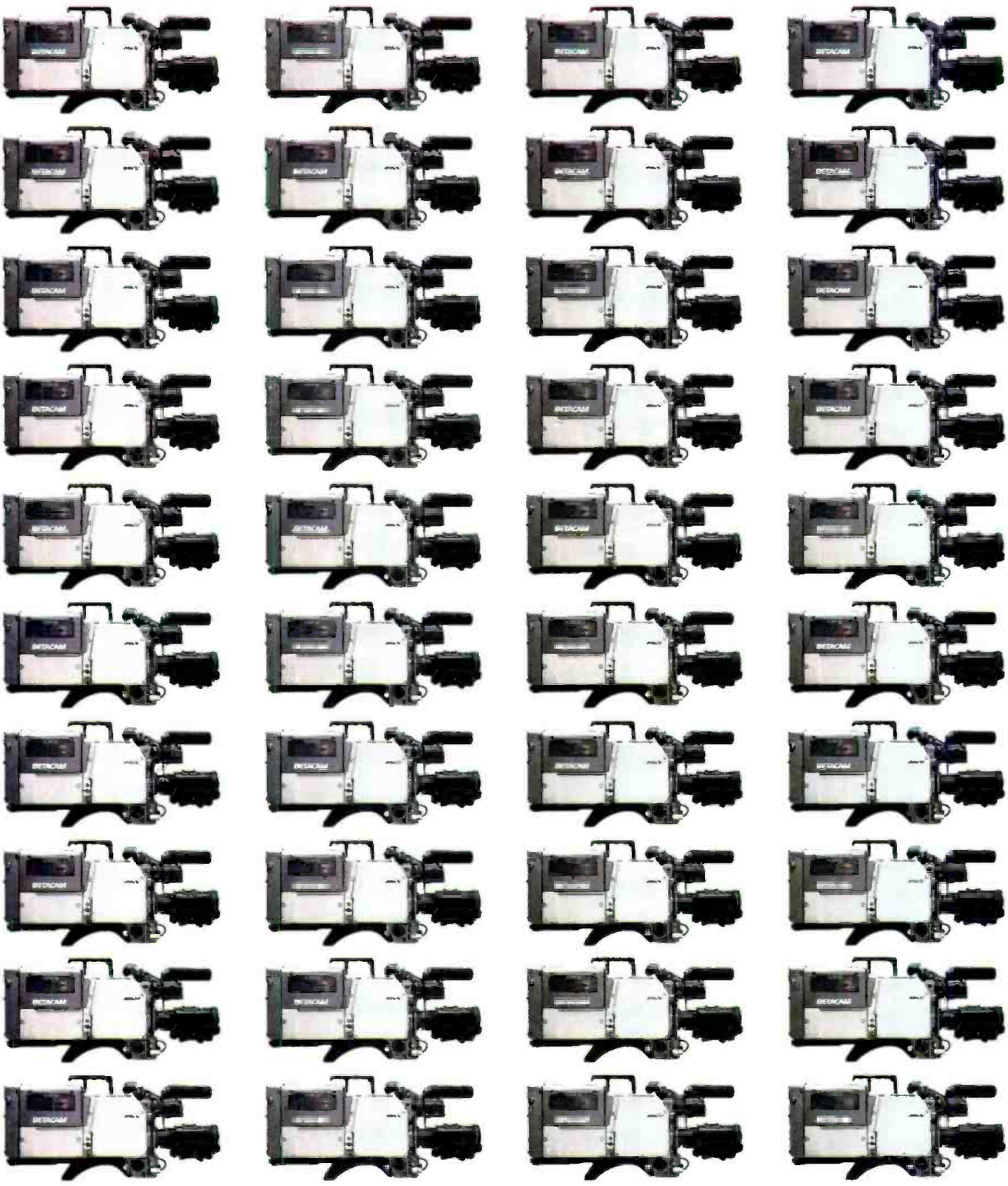

Art Biggs coordinates major engineering purchases for the six Corinthian stations. After careful evaluation of all the ½-inch camera/recorders on the market, he made a multi-million-dollar purchase of the Sony Betacam™ system.

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—Art Biggs, Vice President, Engineering, Corinthian Broadcasting Corporation

"Another Betacam plus is that it's not a patchwork approach. It's a total Sony system developed from the camera to the recorder to the player.

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"I'll definitely be back for more."

For more information on the Sony Betacam system, and there's a lot more to know, contact Sony Broadcast in New York/New Jersey at (201) 368-5085; in Chicago at (312) 860-7800; in Los Angeles at (213) 841-8711; in Atlanta at (404) 451-7671; or in Dallas at (214) 659-3600.

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Continued from page 96

Table I(e).
Transmitter, amplitude modulation

Manufacturer	Sintronic (Singer)		TTC/Wilkinson	
Model Number	**S1-A-5**	**S1-A-10**	**AM-250SS**	**AM-1000B**	**AM-2000C**
Power Output Level	5.5kW	12kW	250W	1kW	26.5kW
Frequency Stability (±)	0.0005%	0.0005%	10Hz	.....	.....
Carrier Shift	2% at 100%	2% at 100%	.....	3% at 100%	5%
Modulation Capability	125%	125%	125%	125%	125%
AF Response (± dB/Hz)	1.5/50-10k	1.5/50-10k	1/50-10k	2/40-10k	1.5/50-10k
Harmonic Distortion	2.5%	1.5%	2% at 95%	3%	3.5% at 95%
AM Noise Figure	– 55dB	– 55dB	– 60dB	– 55dB	– 54dB
Power Consumption	12kVA	22.5kVA	0.5kVA	4kW	65kW
Final Amplifier	4CX5000A	4CX15000A	Solid-state	(2)4-400C	8990
Modulator Final	(2)4CX5000A	(2)4CX5000A	Solid-state	(2)4-400C	(2)4CX10000D
Drivers	Solid-state	Solid-state	Solid-state	Solid-state/tube	Tube type
Other Models	S1-A-1 1.2kW	.....	.....	AM2500B 2.5kW	.....
	.....	.....	.....	AM5000D 5kW	.....
	.....	.....	.....	AM10000D 10kW	.....

Table II(a).
Transmitter, FM broadcast

The RF output impedance is typically 50Ω. Frequency modulation at 100% results in a carrier deviation of ± 75kHz. Values given for monophonic.

Manufacturer	Broadcast Electronics	Continental Electronics	CSI Electronics	Harris Broadcast	
Model Number	**FM-30**	**817R-1**	**T-25-F**	**FMD-50K**	**FM-40K**
Power Output Level	15-30kW	50kW	27.5kW	20-50kW	20-40kW
Feed Line Size	3⅛" EIA	6⅛" EIA	3⅛" EIA	6⅛" EIA	3⅛" EIA
Carrier Stability	± 300Hz	± 500Hz	± 250Hz	± 300Hz	± 300Hz
Modulation Capacity (±)	± 200kHz	100kHz	± 100kHz	± 75kHz	± 75kHz
Audio Input for 100%	+ 10dBm nominal	+ 10dBm nominal	+ 10(± 2)dBm	+ 10(± 1)dBm	+ 10(± 1)dBm
Audio Input Impedance	600Ω bal.	600Ω	600Ω bal.	600Ω bal.	600Ω bal.
AF Response (± dB/Hz)	0.5/30-15k	1/per 7tus curve	0.5/30-15k	0.5/30-15k	0.5/30-15k
Harmonic Distortion	<0.08%	<0.25% THD	0.5% max	<0.2%	<0.2%
Pre-Emphasis	25, 50, 75μs	75μs, other options	75μs	0, 25, 50, 75μs	0, 25, 50, 75μs
AM Noise	< – 55dB	< – 55dB	– 55dB	– 50dB	– 50dB
FM Noise	< – 72dB	< – 65dB	– 65dB	– 68dB	– 68dB
RF Harmonic Suppression	Meets FCC/CCIR specs	> – 80dB	....	Exceeds FCC specs	Exceeds FCC specs .....
Recommended Exciter*	FX-30	Continental 510R-1	EX-20-F	Harris MS-15	Harris MS-15
Power Consumption	50kW	80kW	36kW	ca. 80kW	ca. 60kW
Input Power Requirements	208-240Vac3ϕ	200-250Vac3ϕ	190-460Vac3ϕ	220 or 360-415Vac	208-240Vac3ϕ
Overall Efficiency	.....	62%	.....	62%	66%
Power Factor	.....	0.9	.....	0.95	0.95
Automatic Recycle	Yes	Yes	Yes	Yes	Yes
Final PA Tube(s)	4CX20000A/8990	(2)4CX15000A	3CX15000A7	(2)8990	(2)4CX15000A
Driver Tube(s)	Solid-state	(4)4CX250B	8874	Solid-state	(4)4CX250B
IPA Tube(s)	Solid-state	Solid-state	3CX3000A7	Solid-state	4X150A
Related Models	.....	816R-2A, 21.5kW	T-20-F, 22kW	.....	FM-25K, 25kW
	.....	816R-3, 25kW	FM1200-E, 13kW	.....	FM-20K, 21.5kW
	.....	817R-2A, 40kW	.....	.....	.....
	.....	816R-1, 11kW	.....	.....	.....

Table II(b).
Transmitter, FM broadcast

Manufacturer	Larcan Communications	McMartin Industries	NEC	Singer/CCA	TTC/Wilkinson
Model Number	**FMT 25F**	**BF-55M**	**FBN-7200E**	**FM55000EP/Dual**	**FM30000E**
Power Output Level	25kW	55kW (Dual BF-25M)	20kW	60kW(2xFM27500E)	30kW
Feed Line Size	3⅛"	6⅛" EIA	3⅛"	6⅛" EIA	3⅛" EIA
Carrier Stability	± 350Hz	± 500Hz	± 500Hz	0.0005%	± 1kHz
Modulation Capacity (±)	± 100kHz	± 150kHz	± 100kHz	± 100kHz	± 150kHz
Audio Input for 100%	+ 1.5, + 13.5dBm	– 10(± 2)dBm	– 10, + 12dBm	+ 10(± 2)dBm	+ 10(± 2)dBm
Audio Input Impedance	600Ω	600Ω bal.	>2000Ω bal.	600Ω bal.	600Ω
AF Response (± dB/Hz)	0.5/30-15k	0.5/30-15k	0.3/30-53k	1.5/75μs curve	1/50-15k
Harmonic Distortion	0.4%	<0.3% THD	<0.5%(– 46dB)	<0.5%	0.5% THD
Pre-Emphasis	0, 75μs	75μs standard	50, 75μs	50, 75μs	75μs standard
AM Noise	– 61dB	< – 55dB	< – 50dB	< – 50dB	– 55dB
FM Noise	– 67dB	< – 65dB	< – 63dB	< – 60dB	– 65dB
RF Harmonic Suppression	– 80dB	.....	< – 70dB(1mW)	< – 80dB	.....
Recommended Exciter*	S3161-C	BFM-8000	HPA-4536B	FM-40E	FME-10
Power Consumption	37kVA	98kVA	35kW	87kW	45kW
Input Power Requirements	208-240Vac3ϕ	208-240Vac3ϕ	220, 306-440Vac3ϕ 50Hz	220Vac3ϕ	208-240Vac3ϕ
Overall Efficiency	.....	.....	.....	.....	.....
Power Factor	0.95	.....	>0.9	.....	0.9
Automatic Recycle	Yes	Yes	Yes	Yes	Yes
Final PA Tube(s)	8985	(2)3CX19000A7	4CX15000A	(2)3CX20000A7	8990
Driver Tube(s)	Solid-state	(2)3CX1500A7	Solid-state	Solid-state	Solid-state
IPA Tube(s)	Solid-state	(2)4CX250B	Solid-state	(2)5CX1500A	4CX250B
Related Models	FMT 15F, 15kW	BF-25M, 27.5kW	.....	FM16000EP,18kW	FM25000E, 25kW
	FMT 10F, 10kW	BF-30M, 30kW	.....	FM24000EP, 26kW	FM 20000E, 20kW
	.....	BF-10M, 15kW		FM40000EP, 44kW	
	.....	.....		FM 20000E, 22kW	.....

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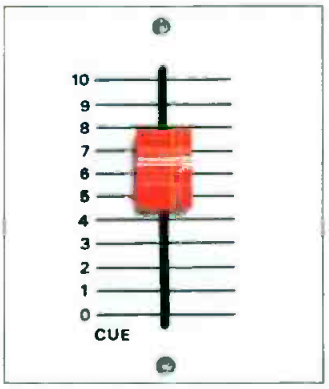

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Studio renovation

By Jerry Whitaker, chief engineer, KRED/KPDJ, Eureka, CA

It is not too difficult to construct a first-class production or on-air facility when you have got plenty of money with which to work. More often than not, however, that is not the case. The suggestions outlined in this article will help produce a quality installation, without breaking your budget. The mark of a good engineer isn't necessarily what you've got, but what you do with what you've got.

The place to start in planning a renovation project is at the operating position. Spend some time in the operator's chair; run the shift yourself. Make note of what is well-placed, and what is not. The cart rack should be near the cart machines, not on the other side of the console. Are source machines laid out in a logical manner? Are audio console inputs grouped to provide a minimum of channel input switching? Is there a standard reference point for the mixer pots that will provide a good level in most cases?

After 10 or 20 hours on the board, draw up a plan and pass it around to management and the operators. Ask for comments and see if some compromises need to be worked out. Once a plan has been finalized, set it aside for several weeks. When you go back to it, see if it still seems like a good layout.

Equipment layout at KRED-AM. Source machines are arranged to be within arm's length of the operator.

I went through a stack of proposals before finally deciding on a new arrangement for our AM control room. The final plan was far removed from the original, which would have cost more, been more difficult to build and taken more time.

Part of the planning must include connection trees, cabling and access to equipment. Install console and source machines so that they can be serviced while in operation. Preferably, allow an access path to the rear of equipment that is separated from the operator's area. This allows maintenance to be performed while the studio is in use. Carefully planning the cable runs and connection tree placement leads to a neat and efficient installation.

There are a couple of alternatives to the usual *Christmas tree* terminal block. I personally prefer this method, but a barrier strip panel or the newer Telco push-in block will perform equally well. I've used barrier strip panels for terminal connections in the past, but they require quite a bit of space and cost can get out of hand. In addition to the barrier strips themselves, you must add the cost of the somewhat expensive insulated terminal connectors and many hours of tedious work. Telco blocks provide a fast, neat and easily modified terminal. These blocks, however, cannot be easily used with larger sizes of wire, such as the popular Belden 8441 2-conductor shielded cable.

Consider running multiple shielded cables, such as the Belden 8766. This type provides 15 individually shielded audio pairs. The cable is expensive, but is much less costly and more convenient than stringing 15 individual audio pairs. For cable runs between studios or equipment racks, always run spare pairs. No matter how much long-range planning you do before installing cable runs, it will not be many months before you run out of lines and have to string more cables.

An access path of at least 18 inches should be left behind the control room equipment to allow servicing.

In addition to audio cables, I always install at least one 15-pair control cable between each studio or rack. These lines are useful for remote control, intercom and switching uses.

Although more expensive initially, it is always cheaper in the long run to buy cable in large quantities. One thousand feet of 8441, for example, may cost about $150, but 10 100-foot rolls could cost $199. One thousand feet of audio cable will go fast, so don't underestimate your needs.

The importance of documentation cannot be overemphasized. A master schematic showing audio and control signal flow will aid you, and your successor, in figuring out how the system is put together. An accurate and complete list of cable number codes should be prepared and kept in the files.

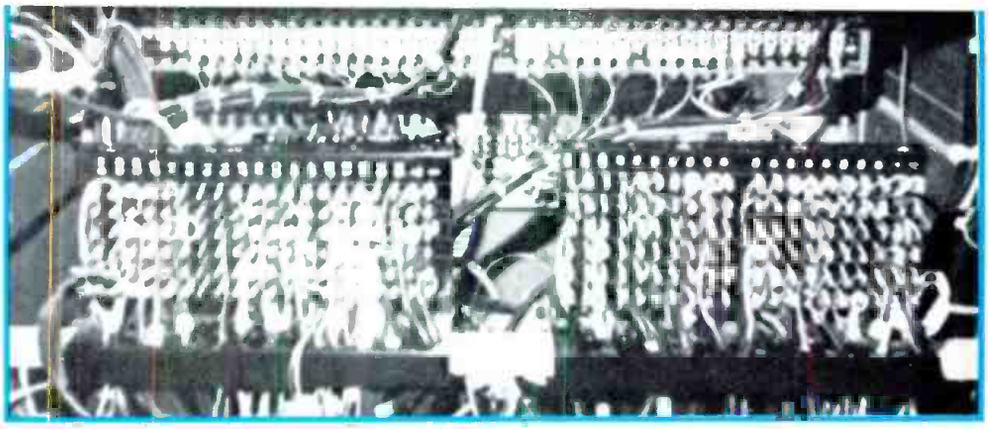
Establish a standard reference output level for all sources, usually 0dB. If your audio console has bridging in-

puts, make sure the sources are terminated with a proper resistor (620Ω in most cases). Place microphone-level cables apart from control or ac lines. It's much easier to wire a studio right the first time than it is to modify the system later because performance is unacceptable.

Plan a station grounding system using heavy gauge wire (#6 or larger) if the studio is not in an RF field. If RF is present, use a wide ground strap, 3-inch minimum. This strap should run from the transmitter and tie all racks and studios together. Establish a main station ground point (the transmitter ground connection will do nicely) and branch out from it to the other equipment rooms. In each room or group of racks, establish a local ground point and branch out from there to the equipment. Use a separate ground cable, #14 or larger, for each piece of equipment. Do not rely on the input or output audio cable shield to provide grounding for the unit. Audio cables should be grounded at one end only, the load end. For example, the output cable from a tape deck should be grounded at the audio console. The input cable to a tape deck should be grounded at the tape deck. (See Figure 1 and Figure 2, pages 104 and 106.)

The ac line ground connection presents a built-in problem. If you ground a piece of equipment through the chassis to the equipment room ground point, once you plug it in (with a 3-prong plug) you've created a ground loop. A solution would be to use a ground adapter plug (3-prong to 2-prong) and separately ground the equipment, with a wire size at least as large as that used for the power line, to the ground point of the room. At the power distribution panel, tie the ground connection to the main station ground point. When doing this, check each piece of equipment before connecting it to the ground point to make sure a fault in the unit does not cause current to flow through the ground connection.

Some equipment includes small capacitors (0.01 to 0.001μf) between each ac line and ground to clip transients and prevent noise generation. I have never been fond of these, and if you have a particularly tough RFI problem, you might consider removing them. In the proper locations with a marginal ground system, they may cause ground currents to circulate, due to the fact that the neutral line is tied (in most cases) to ground at the power distribution panel. An alternative to removing the capacitors would be use of an isolation transformer to provide a balanced ac line with respect to ground to feed the equipment. RFI line filters are commercially available, but they should be



Use of Christmas Tree terminal blocks makes for a neat and easily modified installation.

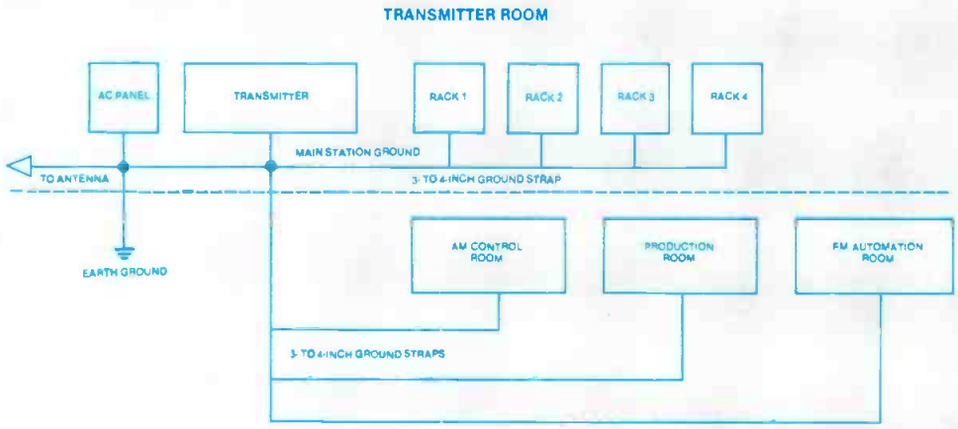


Figure 1. Grounding system layout for radio station with local transmitter.

used as a last resort. Try to locate the problem and eliminate it first.

Protection against transients on the ac power lines should be provided at the utility company service entrance and at any noise generating equipment. This includes power relays for blowers, heavy load switchers and so forth. Examples of transient suppression for a typical studio environment are shown in Figure 3. The Dale transient suppressor is a sparkgap type of unit that is effective in protection against lighting and high level transients. The MOV (metal oxide varistor) device consists of a pair of voltage-dependent, symmetrical resistors that perform similar to back-to-back zener diodes in circuit protection. When exposed to a high energy voltage transient, the varistor impedance changes from a high standby state to a low impedance, thus clamping the spike. The thyrectors perform in a similar manner. The capacitor presents a high reactance at 60Hz and, in effect, is out of the circuit. A typical transient on an ac line is made up mostly of high frequency components, so the capacitor reactance will drop, depending on the frequency of the spike, and shunt the energy to ground. At KRED/KPDJ, the four device types are used in parallel, as shown in Figure 3 (page 107), to take advantage of their various characteristics and to provide mutual backup for one another.

Other considerations for studio renovation include laying out the ac power distribution panel to provide for logical and convenient switching of line voltages. Install separate breakers for each studio, for fans and blowers and for each rack or group of racks (depending on the current requirements of the equipment). This will allow you to drop power to a particular studio for service work without affecting other operations. If one breaker feeds a couple of studios and the program director's office, for ex-

Shown in the KRED-AM control room is Dan Hoff, program director at KRED/KPDJ.

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ample, service of hardwired ac equipment can be difficult.

Through careful studio layout and planning, many headaches and costly delays can be avoided. The initial investment in time and money can be substantial, but in the end you'll have a system that is versatile and reliable.

Checking source equipment

Pull each piece of equipment, one at a time, and check for adherence to specifications. There is no reason why all the source equipment in a studio, if properly maintained, should not be able to meet the new equipment specifications for frequency response, distortion, noise, wow and flutter, etc.

The first step in maintaining equipment in good repair is to have the proper tools. For cart machines and tape decks, two audio voltmeters, an audio generator and an oscilloscope are required to properly setup a 2-channel unit. High quality, industry-standard test tapes for reel-to-reel and cart machines are a must. Ideally you should have two sets of test tapes: a working set and a file set. Periodically compare the working set with the file set to determine if use of the working set has degraded the tape. For turntables, a copy (again preferably two copies) of the NAB standard reference test disc is a necessity, as is a stroboscope-type speed disc.

Establish minimum acceptable performance limits for all of the source equipment. Typical outside limits would be frequency response ±3dB, 50Hz-15kHz; distortion below 1%; noise below −50dB, wow and flutter equal to new equipment specifications.

Before running performance tests, clean the unit and demagnetize the tape heads. Never put a standard reference test tape onto a dirty machine.

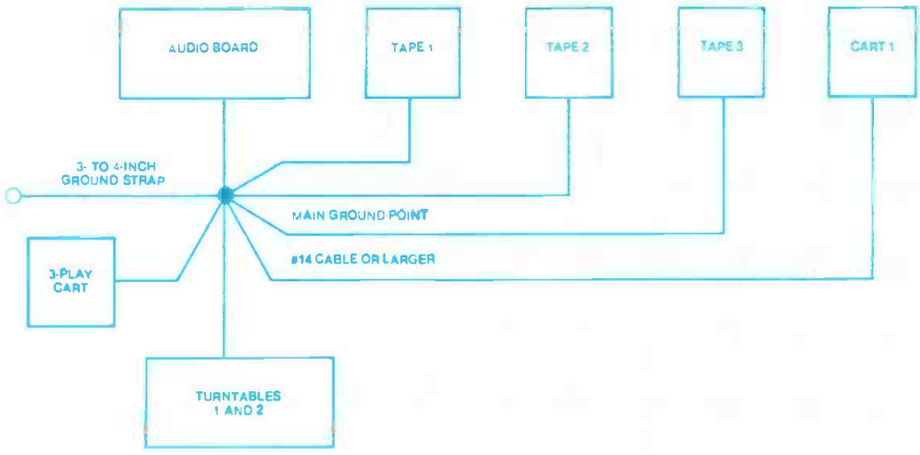


Figure 2. Ground system layout for individual equipment rooms.

Reel-to-reel

Make a visual inspection of the tape path over the heads. An equal amount of the head face should be visible on the upper and lower sides of the heads. The head face should be perpendicular to the deck surface. Variations from 90° will cause increased head wear and poor performance.

Align the playback section of the tape deck first. On 2-track machines,

feed the left channel into an audio voltmeter and into the vertical input of an oscilloscope. Feed the right channel into a second audio voltmeter and also into the horizontal input of the scope. (See Figure 4, page 110.) Polarity inversion available in some oscilloscopes will display the signals 180° out of phase, when they are actually in phase. If this is the case, reverse the polarity of the horizontal channel input.

Find the 16kHz section on the test tape and adjust head azimuth for simultaneous peak outputs on each audio voltmeter and a correctly phased display. Several high points may be found, but take the one with the peak response and 0° phase shift. Equipment manuals should be consulted for any special procedures.

Once the reproduce head has been aligned, run through the frequency response bands and check for uniform output. Resist the temptation to adjust the electronics equalization to provide the same output at 10-15kHz as the reference (generally 700Hz or 1kHz). On many machines, equalizing 10kHz to the reference will result in a 1-2dB bulge around 5kHz. A tape deck, when set up this way, will meet new equipment specifications, but when used as a production machine, problems begin to crop up. After several generations, the 2dB boost at 5kHz will turn into 4dB or 6dB, resulting in an annoying tinny sound. Much better performance will be achieved by holding the frequency response flat (within 0.5dB) from 1-8kHz, allowing the high end (above 8kHz) to droop a couple of decibels. This will result in a much cleaner production sound when a number of generations are required. All test tapes include a NAB standard reference level output. Make note of that level, for it will be used later to adjust the record drive.

When the reproduce system is within specifications, alignment of the record head can proceed. Feed 15kHz into the recorder at 10dB below normal operating level. While monitoring the output of the two channels as outlined above, adjust the head azimuth for peak response with proper phasing. When that point has been found, check the phasing at other frequencies (1kHz, 5kHz, 10kHz) to be certain that

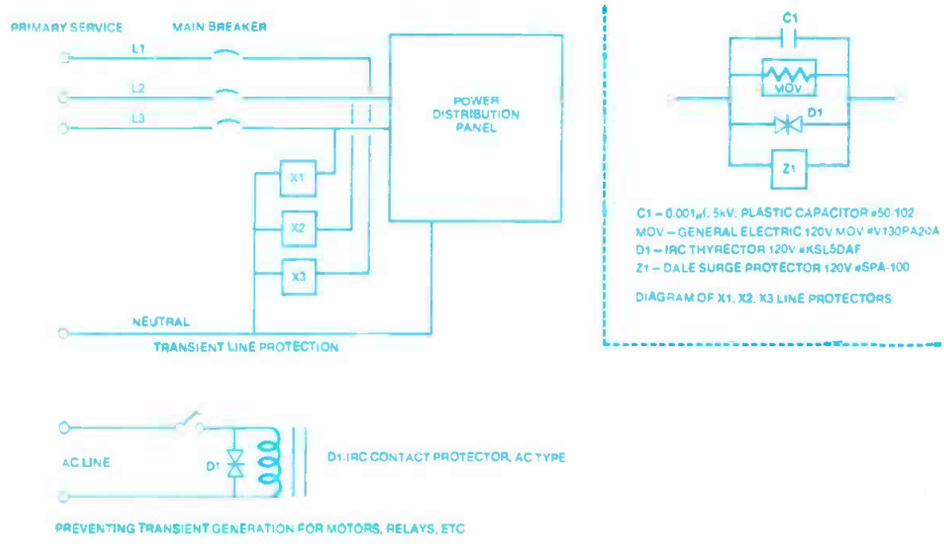


Figure 3. Methods of suppressing transients on the ac power line.

no phase reversals occur.

When adjusting the azimuth on either of the two heads, it may be noted that the point of peak audio output and 0° phase shift do not occur simultaneously. This is due to *gap scatter*, a non-colinearity of the gaps of the individual channels of the tape head. If, for example, the top channel gap is mechanically offset (through manufacturing tolerances) a small amount from the bottom channel gap, it will be impossible to achieve both peak audio output and 0° phase shift because the head will have to be tilted a small amount to zero out the phase difference. This will result in reduced high frequency output from one or both channels.

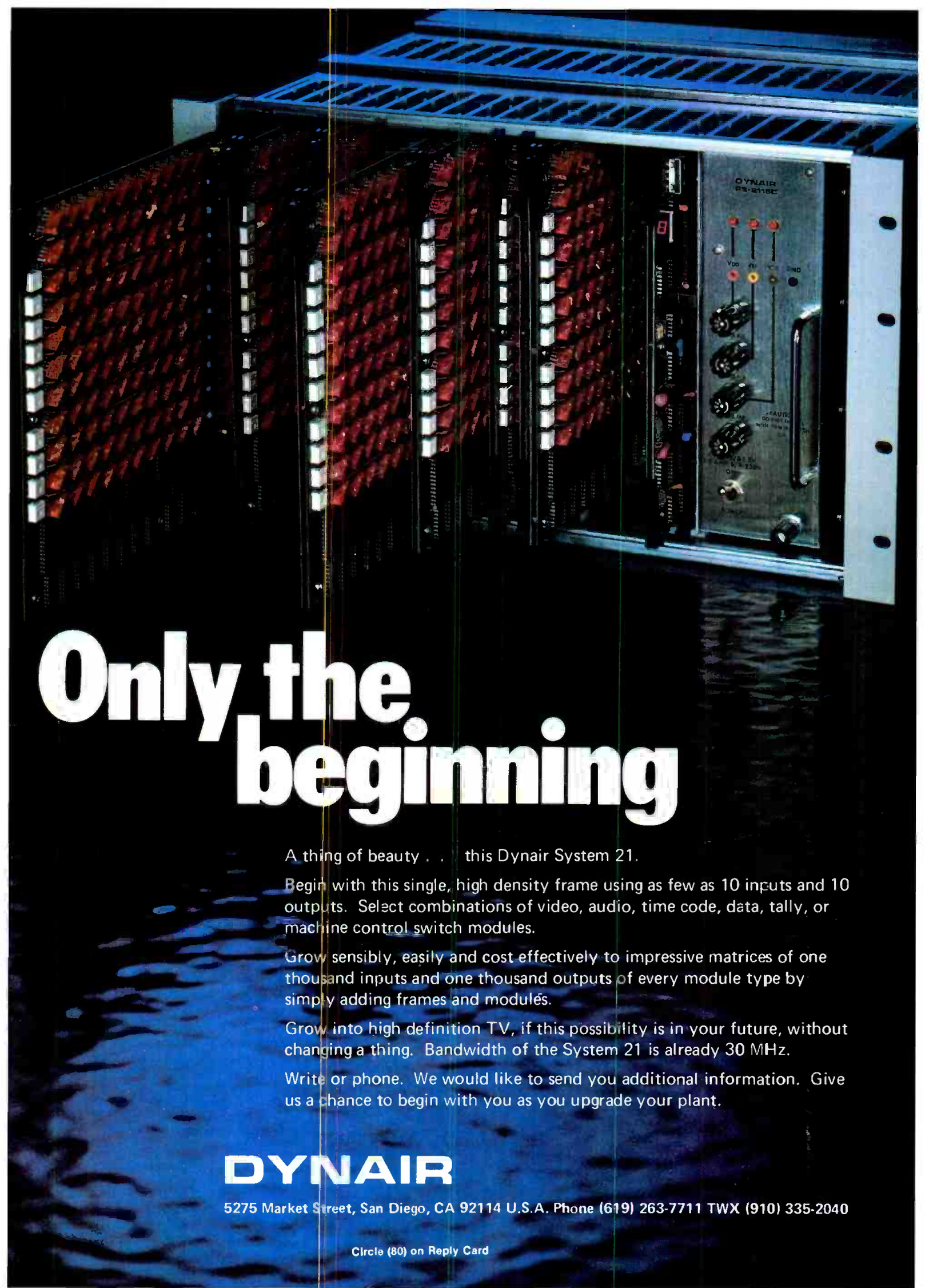
The high frequency equalization adjustment must then be used to compensate for the high end droop, leading to a *peaky*, less uniform high frequency response. The amount of equalization needed to compensate for gap scatter is small, generally 0.5-1dB at 15kHz.

The next step in recorder alignment is to set the bias level. Consult the equipment manual for this adjustment, because it differs from one type of unit to another. Next, set the record drive level. While recording 1kHz at normal operating level, adjust the drive to give the same output as was recorded with the alignment tape standard reference level. Next, proceed with the frequency response measurements and adjust the record channel equalization for flat response, keeping in mind the 5kHz bump problem outlined previously.

Wow-and-flutter measurements require special instruments and the equipment manuals for that test gear should be consulted for correct procedures.

When performing alignment and electrical adjustments on reel-to-reel and cart recorders, always use a typical production tape or good quality cartridge. Optimum record bias will vary from one type of tape to another. It is important to set up the unit with a

Locate any equipment that generates appreciable heat or noise outside of the studio area.



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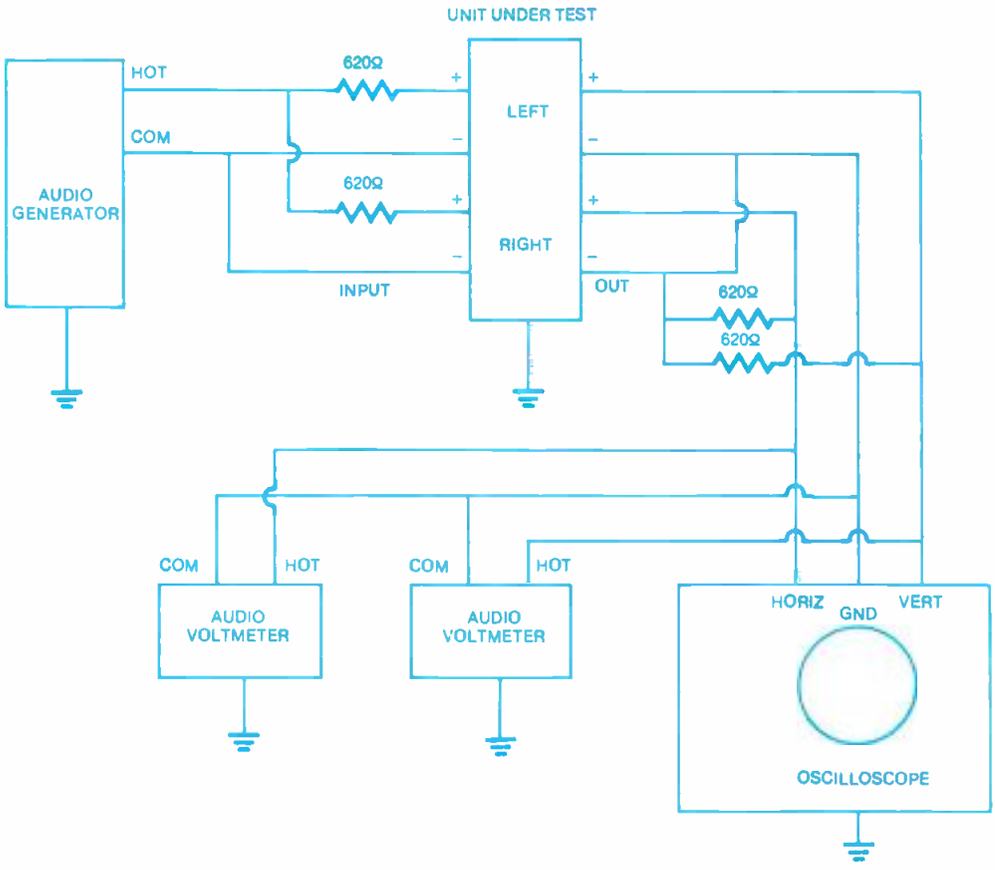


Figure 4. Tape deck alignment test setup.

commonly used type of reel or cartridge material.

Cartridge machines

Proper alignment and maintenance of cartridge machines involves several test devices. A right angle zenith gauge is helpful if head replacement is to be accomplished with a minimum of trouble. This device is a precision 90° square, designed for a reference when setting the cartridge head zenith and height. A head insertion gauge simplifies accurate setting of the head penetration into the cartridge. The device shows the minimum and maximum penetration given by NAB standards. Tape guide height should be checked using the gauge recommended by the tape deck manufacturer. These guides rarely need readjustment, but should be checked from time to time.

A standard spot frequency calibration cartridge is used to align and equalize the playback system of the cart machine. The procedures outlined for reel-to-reel decks apply equally here. Alignment and setup of the record electronics also follow along the same lines as those for reel decks.

A useful alignment cartridge is a fast sweep calibration cart. This gives

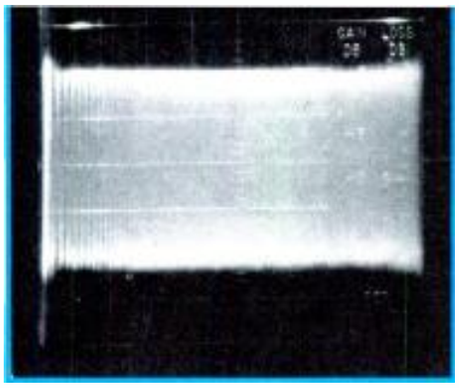


Figure 5(a). Sweep pattern with correct equal zation.

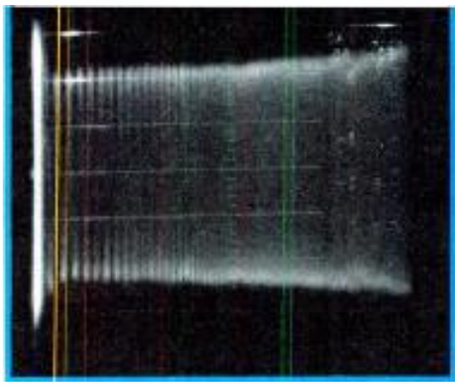


Figure 5(b). Sweep pattern with too much high frequency equalization.

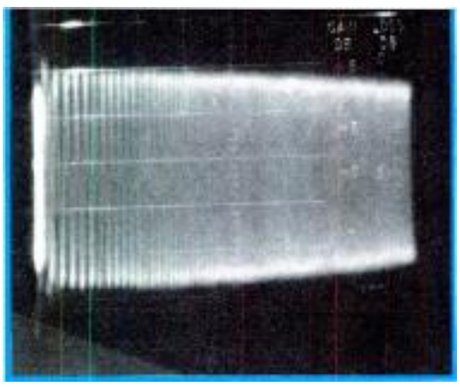


Figure 5(c). Sweep pattern with too little high frequency equalization.

a 500Hz-16kHz sweep with a start pulse for triggering an oscilloscope. Properly aligned and equalized, a cartridge reproducer will provide a uniform output across the band when displayed on a triggered oscilloscope, as shown in Figures 5(a), 5(b) and 5(c). Such a tape provides a convenient check of equalization without the need for waiting through the entire spot frequency cart. A sweep tape is particularly useful when checking the performance of multicart playback machines, such as the IGM Instacart. It would take hours to check all 48 trays with a spot test tape, but by using the sweep tape, the time is reduced substantially.

Some words of caution about reel-to-reel and cartridge test tapes. All magnetic recordings are subject to the effects of magnetic fields, such as those produced by motors. Care should be taken to keep the tapes away from such fields, as well as from temperature extremes.

Cartridge and reel-to-reel alignment tapes are made to exacting specifications. However, no two are *exactly* alike, so all head alignment should be done with a single standard. As a test tape wears, output levels on the high frequency bands will decrease, resulting in overequalization if the work tape is not compared from time to time with the file tape. Both tapes, by the way, should be made by the same company to minimize inherent differences.

It is important to know the manufacturer's theory of test tape generation when comparing the work and file standards. One company may produce the alignment tape to give a flat response from the first time it is used. Another manufacturer, on the other hand, may put a slight boost in the high end frequency bands to compensate for the drop in response that results from a certain number of passes across a tape head. If this is the case, a correction factor will need to be considered when comparing the work and file tapes.

Multiple playback decks, such as the IGM Instacart (shown) can add a great deal of flexibility to either an automated or live-assist operation.

Turntables

The stroboscope-type turntable speed test disc provides a convenient and reliable indication of turntable accuracy. Any speed variation of more than 2% from normal will be audible on most recordings. Many turntables have an idler wheel pressure adjustment that will have a definite effect on speed. Consult the equipment manuals for proper adjustment procedures.

Stylus replacement is the maintenance most often required for turntables. Always be sure a good quality stylus is in place before playing a test disc. Also, check the tonearm for alignment with the platter. In many cases, this is adjustable. Stylus pressure should be set for the value recommended in the literature accompanying the needle.

The NAB test record includes a monophonic 1kHz standard reference level, wow-and-flutter test and frequency response test. The stereo-

Careful layout and planning of a studio renovation project will save time and money when construction actually begins.

TELCO 1	TELCO 2	TELCO 3	EBS ALARM	AM SILENCE	AM TRANS	FM TRANS	FM SILENCE	SCA CARRIER	WARNING DEFEAT	RPU	INTERCOM PTT
TAPE 1 STOP	TAPE 2 STOP	TAPE 3 STOP	CART 1 STOP	CART 2 STOP	CART 3 STOP	CART 4 STOP	CART 5 STOP	TURN 1 STOP	TURN 2 STOP	INTER STA 1	INTER STA 2
TAPE 1 START	TAPE 2 START	TAPE 3 START	CART 1 START	CART 2 START	CART 3 START	CART 4 START	CART 5 START	TURN 1 START	TURN 2 START	INTER STA 3	RESET INTERCOM

CHANGE NEWS			FIRE TRANS	FIRE SHOP
CHANGE CART			FIRE FM	FIRE GEN
UPDATE WEA			CALL 1	CALL 2

Figure 6. Layout of remote control and status alarm panel.

One of the three remote control-status panels custom-built for KRED/KPDJ.

phonic side of the record has a phase-and-balance test, spot frequency test, separation test and level check. Equalization for a turntable preamp may be fixed, but check the print to be sure.

As part of any studio improvement effort, tests should be made on the performance of the audio control board. Conduct frequency response, distortion, noise and crosstalk measurements, comparing them to new equipment specifications to determine if servicing is necessary. If the attenuators on the board have removable covers, clean them and check for any dirty contacts on the channel input key switches.

In nearly all cases, the original specifications for source machines can be maintained throughout the life of the unit. With regular maintenance and the proper tools, this can be easily accomplished. The adjustment procedures outlined in this section apply to most, but certainly not all, source machines. For this reason, your unit's instruction manual should be consulted before attempting any adjustments.

Control and status

At KRED-KPDJ, as new equipment and features were added over the years, the status indicators and remote controls began to get out of hand. EBS and RPU lamps were in one spot. FM system alarms were tacked on somewhere else. The telephone talk show ready lights were mounted on the wall. The remote start switches, installed five years ago, were wearing out. Then there were the new features we wanted to add, but didn't have room to install.

The solution to these problems was to consolidate all remote control and status indicators into one large, conveniently located panel consisting of lighted push-button switches. The result is shown in Figure 6.

The *Telco 1*, *Telco 2* and *Telco 3* lamps signal which telephone lines are ready to go on-the-air for our talk show program. The *EBS* indicator will blink at a 1Hz rate when the EBS receiver is activated by a 2-tone transmission from the station we monitor. The *AM Silence Sense* and *FM Silence Sense* alarms signal when modulation of either system drops below a preset level for a certain length of time. The *AM Transmitter* and *FM Transmitter* alarms are activated by a loss of carrier. The *SCA Carrier* lamp signals loss of the SCA carrier. The *Silence Sense*, *Transmitter* and *SCA alarms*, in addition to lighting their respective lamps, trigger a Sonalert device that can be defeated by a switch near the remote control panel. This is done at sign-off to prevent the Sonalert from beeping through the early morning hours. When the Sonalert is defeated, a lamp labeled *Warning Defeat* is lit.

An intercom system ties the control room with other parts of the building.

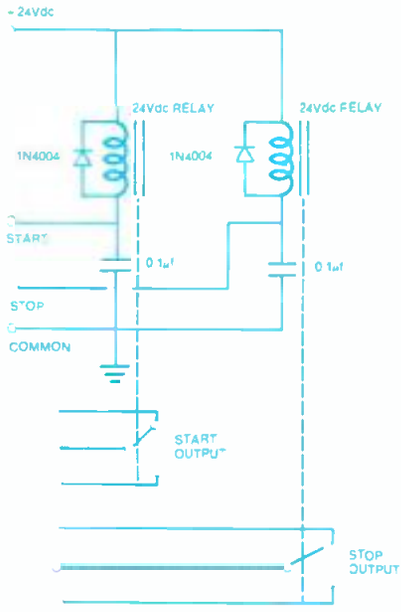


Figure 7. Source control unit.

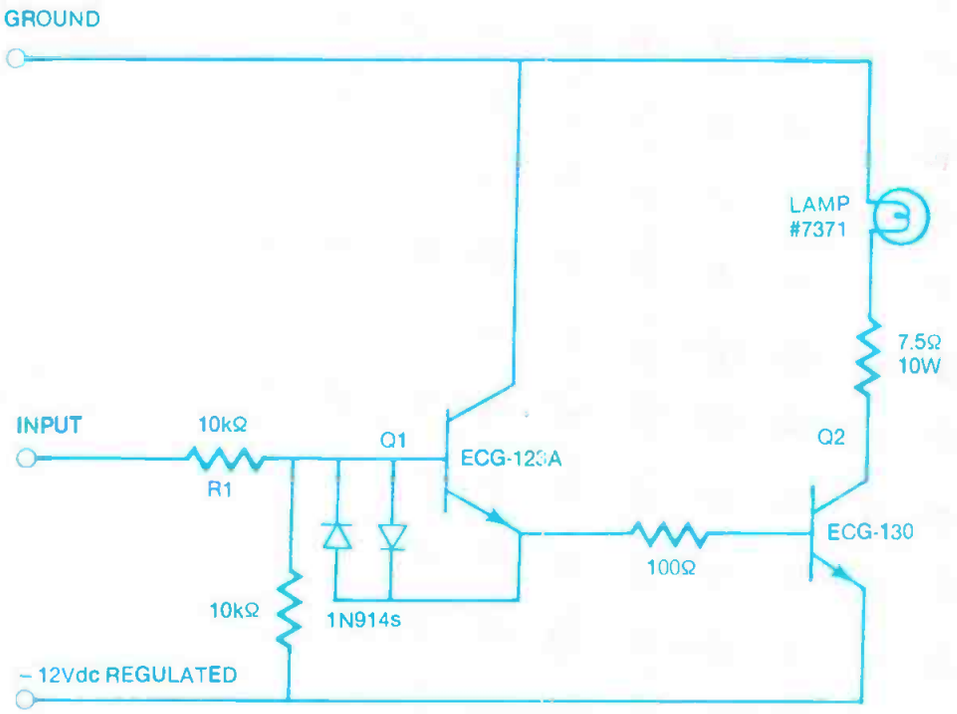


Figure 8. Status and alarm lamp driver.

The *Intercom 1*, *Intercom 2* and *Intercom 3* buttons select the remote station desired. The *Reset* button clears the intercom, and the *Intercom PTT* is the push-to-talk button for the system.

The remainder of the buttons on the main control panel are remote starts and remote stops for the 10 source machines used in the KRED-AM control room. The *Stop* light indicates the ready state (cart loaded, tape tension arm up, etc.) The *Start* light will come on when the source is in the run state.

Other machine control functions and status alarm indicators in the AM control room are contained on another panel. The matrix includes a fire alarm system readout that monitors four locations: the AM transmitter room; standby generator room; engineering shop; and FM automation system room. An alarm from any of these points activates the Sonalert and lights the respective lamp. After-hours call lamps alert the operator if someone is at either of two outside doors. Reminder lamps tell the operator to change the FM news cart, update the weather or change a cart on the FM automation system. These are activated by real time commands programmed into the automation system memory. Six other switches are uncommitted, for further expansion.

The system of two panels gives our operators the ability to monitor the status of the AM and FM systems, as

well as control source machines in the air studio from one central location.

The remote *Start* and *Stop* buttons control relays that perform the actual machine switching action. Other methods of interfacing were considered, such as solid-state relays or transistors, but were rejected because of the high cost (in the case of solid-state relays) and interfacing difficulty (in the case of transistors). Over the years, relays will require some maintenance in the form of contact cleaning, but this has proved to be only a minor problem in our system.

The status lamps are all driven by transistor buffer amplifiers, resulting in light loading on the source machines and small current through remote status relays.

In all, the system contains 39 4PDT plug-in relays, 64 transistors, nine integrated circuits, about 100 resistors and 50 capacitors. A representative diagram for a single source remote control is shown in Figure 7, and a typical remote status-alarm is shown in Figure 8.

The relay interfaces are self-explanatory, as are the lamp driver amplifiers. The devices shown handle loads greater than 1W continuously without externally heat sinking Q2. Power for the system is provided by a central ±34V supply that also feeds several other pieces of equipment in the AM control room. The lamps are fed from a separate −12V supply rated for 15A. Operating the lamps from the negative supply allows remote status indicators to be activated by grounding of the alarm sense line.

The alarm state detectors for the *AM Silence Sense* and *AM Transmitter* functions are contained in the AM modulation monitor. Optional cards in the monitor provide contact closure in the event of a fault. Likewise, the alarm state detectors for the *FM Transmitter*, *FM Silence Sense* and *SCA Carrier* functions from the three FM monitors use optional cards. The

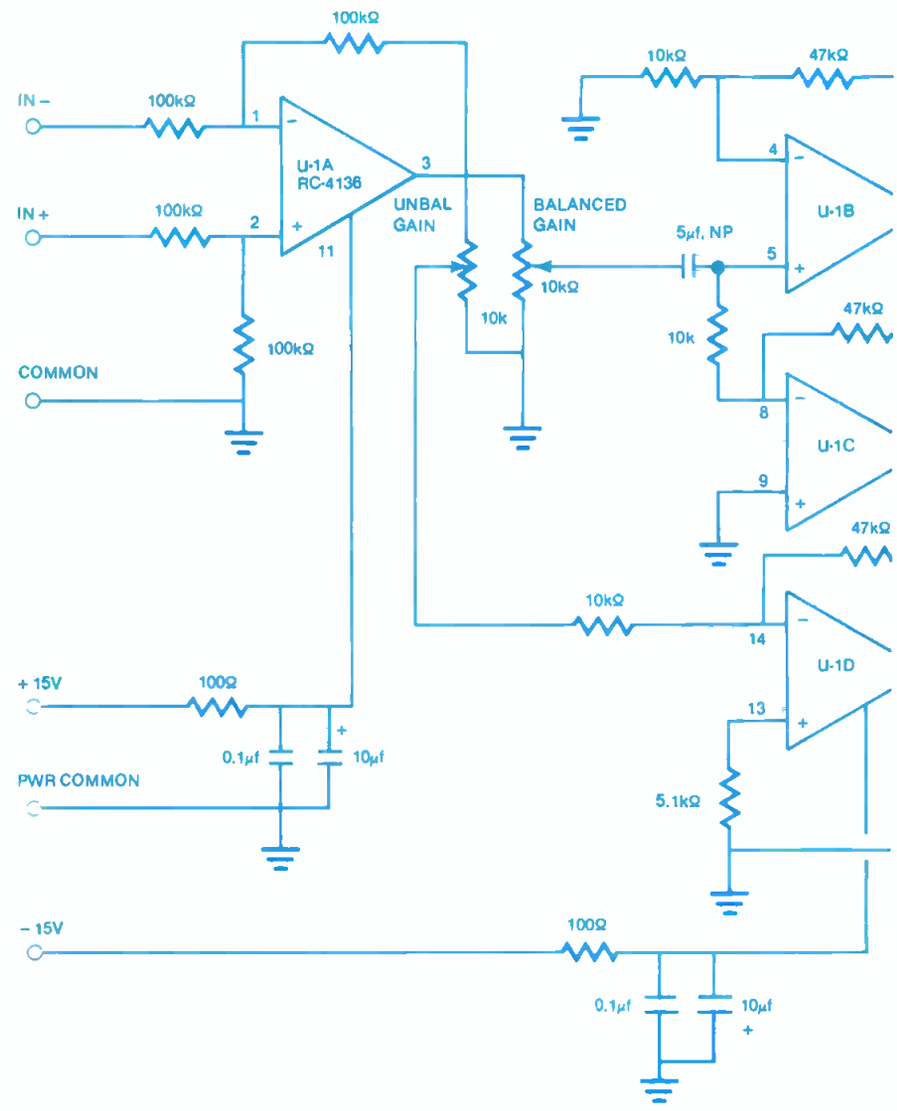


Figure 9. Buffer distribution amplifier.

Fire Alarm system uses standard high temperature sensors to determine an alarm state.

The reminder lamps (*Change News, Update Weather, Change Cart*) are latched on under software command from the FM automation system. The selected lamps remain lit until the respective button (*News, Weather, Cart*) is pushed. Relay logic achieves the latch-on, reset function.

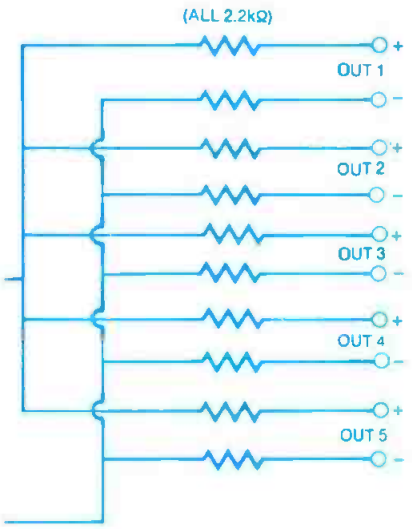
A simple tape deck sequencer is included as another feature of the system. When activated, the three music tape decks in the AM control room sequence automatically from one to another upon receipt of end-of-message tones. This allows increased *walk-away* time for the operator when changing tapes, taking transmitter log readings, etc. When the sequencer is activated, the remote *Start* and *Stop* lamps for the three tape decks are blanked, as a reminder that the system is on-line.

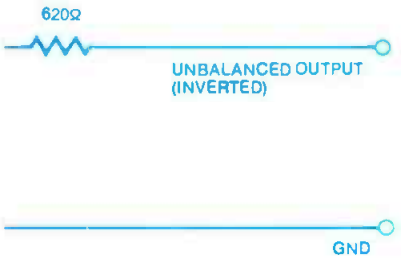
The intercom is a conventional design with a pair of IC amplifiers driving the speaker-talkback arrangement. Balanced lines run to each remote speaker to prevent RF pickup.

There are a number of different methods that could be used to implement such a status and control system. The arrangement described here relies chiefly on relay logic and discrete transistor lamp drivers, however. Depending on what parts a particular station has on hand, a totally different system could evolve. If I were to build this type of remote control unit from scratch now, I would likely use CMOS logic and open-collector IC drivers to interface the system to the source machines and to drive lamps. Whatever method might be used, a well-thought-out remote control and status board will improve operator efficiency and minimize response times to any problem that might develop at the station.

Audio interface

Distribution and isolation of audio input and output signals in a studio are two of the more important, and sometimes least planned, parts of a production facility. Single-source outputs to single-control board inputs





IONS:
T: +22dB (UNLOADED)
dB: BELOW 0.5%
±2dB: 20Hz-20kHz
OW 60dB

present no interfacing problem, provided the levels and impedances match. However when an audio source is fed to several inputs, perhaps in different studios, problems can crop up.

Isolation is the key to eliminating troublesome operation peculiarities. A net source, for example, feeding two studios and a patch panel or two without a distribution amplifier, may be a problem looking for a place to happen. When patching the net source to or from some point at the patch panel, momentary short circuits will probably occur, dropping the feed to other studios. Switching more than one console input onto the net line at a time may result in a drop in source level. A much more logical solution is to feed the net into a distribution amplifier providing isolated outputs. If one line is shorted out or loaded, the other lines are unaffected. Distribution amplifiers are available from a number of manufacturers at a variety of prices.

An alternate solution would be to build your own distribution amplifier system. Figure 9 shows a typical 1-in/5-out distribution amp. The circuitry is simple and straightforward. U-1A is a differential to single-ended buffer, U-1B and U-1C comprise the differential output drivers and U-1D provides a single-ended output for driving unbalanced loads. More versatile and elaborate systems could certainly be devised, but this circuit provides more than adequate output drive and isolation in most cases.

The circuit shown in Figure 9 will easily fit on a single-sided 4"x6" printed circuit board and, when used with plug-in edge connectors in a card cage, will make a high quality audio buffer and distribution amplifier system for the entire station. Installed near the Telco terminal and the satellite demodulator units at KRED-KPDJ, this system distributes AM and FM air monitor signals to various parts of the building, RKO Network audio to several locations, Telco toll loops to patch panel outputs and RPU (Remote Pickup Unit) receiver audio to three control terminals.

The use of submixers for audio inputs that are similar in nature is an easy way to expand the functions of the audio control board. An example of a submixer used with a group of cart machines is shown in Figure 10. This is a basic system. If desired, a more complicated and versatile unit could be used that would include cue provisions and variable mixer gain.

Audio output from the control board should follow isolation and distribution methods similar to those used for inputs. In nearly all cases, distribution can be accomplished through the use of a passive circuit, as shown in Figure 11. This circuit will work well if all inputs are balanced. If unbalanced inputs are present, install an isolation transformer, as shown.

Maintaining good program levels is

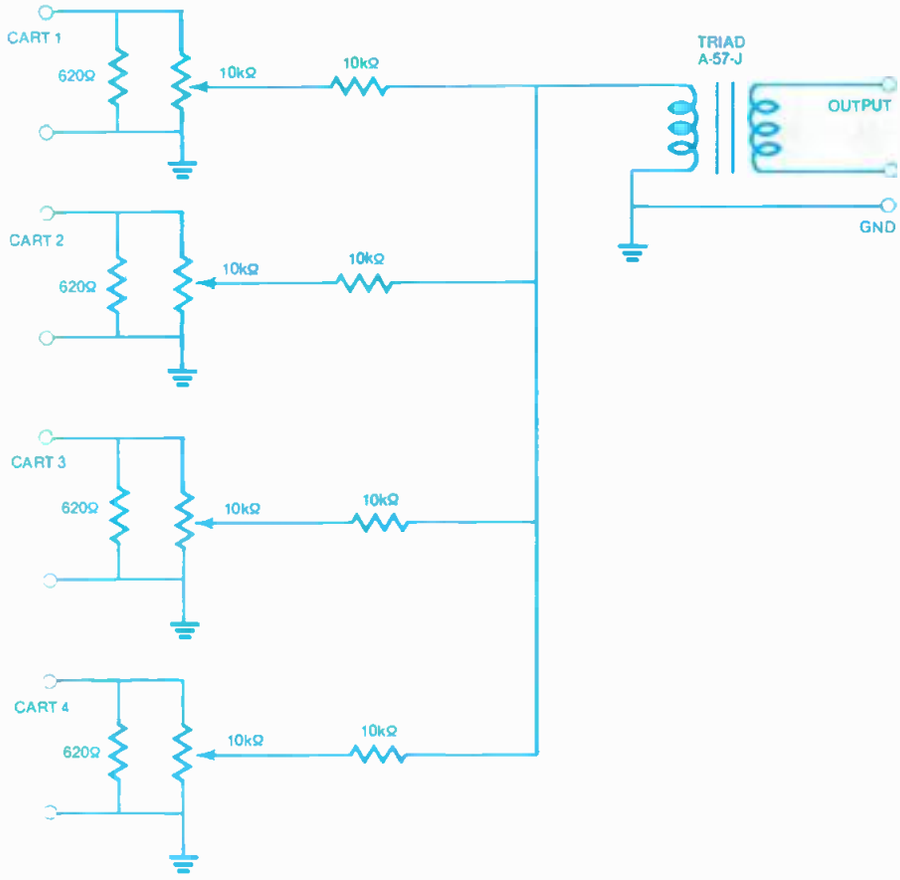


Figure 10. Simple submixer for inputs of a similar nature.

a difficult task without the proper metering. The standard VU meter lets a large number of short duration peaks escape detection because the meter ballistics are relatively slow. A solution to this problem is to incorporate a Peak Program Meter (PPM) into the system so that the transient energy, not shown on a standard VU meter, can be seen. Several manufacturers sell PPMs or VU-to-PPM conversion kits. Ideally, one should have both a standard VU and PPM working simultaneously. The operator can set his level with the standard VU and then reduce it as necessary to keep the PPM reading within range. The PPM is a useful device because it will show transients that could cause distortion in the audio board or further down on the audio chain. Reel-to-reel and cart machines are particularly susceptible to overload distortion.

Phasing audio inputs and outputs is an important step in building or rebuilding an audio studio. Phasing for a stereo installation is absolutely critical, for obvious reasons. Phasing for a mono studio is important as well, but for less obvious reasons. The mono phasing problem shows up in elaborate multisource mixdowns and at the audio limiter just before the transmitter on AM systems. The limiter problem is most pronounced when asymmetrical modulation is used with a limiter that has a peak positive phasing feature.

The main microphone in the air studio should be phased to provide peak positive modulation with the limiter phase switcher in the normal mode. The rest of the air studio, indeed the rest of the station, should be set up to provide peak positive modulation with normal phase.

A convenient way to check for phasing is to connect a 1N914 diode across an audio generator output and bring up the level to give a distinctly clipped audio waveform. Connect the diode to clip part of the negative portion of the

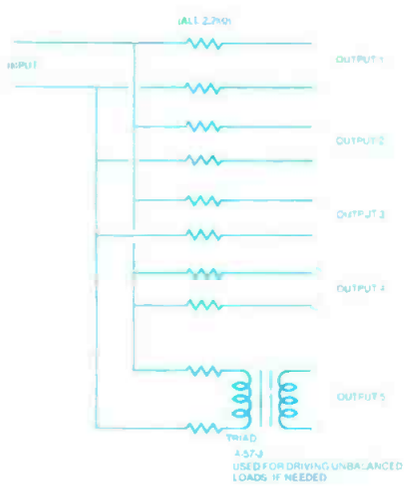
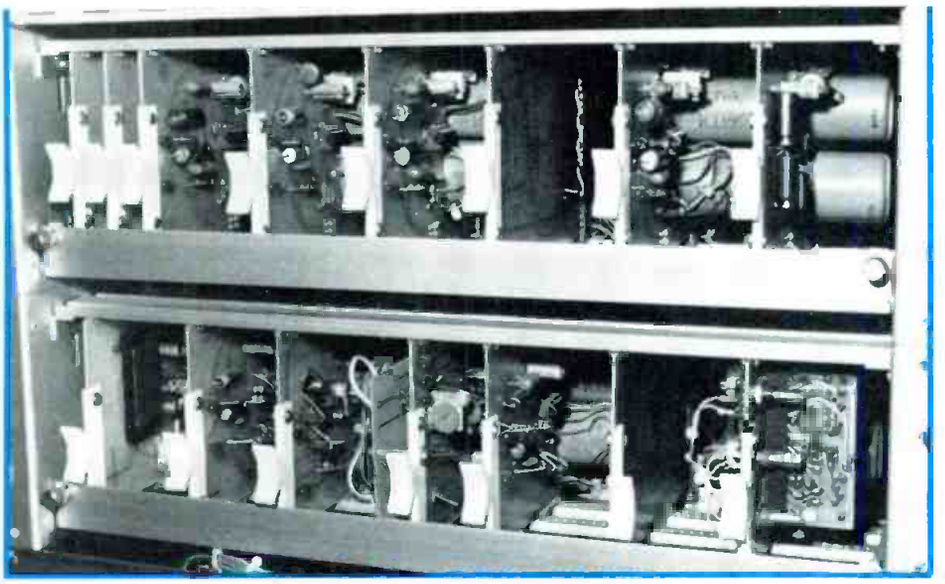


Figure 11. Audio console output distribution board.



A multifunction audio distribution amplifier system custom-built for KRED/KPDJ.

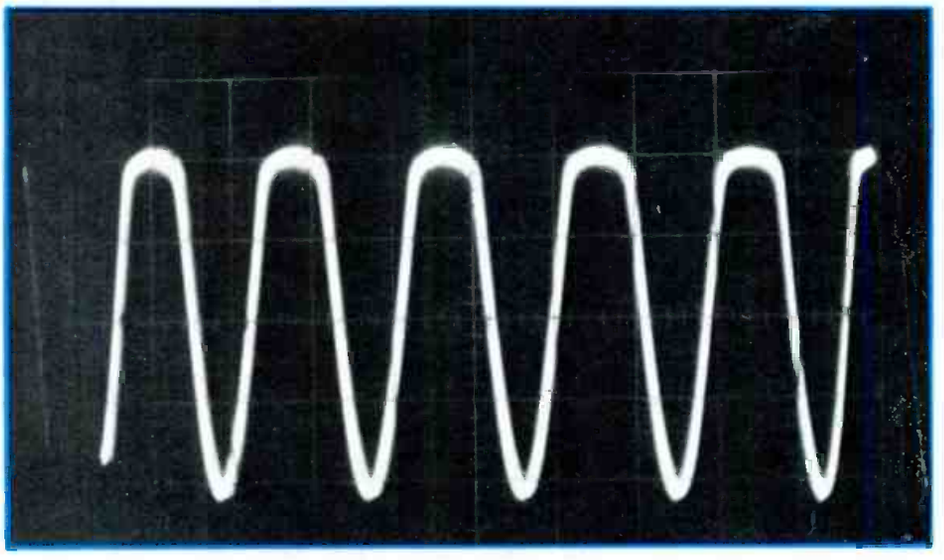


Figure 12. A clipped waveform that can be used to check for proper system phasing.

wave when viewed on an oscilloscope. (See Figure 12.) (Note: If your audio generator has a low internal output resistance to the active stage, use a current limiting resistor of about 620Ω between the hot output and the diode and load.)

When the clipped waveform is recorded and played back on source machines in different studios and through the air chain, the phasing should remain the same. Phase switching will cause the limiter to do more work than it should have to. Ideally the limiter automatic peak phasing circuit will never change from normal. This is not the case in actual practice, however, due to the characteristics of speech and music, but correct phasing of the system will limit the phase changes to that required by the program material.

An interesting problem occurs in an AM air studio when the operator's headphones are being fed from an air monitor and the limiter automatic peak phasing circuit has the phase in reverse. When the announcer opens the microphone and says something, the headset volume is low and the air signal sounds muddy. This is because sound reaching the operator's ears from the headphone is 180° out of phase with the sound reaching his ears from his mouth. There is, therefore, cancellation of the signals, particularly at the higher frequencies. The situation is cleared as soon as the limiter returns to normal, generally a couple of seconds.

Finally, an important part of renovating or building a studio is clearly labeling the sources and preparing a detailed operations manual outlining how to use the equipment. The manual can be divided into sections dealing with normal operation, patch panel use, special functions and troubleshooting. This will save much time on the part of operators using the equipment and the engineers who must answer the questions. The best studio in town isn't much good if only the engineering staff knows how to run it.

RESULTS

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February 11, 1983

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Broadcast Engineering
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associations

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Washington, DC 20036
1-202-293-3570

Brussels Satellite Convention receives support

The NAB's Copyright Committee supports US ratification of the Brussels Satellite Convention. The convention is an international treaty designed to protect broadcasters and other legitimate distributors of programs and signals transmitted internationally by satellite. The treaty requires countries that ratify it to take "adequate measures" against unauthorized interception and use of program-carrying signals within their borders.

The committee said that since 1974 the value of revenues from the sale and use of US intellectual properties abroad, including TV programming, has risen to between $5 billion and $6 billion annually. Unauthorized use of copyrighted materials, including interception of US satellite communications, has also increased substantially abroad. The main potential benefit to US broadcasters is that ratification should bolster the principle, throughout the world, that programs must be regarded as property, having owners who must be paid when the property is used.

Consistent system of standards needed for emerging technologies

NAB President Edward O Fritts issued the following statement regarding the FCC's issuance of a combined notice of inquiry and proposed rulemaking on the basis of the FCC's technical regulations:

"The appropriate role of government is to ensure the integrity of the spectrum, somewhat like a traffic cop. We applaud the commission for its ongoing efforts to eliminate unnecessary regulations and its logical approach regarding a free marketplace. We caution, however, that in this emerging technological age with a plethora of new electronic communications delivery systems that a consistent system of technical standards must soon be introduced for all to live by—much like driving on the right side of the road. Broadcasting by its nature must have compatible transmission standards to operate. Without technical standards, chaos could result. New products will be slow in reaching the marketplace, competitive markets will be limited, the United States manufacturers may lose market shares and the public will suffer."

National Radio Broadcasters' Association
1705 De Sales Street, NW
Washington, DC 20036
1-202-466-2030

NRBA officer and director are honored

RADIONEWS readers, in that publications' 1982 poll, selected Sis Kaplan, NRBA president, as Association Executive of the Year. NRBA Director Bob Duffy was selected as Rep. Executive of the Year. Duffy is the president of Christal Company, New York, NY.

Society of Broadcast Engineers
P.O. Box 50844
Indianapolis, IN 46250
1-317-842-0836

KC chapter meeting focuses on spectrum analyzers

The Kansas City chapter of the SBE met in February in the studios of KCMO-TV 5, Kansas City, MO, to hear a discussion of spectrum analyzer and oscilloscope applications. Chuck Hilger, sales engineer for the Overland Park, KS, office of Tektronix, presented concepts of spectrum analysis that should be considered by broadcasters. Based on the TEK 492 and 496 models, his discussion centered on user controls, relative vs. absolute measurements, performance factors, digital storage capabilities and cautions regarding input signal levels.

The second half of the presentation focused on new additions to the 2000 series of oscilloscopes, the 2400 group (150MHz and 300MHz) and the 2600 group, with integral digital multimetering and other new features.

Of particular interest to many was the availability of applications/instructions on videotape through local TEK field offices, as well as application notes on all TEK products.

During the business meeting of the KC chapter, Harold DeGood, chief engineer, KSHB-TV 41, Kansas City, MO, was elected as chairman of the chapter for the coming year.

Pick a number from 9 to 52!

You've just chosen the ideal DC voltage to phantom-power these new ATM electret microphones.

Introducing four "universal" phantom-powered electret microphones. Designed to work from external power, internal regulation automatically handles any voltage from 9 to 52 VDC without adapters, switches, or rewiring. Just plug in and enjoy. With current drain a mere 0.3 mA at 9 volts (4 mA at 12-52V) a 9V battery lasts thousands of hours, not just the 60 or 70 hours typical of other mikes.

When your power supply isn't available, or isn't enough, use ours. The new AT8501 Dual Battery Supply holds two 9V batteries. One to use, and one in reserve. Instant switchover and test LED eliminates guesswork. And spares are as near as the closest shopping center. Neat!

But convenience and versatility are just two of the advantages of the new ATM models. All-new electronics provide plenty of headroom inside the microphone with no more than 1% THD even when used in acoustic fields of 141 dB SPL. Which sets new standards for clean sound even close-up to big brass or inside a powerful drum kit.

And the sound you hear is wide-range and *musical*. Presence without peaks. Highs to 20,000 Hz but without a raspy "edge." Yet despite their responsiveness, these new ATM microphones have the "Road Tough" reliability proved so often on stage and in the studio.

Before you add another microphone, compare our sound, our convenience, our reliability, and our cost. Write for literature and list of nearby ATM microphone specialists. Get great sound...right from the start! AUDIO-TECHNICA U.S., INC., 1221 Commerce Drive, Stow, Ohio 44224. (216) 686-2600.

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Circle (106) on Reply Card

new products

Color TV test pattern generator

The Signal Source 1206A has been made available by *Visual Information Institute* and is an updated version of the original 1206. The 1206A provides a complete selection of TV display test patterns plus clocked vertical pulse widths (thumbwheel selectable), bounce with bars for evaluation of high voltage capability, split or full centering pattern and front panel adjustment of sync and blanking levels.

Circle (490) on Reply Card

Test equipment

EEV is offering type P4225 camera tube test equipment. The equipment enables broadcasters to check the quality of camera tubes on delivery and during operational life.

Circle (491) on Reply Card

Studio systems

Human engineering is included in system designs from the *Audio Broadcast Group*. High technology components and specially designed cabinetry are used. Low-profile equipment, easy-to-reach controls, suspended turntables and special leveling devices are featured.

Circle (492) on Reply Card

Reference monitor

The BBSM-12 portable reference monitor incorporates two 12-inch drivers, a 6½-inch midfrequency cone and a 1¼-inch dome tweeter. The new product from *Westlake Audio* includes a 24dB/octave crossover slope.

Circle (493) on Reply Card

Audio power amp

Protective circuits for the power supply and driven speakers are included in the *BGW* 7000B Proline power amplifier. Thermostatic switches in the power transformer protect the power supply, while dc speaker protection avoids amplifier-caused speaker damage.

Circle (494) on Reply Card

Remote control

IGM Communications has announced the MARC manual-assist remote control for use with all models of the IGM Instacart system. To operate up to nine Instacart systems, MARC consists of a 12-button keypad, LED indicators for selected source and tray number, serial interface, power regulator and an 8748 microprocessor.

Circle (495) on Reply Card

Flame retardant cases

Plastic cases for 1-inch videotape from *3M Magnetic Audio/Video Products Division* have been shown to be self-extinguishing in five seconds. The high impact plastic makes the cases lighter than previous ones. Dust and moisture seals are included.

Circle (496) on Reply Card

UHF spurious trap

Microwave Filter Company introduces the #4215 UHF transmitter notch filter. Capable of handling 1kW signals, the filter provides 25dB attenuation at its center frequency with less than 0.5dB reduction at ± 5MHz. Frequency range covers the 470-812MHz spectrum.

Circle (497) on Reply Card

Tek 2465

Growing Family of Tek Scopes

The 2000 family of oscilloscopes produced by Tektronix was originally developed to place higher reliability and performance in the hands of service technicians. At the same time, the effort was to keep a price tag on the equipment within reach of many who otherwise could not get high performance and new technology test equipment. The introduction in 1981 of the 2300 ruggedized scopes provided the service community with a highly portable package that could read 100MHz signals reliably.

Soon after came the 2200 low cost/high-volume line, replacing most models of an older T900 and lower performance 400 series. In February 1983, the 2000 family grew still more with four new models—2235, 2236, 2445 and 2465.

Both the 2235 and 2236 feature 100MHz bandwidths, trigger view and sweep speeds to 5ns/div. The dual-channel units have a single sweep mode for transient photography, separate A and B intensity controls and a 14kV CRT. Also, the 2236 includes new measurement capabilities with the digital counter/timer/multimeter (CTM) system, which is integrated into the triggering systems of the scope. According to Tektronix, the 2236 now allows direct digital waveform measurements previously unavailable in a portable instrument.

The strictly high performance models of the 2000 series now include the 2465 and 2445, offering 300MHz and 150MHz bandwidths, respectively. These two instruments replace the previous 465B and 475 scopes with broader bandwidths, four channels, extensive CRT readouts, faster sweeps and increased timing accuracy. Two design features in the 2400 models are a meshless scan-expansion CRT and increased use of microelectronics.

The meshless scan-expansion (MSE) CRT is physically shorter than previous CRTs (about an inch) with greater shock resistance than conventional tubes. Capable of withstanding shocks to 150G, the MSE CRT is announced as producing a finer, brighter trace, an additional plus in portable instruments.

Automated laser wafer trim, 100% chip and wire hybrid array assembly and special packaging have been included in the 2400 series. New processes now provide the highest level of custom analog integration ever used in an oscilloscope, according to Tektronix, with more hybrids now in use than have ever been used in an instrument to date. Additional reliability is expected from the capability of direct drive of the CRT from the microelectronics devices.

BE's editorial director was in the Tektronix plant for a demonstration of the prototype of the 2200 series scope. It was an impressive demonstration. To show the ruggedness of the CRT, a Tek engineer took hold of the CRT socket, with the tube connected to the faceplate of the scope, and used the system for a hammer. Ironically, the CRT seemed to enjoy the abuse.

For details of the portable Tek scopes, contact your nearby rep or write the Tektronix Marketing Communications Dept., P.O. Box 500, Beaverton, OR 97077.

business

Tektronix introduces a 3-year warranty

For its family of 2000 series oscilloscopes purchased Jan. 1, 1983 and after, Tektronix is offering a 3-year warrantee covering parts and labor, including the CRT. Introduced to underscore the Tek commitment to quality and reliability in instrumentation, the new warrantee offer is claimed as an industry-first. Also, there are three new optional warrantee-plus-service agreements that provide choices of extended calibration and service.

For more details, contact your Tek representative or write: Marketing Communications Department, P.O. Box 500, Beaverton, OR 97077.

India buys Townsend LPTV systems

LPTV systems from Townsend Associates are planned to increase TV broadcast coverage of India. For many areas presently lacking TV reception, a satellite receiver system feeds the LPTV retransmit equipment. Ten complete systems have been requested by the Indian government to provide program distribution via satellite.

Andrew makes tentative purchase agreement

In a pending $9.5 million cash transaction, Andrew Corporation has announced a tentative agreement to acquire the assets of Grasis Corporation, a privately held manufacturer of microwave towers and equipment shelters with facilities in Kansas City, MO. The transaction is subject to the signing of a definitive agreement.

EQUIPMENT SALES

Tribune Cable Communications has authorized a blanket purchase order with **Antenna Technology Corporation** for 10 Simulsat-5 satellite receiving antennas. These antennas will be used throughout the continental United States.

DJM, a New York-based post-production facility, has purchased a second **Dubner** CBG2.

Larcan Communications Equipment has recently received an order for a 30kW VHF transmitter model TTC-30000FH from WVAN, Channel 9, Savannah/Pembrook, GA. It also received an order for a 60kW VHF transmitter, model TTP-60FH, from WBIQ, Birmingham, AL.

Recent production switcher sales for **Ross Video Ltd.** include a model 508 to CFRN TV in Edmonton, Canada; to Video House in Melbourne, Australia; a model 514 to Channel 11 in Mexico City; and a model 504 to CBC Television in Ottawa.

NEW ADDRESSES, DIVISIONS

Elector has opened its Eastern sales office, located at 30 Chapin Road, P.O. Box 699, Pine Brook, NJ 07058; 1-201-882-0584.

Anixter has announced the formation of a new operating division, **Anixter Communications.** It will combine the activities of Anixter Pruzan, Anixter Communications Systems, Anixter-AED and Anixter Mark.

people

The International Production Center has recently named **William Jarret** as its new director of engineering. Jarret and his staff will be responsible for all engineering functions and duties at the videotape production, post-production and duplication facility.

Gordon Peters is the new national sales manager for Vital Industries. Peters has been with Vital since 1975 as the regional sales manager for the Southwestern and South Central states. Vital Industries has also named **Jim Moneyhun** senior vice president. Moneyhun has begun a series of policy changes, specifically in the areas of quality control, warranties and customer service.

Hans R. Groll, technical director of the Robert Bosch Television Systems Division in Darmstadt since 1971, retired upon reaching his 60th birthday at the end of 1982. He worked in the division for about 32 years, making a significant contribution to the standards of technical excellence achieved there. His work was most recently acknowledged by the Fernseh- und Kinotechnische Gesellschaft e.V. with the award of the Richard Theile Gold Medal.

Hal Morrison has joined Peirce-Phelps from J. P. Lilley & Son, where he was sales manager. Morrison will be based in Peirce-Phelps' Camp Hill facility and will be concentrating on the Harrisburg, PA, market. Morrison brings with him a 7-year background in the video business and is a state certified media specialist.

calendar

April 14

The *SBE National Frequency Coordinating Committee*, under the chairmanship of Richard A. Rudman, engineering manager, KFWB, Los Angeles, CA, will meet at station KLAS, Channel 8, in Las Vegas, NV. Those interested in attending may call Rudman for arrangements at 1-213-462-KFWB.

April 25-27

Satcom '83, sponsored by the International Association of Satellite Users, will be held at the Hyatt Orlando, Orlando, FL. The Third Annual SATCOM Conference and Exhibition will cover broad satellite industry topics and issues ranging from the newest satellite user applications to future satellite systems designed for the '80s and '90s.

For more information, contact Dr. Kerry Joels, program chairman, at 1-202-357-2828.

May 2-5

The *Test and Measurement World Expo* will be held at the San Jose Convention Center in San Jose, CA. Communications technology issues comprise 25% of the technical program. Workshops include the topics of "Communications/Microwave Test" and "EMI/RFI Test and Evaluation." For more information, contact: Meg Bowen, Conference Director, Test and Measurement World Expo, 215 Brighton Ave., Boston, MA 02134; 1-617-254-1445.

May 8-11

The *International Television Association's 15th Annual Conference*, "Window on the World," will take place at the Royal York Hotel in Toronto. The event will feature 107 1½-hour time blocks of seminars; two general sessions; ITVA's Annual Video Festival Awards Ceremony; and a 2-hour teleconference. For more information, contact: ITVA, 136 Sherman Ave., Berkeley Heights, NJ 07922; 1-201-464-6747.

May 28-June 2

The 13th International TV Symposium will be held in Montreux, Switzerland. A technical exhibition is planned. Keynote addresses will focus on HDTV. Among session topics are the following: wireless TV broadcasting, cable TV broadcasting, digitization of video signals, HDTV and home terminals. A roundtable discussion among invited speakers, other experts and symposium participants will also be featured. For more information, contact the International TV Symposium and Exhibition, P.O. Box 122, CH-1820, Montreux, Switzerland.

Aug. 16-18

The *Third Annual WOSU Broadcast Engineering Conference* will be held at the Fawcett Center for Tomorrow at Ohio State University, Columbus, OH. Final plans for the program are still being completed. Among the speakers will be John Reiser, FCC; Dr. George Brown, formerly of RCA; Dr. John Kraus; and Wally Johnson. A visit to tne "Big Ear" radio telescope at OSU will also be offered as an extra part of the conference.

Registration for the three days, including all meals, has been maintained at $99, with a reduction for early registration. Additional exhibitor space has been provided this year. Further information may be obtained from John H. Battison, director of engineering, WOSU-AM/FM/TV, 2400 Olentangy River Road, Columbus, OH 43210.

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American Women in Radio and Television 32nd Annual Convention, Royal York, Toronto, Canada

June 12-15
National Cable Television Association (NCTA) Annual Convention, Houston, TX

June 22-26
Broadcasters Promotion Association (BPA) 26th Annual Seminar and Broadcast Association, Fairmont Hotel, New Orleans, LA

Aug. 28-31
NAB Radio Programming Conference, Amfac Hotel, Dallas, TX

Sept. 21-23
IEEE Third Annual Broadcast Symposium, Washington Hotel, Washington, DC

Sept. 22-24
Radio Television News Directors Association (RTNDA) International Conference, Las Vegas, NV

Sept. 25-28
Broadcast Financial Management Association (BFMA) 23rd Annual Conference, Hotel Regency, Riviera Hotel, Orlando, FL

Oct. 2-5
NRBA Annual Convention, New Orleans, LA

Oct. 4-6
LPTV East, Sheraton, Washington, DC

Oct. 5-9
CIRT, Mexico City, Mexico

Oct. 9-12
AES 74th Technical Meeting & Exhibits, New York Hilton, New York, NY

Oct. 23-26
CCBA Convention, Toronto, Canada

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