

April 1981/\$3



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BROADCAST engineering

The journal of broadcast technology

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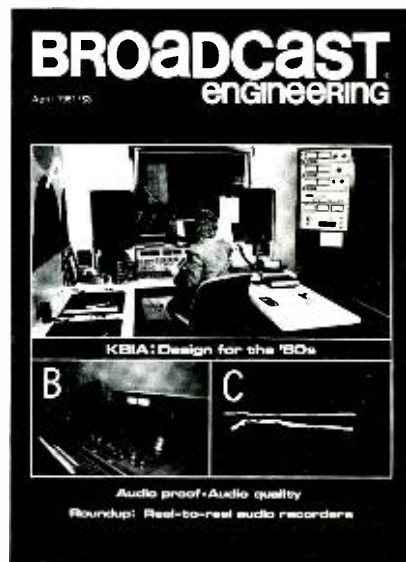
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THE COVER this month shows scenes inside the studios of station KBIA, University of Missouri, Columbia, MO. KBIA's new facilities were completed last July with great attention to the latest in audio technologies available for the '80s. A profile of the station, with emphasis on its technical design and equipment selection for a high quality audio chain, begins on page 14.

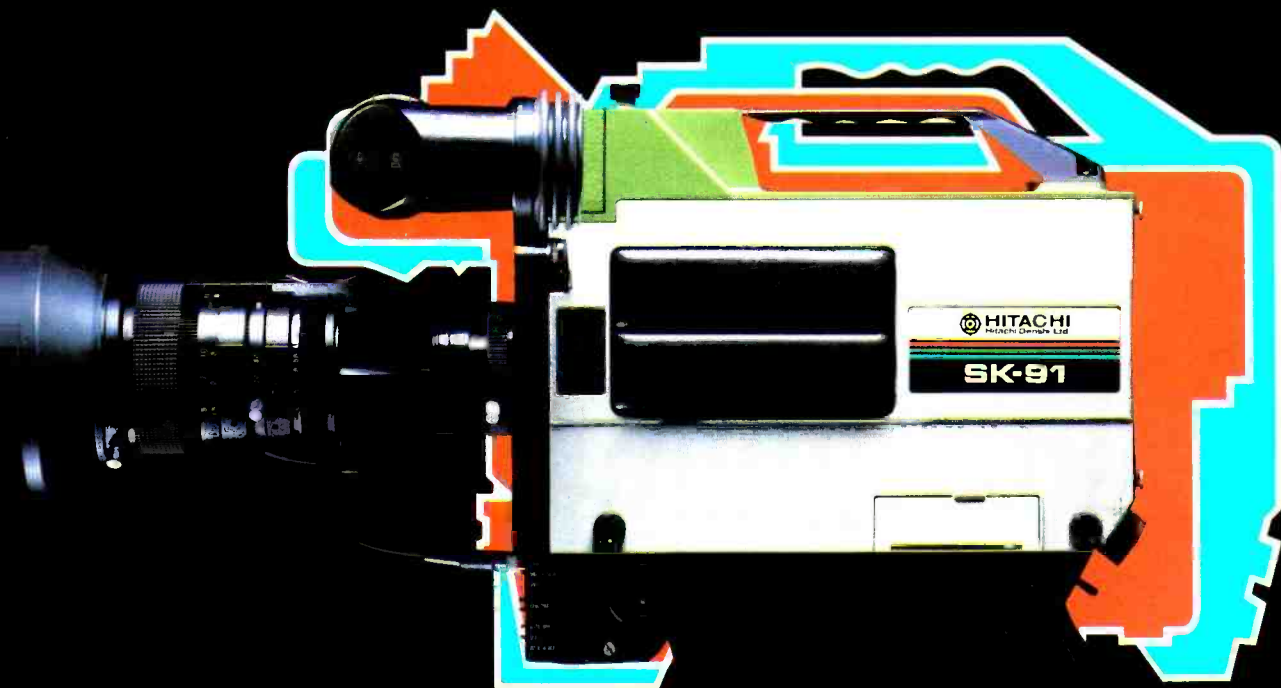
Photo A is of KBIA's Studio A; photo B is a view of one of the station's recorders and tape alignment facilities; photo C is a close-up of the scope being used during tape alignment check-out. The cover photos are also included with the article on KBIA and appear with detailed captions.

Cover photos are courtesy of Roger Karwoski, operations director and chief engineer, KBIA.

NEXT MONTH

The May issue will have a major article on basics of acoustics for studio design, a roundup of character generators and a historical article by Charles Ginsburg of Ampex on the development effort that led up to the introduction of the first VTR 25 years ago.

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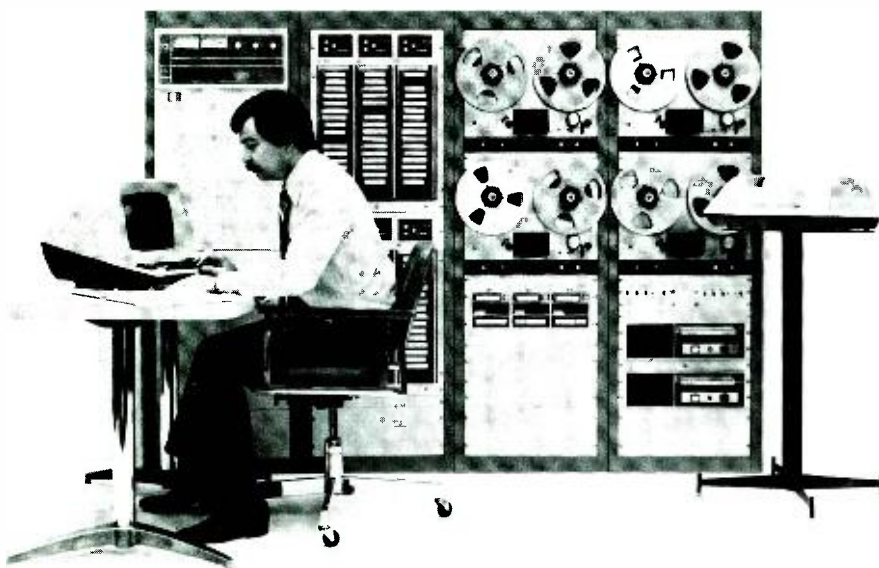
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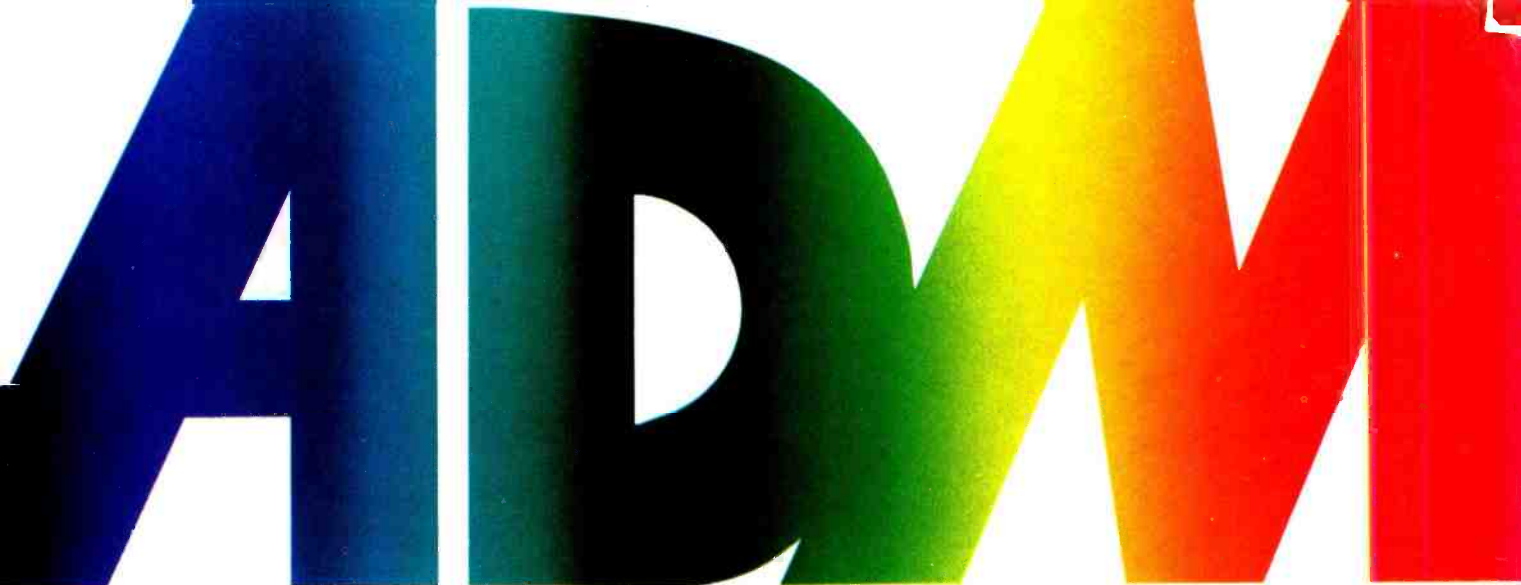
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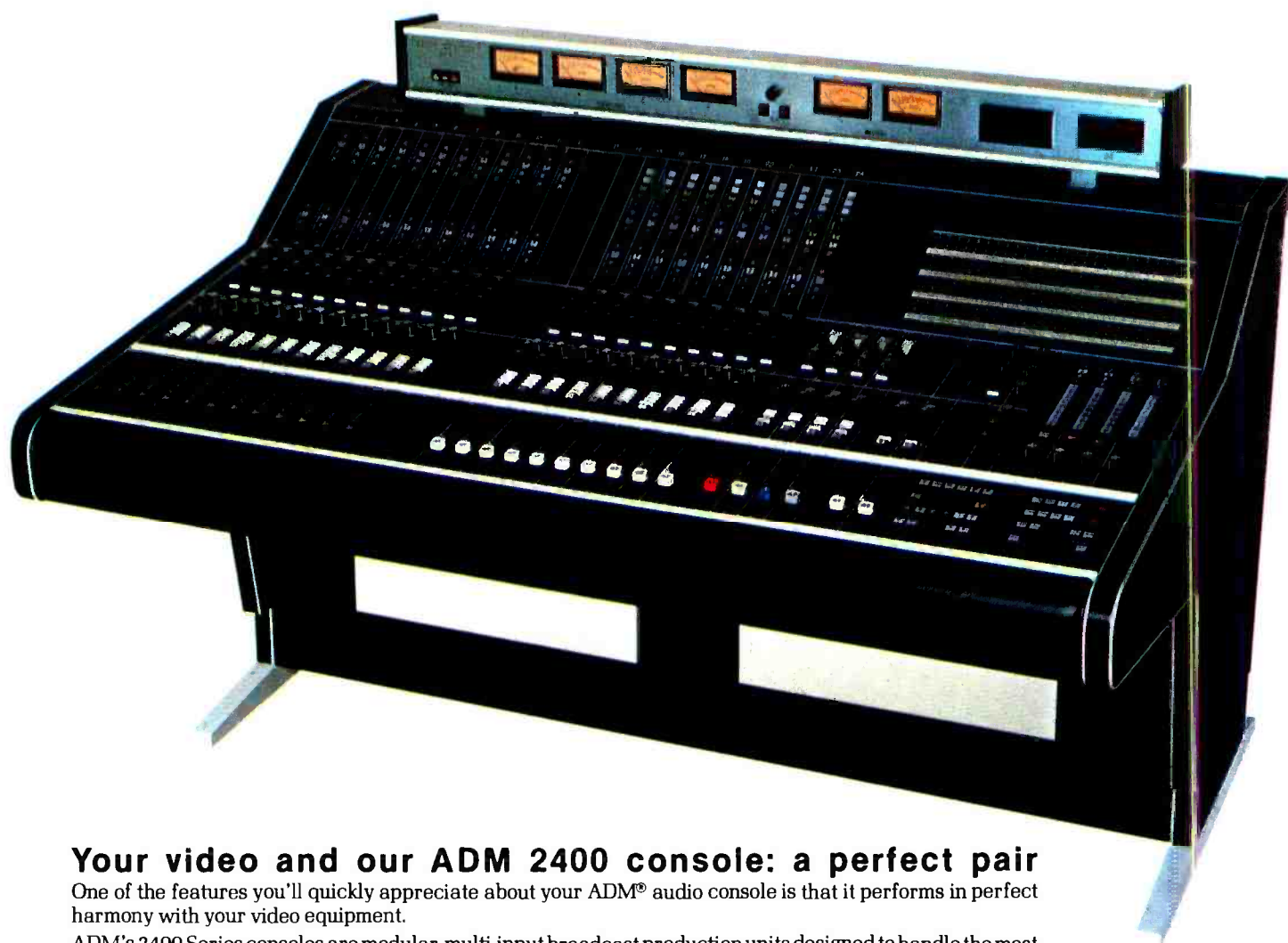


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FCC update

April 1981



Teletext for Chicago; customers to pay

The commission has authorized a 1-year experimental teletext service over the broadcast facilities of station WFLD-TV (Channel 32), Chicago, to test the economic and technical viability of a British teletext system in a major US metropolitan area.

The commission also waived an FCC rule to allow customers of the service to be charged for it. Field Communications Corporation, licensee of WFLD, asked for the experimental authority. The rule involved forbids a broadcast licensee to charge for a service provided in connection with an experimental authorization.

The service as proposed will provide written news, other information and a limited amount of advertising to no more than 100 subscribers, who will be provided with special receivers and decoders. The teletext information will be broadcast in the vertical blanking interval, which places and holds the picture vertically on the TV screen. It will not interfere with regular programming and will be received only through the special receivers and decoders.

Other experimental videotext services using cable TV systems or telephone lines are under way or planned in various US cities.

Field told the commission that, after a 3-month technical phase, it will place about half the receivers and decoders in private businesses, four in private homes and the rest in hospitals, shopping centers, recreational facilities, colleges and universities, transportation facilities and terminals and government buildings.

The second phase, lasting the rest of the year, will evaluate the technical operation on a broader basis and assess the public demand and economic viability of the service. It will provide information on the types of information most in demand, potential audiences, costs of distribution, management and providing of information, acceptability of subscriber fees and demand for advertising. Field said the service charge will meet only a small portion of its investment and

operating expenses but will serve to test the marketability of the service.

Low-power issue heated

The battle continues to be heated for decisions regarding the future role of low-power TV broadcasting and TV translators.

While the proposed rulemaking flows smoothly, the battle centers on what to do about interim applications received after the FCC cutoff dates.

Organizations recently active in affecting decisions on the low-power issue include: CPB (Corporation for Public Broadcasting); NAB (National Association of Broadcasters); PBS (Public Broadcasting Service); NAPTS (National Association of Public Television Stations); and the US District Court of Appeals in St. Louis and Washington, DC.

In its Notice of Proposed Rulemaking regarding low-power TV service, the commission stated that it would continue to process applications for TV translators, including applications accompanied by petitions for waiver of the rules to allow program origination or subscription TV service, while the rulemaking is pending. Two lists of applications ready and available for processing were issued (45 Fed. Reg. 70974, October 27, 1980, and 45 Fed. Reg. 81113, December 9, 1980). The commission set a January 16, 1981, cutoff date for applications on these lists, and, on January 15, extended the cutoff date until February 17 in response to CPB's request and an application for review filed by the NAB. (A cutoff date is the date by which mutually exclusive applications or petitions to deny an application must be filed. Thus, applications that are mutually exclusive with those on the two outstanding cutoff lists were to be filed by February 17, 1981.)

A third list had a cutoff date of March 12. The list of applications had reached about 3000 by that date.

Recent low-power actions include:

- January 14. FCC extends filing comments to March 2 and reply comments to April 13.
- January 14. FCC extends to February 17 the cutoff date for two initial groups of (400) TV translator applications. (Action in response to

NAB petition of January 12.)

- Court temporarily stays FCC's extension of cutoff date. (FCC to hold, rather than return, applications received pending court clarifications.)
- January 21. Court lifts its temporary stay, reinstating the February cutoff date. (Judicial review of the extension slated for April 13.)
- February 6. FCC denies motion of CPS, PBS and NAPTS for stay of interim processing policy of applications. (The motion asked that the commission defer indefinitely the cutoff dates for TV translator applications, including those accompanied by petitions for waiver to permit low-power services while the rulemaking is pending.)
- February 27. Court turns down a motion for an indefinite stay of interim application processing.

The commission said it believes that noncommercial low-power service can develop as rapidly as commercial. It noted that channels should not have to be reserved for noncommercial use, because the low power will be relatively inexpensive.

The commission noted that all interim grants are conditional, subject to outcome of the rulemaking, and that it is likely that many frequencies in the major markets will be the subject of competing applications. Mutual exclusivities will not be resolved until after the rulemaking is completed and comparative criteria and procedures have been adopted. (BC Docket No. 78-253)

AM stereo

The commission has refused to divide its current AM stereophonic radio proceeding and decide whether to let the market choose among various mutually incompatible AM stereo systems before it receives and analyzes additional technical data it asked for July 31, 1980.

The action came as the commission denied review of the FCC Broadcast Bureau's decision December 8 extending the periods for filing comments and replies. Under the most recent extension, granted December 31, comments were due to be filed by February 9 and replies by March 9.

The effect was to continue with the proceeding as planned, primarily toward selection of one of the five proposed AM stereo systems if that is justified by the data submitted during the comment period and information previously received.

Systems have been proposed by Motorola Inc., Magnavox Consumer Electronics Company, Belar Electronics Laboratory Inc., Harris Corporation and Kahn Communications Inc. All were found at least minimally acceptable. (BC Docket No. 21313)



Julius Barnathan, President
Broadcast Operations and Engineering
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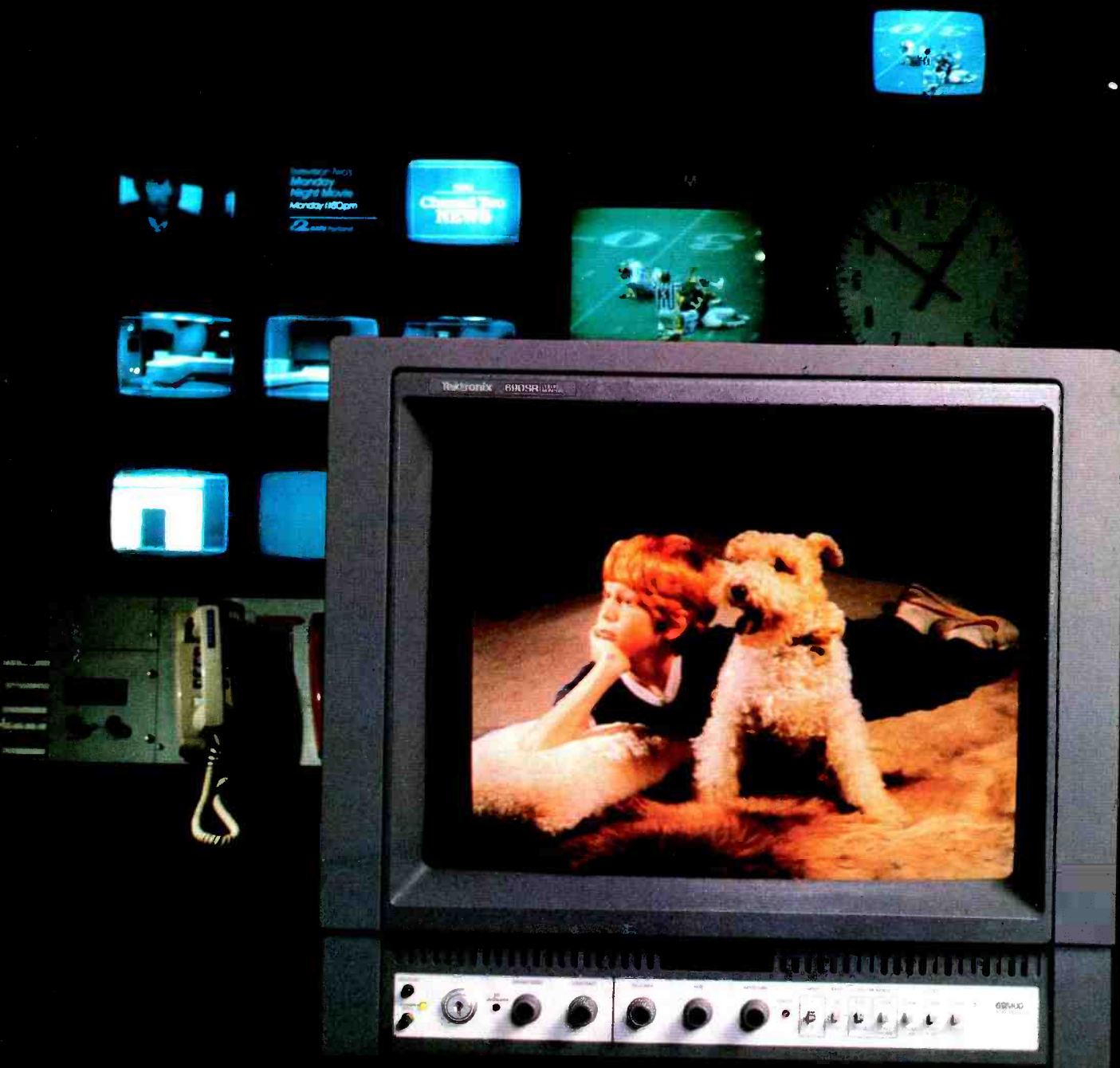
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Monitor set-up is simplified. Logical and non-interactive convergence controls make adjustment a simple, straightforward procedure. And maintenance needs are minimal. Modular design makes troubleshooting easy.

Its adaptability makes the 690SR a long-term investment that fits future

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468 Digital Storage Oscilloscope

Here's digital storage in a portable scope. You'll know the 468 for its bright, crisp display, especially of low duty cycle waveforms. Then look closer. There's stable, sweep triggering of video waveforms in TV line and field rates, plus field selection.

The 468 offers a unique envelope acquisition mode. Ideal for troubleshooting digital equipment, catching glitches, monitoring changing signals and more. A Tek exclusive.

For signal analysis, stored waveforms can be expanded and repositioned vertically and horizontally. Digital cursors offer accurate, repeatable time and voltage measurements of your signal. Storage makes it all easy.

528A Waveform Monitor

When you're looking for consistent, reliable monitoring of your video signal, you're looking at the 528A.

The 528A enhances features of our widely-used 528. New front panel con-

trols, for example, offer faster, easier operation.

An internal CRT graticule assures parallax-free viewing from a bright, easy-to-read display. In short, more accurate overall measurements. With this workhorse around, you'll know for sure levels are right.

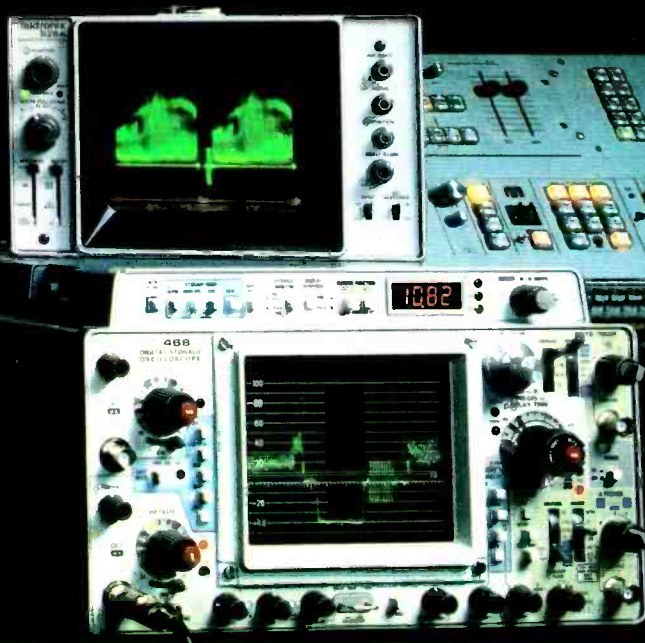
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Production switcher is a GVG 1600-7R with Digital Video Effects and Effects Memory System.

Background photo courtesy of KATU, Portland.

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BBI plans to establish New England network

Boston Broadcasters Inc. (BBI) filed applications with the FCC to establish low-power TV stations in five New England communities. The announcement was made by Robert M. Bennett, BBI president.

BBI/New England, a division of BBI, plans to operate the low-power stations in Springfield, MA; New Haven, CT; and Portland, Auburn/Lewiston, and Augusta, ME. The 5-city system will be known as the BBI/New England Network (BBI/NEN). Other New England cities, including Hartford and New Britain, CT, may be added to the network in the future.

The applications for the low-power stations, with a range of approximately five to 15 miles each, is in response to the FCC's Notice of Proposed Rulemaking authorizing the interim operation of low-power TV stations released in October 1980.

Bennett said that although the network would carry the re-telecast of certain programs locally originated by WCVB-TV, it would also carry other programming, some of which will be specifically designed for the network or for certain communities.

Turner Broadcasting files LPTV applications

Turner Television Stations Inc., a wholly owned subsidiary of Turner Broadcasting System Inc., has filed with the FCC applications for 25 low-power TV stations in various cities throughout the United States.

In announcing the application filings, R. E. "Ted" Turner, chairman of the board of TBSI, said, "The establishment of a network of low power stations in cities across the country will provide an additional source of alternative programming for millions of television viewers. We applaud the efforts of the FCC in their proposed rulemaking to establish a new type of television service."

Programming for the proposed low-power network will consist of free, advertising-supported, full-service, full-time information and public affairs. It will originate at Turner Broadcasting System's facilities in Atlanta, GA, and other locations using the services of WTBS (Channel 17), Cable News Network (CNN), and such additional facilities and personnel as necessary.

It is expected that TBSI's low-power TV stations will broadcast a new programming service. However, program determinations will come as a result of the rulemaking proceedings. If these applications and succeeding ones to be filed are approved, TBSI will establish an entirely new network to provide informational programming to several million homes across the country. If they are not all approved, Cable News Network might be considered as the principal programming source.

TV and VTR sales strong in 1980

Total US market sales to retailers of TV receivers and home videotape recorders were a positive segment of the economy in 1980 and reflected the strong growth of the home video industry.

Year-end statistics compiled by the Marketing Services Department of the Electronic Industries Association's Consumer Electronics Group place 1980 sales of color TV receivers at 10,162,276 units, up 3.2% over 1979 sales and second best industry sales to the record 10,236,319 units sold in 1978.

Industry sales of monochrome TV receivers in 1980 were 6,285,516 units, up 0.5% over the 1979 sales.

Total TV sales of 16,447,792 units in 1980 were the highest since 1972 when 16,523,217 units were sold.

Home videotape recorder sales of 804,663 units in 1980 were 69.3% above the 475,396 units sold in 1979 and were the highest since the EIA/CEG, national trade association for consumer electronics manufacturers, started tracking VTR sales in 1978.

Bright outlook for broadcasting and CATV in '81

Continued growth in 1981 is the outlook for the broadcasting and cable TV industries, according to the forecast made by the Department of Commerce's Bureau of Industrial Economics (BIE).

Advertisers will increase their spending for radio and TV advertising to a record \$17.2 billion, raising broadcasting's share of the advertising market to 28.3% from the 27.7% share it held in 1980, the BIE predicts.

These forecasts appear in an advance excerpt from the US "Industrial Outlook," an annual publication of the BIE that includes 1- and 5-year forecasts for 200 industries.

Expenditures in 1980 for TV advertising alone reached an estimated \$11.5 billion, 13% over 1979. Net revenues to the TV industry from this record spending were an estimated \$8.9 billion in 1980, and are expected to rise about 13% to \$10 billion in 1981.

Profits did not keep pace with gains in revenue. Sharp competition for audiences, which led TV broadcasters to spend more on programming, cut into earnings, as did high production costs, the BIE reports.

McLendon inducted into Hall of Fame

Broadcaster Gordon McLendon, remembered by millions as "The Old Scotchman" and acknowledged as a master of radio innovation, the broadcast editorial and recreated sports broadcast, has been inducted into the Texas Tech University Mass Communications Hall of Fame.

Generally credited with originating radio's modern Top 40 format of music and news, the good music format, the all want-ad format and the all news format, McLendon built and owned the 458-station Liberty Broadcasting System between 1947 and 1952.

Radio deregulation legislation in 97th Congress

On January 27, 1981, bill S. 270 was introduced in the US Senate by Sen. Harrison Schmitt, R-NM, with the co-sponsorship of senators Packwood, R-OR; Goldwater, R-AZ; Pressler, R-SD; Stevens, R-AK; Cannon, D-NV; and Hollings, D-SC. It is called the "Radio Deregulation Act of 1981" and proposes the deregulation of the radio industry. The co-sponsors are a powerful, bi-partisan group that includes the committee chairman, past chairman and ranking minority member of the Communications Subcommittee. Apparently, the move is an attempt to "deregulate the radio broadcasting industry by amending the Communications Act of 1934."

Schmitt's press release which accompanied his bill's introduction said, in part:

"With more than 8500 radio stations in this country, it is clear that current regulations are unnecessary in the highly competitive world of commercial radio. I am pleased to introduce this legislation which will substantially reduce the involvement of the Federal Communications Commission (FCC) in radio programming decisions, program log requirements and program formats. It will also eliminate ascertainment requirements and FCC standards of commercialization. The public interest can be better protected by a high level of competition than by these unnecessary bureaucratic rules."

Announcing new AM/FM Stereo Consoles from ADM

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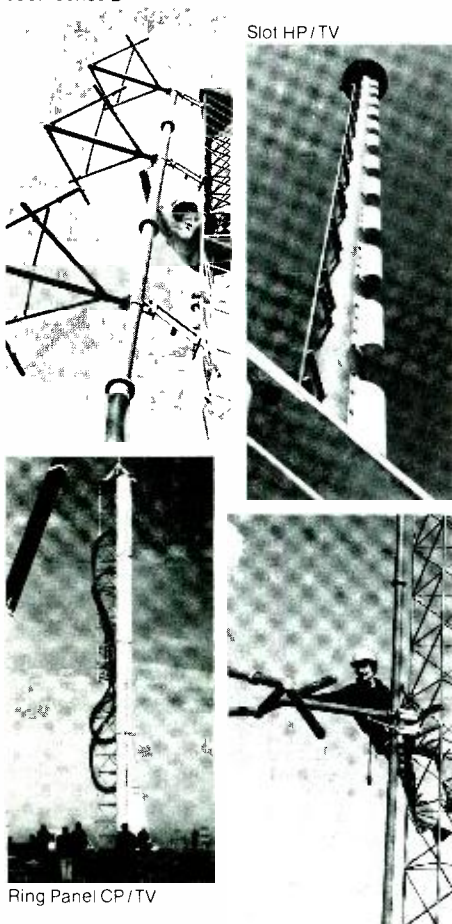
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Kaplan testifies on radio deregulation

Sis Kaplan addressed the US Senate Committee on Commerce, Science & Transportation concerning Sen. Harrison Schmitt's proposed Radio Deregulation Bill S. 270.

Testifying on behalf of NRBA, Kaplan said that S. 270 constitutes a giant step toward the realization that marketplace forces can and will regulate the operation of radio stations licensed in this country to operate in the public interest.

"While the FCC has made some progress in its efforts to deregulate radio, true deregulation, as the NRBA has continually maintained, can only be realized through congressional action. S. 270 is the most farsighted radio legislation to surface in recent years," she said.

In keeping with the sense of the proposed bill, Kaplan said that provisions embodying the following concepts be included therein:

- A prohibition against the filing of petitions to deny transfer or assignment applications.
- A direction by the committee to the FCC to establish standards for petitions to revoke.
- Authorization for the FCC to require the posting of bond by petitioners to revoke in appropriate cases.
- Broadening the language of proposed Section 331 (a) (5) to add the underlined language. "...restrict the length or frequency of commercial announcements or the total amount of broadcast time devoted to commercial matter over any period of time."
- Repealing Section 317 of the Communications Act.
- Prohibiting the FCC from requiring the divestiture of co-owned AM and FM stations in the same market.
- Providing that no petitions to revoke may be granted without a hearing.
- Delegating to the FCC to set by rule the time within which petitioners must reply to petitions to revoke and within which the commission must issue a decision after a hearing on a petition to revoke.
- Examination by the Committee of

the role of the FCC in the enforcement of EEO policies and consideration by the Committee of delegating sole responsibility for enforcement of those policies to the EEOC.

President Kaplan indicated a desire to enter into a continuing dialogue with the committee concerning problems of mutual interest to the public and broadcasters in the passage of a bill such as S. 270.

Deregulation delay calls for caution

The FCC's Report and Order on Docket No. 79-219, "In the Matter of Deregulation of Radio" makes "official" the commission's action of January 14 and effective date of April 3.

Though it is unlikely, it is possible that the effective date could be delayed by a court ordered stay. On the other hand, it is almost certain that the FCC's decision will be appealed to the U.S. Court. A court appeal will not delay the effective date but certainly must await the outcome of the inevitable litigation that will be initiated by citizen's groups.

What does all of this mean to the radio broadcaster who is eager to take advantage of the FCC's new "deregulated" radio?

It means caution should be exercised in changing or eliminating any procedures. It means that any changes must be made with the understanding that they might have to be reversed or modified to meet future mandate.

Brazilian meetings call for comparative 9kHz study

After two weeks of meetings in preparation for the second session of the Region 2 Conference on AM Broadcasting, the International Frequency Registration Board (IFRB) has agreed to do a comparative study of three types of AM channel spacing. The comparative study will be conducted by the Panel of Experts (POE) and will evaluate 10 kHz spacing vs. 9 kHz reducing spacing, using either the US-favored 4 kHz or the Canadian-favored 9 kHz shift plan.

"We are still in favor of the 9 kHz reduced spacing plan utilizing the 4 kHz shift, said Wilson La Follette, chief of the FCC Broadcast Bureau's Technical and International Division. "This was stressed at the meetings. We are also open to a reversal of that opinion should it be demonstrated that 9 kHz reduced spacing is not in the best interests of the United States," he said.

NRBA passed a resolution in January 1980 opposing 9kHz. □

Introducing PR-99 The Broadcaster's Revox that Studer built.

As a broadcaster you know the value of Studer reliability – and the importance of Revox economy. Now both are built into the Revox PR 99. And what's more, it's designed specifically for your needs.

The PR 99 offers balanced inputs and outputs; XLR-type connections, with calibrated or uncalibrated levels; and ASA-VU metering with LED peak indicators.

The rugged die-cast chassis is designed for rack or console mounting. Reel capacity is 11.5 inches and tape speeds are selectable at 3.75, 7.5 or 15 ips with a vari-speed remote control option.

Complete editing facilities include dump editing, full head access and 2-way self-sync which help make the PR 99 the best machine in its class.

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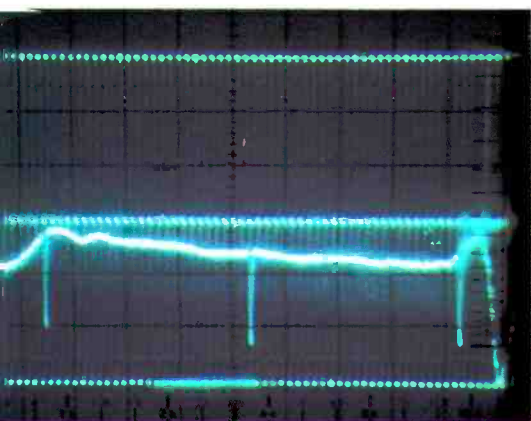
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Circle (7) on Reply Card





This view shows one of the KBIA Studer Revox B67 audiotape recorders. In the background is an Amber 4400A audio test set with a Tektronix T922 oscilloscope. As shown here, this setup is being used to check and align the frequency response of the recorder to assure optimum audio performance. The Amber test set can perform the roles of a function generator, tone burst generator, digital level and frequency meter, and spectrum analyzer.



This is a close-up view of the oscilloscope screen as seen in the background above. This measurement shows a swept sine wave amplitude frequency response of the recorder. Shown here with the low frequency level being brought into alignment, the scope trace will be flat when alignment is achieved.



Becky Preuss, KBIA staff member, at the controls in Studio B, watches an interview through the observation window.



A view inside KBIA's main Studio A announce/control room, with staffer, Becky Preuss, at the controls. On the left are Technic SP-10 turntables and UMC Beaucart cartridge machines. The announcer faces and operates the Broadcast Audio System 16 audio console; Electro-Voice audio monitors flank the viewing window. On the right is an equipment rack housing the Belar monitors and Moseley transmitter remote controls.

Case Study: KBIA, University of Missouri

By Roger Karwoski, operations director/chief engineer, KBIA, Columbia, MO

Attention to techniques and component selection is important in achieving quality audio broadcasting. The author reviews some of the planning that went into remodeling KBIA's facilities and upgrading its audio chain.

KBIA is a noncommercial, 100kW FM station owned by the University of Missouri-Columbia, MO. The station serves as both a full-time public radio station for central Missouri and as a training ground for broadcast students who are enrolled in journalism and speech courses at the university.

In the late 1970s, production room space as well as the impending completion of a multichannel satellite audio service from National Public Radio prompted the station to rebuild the main air control room as well as to add an additional control room/studio complex to the facilities. This article highlights some features of the new facility.

Control board selection

The heart of the control room—the

control board—was given much consideration. The selection of the Broadcast Audio Associates' System 16 board, was based on the following points:

1. *Excellent electrical performance.* Specifications on paper (as well as in the real world) in the areas of frequency response, signal-to-noise ratio, headroom and distortion (both total harmonic and intermodulation) are excellent.

2. *Modular design.* The board uses only two plug-in modules: one as the input amplifier and a second as an output amplifier for cue, headphone and line outputs. Dealing with any malfunction of the board is as easy as unplugging the defective module and plugging in a spare.

3. *Easy expansion.* The System 16 will handle up to 16 input modules; because three inputs are selectable per module, there is a 48-source growth limit. Nine input modules are currently being used.

4. *Easy control interfacing.* The board has two muting relays and eight other relays that can be operated with a momentary or a sustained contact closure. Also TTL logic levels are available from each mixer module. These have been used to control circuits that operate "on-air" lights and equipment starts when relays are not

Proof of performance curves for KBIA are covered on page 77 of this issue in an article by Gary Breed of D. L. Markley & Associates.

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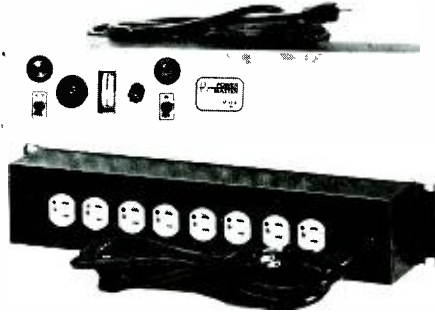
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TECHNOLOGY UPDATE

Are you as up-to-date as you should be?

Here's your chance to learn for the first time or take a refresher course on broadcast technology subject matter.

Bradley University, in conjunction with Broadcast Engineering, is sponsoring a short course on...

- * Microcomputer and Broadcast Automation
- * Broadcast Antennas

Both courses provide a comprehensive introduction to two important topics. The first course covers the subject of digital technology and microprocessors, including applications to broadcast automation. The second covers broadcast antenna theory, design and performance. A technical background is helpful but extensive experience in these areas is not required. For more information on this special educational opportunity, write:

Department of Electrical Engineering
and Electrical Engineering Technology
Bradley University
Peoria, IL 61625

Circle (10) on Reply Card

necessary or desirable. The reel-to-reel machines, cart decks and turntable all "start" when the appropriate mixer is punched "on."

Remote "on" and "off" of mixers is also possible with this board. This feature is used with the cartridge machines so they can punch themselves "off" with the use of a trip cue.

5. *Output channels.* Although most broadcast boards have two stereo output channels ("audition" and "program"), this board has a third stereo channel: "utility." It also has a separate "mono" channel, an excellent feature for checking mono compatibility during production work.

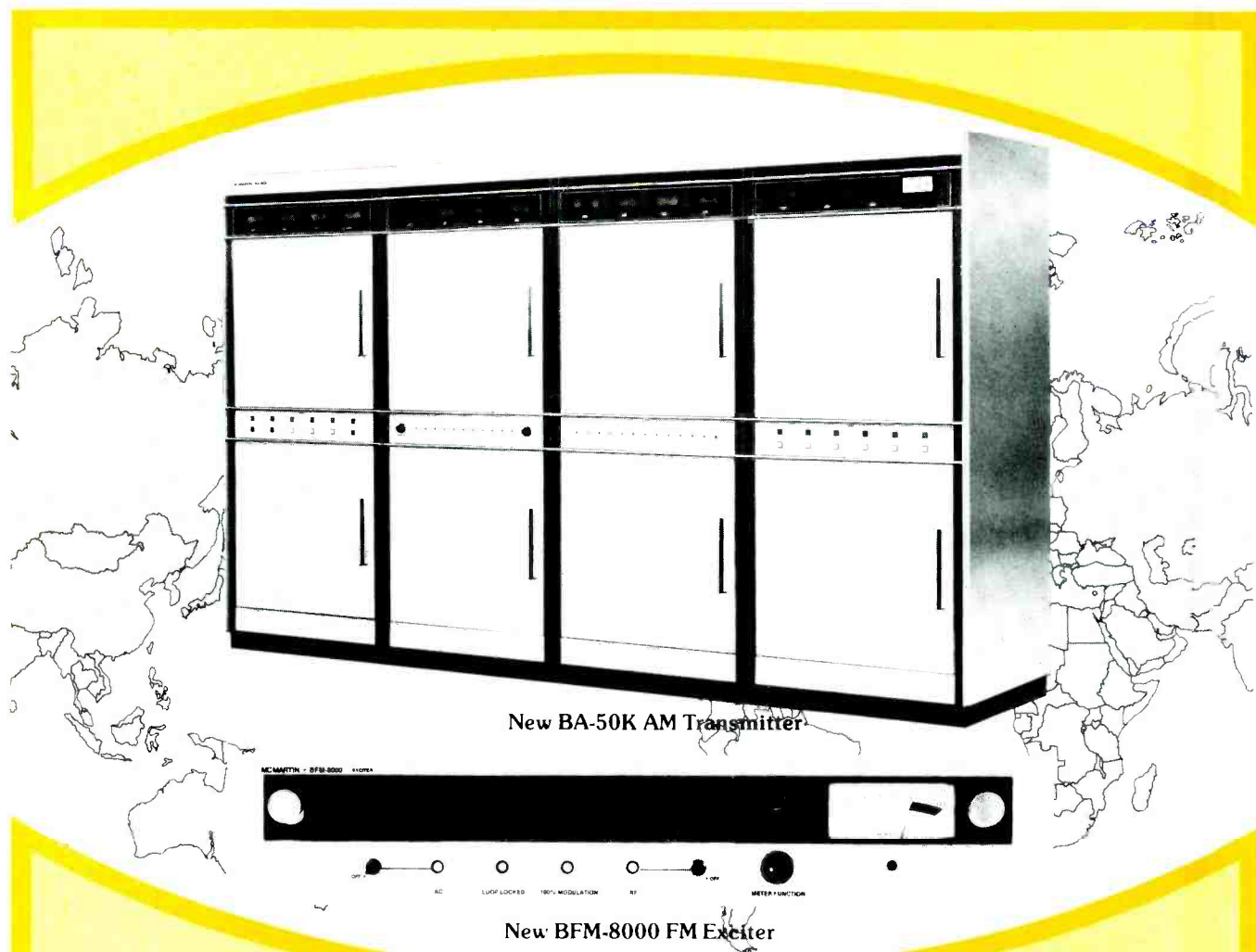
Processing by choice

The music programming at KBIA is mostly classical, but changes to jazz at night. The basic approach to audio processing has been to peak limit only—enough limiting to prevent overmodulation, but not so much as to ruin the dynamic range of the music. This approach has worked quite well with the KBIA audience, with the exception of voice levels. At times (courtesy of a new or careless board operator) voice levels varied widely. That problem has been solved with the new control rooms.

The figure on page 26 shows the audio processing signal flow. The "utility" channel has been redesignated as the "voice" channel. This output goes to a Thomson-CSF Audimax AGC amplifier and then is inserted back into the program bus. The output designation "program" has been redesignated "music" on the mixer modules. A source sent to "music" goes through peak limiting only; one sent to "voice" is AGC-ed as well as limited. This selective approach to processing gives wide dynamics of music but presents a much more uniform sound to the audience during announcements and newscasts.

One additional feature needs mentioning: A good voice level for a morning news show or a jazz show is different from that required during a classical music block. The lower average levels of classical music require a lower voice level. A "voice mode" switch is included in the design that switches "in" and "out" a 7dB pad in the output of the AGC. During a classical block the pad is "in" to give subjectively better voice levels; during long news or jazz blocks, a normal voice level is maintained by switching the pad "out."

Peak limiting is done by a Thomson-CSF Volumax 4111. This unit was



New BA-50K AM Transmitter

New BFM-8000 FM Exciter

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Choose simplicity and reliability in an AM transmitter.

50,000 watts of power is delivered by the McMartin BA-50K, AM transmitter, one of a complete line of McMartin AM transmitters available for 50,000 watt, 10,000 watt, 5,000 watt, 3,000 watt and 1,000 watt operation.

All McMartin AM transmitters are completely solid state except for a total of four tubes—all of the same type—used in the RF power amplifier and modulator. A straightforward design using conservatively rated components insures long life, easy maintenance, and outstanding performance.

Delivers 125% positive peak modulation. Capable of power cutbacks for dual power operation.

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McMartin Industries makes a **complete line of FM transmitters** for every power requirement from 10 watts to 55,000 watts. All feature grounded-grid Class C circuits in the high level driver and power amplifier stages, a design widely recognized for its superior wide band characteristics.

McMartin FM transmitters also offer excellent Power Amplifier efficiency (70% - 80%), automatic recycling, full metering and protective circuitry. Remote control systems can be added without interface adaptors.

The exciter for all McMartin FM transmitters is the new BFM-8000. This new exciter is a more sophisticated design with digital and analog circuitry which allows the use of fewer parts and more durable construction. The result is reliability so great each BFM-8000 is sold with a **full five year warranty.**

McMartin AM-FM transmitters are part of a complete line of McMartin broadcast products at work throughout the world.

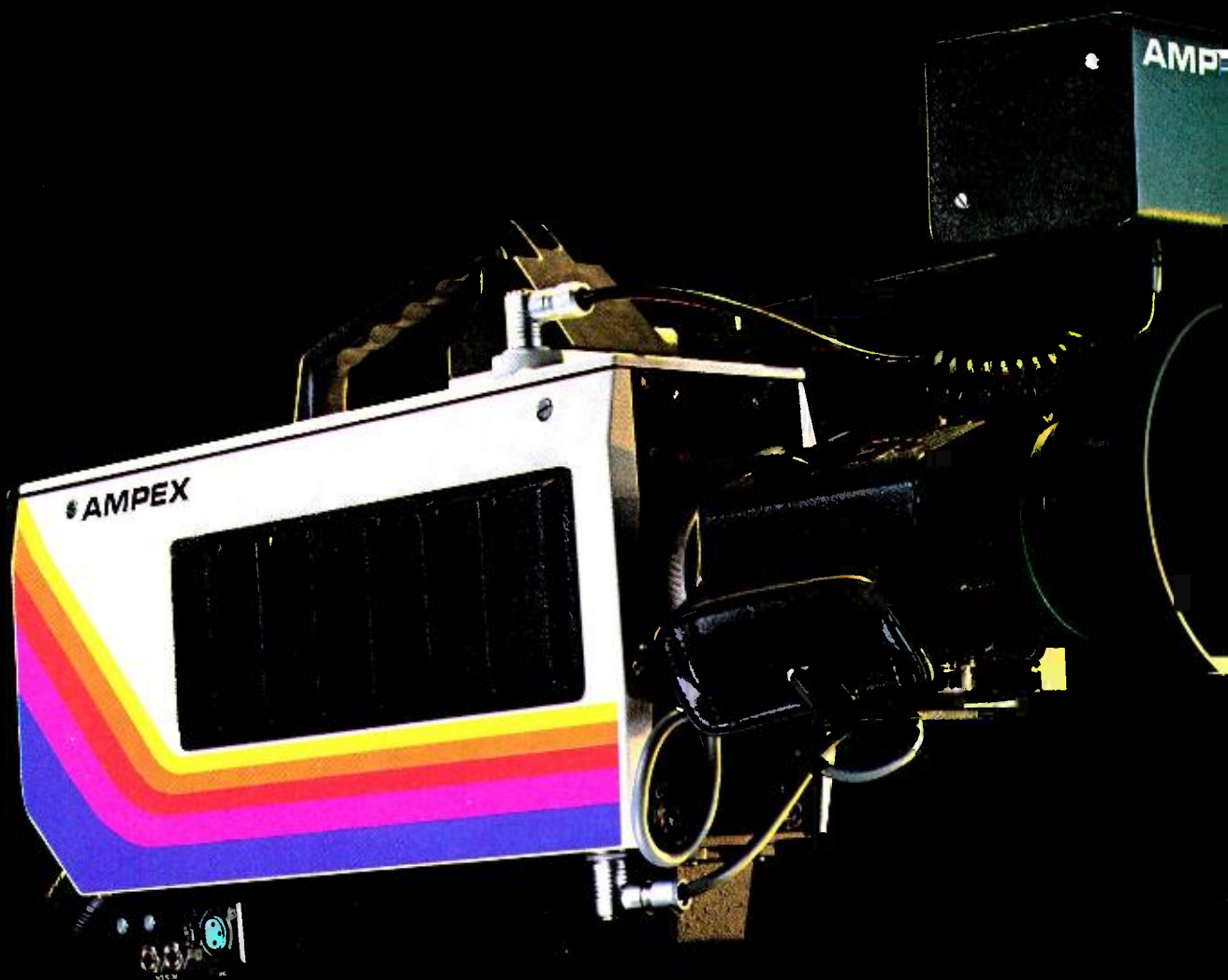
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Automatic performance. Essentially perfect registration. And a picture quality that comes through in the field or in the studio make Digicam the breakthrough camera you've been waiting for.

Automatic Set-Up You Can Depend On.

The BCC-20 delivers superior registration and picture quality. Time after time after time.

Using unique digital measurement techniques, Digicam's ASU (automatic set-up unit) converts video signals from the diascope pattern to digital signals. It then electronically compares these signals to its electronic pattern test chart.

This allows the ASU operating with digital commands from the MSP (master set-up panel) to measure all important adjustments.

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The ASU then sends corrective digital commands to the camera head microprocessor. There the camera's revolutionary SECS (spatial error correction system) makes critical adjustments. To geometry. To shading. And, in the case of registration, incredible adjustments in 210 zones to .05%!

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We didn't overlook the smallest detail to ensure Digicam's quality.

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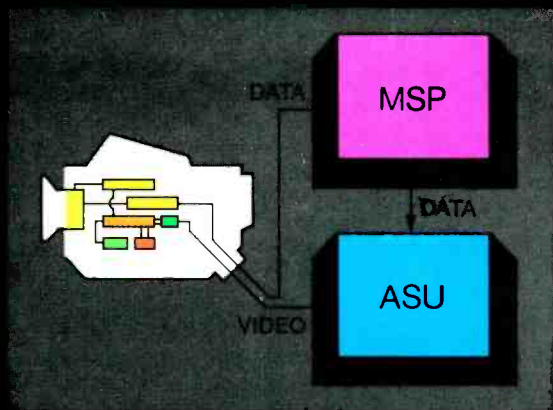
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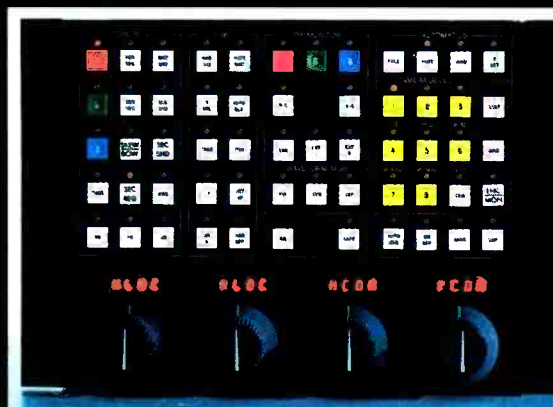
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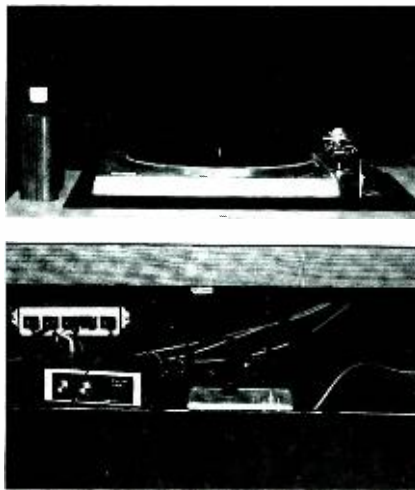
MASTER SET-UP PANEL



LENS DIASCOPE PATTERN



Turntables, mounted in table cut-outs, are shock-mounted on isolation pads (One sits on the table edge for a better view).



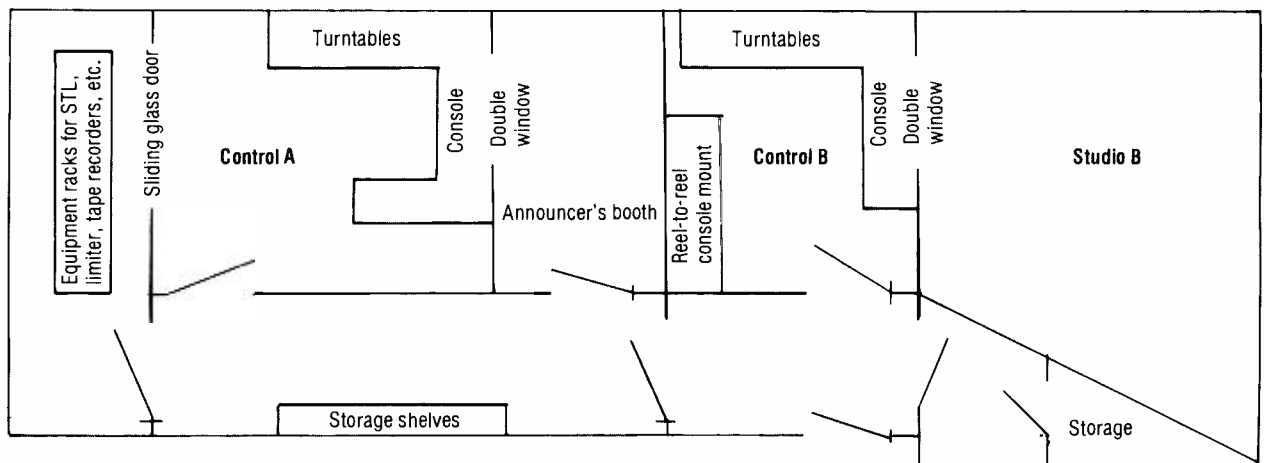
Turntable cabinets are wall-mounted and the front door opens to give access to the preamps and power supplies.

KBIA

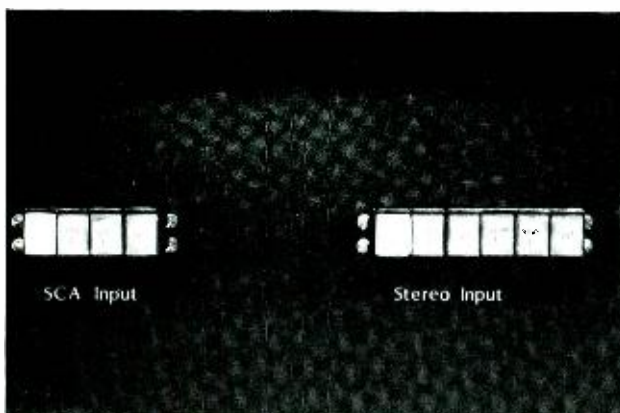
chosen over several others years ago during an "A-B" on-air test that KBIA conducted. No problems have been encountered with overshoot. The lowpass filter and pre-emphasis has been removed from the stereo generator; the filter is placed before the limiter and pre-emphasis is obtained from the limiter.

The turntables

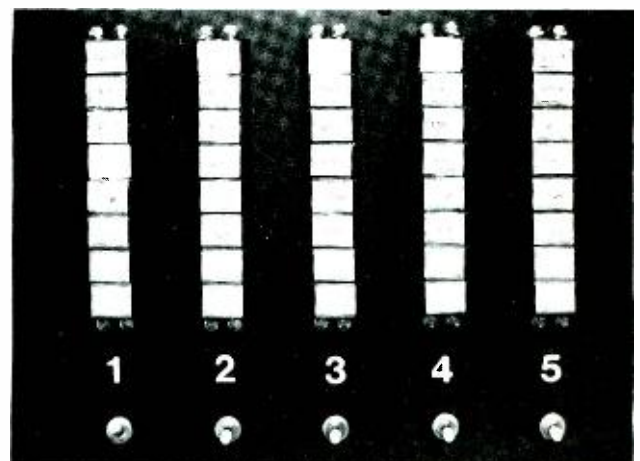
Two Technics SP-10 MKII turntables were used even before the studio renovation. These replaced two rumble-prone, rim-drive antiques. Because the SP-10s have been a delight to the ear, two more were included in the new control room. The



KBIA Studio A and B floor plans

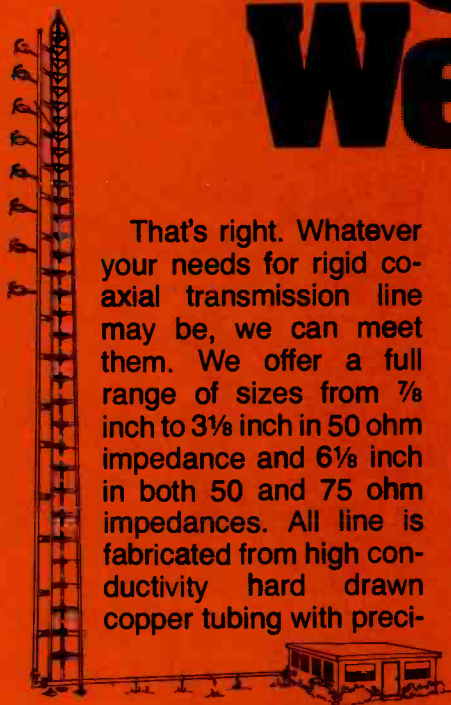


KBIA broadcasts a main channel and uses an SCA transmission as well. The passive switches shown here are used instead of patch panels to determine what goes into the main channel and what goes into the SCA.



Push-buttons select the source to be chosen for each recorder (1 through 5 shown). Toggle switches at the bottom activate a clock system to automatically start the recorders.

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sion machined, pin-type Teflon dielectric insulators. EIA bolt type flanges and connectors are fabricated to EIA standards and US Mil specifications. You have the option of ordering in 20 foot sections or any special length with flanges on both ends, one end or without flanges. A full line of matching components, hardware and installation accessories are also available.

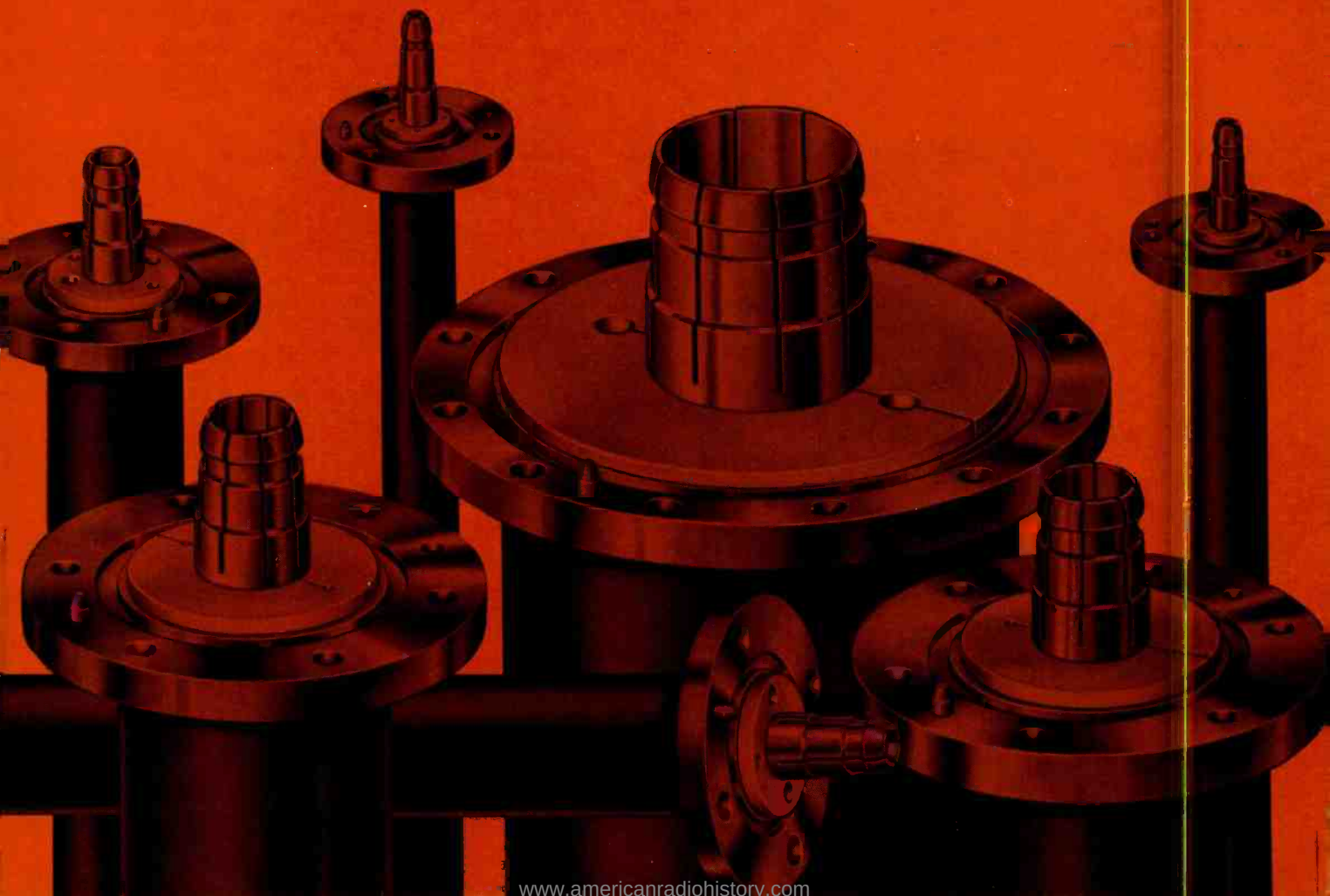
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	Hewlett Packard 339A	Sound Technology 1710A	Potomac Instruments AT-51
AUDIO GENERATOR	Combined With Analyzer	Combined With Analyzer	Separate Unit
Intermodulation test signal	No	Option	Yes
Wow & Flutter test signal	No	No	Yes
Simultaneous L&R Outputs	No	No	Yes
600 ohms and 150 ohms Source	No	Yes	Yes
Stereo Matrix Switch (L,R, L+R, L-R)	No	No	Yes
Switch to remove signal and terminate line for S+N/N	No	Yes	Yes
10 dB, 1.0 dB, 0.1 dB Step Attenuators	No	Yes	Yes
AUDIO ANALYZER	Combined with Generator	Combined with Generator	Separate Unit
Harmonic Distortion Mode	Yes	Yes	Yes
Automatic Nulling	Yes	Yes	Yes
Automatic Set Level	Yes*	Option*	Yes
Intermodulation Distortion Mode	No	Option	Yes
AC Voltmeter Mode	Yes	Yes	Yes
Stereo Phase Meter Mode	No	No	Yes
L/R Amplitude Ratio Mode	No	No	Yes
Wow & Flutter Meter Mode	No	No	Yes

* Limited to 10 dB capture range.



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KBIA

only problem in the old control room was that the turntables were mounted in bases that sat on the floor, a wooden floor subject to "bounce."

This problem was solved in the new facilities by mounting the turntables in a base that doesn't touch the floor; it's bolted to a wall. The base is constructed with 1½-inch-thick plywood sides on the back and top. A ¾-inch-thick front has a long fold-down door that allows easy access to the turntable power supplies and phono preamps. Each turntable system is mounted on four Audio-Technica audio isolator pads to separate them from the base assembly.

Patch panels gone

The old control room had everything going through a patch panel. The panels were wired with solid, single pair, shielded wire—an arrangement that made for lots of wire and problems. Repairs or changes to the panels often resulted in breaking one of those solid wires, creating a nightmare. Patch panels were also difficult for student operators to figure out and operate.

The new control rooms have no patch panels.

Why have patch panels? If the main air studio has a major malfunction, studio transitions can be made with the push of a button. A passive studio select switcher handles this job. If a taped program is playing that requires noise reduction decoding, a push of a button re-routes the tape machine's audio through the appropriate device. A typical patch would have required two or four patches to perform this task. KBIA has eliminated unnecessary patching or routing (a turntable preamp should go directly to the control board) and uses pushbutton switching where routing is required. (Another example is the tape input switcher.)

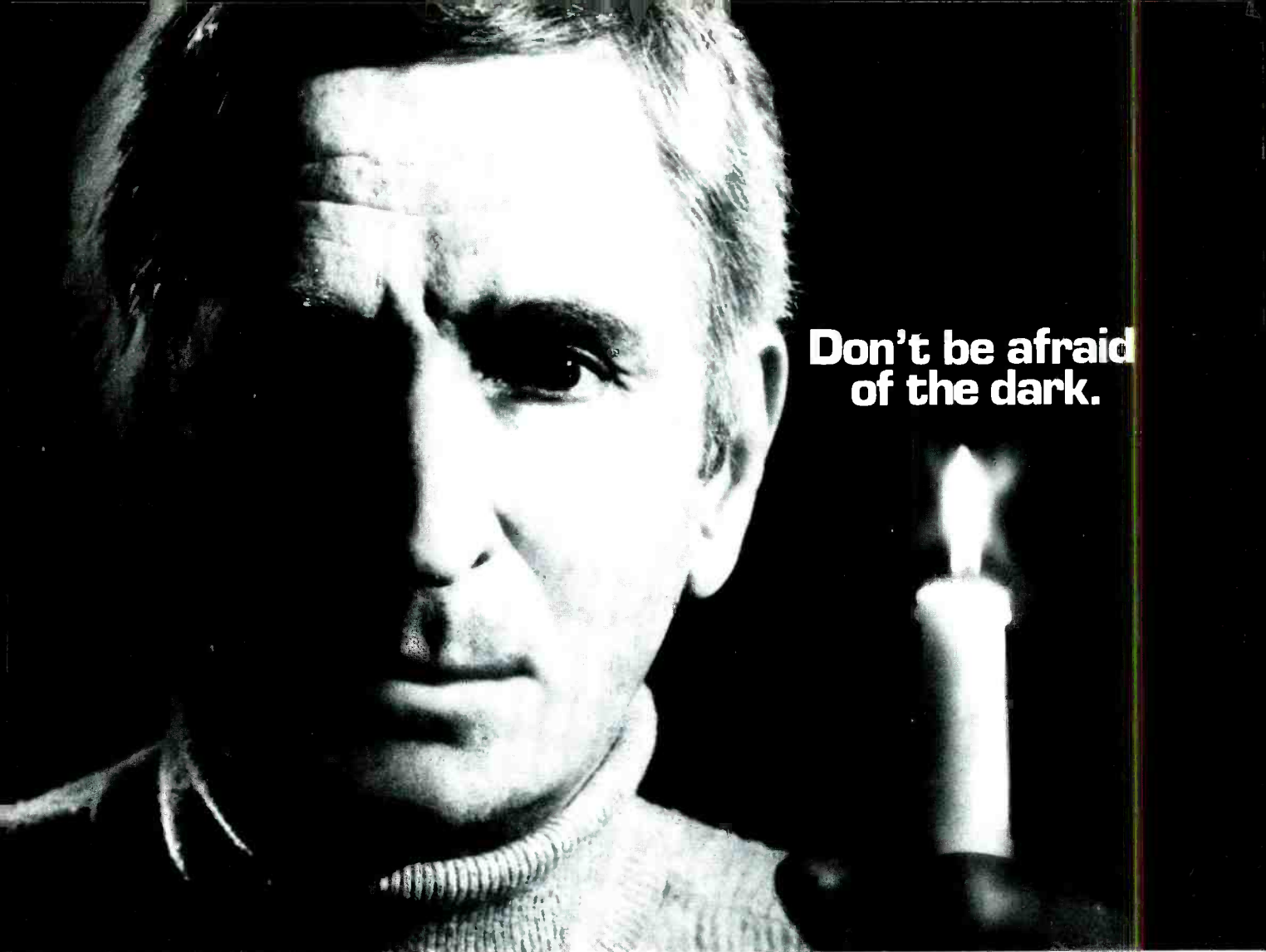
Telephone technique

The punch block approach used by the telephone company for wiring was borrowed by the station. A large metal cabinet (complete with its own lighting) is in the station's workshop. Multi-pair cable is run from the workshop to each studio and control room. The station's various audio sources, distribution amplifiers and control lines also run to this cabinet. A separate block also brings in telephone company lines. Various signal routings are easily made by punching jumper wires from one block to another.

The use of multi-pair cable over single-pair cable reduced wire cost

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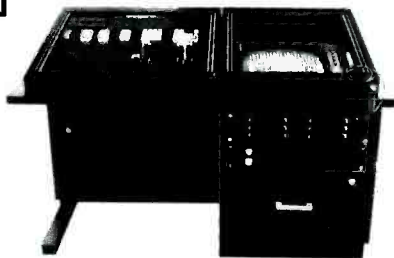
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**Zoom lenses for $\frac{1}{2}$ "
format cameras...**

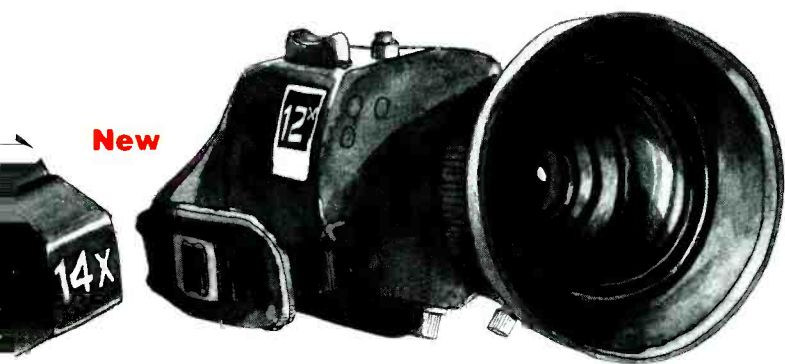
**The ultimate
field zoom for $\frac{2}{3}$ "
cameras...**

**High resolution
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**A full-featured,
economical studio
lens for 1" cameras...**

**Some of the reasons to see
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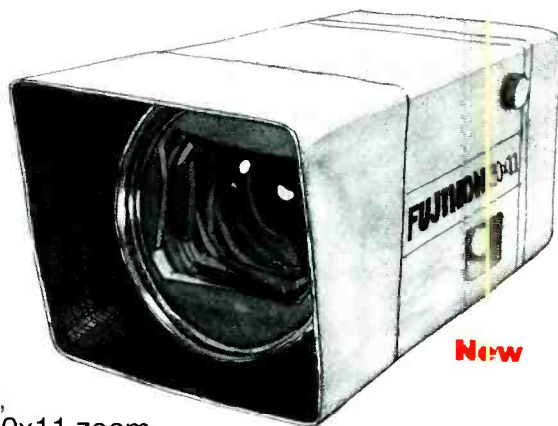
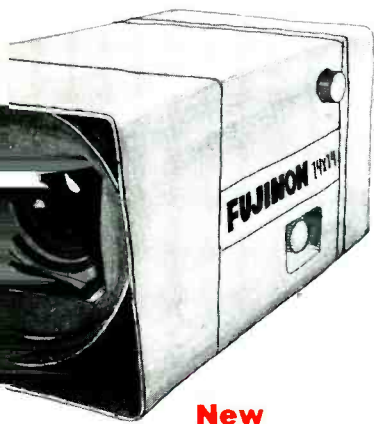


You'll see two new very lightweight zoom lenses for $\frac{1}{2}$ " format cameras. There's a 12x7 (7mm to 84mm) and 14x7 with built-in 2X extender (7mm to 196mm). Each offers F/1.4 speed, auto/manual iris, servo/manual zoom and focus. MOD is 0.8mm, weight 1.3kg.

Fujinon's first two lenses for electronic cinematography are fast, high resolution 14mm and 40mm fixed focal length models. Speed is F/1.4.

(You can be sure Fujinon will be doing for EC what it has done for ENG/EFP . . . and that's a big commitment.)

A new full-featured studio lens for 1" camera format is Fujinon's 14x14 with built-in 2X extender. Its F/1.6 aperture can be maintained out to 140mm. And at 200mm, it offers a very respectable F/2.0.



For field events, Fujinon's new 30x11 zoom with built-in 2X extender gives new range and flexibility to $\frac{2}{3}$ " format cameras. At maximum focal length of 660mm, it's the equivalent of 1,000mm on $1\frac{1}{4}$ " format. Its F/1.6 aperture stays flat out to a 20X zoom. And at 30X, it gives you F/2.4. There isn't anything else in production that even comes close.



Another lens is a new, faster version of Fujinon's exclusive 3.5x6.5 wide angle ENG/EFP zoom. Now it gives you F/1.7 speed along with performance that is difficult to believe . . . even when you see it.

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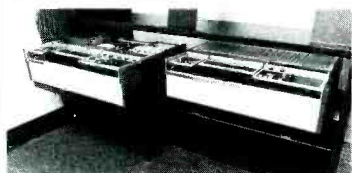


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Now how are you going to mount it?

Contact: HSC.

Our DVR (double vertical rack) has space for up to 4 of the largest 3/4" units (in groups of 2), and each unit is slide mounted for easy access. As for additional rack mount space, 10.5" has been allowed above and below the 3/4" mounting shelves for mounting peripheral equipment.



The DVR, like all SYSTEM 700 components is modular in design allowing you to build your complete production facility. Video and Audio using SYSTEM 700 products...Contact an HSC packaging engineer today for details.



How are you going to mount your TECHNICS M45 or any other non(19") component in a 19" rack?

Contact: HSC.

We offer over 300 different types of rack mounts for non(19") standard units. If you have a custom requirement we will be glad to help you...Contact a HSC packaging engineer today.



Whether your needs are tapped rails, rack mounts, 19" fillers and fasteners or a complete production facility...Contact HSC, your packaging specialists.

Now that you've purchased the equipment...Contact HSC to mount it!



PHONE NO. 312-452-5551

Circle (17) on Reply Card



Charlie Peek, KBIA assistant chief engineer, works on wiring punch blocks of the center wire cabinet.



KBIA's Studio B has a comfortable and attractive interview room. Track lighting gives a dramatic effect on the acoustical wall panels.

KBIA

and wire raceway size. Two-pair cable (Belden 8723) for input and output connections to equipment is even being used. In several instances 5-pin XLR-type connectors and 2-pair cable is being used. Thus a stereo tape machine requires only two wires and connectors to carry input and output lines instead of the usual four.

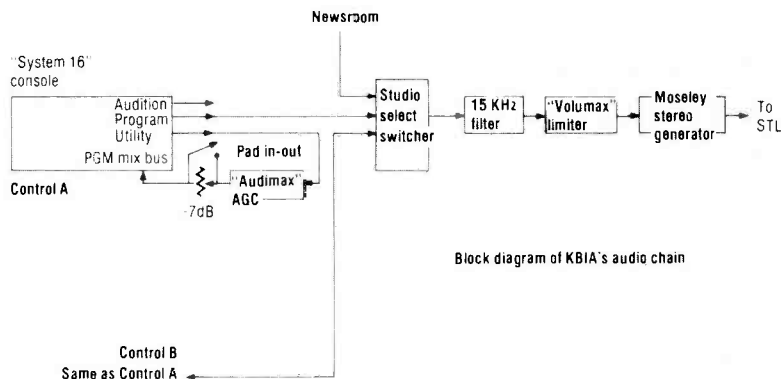
Technical back-up

Between the main air facilities, production rooms and newsroom operations are 33 reel-to-reel tape decks and 17 cartridge tape machines to maintain. To help with the maintenance of these machines, as well as other pieces of equipment, KBIA has recently updated its test equipment facilities with the purchase of an Amber 4400A multipurpose audio test set. This piece of equipment, along with an oscilloscope, performs the tasks of function generator, gated tone burst generator, digital level meter, frequency counter and audio spectrum analyzer. This combination makes routine equipment checks faster and more accurate.

Final remarks

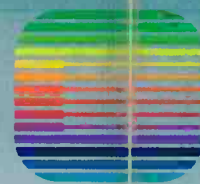
In their final configurations, the two new control rooms are similarly equipped and laid out—the same board, same turntables, same tape decks, etc. Students and full-time staff can easily move from one facility to the other. Even the remote control and modulation monitor rack can be rolled from one control room to the other when necessary.

The new control rooms have proved to be easier to operate, better sounding and better looking. In fact, many of the area stereo stores use KBIA as a hi-fi demo source. What better way to start in the 1980s. □



Block diagram of KBIA's audio chain

INNER VIEW 3: A closer look at Conrac Monitors



Comb Filter Separator: Resolution Solution at 3.58 MHz.

Conrac's Comb Filter Separator delivers the high resolution needed for today's high performance camera and taping equipment. It removes color information from the composite video signal without the luminance loss in the 3.58 MHz region produced by notch filters.

Conrac's Comb Filter takes advantage of spectrum interweaving to separate luminance from chroma, without reducing luminance bandwidth.

But the best part of Conrac's Comb Filter is that it gives you this improved picture clarity without the drawback of conventional comb filters. Because, unlike conventional comb filters which exhibit heavy dot patterns in the luminance path, Conrac utilizes non-linear techniques to virtually eliminate these patterns around vertical and horizontal transitions.

Conrac Quality: Computer-controlled for the 80's.

The implementation of a failure analysis documentation system has become an essential new tool in

the quality factor. This system provides the capability of daily test analysis from four different product test and inspection areas. The net results are improvements in product quality and long term reliability.

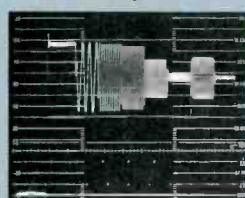
Conrac Technology: Over 30 years of leadership.

Conrac's track record of technical innovations stretches back nearly three decades; and what we've learned since then goes into every monitor we make today. That is important to you because the more technology we pack into each monitor, the more performance you will receive from it.

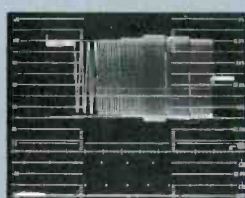
Comb filter separator and computer-controlled quality are just two ways Conrac technology can save you time and money.

For the complete inner view of Conrac technology, call or write us today. Conrac Division, Conrac Corporation, 600 North Rimsdale Avenue, Covina, California 91722, Telephone (213) 966-3511, Telex: 67-0437.

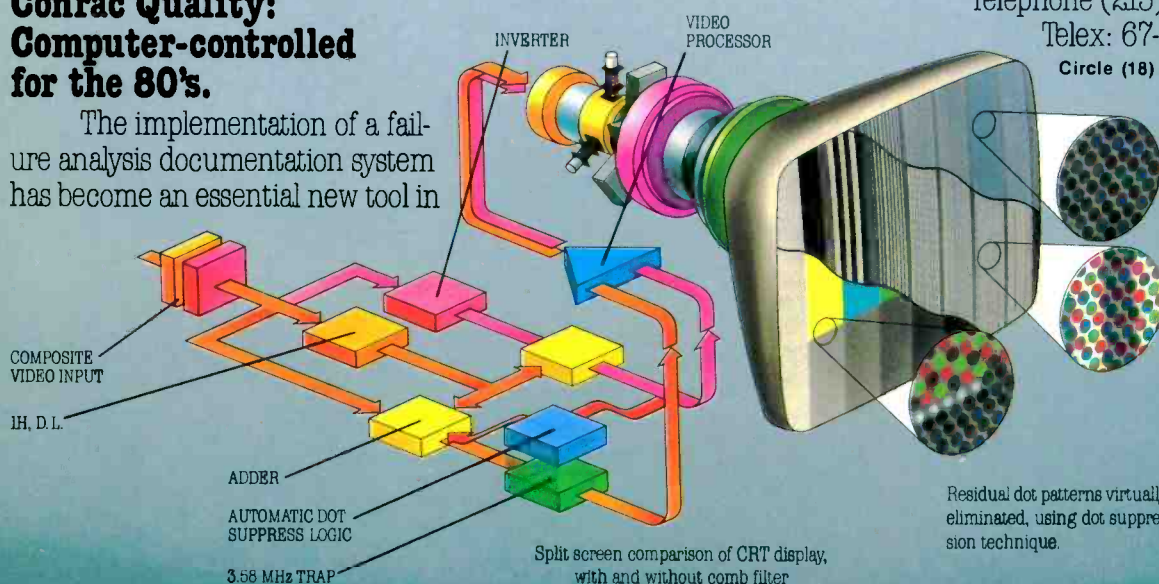
Circle (18) on Reply Card



1. Multiburst test signal with conventional bandpass and notch luminance/chrominance separator.



2. Multiburst test signal with Conrac's Comb Filter luminance/chrominance separator.



1. Luminance resolution using the conventional notch/filter separator.

2. Luminance resolution using the comb filter separator.

Residual dot patterns virtually eliminated, using dot suppression technique.

Quality you can take for granted.

AES conference slated for Los Angeles

- May 12-15, 1981
- Los Angeles Hilton
- More than 186 exhibitors expected

As this issue of **BE** goes to press, the plans for the Audio Engineering Society's 69th Technical Meeting and Exhibits are still being made. A call for papers went out in November, but the final selection of papers and their scheduled presentation times will not be available for another few weeks.

The convention chairman for this major meeting is John Eargle of J.B. Lansing Sound in Northridge, CA. The papers chairman is Daniel Queen of Daniel Queen Associates in Chicago, IL.

For more information about the technical program to decide about attending this year's meeting, contact the AES directly at:

60 East 42nd St.
New York, NY 10165
(212) 661-8528

Also, a preview of this convention is expected to be included in the March issue of the "AES Journal" which is scheduled for mailing March 15. However, the final selection of papers will probably not be available until the convention convenes on May 12.

AES Exhibitors

The exhibitor sign-up for the 69th AES meeting is not yet complete, but the registration at press time is as follows:

AB Systems
Accurate Sound Corporation
Acoustic Design by Jeff Cooper
Acoustilog Inc.
Advanced Music Systems
Advanced Technology Design Corp.
Agfa-Gevaert Inc.
AKG Acoustics Inc.
Allen & Heath Brenell Ltd.
Alpha Audio
Altec Lansing
Amber Electro Design Ltd.
Amek Systems & Controls Ltd.

Ampex Corporation
Anvil Cases Inc.
Aphex Systems Ltd.
Association of Sound and
Communication Engineers
Ashly Audio Inc.
Audico Inc.
Audicon Inc.
Audio Concepts
Audio & Design Recording Inc.
Audio Developments
Audio Engineering Associates
Audio Kinetics (UK) Ltd.
Audio/Tek Inc.
Auditronics, Inc.
BASF Systems
Beyer-Dynamic Inc.
BGW Systems Inc.
Bose Corporation
Brüel & Kjær Instruments
The BTX Corporation
California Switch & Signal
Canford Audio Ltd.
Cara International Ltd.
Cerwin-Vega Inc.
Cetec Gauss Inc.
Cetec Vega

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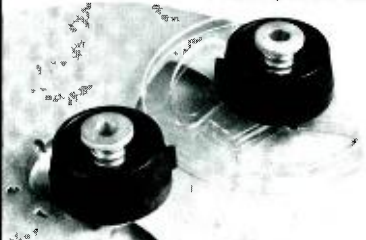
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When you're looking for a quick-loading, highly reliable method of securing either NAB or RETMA tape reels in place, look to the VIF 1000 Lock-Down Reel Retainer.

This precision designed retainer works with 1/4" and 1/2" reels on both rack and console mounted recorders. And, the VIF 1000 has been developed to provide you with years of trouble-free service even under the roughest handling.

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Sound Advice

The Problem: Selecting a first playback stage, low noise tube for an Ampex Professional Audio tape recorder.

The Solution: Replace the tube with a VIF 1006 JFET device that has lower noise, higher amplification, and will last about 600 times longer than an equivalent tube without drift or aging.



The Price: \$33.00 each. Some Ampex models require an Adaptor, available at \$16.00 each.

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April 1981 **Broadcast Engineering** 29



The moving coil replacement from Stanton Magnetics... the revolutionary 980LZS!

Now, a low impedance pickup that offers all the advantages of a moving magnet cartridge without the disadvantages of a moving coil pickup. It offers a dramatic new crispness in sound, a new crispness resulting from its rise time of less than 10 micro seconds. Low dynamic tip mass (0.2 mg.) with extremely high compliance assures maximum smooth trackability. The 980LZS connects to either a moving coil input or a separate preamp.

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For further information write to Stanton Magnetics Inc., Terminal Drive, Plainview, N.Y. 11803

Visit Us at the AES
Booth 59/60 in Los
Angeles May 12-15.



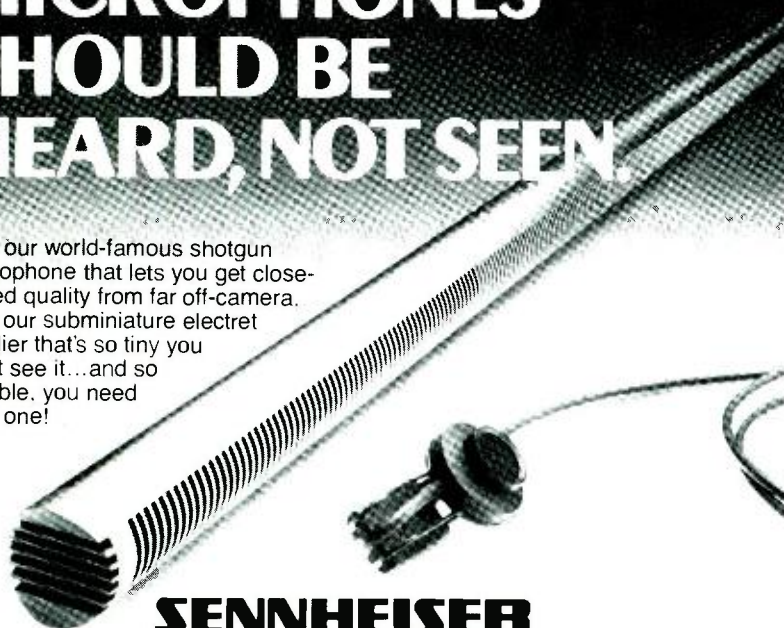
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Con Brio
Cross Ltd.
Crown International
Dallas Music Industries Inc.
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David Lint Associates Inc.
dbx Inc.
DeltaLab Research Inc.
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Matthews Studio Equipment Inc.
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MICMIX Audio Products Inc.
The Mike Shop
Mitsubishi Electric Sales
America Inc.
Music World Merchandise
MXR Innovations Inc.
Nady Systems Inc.
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Division
Peavey Electronics



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The all new Telex 3000 is here NOW!

No industry has witnessed more technological improvements over the past few decades than our own. So, if you're looking for a tape transport for broadcast, studio or industry, it's important to choose a product with all the latest industry innovations in one unit, the NEW Telex 3000. Write for exciting details about these features.

- Interchangeable head blocks
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CHRONTROL: THE NEW MANAGER

To manage time.

To appoint a series of tasks and have them accomplished,
timed accurately to the second.

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Accuracy that is possible in a programmable timer
because of our microprocessor technology.

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The tool of time management.

The new manager.



Over 36 public radio stations nationwide use ChronTrol's rack mount units to automatically start and stop recorders for satellite feed from the geo-stationary satellite Westar I. Additional references and a catalog of other ChronTrol models and their applications are available from: Lindburg Enterprises, Inc., 4878 Ronson Court, San Diego, CA 92111, (714) 292-9292, TLX/TWX 910-335-2057. Time was. ChronTrol is.

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AES

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Phase Linear Corporation

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Facts from Fluke on low-cost DMM's

Our new 4½-digit bench/portable: You've never seen anything like it.

Take a close look at the face of this instrument. Notice anything new? If you just realized you've never seen *words* on a low-cost DMM display before, you're on the right track.

This is the new 8050A from Fluke, the *lowest* priced 4½-digit multimeter available that uses microprocessor technology.

The legends on the LCD are clues to what makes the 8050A unique.

dB: You're right. The 8050A delivers direct readouts in dBm, referenced to any of 16 impedances. Use the "REF Z" button to scroll through the memory and locate the zero dBm reference you need,

then set it and forget it. No more tedious calculations or conversions.

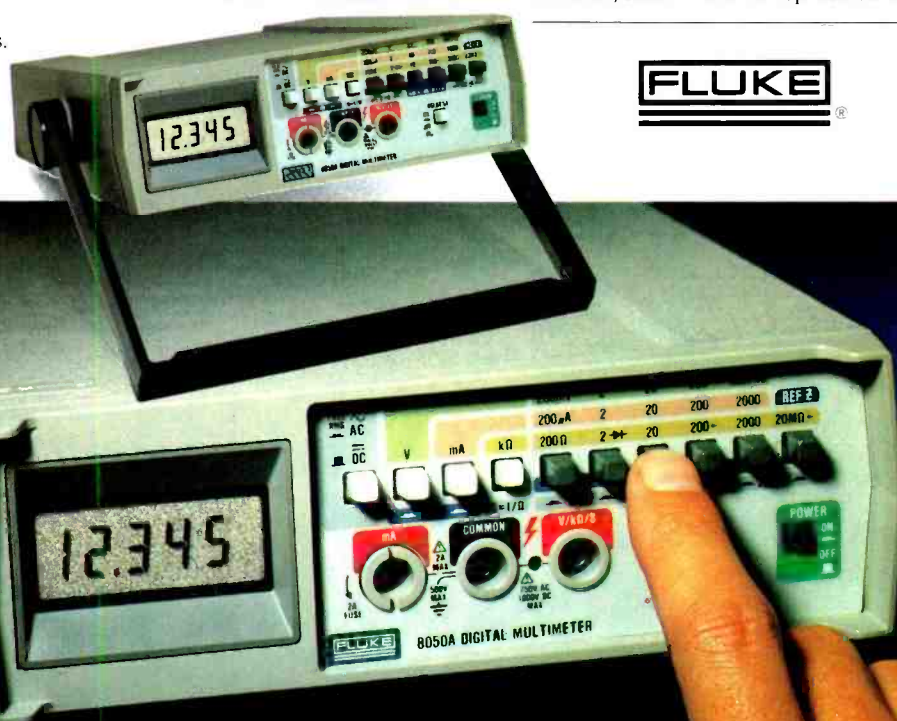
REL: For relative references in the dB mode or offset measurements in all other functions. Lets you store any input as a zero value against which all others are automatically displayed as the difference. Another timesaving convenience.

HV: Just a reminder when your input is over 40V, so you won't forget about safety while in the dB or relative modes.

Of course there's much more to the

8050A. True RMS measurements to 50 kHz. Conductance for measuring resistance to 100,000 Megohms and leakage in capacitors, pcb's, cables and insulators. Diode test, 0.03% basic dc accuracy and full input protection. Plus a large family of accessories. Just \$369 U.S.

For all the facts on the versatility and value of the new 8050A, call toll free **800-426-0361**; use the coupon below; or contact your Fluke stocking distributor, sales office or representative.



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Tilburg, The Netherlands
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BE 4/81

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☐ Please send all the facts on Fluke low-cost DMM's.

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For technical data Circle (28) on Reply Card

AES

British Companies to introduce new equipment

More than 20 UK companies are among the 188 exhibitors currently signed up for the AES show. There will be some new faces and stacks of new equipment, including a bi-amplified electronic crossover studio monitoring loudspeaker and a new range fader, among the exhibitors.

The 2-drive unit bi-amplified electronic crossover switch monitoring loudspeaker is to be launched by Swisstone Electronics, taking part in the show for the first time. It is designed for full bandwidth (40Hz to 20KHz) high-level monitoring (114dB linear response at 2M from a pair), and reportedly, permits far less coloration and distortion than has previously been possible in a high-level monitor.

Keith Monks (Audio) Ltd., will launch its KMAL/POL Producers' and Office Listening Unit. This incorporates a servo belt drive turntable with integral low mass arm and high compliance cartridge, with 2x10W stereo amplifiers, and can be used by a radio producer to listen to records being played during the recording transmission of a program, or by radio sta-

tion engineers and executives to listen in to a direct line recording via a 600Ω line signal.

New from Penny & Giles Plastics will be the 3000 range fader, a compact, robust, high-performance fader designed for portable mixing consoles, or as a secondary controller for fold back and monitor level in studio mixers.

Klark-Teknik products to be featured by Statik Acoustics include the DN80 16-Bit Real Time Audio Computer. Being demonstrated for the first time in the United States, the product is designed around a fast processor, reportedly utilizing bi-slice technology to achieve operating speeds previously unattainable.

Audio Kinetics (UK) Ltd. will give a first West Coast showing to the Q-LOCK 310 synchronizer, which can synchronize three machines with a wide range of interfaces. A high-speed reader option has been introduced to allow use with any SMPTE time code source. Like its sister product, the Q-LOCK 210, the unit will locate and lock multiple audio and videotape transports.

First production models of Allen & Heath Brennell's new range of portable mixing consoles, the 16:4:2, will be demonstrated. Designed specifically for sound reinforcement and

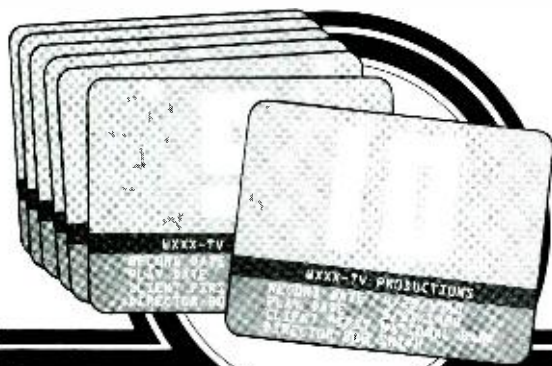
multi-track recording, the 16:4:2 is built directly into a heavy-duty PFP case with slip on PFP cover and integral carrying handle.

Another first-timer, Jordan-Watts, will feature the Black Dwarf, a loudspeaker system producing 118dB of sound on just 256W and in an enclosure measuring only 2x1½x¾ feet.

The West Coast will also get its first look at the TSR professional multi-track recorder from Trident Audio Developments. Standard features of this 24-track tape machine include compact remote and autolocate and transformerless input and outputs; 5-6dB savings in signal-to-noise ratio over comparable machines is claimed.

Solid-State Logic will unveil two new features added to its LS 4000E series recording and mixing console. One is a plasma display bar-graph monitoring system; the other is a redesigned master panel, including a bar-graph meter switching and peak load system.

Those who still cannot find the mixing console they need from all the standard hardware on show will have a new source to check out among the custom builders in Tweed Audio, which makes them to spec for TV, radio, film dubbing, recording and ENG/EFP.



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Now you can generate a count-down for ENG editing and film-to-tape transfers without tying up a camera.

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Circle (31) on Reply Card

April 1981 **Broadcast Engineering** 37

Professional reel-to-reel audio recorders: a roundup

By Dennis Ciapura, general manager of telecommunications, Greater Media Inc., East Brunswick, NJ, and Bill Rhodes, editorial director

Each year there are new predictions of how some new "high technology" cassette or cartridge device will make open reel machines obsolete. Yet reel-to-reel continues to flourish in the broadcast industry, and until some sort of all-digital tape cartridge and editing system becomes a reality, reel-to-reel analog machines will dominate the audio production market.

Aside from some of the obvious editing advantages, a good reel-to-reel machine mated to one of the high performance tapes can yield audio per-

formance approaching digital, and, in the production studio where multiple generations are often the name of the game, all-out fidelity is an important consideration. It is not surprising, therefore, that the reel-to-reel tape deck manufacturers have emphasized these two areas in upgrading their wares.

No matter how attractive the old reliables are, there will always be those that turn the heads of equipment purchasers. New machines and new models continue to attract lots of attention at trade shows, and sales are brisk. There is a market for new and innovative designs as well as the latest versions of the more familiar products.

Most broadcast facilities employ a combination of time-proven decks with some of the newer designs, and many new brand names are finding their way into broadcast facilities. Each broadcaster's requirements are

different, but the wide range of reel-to-reel equipment available makes shopping for a new machine exciting and rewarding.

The roundup of reel-to-reel audio recorders that follows is a compilation of models and the major features of each that are of particular interest to broadcasters. This roundup was developed by contacting major manufacturers and compiling their data. However, some brand new models may be shown at NAB '81/Las Vegas, April 12-15, that are not being announced in this article.

Prices are approximated for general reference only; contact the manufacturers for quotes of prices. Delivery information is for typical ARO shipments but may vary with order backlogs and availability of components.

For data on each of the models listed, use the reader service card and the number following the recorder.

*Ciapura serves as technology consultant for **Broadcast Engineering** and covers a wide area of advancing technology topics for radio, television and satellites. He is general manager of telecommunications for Greater Media Inc., a broad-based communications company currently operating 13 broadcast stations and several cable TV systems as well as satellite and land mobile facilities. Ciapura has written more than 40 major articles covering a wide range of technical subjects in broadcasting, recording and satellite communications.

Ampex Corp.
402 Broadway
Redwood City, CA 94063

Ampex ATR-100 series



The ATR series (ATR-101, 102, 104) recorders feature an exclusive tape handling system first developed by Ampex for computer tape transports that eliminates the use of pinch rollers, and advanced signal electronics. The recorders have a transport design that includes a fully servo-ed tape drive system permitting

substantial improvements in tape handling and timing accuracy. The ATR-100 recorders employ a closed loop servo system that maintains constant tape tension at each reel in all operating modes.

Special features: matrix-display control panel; built-in digital computer logic; pick-up record capability; and any reel size from 2 to 14 inches may be used without tension readjustment.

Prices: ATR-101, \$5900; ATR-102, \$7200; ATR-104, \$9400.

Delivery (ARO): 30 days.

Circle (150) on Reply Card

Ampex ATR-124



The ATR-124 multi-track recorder features the smooth tape handling characteristics developed by Ampex for computer tape transports and features a tape handling system that eliminates the use of pinch rollers. The ATR-124 employs a closed loop servo-ed transport that maintains constant tape tension at each reel in all operating modes and a phase-lock servo-controlled capstan. The recorder has a 16-inch reel capability, useful for double system recording in a quad videotape recorder environment. Dual microprocessor controls are used in all ATR multi-track recorders for greater reliability and less downtime.

Special features: flux gate recording head; phased equalized recording; Sel-Sync synchronous recording; PURC record insert controller; and auto-bias accessory that enhances the setup efficiency of the ATR-124.

Price: \$63,250.

Delivery (ARO): 30 days.

Circle (151) on Reply Card

Ampex ATR-700

The ATR-700 audio recorder provides expanded production capa-

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Recorders



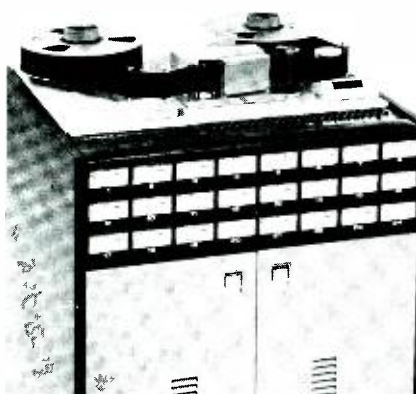
response; motion sensing; edit control; and tape guidance system.

Price: \$9000.

Delivery (ARO): 30 days.

Circle (153) on Reply Card

Ampex MM-1200



bilities to professional users at AM-FM radio and TV stations. It incorporates variable speed, 10½-inch reel capability, full remote controls and a built-in 4x2 mixer. The recorder has a 3-motor tape drive system with a capstan servo dc motor that provides greater torque with improved operational control and speed accuracy. A universal supply permits operation on ac power anywhere in the world.

Special Features: synchronous reproduce capability; 2-channel electronics; three record/reproduce formats; three reel sizes.

Price: \$1995.

Delivery (ARO): 30 days.

Circle (152) on Reply Card

Ampex AG-440C



The AGC is designed for recording studios, radio stations and professional recording uses in the broadcast industry, education, industry and government. The 440C transport eliminates the problem of switching from fast forward-rewind to play by adding motion sensing. Edit control releases brakes, eliminating handling of the tension arm. Sapphire guides and a flutter idler reduce skew, thereby improving tracking.

Special features: high frequency

The MM-1200 is a multi-channel audio recorder for use by professional recording studios in making master recordings for record albums and in sophisticated TV and motion picture productions. It is designed to work with various synchronization equipment in professional audio-video dubbing and mixing operations. The MM-1200 has a common chassis and transport, plus an electronics package that allows the 8- and 16-channel recorders to be upgraded to 24 channels. With the EECO time code accessory equipment, the MM-1200 offers precise synchronization of multi-track audio recorders with quad or helical video recorders, or for synchronizing two or more audio recorders.

Special features: built-in search-to-cue; full capability remote connector panel; rotary tape guides; and 16-inch reel capability.

Price: 24-track machine, \$38,500.

Delivery (ARO): 30 days.

Circle (154) on Reply Card

Ampro/Scully

826 Newtown-Yardley Road
Newtown, PA 18940

Scully 255 tape reproducers



The 255 series of machines, developed for broadcasters, are compact 10.5-inch reel tape reproducers for mono or stereo automation or reproduce-only applications. This series has a heavy cast deckplate to maintain tape alignment, short head-to-capstan distance to reduce flutter, trouble-free TTL logic, optional 25 Hz tone sensor for automation and optional remote control.

The 255 also features all touch-button control logic with protective motion sensing circuits to prevent tape break or spill when operating from fast mode to play. Automatic tape lifter defeat is actuated by depressing fast mode button on transport or remote control. Set-up adjustments and easy maintenance are accomplished by pull-off front dress panel that permits access to equalizers. XLR output connectors are employed to make the Scully 255 compatible to broadcast standards.

Price: monaural, \$1525; stereo, \$1595.

Delivery (ARO): 30 days.

Circle (155) on Reply Card

Scully 250 recorder/reproducer

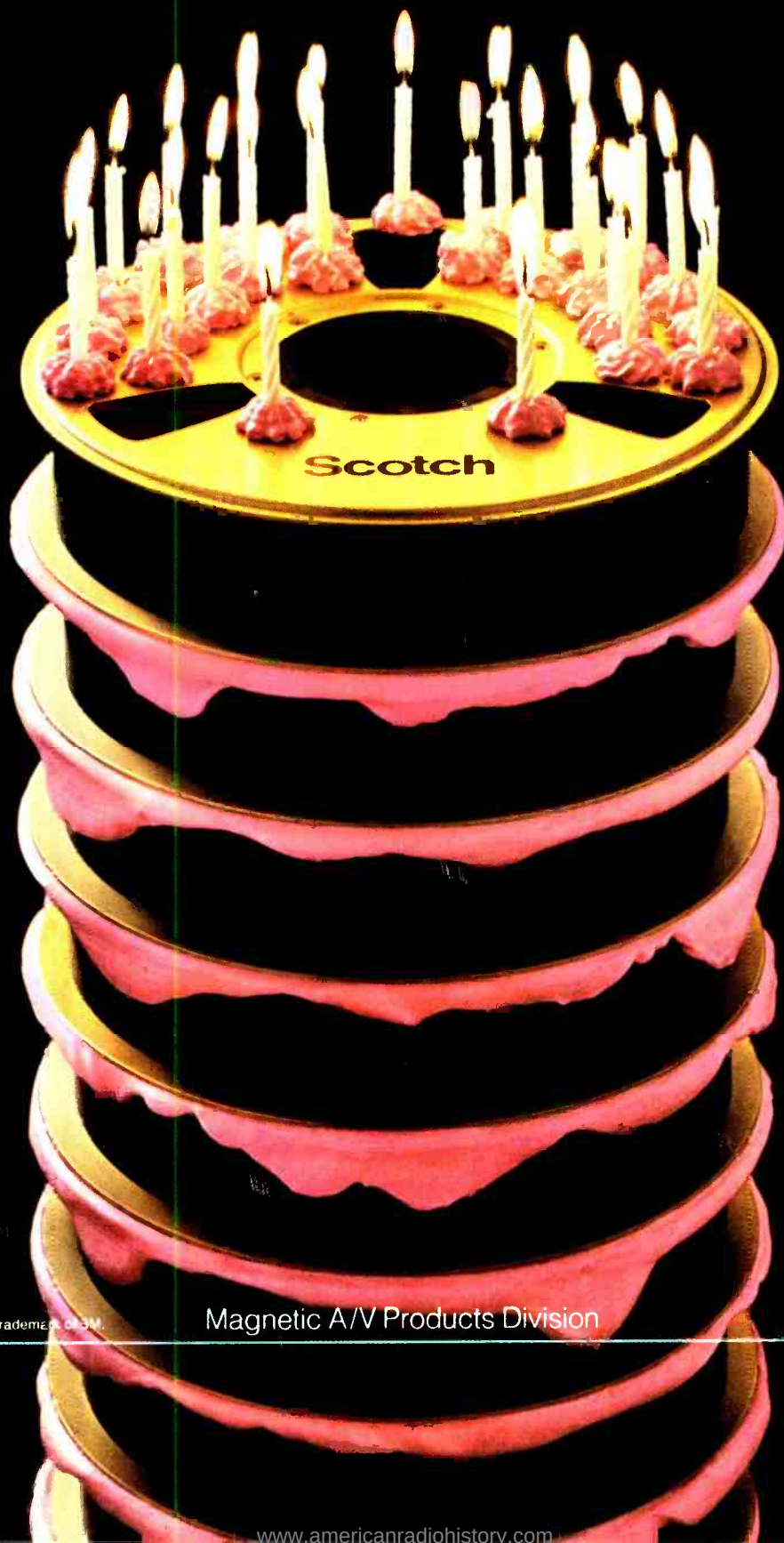


The 250 has all the features of the 255 reproducer plus dependable electronics in a pull-out sleeve drawer for easy alignment and maintenance. Designed to take on all assignments in which a compact recorder is needed, the 250 has accessory plug-in mic-preamps and a portable case for field applications. Available in full or ½-track mono; 2- or ¼-track stereo. NAB or IEC equalization.

Contemporary—yet totally compatible with the traditions of Scully Recording instruments—the new 250 series is designed to meet quality, reliability and operational needs in a professional, compact 10.5-inch (26.67cm) broadcast recorder/reproducer.

The 250 features low-noise dependable electronics with sync control provided for adding a track to alternate channel, and input/playback monitor/VU selectors. Equalization is

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www.americanradiohistory.com

Recorders

switched with speed control. Adjustments and maintenance are made easy by a pull-out drawer providing top access to equalization and bias controls.

Price: monaural, \$2620; stereo, \$2745.

Delivery (ARO): 30 days.

Circle (156) on Reply Card

Scully 280B recorder/reproducer



This series incorporates functionally illuminated transport controls, motion-direction sensing, dynamic braking and a new constant tape tension control for improved tape handling.

Also offered is an optional dc capstan-servo drive with variable pitch control. Two advantages are gained, in addition to servo control: the capability of adjusting pitch up or down to a desired level; and the more positive tape drive at all speeds afforded by the larger capstan and pinch roller in the servo system. The result is a system for broadcast and studio recording in which smooth, positive tape handling, low-noise electronics and control convenience provide truly professional results.

The 280B is available in full- or ½-track mono; 2- or ¼-track stereo in ¼-inch (6.35mm) models, or 4-track (quad stereo) in ¼-inch (6.35mm) or ½-inch (12.7mm) tape width models. Options/accessories: dc capstan servo system with pitch control, VARISYNC accessory, console mount, remote transport control.

Prices: monaural, \$3955; stereo, \$4895; ½-inch, 4-track, \$6815.

Delivery (ARO): 30 days.

Circle (157) on Reply Card

Scully 270 series reproducer

The Scully 270 professional long-play reproducer has been well-received by the automated broadcast industry. Designed to run for long periods, reliably and with trouble-free performance, the 270 is a rugged, heavy-duty reproducer designed and

built with professional craftsmanship.

This bidirectional, 14-inch (35.56cm) reel capacity tape reproducer is used for automation and other long play professional applications. Automatic reversing models available in ½-track mono- or ¼-track stereo. A single direction model for 2-track stereo is also offered.

Features include: disc brakes; fully transistorized, plug-in amplifiers; cast frame and solid panel construction; direct drive heavy-duty motors; removable face plate; instant access for maintenance; automatic start torque tension control; and reversing capability with mono half-track and stereo ¼-track units only; accomplished by foil-sensing low current transistor switching.

Prices: monaural, \$3933; stereo, \$4428; 2-track, bidirectional, \$4857.

Delivery (ARO): 30 days.

Circle (158) on Reply Card

Scully 284B-8 recorder/reproducer

The 284B-8 series Master Recorder/Reproducer is available in an 8-channel version using the popular low noise 280B electronics. The 284B-8s use 1-inch (24.5mm) tape for maximum 8-channel separation and quality and up to 14-inch (35.56cm) tape reels to provide a realistic supply of tape for program-length recording and post-production.

The 284B-8 has motion-direction sensing, dynamic braking, and automatic start-torque boost for smooth, positive tape shuttling and uses a new constant tension system for added tape handling precision in the Play/Record modes. Scully dc capstan servo drives are standard on all units, as is the variable pitch control.

Any two specified adjacent speed-pairs will be present when the machine is ordered. Equalization is automatically switched with speed control. A sturdy console cabinet is included as standard equipment.

Accessories include: VARI-SYNC, remote transport control.

Price: \$12,650.

Delivery (AR): 30 days.

Circle (159) on Reply Card

Scully 285B reproducer

The 285B Reproducer is a professional quality playback or editing system for broadcast or studio applications, as automated tape players, quality control monitors, broadcast control room reproducers or music library reproducers. Its electronics include 600 Ω line output and 8 Ω (3W) speaker output for cueing, editing and monitoring. Speaker gain control is on

the front panel.

Transport features found in the 280B series are standard, such as motion-direction sensing logic, functionally illuminated push-buttons, edit control and dynamic braking. Rack-mount units occupy only 15.75 inches (400mm) of vertical space—electronics are mounted behind the transport deck plate. Electronic set-up adjustments are accessible by removing the head cover. A monitor headset jack is mounted on the transport panel for convenience. It uses ¼-inch (6.35mm) tape and up to 11.5 inches (29.21cm) reels.

Configurations include: full-track mono, 2- or ¼-track stereo. Accessories: slope-front console, remote control.

Prices: monaural, \$3075; stereo, \$3185.

Delivery (ARO): 30 days.

Circle (160) on Reply Card

Gotham Audio

742 Washington St.
New York, NY 10014

Telefunken M-12A

This ¼-inch tape recorder is available in mono and stereo formats and mic/line inputs are available on models with built-in mixer. It has servo tension control, takes 10½-inch reels, and is rack-mountable.

Price: \$5000 to \$6000.

Delivery: from stock

(Write Gotham for data.)

Telefunken M-15A-SU2/VU

This ¼-inch tape recorder is console-mounted with VU meters and has a full range of accessories, including vari-speed and auto-locator.

Price: \$13,500.

Delivery: from stock

(Write Gotham for data.)

Telefunken M-15A Multi-Track

This multi-track recorder has up to 32 tracks on a 2-inch tape and features advanced digital logic control and servo system. It has a full range of accessories and options.

Price: to \$86,000.

Delivery: from stock.

(Write Gotham for data.)

International Tapetronics Corp.

2425 S. Main St.
Bloomington, IL 61701

ITC-770

The 770 series reproducer and

No other recorder stacks up to Scully.

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When it comes to quality and enduring performance, nothing beats a Scully ... the original workhorse. For over 20 years, Scully recorders have been the standard of excellence. Their exceptional durability and engineering flexibility allow them to serve engineers today as well as they did in 1960. With our economical refurbishing service, you can update your studio without having to buy a new Scully to do it. Call us for an estimate.

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Circle (33) on Reply Card

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Recorders



recorder/reproducer has been designed for broadcasters. The reproducer is designed for use in program automation systems and the recorder/reproducer is a general purpose reel-to-reel machine. The 770 series is designed to meet or exceed the NAB standards for reel-to-reel tape reproducers; available in a variety of configurations, including 1- and 2-track, mono or stereo capabilities and tape speeds of 3¾, 7½ and 15ips; constructed with ½-inch thick aluminum tool plate deck for stability; equipped with a unique, high quality, professional head assembly that uses two torque motors for supply and take-up reel handling—a dc servo capstan motor for tape drive; and is designed for simplicity and serviceability of electronic and mechanical components.

Price: reproducer, 7½ips, 1-track, stereo, \$1570; recorder/reproducer, (mono), \$2600; (stereo), \$2935.

Delivery: April 1981.

Circle (161) on Reply Card

MCI Inc.

1400 West Commercial Blvd.
Ft. Lauderdale, FL 33309

MCI JH-110B series



The JH-110B series of tape recorders and reproducers includes models from mono to eight tracks. Standard features include three speeds with separate EQ and bias settings for each speed, variable speed, RTZ III spot

timer/locator, including four programmable memories and built-in tape velocity indicator, transformerless head coupling for increased frequency response and quick change tape format capability. Available for rack-mounting—or in either of two cabinet styles—the JH-110B also includes many options and specialty versions for various special applications.

Price: stereo, \$5800.

Delivery (ARO): 45 days.

Circle (162) on Reply Card

MCI JH-24 series



The JH-24 series of multi-track recorders is available in 8-, 16- and 24-track versions. Features include totally transformerless circuitry, quick-change tape format capability, full remote provided as standard equipment and the optional AutoLocator III, including 10 programmable memories, tape velocity indicator and yo-yo (repeat) functions.

Special features: 2-speed operation with separate EQ and bias settings for each speed. NAB/IEC switching; and spot erasure capability.

Price: 24-track, \$37,477.

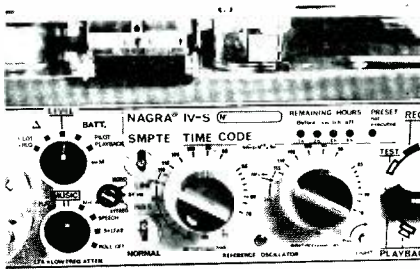
Delivery (ARO): 45 days.

Circle (163) on Reply Card

Nagra Magnetic Recorders Inc.

19 W. 44th St.
New York, NY 10036

Nagra IV-S, 4.2, IS, and SN



The Nagra line is widely used in cinema, television and radio for sound reproduction and sync of sound with

visual images. The IV-S is a stereophonic version for radio, TV, recording and cinema industries and can be adapted to SMPTE/EBU time code editing.

The 4.2 is a mono recorder for cinema and broadcasting.

The IS resembles the 4.2 but is smaller and lighter.

The E version is particularly sturdy for field recording purposes.

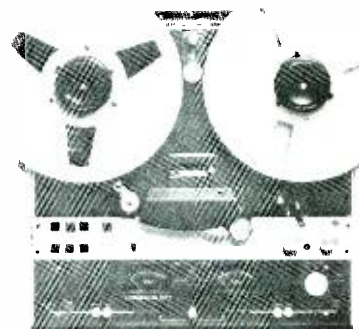
SMPTE/EBU time code generators are available for the Nagra 4 and IS models as well as for the IV-S.

Circle (164) on Reply Card

Neal Ferrograph (USA) Inc.

652 Glenbrook Road
Stamford, CT 06906

Neal Ferrograph SP7



SP7 Reel-to-reel recorder

The SP7, designed with the broadcasting industry in mind, is used extensively by the BBC and other leading broadcast authorities worldwide. The logic control deck can be supplied in a form determined by the customer—with or without mic preamps, setter stereo, mono, track configuration, etc. The SP7 is a 3-head, 3-motor, 3-speed recorder capable of being custom built at a very competitive price.

Special features: ability to switch in and out of record while running; variable speed rewind; uncluttered deck; and cabinet- or rack-mounting.

Price: \$1700 to \$2200.

Delivery: from stock.

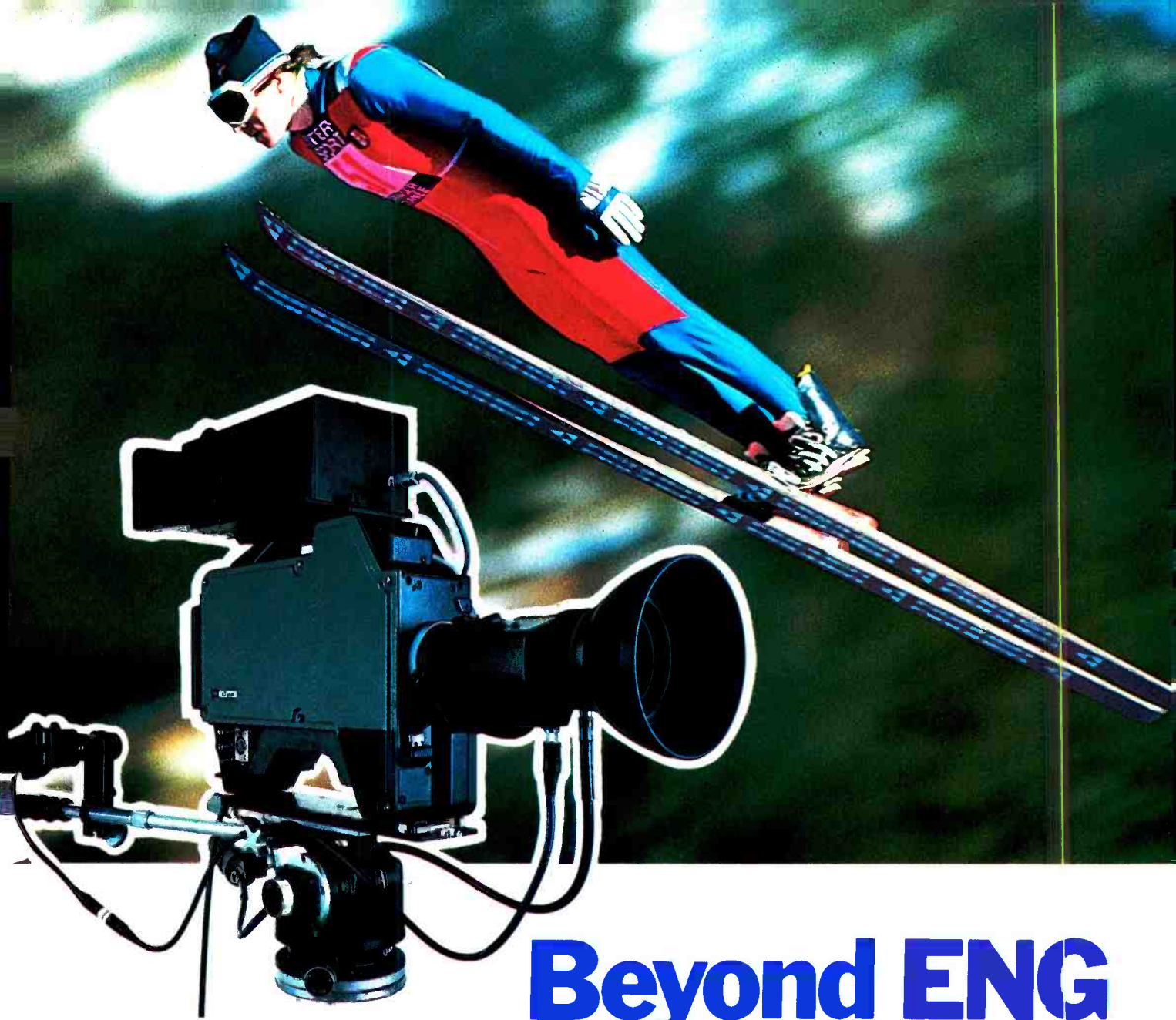
Circle (165) on Reply Card

Otari Corp.

1559 Industrial Road
San Carlos, CA 94070

Otari MX-5050B series recorder/reproducer

General features include switchable +4 or -10dB levels; dc servo motors for adaptability to SMPTE interlock and video production; easy



Beyond ENG

Born into ENG, the HL-79A adapts beautifully to EFP. The accepted leader in ENG, the HL-79A, reinforced its position as the preeminent portable camera at the 1980 Winter Olympics. Scores of HL-79A's covered the ski slopes, the bobsled and luge runs and the skating rinks for the ABC Network. Their performance brilliantly etched into the world's visual memory, is history. But the industry already knows about the HL-79A's capability.

Today, more and more broadcasters are learning that the HL-79A is a superior EFP color camera. Options such as 4½-inch electronic viewfinder with return video, program and intercom audio plus gen-lock — among other features —

transform it into the ideal camera for sports and special events, commercials and high quality production. Triax equipped, it ranges nearly a mile from its base station. Near-darkness is its frequent habitat; but it has knee control for brilliantly lit scenes too.

Of course, you may need some of its ENG flexibility for EFP too —like its shoulder action shape, 11.2 pound weight, 6-hour clip-on battery.

The specs and automatic features of the HL-79A are equally outstanding. They're yours, along with an eye-opening demonstration, at your Ikegami distributor. Or contact Ikegami Electronics (USA) Inc., 37 Brook Avenue, Maywood,

N.J. 07607, (201) 368-9171. West Coast: 19164 Van Ness Ave. Torrance, CA 90501 (213) 328-2814; Southwest: 330 North Belt East, Suite 228, Houston, TX 77060 (713) 445-0100; Southeast: 552 So. Lee St., Americus, GA 31709 (912) 924-0061.



Ikegami HL-79A

Circle (34) on Reply Card

Recorders



alignments; overdubbing and other production features. Three speeds, 1/4-track reproduce, full edit including indexed splicing block, noise-free inserts: XLR connectors, NAB/IEC switching and a 3-position alignment level switch.

Special features: two channel 1/2-track recorder/reproducer with 1/4-track reproduce capability; three speeds in speed pairs 15/7 1/2 or 7 1/2/3 3/4; and 600Ω balanced output.

Price: \$2150.

Circle (166) on Reply Card

Otari MX-5050BQ series II recorder/reproducer



General features include compact 1/4-inch 4-channel machine with dual speed (15/7 1/2-1/2ips) variable speed dc capstan servo, selective reproduce, motion sensing control logic, built-in test and cue oscillator, plug-in heads and easily accessible electronics adjustments.

Plus: proprietary microprocessor to govern transport control; electronic real-time counter with LED display; automatic monitor switching; selectable 20dB mic input attenuator on each channel headphone monitoring for each channel (selectable combina-

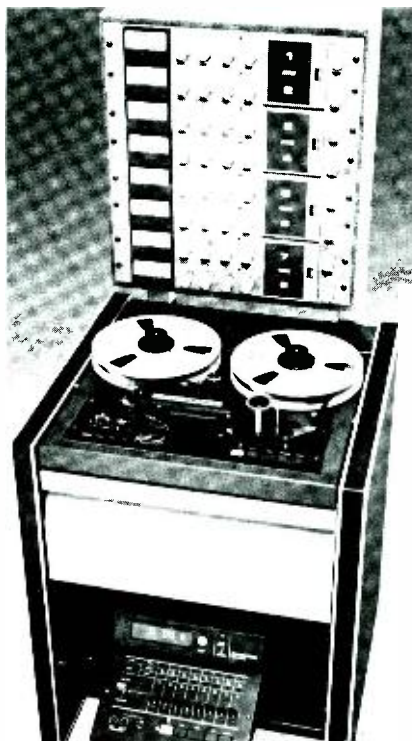
tions); peak reading indicators on each channel; separate mic/line mixing on each channel; integral electronics chassis design.

Special features: 2-speed, four channels; 10 1/2-inch reel capacity and bridging input and low impedance output for driving 600Ω loads.

Price: \$2995.

Circle (167) on Reply Card

Otari MX-7800



The MX-7800 is a 1-inch 8-channel recorder featuring 30/15ips; 600Ω balanced output; dc capstan-servo system; console cabinet; automatic monitor switching; VU meters plus peak LEDs; constant tape tension with dynamic braking; dual-frequency test oscillator; lift-up access to transport; and punch-in/punch-out.

Special features: channel selection and punch in/out can be accomplished from control position with optional CR-706 remote session controller, and CT-501 real-time tape timer also available optionally.

Prices: MX-7800, \$10,900; CR-706, \$700; CT-501, \$400.

Circle (168) on Reply Card

Otari ARS-1000 reproducer

Designed for the automated radio station, the ARS-1000 is engineered for heavy-duty continuous operation, with special emphasis placed on long-term reliability, simple operation and consistent performance. Design features include ease of maintenance with plug-in PCBs and mother board configuration; easy access head-cover



plus front adjustable output level and head azimuth; simple interlocked controls and straight line tape threading.

Special features: two speeds—7 1/2 and 3 3/4ips; adjustable front panel cue control; recessed front adjustable output level and head azimuth, with flip-up head cover; plug-in professional grade PC boards and relays; and 25Hz sensor available.

Price: \$1465.

Circle (169) on Reply Card

Otari Mark II-2, II-4 recorder/reproducers



The MK-II series is designed for those applications in which separate transport and electronics are necessary for ease in editing and maintenance. The electronics of the MK-II series feature glass epoxy (rear) plug-in boards with gold-plated contacts. Pictured in an optional Ruslang roll-around console.

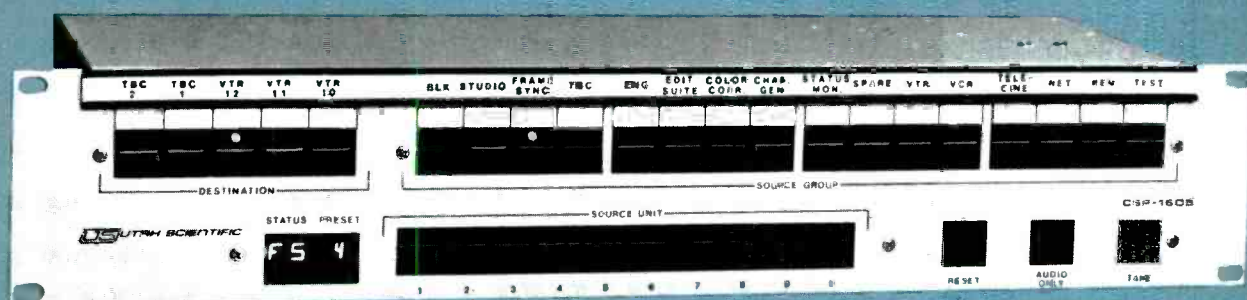
The Mark II-2 is a 2-channel, 1/4-inch tape recorder/reproducer at 15/7 1/2ips with 600Ω unbalanced output. It's a dc servo capstan system in a tabletop console.

The Mark II-4 is a 4-channel, 1/2-inch tape recorder/reproducer, 15/7 1/2ips, dc-servo capstan system with 600Ω unbalanced output in two wood cabinets.

Prices: Mark II-2, \$2695; Mark II-4, \$3895.

Circle (170) on Reply Card

ALPHANUMERIC ROUTING SWITCHER CONTROLLER



CSP-1605 FIVE-BUS ALPHANUMERIC PARTY LINE CONTROLLER - \$1,700

The CSP-1605 panel is one of a new series of routing switcher controllers from Utah Scientific. Each of these new models features alphanumeric Preset/Status displays with up to 1600 assignable name/number combinations to let your operator address sources by their actual name — VT14, CM 3, etc.

The CSP-1605 model pictured here can control five matrix busses and provides current status readout instantaneously as busses are addressed. Input selection is made by either one, two, or three keystrokes. Separate audio switching and statusing is standard and, as with all Utah Scientific party line panels, connection to the matrix is via a single coax.

ALPHANUMERIC DISPLAY — 1600 NAME/NUMBER — SINGLE COAX CONNECTION

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TWX #910-925-4037**

Circle (35) on Reply Card.

Recorders

Otari MTR-10-2, 10-4 production/master recorders

These are professional 2- and 4-channel production and mastering recorders offered in two professional formats: 1/4-inch 2-channel and 1/2-inch 4-channel. It features full dc PLL servo tape transport operation; transport logic and an exclusive, dual real-time counter are controlled by separate proprietary microprocessors; audio and transport electronics card frame is located for ease of adjustment and servicing; direct-coupled outputs; ac-

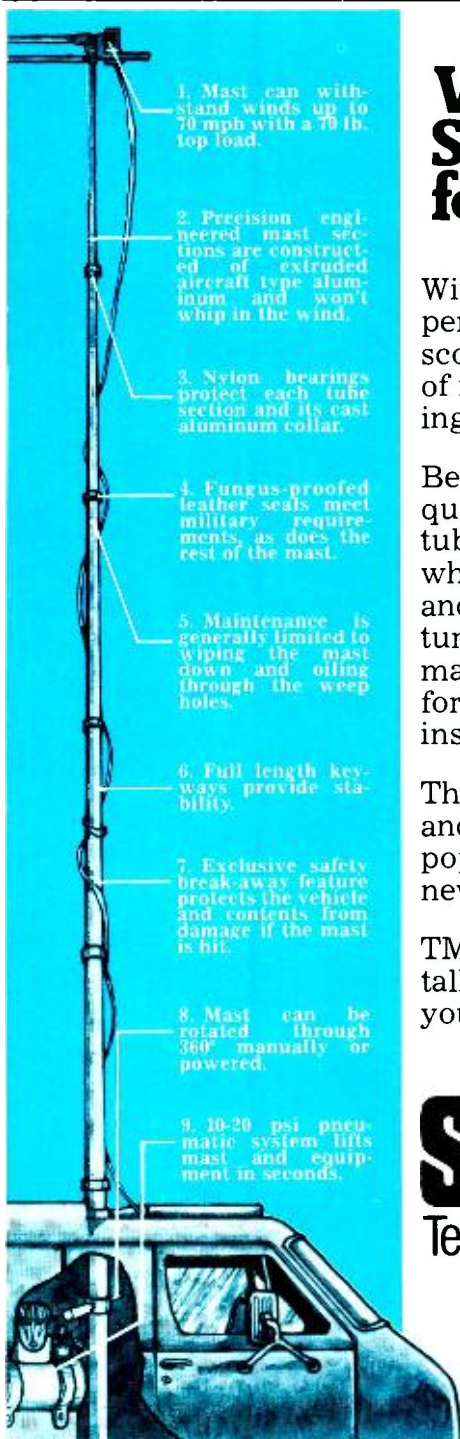


tive balancing on inputs and outputs; adjustable phase compensation, bias, record and playback levels that are aided by an internal multi-frequency square/sine wave generator; and rear-panel interface to transport and time base functions for SMPTE interlock.

Special features: rear-panel interface to transport and time base functions for SMPTE interlock; adjustable phase compensation; active balancing on inputs and outputs; and microprocessor-controlled tape transport operation with full logic.

Prices: MTR-10-2, \$6450; MTR-10-4, \$8450.

Circle (171) on Reply Card



What makes Sky-Hi the best for ENG?

With more than 20 years of experience making Sky-Hi telescoping masts, TMD has a way of making it the best telescoping mast for ENG.

Because they're made of high quality extruded aluminum tubing, because they don't whip when the wind builds up, and because of the other features you see here, Sky-Hi masts have been specified for more than 1000 ENG installations.

There are many sizes available, and now the 43' mast, the most popular size for ENG, has a new, lower nesting height.

TMD engineers are ready to talk to you about the mast you need.

SKY-HI®

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Wooster, Ohio 44691
(216) 262-7010

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Otari MTR-90 master recorder



This 2-inch 16/24 channel master recorder is tailored for post-production houses, networks and recording studios. It features superior tape handling—the industry's first 3-motor, pinch-rollerless 2-inch tape transport that can keep up with a VTR; advanced audio—high slew-rate components, active mixing of bias and audio, single-card electronics, and a 71dB dynamic range (24-track); and advanced control circuitry—digitally controlled LSI circuitry for reliability and ease of operation.

Special features: digitally timed gapless inserts, easy to access to EECO, BTX, ADAM-SMITH, AUDIOKINETICS, CMX and CVC; and optional phase-compensated wide-band amplifier available for high speed SMPTE code reading.

Prices: MTR-90-16/24, \$29,950; MTR-90-24, \$36,950.

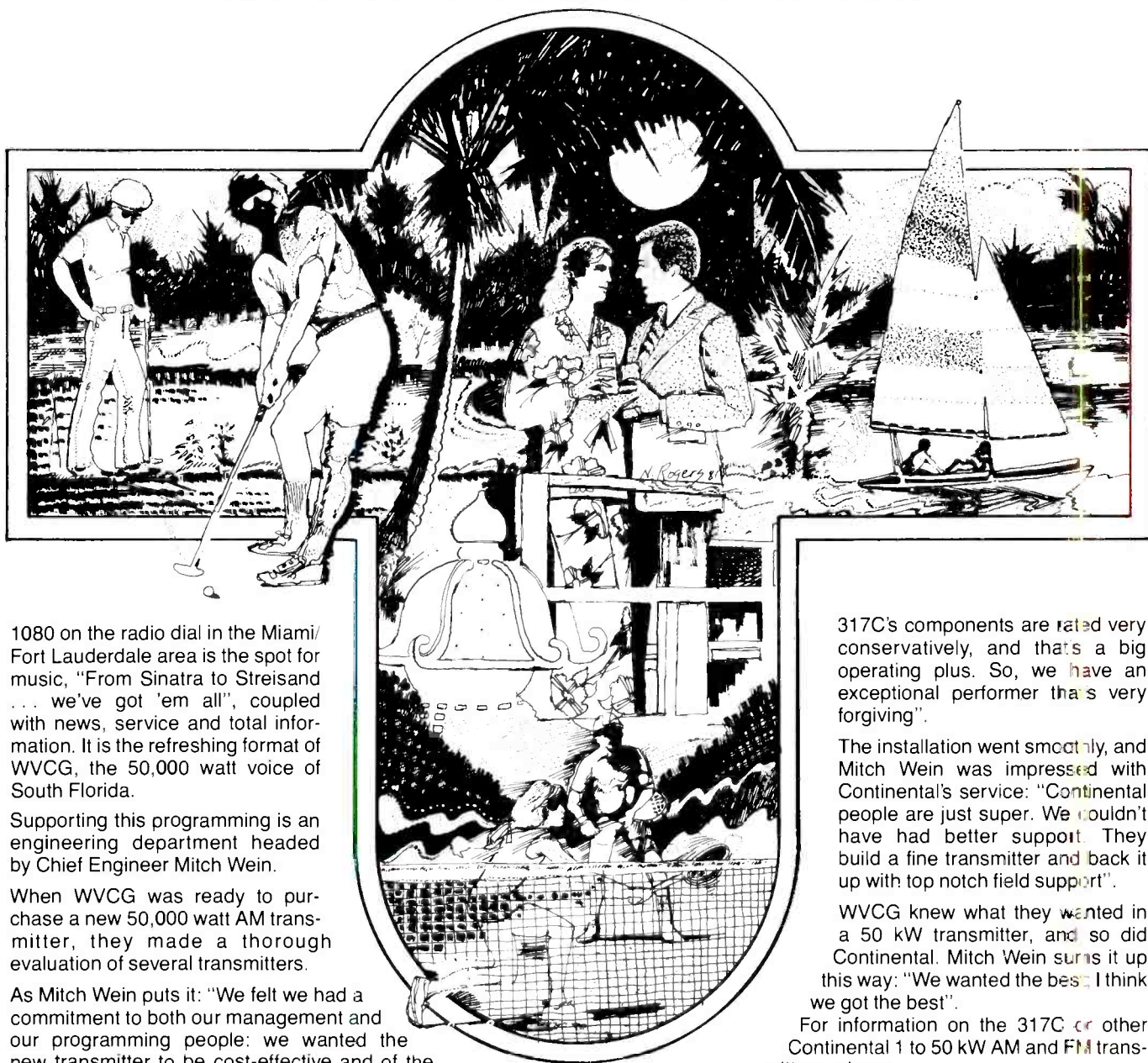
Circle (172) on Reply Card

Panasonic Co.
Professional Audio Division
One Panasonic Way
Secaucus, NJ 07094

Technics R&B series RS-10A02

The RS-10A02 is a 2-track stereo open-reel deck designed for professional and semi-professional applications in broadcasting, recording and

WVCG KNOWS EXACTLY WHAT THEY WANT IN A 50 KW AM TRANSMITTER. SO DOES CONTINENTAL ELECTRONICS!



1080 on the radio dial in the Miami/Fort Lauderdale area is the spot for music, "From Sinatra to Streisand ... we've got 'em all", coupled with news, service and total information. It is the refreshing format of WVCG, the 50,000 watt voice of South Florida.

Supporting this programming is an engineering department headed by Chief Engineer Mitch Wein.

When WVCG was ready to purchase a new 50,000 watt AM transmitter, they made a thorough evaluation of several transmitters.

As Mitch Wein puts it: "We felt we had a commitment to both our management and our programming people: we wanted the new transmitter to be cost-effective and of the highest quality".

After analyzing performance and operating data WVCG chose a Continental Electronics 317C transmitter.

Mitch Wein comments on the choice of the 317C: "Continental's 317C is certainly top quality. It's easy to tune; it's easy to maintain; it uses a minimum of floor space. The

317C's components are rated very conservatively, and that's a big operating plus. So, we have an exceptional performer that's very forgiving".

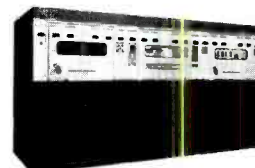
The installation went smoothly, and Mitch Wein was impressed with Continental's service: "Continental people are just super. We couldn't have had better support. They build a fine transmitter and back it up with top notch field support".

WVCG knew what they wanted in a 50 kW transmitter, and so did Continental. Mitch Wein sums it up this way: "We wanted the best. I think we got the best".

For information on the 317C or other Continental 1 to 50 kW AM and FM transmitters, phone (214) 381-7161 or

write to:

Broadcast Sales Department;
Continental Electronics Mfg. Co.
Box 270879
Dallas, Texas 75227.



Continental Electronics



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Circle (38) on Reply Card

Recorders



filmmaking. The major feature of this deck is its "isolated loop" transport that maintains stable tape tension, limiting modulation noise, and wow and flutter. Other features are variable pitch control; full IC logic control with optional remote control; Sendust Extra heads for low distortion; front panel controls for adjustments of bias, record, playback, EQ and level calibration; and LED peak overload indicators with VU meters.

Price: \$2300.

Circle (173) on Reply Card

Panasonic Co.

Technics Professional Audio Division
50 Meadowland Parkway
Secaucus, NJ 07094

Technics RS-1500US



The 2-channel, 2-track, isolated loop, quartz-controlled tape deck design of the RS-1500US features increased dynamic range, lower noise and editing/splicing capabilities required in professional applications. Design considerations include low modulation noise; low head wear; stable high frequency; separate 3-position bias and EQ controls; record/playback format is 2-track, 2-channel; and can be mounted in 19-inch rack.

A 4-track, 2-channel version is available as model No. RS-1506.

Special features: 0.018% wow & flut-

UNCOMPROMISED AUDIO FULL LINE OF INNOVATIVE AUDIO PROCESSORS



The **TFL-280B FM AUDIO LIMITER** presently protects the modulation of hundreds of FM, TV, and SCA facilities, providing maximum loudness consistent with program clarity. Featuring low distortion treble AGC and built-in audio lowpass filtering, it is recommended for maximum fidelity operations. Stereo/quad compatible

The **TAL-320 AM AUDIO LIMITER** cleanly maximizes the modulation of AM broadcast transmitters. It features a wide control range, treble equalizer, and an efficient multi-stage allpass network to handle asymmetric program material. Stereo compatible

The **TGR-340 AUDIO GAIN RIDER** is designed to ride gain on a program line. On a long-term basis it yields maximum signal volume with minimal unwanted side effects. Switchable treble AGC accommodates aural STLs, satellite feeds, and other systems with treble pre-emphasis. Stereo/quad compatible

FOR FURTHER INFORMATION PLEASE CONTACT OUR MARKETING DEPARTMENT



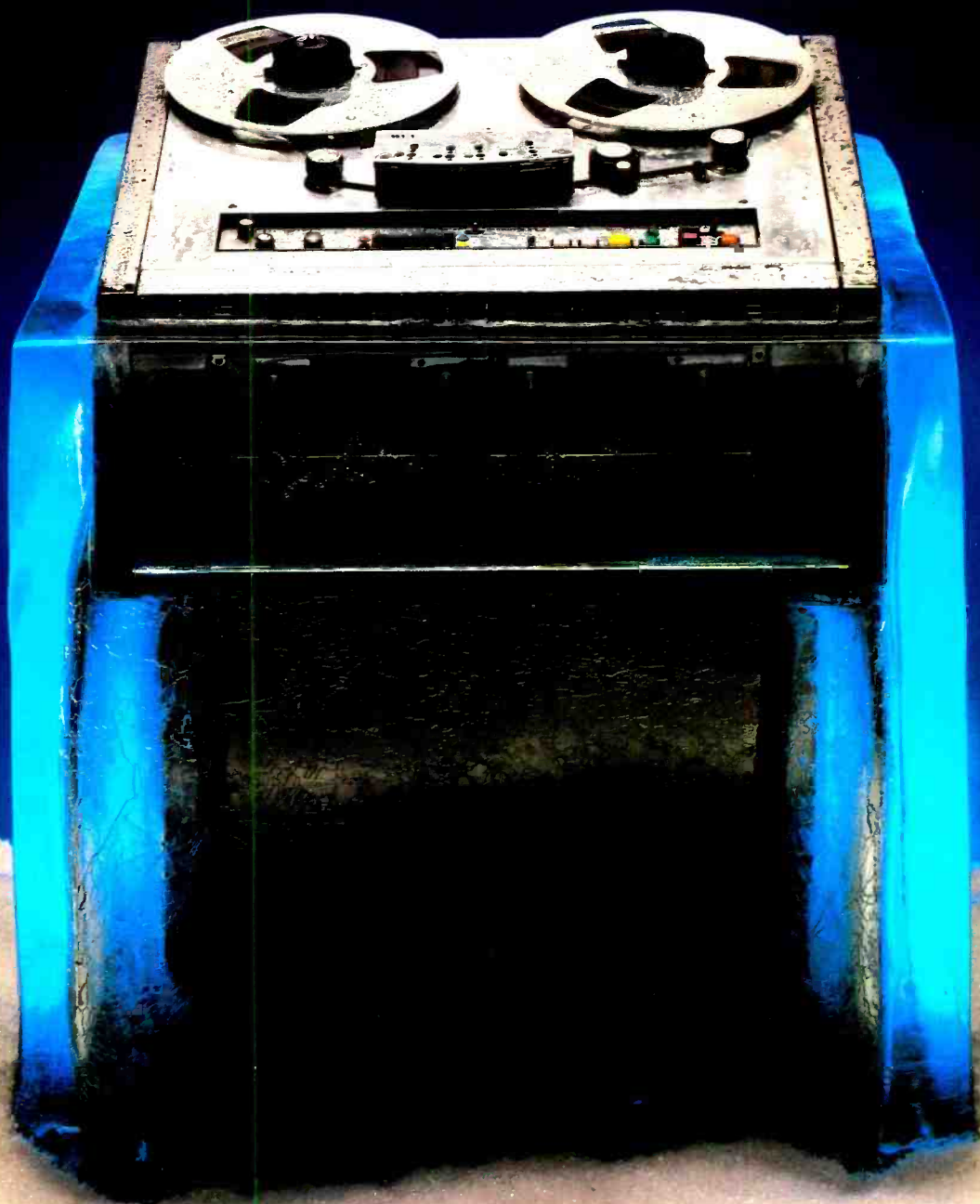
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Circle (39) on Reply Card

The cold, hard facts.



Specifications speak for themselves.

MCI invites you to compare specifications for the JH-110B against those of any other tape recorder on the market today. No pretty pictures, no bright copy, just facts. The JH-110B...unsurpassed in a field of professionals. And that is a cold, hard fact.

Unless otherwise specified, the following conditions apply to all graphs:

Speed: 30 ips

Overbias: 1.0dB @ 10kHz

Fluxivity: 0dBm = 250nWb/m

Speed: 15 ips

Overbias: 3.0dB @ 10kHz

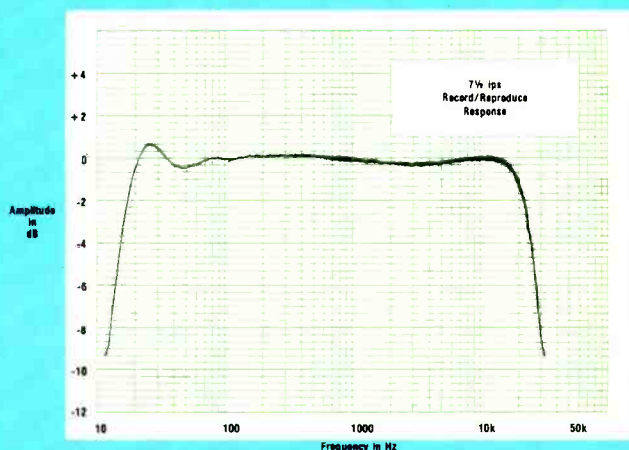
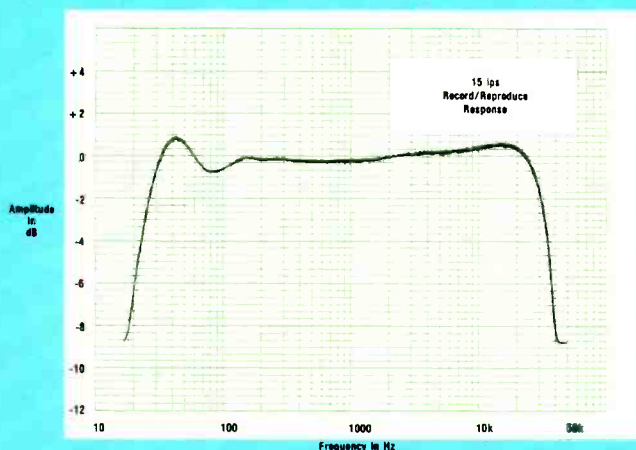
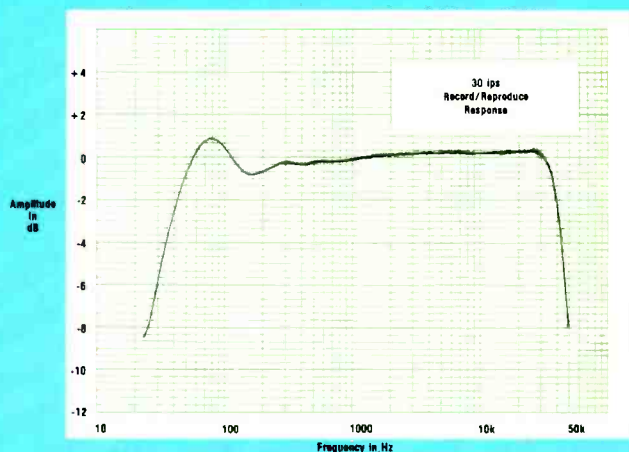
Fluxivity: 0dBm = 250nWb/m

Speed: 7½ ips

Overbias: 3.0dB @ 10kHz

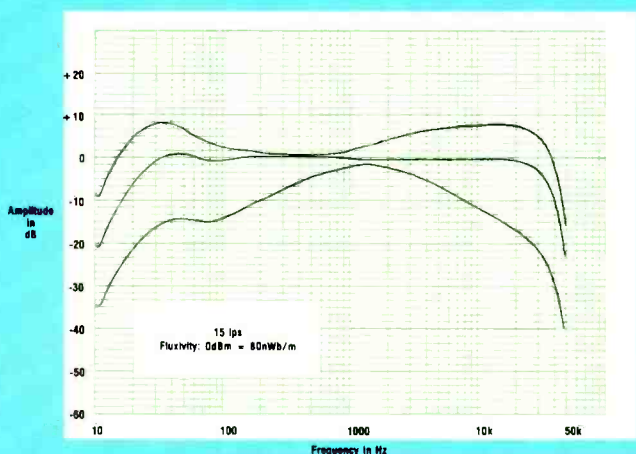
Fluxivity: -10dBm = 80nWb/m

All tests were performed utilizing Scotch Type 226 Tape.



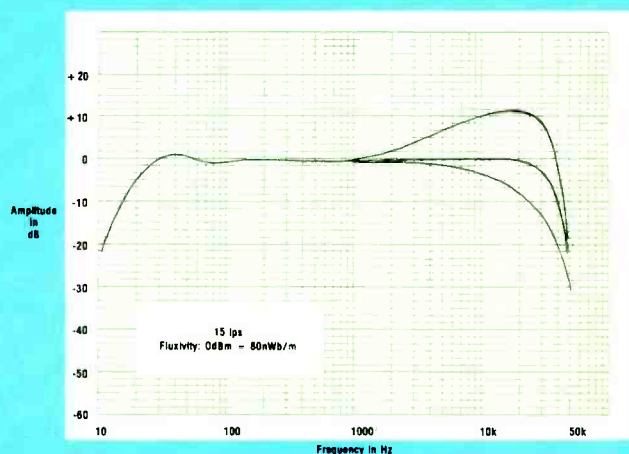
RECORD/REPRODUCE RESPONSE

These graphs represent the frequency response of the recorder on and off tape, assuming a constant input level. They demonstrate the flat and extended response of the JH-110B Recorder.



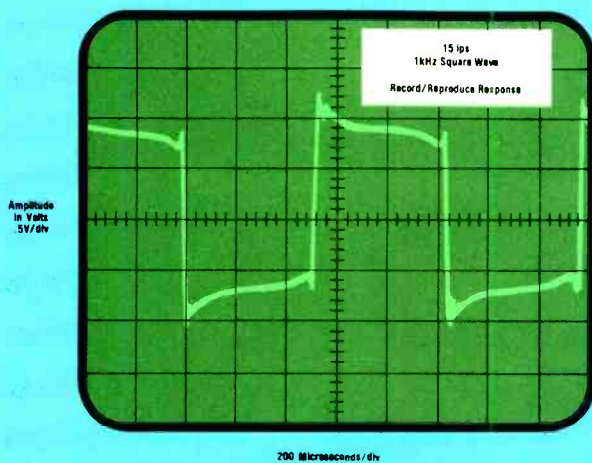
REPRODUCE EQ RANGE

A wide range of reproduce equalization adjustment ensures that the JH-110B will conform to NAB, IEC and AES standard response curves. There is sufficient range to compensate for head wear and to align to reference tones on aged or degraded tape copies.



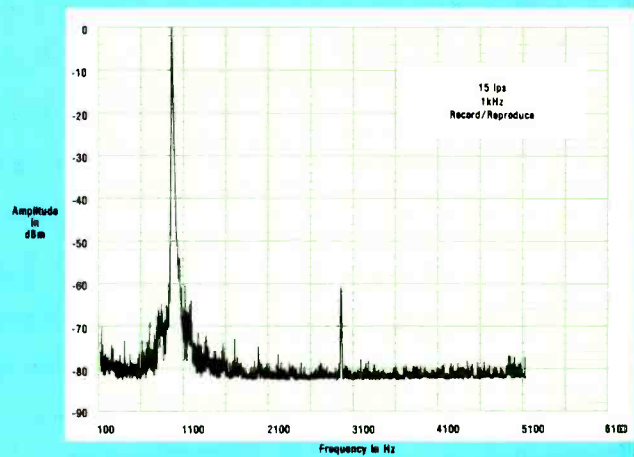
RECORD EQUALIZER RANGE

The record circuitry of a recorder is aligned to complement the reproduce response previously aligned to match standard curves. The JH-110B features a wide range of adjustment to allow alignment using any of the range of tapes available today.



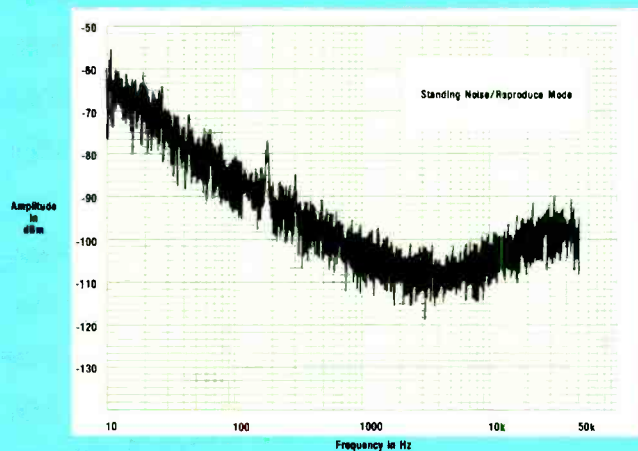
SQUARE WAVE RESPONSE

Square Wave Response demonstrates both transient response and phase linearity throughout the recording process. Response such as with the JH-110B produces excellent reproduction of live, dynamic material and reduces copy to copy degradation.



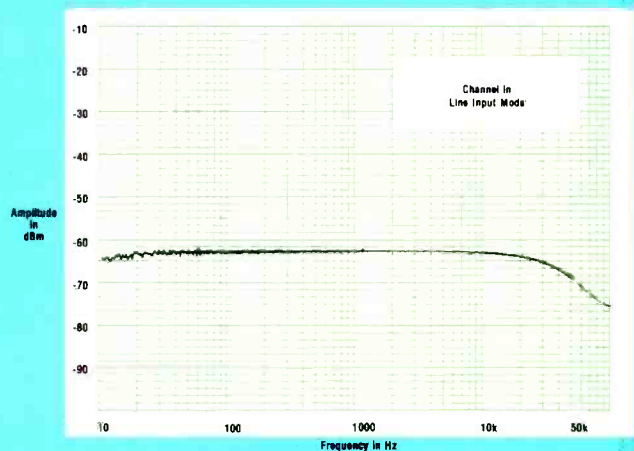
DISTORTION/PURITY OF SIGNAL

Both flutter, or variations in tape speed caused by transport eccentricities, and distortion degrade the purity of recorded signals. Using latest technology op amp design, the JH-110B minimizes second order distortion, while maintaining a wide dynamic range and very low noise floor. This, in combination with the closed loop servo capstan drive system and standard scrape flutter filter provides purity of signal unsurpassed by any other professional recorder. Odd order harmonic distortion and modulation noise are functions of the tape used.



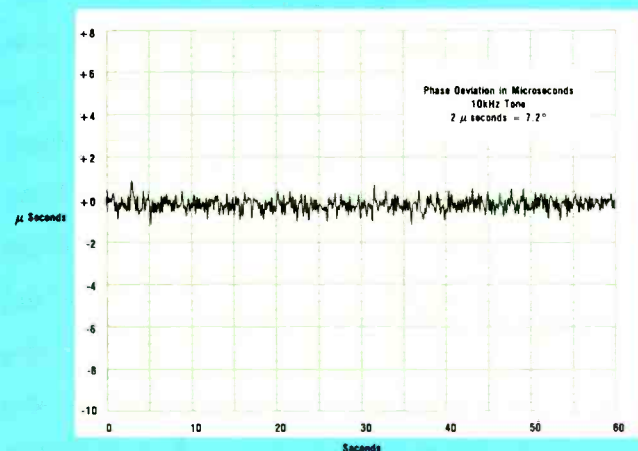
STANDING NOISE/REPRO MODE

This is an amplitude versus frequency plot of the various noise components generated internally by the electronic circuitry. Use of latest technology and high specification components ensures low noise figures on the JH-110B.



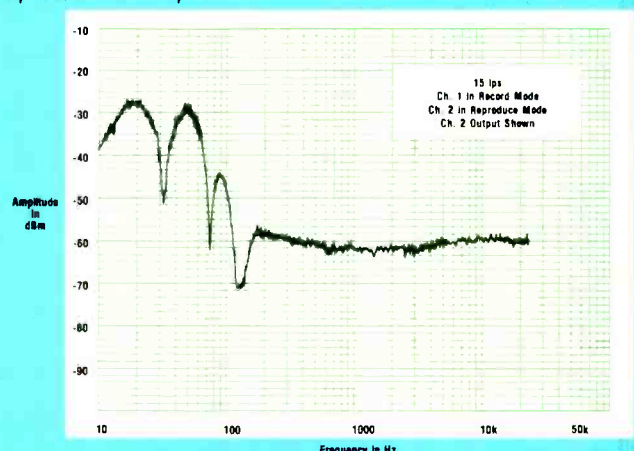
COMMON MODE REJECTION RATIO

Common Mode Rejection is the ability of the electronics circuitry to reject any signal applied equally to both sides of its balanced input, signals such as RF, hum, etc. The JH-110B design ensures a high Common Mode Rejection Ratio, making it ideal for use in any operational atmosphere.



TAPE WALK

Phasing between tracks is very important and is a function of the machine's tape path stability. The JH-110B transport and head assembly design yield a most stable tape path for maximum phase integrity.



REPRODUCE CROSSTALK

Crosstalk is the leakage from one track or channel to another, and is primarily a function of the heads. The JH-110B exhibits excellent crosstalk figures across the frequency spectrum, including minimizing of the low frequency nodes encountered in typical head design.

JH-110B Specifications

Frequency Response

Record/Reproduce

30 ips, AES 40 Hz - 28 kHz +.75/ - 2 dB
15 ips, NAB 30 Hz - 24 kHz +.75/ - 2 dB
7.5 ips, NAB 30 Hz - 20 kHz +.75/ - 1.5 dB

Record/Sync

30 ips, AES 50 Hz - 16 kHz +.75/ - 2 dB
15 ips, NAB 30 Hz - 10 kHz +.75/ - 2 dB
7.5 ips, NAB 30 Hz - 4 kHz +.75/ - 2 dB

Signal-to-Noise

Record/Reproduce, reference to 510 nWb/m

Unweighted, 20 Hz - 20 kHz

	mono	2TK	4TK
30 ips, AES	70	66	66
15 ips, NAB	68	64	64
7.5 ips, NAB	67	63	63

Weighted, dB(A)

30 ips, AES	74	71	70
15 ips, NAB	70	68	68
7.5 ips, NAB	70	67	67

Distortion

Harmonic distortion,

510 nWb/m, 1 kHz fundamental

3rd harmonic: 30 ips, AES <.35%
15 ips, NAB <.52%
7.5 ips, NAB <1.6%

2nd harmonic: 30 ips, AES <.10%
15 ips, NAB <.10%
7.5 ips, NAB <.10%

3% 3rd harmonic: 30 ips, AES 1040 nWb/m
fluxivity: 15 ips, NAB 1020 nWb/m
level: 7.5 ips, NAB 1000 nWb/m

Distortion is primarily a function of tape formulation and bias setting used. All specifications are typical and may vary.

Bias and Erase Frequency

120 kHz

Depth of Erasure

(Ref. 250 nWb/m)

At 1 kHz better than 80 dB

Amplifier Electronics

Input impedance 10k ohms balanced
Output impedance 120 ohms balanced
Output clipping + 24 dBm

Transport Speeds

Fixed 7.5, 15 and 30 ips
Variable $\pm 20\%$ around fixed speeds

Configurations

1/4 inch	Full track
1/4 inch	2 track
1/2 inch	2 track
1/2 inch	4 track

Reel sizes

Available with NAB A (3.5 or 7 inch), NAB B (10 1/2 or 14 inch), DIN 1000m (11 1/2 inch)

Tension

5 1/2 oz. $\pm 1/4$ at all play speeds, beginning to end of reel

Long term speed stability

Better than .02%

Wow Flutter

30 ips <.022% DIN 45507 weighted
15 ips <.035% DIN 45507 weighted
7.5 ips <.055% DIN 45507 weighted

Rewind time

2400 ft. 110 seconds
4800 ft. 170 seconds

Start time

to 0.1% DIN 45507 flutter, 10 1/2" reels

30 ips	900 msec
15 ips	500 msec
7.5 ips	500 msec

System Weight

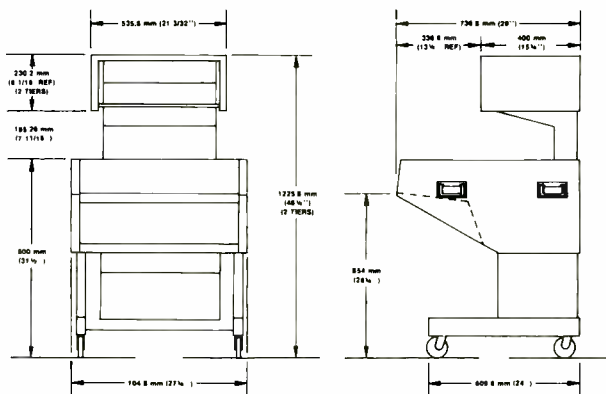
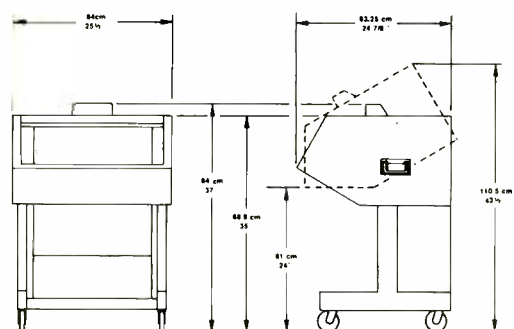
Transport unmounted	34 lbs.
Electronic drawer, dual channel	19 lbs.
Variable profile cabinet (VP)	73 lbs.
High profile cabinet (HP)	115 lbs.
Power supply	23 lbs.



FLEXIBILITY TO MEET YOUR NEEDS.

The JH-110B is available stock in mono, stereo, 4-track and 8-track formats for use with 1/4", 1/2" and 1" tape on reels from 5" up to 10 1/2" in diameter (14" diameter optional). Ready for mounting in the MCI variable profile (VP) cabinet with electronics under the transport or in the MCI high profile (HP) cabinet with electronics over the transport, it can also be mounted in your 19" rack or custom console.

JH-110B Dimensional Data



1400 West Commercial Boulevard, Fort Lauderdale, Florida 33309 USA.
Telephone: (305) 491-0825. Telex: 514362 MCI FTL.

MCI reserves the right to make changes at any time without notice in colors, equipment, specifications, prices and models.
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MCI-81SB-5

Recorders

ter (WRMS at 15ips); frequency response: 30 to 30,000Hz +3dB (at -10VU); S/N ratio (DIN weighted): 68dB; distortion at OVU: 0.8%; and optional remote control available.

Price: \$1203.

Delivery: 4 weeks.

Circle (174) on Reply Card

Technics RS-1520

The 2-track studio model RS-1520 is a tape deck designed to meet the needs of the professional recordists. It is the original RS-1500US with a number of additional features and functions to make master taping convenient, and with a professional touch. Features added include: built-in test tone oscillator, mic attenuators, meter sensitivity selector, playback equalization selector (NAB/IEC), equalization fine adjustment control and bias fine-adjustment control.

Price: \$1579.

Delivery (ARO): 4 weeks.

Circle (175) on Reply Card

Stephens Electronics Inc.

3513 Pacific Ave.
Burbank, CA 91505.

811D-103A



The complete Stephens line is modular in construction, and all sub-assemblies are easily removed for servicing. Each system's complexity has been reduced to a minimum and repairs can usually be undertaken by substituting a plug-in circuit board.

The unique design of the Stephens recorder transport uses servo-operated supply and takeup reel motors operating in a "tight" servo

loop. Tape speed is constantly monitored across the heads and is phase-referenced to a fixed frequency crystal time base. The result is frame-accurate tape speed from the beginning to the end of the reel. This servo system maintains a constant tape tension and does this without the aid of tensioning arms.

General features include: tape speeds—15ips, 30ips, and 60ips, phase-locked and variable, 10ips to 80ips, non-locked; autolocator; vertical drive lockup; SMPTE lockup system (under development); lightweight; electronics are rack-mountable.

Special features: transformerless; capstanless; battery-powered available; transport and electronics removable; and available as portable.

Prices: 821B-104A: \$32,800—14-inch reel, 24-track; 821B-104 24/16: \$27,500—14-inch reel, pre-wired for 24-track; 811D-103A: \$17,600—10.5-inch reels, 8-track (photo shown); 811D-103A: \$14,400—10.5-inch reels, 4-track.

Delivery (ARO): 6-8 weeks.

Circle (176) on Reply Card

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Shot with a Sony BVP-300 camera at f2.5 with approximately two footcandles' light.

DARK SIDE OF A CITY, YOU CAN'T WITH BRIGHT LIGHTS."

*Henry Sheppard,
WCCO-TV, MINNEAPOLIS*

"There are news-gathering and documentary situations where the use of artificial light is just too intrusive or difficult to achieve," says Henry Sheppard, Chief Engineer of WCCO-TV, the CBS affiliate in Minneapolis.

"That's why our Sony portable BVP-300 cameras are such a big plus. With them, we can shoot in low-light conditions and get a lot of detail other cameras might not pick up. We even get good pictures with as little as two footcandles of light."

WCCO-TV owns seven Sony BVP-300's, which the station's photographers use together with Sony BVU-50 recorders. The cameras are used to shoot public-affairs programs and segments of PM Magazine, as well as for ENG and documentaries.

"We're very particular about picture quality," says Sheppard. "And before we committed ourselves to Sony, we evaluated just about every portable color camera available."

"Sony's colorimetry is excellent, its signal-to-noise ratio is high, and it always turns out pictures that meet our standards. Many of our engineers find its quality comparable to studio cameras. And our photographers like the way Sony handles. For example, in a helicopter, they can cradle the camera on one shoulder to reduce vibrations and get a very steady picture."

"And with the Sony system, each photographer can operate independently, without a second person along to monitor sound."

When asked about Sony durability, Sheppard replied, "We don't coddle our cameras here. Each one gets handled by about 15 or 20 different photographers. They come in in the morning, grab their equipment, throw it into the back of the car, and they're off. Sony takes that kind of treatment remarkably well, and it's a good thing, because we can't afford to have our cameras down."

Of course, Sony makes a full line of one-inch broadcast equipment, including cameras, recorders, editors and the BVT-2000 digital time base corrector.

For information, write Sony Broadcast, 9 W. 57th Street, New York, N.Y. 10019. Or call us in New York at (212) 371-5800; in Chicago at (312) 792-3600; or in Los Angeles at (213) 537-4300.



**SONY
BROADCAST**
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Circle (40) on Reply Card

Recorders

Studer A80RC MKII series



Ultra heavy-duty high performance recorder/reproducer; available in mono, 2-track, stereo, mono-stereo switchable and mono or stereo with pilot-tone with or without resolver; heavy die-cast chassis with three direct drive motors; spooling motors and capstan servo controlled; constant tape tensions in all operating modes; excellent editing features with tape marker and scissors; built-in monitor/cue, speaker/amplifier; console-mounted.

Special features: two speeds; three direct drive motors, all servo controlled; electronic positive and negative counting real time counter

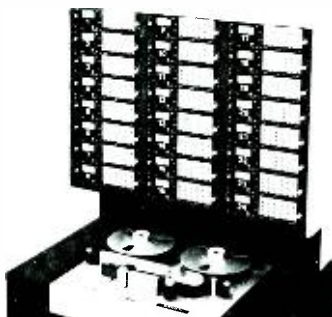
with search to cue feature; real time indication in any selected speed; tape marker and scissors for rapid editing; variable spooling speed with manual cue lever for speedy and accurate cueing.

Price: from \$7200, console-mounted.

Delivery (ARO) 2-3 weeks.

Circle (177) on Reply Card

Studer A80VU MKII/MKIII series



Flexible studio standard machine for heavy-duty use in recording, production, editing, etc.; available in full-track mono up to 24 tracks on 2-inch tape; high performance electronics with sel-sync, fully remote controllable; modular construction, easy to service; most parts interchangeable between any A80VU format machine;

wide range of accessories, including a 20-memory microprocessor autolocator, channel remote control and SMPTE code synchronizer and editing system.

Special features: die-cast deck with three servo-controlled direct drive motors; constant tape tensions in all operating modes; variable speed capstan servo; electronic positive and negative counting real time counter with search to cue feature; high performance electronics, fully remoteable; modular construction and great flexibility for a great range of demanding applications; smooth operating machine with maximum protection to valuable master tapes.

Price: from \$8550.

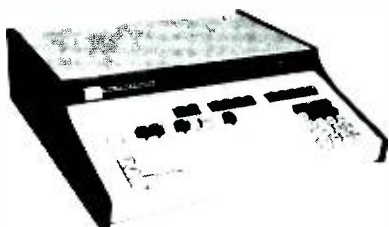
Delivery: 4-6 weeks.

Circle (178) on Reply Card

Studer A800 Series

Fast, high performance multi-track machine for video sweetening and video post-production; available in 8-track on 1-inch tape, 16- or 24-tracks on 2-inch tape; heavy-duty die-cast chassis with two ½ hp dc spooling motors and ac asynchron capstan; all motors direct drive and servo controlled; constant tape tension in all operating modes; microprocessor-

We're Better Than Ever!



The new **TPT-2500** titler offers features not expected in this price range: eight character sizes, upper and lower case, border line, underlining, graphics, flash, crawls, positionable title window, 32 page resident memory and optional 700+ page tape memory.

Operating features include: auto line and page centering, word/line open and close, tab and elastic memory. See the TPT-2500 and the rest of our titler line at the NAB booth 1523.

Priced at \$4995.00



Video Data Systems

Headquarters, Hauppauge, N.Y. (516) 231-4400

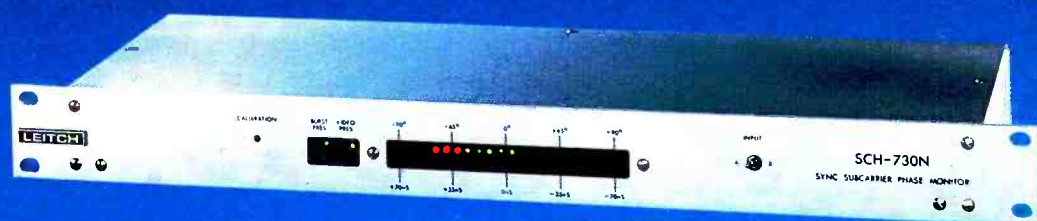
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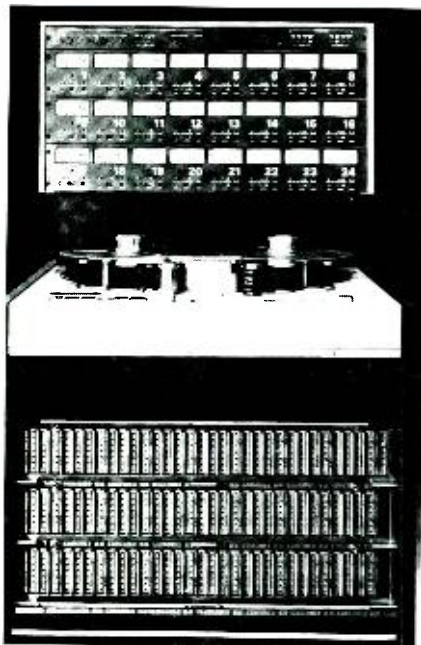
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Tel: (416) 438-5060 Telex: 065-25420

Leitch Video Inc., 210 South 8th Street, Lewiston, N.Y. 14092 — Tel: (716) 754-4349

Circle (41) on Reply Card

Recorders



controlled transport and electronics; electronic real time counter; two address search to cue, vari-speed with digital display; computer interface capable; processor-controlled signal switching for electronic editing; wide range of accessories.

Special features: ultrafast transport, ideal for synchronization with video transports; edit rehearse feature for simulation of electronic editing; SMPTE code channel with wide-band read capability; interface to most editing systems.

Price: from \$38,000.

Delivery (ARO): 4 weeks.

Circle (179) on Reply Card

Studer B67 MKII series



Direct drive servo-controlled motor deck for heavy-duty use in production, mastering and on-air applications; balanced in and out with calibrate/uncalibrate switch; tape ten-



sion control in all transport modes; full logic control with motion sensing; portable, rack-mount and console-mount versions available; mono, 2-track, mono-stereo switchable.

Special features: three speeds, three motors, all servo-controlled mounted on heavy die-cast chassis; positive and negative counting electronic timer, real time at all speeds; built-in monitoring/cueing amplifier and speaker; wide range of versions available including pilot-tone resolver model.

Price: from \$3910.

Delivery (ARO): 2 weeks.

Circle (180) on Reply Card

Revox B77 series



Universal reliable direct drive tape deck based on die-cast chassis; motion sensing and full logic control of all tape transport functions; two speeds; wide range available; for VU meters with peak indicators; professional headblock with 3-point mounting; electronics with high head room.

Special features: three direct drive motors, capstan servo controlled; wide range of speed configurations from 15/16ips to 15ips; voice activated version and sel sync version available; modular construction, easy to service.

Price: \$1649.

Delivery (ARO): from stock.

Circle (181) on Reply Card

Revox PR-99 series



Professional broadcast recorder/reproducer. Three direct drive motors; servo-controlled capstan; tape dump feature; sel sync for both channels; optional balanced microphone input; full logic control with motion sensing; modular construction with die-cast chassis; 2-track or mono versions, portable, rack- or console-mount versions available.

Special features: balanced inputs and outputs with calibrate/uncalibrate switch; flush tape deck with excellent head access for easy editing; fully remoteable.

Price: \$2095.

Delivery (ARO): from stock.

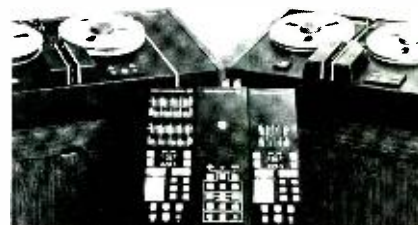
Circle (182) on Reply Card

3M Company

P.O. Box 33600

St. Paul, MN 55133

3M digital mastering system



The 3M digital editing system consists of a compact console (21½x6½x5 inches) of microprocessor electronics offering extreme precision, risk-free audition of edit preview capability, unaltered originals and splice-free masters. The control module, which determines and monitors the tape movement of two 3M recorders, offers special function buttons for determining exact editing points. Refinement can be made by as little as 1/1000 of a second.

General features of the system include approximately 94dB signal-to-noise ratio with no degradation during multiple generation processing; freedom from noise and distortion—no tape hiss, wow and flutter and less than .03% IM and harmonic distortion; excellent electronic editing for risk-free assembly.

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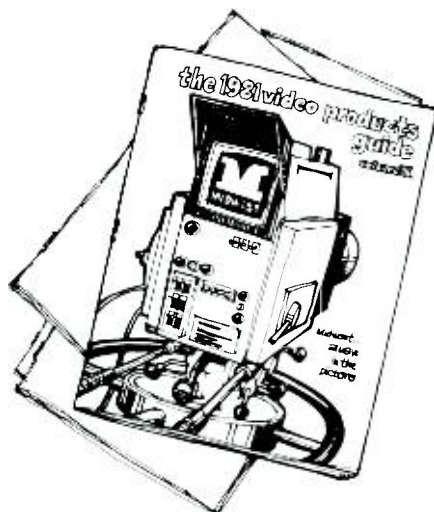
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6 A UNR Company

Recorders

Special features: Using a standard SMPTE controller and special interface, digital audio recorder can be synchronized with a videotape recorder; may be remote controlled; and has operations similar to analog recorders.

Price: 4-channel, \$40,000; 30-channel, \$138,000.

Delivery (ARO): 60-90 days.

Circle (183) on Reply Card

TEAC Corp.

7733 Telegraph Road
Montebello, CA 90640

Tascam 35-2B recorder/reproducer

The Tascam 35-2B professional 2-track recorder/reproducer system uses a -10 unbalanced technique to substantially reduce cost of line amplifiers, transformers and balanced audio cables. This is especially attractive unless cable lengths of hundreds of feet are being used.

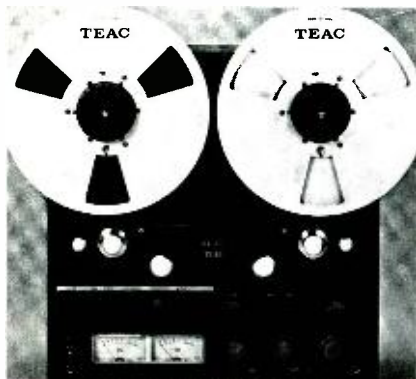
Special features: meets NAB standards of 185nW/m; switchable, built-in ¼-track playback head; rugged 3-motor transport and full IC logic transport control; and cue and edit functions and a flip-up hinged head cover for easy editing.

Price: \$2000.

Delivery (ARO): from stock

Circle (184) on Reply Card

Tascam 32-2B and 22-2, 22-4 systems



These TEAC recorder/reproducers are designed to meet other professional recording needs. The 32-2B is a 2-track master based on conventional tape transport design. The 22-2 and 22-4 are 2- and 4-track machines, respectively, and are designed for low cost, portability and short (10-20 minute) runs on 7-inch reels at 15ips.

Prices: 32-2B, (2-track), \$1100; 22-2, (2-track), \$750; 22-4, (4-track), \$1425.

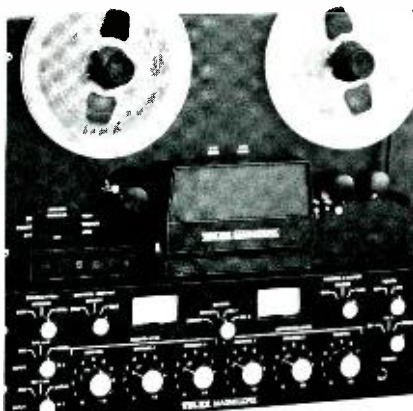
Delivery (ARO): all from stock

Circle (185) on Reply Card

Telex Communications

9600 Aldrich Ave. South
Minneapolis, MN 55420

Telex 1400 series Magnecord



The 1400 recorder/reproducers combine rugged reliability with current state-of-the-art functions. A dc servo drive system with closed loop quartz crystal oscillator assures outstanding timing accuracy. Solid-state controls eliminate contact noise and allow minimum EMI. Bi-level illumination of controls shows activated operating mode at a glance. Solid-state electronics with separate gain controls for mic, and line inputs as well as master gain.

Other features include: die-cast main frame; three speeds (1⅞, 3¾, 7½ or 3¾, 7½m 15ips); mono or stereo models; full, ½- and ¼-track configurations; remote-controllable; Mu metal head shields; handles up to 8¼-inch reels.

Special features: extra playhead (selectable) on stereo models; built-in monitor amp and speaker on mono models; exceptional speed stability; and 1-hand cueing.

Price: \$2500-\$2900.

Delivery (ARO): 2 weeks.

Circle (186) on Reply Card

Telex 3000 series Magnecord



The 3000 is a heavy-duty commercial tape transport with Telex RP85 record/reproduce preamplifier. Tape

transport accepts reels up to 10½ inches and includes automatic cycling, automatic cue release (AQR) and CMOS logic tape motion controls. The preamplifier has tape head connections that can accommodate all standard track and channel configurations offered in the 3000 tape transport series.

Additional features include availability as transport only or complete with electronics; two-speed (3¾-7½ or 7½-15ips); three motors; up to four head positions; 1-, 2- or 4-channel heads; ½-track and ¼-track configurations; tape index counter; and Mu metal head shields.

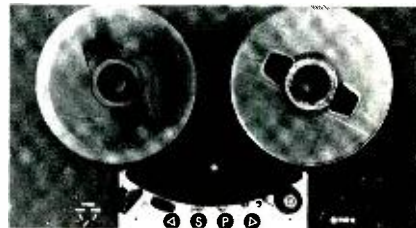
Special features: snap-in interchangeable head blocks; automatic recue and repeat using clear leader tape; and fully remote-controllable and compatible with all automation systems.

Price: transports: \$1300-\$1570; record/reproduce systems: \$1990-\$2490.

Delivery (ARO): 2 weeks.

Circle (187) on Reply Card

Telex 230 series



The 230 is a heavy-duty, commercial/industrial 3-motor tape transport with hysteresis synchronous capstan drive. Momentary electric tape motion push-buttons suit remote and automatic operations. Available in various speed and head configurations.

Additional features: handles up to 7-inch reels; two speed, three motors; speeds range from 15/16ips to 7½ips; one, two, four channels play only or record play; ½- and ¼-track; and remote-controllable.

Special features: 230L logger systems available for more than 12 hours per channel; optional cycle control available for multi-transport logging; full selection of reproduce only and record/reproduce electronics; audio repeat/re-cue models available.

Price: Transport: \$850 and up (electronics extra); complete logging systems from \$1570.

Delivery (ARO): 2 weeks.

Circle (188) on Reply Card

United Research Laboratory Corp.

681 Fifth Ave.
New York, NY 10022

A large, professional-grade video camera, the Ikegami HK-357A, is shown mounted on a tripod. The camera is white and black, with the 'IKEGAMI' logo visible on the side. It has a large lens assembly, various control buttons, and a viewfinder. The camera is positioned diagonally across the frame, pointing towards the upper right.

Ikegami's third microprocessor-controlled camera reduces registration set-up time and cost

The ideal camera for field broadcast television assignments must meet three major criteria. It must be air-ready moments after arrival at the camera site. It must deliver pictures of studio-quality color, crispness, and clarity. And it must be consistently reliable.

The Ikegami HK-357A meets those criteria in the field and is equally suitable as a studio camera. And it allows the camera crew to concentrate on creative aspects of their assignment instead of on time-consuming set-up and readjustment tasks.

Once on-site, the HK-357A requires hook-up to only three cables and power source. Then, a push of the microprocessor activate button automatically cycles it

through a check and recheck of all set-up and registration adjustments. This takes approximately 45 seconds per camera (up to six cameras can be handled). No external registration and chip charts are necessary because a test pattern projector (diascope) is built into the lens. Camera distance from the compact base station can be nearly a mile with triax, or 2,000 feet with TV-81 multi-core cable.

Because the HK-357A optimizes the capabilities of the newly developed Diode Gun Plumbicon®, the picture output is of very high resolution, low lag, low noise and wide dynamic range. Dynamic Beam Stretch to reduce comet tailing; Geometric Correction for near-perfect registration; auto iris and auto white balance — all contribute to the superior color picture program output of this camera.

The HK-357A is notably versatile too. It offers selectable contrast compression levels; built-in chroma keyer; gen-lock to Sync and SC or VBS/BBS; and several other features, including an unusually compact CCU, optional RCU, tiltable and rotatable 7-inch high-resolution electronic viewfinder.

The performance record of Ikegami cameras at the major networks in the United States and around the world attests to their consistent reliability and long, trouble-free service life.

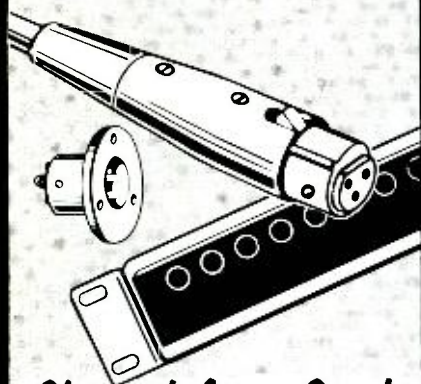
If you are upgrading, a demonstration may well reveal that the other cameras you've considered may already be obsolete when compared against the HK-357A.

Ikegami HK-357A

Broadcast Products Division, Ikegami Electronics (USA) Inc., 37 Brook Avenue, Maywood, N.J. 07607; (201) 368-9171. West Coast: 19164 Van Ness Ave., Torrance, CA 90501; (213) 328-2814; Southwest: 330 North Belt East, Suite 228, Houston, TX 77060; (713) 445-0100; Southeast: 522 So. Lee Street, Americus, GA 31709; (912) 924-0061.

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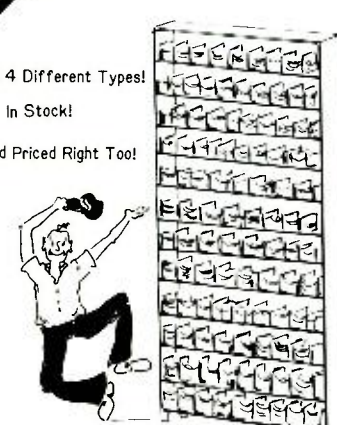
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Recorders

AuTo-Tec—S series

The S series incorporates closed loop transport, dual capstan drive, hysteresis synchronous motors, optional 14-inch reel capability, low-noise electronics, special coated pinch rollers, illuminated push-buttons and programmable automated remote control.

Special features: patented AuTo-Sense electronic motion sensing; patented instant change plug-in head assembly; and ¼- to ½-inch transport interchangeability.

Price: \$5000 (2-track stereo).

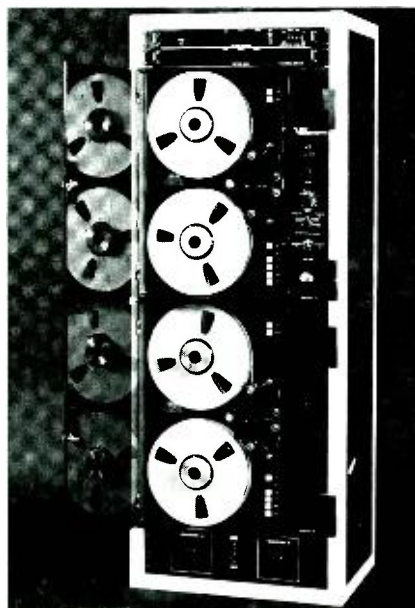
Delivery (ARO): 30 days.

Circle (189) on Reply Card

Video Research Corp.

6985 Garden Road
Riviera Beach, FL 33404

VRC Mark Twenty logging system



The Mark Twenty is a 20-channel professional communications logging system with extraordinary reliability, computer-style tape handling, direct-drive dc servos, digital time indexing, "fail-safe" detecting and transferring circuitry; and all-digital remote controls.

The system is recommended especially for air traffic control and public safety communications systems. However, the system warrants consideration by broadcasters in cases in which exceptional reliability and fail-safe operations may be crucial.

Price: \$16,000.

Delivery (ARO) 90 days.

Circle (190) on Reply Card

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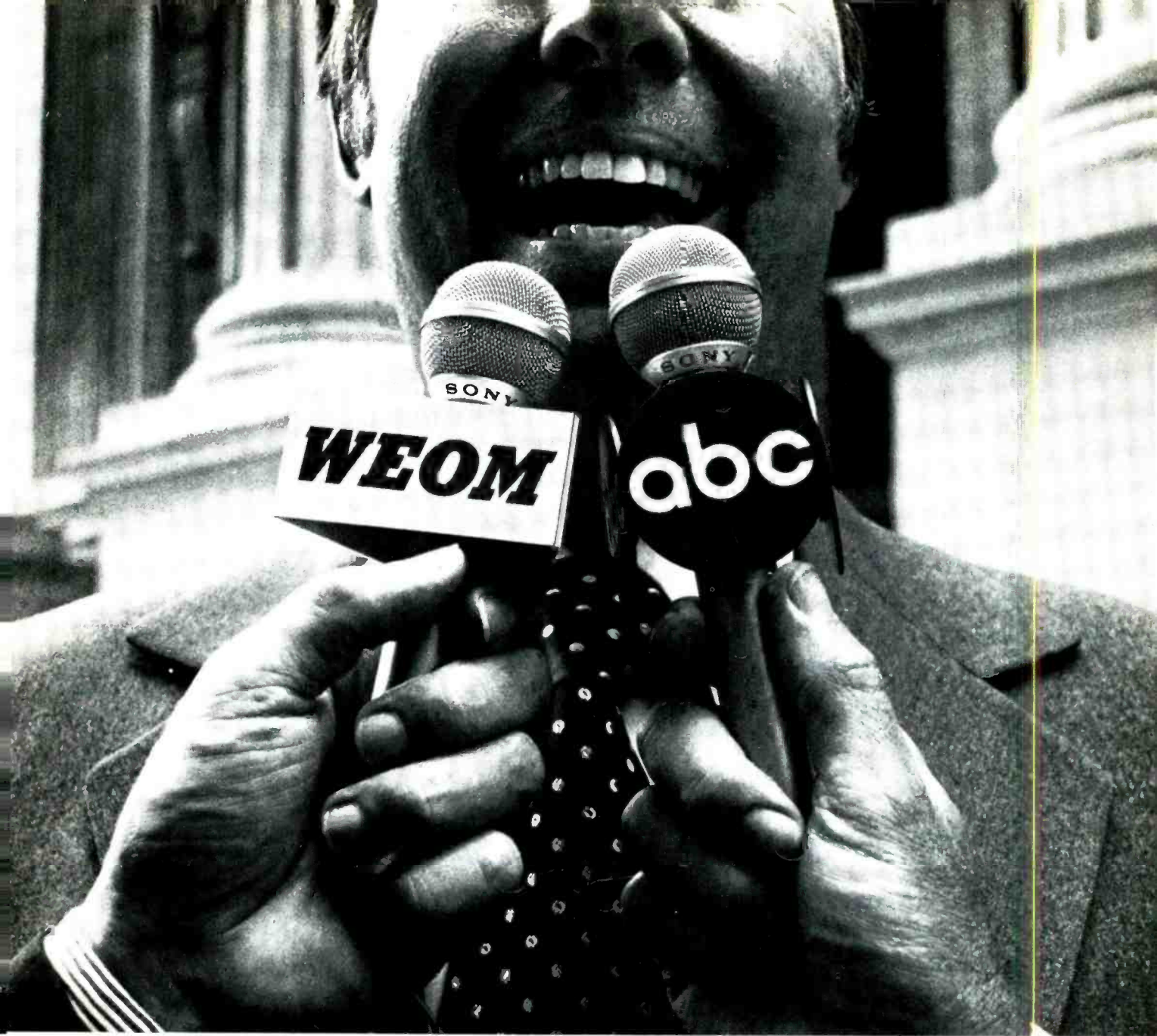
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Beyond the audio proof

By Gary Breed, consulting engineer, D. L. Markley & Associates, Peoria, IL

As audio quality improves in the area of equipment, the techniques of audio quality must keep pace. The demands of broadcast management for the most competitive sound have also become greater, and a better yardstick must be employed for performance measurements for this reason too.

When a program director or manager comes to the chief engineer with comments or complaints about the station's audio quality, what performance data can be shown to them that indicates the station's true performance? What data does the chief engineer have available to show the station's true performance? To the greatest extent, the final analysis of a station's performance is done by ear, but flaws detected by listening must

be identified so they can be corrected. Fortunately, nearly every parameter of audio performance can be measured in a manner that is not colored by personal taste. As the title of this article suggests, the annual FCC-required proof-of-performance is not enough information to accomplish this evaluation.

The FCC audio proof

First, look at those parameters that are measured during the annual audio proof. Using an FM stereo proof as an example, measure the frequency response and harmonic distortion at various modulation levels, performed on both the left and right audio channels, plus measure the FM and AM noise levels referenced to 100% modulation. The frequency response

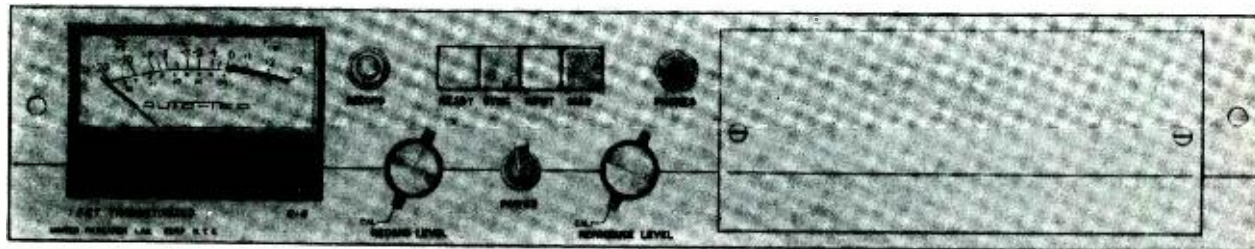
must fit within the 75 μ s pre-emphasis envelope, and the distortion must be within prescribed limits at the various frequencies.

The required technique is to introduce the audio test signals into the main microphone input; to disable all gain control and audio processing functions; to eliminate all equalizers, reverb units or other signal modifiers; and to maintain normal levels throughout the system. The primary test instruments are the modulation monitor, audio generator, gain set and distortion analyzer. Also part of the proof is the requirement that test equipment roll off frequencies greater than 30kHz, and the use of sine waves, applied in single frequencies between 50 and 15,000 Hz. Although not specifically required in the proof,

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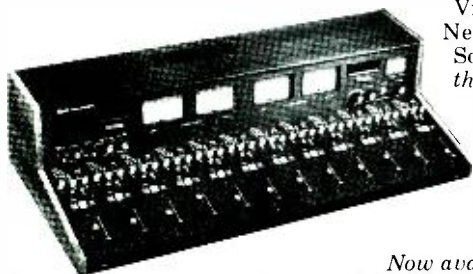


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The Ikegami color monitor line consists of the High Resolution Series RH Color Monitors and the High Performance Series 8 Color Monitors. The High Resolution Series RH Color Monitors are available in the 14" TM 14-2RHA and the 20" TM 20-8RH. Both provide precision color reproduction at 600 plus lines for professional studios, control rooms, remote vans, etc., and feature a high resolution CRT with High Density Dot Matrix, a switchable comb filter in the decoder, and the AFPC (Automatic Frequency Phase Control) system to maintain exceptional color reproduction. Both models are rack-mountable, with the TM

14-2RHA featuring plug-in circuit boards for easy maintenance.

The High Performance Series 8 Color Monitors are available in the 14" TM14-8RC, 20" TM20-8R and 25" TM25-8. The Series 8 monitors offer high quality color reproduction, a Shadow Mask Dot Matrix CRT, Pulse Cross Circuit, Active Convergence Circuit, low power consumption, and more.

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Audio proof

stereo separation is usually checked to assure that the minimum 29.7dB is being achieved, and main and crosstalk is checked for compliance with the 40dB standard.

Having successfully completed these measurements, a station has passed its proof and is guaranteed to sound just great, right? Maybe.

What's missing?

Although the audio proof is a good

place to start in evaluating audio performance, it only begins to scratch the surface of really proving performance. What about those frequencies between the test points? What happens when more than one frequency is present? Does the station broadcast only sine waves? What about cart machines and turntables? What does the limiter do to the audio when it is switched back on?

And the list goes on. Where is the

starting point in the search for real proof of audio performance?

Individual components

The place to start in the pursuit of quality is with each piece of equipment, checked out individually.

- Check the transmitter thoroughly, with test signals applied directly to the input.
- Check every turntable, tape deck, cart machine and every other piece of program origination equipment.
- Check consoles, line amps, distribution amplifiers, switching equipment and all other program mixing and distribution equipment.
- Check every piece of audio processing equipment in the shop before it is put on-line.
- Check all grounding, wiring, patch panels and all other passive devices. These are often overlooked and can be a source of hard-to-find trouble.

Finally, put the system together piece by piece, working backward from the transmitter. Check the system performance at each step, adding another piece in the chain until the entire chain is complete.

Last, check the system using every possible signal path, from each input to each output to be sure all interconnections are free of audio noise. This outlines the general procedure to systematically develop a clean audio system, but the actual techniques and measurements haven't been covered.

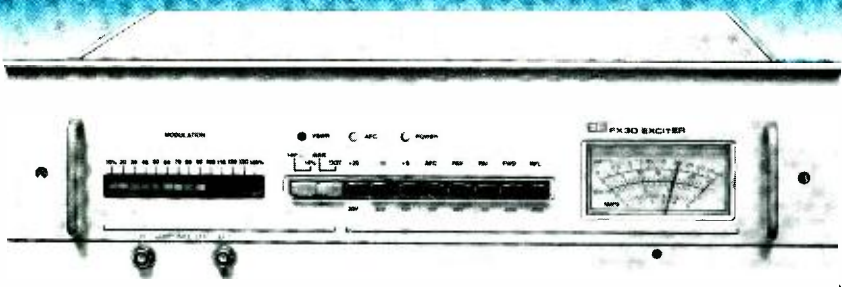
Measurement techniques

Many checks can be made beyond the audio proof without additional financial investment. In this category are the following:

1. *Noise and crosstalk measurements.* Noise and crosstalk should be measured and maintained at or below -60dB, using all possible combinations of inputs and outputs. In other words, be sure that each piece of equipment is quiet enough to contribute little to the total noise so that combining two or more sources does not raise the noise level to contribute to audible degradation. (Tape hiss, room noises and disc noise are not included because there is little control over them.) Also, be sure that crosstalk from signal paths not on the air do not add to the noise level. Carry the audio proof noise measurements beyond the main microphone channel and program line equipment.

2. *Check additional frequencies.* In the measurements, as they are done, add more test frequencies than those specified by the audio proof. It is easy to use only those frequencies because they are standard and easy to

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The SG 505 Oscillator outputs a sine wave with the lowest residual distortion on today's market (.0008%). The AA 501 Distortion Analyzer uses digital processing to lock in on test signals, set levels and adjust the notch filter for nulling. All measurements, including dB levels are precalculated and then displayed on an LED readout.



In addition to level and harmonic distortion measurements, the AA 501 measures intermodulation distortion to three standards: SMPTE, DIN and CCIF difference tone. Automatically selected.

The AA 501 and SG 505 are both TM 500 Plug-ins that can be installed in any of five mainframes, including rackmount, bench and portable. They can also be separated and still used as a team, even though miles apart. Or configured with over 40 other TM 500 Plug-ins currently available.

To find out more about the AA 501 Distortion Analyzer and SG 505 Oscillator, contact:

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Audio proof

remember, but frequency response "bumps" or frequency-sensitive distortion may not show up unless the number of frequencies is increased. A minimum number of extra test frequencies would be two added between proof test points (for example, 50, 65, 85, 100, 200, 300, 400, 650, 800, 1000Hz., etc.). Also add 30 and 20,000Hz points above and below the proof frequency range. From this additional data, a more complete picture of audio performance across the entire range of operating frequencies will emerge. Whatever frequencies are chosen, be sure enough are included in your tests to satisfy you that the whole spectrum has been covered with accuracy.

3. *Headroom measurements.* Every audio input to output path should have virtually no degradation in performance when operated at a level 10dB higher than normal. Microphone inputs and other devices handling primarily speech should have 15 to 20dB of headroom. Program peaks are not indicated accurately by a VU meter, and test signals are usually sine waves. These two factors make good headroom per-

formance mandatory for high-quality audio performance. Microphones should be checked for mechanical headroom; that is, overload from sound pressure levels generated by the loudest disc jockey. Phono preamps are often headroom problem spots, as are cartridges/styli. Test records usually have over-deviated test bands on them to evaluate turntable systems under such conditions.

4. *Dynamic response of audio processing equipment.* Although single-tone testing of audio processing equipment is far less than the ideal method, it will tell whether there are any gross errors in the processing functions and will indicate the distortion that may be introduced under various levels of processing. Check the linearity (or pre-emphasis accuracy) of frequency response of the AGC or limiting action. Compression slope, gating threshold and added distortion should be close at all frequencies, except in multiband AGC units where each band should have uniform characteristics within its passband. Also treat these units as "black boxes" and learn their behavior. Look closely at the frequencies of transition be-

tween each passband, where improper phase response or other non-linearity can cause response and distortion problems. It is also valuable to know the level of added distortion at a number of different processing levels. It is valuable documentation when the argument of "loud" vs. "clean" arises, if the measurements are available to illustrate the tradeoffs.

5. *Stereo phase measurement.* Phasing can be checked with a simple X-Y display on an oscilloscope. Of course, both audio channels must have identical phase response or the mono signal goes downhill fast, along with stereo performance degradation. Each piece of equipment should have uniform phase response in both channels at all frequencies. Even if both channels have good phase agreement, subtle changes can occur if low and high frequencies have much different phase shifts. For example, the timbre, or tonal quality of a musical instrument, is a function of fundamental and harmonic frequencies (overtones). If the phase relationship between these components changes, an audible alteration of the natural timbre can occur.

6. *Read and research.* Don't take anyone's word as the last one on audio quality—study the subject carefully. Audio quality is achieved with knowledge derived from every available source.

Read and research equipment manuals too. Make sure the transmitter meets all FCC specifications, especially those necessary for type acceptance but that rarely get checked out once the transmitter leaves the manufacturer's test line. Make sure modulation monitors are working properly, giving accurate test data. Tape equipment setup and maintenance is especially critical. Because of its heavy usage and mechanical nature it is prone to wear, tear and physical abuse. Learn the techniques required to maintain every piece of equipment at factory-fresh specs.

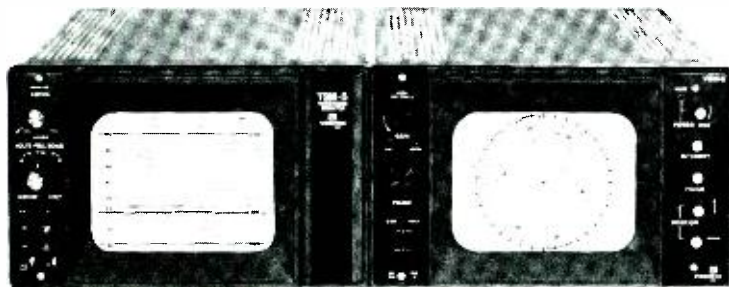
Sophisticated techniques

If the budget is available and if the demand for quality and the time to invest in the additional work is necessary, there are some techniques of measurement that can be highly revealing in terms of equipment performance.

1. *Intermodulation (IM) distortion.* Of growing interest among broadcasters, intermodulation distortion measurements have been around for a long time. IM distortion measures the products generated by two (high and low)

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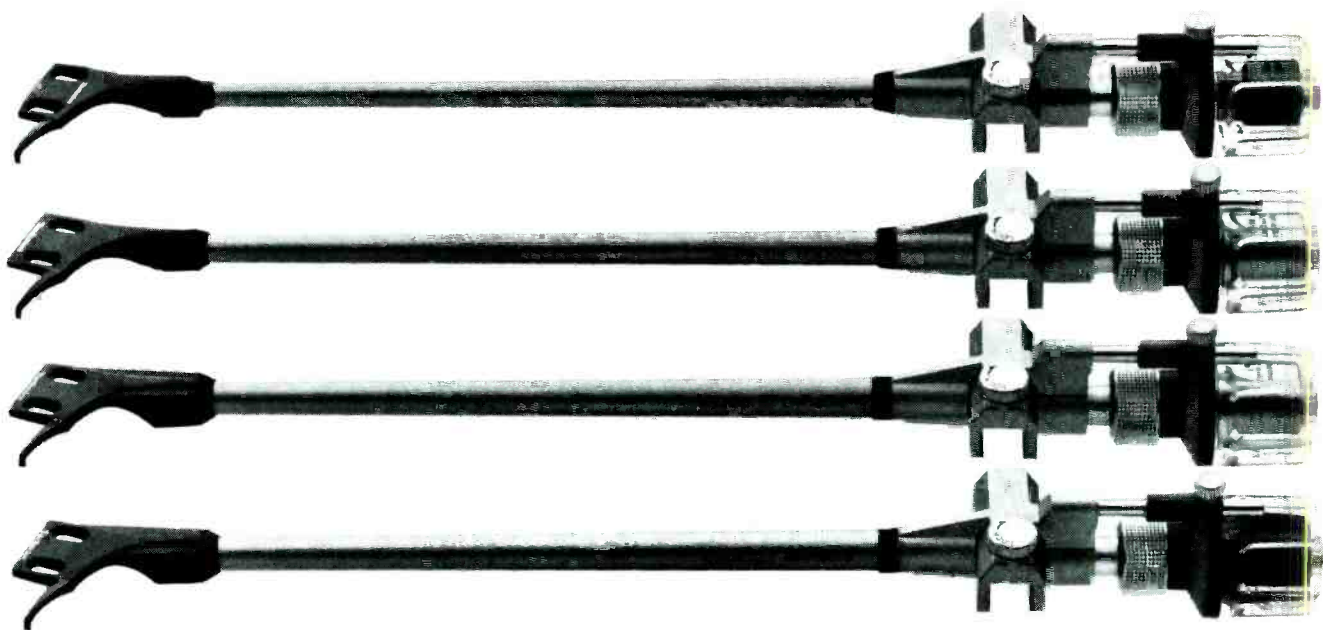
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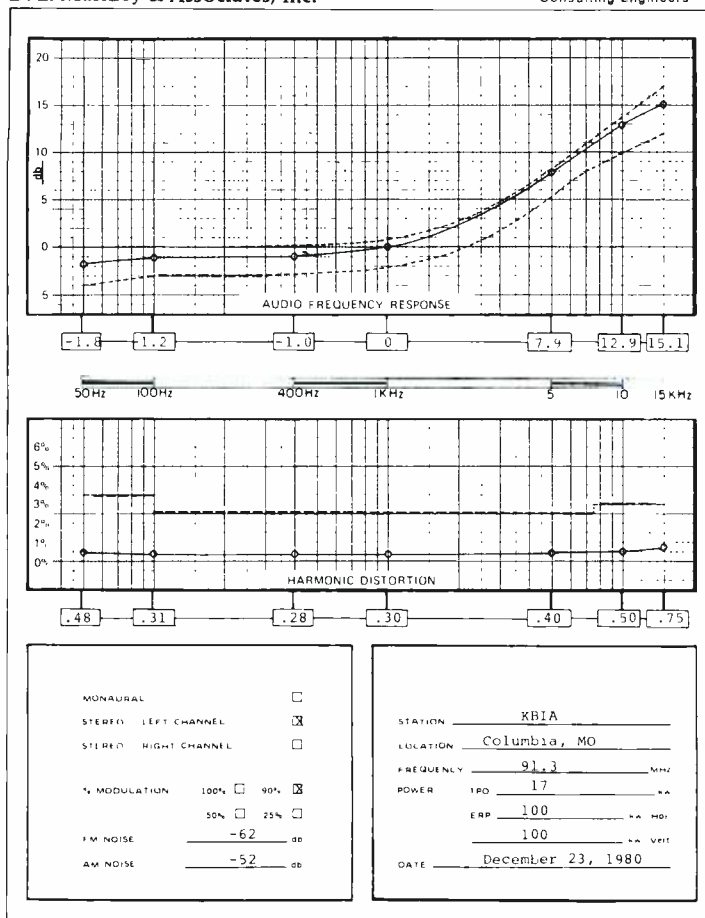
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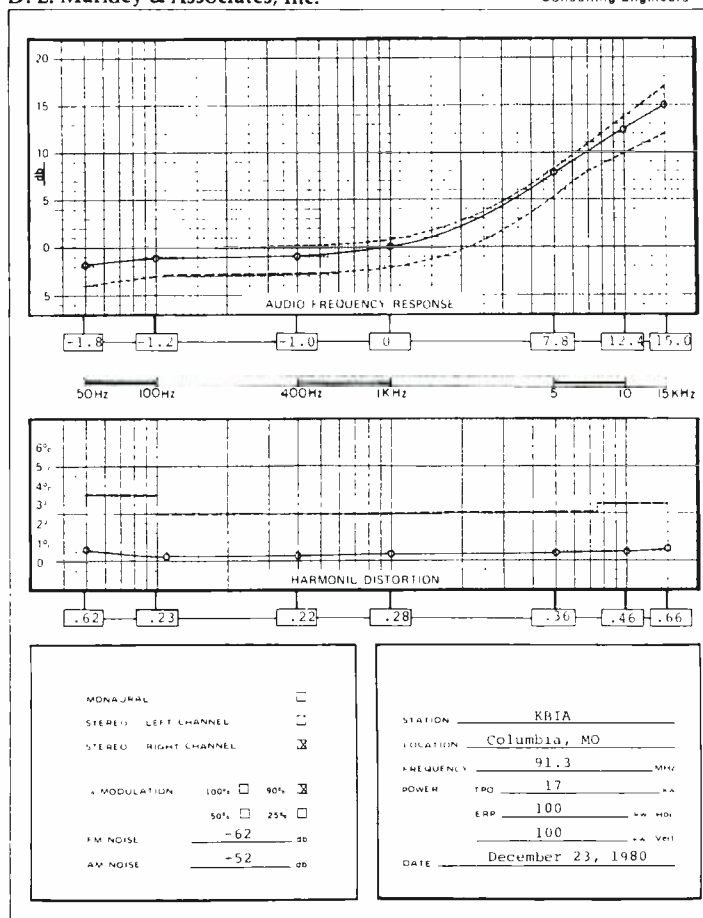
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Left and right channel audio proof results (90% modulation) for KBIA, Columbia, MO. These excellent results are characterized by a smooth fitting of the frequency response to the FCC 75 μ s pre-emphasis curve, by outstanding harmonic distortion measurements and by AM and FM noise measurements exceeding FCC requirements. Fortunately, KBIA also has an outstanding quality on the air under actual operating conditions, because attention is constantly given to all areas of engineering that affect the audio quality.



However, the author has also produced similar, if not better, audio proof results from stations that *do not* have good on-air sound quality, because the FCC proof results do not include many of the station's features—such as disc and cart reproducers, or the entire production room, which provide nearly all of the program material that is broadcast.

An article on KBIA's upgraded facilities appears on page 14 of this issue.

Audio proof

frequencies when introduced simultaneously into a circuit. The FCC proof misses this important performance measurement, one that can seriously degrade performance without ever showing up unless it is specifically sought out. Because it is a well-established standard measurement, IM distortion measuring equipment is easily obtain at reasonable prices.

2. Non-standard waveforms. Testing with non-standard test waveforms,

particularly triangle and square waves, provides an oscilloscope trace revealing valuable information about circuit performance. A triangle wave with straight-line rise and fall, and good symmetry indicates good circuit linearity in both positive and negative-going signal conditions. Zero-crossing errors show up particularly well with triangle waves. Square waves indicate high-frequency response by fast rise times and clean, sharp corners. Rounded corners and slow or ill-defined rise and fall times indicate deficiencies in high frequency perfor-

mance. "Tilting," or deviation from horizontal of the flat portion of square waves, indicates deficient coupling between audio stages, or poor transient response.

It is easy to compare input and output waveforms of the circuit under test with a dual-trace scope, and deviation from perfect reproduction is readily apparent. Don't expect absolutely perfect reproduction of these waveforms at frequencies above about 2kHz because some of the harmonic frequencies contained in these waveforms will be lost, even in very

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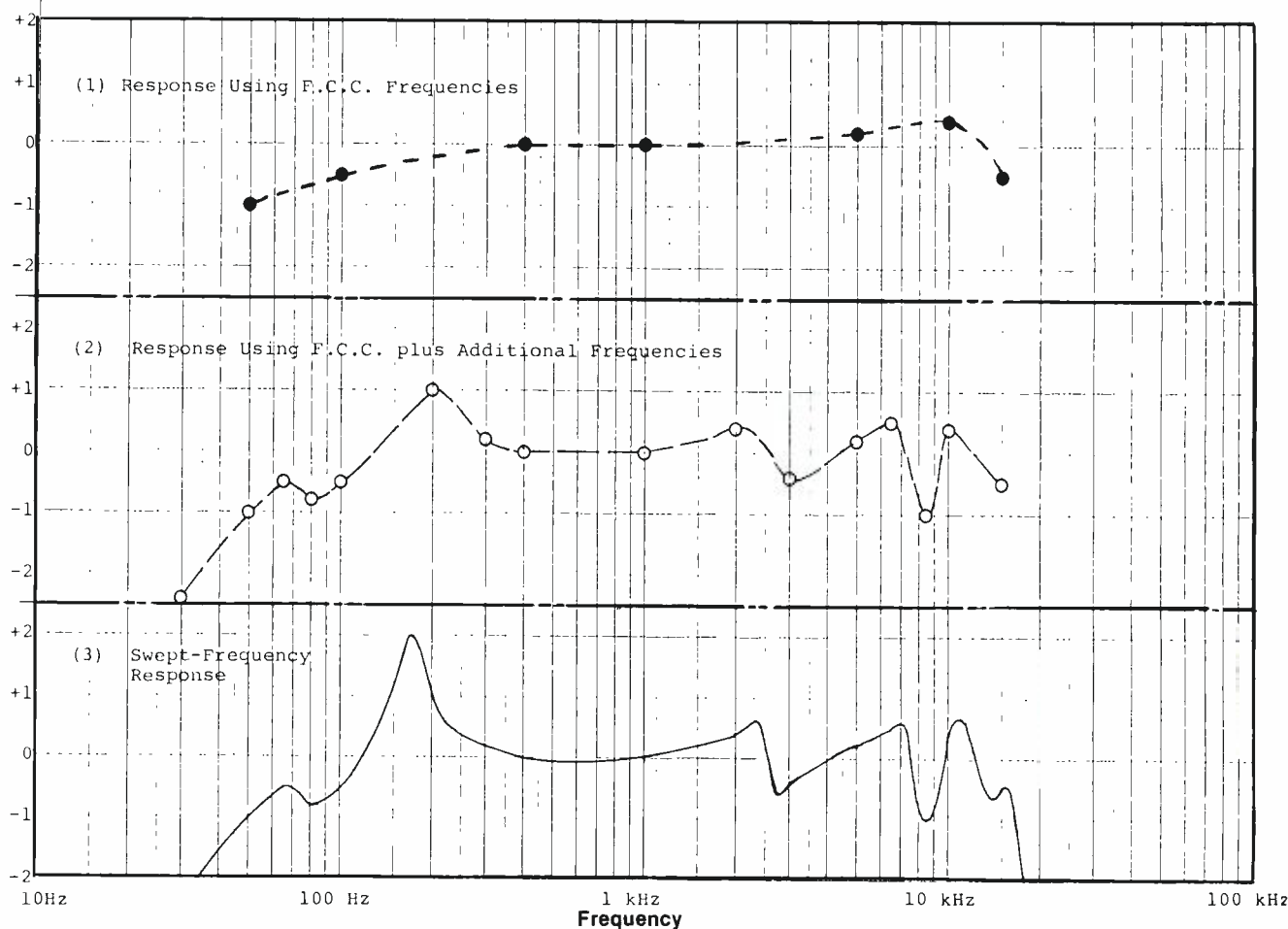
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For more information and a list of manufacturers of guy lines of KEVLAR, write: DuPont, Room 38811, Wilmington, DE 19898.

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These frequency response curves illustrate the need for more measurement points than those required by the FCC proof. The curves are those of a hypothetical system, being checked from the playback of a cartridge machine to the input of one channel of a stereo FM transmitter (stereo generator).

Curve 1 shows the result of FCC-proof style measurements. It shows a smooth curve with frequency response of -1, +0.4dB maximum, which is an acceptable response for good quality.

Curve 2 shows the same system, but measured at additional frequencies between the proof frequencies. At the low end, continued roll-off below 50Hz is no problem, but a +1dB "bump" at 200Hz could begin to add some low frequency "muddiness," which could degrade bass clarity. At the high frequency end, there appear to be some problems, perhaps with the filters before the stereo generator input. Still, the overall response is -1, +1dB from 50-15000Hz, which is considered in the "good" category.

Curve 3 shows the result of a swept-frequency test covering all frequencies. The "bump" is higher than previously indicated, because the center is at 170Hz, which was not used in the previous curves. It is likely to be a resonance problem in the playback head of the cart machine, not an uncommon occurrence. At about 2.5kHz, a sharp change occurs from +0.5 to -0.5dB. This is another possible resonance problem, maybe in a coupling transformer at some point in the system. Finally, the ripple in the frequencies approaching the filter cutoff frequency is even more pronounced. This system needs attention.

Although this illustration is hypothetical, it was derived from real-life problems: tape head resonance, transformer winding resonance with external capacitance, and pass-band ripple of stereo generator input filters. It shows, in exaggerated form, how problems can remain hidden unless analysis of an audio system is expanded beyond the techniques required by the FCC proof.

Audio proof

good equipment. Similar to IM distortion, these test waveforms are, in reality, multiple-frequency test signals containing fundamental and either even or odd harmonics.

3. **Audio sweep testing.** Frequency response measurement using a swept-frequency source and a synchronized

oscilloscope display is the logical extension of performance measurement at a large number of separate frequencies. It provides a rapid checkout and a visual representation of the frequency response of the device under test. Because all frequencies are included, bumps or other quirks in frequency

response will be discovered and can be dealt with. Sweep testing is especially valuable in setup of equipment having a specific type of frequency response, such as tape equipment, FM pre-emphasis and de-emphasis circuits, as well as checking for flat response characteristics.

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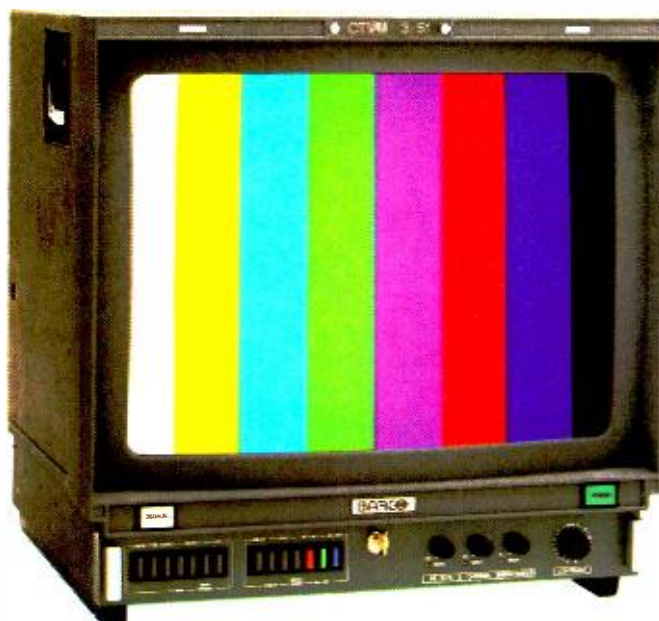
Facilities to be essential including colour subcarrier filter, pulse cross, size switch, remote control, internal/external sync. offer broadcast-oriented operating features and controls.

As regards to the CRT a choice is offered between WA (6500°K Illuminant D) and W (9.300°K) phosphors. Screen size and mechanical construction can be chosen as with the colour monitors.

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Audio proof

4. *Other techniques.* The use of an audio spectrum display together with a pink noise generator or audio multi-burst generator are currently the extremes in sophisticated audio testing.

The single drawback of every previously mentioned test procedure is the inability to measure a circuit or device under true dynamic conditions—the way it operates under program conditions. An audio-frequency spectrum display is required to look at all parts of the audio bandwidth simultaneously. There are two basic types of equipment. One is a spectrum analyzer, similar to the more common RF types, using a swept-frequency display. The other type has a discrete number of independent channels, usually spaced at one-third octave intervals, providing a nearly continuous look at the spectrum. It is the "total picture" aspect of these real-time spectrum displays that is the key to advanced analysis. The audio energy present at all points across the audio spectrum can be seen at once.

To best simulate the complex audio of program material, a large number of frequencies spread across the entire spectrum must be introduced into the system under test. A multiburst

signal containing several frequencies can be used, with simultaneous or stepped generation of those frequencies. Another method is to use a pink noise generator, which creates random signals (noise) that, over time, have an even distribution throughout the audio spectrum. With either of these test signals, the apparatus under test receives energy at all portions of the spectrum at once, not in discrete steps or in a sweep. In this manner, and only in this manner, can equipment accurately be tested that has frequency and amplitude dependent characteristics—such as FM limiters, multiband processors and noise reduction units. These types of equipment can be analyzed in their normal operating modes to determine their effects on the audio passing through them. Uniform frequency response under operating conditions can be shown, or deficiencies can be seen, such as an increase in low- and mid-frequency energy at high processing levels (possible IM distortion), or increased high frequency energy at high processing levels (harmonic distortion products).

The spectrum display can also be used for single-tone or IM-type

testing. Harmonic distortion products can be identified, as can IM products occurring at frequencies other than those being applied to the equipment. An additional feature is that a spectrum display will show the amplitude and frequency of each distortion product, not just a sum of all the distortion products generated. This can be extremely valuable when troubleshooting a distortion problem.

RF tests

Although not specifically in the realm of audio tests and measurements, the RF performance of a transmitting system can severely limit the ultimate audio quality of that station. FM exciters and AM modulators should be at top operational capabilities. Antenna systems should present the transmitter with a well-matched load over a sufficiently broad bandwidth to avoid attenuation or asymmetry of sidebands, and to minimize in-band intermodulation products that can arise in a mismatched condition. AM high frequency and high modulation performance can be severely degraded by a bad antenna system, as can FM stereo performance. □



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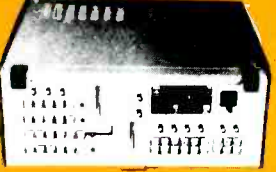
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Monitoring systems for audio quality evaluation

By Gary Breed, consulting engineer, D. L. Markley Associates, Peoria, IL

In spite of all the tests, measurements and analyses performed, the last word in broadcast audio quality evaluation is subjective listening. Taste and judgment in deciding how much and what type processing, or whether to equalize, is not a factor that engineering can measure. However, engineering can do a lot to assure that the persons making the final judgment receive an unbiased and consistent reproduction of the station's audio as it is being broadcast. A monitoring system can be provided that accurately and consistently reproduces what is broadcast.

Establish a standard

The first step in getting the right monitoring system is to decide on the type of system. If the program director's home stereo system is to be the last word, most of this article can be skipped. The same goes for using the general manager's car radio. But if a high-quality, in-house monitoring system is to be used as a quality standard, read on.

The second necessary standard is a person or persons who will make the judgment of quality. The station management team must decide on a method of evaluation. It doesn't matter whether it is the program director, the general manager or the cleaning lady as long as the decision is final. Committees should be avoided because of the difficulty of agreeing on anything. The nice thing about having a pitched battle over getting started is that everyone gets involved and excited about the project, and that enthusiasm carries over into the regular work.

After an "Audio Quality Expert" has been selected, the monitoring system can be built.

The equipment

The system described here is assumed to be for stereo monitoring. For AM or monaural monitoring, both channels could be driven simultaneously to retain stereo capability; alternatively, a monaural monitor or a single channel/speaker system could be used.

1. *The receiver.* In most cases, the station's modulation monitor is the best choice for receiving and demodulating the RF signal. Be certain it is functioning at peak performance and has an accurate and clean

audio output to feed the monitoring system. Send it back to the factory with orders to "do it right" if there are doubts about its performance.

There is some merit in using a high-quality consumer tuner for reception and demodulation because it may be more representative of the equipment used by the audience. However, be careful of its performance in a high RF environment if used at the transmitter site. Shielding and padded inputs could be required if the unit is susceptible to overloading.

When either unit is used at a station with separate studio and transmitter sites, be certain there is an outdoor directional antenna and a clean shot to the transmitter site to minimize multipath effects on reception.

2. *Amplifiers.* At least 30W per channel of power will be needed. Peaks should reach about 60W, and the unit should have low harmonic and IM distortion figures. A unit with impeccable audio quality specs, and typical broadcast ruggedness and reliability is required. Don't go cheap. Remember that quality is the goal, so use quality to look for it.

3. *Speakers* First, match the speaker with the amplifier power capabilities. If an inefficient speaker is chosen, more power than was suggested earlier is necessary to drive it. Choosing the speaker can be quick and simple, or it can take longer. There are several recognized "studio monitor" speakers marketed by major broadcast equipment houses. The top models of the better-known manufacturers will probably do an excellent job. Be sure to get a model that has the following features:

- Good off-axis high frequency dispersion to eliminate the need to listen from an exact spot. (But listen from the same spot anyway just for consistency.)
- Adjustment of mid-range and tweeter drive levels.
- As flat as possible sound pressure response from 30 to 20,000 Hz. Published data should be available to determine this.

Shop at a professional audio distributor. Most audio retailers do not have the expertise in either broadcasting or the recording industry that is necessary to assist in this choice. They also sell speakers that may be more decorative than useful. Selecting a speaker can be done quickly if criteria are established, but may take a

while longer if the subject is researched in depth.

4. *Equalizers.* A graphic equalizer with one-octave bands would be a valuable addition to a monitoring system to eliminate room resonances or slight speaker deficiencies.

5. *Sound Level Meter (SLM).* A low-to medium-priced SLM will suffice for the relative measurements suggested. However, the buyer won't necessarily know how to use this relatively simple instrument. Different brands may look alike but operate differently because of the type of microphone used for signal pickup. Make sure the instrument is working correctly. In the more expensive instruments, calibrators are available to assure the SLM is functioning properly.

The room

A production room would be the most common location for the monitoring system because it would do double duty. Other possibilities are the program director's or general manager's offices or a conference room.

1. *Room size.* A typical studio of 10 x 12 feet is the minimum required for a good monitoring system. Small rooms should be avoided.

2. *Acoustics.* It might seem that an anechoic chamber would be required for a good monitor, but that doesn't come close to approximating the average listener's home system. A good studio will be "dead," but may have windows, doors, tabletops, etc., that provide just a bit of liveliness from reflections. Paneled walls, tile floors and formica decks are definitely to be avoided. Carpet, cork, soft furniture and acoustic ceiling tile are preferred.

3. *Speaker position.* Locate the speakers in the most symmetrical manner possible with respect to the shape of the room, the location of doors, windows and furniture. What is desired is uniform performance from both speakers. They need to be mounted in the same manner: attached to the wall (avoid this; it adds bass), suspended in mid-air at equal distances from walls, ceilings or other objects, or mounted on pedestals with equal spacing. Arrange them so on-axis listening can be done from a convenient point in the room. The goal is to have identical reflection characteristics from each of the speakers.

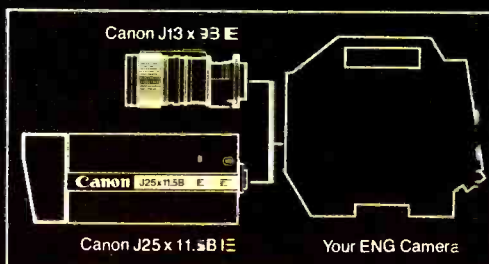
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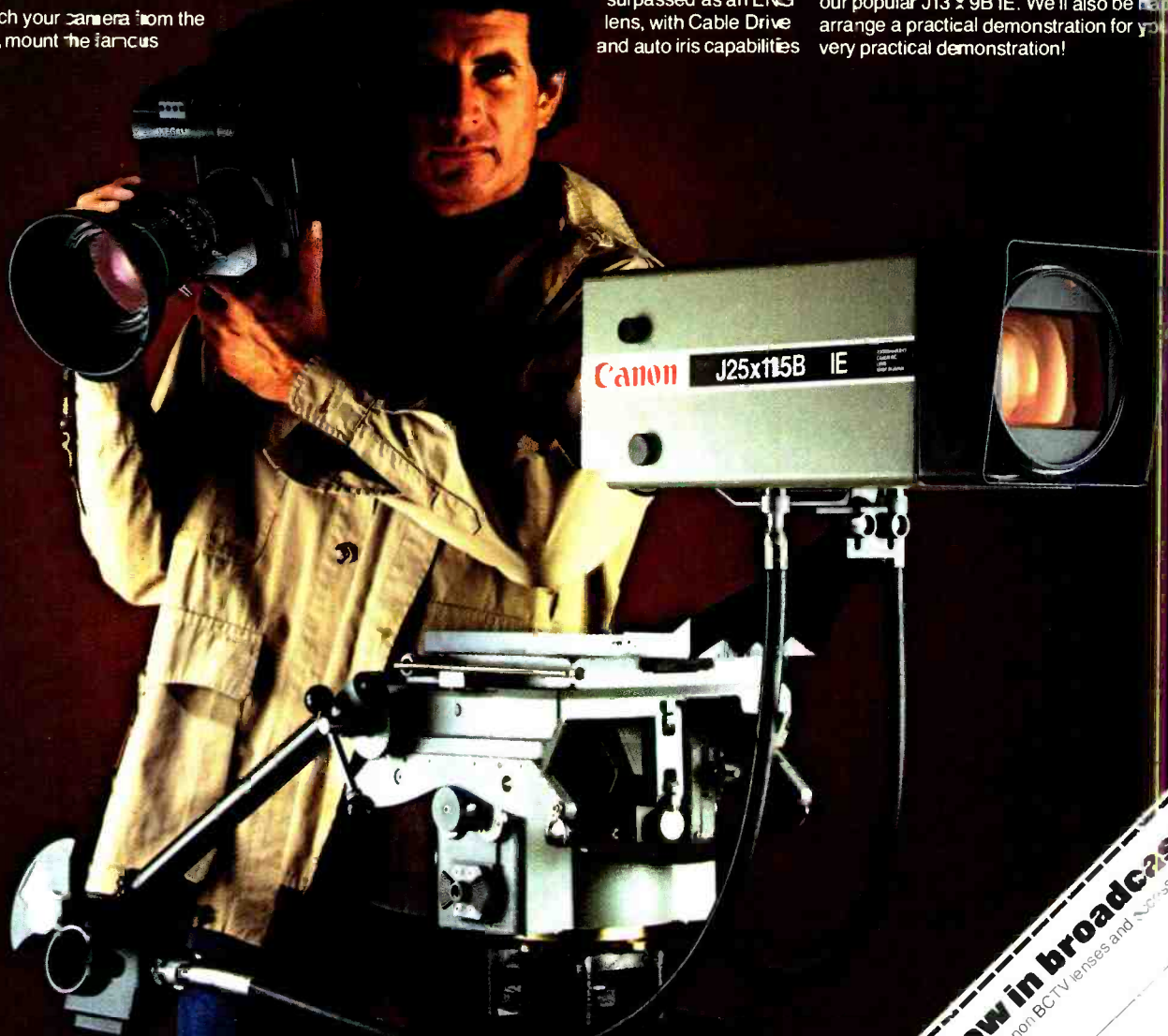
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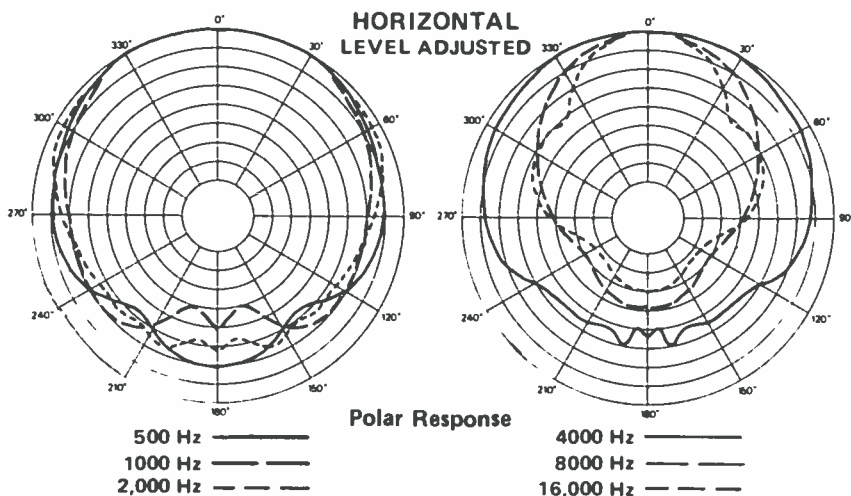
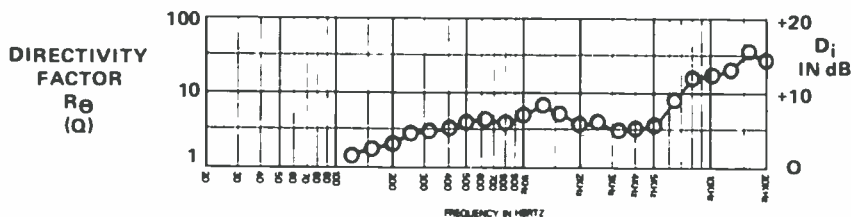
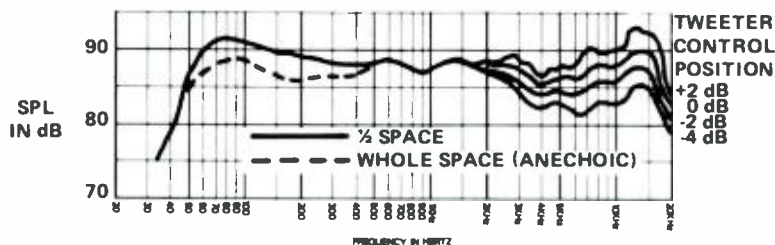
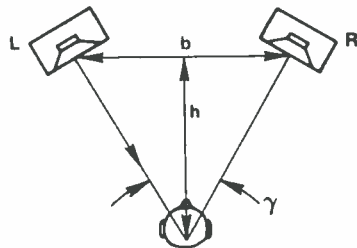
Monitor selection tips

The studio audio should be monitored with a high quality speaker system—preferably a professional grade audio monitor with closely matched performance curves. Because there is no such thing as a perfect sound reproduction system, selected monitor specifications and performance curves should be studied in setting

up listening tests and in arranging a studio.

Monitor suppliers will gladly supply performance data on professional monitors. Here, three curves illustrate the performance of Electro-Voice Sentry 100 professional monitors. These speakers have been engineered with the broadcast/recording studio engineer in mind. Particular attention was given to high efficiency and extended low frequency response, high power capacity across the entire frequency range, uniform frequency response and dispersion, and compact packaging.

Similar data will be available from other professional monitor sources. Regardless of the system selected, monitor specs should be studied thoroughly before conducting listening tests and before making the studio design final.



4. Set-up procedures. Start with all amplifier, equalizer and speaker adjustments set for flat frequency response. Next, use single tones and a sound level meter to look for any unusual resonances and to get a picture of the actual frequency response of the system in this configuration. Adjust the speaker controls or the equalizer to achieve the smoothest response across the audio spectrum. At this point be sure to use identical adjustments for each speaker or audio channel. If the two speakers exhibit vastly different characteristics with identical inputs, see what can be done to arrange them better in the room. If it is impossible to achieve equal response, it is permissible to equalize each speaker differently, but be certain of the results.

In addition to the above procedure, the final set-up should be done with several unprocessed audio sources such as records, music service tapes or top-notch ad agency tapes, and with equalization adjusted to provide the tonal balance desired by the "Audio Quality Expert" who is the final judge. Once the system is set up to the "expert's" specific taste, the station's broadcast audio is ready for evaluation. Remember, no changes should be made in the set-up once it is completed, or the consistency will be lost.

Listening procedures

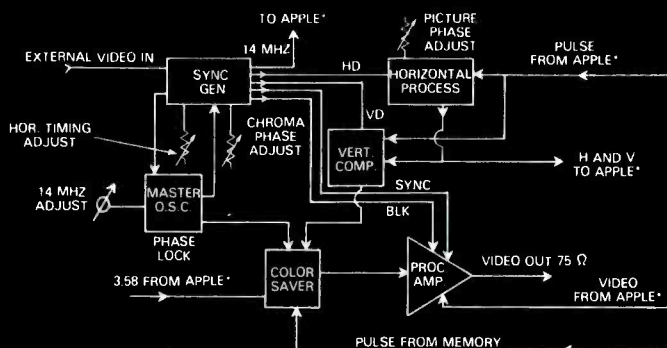
There are several principles that should be adhered to in the subjective evaluation of audio. First, the listener should be aware of the components of what is being heard, not just the overall impression. For example, to correct a problem of high frequency response, the listener should hear deficiency in cymbals, bells, voice sibilants and brass instrument "brightness," not just report that the sound isn't "crisp." The listener should be able to detect the additional distortion products of an intermodulation problem as a "busy" or "fuzzy" sound with a loss of transparency, or the ability to pick up every detail of the audio. Practice on unprocessed material that is known to be clean will sharpen the listening skill of the house "expert."

Communication between the listening expert and the engineering staff should be established early. Each person needs to learn what technical aspect of the audio is referred to in each other's own language. Learn to relate "boom" and "bassy" with low frequency response, and "crisp" and "bright" with high frequency response. Agreement on terminology is necessary so listeners can com-

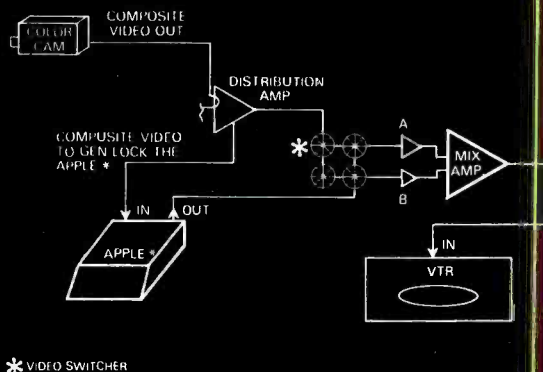
Apple* on the air

with BDL elec. full N.T.S.C. Converter with Gen Lock operation.

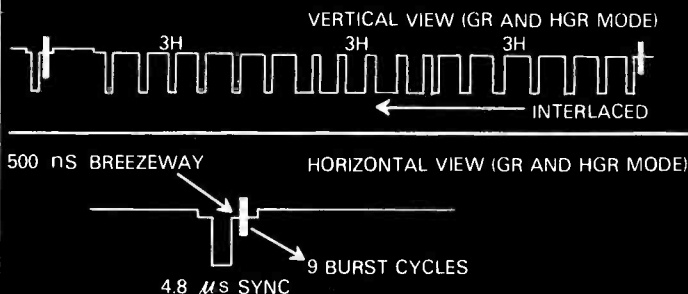
CONVERTER BLOCK DIAGRAM



VIDEO PRODUCTION WITH APPLE*



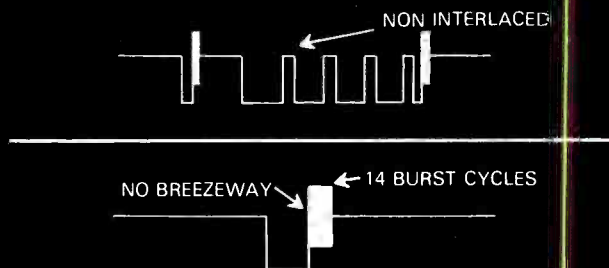
APPLE* WITH CONVERTER



Technical specifications of the Apple* with Converter

Color Sub.: 3.579545 MHZ	Burst: 9 cycles
H. Freq.: 15,734 HZ	Breezeway: 500 nS
V. Freq.: 59.9 HZ	H. Sync: 4.8 μs
Rise time: 150 Nano second	Video: 525 lines interlaced

APPLE* WITHOUT CONVERTER



Technical specifications of the Apple* without Converter

Color Sub.: 3.579556 MHZ	Burst: 14 cycles
H. Freq.: 15,700 HZ	Breezeway: No Breezeway
V. Freq.: 60 HZ	H. Sync: 7.8 μs
Rise time: 10 Nano second	Video: Non interlaced

The converter process all horizontal and vertical impulses to give you a signal with 2 interlaced fields, and horizontal sync of 4.8 μs with a (9) nine cycles burst flag place on the back porch at 500 nS of the horizontal sync trailing edge. The rise time as been corrected to 150 nS.

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Monitoring

municate during the tests.

The last important principle is the A-B comparison. When a change is being evaluated in the audio signal, the most reliable test is a rapid comparison between existing and proposed sound quality. It may take some doing, technically, to set up for such a procedure, but it is worth it. It can also be valuable to compare processed and unprocessed audio to see the effects of the processing on the transparency or frequency response of the audio. In all cases, the single most important thing is balance in levels. Because loudness is usually one of the criteria in broadcast audio evaluation, be sure that level between the A and B sources does not change. An oscilloscope should be used to assure that peaks are kept constant between the two sources. In unprocessed to processed comparisons, it is even more important to know the change in peak and average levels, to evaluate loudness as well as reproduction accuracy.

Secondary monitor systems

It is always valuable to have a second opinion to provide check and balance. In the area of audio evalua-

tion, there are two alternate methods of evaluation, but these should be used only to verify the accuracy of the evaluation with the standard monitor system.

One method uses another person as a second "expert." This second opinion allows the original "expert" to rethink an analysis and either reinforce or re-evaluate the judgment.

The second method uses an alternate monitor system. Depending on the target audience, it is wise to use another system as a second source of data on quality. This may be an automobile sound system, a home stereo system, the listening room of a local hi-fi shop or a representative portable or table radio. Again, use them only as a secondary source of data with your house standard, but do use them.

Lastly, and most carefully, use comparison with other stations as information regarding quality. These comparisons shouldn't be relied on too heavily because they tend to encourage judgments that are not made on sound audio principles, but rather in the emotional spirit of competition. The proper use of competitive comparisons is through audience feedback or over a period of time. Do not make

any quick decisions regarding quality based on a direct comparison with a competitor. Establish the station's goals, based on the factors of audience, program material and the taste and judgment of the staff, and stick with them until the goals are reached. Then, and only then, will competitive listening provide useful input for possible changes.

Final notes

It is an accurate and consistent monitoring system that will allow proper evaluation of a station's audio. It is the use of a designated single "expert" that will allow consistent judgment of progress toward established goals. It is the use of a second opinion in those judgments, either another person, or another audio monitoring system, that will confirm the judgment that has been made.

If the goal is to sound "pretty good," ignore these tips. If a station is committed to providing the best possible quality to its audience, it needs to use the proper techniques to evaluate that quality, and the monitoring system is the most important piece of equipment that is used for subjective evaluation. Be sure it is the best possible. □

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The 25th anniversary of the VTR

- April 14, 1956
- Chicago, IL
- National Association of Radio and Television Broadcasters (NARTB)

Material supplied by Ampex Corp.

Videotape recording is so commonplace it is difficult to believe the technology astounded TV broadcasters and created a multi-billion dollar industry just 25 years ago.

But in April 1956, the ability to broadcast from tape stirred pandemonium among the viewing audience and revolutionized the TV industry.

The event culminated four years of work by a 6-man team at the Ampex Corporation that would not give up its dream of recording TV pictures on magnetic tape. Today, at least 85% of

TV programming is broadcast from videotape recordings.

The story of how that dream came true started in 1951 with the arrival of Charles P. Ginsburg at Ampex. Ginsburg, now vice president of advanced technology planning, joined the Redwood City, CA, company for the express purpose of putting pictures on tape. (Ginsburg's story of the early development leading up to the first VTR demonstration will be in the May issue of BE.)

Historical VTR and Ampex landmarks

1956 (April 14) Before NARTB opened, Ampex holds a private showing of the VR-1000 for CBS executives.

1956 (November 30) Recording and coast-to-coast broadcast of "Douglas Edwards and the News," a milestone that wins Ampex an Emmy from the Academy of Television Arts and Sciences.



Disbelief, surprise and total acceptance struck the spectators at the Conrad Hilton Hotel as the Ampex record/playback demonstration proved the practicality of videotape recording for television. In the year that followed CBS, NBC and ABC television adopted videotape for use for delayed program broadcast. Today, more than 85% of all sports, news, variety and commercial programming is done on videotape.

The 40-4, a professional point of view.

Tape recorders are like tools. In the hands of professionals, they do their best work. And when professionals choose to use them time and time again, they become tools of the trade.

The TASCAM SERIES 40-4 recorder/reproducer is a shining example of a professional recording tool. Look inside.

The transport is the same as our 80-8 half-inch 8-track. Designed to handle the heavier half-inch tape, the 40-4 controls standard quarter-inch tape with remarkable ease.

It's rugged enough to take the constant wind/rewind process of building multitrack masters.

The switching matrix for record status and monitoring

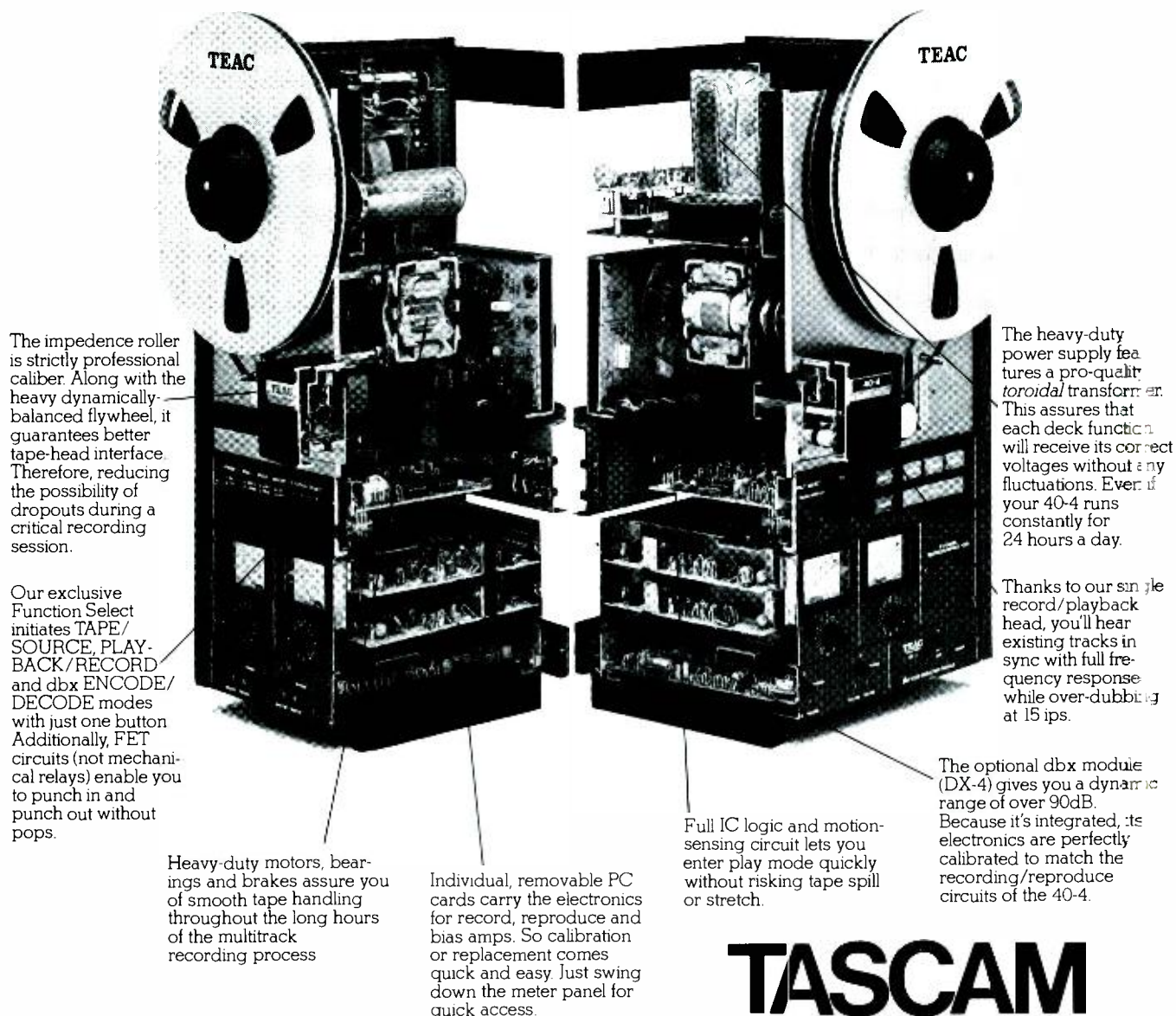
make overdubs and punch-ins convenient as well as positive.

Calibration adjustments are readily accessible, because professionals constantly maintain their tools in peak operating condition.

The results produced on the 40-4 (and its 8-track companion, the 80-8) are a matter of record. Sometimes gold.

And results, on demand, for payment is what we think professional recording is all about.

Check out the details below, then check in at your authorized TASCAM Dealer. And get the inside story from another professional.



The impedance roller is strictly professional caliber. Along with the heavy dynamically-balanced flywheel, it guarantees better tape-head interface. Therefore, reducing the possibility of dropouts during a critical recording session.

Our exclusive Function Select initiates TAPE/SOURCE, PLAY-BACK/RECORD and dbx ENCODE/DECODE modes with just one button. Additionally, FET circuits (not mechanical relays) enable you to punch in and punch out without pops.

Heavy-duty motors, bearings and brakes assure you of smooth tape handling throughout the long hours of the multitrack recording process.

Individual, removable PC cards carry the electronics for record, reproduce and bias amps. So calibration or replacement comes quick and easy. Just swing down the meter panel for quick access.

Full IC logic and motion-sensing circuit lets you enter play mode quickly without risking tape spill or stretch.

The heavy-duty power supply features a pro-quality toroidal transformer. This assures that each deck function will receive its correct voltages without any fluctuations. Even if your 40-4 runs constantly for 24 hours a day.

Thanks to our single record/playback head, you'll hear existing tracks in sync with full frequency response while over-dubbing at 15 ips.

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VTR anniversary

- 1959** An Ampex color VTR at a Moscow trade fair is used to record the celebrated Nixon-Khrushchev "Kitchen Debate."
- 1964** The VR-2000, a high-band broadcast VTR that permits improved color and duplication characteristics is introduced by Ampex.
- 1966** Ampex delivers its 500th high-band color VTR. The company also introduces the VR-1200, a high-band broadcast color and monochrome recorder for medium and small TV stations.
- 1967** Ampex introduces the HS-100 "instant replay" recorder, the first high-band color disc recorder for playback of short program segments in normal, slow or stop action. First used by ABC-TV in coverage of the "World Series of Skiing."
- 1967** Ampex introduces three new VTRs: VR-3000, the first battery-powered broadcast recorder with high-band color recording capability, and the VR-2000B and 1200B high-band color VTRs.
- 1967** Ampex receives its second Emmy for the development of high-band recording.
- 1967** The 1000th high-band VTR manufactured by Ampex is delivered to WCIA-TV, Champaign, IL.
- 1968** More than \$6 million worth of Ampex equipment is used to record the 1968 Winter Olympics in Grenoble and the Summer Olympics in Mexico City.
- 1969** Ampex introduces a "third generation" broadcast VTR, the AVR-1. Today, the AVR-1 is as widely used as were its predecessors, the VR-1000 and the VR-2000 series.
- 1970** Ampex receives a citation from Academy of Television Arts and Sciences for development of "instant replay" color disc recorders.
- 1970** The ACR-25, an automatic videocassette recorder, is marketed by Ampex for use in programming of short segments for TV stations.
- 1972** The 20th Summer Olympiad in Munich is broadcast by major TV networks throughout the world to more than one billion viewers using more than \$10 million in Ampex videotape, disc and audio recorders.
- 1974** Ampex introduces the AVR-2, the first modular quadruplex recorder/reproducer for broadcasters. The studio console ver-
- sion of the system weighs approximately 600 pounds and uses 1/3 to 1/2 the operation space required by existing quad recorders. It becomes the most successful quad recorder in Ampex history.
- 1975** The company delivers the 200th ACR-25 automatic cassette recorder to WAVE-TV, Louisville, KY, and the 500th AVR-2 to Australia TV station Ten-10.
- 1976** Ampex equipment worth more than \$14 million is used to broadcast the Winter Olympic Games from Innsbruck, Austria, and the Summer Games from Montreal.
- 1976** Ampex starts the helical VTR revolution with introduction of VPR-1 with automatic scan tracking (AST) and with a portable model, the VPR-10. Designed for professional broadcast, CCTV and post-production users, the VPR-1 with AST provides broadcast-quality slow motion and still-frame playback.
- 1978** The VPR-2 and its portable companion, the VPR-20, are introduced in the new Type "C" format. They retain the exclusive features of the VPR-1 and the VPR-10.
- 1978** Ampex signs add-on contracts with the American Broadcasting Company for 83 VPR-2s, with an option to purchase up to 37 more units. The contract represents the largest number of VTRs ever sold by Ampex under one agreement.
- 1979** Ampex receives its third and fourth Emmys from the Academy of Television Arts and Sciences, Hollywood, for the development of AST technology and from the National Academy of Television Arts and Sciences, New York, for development of the type C format.
- 1979** Ampex delivers the 1000th VPR-2 to WBBM-TV, Chicago.
- 1980** Ampex introduces the VPR-2B, an enhanced version of the VPR-2 that incorporates several new features, including reverse slow motion.
- 1980** Datacommunications, Paris, takes delivery of the 2000th VPR-2.
- 1981** McDonnell-Douglas, St. Louis, takes delivery of the 3000th VPR-2 (the 4000th system from the VPR Series).
- 1981** April (14-15) Ampex celebrates the 25th anniversary of the VTR industry.



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zoom lens.
At right:
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1955. The late Brigadier Gen. David Sarnoff displays an experimental ½-inch videotape, a forerunner of today's videocassettes developed by 3M. He is standing in front of a research model RCA color recorder during closed-circuit telecasts from New York to 3M Headquarters in St. Paul, MN.



1956. 3M introduces the world's first videotape, the Scotch brand 179. The 2-inch tape was about one-half mile long and weighed 22 lbs. a roll.

The 25th anniversary of the videotape

- April 15, 1956
- Chicago, IL
- National Association of Radio and Television Broadcasters (NARTB)

Material supplied by Dick Ziff, 3M Company.

Imagine a phone call to 3M's magnetic tape laboratory at 12:30 p.m. with the following request: "I need a videotape tomorrow morning for a demonstration at the National Association of Radio and Television Broadcasters (NARTB) convention in Chicago. Can you get one to me?"

The caller was William Wetzel, then general manager of 3M's Magnetic Tape Division. His request would not have been difficult today, but that call was made in April 1956, and the 2-inch quad videotape had not been invented.

Twenty hours later, after pooling results of several magnetic tape projects already in progress in the 3M lab in St. Paul, MN, including an experimental helical videotape for RCA, a package was delivered in Chicago. Inside was an untested, 2-inch-wide magnetic tape that theoretically worked for video. The tape was developed without 3M researchers even seeing the first Ampex videotape recorder, the machine to be used at the 1956 convention demonstration. So, there was no way to test the tape ahead of time.

The demonstration on April 15, 1956, began simply and quietly. The speaker's remarks were recorded on the "overnight wonder" tape as he delivered them. Then the speech tape was immediately played back on the recorder and the signal fed to a TV

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Videotape anniversary

monitor. The broadcasters in the audience saw what was later described as photographic quality pictures. There was a moment or two of stunned silence then an outburst of cheers, stamping feet, whistles and pandemonium.

A month after the demonstration, the three major networks placed orders for the new tape and the video recorder. And before the year was out, CBS aired an experimental videotape telecast of "Douglas Edwards and the News," and liked the results.

Seldom has a new technology changed a major American industry as rapidly. Within 18 months of videotape's network debut, 100 local TV stations had installed videotape recorders. Within five years, approximately 400 stations, serving 90% of the American viewing public, had converted to the new medium.

KING-TV, Seattle, was first on the air with its own videotape system. Station management estimated that videotape cut the cost of recording a program hour from \$88 when using film to less than \$3.

Some early uses of the new technology included:

- May 1958. First nationwide taped commercial aired (Florist's Telegraph Delivery Association ad on Edward R. Murrow's "Person To Person").
- September 1958. L.A. Rams videotaped game for halftime analysis.

The early video recorders of the 1950s were cumbersome by today's

standards. They weighed about 900 pounds and employed 160 vacuum tubes. Then in 1962, RCA announced the first fully transistorized video recorder and, a year later, Ampex introduced its first solid-state version.

Motion pictures took several decades to move out of black-and-white into the new world of color. Videotape converted to color just nine years after its black-and-white introduction.

By the mid-1960s, the electronic recording medium had come into general use for both programming and commercial production. Emmy awards went to videotaped TV "specials" in 1965, 1966 and 1967.

As the '60s drew to a close, tape and recording equipment continued their rapid advance. In 1969, the IVC-900 1-inch helical recorder for color broadcasting was introduced. A year later, 3M introduced Scotch high-energy helical videotape for improved color recording.

New horizons for the videotape industry opened in 1969 when the Sony Corporation introduced the first videocassette recorder that used 3/4-inch tape. By the middle of the decade, home video recorders using cassettes with 1/2-inch tape were introduced in the VHS and Beta formats. Industry sources report that just under two million recorders were sold by 1980. Tape manufacturers sold millions of blank videocassettes in the Beta and VHS formats in the same period.

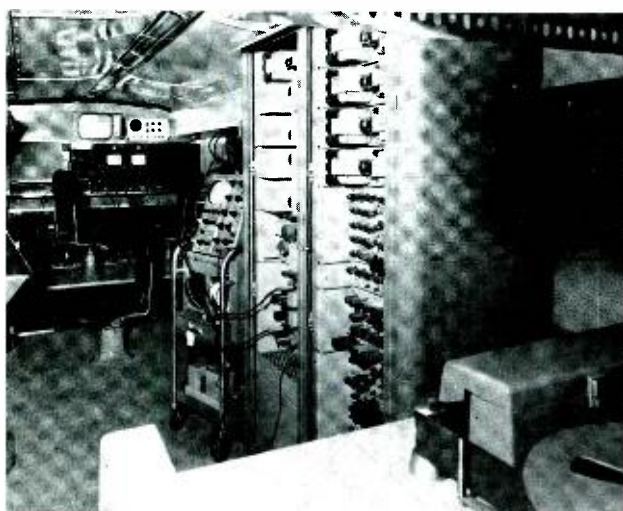
For the future, the new metal particle tapes now moving into the audio market hold the promise of improving the quality of video recording as well, according to William Madden, marketing director of 3M's Magnetic Audio/Video Products Division.

Madden said that the 2-inch quad videotape that made its network TV debut in 1956 used 30 square inches of tape to record one second of video information. However, today's home videocassettes record a second of video information on just 1/3 of a square inch of tape; a reduction ratio of 100:1.

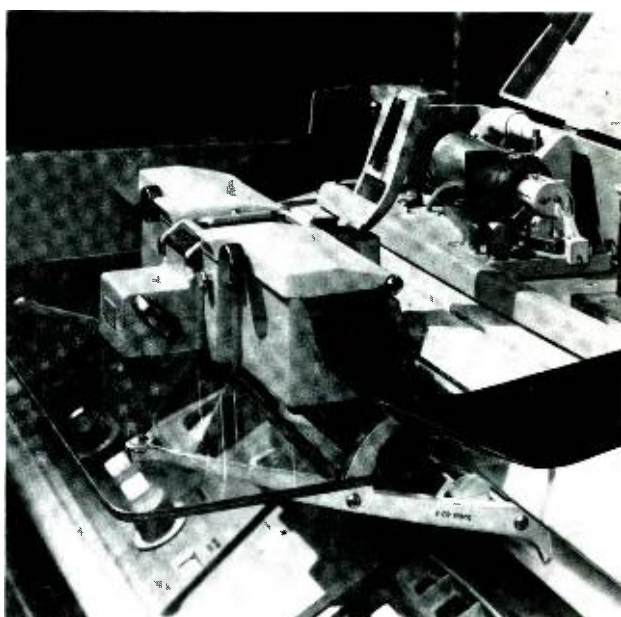
The price of video recording also has come down dramatically. Early videotape stock sold for about \$5 per minute. Today's videocassettes cost about 5 cents a minute, a reduction of 99%.

However, some tape price increases are inevitable in the future, Madden said, because petroleum derivatives make up about 85% of the raw materials that go into a reel of tape.

"Nonetheless, the future looks bright for videotape market growth," said Madden. "From the growing switch to tape in TV journalism to the increasing use of tape in education and training to the mastering of entertainment programs for videodiscs and cable networks, the strip of thin plastic coated with magnetic particles that we call videotape has advanced a long way from that electrifying demonstration 25 years ago for a convention audience." □



1959. Mobile Video Tapes, Hollywood, forms first mobile videotaping company in the United States. It was founded by three former ABC employees: Jack Meyer, camera operator-director; Clair Higgins, first camera operator; and John Allen Jr, technical supervisor. This view of their van interior shows, left to right, audio mixer, monitors, scope, and, in the right center and foreground, racks and console for the VTR.



1958. 3M introduced precision videotape splicer to attach to front of Ampex VTR, making accurate tape splicing and editing possible.

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Digital television demonstrated during SMPTE conference

By Bill Rhodes, editorial director

The 15th Annual SMPTE Television Conference in San Francisco featured the historic demonstration and evaluation of digitally processed TV signal techniques. This event took place in the new broadcast facilities of KPIX Channel 5, (Westinghouse Broadcasting Co.).

The impact of these digital experiments will probably serve as a reference point noting the change in

TV broadcasting technology and the ultimate transition to the all-digital studio of the future. It is only coincidental that these valuable experiments occurred 25 years after the first demonstration of the videotape recorder.

SMPTE spearheading digital video

The leadership toward digital video

standardization is increasingly evident in SMPTE activities. In fact, this effort is dominating other important SMPTE works as well as the annual Winter Television Conferences. Last year in Toronto, "The Digital Decade" was the theme of the conference and all other topics and exhibitors were excluded. At this year's meeting in San Francisco, the theme was "Production and Post-Production in the Eighties"—but the digital experiments at KPIX stole the show.

History made at KPIX

Behind the success of the digital experiments conducted by SMPTE was a vast coordination effort by SMPTE committee members, the engineering talent and skills of major companies around the world and support by numerous suppliers.

The successful coordination of these efforts is testimony to the management skills of SMPTE's working groups.

Broadcast Engineering joins the broadcast community in applauding the efforts of all those who participated in the KPIX demonstrations.

The KPIX experiments

Digital video is recognized as one of the most important technologies affecting TV program production and broadcasting. SMPTE, through its Committee on New Technology, has established four technical groups on this subject since 1972.

Although the initial emphasis on digital video in 1979 was on composite coding (fully encoded luminance and chrominance), the interest in component coding (separate luminance and color difference signals) grew rapidly because it has the advantages of higher picture quality, ease of complex signal processing and elimination of subcarrier complications in editing and other broadcast operations.

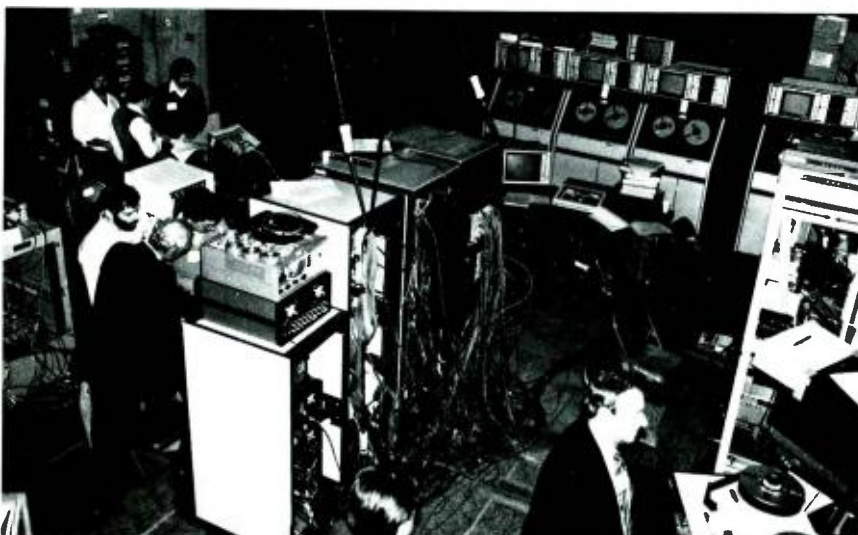
The ultimate goal of the SMPTE digital groups is to contribute to a worldwide compatible digital code usable by all broadcasters. Although current color TV systems are not amenable to total compatibility, equipment compatibility would yield simpler, more economical operation. One advantage would be the capability of a digital VTR to function in both a 525/60 and 625/50 environment without modification.

To establish the desirable parameters for component coding, a



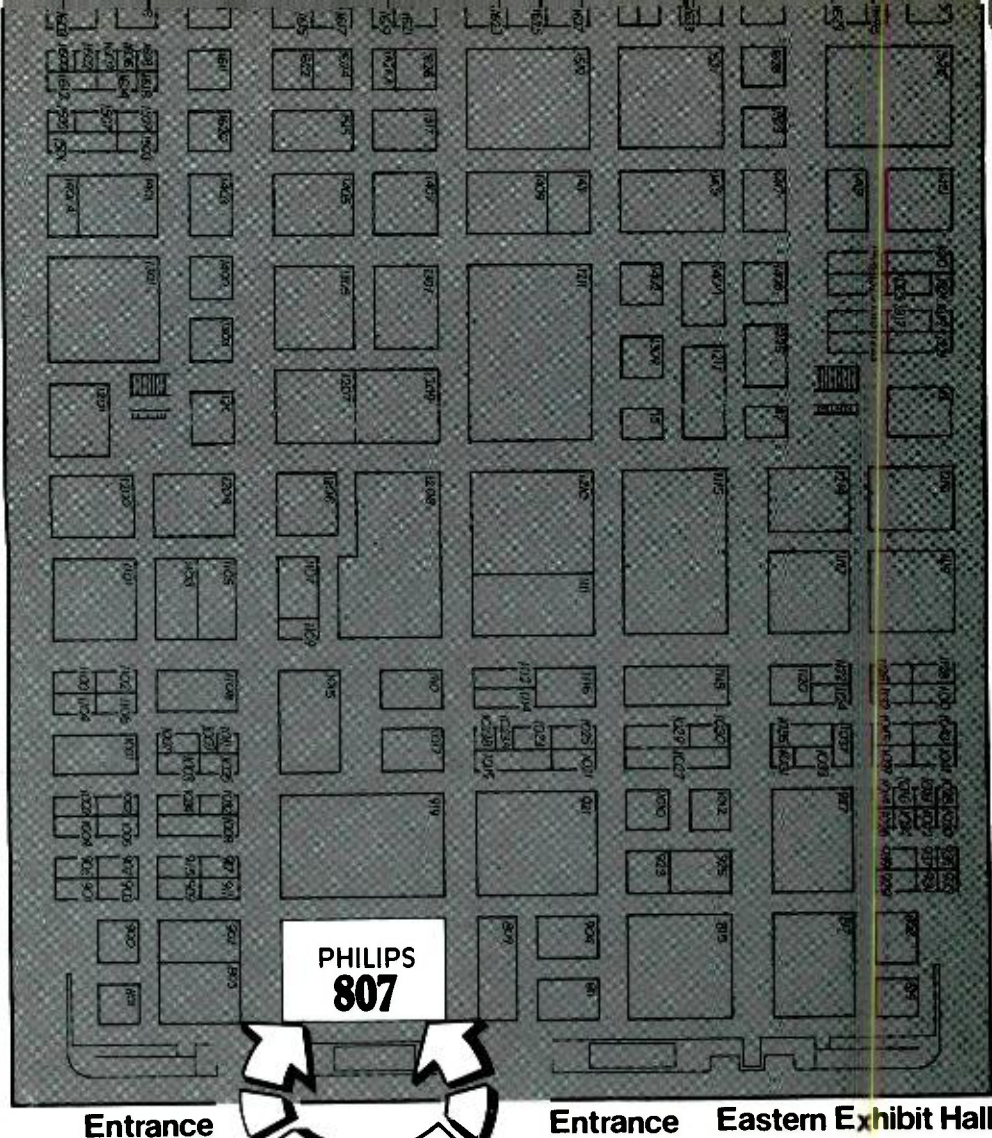
Courtesy SMPTE/Photographer Donna Foster-Roizen

The digital component encoding demonstrations at KPIX involved a wide array of TV equipment, as this partial view shows. In the center of the room, the racks house the Dynair switcher, the VG zone plate generator and various pieces of test equipment. To the left are the Ampex VTRs, in the back the Sony DVRs and in the forefront the CCU for the RCA TK 47.



Courtesy SMPTE/Photographer Donna Foster-Roizen

This view from another angle shows additional equipment plus a vast collection of cable interconnects.



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SMPTE conference

series of carefully monitored, precise, technical demonstrations were organized by the society. The Task Force on Component Digital Coding was asked by the Committee on New Technology to organize these demonstrations with the assistance of the other digital groups. The groups involved, and their chairmen are:

Committee on New Technology
Robert Hopkins
Study Group on Digital Television
Charles Ginsburg
Working Group on Digital
Video Standards
Kenneth Davies
Study Group on Digital TV
Tape Recording
William Connolly
Task Force on Component
Digital Coding
Frank Davidoff

Most of the work was done by the Working Group on Digital Video Standards.

The two most important parameters of digital component coding, which were under scrutiny, were the sampling frequency (rate at which an analog signal is sampled for conversion to digital format) and the ratio of the luminance to color difference components. This is usually expressed in a 3-part number, such as 4:2:2, indicating that the luminance is sampled at a rate twice that of each of the two color difference signals.

The purpose of the KPIX demonstrations was to examine a



Courtesy SMPTE/Photographer Donna Foster-Roizen

The Sony experimental DVR and support equipment.



Courtesy SMPTE/Photographer Donna Foster-Roizen

Part of the Sony team that contributed to the development of the experimental DVR used for the KPIX/SMPTE digital video test posed near their equipment. Kneeling, left to right, are Hirofumi Yoshida and Masahiko Morizono. Standing, left to right, are: Yoshitaka Hashimoto, Takeo Eguchi, F. Howard Steele and Arnold Taylor. This team represents the Japanese, European and US operations of the Sony Corporation and reflects the worldwide cooperative effort of the Sony resources that made the DVR project feasible.

SMPTE's Statement On Digital Coding of Television (February 9, 1981)

A meeting was held of the chairmen and members of the SMPTE who are seeking an appropriate digital TV interface for use within the studio with the Bureau of Technical Committee of the European Broadcasting Union, who have similar interests.

After exchanging views and considering the technical aspects, the following statement was made and agreed upon.

- We all recognize the importance of using a digital code that describes a high quality TV signal. This code must permit the development of digital studio production techniques that are required to produce an effective service in an economic manner.
- We recognize that the worldwide use of the same code is attractive in principle, facilitates operations, and if an appropriate choice is made, will bring about cost reductions and encourage worldwide exchange of program and engineering information.

- We resolve to promote these ideas with our organization.
- We support the draft Recommendation 11-D-1 contained within CCIR Studio Program 25A/11, and, in particular, seek to define the number of samples to be used to describe a TV line.

- We believe the system decision should be based upon the performance of the quality level represented by a 4:2:2 orthogonally sample system.

* The circumstances surrounding the introduction of a digital code are different in the 625-line countries and the 525-line countries, and, as a consequence, the SMPTE sees advantage in the use of a number of samples per line in the vicinity of 910. The European Broadcast Union prefers a lower number. In the interest of reaching an agreement, it is expected that the EBU would move up to 832 samples per line, and SMPTE has indicated it will consider to move to a lower rate in the interest of achieving a worldwide compatible standard.

The differences between these two views are small and we resolve to urgently consider the problem within our various organizations, in an attempt to close this gap. Joint meetings of the SMPTE and the EBU are planned.

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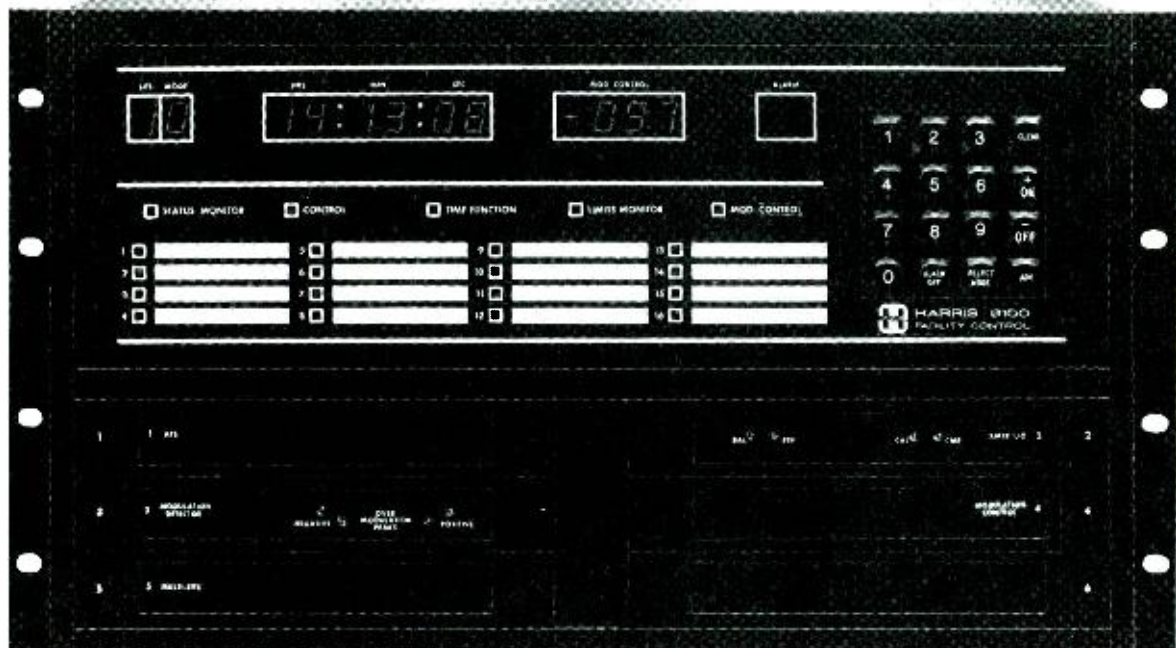
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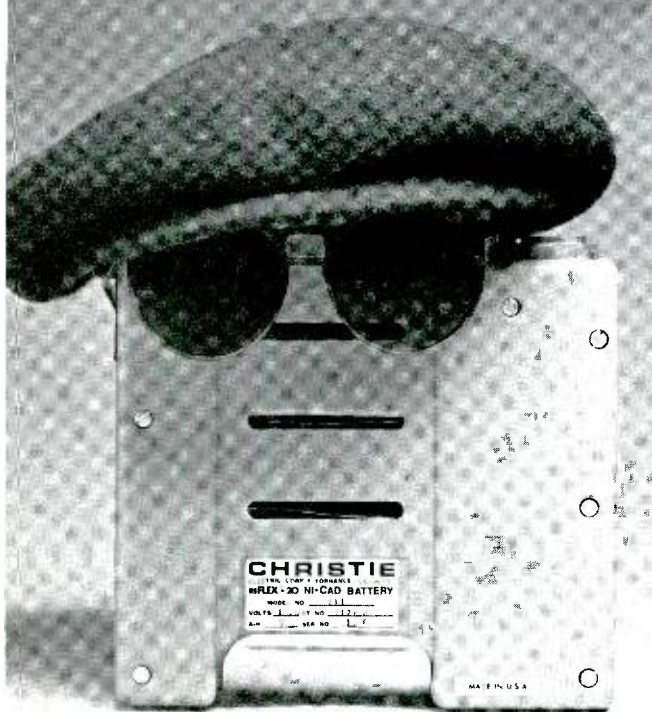


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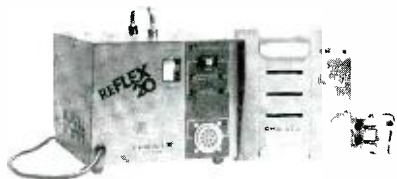
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SMPTE conference



The panel that discussed the digital video component tests at the SMPTE convention. Participating on the panel were, left to right: Roland Zavada, Eastman Kodak; Charles A. Ginsburg, Ampex; Frank Davidoff, consultant; Kenneth B. Davies, Canadian Broadcasting Corp.; William G. Connolly, CBS Television; and Stephen D. Kerman, Tektronix.

Book on digital video/TV future

The 15th Annual SMPTE Television Conference presented an outstanding collection of technical papers under sessions of "Digital Video Recording," "New Camera Technology," "Digital Techniques," "Future Directions of Television," and "The All-Digital Studio."

Selected papers from this conference treating the future of television, with a heavy emphasis on digital technology, is available from SMPTE. It is titled "Television Technology in the 80's." The price is \$30. A 20% discount is available for SMPTE members. Contact: SMPTE Books, 862 Scarsdale Ave., Scarsdale, NY 10583.

Conference planners

The conference chairman was M. Carlos Kennedy, Ampex Corp., and the papers program chairman was Louis (Dee) Pourciau, consultant. The conference was under the supervision of SMPTE Conference Vice President Charles Ahto, Tape-Film Industries, Inc.; Editorial Vice President Maurice L. French, Canadian Broadcasting Corp.; and Vice President for Television Affairs Frederick M. Remley, University of Michigan.

The program topic chairmen were David Fibush, Ampex Corp.; Stephen D. Kerman, Tektronix; and Ray M. Swenson, KTVU-TV.

Conference exhibitors

A 41-booth equipment exhibit held along with the conference technical sessions involved most of the major companies having equipment related to the conference program. The 23 companies that showed equipment are: ADDA Corp.; Ampex Electronic Co.; Ampex Corp.; Amtron Corp.; Cinema Products; CMX/Oroxx Corp.; Colorado Video Inc.; Digital Video Systems; Dolby Laboratories; Fujinon Optical Inc.; The Grass Valley Group; Grinnel Systems; Harris Video Systems; 3M Video Products; Merlin Engineering Works Inc.; MCI/Quantel (Micro Consultants); NEC America Inc., Broadcast Equipment Division; Sony Corp.; Sound Genesis; Tele-Cine Inc.; Thomson-CSF Broadcast Inc.; Toshiba America Inc.; and Vital Industries.

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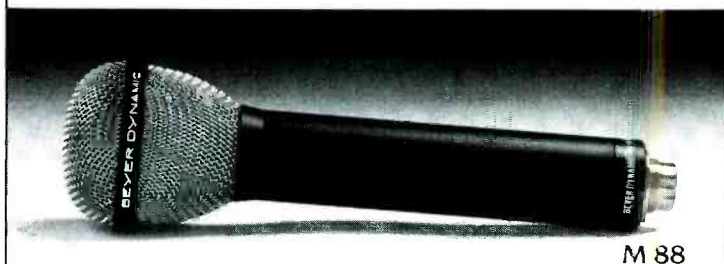
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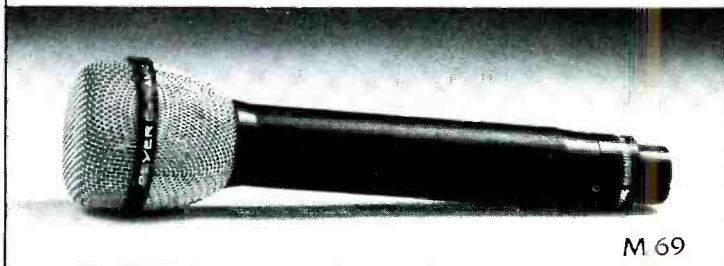
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SMPTE conference

range of proposed sampling rates (768, 864, 912 samples per line) and quality levels (4:4:4, 4:2:2, 4:1:1, and 2:1:1) in the contexts of direct display NTSC compatibility, processability and recording, with an eye toward gathering a factual base for the establishment of standards for component-coded digital video. The results of these demonstrations were analyzed by the working groups during the convention and an urgent meeting was scheduled subsequently. At that time, an effort was made to obtain a consensus within the working group regarding digital TV coding formats that could be communicated to the task force.

In addition to the work in the digital coding field which is being conducted by the SMPTE, the EBU (European Broadcasting Union) a major broadcast organization, investigated digital

coding parameters and conducted a series of demonstrations in January at the IBA engineering headquarters in Winchester (UK). These demonstrations were attended by the SMPTE task force. SMPTE, in recognizing the worldwide implication of digital coding, reciprocally invited the EBU Bureau of the Technical Committee to observe the February demonstrations at KPIX.

The task force and SMPTE management met with the EBU Bureau after the convention. During the meeting, they discussed the consensus. An agreement might now be reached on the fundamental parameters so that a worldwide compatible code may be developed by both organizations. The resultant digital code will influence TV program production and broadcasting operations for the next 20 to 30 years.

The SMPTE demonstrations represent a massive effort not only by SMPTE but also by those organizations that contributed heavily by providing equipment, facilities and personnel. These included KPIX and Walt Nichol, engineering manager, and his assistant, Merrill Weiss, who provided the studio space and set-up assistance.

Other contributions

The direct encoding and decoding equipment was provided by RCA and a digital conversion unit was supplied by the CBS Technology Center. An NTSC coder/decoder working at 912 samples per line (SPL) came from Sony, and a similar unit working at 864 SPL was supplied by Digital Video Systems. The digital VTRs, actually two transports built with common electronics, were brought from Japan by Sony.

The digital experimental equipment was supported by a wide array of relatively standard gear that was connected specially to switch RGB, sync and NTSC signals at a high level of performance. The RGB recording equipment consisting of three type C 1-inch helical machines, operating in synchronism, were supplied by ABC-TV; the two VPR-2 analog NTSC machines and a time base corrector came from Ampex Corp.; and a DPS-1 frame store synchronizer was a Digital Video Systems unit. Dynair supplied the System 21 switcher and the distribution amplifiers that routed the signals between selected points; and Tektronix 1410 and 1900 test signal generators provided the proper base video, sync and test signals. Thomson-CSF Broadcast lent a TTV-2705 flying spot slide scanner and a Vidifont character generator to provide both color images and electronic graphics, and VG Electronics supplied its unique 1032 zone plate generator for special tests. Live color images were provided from a TK-47 color TV camera supplied by RCA. An Ultimatt color matte generator came from VGR Corporation and a B-3373 analog NTSC encoder was provided by Marconi. The display devices came from Barco and consisted of high resolution picture monitors and comb filter decoders.

The experiment reflects the international role of SMPTE by attracting delegates from many parts of the world, who were looking at equipment supplied from Japan, the United Kingdom, France, Belgium, West Germany and the United States.

Early preparations

Weeks before the conference Robert



During the SMPTE luncheon, John Summers, National Association of Broadcasters, described the difficulties of working with Capitol Hill in getting good legislation.



William Connolly, CBS, was just one of many who addressed speakers with questions from the convention floor.



The KPIX digital video demonstrations were supported by many organizations. During a special reception honoring all contributors, the SMPTE recognized five sources for their exceptional contributions. Accepting the awards for their respective organizations were, left to right: John Rossi, CBS Technology Center; John Lowry, Digital Video Systems; S. Merrill Weiss, KPIX; Takeo Eguchi, Sony; Yoshitaka Hashimoto, Sony; (Ken Davies, who presented the awards); and Frank Marlow, RCA.



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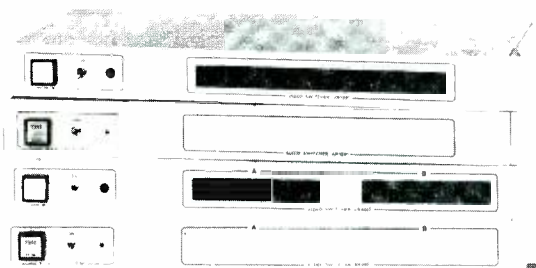
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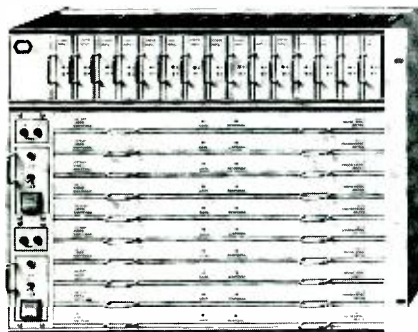
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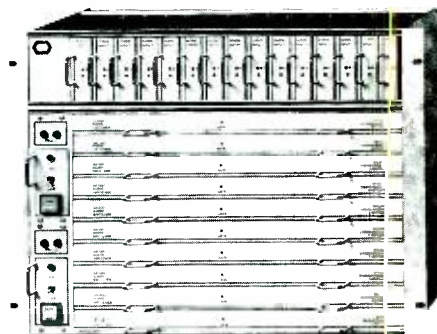
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SMPTE conference

S. Hopkins, chairman, SMPTE Committee on New Technology, issued special invitations for the digital demonstrations. Among these were 14 sessions of subjective assessment of the experiments and 12 sessions for system presentation (to special groups, including the press) scheduled. Participating in the subjective assessments were 102 specialists, most in one or more sessions (for statistical reasons), and 450 viewed the systems presentations, all at KPIX.

During the final technical session, a panel from SMPTE reviewed the significance of these experiments for the conferees and presented a videotape of the KPIX experiments.

Viewing and observations

The subjective assessment of digital picture quality produced at KPIX involved two groups of experts. One group of 90 experts viewed the pictures at distances of four and six times the picture height. A smaller group of 12 experts viewed the pictures at a distance of 2½ times the picture height. The larger group was divided into three panels of 30 each.

To avoid eye fatigue, the panels worked only about 30 minutes each day, with three panels being tested morning and afternoon. The volume of data compiled was fed into a computer for analysis.

About 450 people from major organizations were invited to the system presentations. These people represented interests from around the world, but the majority of representatives were from 525-line countries. Twelve groups were scheduled for these viewings, with about 30 people in each group.

The KPIX experiments represent the first all-digital video studio and the first public demonstration of digital video editing and dubbing. Because of their success, a vast quantity of data on digital video signal processing and handling for the all-digital studio was produced.

The data are not yet available from

the SMPTE working group, but these are some overall observations:

- The excellent quality of the digitally processed pictures did not show widely varying quality differences. All combinations of sampling rates and quality levels appeared acceptable on first viewing.
- The digitally transcoded samples seemed to enrich the picture's red color content.
- The sampling rate appeared to have a lesser effect on the picture quality than did the various quality levels.
- The 20% horizontal picture expansion capabilities possible with digital processing was particularly impressive.
- In shuttle mode operation, the VTRs did little to impair the picture quality, even in forward and reverse operation at 10 times normal forward speed. This achievement is particularly important for editing. Normal replay action was accomplished with ease and high clarity.
- Error correction and error concealment were easily handled, without dropout streaks.
- In multi-generation dubbing, 20th-generation copies showed no degradation, indicating that dubbing possibly could be extending to high numbers.

Meeting the press

The press that attended the system presentation met with members of SMPTE following the KPIX demonstrations. The purpose was to review the significance of the test results and to project their future impact.

Roland Zavada, engineering vice president, described the standardization efforts being undertaken by SMPTE and said, "These efforts transcended all international boundaries."

He praised the support of the many companies that had contributed talent to make the experiments a success and the \$2½ million in KPIX equipment that made them possible.

It was also noted that on the first

trial of the controlled experiments, it was not easy to discern distinct picture quality differences when the processing was switched among the three sampling rates and four quality levels.

Ken Davies, chairman of the Working Group on Digital Video, said that this was the case for the untrained observer and for some of the early scenes but that the experts doing the subjective assessments quickly mastered those differences and were soon able to identify the key parameters without watching the cue sheets.

Davies also said that an underlying factor in the experiments and analysis was an attempt to reach a worldwide standard in equipment. This would make costs more reasonable.

The crucial international meetings are scheduled for 1982, with preliminary meetings being held in September 1981—for which the KPIX data will be of major importance.

Joseph Flaherty, executive vice president, alerted the press to the historic impact of the digital studio and experiments at KPIX. He also said that the high definition television being demonstrated on the floor was highly significant as well. In terms of a digital standard, he said that it is important that the industry arrive at a hierarchy based on a thorough assessment of need vs. cost to achieve an acceptable quality for broadcasters at an affordable price.

Final note

Traditionally, SMPTE carefully avoids singling out manufacturers for citations, but it does recognize individual achievements with awards. In an uncharacteristic move, SMPTE officers were quick to praise the support of KPIX and the many companies and organizations that made the digital experiments possible. SMPTE sponsored a special evening reception in honor of this support and gave special awards to CBS Technology Center, Digital Video Systems, KPIX, RCA and Sony.

HDTV demonstrated at the SMPTE convention

The digital video experiments at KPIX were not the only attraction at the SMPTE convention. A cooperative effort by CBS and NHK (the Japanese Broadcasting Corp.)

moved high-definition television (HDTV) into high gear.

The NHK/CBS demonstrations were held in The Borgia Room adjacent to the main exhibit floor in the St. Francis Hotel. Between sessions, the room

was packed with viewers.

A high resolution studio camera was used to pick up still pictures and a model set-up in a simulated studio environment. The pictures were processed and displayed on high resolu-



High-definition television (HDTV) was demonstrated at the SMPTE convention by NHK; CBS was the sponsor. Joseph Flaherty, left, CBS vice president for development and engineering, comments on the system during a special demonstration for film producer/director Francis Ford Coppola, second from left. Also attending were M. Joseph Polonsky, second from right, Thomson-CSF, France, and Takashi Fujio, far right, NHK Technical Research Laboratories Tokyo.

tion monitors and by a large 55-inch TV screen projection.

Even at close inspection of a few inches the scanning lines were only barely discernable on the wide screen projections or on the high resolution monitors. Color and picture quality were outstanding, and the scan lines from the 1125-line system were invisible at normal distances for viewing.

The Saturday morning sessions at the convention were devoted to "Future Directions for Television,"



The Borgia Room containing the NHK high-definition TV demonstrations was packed between conference sessions.

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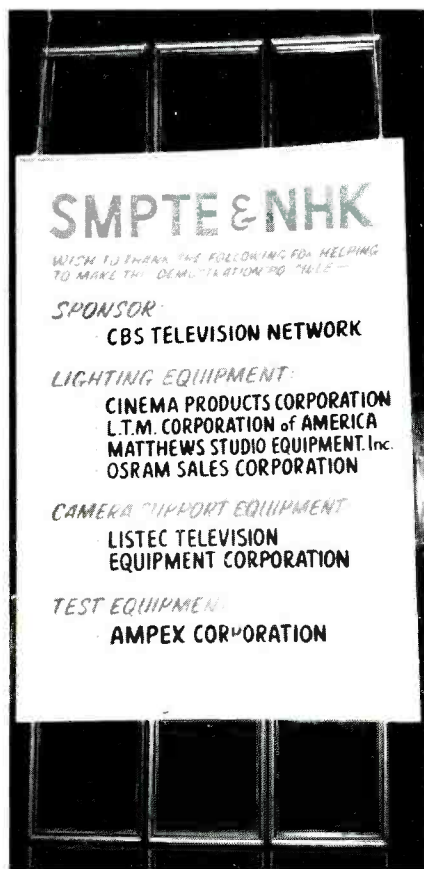


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The HDTV demonstrations at the SMPTE convention were sponsored by the CBS Television Network and supported by many manufacturers. This sign at the entrance of the demo room recognized the industry support.

SMPTE conference

and three of the four papers scheduled were devoted to HDTV. M. Joseph Polonsky of Thomson-CSF, France, and an early contributor to HDTV technology, described orientation of research in HDTV for the '80s. His paper addressed the question of systems marketing, bandwidth compression and compatibility of HDTV with present TV standards. He said his hypothesis was that professional HDTV systems would only reach the quality of 35mm film (1200-1500 lines, fully digital) by the end of the '80s—giving the industry about 10 years to optimize the future standards of professional and consumer HDTV systems.

Broder Wedlund, University of Dortmund, West Germany, addressed the HDTV system's compatibility with present standards.

Although today's TV systems do not offer optimum picture, he said that improvements in the present system should precede new standards for HDTV systems standardization.

Takashi Fujio, NHK Technical Research Laboratories, Tokyo, and chief developer for the HDTV system, described the current status of the system's development in Japan. This work has been under way since 1970 to meet the demands of the post-industrial society of the future. His paper dealt with studies of progress in picture quality, aspect ratios, signal standards and broadcast systems. HDTV equipment, such as a high resolution camera, a laser telecine for 70mm movie film, a high resolution CRT with wide aspect ratio, and a color multiplexer and receiver for satellite transmission, have already been developed. Transmission tests have already been carried out via the Japanese medium-scale broadcast satellite for experimental purposes.

It is clear that the development of higher picture quality TV technology is essential for the future image-oriented society, Fujio said. Thus, the unification and establishment of the HDTV standards is expected—and needed.

Following its demonstration at the SMPTE convention, the HDTV system was scheduled to be displayed by CBS and NHK in Washington, DC, to legislators, the FCC and members of the press. The combined impact of exposure at the convention and in Washington could have far-reaching consequences—and move up standardization efforts significantly. The appearance of the HDTV system at the upcoming Montreux conference could help accelerate adoption of standards. □



Courtesy of SMPTE/Photographer Donna Foster-Roizen

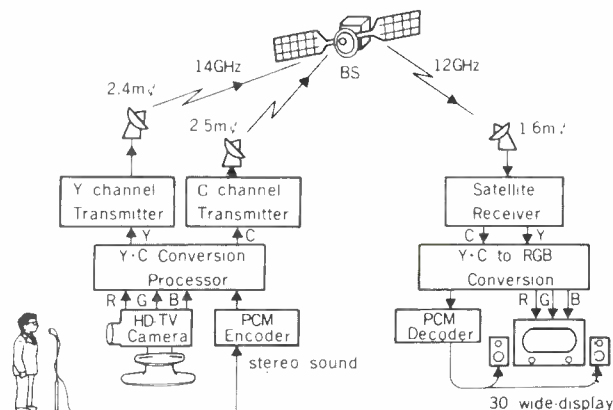
HDTV pictures produced by the NHK system, displayed both on high resolution monitors and by wide screen projection, showed remarkable clarity and color.

NHK-proposed standards for an HDTV system

Number of scanning lines	1,125
Aspect ratio	5 : 3
Line interlace ratio	2 : 1
Field repetition frequency	60 Hz
Video frequency bandwidth	
Luminance (Y) signal	20 MHz
Chrominance (C) signal	
Wideband (C _W)	7.0 MHz
Narrowband (C _N)	5.5 MHz

$$\begin{pmatrix} Y \\ C_w \\ C_n \end{pmatrix} = \begin{pmatrix} 0.30 & 0.59 & 0.11 \\ 0.63 & 0.47 & -0.16 \\ -0.03 & -0.38 & 0.41 \end{pmatrix} \begin{pmatrix} R \\ G \\ B \end{pmatrix}$$

Courtesy of NHK and SMPTE



Courtesy of NHK and SMPTE

The Japanese experimental HDTV transmissions in 1978 via satellite on the 12GHz band carried stereo audio as well.



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business

Catalyst Productions burglarized

Catalyst Productions of Berkeley, CA, was burglarized recently. The company suffered the loss of a substantial quantity of broadcast video and audio equipment.

However, Catalyst was still able to meet the scheduled rental needs of its production clients and various deadlines on each of its own commercial and broadcast productions because of the immediate assistance of its equipment suppliers.

Datatron reports 2nd quarter results

Datatron Inc. (OTC) reported an operating profit of \$80,626 on sales of \$1,856,056 for the second quarter, which ended December 31, 1980.

Herbert M. Perkins, president, said that results conformed to forecasts, with increased sales being offset by increased operating costs and expenses resulting from the development of new products. He also said that an extraordinary loss of \$78,700 was being reported as a result of the early retirement of a portion of the company's outstanding debentures. Perkins said that the retirement of these debentures would have the positive effect of minimizing the dilution of the company's stock.

BCD adds new broadcast lines

BCD Inc., distributor of professional audio and video broadcast equipment on the West Coast, has added Datatron and Convergence to their extensive lines of broadcast equipment.

BCD has been named exclusive distributor of Datatron in California, Arizona and Nevada. The line includes high performance videotape editing systems such as the Tempo 76 series and the Vanguard Editing System.

The company has also become a distributor for Convergence Corporation, which features the ECS-90 Joystick Video Tape Editing System.

VHF station goes on-air with RCA transmission system

KCPQ, Channel 13 in Tacoma-Seattle, WA., a new commercial VHF TV station serving the Puget Sound viewing area, has begun maximum-power, circularly polarized TV broadcasts using RCA transmitting systems.

In a complete modernization of its studio and transmitting facilities, the station has installed RCA Broadcast Systems equipment valued at more than \$3 million.

The new transmitting system in-

cludes a TTG-30/30H, 60kW transmitter and a type TBJ-12 circularly polarized panel antenna.

The station's transmitter and antenna combine to produce the maximum authorized 316kW of effective radiated power. This makes KCPQ-13 the only TV station in the Tacoma-Seattle market operating at maximum power at a maximum allowable antenna height, said Bill Karpisek, KCPQ director of engineering.

Knight-Ridder orders RCA videotape equipment

Knight-Ridder Broadcasting Inc., which has headquarters in Providence, RI, has ordered RCA videotape equipment valued at about \$1.6 million to improve technical facilities at three of its group TV stations.

The equipment on order, manufactured by RCA Broadcast Systems, includes eight TR-800 1-inch type C VTRs and three TCR-100A videotape cartridge machines.

KGO-TV switches to Sony wireless mics

After extensive testing of major broadcast quality wireless microphones, ABC-owned and operated KGO-TV has purchased 45 Sony WRT-27/WRR-27 wireless mic systems.

KGO also purchased 16 more wireless systems for the station's film crews. The Sony systems consist of a tiny lavalier microphone and a cigarette-pack sized transmitter that is worn on a belt or concealed in a pocket. A compact receiver is operated by the sound engineer at the mixing console or portable video recorder.

SABC buys Convergence editing equipment

The South African Broadcasting Corporation (SABC) has placed an order for an estimated \$500,000 worth of Convergence videotape editing equipment. SABC issued a contract for 11 full ECS-103B videotape editing systems with time code readers and other optional equipment for multi-source operations.

The sale was coordinated through Radiokom, the authorized Convergence dealer in South Africa. The equipment will be used to produce programs in the Afrikaan languages. SABC, the only broadcast facility in South Africa, is government-owned and currently broadcasts more than 2300 hours per week in 18 different languages.

Cosmos/Orion reach agreement

Cosmos Broadcasting Corporation and Orion Broadcasting Inc. have

reached a definitive agreement for the sale of WFRV-TV in Green Bay, WI, and its satellite, WJMN-TV, in Escanaba, MI, to Midwest Radio-Television Inc. of Minneapolis.

For Cosmos to purchase Orion, the two stations must be sold because of the FCC ownership regulations limiting the number of stations owned by one company. An agreement was reached in June 1980, for the purchase of all outstanding Orion stock by Cosmos.

Two other Orion stations, WMT-TV in Cedar Rapids, IA, and WAVE-AM, Louisville, KY, are expected to be sold before completion of the Orion acquisition to comply with the FCC regulations.

Times Mirror selects Telidon for videotex trial

The Times Mirror Company has selected Telidon for a major videotex field trial in the Los Angeles area.

Telidon Videotex Systems Inc., a company established by Toronto-based Infomart to sell Canadian-developed Telidon videotex systems to the US market, will supply a complete turnkey system under an initial contract worth more than \$1 million.

The field trial is scheduled to start in late 1981 and will include 200 terminals to be installed in homes in Los Angeles and Orange counties. The Los Angeles Times and other publishing subsidiaries of Times Mirror are expected to be major information providers.

A unique aspect of the Times Mirror videotex system is that it will operate simultaneously over both telephone and 2-way cable networks. The trial phase will offer data retrieval as well as transaction services using a Digital Equipment Corporation VAX 11/780 host computer.

Hitachi sales up 15%

Hitachi Ltd. and its 40 consolidated subsidiaries recorded another improvement in its business results in its first half-year period, which ended September 30, 1980. Compared with the same period a year earlier, sales rose by 15% to \$7.8 billion and net income was up by 9% to \$286.9 million.

Net income per American Depositary Receipt (ADR) representing 40 underlying shares per ADR, increased to \$4.35 from \$4.02 a year ago.

The increase in sales is attributable to the shipment of large heavy electrical items, and good advances registered by semiconductors, electron tubes and other electronic items, as well as by wire and cable products. Another factor was an improvement in overseas sales which, in terms of contribution to total sales, climbed from 19% to 23%.

people

Charles E. Anderson, product planner in the Audio-Video Systems Division of Ampex Corporation, has been elected president of the Society of Motion Picture and Television Engineers. He will serve a two-year term.

Vern Bushway has been appointed senior vice president/operations of Cinema Products. Bushway will assume complete responsibility for all aspects of engineering and manufacturing (including quality control) for Cinema Products' product line of 16mm and 35mm motion picture professional camera and editing equipment and accessories, as well as its expanding video equipment line.

Larry Waggoner has been promoted to vice president of Long-Pride Broadcasting in charge of engineering and operations. Waggoner's primary responsibilities will be working on corporate development in the growth of Long-Pride Broadcasting.

Emerson Ray has joined ADDA as central region district manager. He can be reached at 9517 Moody Park Circle, Overland Park, KS 66212; (913) 631-1500.

Rhonda Wickham, associate editor of *Video Systems* magazine for the past year, has been named associate editor of *Broadcast Engineering* magazine, effective with the April issue. Wickham succeeds **Joan Jackson**, who has been promoted to Intertec Publishing's Technical Book Division where she will take a position in the marketing department.

The Harris Corporation has elected **John J. Myers** vice president—corporate development, to be responsible for coordinating the acquisition of companies or product lines and the negotiation of joint ventures.

William C. Jones has been named president of Switchcraft Inc., a subsidiary of Raytheon. Jones succeeds **Raymond J. Dowling**, who was recently named president of Caloric Corp., another Raytheon company.

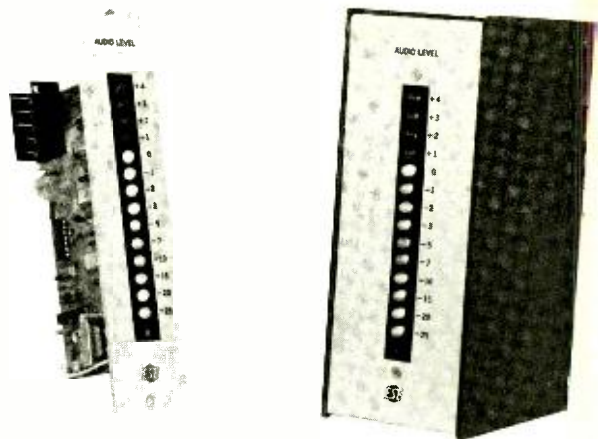
Ronald D. Spicer has been named vice president, administration and corporate planning, at the ADDA Corporation. He was formerly executive vice president at the California Commerce Bank.

Jason Farrow has been appointed general manager, advertising, for the Sony Video Products Company. He will be responsible for the advertising programs of Sony Office Products, Professional Audio and Digital Audio Divisions, in addition to the Broadcast and Video Communications Divisions of the Sony Video Products Company.

Mike Boyd has been appointed account executive—production sales for General Television Network. His responsibility will be to help increase the marketing and sales activities of General Television Network's videotape production facilities division.

Shure Brothers has announced the appointment of **Donald "Sandy" Schroeder** to the newly created position of marketing manager, loudspeakers, with responsibilities for planning, developing and marketing all of Shure loudspeaker products.

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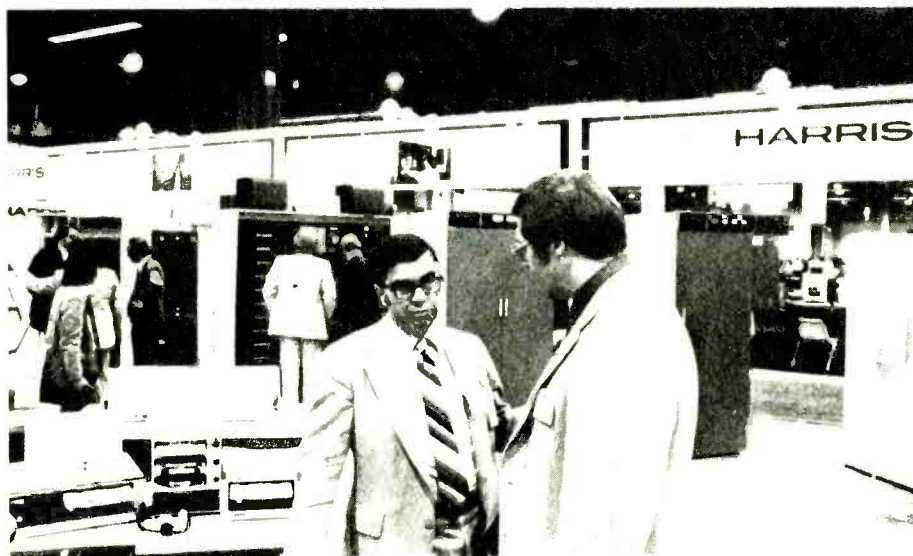
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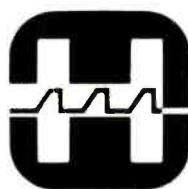
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TECHNICIANS WANTED for maintenance and operation of major television facility. Formal training in electronics and First Phone. Previous experience desirable. No phone calls please. Send resume and salary requirements to: JACK VERNER, 1050 TECHWOOD DRIVE, ATLANTA, GEORGIA 30318. 4-81-21

TELEVISION MAINTENANCE ENGINEER—Expanding major post production facility in Chicago has an immediate opening for a maintenance engineer with experience in 2-inch, 1-inch type-C, TK-28, Chyron, CMX computer editing systems, color cameras, and other related equipment. Send resume with salary requirements to: Post Office Box 11533, Chicago, Illinois 60611. 4-81-11

PRODUCT SALES MANAGER: Telex Communications, Incorporated is looking for an aggressive product manager to handle its well known line of Pro Audio equipment. Must have a minimum of 4 years sales responsibility in an allied field, working with or through a Rep/Distributor type organization. Requires experience in pricing, planning, sales forecasting and sales training with demonstrated ability to motivate, plan, organize and sell. Send resume and salary history to Don Meehan at the address shown below. We are an equal opportunity employer. Telex Communications, Inc., 9600 Aldrich Avenue, Minneapolis MN 55420. 4-81-11

DETROIT BASED video production facility has created a need to supplement their video staff. **POST PRODUCTION SUPERVISING EDITOR** with minimum two years experience and knowledge of Tempo/Mach I is a plus. **VIDEO MAINTENANCE ENGINEERS** with thorough knowledge of digital circuitry, production and editing 2" and 1" VTR equipment. Our progressive company offers challenging work, good working environment, competitive salaries, overtime and a fine benefit package. Send resumes to: Maritz Communications Company, A subsidiary of Maritz, Inc., 4925 Cadieux Rd., Detroit, Michigan 48224. 4-81-11

HELP WANTED—TELEVISION TECHNICAL: ASSISTANT CHIEF. Immediate opening on the beautiful California Central Coast. Modern, well equipped VHF network affiliate seeks a fully qualified working engineer, capable of supervising maintenance operation. Self starter with minimum 5 years maintenance experience; maintenance supervisor background preferred. Electronics school graduate or equivalent technical education, including digital technology and experience with: ACR-25; 3/4" and type "C" 1 inch; Ampex & RCA Quad; Grass 1600; TK-28 and TK-46. Excellent salary and company paid benefits, including pension plan. All replies in confidence to Dept. 533, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. EOE, M/F. 4-81-11

TELEVISION CHIEF ENGINEER—3-5 years hands-on experience for Sunny Florida UHF affiliate. RCA package plus Sony ENG. Call Jim Matthews, General Manager, (904) 893-3127 or resume to WECA Television, P.O. Box 13327, Tallahassee, Florida 32308. 4-81-11

ASST. CHIEF ENGINEER—minimum 2 years television maintenance experience for affiliate in Florida's capitol city. Call Jim Matthews, General Manager, (904) 893-3127. 4-81-11

MAINTENANCE ENGINEER—minimum 1 year television maintenance experience for affiliate in Florida's capitol city. Call Jim Matthews, General Manager, (904) 893-3127. 4-81-11

HELP WANTED (CONT.)

SALES AND ENGINEERING POSITIONS OPEN. Call 918-494-9500 or send resume to Delcom 6019 S. 66th E. Ave., Tulsa, OK 74145. 4-81-11

VTR SUPERVISOR WANTED: Must be capable of supervising large crew of VTR operators at major duplication center in Los Angeles. Should have 5 years hands on experience with 2", 1", 3/4", and 1/2" machines. Will be in charge of total technical quality of production output, hiring and training of personnel, scheduling of machines and manpower to attain maximum output of the facility. A secure position with high salary and excellent benefits. Qualified applicants only. Call Lucia Steger, (213) 985-1666. 4-81-11

RADIO—HELP WANTED: TECHNICAL. Chief for Chicago area FM/AM. Requires 1st phone, strong background in studio and transmitter maintenance. Digital knowledge needed. Experience in radio a must. Should be self-starter, able to work without direct supervision. Contact James Maddox, General Manager, WBMX, 312-626-1030 or 408 South Oak Park Avenue, Oak Park, Illinois 60302. 4-81-31

ELECTRONICS ENGINEERING: ENGINEERS & TECHNICIANS—WWSG-TV Phila. has immediate openings for personnel with television systems maintenance and installation experience. Send resumes and letters of application to Employment Dept., WWSG-TV, 300 Domino Lane, Phila., PA 19128. WWSG-TV is an Affirmative Action/Equal Opportunity Employer. 4-81-11

TELEVISION MAINTENANCE ENGINEER: Prime Sunbelt Location. First phone required with minimum of 5 years experience in studio maintenance. Maintain TCR-100, TK-46's Ampex quad, one inch, and Harris transmitter. We appreciate our engineers. EOE. Contact Earle Connors, KMBT-TV, Beaumont, Texas (713) 833-7512. 4-81-11

IMMEDIATE OPENINGS—VIDEO/MAINTENANCE ENGINEERS. Southwest television sports production company seeking Video/Maintenance Engineers for remote unit with Ampex 1" Tape, Phillips cameras, and Grass Valley Switching. Contact: Russ A. Abernathy, MCI Productions, #10 Greenway Plaza, Houston, Texas 77046, 713-627-9270. 4-81-21

QUALIFIED SERVICE TECHNICIAN to maintain all types of video equipment, CCTV, helical VTR's, TBC, editing systems, etc. Contact Bob Hemenway, Lake Systems Corporation, P.O. Box 65, Newton, Massachusetts 02160, (617) 244-6881. 4-81-11

KLEB/KZZQ BROADCASTING is now taking applications for an engineer with a First Class License. Resumes should be sent to KLEB Broadcasting, 1842 Henry St., Golden Meadow, LA, or apply at the station in Golden Meadow. KLEB/KZZQ is an affirmative action, equal opportunity employer. 4-81-11

TRANSLATOR DESIGNER—Degree optional but FCC 1st Phone and ability a must! To design new line of 100 watts TPO (and less) UHF TV translators and transmitters to meet demands of low power TV "craze". I already have industrial zoned plant available. Beautiful area about 40 miles North of San Francisco. Resume or informal proof of your ability, please, M. Gottesman, P.O. Box 4234, Napa, CA 94558 or call (707) 253-2220 anytime! 4-81-11

TELEVISION ELECTRONICS ENGINEER: Major corporate teleproduction facility seeks Television Electronics Engineer. Major responsibilities include maintenance of TR600, UPR2B and UPR20 VTR's; EPIC computer editing system; TK45 and HL79A cameras; Fernseh Compositor and Grass Valley 1600 switches. Candidates should have hands-on electronic background. Digital broadcast and/or major teleproduction facility background is also desirable. Interested applicants send resume and salary history in confidence to BANK OF AMERICA, Instructional Media Services #3630, Barry Joseph, Box 37000, San Francisco, CA 94137. Equal Opportunity Employer M/F/H. 4-81-11

TELEVISION ENGINEERS—Immediate opening for experienced maintenance engineers in fully equipped northern California VHF facility. Candidates should possess a valid FCC 1st class license and have a background in studio maintenance. Electronics school or equivalent technical training required, including digital technology. For prompt consideration contact: Personnel Department, KNTV, Inc., 645 Park Avenue, San Jose, CA 95110. EOE, M/F. 4-81-11

HELP WANTED (CONT.)

ENGINEERING AND TECHNICAL SALES POSITIONS

We specialize in the placement of Technical Engineers with Television Stations, Cable TV, Satellite Programmers & Networks, Pay TV, Manufacturers, Industrial TV, CCTV, Production Houses & Dealers. Also, technical sales with Manufacturers & Dealers. All levels, positions & locations nationwide. Employers pay all fees - confidential, professional. Over \$3,000,000.00 in Salaried Positions Placed. Employee & Employer inquiries invited.

PHONE/RESUME - Alan Kornish (717) 287-6335

KEY SYSTEMS

106 new bridge center, kingston, pa. 18704

TELEVISION HELP WANTED—TECHNICAL: \$40,000 + FIRST YEAR GUARANTEED. Our company has grown so quickly in the past 5 years, we are in desperate need of a very special person who knows broadcast equipment intimately and has aggressive sales ability. We are diversifying into other areas and need someone to take over the equipment sales division. Responsibilities include sales of new and used broadcast equipment and further development of equipment sales division as business demands. We are a first rate company and believe in paying top dollar for the right person. Call Bill Kitchen, Quality Media Corp., (800) 241-7878. 9-10-TFN

ENGINEERS, TV Systems Engineers, Electronic Technicians, Technical Supervisors, Maintenance. Immediate openings. Experienced. Full time. Full benefits, plus Pension. Excellent salary plus commissions. Send resume to Technical Operations, Inc., P.O. Box 840, New Hyde Park, N.Y. 11040, or call Personnel Mgr. (516) 352-2238. 4-80-tfn

ASSISTANT CHIEF ENGINEER—experience with 3/4" and 2" VTR's; RCA TT50 Transmitter, microwave and general studio equipment desirable. Good manager plus first class license. Contact Chris Burgbacher, WMBB-TV, Box 1340, Panama City, Florida 32401 or call (904) 769-2313. EOE. 4-81-21

WE'RE IN THE MARKET for a qualified maintenance engineer with aspirations to become assistant chief. Needs background in studio and transmitter. Offering good salary and benefits package and the Monterey Peninsula to live. Send resume to Ken Warren, Chief Engineer, KMST-TV, 46 Garden Court, P.O. Box 1938, Monterey, California 93940. A Retlaw Broadcasting station. EOE. 4-81-41

MAINTENANCE ENGINEER for TV Production Company. Experience on 2" quad VTR's, cameras, and switching equipment. Contact: Jimmie Fortner, MCI Productions, 2500 Farrington, Dallas, TX 75207, (214) 630-1262. 4-81-21

VIDEO PRODUCTION ENGINEER for growing Northeastern production house, 3/4" and 1". Maintenance and location experience required. Send resume to Dept. Number 534, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. 4-81-11

ENGINEER/ELECTRICIAN: Maintain and supervise use of R-TV equipment. Act as consultant on technical production problems. 2 years experience required. Opportunity to teach classes. 12 month academic year. \$12,480 - 16,080 + excellent benefits. Send resume to Personnel Services, Pepperdine University, Malibu, CA 90265, (213) 456-4397. Equal Opportunity Employer, M/F/H. 4-81-11

CHIEF TV STUDIO ENGINEER—Excellent opportunity to plan, develop and administer operations of an in-house TV production facility. Must have B.S. in electrical engineering or related degree and experience as a studio engineer. Minimum 5 years background in TV production operations and maintenance. First class FCC license and management experience preferred. Salary—low to mid 20's. Excellent benefits. Located in mid-size, family oriented community in east central Wisconsin. Send resume to: Employment, Aid Association for Lutherans, Appleton, WI 54919. 4-81-11

HELP WANTED (CONT.)

TO AN ENTERPRISING E.E.

We are audio products producers located in the Northeast and are looking for an Electronic Engineer with a demonstrable track record in the design of components for audio consoles, complete consoles for recording and broadcast, and an entrepreneur at heart. Initially, this position entails the design of audio products and systems but will phase into company management, leading to ownership and control.

Compensation includes an attractive salary, profit sharing and stock bonuses. If you are an aggressive, talented designer, unafraid of work and challenges and are looking for a future under your own control, you should answer this ad. Please give sufficient detail on education, work experience, accomplishment and objectives to permit us to go to the next step, a personal interview. Reply Dept. 535, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212.

CHIEF ENGINEER: Automation, FM, AM with DA, must be a worker and know FCC rules with 1st Class. Believe in maintenance. Call Manager, 813-639-1188. Equal Opportunity Employer. 4-81-3t

MAINTENANCE ENGINEER—Growing independent 1/4" production company seeks experienced 1st-ticket engineer to maintain studio/remote equipment. Hitachi, Sony, JVC, Microtime, Videomedia, etc. Live and work in one of the most beautiful areas of the country. EOE. Send resumes and salary requirements to: Mark Wilson, P.O. Box 70, Hendersonville, NC, 28791. 4-81-1t

TELEVISION DESIGN ENGINEER: Must be able to specify, design, supervise installation and troubleshoot TV systems. Hands on Experience is a plus. Work with minimal supervision. **TV/AUDIO-VISUAL ESTIMATING ENGINEER**—Must have knowledge of TV & audio visual equipment and systems. Will be involved with sales, system concepts, equipment & labor cost analysis, and specification reviews. Both positions provide challenge, excellent salary and benefits. Please call Stylist Systems, Inc., Teterboro, N.J. 201-288-6130. 4-81-1t

HELP WANTED (CONT.)

Field Service Engineers

The Grass Valley Group, Inc. a leading manufacturer of television broadcast equipment, is looking for people who want challenging professional positions PLUS the added attraction of working in a small town nestled in the Sierra foothills.

These challenging positions combine chances for U.S. travel plus marketing and engineering career opportunities. Individuals with experience designing and/or maintaining television broadcast systems are required to provide after-sales support for our wide variety of complex systems.

Interested and qualified candidates are invited to send a resume in confidence to Sylvia Smith, The Grass Valley Group, Inc., P.O. Box 1114 Grass Valley, CA 95945. An Equal Opportunity Employer M/F/H.

The Grass Valley Group Inc.

A Tektronix Company

HELP WANTED (CONT.)

Regional Sales Manager

VIDEO PRODUCTS

We're looking for an aggressive individual for an immediate opening in the Western Region. Responsibilities include Distributor and Direct Sales Experience in technical and video sales. A basic understanding of Time Base Correctors, VTR's and other related video equipment is essential. Base of operations on the West Coast. Travel required.

Excellent opportunity. Salary plus commissions and company benefits. Send resume to Director of Personnel Microtime, Inc. 1280 Blue Hills Avenue, Bloomfield, CT 06002.

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MICROTIME
For Video Processing

MAINTENANCE — TECHNICAL SUPPORT ENGINEER: first phone preferred, experience in microwave digital electronics and switching, telco interface, design and repair of broadcast equipment. Salary commensurate with experience. Chance to grow with new radio network. Good benefit package. Avon, CT (203) 677-6843. 4-81-1t

ASSISTANT CHIEF ENGINEER for TV station in beautiful Highland Lakes area of the Hill Country, Austin, Texas. Must have 1st phone, extensive experience maintaining studio equipment, know logic and digital circuits. UHF transmitter experience desirable. Contact Chief Engineer, KTVV, Box 490, Austin, Texas 78767 or call 512/476-3636. 4-81-1t

TV ENGINEER—Independent Houston UHF station has an opening for a full time licensed Maintenance Engineer. Duties include technical maintenance and alignment of all studio equipment. Other duties as required. Send resume and salary requirements to KRIV-TV, 3935 Westheimer, Houston, Texas 77027. We are an equal opportunity employer. 4-81-2t

WANTED

WANTED: Pre-1928 radio equipment and tubes. August J. Link, Surcom Associates, 305 Wisconsin Ave., Oceanside, CA 92054, (714) 722-6162. 3-76-tf

HIGHEST PRICES PAID for 112 Phase Monitors and for clean, 12 year old or less, 1 KW and 10 KW AM Transmitters. All duty and transportation paid. Surplus Equipment Sales, 2 Thorncliffe Park Dr., Unit 28, Toronto, Ontario, Canada. M4H 1H2, 416-421-5631. 2-79-tfn

INSTANT CASH FOR TV EQUIPMENT: Urgently need transmitters, antennas, towers, cameras, vtrs, color studio equipment. Call toll free 800-241-7878. Bill Kitchen, Quality Media Corporation (in Georgia call 404-324-1271). 6-79-tfn

WANTED: Radio Transcriptions 16" E.T.'s, any Eddy Arnold, or other Country 15" or 12" Transcriptions. Will consider others. Interested in Radio Station Libraries to purchase, all speeds of records. Boyd Robeson, 2425 W. Maple, Wichita, Kansas 67213, (316) 942-3673, 722-7765 Eve. 9-80-tfn

WANTED: Used tower to support FM antenna. Must be at least 1200'. Contact Ben Weiss (816) 531-3400. 3-81-2t

ANTIQUE MICROPHONES, ETC.—Interested in purchasing old microphones and early radio and T.V. equipment suitable for museums. Please supply description and price. Dept. 532, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. 4-81-2t

ATTENTION TOWER OWNERS: We are seeking rental of tower space located within ten miles of concentrated population centers. Send details, price and terms for immediate response: Walter L. Larkin, III, Affiliated Communications Corp., 3200 Expressway Drive South, Central Islip, New York 11722, (516) 582-6721. 3-81-2t

career opportunities ...at audiotechniques

Continuing expansion has created immediate openings in our New York City office for the positions that are described below. Please reply by letter only, enclosing a resume of your experience and qualifications.

BROADCAST SALES ENGINEER

For our new broadcast sales department we will hire a technically qualified person with at least three years broadcast engineering experience in AM/FM. TV and/or sales experience also helpful. Some travel thru Northeast to demonstrate MCI tape recorders and other equipment to broadcast users may be required.

AUDIO TECHNICIAN

Our Audiotechniques Rentals division requires a technician with several years maintenance experience in recording studios or radio stations. Ability to check out, trouble shoot and make minor repairs on various pieces of audio equipment is required. This job would be attractive to someone in Radio-TV repair desiring to move into professional audio.

Reply by letter only to Hamilton Brosious, President.

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The Only 2" ATR That's As Advanced As Your 1" VTR

With the Otari MTR-90, your audio can be as good as your video. It has all the advantages of one inch video format: compact size, broadcast quality, essential production features, and fewer dollars. It's the two inch multi-track production machine that's earned the reputation for being *The New Workhorse*. Post production houses, networks and recording studios are discovering that it's the new machine that outpaces the big names.

Here are some of the advantages of *The New Workhorse*:

- Superior Tape Handling — the industry's first three motor, pinch-rollerless two inch tape transport that can keep up with your VTR.
- Advanced Audio — high slew-rate components, active mixing of bias and audio, single card electronics, and a 71 dB dynamic range (24 track).
- Advanced Control Circuitry — digitally controlled



LSI circuitry for reliability and ease of servicing.

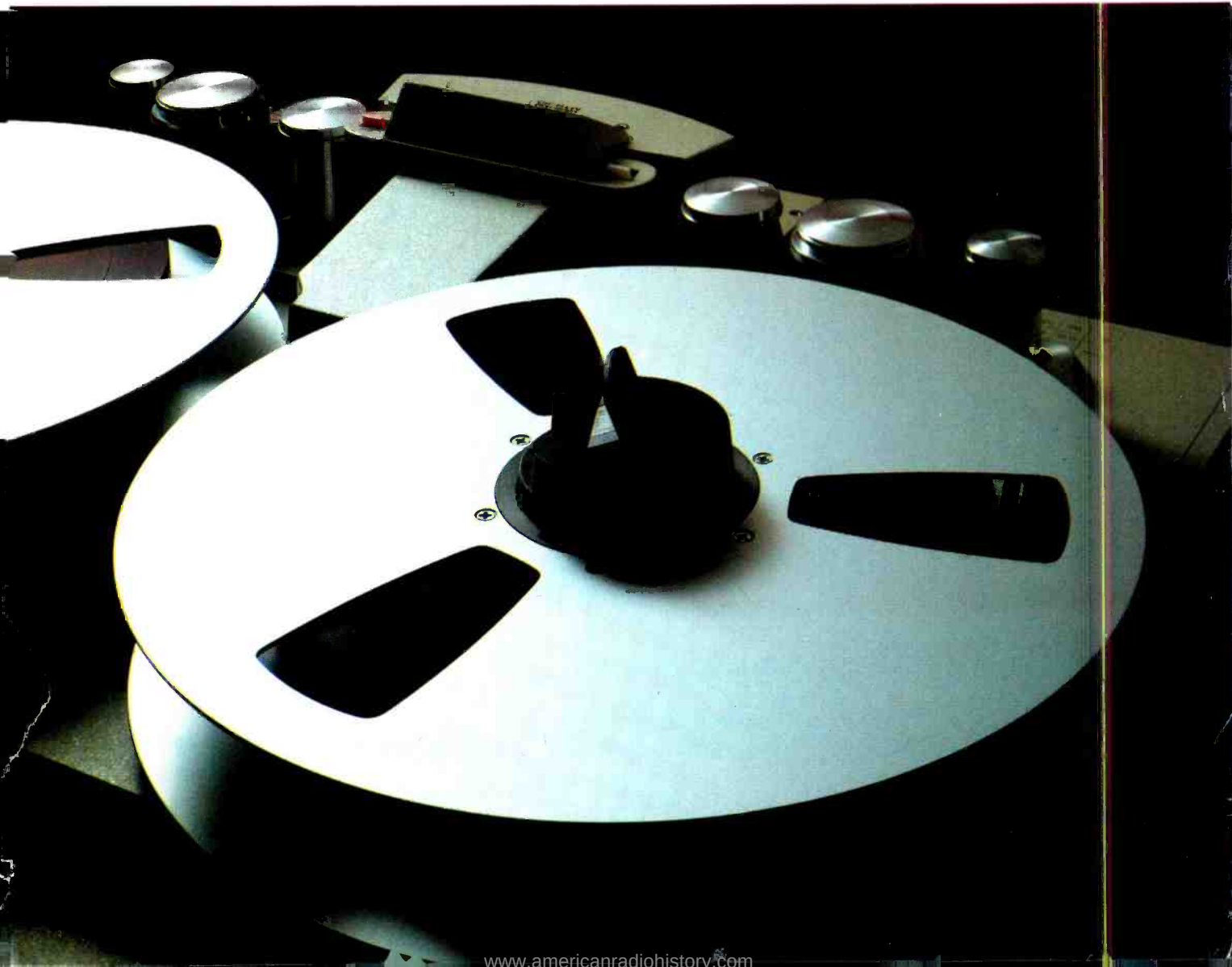
- Superior Editing — digitally timed, gapless electronic inserts. The capstan speed is continuously variable from 1 to 400 ips with external control.

The MTR-90 was designed for easy access to virtually any tape controller/editing system: EECO, BTX, ADAM-SMITH, AUDIOKINETICS, CMX and CVC. And, an optional phase compensated wide-band amplifier is available for high speed SMPTE code reading.

The MTR-90. Stay ahead of your competition with *The New Workhorse* — The frontrunner in video sweetening.

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Broadcast Engineering

The Technical Journal of the Broadcasting Engineering Society



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COAX MAINTENANCE

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Tape Evaluation

VI Applications

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