

COVER STORY

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Mixdown**

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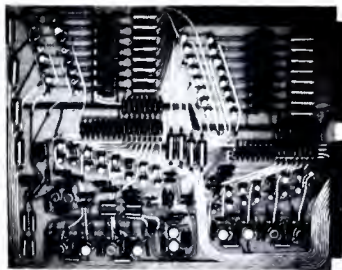


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Published by DYNAIR, this book covers problem areas such as hum, equalization, resolution/bandwidth, balanced-line transmission and many others. This is a limited printing . . . order your copy today.

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Published by DYNAIR, a pioneer in the field of solid-state video cable transmission equipment, this book covers in detail the problems encountered with routing video through cables . . . and presents the solutions!

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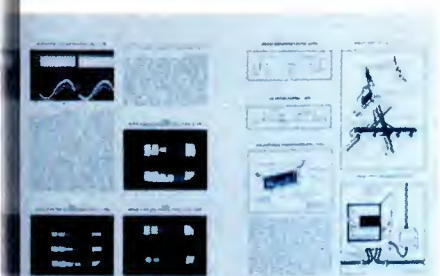
The practical building-block construction techniques used in solid-state DYNAIR equipment allow systems of virtually any size to be easily assembled. Plug-in modular etched circuit boards are used in most cases, assuring ease of maintenance. Equipment can be provided to suit almost any system requirement.

DYNAIR also manufactures a variety of other solid-state television equipment, including modulators and demodulators, video and pulse amplifiers, local and remote-control switching systems, switcher-faders,



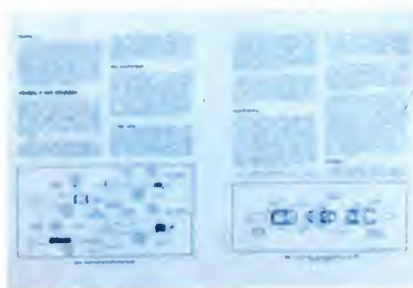
special effect generators, sync generators and sideband analyzers.

If you use this type of equipment, you might like to receive either our complete catalog or literature on specific devices; DYNAIR product information is available upon request —just write, outlining your needs.



The photographs shown are sample pages reproduced directly from "Video Transmission Techniques" and are typical of the material presented. Pictorial diagrams, supported by easy-to-understand text and numerous photographs, charts and tables, make system design simple.

This book includes useful design information for a multitude of systems, both unbalanced and balanced . . . simple and complex. It covers everything from cable types to complex electronic terminations. The problems involved in selecting the



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Please send free copy of "Video Transmission Techniques"

Have you seen "Video Switching Techniques"?

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For Gourmet Listening, Use Multi-Channel Mixdown. Says it all. Recipes begin on page 28.

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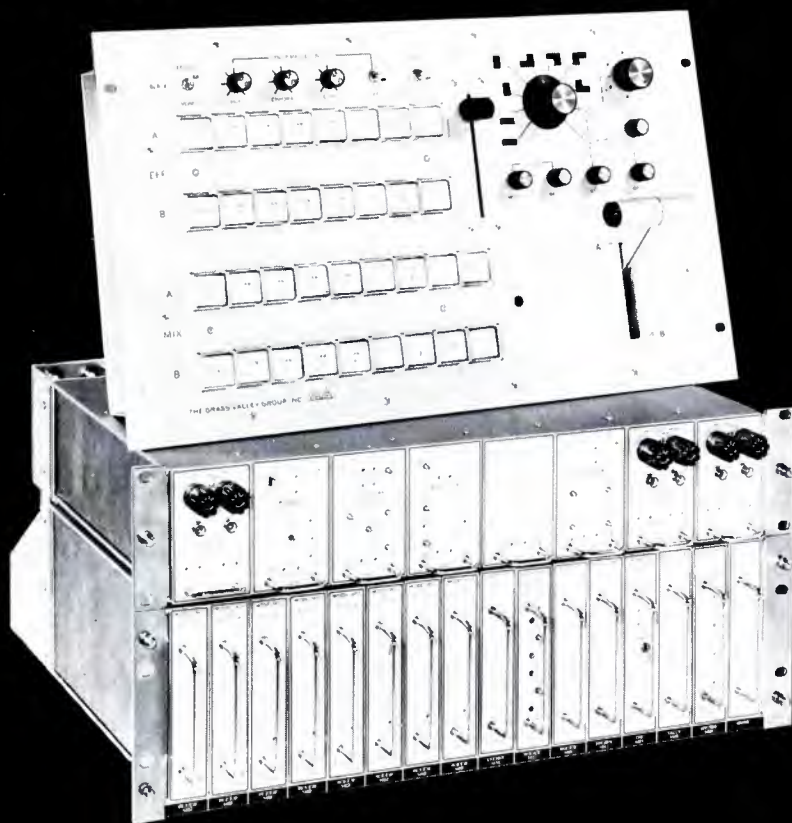
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BROADCAST INDUSTRY NEWS

Cable Plus-Broadcasts Could Make Networks

The future, as discerned from the President's Office of Telecommunications Policy, might include some combination of broadcasting and cable to create additional networks, it became clear recently. Clay Whitehead, director of OTP, told the San Francisco Chapter of the National Academy of Television Arts and Sciences, in September, that OTP recognized the need for more program diversity and was not against additional networks, just against government-owned or operated networks. Acknowledging the difficulties in starting more present-style broadcast networks, he said: "New networks do not have to look like present ones . . . (there is no reason) why new networks can't be combinations of broadcast stations and cable systems." He also said that OTP was studying what to do about reruns and about the prime-time access rules.

CBS Test Plan Shows Effectiveness of Radio Spots

A plan for testing the effectiveness of radio spot campaigns, developed by CBS Radio, has shown gains in both product awareness and sales in every test made so far, according to a report from CBS. Scott Schanzenbach, director of marketing and research for CBS Radio, said that gains in awareness ranged up to more than 60%. The test is based on 600 telephone interviews before, and 600 after, the radio campaign. "Our test plan has proved the efficiency of radio," said Mr. Schanzenbach.

NAB Opposes Fees to to "Consultants" Contesting License Renewals

In comments filed with the FCC, the National Association of Broadcasters has warned that payment of "consulting" fees by broadcasters to license-renewal contestants is "an open invitation to a wide range of groups to seek such consultancies . . . citizen participation will not stop with a few minority groups." The

comments went on: "A new era of public participation is dawning, and we should not (endorse) the indecision, intimidation, and outright blackmail which characterized the (earlier) era . . . the only limitation on such activity would be the total number of diverse groups which make up our society."

Video Cassette With Chrome Tape Coming From Memorex

A $\frac{3}{4}$ -inch videocassette with chromium dioxide tape will be marketed by Memorex, the Santa Clara, Calif., firm announced in October. The cassette will be compatible with Sony, Japan Victor, Panasonic, and Wollensak video recorders. The blank cassettes will come in 60, 30, 20, and 10 minute versions, with first shipments expected in January 1973.

NAEB Produces Seminars on Rights of Broadcasters

A series of seminars intended to alert educational broadcasters to their rights and obligations under the rules of the FCC will be held by the National Association of Educational Broadcasters over a three-year period, James Fellows, NAEB director of professional services, announced recently. The seminars will be held in various parts of the country in coordination with license renewal dates, which are staggered on a regional basis. The first seminar was held in Atlanta in October. Future dates and places are available from NAEB at 1346 Connecticut Ave. N.W., Washington, D.C. 20036.

The Movies Are Free

Another hotel-movie-on-TV system, this one developed by Creative Cinetel, Inc., of New York and Los Angeles, has the movies on Sony U-Matic videocassette machines, which are fed continuously onto unused TV channels through the master antenna system. The room occupant can tune in either of two movies at any time; there is no extra charge. In addition to the Sony U-Matic machines, the system includes a spe-

cial unit built by TeleMation of Salt Lake City, which shifts automatically from one cassette machine to the next. The system got a start in October at the Downtowner Inns.

Ampex Halts Development Of Instavideo System

The Ampex Corporation said in October that it was halting its work on the development of the Instavideo cartridge video recording system. Charles A. Steinberg, vice president, referred to market studies that indicated there would not be an adequate return on the projected investment.

NAB Says Keep Fighting for License Renewal Bill

Richard W. Chapin, board chairman of the National Association of Broadcasters, told his constituency that they must keep pushing for a license-renewal bill from Congress. "We've played a great first half, but it takes two halves to win a ballgame," he said, noting that while some 256 Congressmen and 49 Senators had pledged support, there could be no action at this session. "Our second half begins in January when the new Congress assembles," he added.

TelePrompTer Readies Program Packages for Cable Network

TelePrompTer Corporation showed previews of three packages of syndicated programs at the Northeast Cable Exposition in Hartford, Conn., in November. TPT's Group Communications Division is offering the programs to the CATV Regional Distribution Network, set up by TPT and the Columbia Cable System. The "A" series will be 80 same-day cable-casts of New York Nets basketball and New York Islanders hockey games. The "B" series includes 25 hours a week of daytime programs for women and children; evening programs include an adventure series, old-time movies and operas. Package "C" includes Broadway the-

continued on page 8

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Wherever you go, you'll find these two thoroughgoing professionals working together. On location and in the most demanding studio situations.

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Or take the new Beyer M500 microphone. You've never used anything quite like it. It combines the sharp attack of a condenser and the sturdy reliability of a moving coil with the unduplicatable warmth of a ribbon.

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Your nearest Revox-Beyer dealer will be pleased to demonstrate any of these fine products for you.

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For additional information and complete technical specifications, write: Revox Corporation, 155 Michael Drive, Syosset, New York 11791.

California: 3637 Cahuenga Blvd. West, Hollywood 90068. Canada: Revox Sales and Service, Montreal.

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- Output Load: 8 Ohms
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- Power Output: 25 Watts RMS (Harmonic Distortion: < 0.5%)
- S/N Ratio: 90 DB Typical
- Idling Current: 30 MA Typical
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NEWS

atre, rock and classical concerts, and other cultural material.

Network Viewing Is Breaking Records, Says TvB

Overall television audiences continue to reach higher totals than ever, the Television Bureau of Advertising reported. Network nighttime programs are reaching an average of 13.6 million homes; average-minute home nighttime viewing has increased from 60.7% last year to 61.9% in October, 1972. Homes viewing television went up 2.4 million to a total of 40.1 million per minute. Daily viewing time went to 6 hours, 2 minutes, up 7 minutes over 1971 and 15 minutes over 1970, said TvB.

NCTA Cable Marketing Study Available in Transcript

The first annual marketing workshop for cable operators, held by the National Cable Television Association in Denver in July, can now be bought in transcript from NCTA. It is a comprehensive assembly of information on how cable television is currently being marketed under the title "The Selling of Cable Television, 1972." Copies are \$1.95 to NCTA members and \$2.95 to others from NCTA at 918 16th Street, N.W., Washington, D.C. 20006.

FM Stations Pledge \$1 Million To Push FM In Cars

FM stations around the country have pledged \$1 million for advertising to urge buyers of new 1973 cars to include FM radios in their options, John Richer, president of the National Association of FM Broadcasters, reported recently.

Memorex Introduces Video Master Tape "Previewed" by Maker

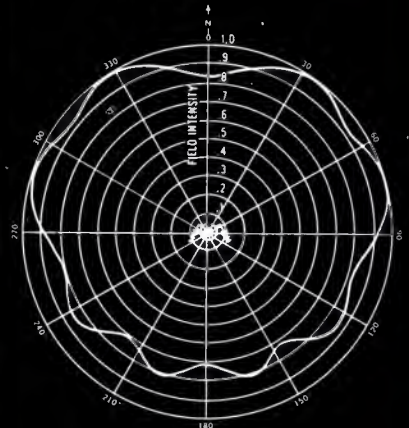
Memorex has started to sell a video master tape, each reel of which has been completely inspected for drop-outs which are pinpointed on the inspection chart furnished with the tape. Memorex says this will eliminate the need for inspection by the buyer, with consequent important savings of time and money.

TV-FM Rock Simulcasts To Be Syndicated in 1973

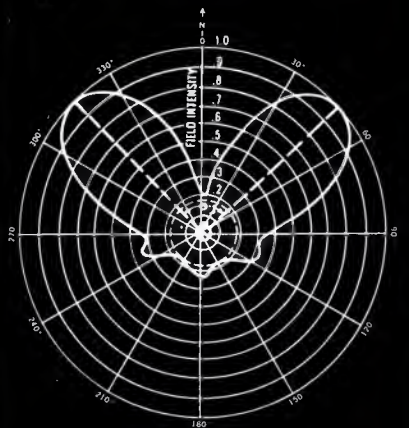
A series of rock music concerts, produced in video form with sound continued on page 10



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rock concerts, opera, cinema verite . . . the list grows daily in recording, broadcasting, filmmaking, education and technology. We have not rested on achievements either.

Creating and improving condenser microphones with new features, new capabilities. And happily, you adopted them to an extent that has made us the industry standard. Perhaps though, you are unaware just how large the "first family" of professional condenser microphones and accessories has become. For the latest information, please write or call us.

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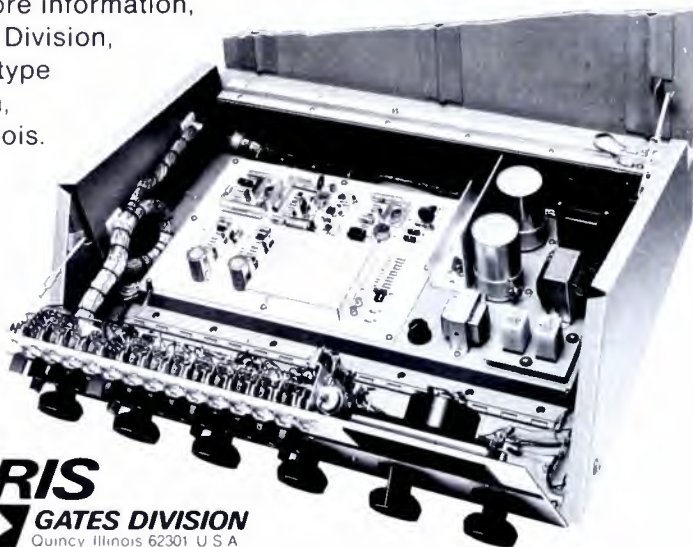
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NEWS

in stereo so each concert can be simulcast by a TV and a stereo FM station, will be syndicated nationally during 1973 by the Tubeworks Production Company of Southfield, Mich. Called "Detroit Tubeworks," the series is already slated to start early in 1973 in more than 20 markets. The producers have announced the purchase of new transportable video and audio pickup equipment, for remote originations.

Armstrong Committee to Give \$4000 for Best 1972 FM Programs

The Armstrong Awards Committee, formed to memorialize Edwin H. Armstrong, inventor of FM, announced that it will give eight prizes totalling \$4000 for FM programs produced in 1972, with entries due in the Committee's hands by January 31, 1973. Awards will be made at the NAFMB Convention in March. Categories are news, community service, education, and music, for both commercial and non-commercial stations. Address: Kenneth Goldstein, Room 510 Mudd Building, Columbia University, New York 10027.

Cable Test Date Under Consideration by FCC

As stated in the new FCC cable rules, adopted February 1972, performance tests are due at least once each calendar year from each cable operator. Thus the first tests would be required on or before December 31, 1972. However, according to the FCC, a number of cable operators and engineering consultants asked for an extension, saying that the scarcity of experienced personnel and general unfamiliarity with economical test methods would make the 1972 date very difficult for many cable operators. The NCTA suggested December 31, 1973. The FCC asked for comment by November 5th; no action had been announced when *BM/E* went to press, so comment may still be appropriate. Docket No. is 18894.

FCC on "Staging" of News

Answering a request by the House Special Subcommittee on Investigations of the Commerce Committee, the FCC said its area of concern with "staging" of news reports did not extend to matters of journalistic judgment, but to the deliberate portrayal of a significant event which

continued on page 12

The Super Parametric Equalizer



Of the many Equalizers available today, the ITI ME-230 Parametric Equalizer is the only one that offers you all these truly outstanding recording features—

- **All controls are continuously variable.** No more working with arbitrarily fixed positions. With the ITI Parametric Equalizer—you record using your mind and ears, with your hands only transmitting the orders of what you hear.
- **Remarkable frequency range.** 10-800 Hz, 100-8,000 Hz, and 400-25,600 Hz, each accurately calibrated, with boost or cut up to 12db about any center frequency.
- **Continuously variable Selectivity or "Q".** From 4 to 14dB/octave with no effect on the absolute magnitude of the center frequency.
- **No inductors used**—In the Parametric sections. Ringing on transients is virtually non-existent.

The ME-230 Parametric Equalizer—our Super Equalizer—is for all those who want more than "just good enough" sound recording. We invite you to call or write for more details about its high degree of flexibility and superb performance.



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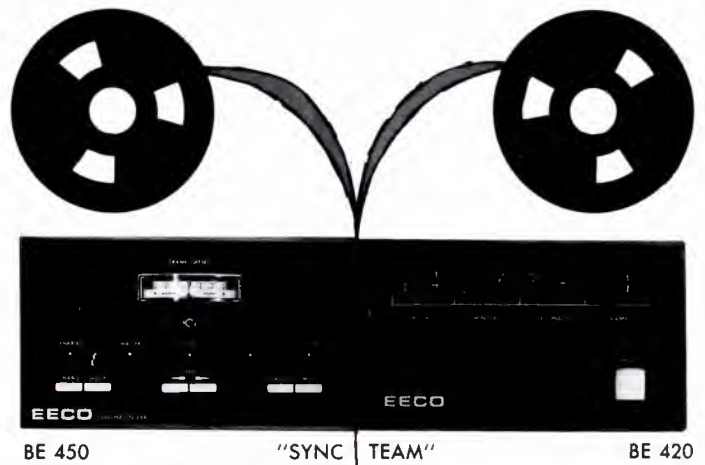
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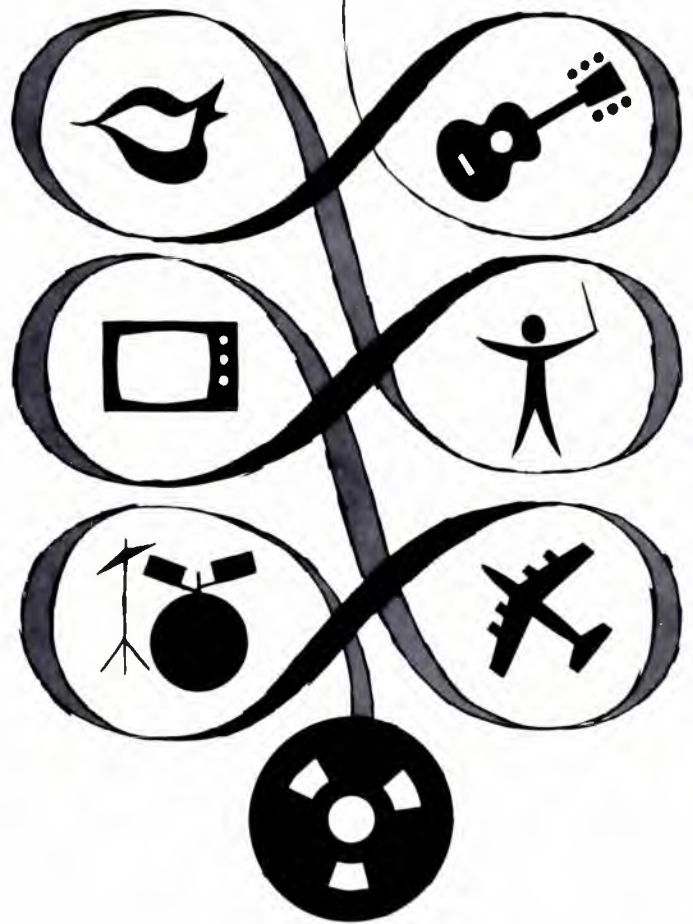
The EECO synchronizer has an initial capture range of ± 30 seconds and maintains sync, or manually adjusted offset, for any length of time regardless of tape stretch or shrinkage.



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ALL-IN-ONE SPORTSCASTER HEADSET

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He can do all this because Telex has now combined the finest professional microphone available, one of proven broadcast quality, with an equally high-performance headphone.

This wide-range, dynamic, boom microphone has a low frequency response to transmit his voice clearly and crisply, and an omni-directional design to pick up colorful crowd noise. The two channel headphone fits comfortably with a padded headband and foam filled earcushions to screen out ambient noise. It is adaptable to any application or equipment by means of non-terminating cordage and features exclusive Telex audiometric type driver elements. And both headphone and microphone are designed to stand up even if the sportscaster has to work in all types of weather extremes and can't avoid some hard bumps. In fact, if the sportscaster doesn't hold up as well as the CS-90, there is a "push-to-cough" switch that mutes the mike when necessary.

Constructed of high-impact ABS plastic and stainless steel. Styled in non-reflective black and grey to eliminate glare on camera. Write for further information.



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NEWS

did not in fact occur being acted at the behest of news personnel. Critical factor making inquiry or investigation appropriate, said the FCC, is extrinsic evidence that a licensee has staged such a "news" event. The announcement also said that the Commission has asked ABC and CBS to comment on reports concerning a number of specific programs.

Burch Supports Bills To End Local TV Sports Blackouts

Chairman Burch of the FCC, in Congressional testimony, supported the enactment of a bill which would end local television blackouts of sports events. Two such bills are now before Congress. One would make the blackout illegal for National Football League games if the game is sold out 48 hours in advance; the other bill would end all such blackouts whether the game is sold out or not. Burch said that the FCC position was based on its responsibility under the law to promote "the larger and more effective use of radio."

Waivers of Prime Time Rule Ease Network Problems

The FCC recently granted waivers of its prime time access rule which allows the networks a little more room for their own programs in the hot-spot 7-11 p.m. period. ABC, CBS, and NBC got permission to continue until March 31, 1973 to present "one-time-only" network news and public affairs programs without counting them as part of the permissible three hours of network in prime time.

A somewhat similar waiver of the rule was granted to stations in the Mountain and Pacific time zones to present network news, without its counting in the three-hour allowance, following a network sports event or other live programming. The main reason was the necessity for putting live shows on earlier, in local time, than Eastern and Central zone stations.

Briefs

New station KAAT in Denver went on the air in early November with 50,000 watts, AM, with programming emphasis on the 25-49 age group, but also some programs aimed at younger listeners . . . A

continued on page 14

Using a Bruel & Kjaer Type 3347 Real-Time 1/3-octave Analyzer, we plotted room response in some of the busiest recording studios in the country.

Real proof, in real time, that a new order of quality is here.

Then we repeated the response measurements substituting a new Electro-Voice SENTRY IV speaker system for the existing studio monitor.

In every case the SENTRY IV was measurably flatter. Measurably wider range. Even where broad-band equalization had been attempted and was in use (versus the SENTRY IV unequaled).

But perhaps most impressive, the working studio engineers judged the SENTRY IV subjectively better sounding than the speaker systems they had been using for years. In every single studio!

There are a host of good reasons why, including lower distortion and outstandingly uniform dispersion from the first new sectoral horn design in 25 years. With response at 60° off-axis that is identical to on-axis performance.

Plus three new drivers, full-range horn loading, and a computer-aided design that led to more efficiency and higher power handling than any of the standard monitors.

You can read about SENTRY IV design in an AES convention preprint we'll send you. It was written by our Ray Newman (left) the man behind the SENTRY IV. We can also show you curves and specs that make impressive reading. And even better listening.

But we know you won't be truly convinced until you hear the SENTRY IV. That's why we're scheduling studio demonstrations now all across the country. You can arrange an audition through your E-V sound specialist. Or write us today. But be prepared to accept a new standard in sound. The Electro-Voice SENTRY IV monitor speaker system.



Sentry IV Professional Monitor and Sound Reinforcement Loud Speaker

Response: 50 — 18,000 Hz. Dispersion: 60° x 120° from 600 to 15,000 Hz. Sound Pressure Level: 117 dB at 4' on axis, with 50 watt input. Dimensions: 27-3/4" w. x 20-5/8" d. x 50-3/4" h. as shown. Weight: 148 lbs. \$501.00 suggested professional retail net.

a **Gulton**
COMPANY

ELECTRO-VOICE, INC., Dept. 1221EM, 614 Cecil Street, Buchanan, Michigan 49107
In Canada: EV of Canada, Ltd., 345 Herbert Street, Gananoque, Ontario
In Europe: Electro-Voice, S. A., Romerstrasse 49, 2560 Nidau, Switzerland
www.americanradiohistory.com

Electro-Voice®

NEWS

radio series, "Your Home Handyman," has 260 45-second segments covering easy do-it-yourself home repairs, helpful hints for homeowners and apartment dwellers; it is available from Alan Sands Productions, 565 Fifth Ave., N.Y.

Times Wire and Cable Co., Phoenix, Ariz., will increase CATV cable production capacity by 30% with a 40,000 square foot addition to the plant . . . **GTE Sylvania** will move its CATV equipment and installation activity from Seneca Falls, N.Y., to El Paso, Texas, over the next several months.

Systems Wire and Cable, Inc. is another firm greatly expanding capacity to make CATV cable; the firm's Rome, N.Y., plant was enlarged to double capacity, starting in November . . . And still another is **Belden Corporation**, which has begun construction of a new \$4.5 million plant in Monticello, Ky., for wire and cable production, principally CATV cable.

Cable Information Systems, Inc. has bought 80% of the stock of Good-Vue CATV, Inc., which holds cable franchises for Clarkstown, Ramapo, and Spring Valley, N.Y.; the addition will bring to 110,000 the homes passed by CIS cable sys-

tems . . . **GBC Closed Circuit TV Corp.** has obtained a contract from the Commonwealth of Massachusetts for a \$156,000 CCTV system at Worcester State College.

Schafer Electronics Corp. has formed an agreement with EMI Ltd. of England for distribution by EMI of Schafer automation systems throughout the world, except in the U.S., Canada and Mexico . . . **To-com Inc.**, Dallas CATV manufacturer, reported sales of \$1,786,520 for the year ended June 30, 1972, the first full year of operations, with net of \$218,302. . . . **The Grass Valley Group** announced record high sales of \$3,257,000 for the nine months ended September 30, 1972, with earnings of \$642,000, up 74% from the 1971 net.

Ampex Corporation reported \$68,809,000 in sales and net loss of \$3,155,000 for the three months ended July 29, 1972, a sharp drop from earlier large losses; order backlog was said to be more than \$100 million.

People

Cascade Electronics made these appointments: **Jan Spiser**, vice president engineering; **J. Peter Rudderham**, secretary-treasurer; **Jerry Conn**, eastern regional sales manager; **Joe Derocher**, western regional sales manager . . . **Russell Ide** became vice president, sales, corporate marketing division of TeleMation, Inc . . . **Donald R. Calver** is the new director of marketing, audio division of Audiometrics Corporation.

William A. McCullogh was named quality control manager of CATV for GTE Sylvania Inc. . . . **Richard R. Peterson** has joined Optical Systems Corporation as vice president and general manager on Channel 100, the firm's pay-cable-television subsidiary.

Richard Goldstein was named vice president engineering, of Dynascan Corporation . . . **Gay C. Kleykamp** became manager of products, CATV, and **Richard P. Walters** became manager of products, AML, both for Theta-Com . . . **John J. Leay** was named manager, technical systems, Imero Fiorentino, Inc . . . **Bill Toomy**, Olympic decathlon champion, joined Video Cassette Industries, Los Angeles, to direct videocassette and broadcast programming on physical fitness, sports, and related topics . . . **Kenneth B. Schneider** rejoined Visual Electronics to direct marketing for Garron Electronics, subsidiary selling audio cartridge tape equipment, and also Visual TV equipment in the west.

Spotmaster

The incomparable new **Ten/70**



World's finest
cartridge tape
equipment

Here is the bold new standard in cartridge tape performance, versatility and ruggedness—the equipment that has *everything!* Five models of the magnificent Ten/70 are offered to meet every recording and playback application. All have identical dimensions. Any combination of two will fit in our sleek 19-inch roll-out rack panel, just 7 inches high.

Control features and options include manual high-speed advance, exclusive Auto-Cue with automatic fast-forward, automatic self-cancelling record pre-set, front panel test of cue and bias levels, built in mike and line level mixer, color-coded design for easiest possible operation.

Inside is a massive U.S.-made hysteresis synchronous "Direct Drive" motor, solid state logic switching, modular construction and premium components throughout, separate heads for A-B monitoring, full bias cue recording, transformer input and output, flip-top access to heads and capstan.

THE CLASSIC 500 C SERIES. Long the industry standard, SPOTMASTER'S 500 C series is still offered. Performance and specifications are second only to the Ten/70.

For complete details about SPOTMASTER cartridge units (stereo, delayed programming and multiple cartridge models, too), write or call today. Remember, Broadcast Electronics is the No. 1 designer/producer of broadcast quality cartridge tape equipment . . . worldwide!



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COMPRESSOR-LIMITER Model 525

Push-button selection of Compression, Limiting, De-essing and release time. Single knob 20dB Ceiling Control. Lighted meter. Transformer isolated. Size: 1½" x 5¼" x 6¼" deep.



MICROPHONE PRE-AMPLIFIER—Model 312

Transformer coupled input and output with exceptionally low noise (−129 dBm) and high output power capability with low distortion. Adjustable gain. Utilizes Model 2520 operational amplifier.

LINE AMPLIFIER—Model 325

Bridging input, low noise. Output power capability greater than +30 dBm. Adjustable gain, transformer coupled output. Can function as line amp, booster amp or "no-loss" combining network. Utilizes Model 2520 operational amplifier.

In both components, the output transformers are unique, permitting simultaneous multiple outputs. Both are PC cards (2¾" x 4½" x 1½") permitting standard modular use. Power supply decoupling and reverse voltage protection are provided.



LINEAR FADER—Model 440

Illuminated scale; infinite resolution; low-noise and long life; multi-gang and cue switch units available. Size: 7" x 1½" x 2⅞" deep.



EQUALIZER — Model 550A

Concentric High, Mid and Low frequency range switches allow a choice of 15 center frequencies with up to 12 dB boost or cut in each range. Additional switches provide independently selectable low and high frequency bell or shelf curves, band pass filter, and in-out function with indicator light. Output +28 dBm, transformer isolated.

EQUALIZED PREAMPLIFIER Model 330

Models available for RIAA Phono, NAB Tape, and Magnetic Film. Low noise, adjustable gain, high output capability. Equalization adjustable. Film model provides both 16 and 35 mm. curves, externally selectable. Utilizes Model 2520 operational amplifier.



Model 2520 Operational Amplifier, sockets, card mounting frames, power supplies and other accessories available.

Our staff is fully equipped and stands ready to provide engineering services, from applications assistance to complete system design and fabrication.



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INTERPRETING THE **FCC** RULES & REGULATIONS

Licenses' TV Programming Autonomy: Prime Time Network Access Rule And Renewal Challenges By Activist Groups

In the overview, the Communications Act of 1934, as amended, grants the Commission station licensing authority, if the public convenience, interest, or necessity will be served thereby. One of the basic duties of the Commission in considering such applications for licenses is contained in Section 307 (b) of the Act. This section requires the Commission, in considering such applications, to make a fair, efficient, and equitable distribution of radio (and, hence, television) service among the various states and communities. The service referred to is both a transmission and reception service. Thus, aside from the technical quality of the signals, the basic purpose of broadcasting is to provide programming for the *education, information, and entertainment* of the public.

There are a number of provisions in the Act relating to programming, including the political broadcast provisions (Section 315); the fairness doctrine (also Section 315); sponsor identification and payola provisions (Section 317); prohibition of Commission censorship or interference with freedom of speech (Section 326); and the prohibition of obscene, indecent or profane language by means of radio communication (18 U.S.C. §1464). No legislation has been enacted as a result of the provisions of Section 307 (c) of the Act concerning the allocation of fixed percentages of radio broadcasting facilities to particular types of or kinds of nonprofit radio programs, and after these many years presumably none will be enacted. The authority to program a station, however, has historically been committed by Congress to the broadcast licensee.

In the Statement of Commission Policy on Programming of July 29, 1960,¹ the Commission reviewed the authorities with respect to the free speech provisions of the Act and the application of the First Amendment to broadcasting. In recognizing the programming pre-eminence of the broadcaster, the Commission stated:

An examination of the foregoing authorities serves to explain why the day-to-day operation of a broadcast station is primarily the responsibility of the individual station licensee. Indeed, Congress provided in Section 3(h) of the Communications Act that a person engaged in radio broadcasting shall not be deemed a common car-

rier. Hence, the Commission in administering the Act and the courts in interpreting it have consistently maintained that responsibility for the selection and presentation of broadcast material ultimately devolves upon the individual station licensee, and that the fulfillment of the public interest requires the free exercise of his independent judgment. Accordingly, the Communications Act, 'does not essay to regulate the business of the licensee. The Commission is given no supervisory control of the programs, of business management or of policy . . . Congress intended to leave competition in the business of broadcasting where it found it . . .' The regulatory responsibility of the Commission in the broadcast field essentially involves the maintenance of a balance between the preservation of a free competitive broadcast system, on the one hand, and the reasonable restriction of that freedom inherent in the public interest standard provided in the Communications Act, on the other.

Despite this delegation by Congress to broadcast licensees, Congress placed on the Commission the burden of determining whether an application for a license or renewal will *serve* the public interest. As such, the programming authority of broadcasters is not absolute. The problem presented is how best to balance the broadcasters' freedom and responsibility to program his station with the Commission's responsibility to make certain that the public interest is being served.

The Commission's *solution* was as follows:

To enable the Commission in its licensing functions to make the necessary public interest finding, we intend to review Part IV of our application forms to require a statement by the applicant, whether for new facilities, renewal or modification, as to: 1) the measures he has taken and the effort he has made to determine the tastes, needs and desires of his community or service area, and 2) the manner in which he proposes to meet those needs and desires.

Thus we do not intend to guide the licensee along the path of programming; on the contrary the licensee must find his own path with the guidance of those whom his signal is to serve. We will thus steer clear of the bans of censorship without disregarding the public's vital interest. What we propose will not be served by pre-planned program format submissions accompanied by complimentary references from local citizens. What we propose is documented program submissions prepared as the result of assiduous planning and consultation with leaders in community life—public officials, educators, religious, the entertainment media, agriculture, business, labor—professional and eleemosynary organizations, and others who bespeak the interests which make up the community.

By the care spent in obtaining and reflecting the views
continued on page 21

¹ 20 RR 1901.

REEL PRIME-TIME

Freeing up reel-to-reel VTRs for production use: The "Cart" keeps rolling along.

Chief engineers all over the country are sold on the TCR-100 Video Tape Cartridge Recorder. They've told us as much.

But what is the Cart doing for production people?

Well, we talked to production managers in all parts of the country, and the consensus was overwhelming! The Cart's main advantage for them is that it frees a station's reel-to-reel VTRs for more production.

New Orleans' WWL-TV, for instance. They report that with their Cart and four reel-to-reel machines, they're able to make reel-to-reel recordings even in heavy playback times, such as local news shows.

They were able to tape a pilot of a jazz show at a time of day when they'd have been hard put to do it in pre-Cart days. And they're planning more new shows.

One imaginative use of a reel-to-reel VTR freed up by the Cart is at KNTV, San Jose. According to Stew Park, program director, they use the reel machine to make two studio cameras act like three. They record a few shots like inserts or special closeups on a "wild" basis, and roll them on cue onto the work reel of another machine. "Using a reel-to-reel machine as an extra 'camera

source' was just not possible most of the time before we got our Cart," he notes.

But freeing reel machines for other uses isn't the only way the TCR-100 helps producers. Ralph Kuehn, production director at WISN-TV in

Milwaukee, reports that the Cart directly supports production at Studio 12, the station's commercial-producing arm. When the dubbing schedule gets heavy, commercials are put on the Cart in the necessary order and dubbed to spot reels for outside dis-



Freeing up reel-to-reel machines at Studio 12 in Milwaukee has increased the output of taped commercials for local and regional sponsors.

tribution. "We have as many as three machines going at once," Kuehn says. "We couldn't do it without the Cart. The engineering is amazing."

More and more stations are tending to record *all* their commercial spots, promotions, announcements, and other short segments on the Cart so that their reel machines are available for uses they're better equipped for. Many stations predict that "cartridge" and "tape spot" will eventually be synonymous.

It seems that everybody agrees on the desirability of having a TCR-100 around. That's probably the reason for another trend that stations advised us about. When people from one station see it in operation at another, they very often see to it that their own station gets a Cart.

If you haven't seen the Cart at work yet, contact your RCA representative. He'll arrange for a demo at your convenience.



Circle 114 on Reader Service Card

TCR-100 Box Score

Number delivered	66
Number of commercials broadcast	959,000*
Present rate (commercials/day)	3,500*
Man hours saved	39,700*

*Estimate

TCR-100's Delivered

KARD-TV, Wichita, Kan.	WDCA-TV, Washington, D. C.
KCEN-TV, Temple, Tex.	WEAT-TV, W. Palm Beach, Fla.
KHQ-TV, Spokane, Wash.	WECT-TV, Wilmington, N. C.
KIRO-TV, Seattle, Wash.	WFMY-TV, Greensboro, N. C.
KNTV, San Jose, Calif.	WGN-TV, Chicago, Ill.
KPLR-TV, St. Louis, Mo.	WGR-TV, Buffalo, N. Y.
KPRC-TV, Houston, Texas	WISN-TV, Milwaukee, Wisc.
KPTV, Portland, Ore.	WJAR-TV, Providence, R. I.
KRON-TV, San Francisco, Calif. (2)	WKBW-TV, Buffalo, N. Y.
KSLA-TV, Shreveport, La.	WKRC-TV, Cincinnati, O.
KSTP-TV, St. Paul, Minn.	WKRG-TV, Mobile, Ala.
KTBS-TV, Shreveport, La.	WKYC-TV, Cleveland, O.
KTSM-TV, El Paso, Texas	WMAL-TV, Washington, D. C.
KVRL-TV, Houston, Texas	WMAQ-TV, Chicago, Ill.
KWGN-TV, Denver, Colo.	WNCT-TV, Greenville, N. C.
KWTV, Oklahoma City, Okla.	WPTV, Palm Beach, Fla.
NBC, Network, N. Y. C. (4)	WRAL-TV, Raleigh, N. C.
NBC, Network, Burbank, Calif. (2)	WRC-TV, Washington, D. C. (2)
WAFB-TV, Baton Rouge, La.	WSAV-TV, Savannah, Ga.
WAPA-TV, San Juan, P. R.	WSB-TV, Atlanta, Ga.
WBAL-TV, Baltimore, Md.	WSPA-TV, Spartanburg, S. C.
WBAY-TV, Green Bay, Wisc.	WTAE-TV, Pittsburgh, Pa.
WBNS-TV, Columbus, O. (2)	WTAF-TV, Philadelphia, Pa.
WBRC-TV, Birmingham, Ala.	WTV, Chattanooga, Tenn.
WBRE-TV, Wilkes Barre, Pa.	WTVN, Columbus, O.
WDAF-TV, Kansas City, Mo.	WUTV, Buffalo, N. Y.
WDAY-TV, Fargo, N. D.	WWL-TV, New Orleans, La.

Austarama TV, Melbourne, Australia
 CHAN-TV, Vancouver, B. C., Canada
 London Weekend TV, London, United Kingdom
 TIMSA, Mexico City, Mexico
 Venevision, Caracas, Venezuela

Our new UHF Pylon Antenna handles more power... without a new tower.

If you're planning to switch to a higher power UHF transmitter, here's a tip: Watch out for the problem of "critical overturn moment".

That's the difficulty you run into when you try to install a big, heavy antenna on a tower designed for a smaller, lighter one. The tower may not be able to handle the extra weight.

One solution is to build a stronger tower. But that runs into money—lots of it.

So we anticipated the problem and came up with a less expensive answer: the new TFU-24J UHF Pylon Antenna.

It's shorter and has a lower over-

turn moment than previous TFU — "D" series antennas for comparable channels. It could save you the price of a new tower.

It's a direct replacement for early RCA and certain competitive antennas—an omnidirectional "J"-type antenna using bar couplers, a 5-inch harness, and a 10³/₄-inch (O.D.) outer pipe.

Power input is 60 kW at Ch. 14, decreasing to 38 kW at Ch. 70.

For more information, see your RCA representative or use the Prime Timesaver Information Card.

After all, new towers don't grow on trees.

Circle 115 on Reader Service Card



RCA PRIME TIME

Revolution in the Film Room: Consistent quality for all your films

Year after year, color film reproduction has been a big problem for broadcasters.

Stations get their film from a lot of different sources, and the variations in picture quality are both numerous and obvious. Maintaining continuity of color quality is a difficult and sometimes almost impossible task.

But now, finally, there's a revolutionary new color camera that tackles these problems and solves them—automatically.

It's the new RCA TK-28. And it does for picture quality what no other color film camera has done before.

It actually improves on the reproduction of original film wherever necessary — automatically, dependably, economically.

Result? The kind of performance long needed to achieve continuously uniform picture quality from begin-

ning to end. Even in difficult multi-source sequences.

To realize fully how much the TK-28 can do for your station, you've got to see it in action. But basically, it can correct the following common film faults: low saturation, wide variations in density and contrast, and color errors in the film-base.

Here's how it works.

Exclusive new automatic color circuits maintain color balance and automatically correct for printing errors and color temperature variation from projector to projector. Pre-selected chromacomp, RCA's system of color masking, gives a boost to low saturation color films, compensates for scene-to-scene variations, and corrects dye transfer errors.

White and black levels are also maintained automatically to handle

wide variations in film density and contrast.

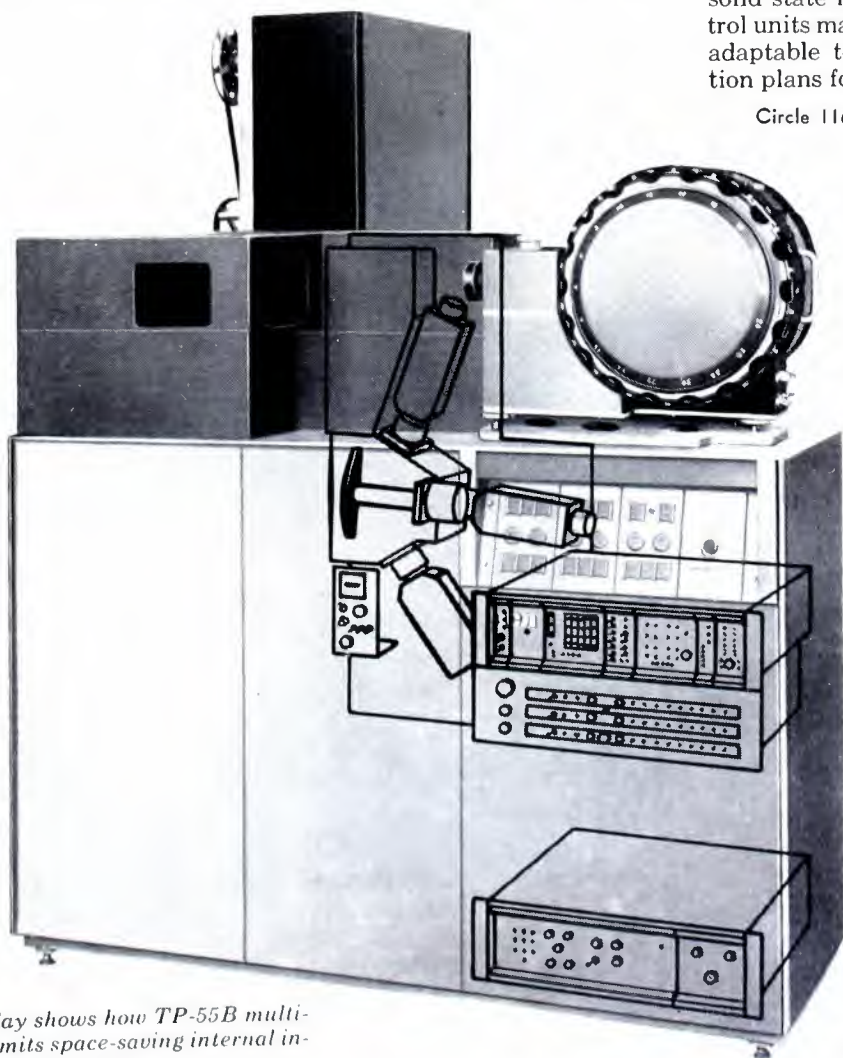
And a new order of circuit simplicity with three tubes (vidicon or lead oxide) gives performance approaching that previously associated only with live camerassuch as the TK-44B.

Tomorrow Telecine System Today.

Couple the TK-28 with RCA's new TP-55B multiplexer and the savings in space are also revolutionary. Two film islands can be installed in essentially the same space now occupied by one. The TP-55B permits numerous configurations ranging from a simple one-projector, one-camera system all the way through an interactive four-projector, two-camera island.

The camera can be installed within the multiplexer cabinet for really compact arrangements. Moreover solid state logic in multiplexer control units makes such systems readily adaptable to cost-effective automation plans for the future.

Circle 116 on Reader Service Card



Line overlay shows how TP-55B multiplexer permits space-saving internal installation of TK-28 camera.

RCA PRIME TIME

A simple, pleasant fact for anyone interested in high-power, remote controlled UHF: One transmitter costs less than two.

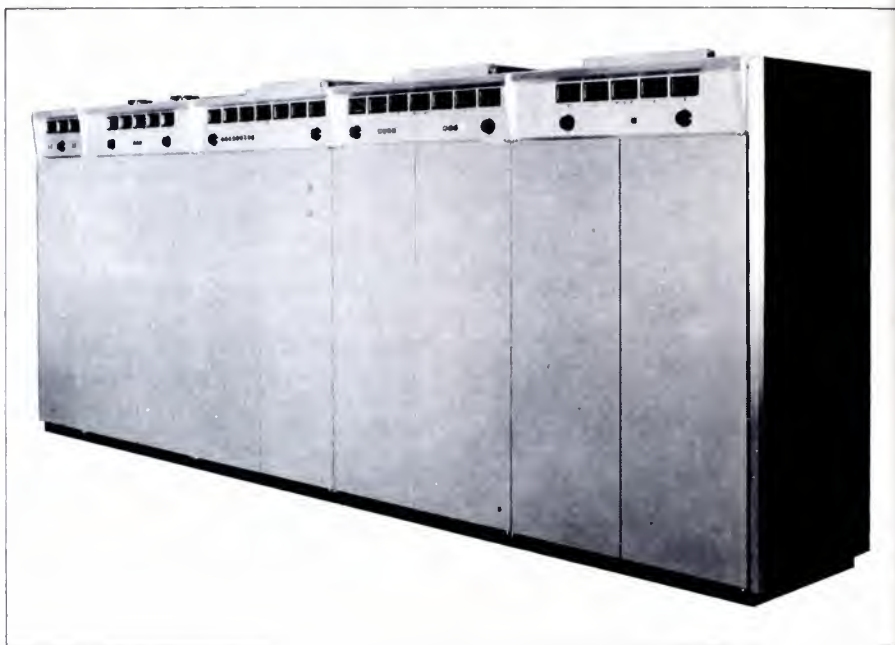
With the new RCA 60 kW TTU-60B UHF Transmitter, it's easy and economical to convert to remote operation. All you need is our new standby power package.

You *don't* need to spend money on a parallel or backup transmitter to meet FCC requirements for once-a-week inspection. Equipped with its standby power option, the TTU-60B meets them all by itself.

The big reason it does is its three identical klystron power amplifiers—two dplexed in the visual PA and one aural klystron. They can be switched in a number of combinations to maintain more than the minimum 20% operating power required for remote operation with weekly inspection.

These are the latest vapor-cooled, integral-cavity klystrons, and they're super-reliable. But should one ever fail, it can be quickly replaced using our unique "klystron carriage".

However, to get to the heart of what makes the TTU-60B a major step forward in broadcast technology, you've got to look at the exciter.



It's all solid state for unprecedented reliability and stability. And for even more savings, there are no tubes to replace.

The TTU-60B. Easily converted to remote operation. Solid-state ex-

citer. And with its standby package, it gives you the redundancy you need. Consider the possibilities...and get in touch with your RCA representative. Or use the Prime Timesaver Coupon.

Circle 117 on Reader Service Card

Introducing Prime Timesaver Information Service.

RCA Broadcast Systems
Building 2-5
Camden, N. J. 08102
Attention: Editor, PRIME TIME

Gentlemen:

Please send me more information on the circled items.

- TCR-100 Cartridge Recorder
- TTU-60B 60 kW UHF Transmitter
- TFU-24J UHF Pylon Antenna
- TR-70C High Band Color Recorder
- TK-44B Color Camera
- TK-630 booklet
- TK-28 brochure

Please have an RCA representative call.

Name _____

Title _____

Company _____

Address _____

City _____ State _____ Zip _____

For further information, fast, on any subject covered in this issue of Prime Time, circle the appropriate items, clip the coupon and mail to the address at left. We'll see that you get the details by return mail.

New and free from RCA.

TK-630

Informative booklet explains how the new TK-630 easily portable, low-priced broadcast color camera delivers quality pictures. Circle item on Prime Timesaver Coupon.

Circle 118 on Reader Service Card

TK-28

14-page brochure introduces the new TK-28 Telecine System, which automatically corrects color film errors for improved television reproduction. Circle item on Coupon.

Circle 119 on Reader Service Card

DECEMBER, 1972—BM/E

thus obtained, which clearly cannot be accepted without attention to the business judgment of the licensee if his station is to be an operating success, will the standard of programming in the public interest be best fulfilled.

With this background on programming, an evaluation of specific problems of 1) the Prime Time Network Access Rule (47. C.F.R. §73.658 (k), and 2) contracts and agreements with activist groups concerning programs related to the renewal of licenses is in order.

Prime Time Network Access Rule (See also BM/E November 1972, "The Prime Time Access Rule")

Sometime prior to 1964, independent program producers began importuning the Commission to guarantee them reasonable access to evening prime time. This raised the specter of delegating control of programming content to non-licensees of the Commission. Such had occurred in the packaging of radio programs by advertising agencies, also the subject of Commission concern. Moreover, such a course involved the Commission in the economics of who would make the money on programming without having any potential for increased variety and an improved program product because substantially the *same* producers were involved. In addition, an arbitrary limitation of access by local stations to network programs in prime time would arguably, constitute a predetermination by the Commission of the source of programs to meet the needs or prob-

lems before they were determined by the licensee. In adopting the Prime Time Access Rule, the Commission conceded the *experimental* nature of the rule and indicated it could be readily rescinded if it failed to achieve its purpose.²

Today, broadcasters contend that the hope of increased programming variety to the American public would have warranted the experiment in the early 1960's. However, beginning in 1968, with the development of cable television (and the requirement for originations in the markets affected), video cassettes, satellite potentials and other forms of competitive visual-aural entertainment and instruction it is agreed the networks have not and will not increase their domination of television sets in this country or the people who own them. To the contrary, many broadcasters contend that an objective examination of television trends would indicate that the networks are *less* dominant today than they were five years ago. Hence, because of 1) the future economic battles that lie ahead in the program distribution fields and 2) the fractionalization which many technologies will introduce, broadcasters may well see the restraint by the Commission of access to network programs rescinded, or at least curtailed someday.

Contracts And Agreements With Activist Groups Concerning Programming

There has been a growing tendency among various groups to file objections to applications for

² Para. 24, *Report and Order*, Docket No. 12782 (May 7, 1970). continued on page 22

Neve installs consoles in hours—not weeks



Neve Console in André Perry's Studio "A," Montreal, Canada.

Rupert Neve, Inc.: Berkshire Industrial Park, Bethel, Conn. 06801. (203) 744-6230.
Hollywood: Suite 616, 1800 N. Highland Ave., Hollywood, Ca. 90028. (213) 465-4822.
Rupert Neve & Co., Ltd., Cambridge House, Melbourn, Royston, Herts, England.
Rupert Neve of Canada, Ltd., 7528 Bath Rd., Malton, Toronto, Ontario, Canada. (416) 677-6611.

Can't believe it? We'll prove it.

Neve can install a sophisticated, perfected, thoroughly tested Sound Mixing Console (like the one shown) in your studio in *less* than a day.

So you can start using it immediately. Instead of waiting indefinitely.

Reason: All modular components are built precisely to specs. Designed for ultra-fast installation. Another surprise: *no* bother with in-studio modifications later on. Neve Console craftsmanship is unmatched. For example: fantastically low distortion (never above 0.075% at 1 kHz).

On-time delivery? It's *always* a matter of policy with Neve. And a matter of honor as well. We'll custom-design a console for your particular needs. We also offer a wide choice of stock audio control consoles. Neve Consoles are used in major studios for music recording, broadcasting, ad commercial, and motion picture production — in 24 countries.

The sound of Neve is world wide. Write for more facts. Now. You'll never be disappointed — with Neve.



Write for Bulletin BME-1

renewals of broadcast licenses. This activity incurs legal as well as other expenses. For the most part, objections to renewal do not go to the qualifications of the licensee, but appear to have, for their purpose, obtaining concessions from the broadcaster to carry particular types of programs. In some instances, these challenges are designed to force the broadcaster to commit substantial sums of money to particular types of programming, including consultants, and to obtain reimbursement for such expenses. In return for such concessions, the objecting groups agree to drop their objections to the licensee's renewal.

Such agreements, whether or not they are entered into under duress, may well be violative of the obligation of the broadcaster under the aforementioned Statement of Program Policy. Arguably, the obligation of the broadcaster to seek out *all* program problems and needs of the public, to evaluate those needs and to design programs to meet them is being transferred to private groups with sufficient leverage to impose their own programming interests upon the broadcaster. To the extent that the broadcaster submits to such pressures, he may be abdicating his programming responsibilities.

Although the Commission issued a Report and Order³ in 1971, adopting the Primer on the Ascertainment of Community Problems by Broadcast Applicants, it has not yet utilized it to answer many of the program problems presented by the challenges of some activist groups. In the future, the Commis-

sion may refer⁴ these problems back to the broadcaster for a more detailed showing of the ascertainment of problems or needs coupled with innovative programming designed to meet these needs. This procedure would 1) preserve the program authority and responsibility of broadcasters, as well as 2) eliminate private groups from dictation, the terms of license renewal (with Commission approval), and 3) permit the Commission, in many cases, to more expeditiously dispose of objections under the demurrer procedure.⁵

Analogous to the drop-out merger provision of Section 311 (e) of the Act, *agreements* to either 1) pay the expenses of parties challenging a renewal of license or 2) program certain types of special-interest programming as a *quid pro quo* for dropping the challenge raise many public interest questions.

Initially, the Commission would not dismiss without prejudice an application when it appeared that the surviving applicant would pay the dismissed applicant's out-of-pocket expenses.⁶ When a competing application was dismissed, the surviving applicant was removed from hearing, making his application subject to further competing applications.⁷ Because of the backlog of hearings on applications for television station construction permits, the Commission instituted the drop-out-merger procedure by which the surviving applicant would be retained in

³ 21 RR 2d 1507.

⁴ Section 3, House Report No. 1800, 86th Cong., 2d Sess., 1 P & F, Current Service 10:418.

⁵ 47 USC §309(d) (2).

⁶ *Four States Broadcasters, Inc.*, 3 RR 1545 (1947).

⁷ *Wichita Beacon Broadcasting Co., Inc.*, 8 RR 527 (1952).

continued on page 24

new encoded chroma keyer



The VK-2140 offers quality chroma keying from many previously restricted sources:
 • Video-tape • Networks • Mobiles • Single line cameras • Requires no separate R G B inputs



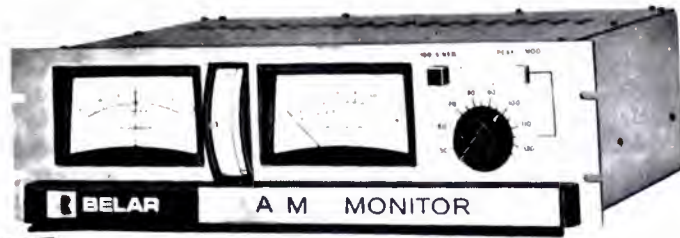
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now...

a company
that has AM, FM
and TV frequency
and modulation
monitoring
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hearing and the payment of reasonable and prudent out-of-pocket expenses permitted. In this way, many hearings were eliminated by the payment of out-of-pocket expenses or the merger of applicants. This procedure enabled the Commission to permit the introduction of television service to many areas on an expedited basis. No such public policy considerations apply to the payment of expenses to a group objecting to the renewal of a license when other, more effective procedures are available.

The Commission presently has pending a Notice of Inquiry and Proposed Rule Making in Docket No. 19518⁸ concerning the reimbursement of expenses to parties objecting to renewals, such as was considered in the *United Church of Christ* case. In that case, if the Commission approves an agreement between a broadcaster and a protesting group, whereby the broadcaster agrees to carry programs the group desires and pay their expenses, the Court will require approval of reasonable expenses. This is true, even when the agreement to pay expenses is not disclosed to the Commission until after the program agreement is approved.

In conclusion, the most effective defense to this result, by either the Commission or the broadcaster, is to refer these types of objections to renewals back to the broadcaster for a more detailed showing on the ascertainment of problems, as suggested above. Such a procedure is in keeping with the legislative history of the 1960 amendment to Section 311 (e) of the Act. Such procedure should also expedite

inauguration of any new programs found to be desirable by the broadcaster in exercising his statutory obligation.

BM/E

⁸ 2 P & F, Current Service, p. 51:35

Your answers please if your name is picked

BM/E is about to launch a major study of the broadcast industry. We will seek statistical information concerning your equipment and opinions on how well manufacturers are currently serving you.

Should you be selected to participate by either a mailed questionnaire or a phone interview, we hope you will respond. We thank you for your anticipated* cooperation.

* Our thanks, too, to those of you who send comments on Reader Service Cards, and those who have already responded to recent ad readership and equipment-use surveys. Feedback is vital.

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— Ernie McDaniel, Director
Technical and
Broadcast Operations,
WCBS Newsradio 88

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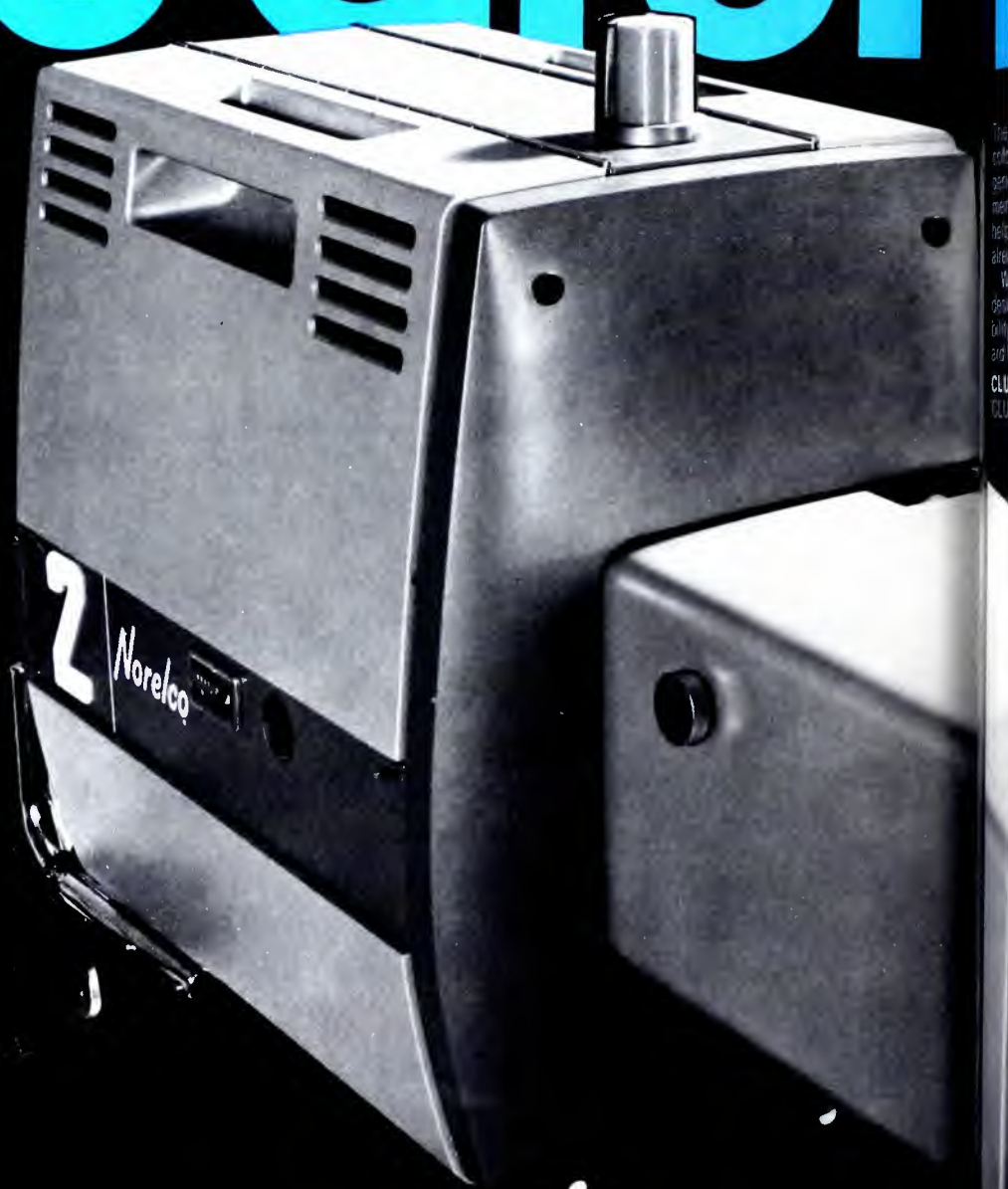
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An innovative
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color camera
that eliminates

- Camera mismatch
- Cable mismatch
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With the latest solid state circuit technique and modular design, the PC-72 achieves new standards of stability, reliability, and ease of maintenance. Plus three major new standard features you can't find in other cameras.

CLUE for quick, precise set-up and camera matching. CLUE allows you to set up accurately and more easily without a waveform monitor. Using a black and white monitor,

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Presto, your cameras are set up and matched in a fraction of the usual time!

Precise compensation for standard cable, mini cable or any combination of both. Now ringing and smearing from cable mismatch disappear. It's as easy as dialing a phone. The PC-72 operates with up to 3,000 feet of standard cable or 2,000 feet of mini. Mix 'em up in the line if you like. Just dial the footage of each into the camera. Presto, perfect camera/cable compensation!

Pre-set pushbutton varichrome variable matrixing holds the color the sponsor wants on every shot. Varichrome gives independent remote control of hue and saturation settings for all primary and secondary colors. Without affecting grey scale. Once you've decided the settings you want to compensate for lighting from each camera angle, your final take is routine. Just push a button for each angle. Presto, the color you want in every shot!

Bias light—no lag at low light levels. Bias lighting, adjustable individually in Red, Green and Blue, virtually eliminates lag at low light levels.

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What Broadcasters Are Learning From The Recording Studios

On two main counts—the importance of top-quality sound and the relevance of state-of-the-art audio consoles—broadcasters are beginning to swing into line with the recording studios.

FOR A LONG TIME there was a hierarchy among pro users of audio technology. The movies and the big-company recording studios demanded the best sound and they used the most elaborate equipment to get it. Second in audio quality came broadcasting. The average radio engineering staff had a lot of other things on its mind: RF stage efficiency, antenna



One of the most advanced consoles at the AES Convention: the Olive 2000 priced at \$50,000 and up.

Good Example: Neve Unit at CBS

THE KIND OF OPERATIONAL FLEXIBILITY and performance quality broadcasters are getting in top-grade audio consoles today are beautifully exemplified in a Neve unit bought by CBS for use at the political conventions last summer and then permanently installed in New York to aid in production of network television and radio shows.

The console has the now almost classical overall audio console configuration with 16 modular input channels, each complete with line and microphone

patterns, etc., etc. Audio had almost the quality of an afterthought. On the third level were the sound distributors, in charge of projecting voices into airports, stadiums, etc.

As far as the broadcasters are concerned, a big change is underway. A few stations have been committed to high-grade sound for a long time and recent stories in *BM/E* have indicated that the number of such stations is now rapidly increasing. Benefiting from that trend, and also contributing to it, is the current "look" in console technology. In particular, the firming of large console design around a modular channel of very high quality has had one perhaps unanticipated result: broadcasters are technically and *psychologically* enabled to use the *same modules* since the number of channels and switching arrangements can be adapted to each user's need. This tends to make "customized" console design with high-quality modules the norm for both recording and broadcast applications, and the basic *quality* of broadcast console performance is shooting up toward the same level as that of the top recording studios.

Although many broadcasters need less elaborate audio switching than a recording set-up, where 16 to 32 input channels and up to 16 outputs are common, the availability of the very compact and flexible switching, developed for recording is beginning to attract broadcasters to many-channel console design. Such design suggests to them new approaches to audio production for radio. That is a story in itself which *BM/E* hopes to return to in a later issue. Here we describe several recent recording studio set-ups and some specialized console designs, that highlight the trends noted.

inputs, slide fader, adjustable equalization, and push-button output routing. Each of the four output busses has a limiter-compressor and slide fader and can be used as a sub-mix bus with output to be fed back for a final mix-down. Any input channel can be connected to any combination of the output busses by push-button switching.

A push-button cuts a pan pot into any input channel which can then be panned to any combination of odd or even outputs. There are two reverb



The Neve console purchased by CBS.

sends and returns, switchable to any input or to any output buss. There is an eight-track monitor circuit, switchable to the program at various stages of progress through the console.

Once modular channel design is accepted, this super-flexibility becomes relatively easy to provide, and is the basis for easy multi-channel mix-down and creative use of "sound shaping" techniques. But clever push-button circuitry is only half the story. The performance characteristics of a console like the Neve, as pointed out in the story on page 30, are extremely valuable to the broadcaster, not only to help in producing a super-fine sound, but to raise the whole level of the audio quality so that legal

performance requirements are more than met—there is never any anxious jacking-up of the station, painful bit by bit, to reach FCC standards.

The maker of the Neve consoles guarantees signal-to-noise ratio under realistic conditions to be 77 to 80 dB (usually it is better), total harmonic distortion at .075% at 20 dBm out, into 600 ohms, and frequency response within 1 dB, 20 Hz to 20KHz. Other console makers are providing similar performance quality: the simple fact is that audio technology, in really expert hands, has reached a super-level today. And the broadcaster can benefit from that in a number of important respects, as outlined in this issue.

Univ. Radio Station Goes To 24 In, 8 Out

STATION WHA, AT THE UNIVERSITY OF WISCONSIN IN MADISON, is one of the most progressive non-commercial FM stereo operations to be found anywhere. Recently WHA put in an Audio Designs Model 24/8 console, one of the new breed we've been talking about in other stories in this issue. The new console has 24 inputs, 8 output busses, quad capability, and elaborate switching for use in shaping and mixing the program material. There is highly available echo, panning of any input around four outputs in quad production, and adjustable equalization on each input as in most of the top-grade consoles.

Among the early applications of the new console is the production of a radio play by another campus organization, the National Center for Audio Experimentation, which has been pioneering for several years in specialized applications of audio to taped material for non-commercial radio broadcast—drama, music, and much other material. "Transistor Radios on The Moon," the play, is carried by just two voices. By using the switching and sound shaping facilities on the new console in a mix-down to quadraphonic sound, NCAE will produce such effects as panning the voices around the listeners, having the voices, with strong reverb added, repeated from the rear channels; bringing voices in

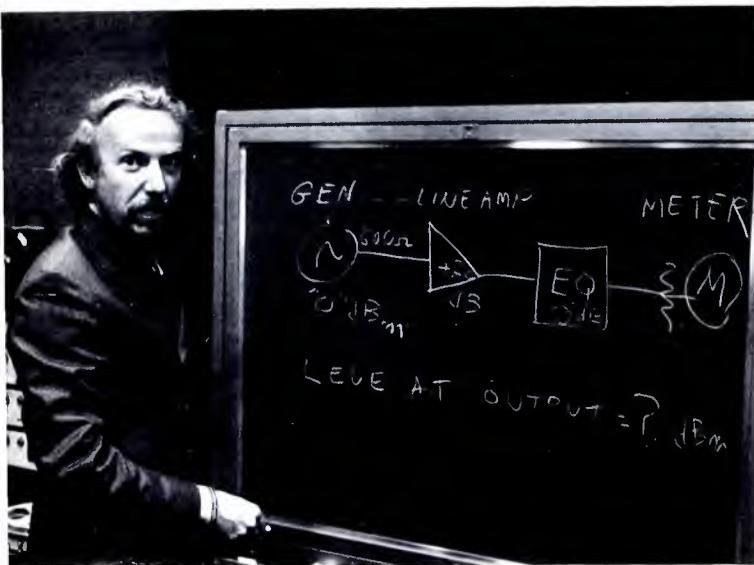
over the listener's head, audio "wipes," and many others.

The complete play will be available on quad tape for use by public radio stations around the country. Broadcast in two-channel stereo, the play will still have effective drama, but of course without front-rear differentiation. NCAE is hoping to encode it for matrix broadcasting.

BM/E



The Audio Designs console at station WHA can handle quad production.



Mr. Grundy teaches a class at the Institute of Audio Research

FOR A LONG TIME, as everybody knows, the audio art practiced in commercial recording was a different breed from the audio in the average broadcast station. Both used compression, but similarity ended about there. The recording engineer had to be strongly concerned with quality because that was an important part of what he was selling. In AM-only days the radio man didn't have to think about audio quality very much. The main pressure on him was to get the strongest possible signal out to the maximum number of listeners.

The coming of FM brought *sound* to the front of the radio engineer's concerns, and stereo FM intensified this new focus. Many station managements today are trying to put out the best possible sound. But while radio sound was moving substantially ahead in quality, recording audio also moved ahead into a new world in which multi-channel recording and the mix-down are used to reach a new level of sound effectiveness. The gap between the two audios, by and large, has stayed wide.

When a recording engineer today works toward getting a "good sound," he aims not only for wide frequency response and vanishing-level distortion, but for effective microphone technique, use of "sound shaping," and careful mix-down to produce

Recording Audio And Broadcast Audio: Two Arts On Converging Tracks

By Albert B. Grundy

"We in the recording field happened to get there first, so we know that the future will demand more and more from audio in broadcasting."

clarity and identity of individual instruments, lead voices with appropriate echo, solid bass with clear beat. Each individual sound may be treated for the most pleasing "quality." He has a large bag of tricks at hand to help him—several kinds of echo, selective equalization, the ability to vary microphone technique individually for separate parts of his pickup.

The broadcaster will find it more and more desirable to aim for at least the main elements of the "new sound,"—clarity, pleasantness, and effectiveness of individual instruments and voices, exciting balance. Without such a sound he is going to lose an important segment of his audience, the young generation who do most of the listening to records, who know what a well-produced and well-repro-

Mr. Grundy has long been one of the best known figures in professional recording in the New York area. Currently he is director of the Institute of Audio Research, which is very successfully producing a series of courses in audio design and recording studio practice.

duced recording sounds like. These listeners use home equipment that averages very high in fidelity, and their audio expectations are correspondingly high.

Consider first the general basis for the new sound, multi-channel pickup with mix-down. The broadcaster may find it hard to imagine a program which would need 16 inputs, but the mix-down principle is one he can adopt to advantage. Using, say, four inputs to produce commercials, having elements recorded on different tracks, he has a way to update the commercial after the original has been used or to change something the sponsor changed his mind about, without redoing the whole thing.

If musicians are used who have recording-studio experience, they are likely to expect at least a minimum of mix-down capacity, so they can get the effects they want. But entirely aside from what musicians may want, the effectiveness of the commercials with the listener, no less than of entertainment material, is riding on a "pro" sound today. Nothing is more deadly to the hi-fi-conscious hearer than a commercial simply read by the relief announcer in a small, dead studio. The great body of commercials which are the bread and butter of smaller stations everywhere, for which there is no money, personnel, or equipment to make an elaborate production, can often benefit from judicious use of reverb (**Editor's note:** see page 32), and perhaps of equalization, or of some of the "sound shaping" referred to in a moment.

What has been said so far, and practically all of the rest, points to one basic need of any radio station that wants a competitive sound: one or more top-flight tape machines with at least four tracks, so that mix-down with sound shaping can be used on any program that is recorded before being aired. Once the broadcaster gets used to this approach, he will think of more and more ways to be creative with it. If the station is producing its own music programs or doing that on a custom recording basis for outsiders, four tracks are not likely to be enough.

An area of technique that becomes fully available with mix-down production is the creative use of audio processing equipment. The recording engineer today uses compressors, limiters and expanders not only as level adjusters for automatic avoidance of overloads, but as sound shaping devices. He listens to what the compressor settings are doing to the sound quality, and makes esthetic judgments that are just as important as the technical ones.

The same applies to other audio processing units, feedback to echo chambers, spring reverb units, etc. Even the Dolby system, while certainly desirable in the first place for noise reduction, can also be used as a sound-shaping tool. This points to the fact that today's broadcast audio man needs the habit of using his ears as measurement devices much more than he did in the past.

Another corollary is that the audio monitoring equipment has to be absolutely top grade. You can't come even near to knowing what you are doing in this area without monitoring amplifiers, speakers, and

rooms that reproduce the whole range with good balance and with vanishing-level distortion of all kinds. The days of the five-inch audio monitor speaker stuck in a corner of the control room started to disappear some time ago. Now that old system is literally impossible.

That brings us to the general question of equipment quality levels. Another thing that has happened in the last decade or so in the recording studios is reduction of noise and every form of distortion in the equipment by almost an order of magnitude. This reduction became a necessity when a program, or parts of it, had to go through the equipment three, four, five or more times. Advancing technology, the swing over to solid state, made drastic reduction of distortion levels possible. The Dolby and similar systems have pushed noise far down, freed the recording engineer of the severe limitations noise used to impose.

Broadcast audio needs to come up to these standards straight through the audio chain. The consoles, and all of the processing equipment, have to reach today's state-of-the-art quality levels if the broadcaster is to be free to manipulate his sound in creative ways. The equipment has to be maintained properly. The interfaces between units must be right, with the correct impedance and level relations, to keep noise and distortion well below troublesome levels.

Finally, a word about the very elaborate switching now built into the larger audio consoles for recording studios. Anybody who has looked at such consoles at audio shows, or read specifications in ads, knows that switching is common these days that allows every processing element to be added to any channel separately, orders to be reversed, new combinations made, etc., etc. The broadcaster has generally got along without this kind of audio flexibility, and he still can go without it.

The point of having it, though, is that once you *can* make new and unusual combinations simply by punching up the control console buttons, you begin to think more creatively about your sound. Probably few broadcast stations want to go as far in this direction as the more elaborate recording studios. But any broadcaster who is concerned about sound quality and prepared to spend the time to "shape" his sound to make it more attractive will find some approach to recording-console flexibility highly useful and stimulating. The console makers today are prepared to deliver any degree of switching flexibility, built around the "modular" console channel that is emerging as the standard. (**Editor's note:** see page 29). That modular channel, with equalization built in and top-grade performance characteristics, makes it easy for the broadcaster to get the quality he wants as far as the console is concerned.

As quad broadcasting becomes more common it will intensify the drive toward top-grade, professionally-shaped sound in broadcasting. In effect, quad throws an even stronger focus on the quality of the sound. All of us, both in recording and in broadcasting, are going to have to learn how to handle quad in the most effective way. **BM/E**

Sound Too Dry? You Need Artificial Reverb

By George Alexandrovich

Artificial reverb has been used in recording for a long time. Here is a run-down on today's inexpensive, convenient reverb devices, and what they can do for the broadcaster.

IT'S TOO DRY—LIVEN IT," has been a standard instruction in recording studios for years. The broadcast engineer in a station that cares about the quality of its sound *must* understand what the instruction means, and have the equipment to put it into practice.

In a word, it is artificial reverberation, judiciously used, that changes a sound from dry and weak to full, spacious, and powerful. Reverberation is the bouncing of sound back and forth in a room after the original sound source stops. Every room and hall has its own complex pattern of reverberation, which gives that space its own acoustical character. Without some reverb, a sound is dry, weak, thin. That's why there has been work for years on methods of producing artificial reverb which could be added at will to musical program material.

At first audio and acoustical engineers built small, hard-surfaced rooms with non-parallel walls to get a lot of bouncing sound without standing waves. The signal is fed into the room through loudspeakers, and the signal plus the reverb in the room is picked up by one or more microphones. To get decent results, the rooms had to be large, walls hard, and the microphones and loudspeakers of top quality, strategically placed on the inside. In addition, the

rooms had to be protected from outside noise. Such rooms did very well for the recording companies for a number of years, but the advent of multi-channel recording made them uneconomical. Can RCA afford 16 echo rooms?

The easiest substitute was the delay line, nothing more than a hollow pipe with a microphone at one end and a speaker at the other. This does produce a delayed sound that simulates the delay heard in large halls, but does not produce the continuing series of back and forth bounces that is so important in real reverb. In addition it is sensitive to ambient noise, and suffers from losses in the transmission line and the transducers.

Another method that also worked reasonably well (and still does) is the large metal plate, with energy fed to the plate and picked up from it with dynamic units. The plate had to be acoustically isolated from the building structure to keep rumble out of it, and well insulated from ambient noise in general.

Spring delay units, with the vibrational energy fed to one end and picked up from the other, have the convenience of small size, lower susceptibility to ambient noise, and low cost. Spring units were first used for reverb in the enhancement circuits of the Hammond electronic organs. The energy not only travels from one transducer to the other but bounces back and forth until it dies away, very much like real reverb. Each spring has many minute resonances which show up as peaks in the frequency response. If several springs are paralleled, each tuned to resonate at a different frequency from the others, the overall response can be made quite smooth.

Other refinements that have been developed for spring units are careful equalization of the frequency response, limiting, advanced suspension systems for the springs, and special mechanical damping for optimum decay characteristics. These refinements have greatly improved the "sound" of spring units, prolonged the decay time, and improved the signal-to-noise ratio.

It is important to distinguish between a true *reverb* effect like that produced by a carefully-designed spring unit or reverb chamber, and a simple *echo*, which can be produced by feeding back the output of a tape machine into the input. In a limited number of cases, the one-shot echo can be pleasing, producing the effect of a fairly large room; but in a great many cases the results are most unpleasing—in fact, awful, not to mince words. If the delay is

Mr. Alexandrovich is vice president of Fairchild Sound Equipment Corp.

AKG Uses Spring Modified To Produce Statistically-Distributed Response in Frequency and Time

Several sophisticated artificial reverb units using springs as the delay medium are described in the accompanying story. Another is made by AKG, and sold in this country by North American Philips. To produce the required density of resonances and statistical distribution of response in frequency and time (achieved in some other units by using multiple springs in parallel), the AKG unit alters the spring mass, diameter, and other parameters at randomly-selected points. Adjustable damping allows for alteration of the decay time over the range from 2 to 4.5 seconds. Each of the two springs (one for each stereo channel) is folded at two points to get the whole assembly into a cabinet less than four feet high. The entire unit is suspended inside the cabinet, with a natural resonance below 1 Hz, for protection against shock and outside noise.

more than about 35 milliseconds, a distinct, separate echo will be heard. Even with a shorter delay, there isn't a true reverb effect because the reverb does not bounce repeatedly in a random manner, with the total energy slowly dying away. In a real room, every note in the program is extended by the repeated bouncing from wall to wall. The time delays and amplitude patterns of the bounces will be characteristic of the particular room and will establish its acoustic character.

To continue the explanation: consider that sound acts pretty much like light (although light travels almost a million times faster), with sound filling the room, bouncing off the first flat surface, diffusing, or focusing if a curved surface is present. Thus reverberation, as opposed to echo, is like replacing a parabolic reflector behind a spotlight with a flat mirror dispersing the energy in a wide pattern.

Well-designed artificial reverberation produces the effect of having the "dry" sound, arriving directly from the sound source, followed by a multiplicity of reflections that become a part of the sound. The direction and time delay of each of the reflected sounds is most important to our perception of the quality of the sound and of the room acoustics. Our hearing system acts as an acoustic analyzer, deriving from the reverb pattern information about the size, shape, and sound-absorptive character of the room.

Duplicating in a recording or transmission channel the tremendously complex pattern of natural reverb is difficult. Phases, levels, directions of each element of the reverb, as well as the delays, would have to be identical to the original. That is why no one can claim so far an ideal audio system producing a sound that cannot be distinguished from the original. We are trying to approach that ideal with four-channel sound reproduction, but in actual life sound comes from an infinite number of directions. No one can spare enough tracks or speakers to do the same job artificially.

However, we can do quite well in fooling the ear; and this is the name of the game. Artificial reverberation is only a part of it, but a very important part. It is capable, when well handled, of producing a sound with power and depth that are satisfying in much the same way as the real thing. Moreover, as already noted, a "dry" sound, *without* adequate reverb, is almost sure to be highly displeasing.

A good number of manufacturers and engineers are serious about the importance of artificial reverb, and have produced devices for creating it. I want to tell about the principal available devices, trying to do justice to all of them.

One of the most widely used reverb devices is the

EMT model 140 metal plate (described in the foregoing), and the newer model 240 plate (not available at the time this was written). These devices have mechanical means of adjusting damping and reverberation time. Model 240 will be a portable unit, much less bulky than the model 140, which has been a favorite of permanently-set-up recording studios. I know of no other plate units.

The spring unit category is the most competitive one. There is the simple tube system of Fisher Radio, sold for less than \$80. There are a number of units made for car sound systems and other entertainment devices, but none would normally be chosen for professional applications.

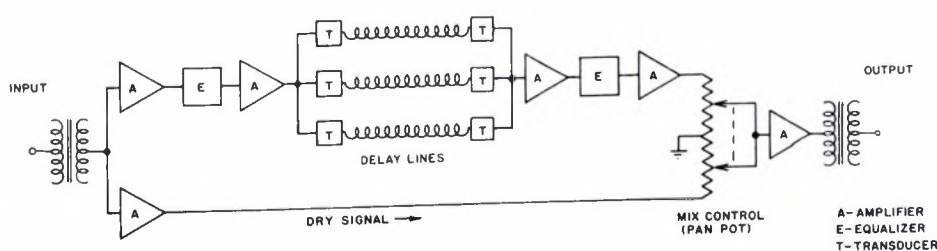
In the pro groups are units by Sennheiser, using a single spring with mechanical damping to adjust the decay time; Quad Eight with a four-spring unit, also with mechanical adjustment of the time constant; Para Sound with a two-spring unit; and my own company (Fairchild) with the Reverbertron, which has six springs and is designed for broadcast as well as recording use. It has variable equalization, electronic control of decay time, and can be remotely controlled.

All the pro units mentioned are available for rack mounting, are small and light, use very little power. What is more important, all sound at least fairly decent, and choice can be made based on taste and the budget for reverb.

I cannot close without mentioning another, newer, but fast-maturing technology which can create artificial reverberation: digital, all-electronic delay systems. Audio signals, which are analog information, are converted to digital form, with enough resolution so quality will be nearly identical to that of the original. Digital signals can be delayed in IC circuits, with a multiplicity of such circuits capable of producing a multiplicity of different delays. Then the original signal, with the pattern of delayed "reflections" added, is converted back to analog form.

Naturally without the development of LSI (large-scale integration), putting a very large number of circuits in small space, digital delay reverb would have been impractical. Obviously the complexity of the design is high, but it is not insurmountable. Likewise for the cost—it is high (in the few-thousand dollars range) but again that is not insurmountable for applications in which artificial delay is indispensable and is constantly used.

It is safe to say that the time will come when we can make a recording, or originate a broadcast, in a 10 x 10 foot room, and add digital-delay reverb that will make the most perceptive listener swear he is in Carnegie Hall. **BM/E**



A typical artificial reverberation unit.

See It, Measure It

Latest generation of swept-band spectrum analyzers for audio and low-radio frequencies quantifies accurately enough for most standard engineering measurements

IN THE AUDIO AND LOW RADIO FREQUENCIES, swept-band CRT spectrum analysis long had its main utility in giving a fast look at a whole band, to find the ballpark locations and relative amplitudes of the main features of the band. Metered instrumentation would have to supplement the analyzer for measurements accurate enough to guide system design or correction.

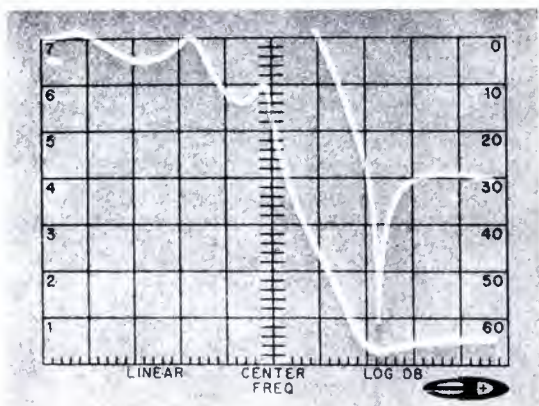
But there has been a strong trend in recent years, as every engineer knows, toward higher stability and calibration accuracy in all CRT analysis instruments. A family of spectrum analyzers covering the 10 Hz to 64 MHz range, developed by the Systron-Donner Corporation of Van Nuys, Calif., have ad-

vanced this trend far enough to put CRT sweep analysis on a par in measurement accuracy with commonly used metered instruments for a very wide variety of the measurements engineers need in this range. This gives the engineer, in many cases, the best of both worlds: he has the unique advantage of seeing all the features in a band at once, plus the ability to quantify the things he sees precisely enough for most of his needs.

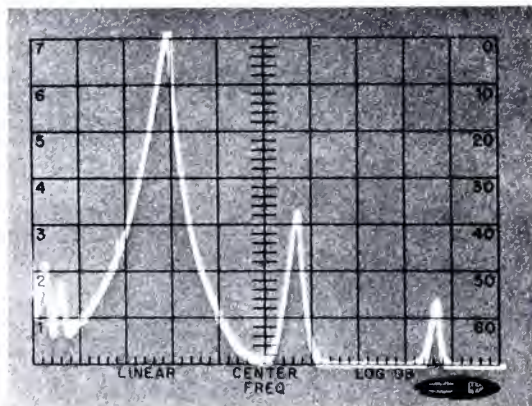
Many refinements help put these analyzers on top of the job. A few of them: dial setting for the sweep center frequency is accurate to 1%; the instruments use a heterodyne system, with the IF bandwidth

continued on page 37

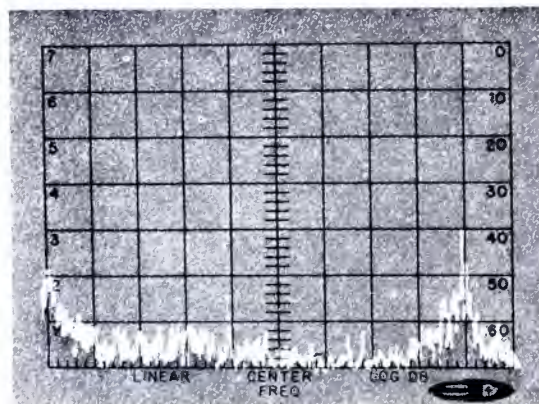
A few typical patterns with their interpretations:



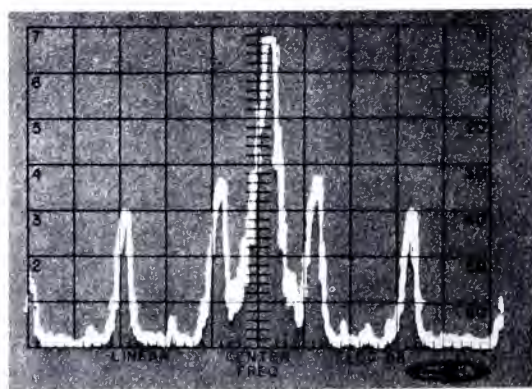
Audio Frequency Response—At left the frequency response of a low pass filter over 60 dB dynamic range. At the right, the sidelobe of the same filter with input sensitivity increased by 40 dB.



Harmonic Distortion—Distortion characteristics of an audio amplifier driven to full output. Second and third harmonics measure 38 dB (2%) and 55 dB (.2%) respectively. At extreme left, power supply ripple at 120 Hz, 240 Hz and 360 Hz, all below 40 dB.



Sensitive EMI Receiver—50 kHz scan width allows rapid evaluation and measurement of EMI from an electric motor. Note peaks at 20 kHz and 43 kHz. Calibrated 50 dB log display, 30 uv full scale.



Selective Nanovoltmeter—Linear display of 30 kHz sine wave with 60 Hz power supply modulation side bands. Sensitivity setting: 30 nv/div.

The on-the-spot spots.

With film it's so simple to give local advertisers a big boost. Just take a camera, a power pack, some lights, a few rolls of film—and shoot a commercial in the merchant's local habitat.

Viewers get to see the place, the products, and the personnel as they really are. It's a lot more effective than having a businessman come to a studio where he stands on a fake set—or in front of a curtain.

Another thing to consider. Film equipment is mechanical so any optical repairs that might have to be made are normally inexpensive. And there's no need for expensive standby equipment as there is with tape.

On-location shooting is just one advantage of film. Your Kodak Sales and Engineering Representative can tell you about the others. In no time at all you can be helping local merchants star in their own 30- or 60-second specials.



EASTMAN KODAK COMPANY ATLANTA Bob Baker 404/351-6510
CHICAGO Dick Potter 312/654-5300/DALLAS Frank Reinking 214/351-3221/
HOLLYWOOD John Waner 213/464-6131/NEW YORK Bill Reddick 212/262-7100/
SAN FRANCISCO Joe Semmelmayr 415/776-6055



shhhh!

DON'T MAKE A SOUND UNTIL YOU HAVE AUDIMAX AND VOLUMAX.



This is the team that quietly goes to work to produce a perfect sounding program. Audimax eliminates distortions like thumping, audio holes and the "swish-up" of background noises. Volumax prevents overmodulation and limits program peaks, permitting broadcasters to achieve maximum power from each watt of carrier power. Together, Audimax and Volumax

produce a new excellence in sound control, increase audience coverage and amplify your station's profits.

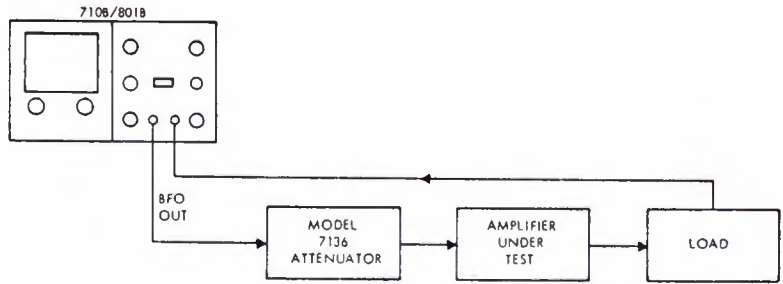
CBS LABORATORIES

A Division of Columbia Broadcasting System, Inc.
227 High Ridge Road, Stamford, Connecticut 06905

Circle 128 on Reader Service Card



Model 711/801B spectrum analyzer combines storage display unit with analyzer tracking BFO. Other models combine basic units in other pairings.



Typical test set-up with analyzer using tracking BFO for frequency response check of audio amplifier.

adjustable to make the resolution match the sweep range and speed; output can be either linear or logarithmic, with the graticule scale markings linear on the left edge and in dB steps on the right; scan width is variable over a 1000-to-1 range, in eight calibrated settings, sweep time is variable in calibrated steps over a 3000-to-1 range and input has calibrated attenuator to change sensitivity in precise 20 dB steps—these features mean that a whole band of interest can be covered, and then the user can zero in on a very small fraction of the band, for highly precise measurement.

One model has a built-in BFO, with the analyzer input automatically tracking the oscillator frequen-

cy. Since the analyzer reads only the fundamental frequency, noise and distortion are sharply reduced in the reading.

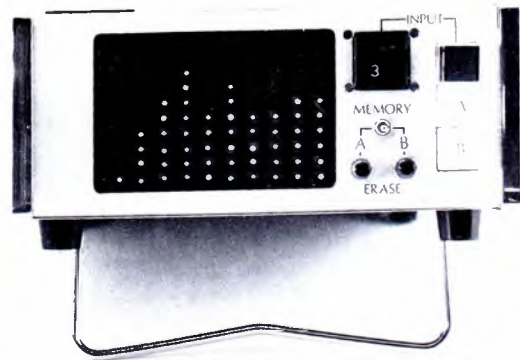
Frequency response measurements can be made over a 140 dB range on filters, amplifiers, transmission lines, loudspeakers, etc., with the high resolution showing holes and spikes in response much narrower than those uncovered with a 1/3-octave analyzer. Also, harmonic and intermodulation distortion; wave analysis; Fourier analysis of pulses; ripple and noise in power supplies; broadcast band field-strength RF measurements (a battery power pack makes this convenient); EMI analysis and measurement; many, many, others. **BM/E**

With This Spectrum Display, You Can See The Frequency Content of Your Audio Program in Real Time

In recording, in open-reel and cassette duplication, in disc mastering, in FM broadcasting, it is frequently important to know the frequency-vs-amplitude characteristic of the program material. There may be peaks in parts of the spectrum strong enough to cause trouble, but not broad enough to show up on a VU meter. Extra strength in the highs, in particular, often causes severe distortion on tape and in FM broadcasting, without pushing the average level, as read by the meters, into a clear danger zone.

Clearly it would be handy for the operator to be able to "see" the frequency-amplitude characteristic of program material, at a glance, in real time, with enough resolution to spot potential narrow-peak overload. That is just what the Spectrum Display unit, made by Olive Electro Dynamics of Montreal, does. It is not intended to replace laboratory spectrum analyzers with accurate measurement capability (Editor's note: see page 34), but to give the operating engineer an instant approximate indication of the energy distribution with frequency.

The display consists of ten vertical rows of light-emitting diodes, each row consisting of nine diodes. In one model, each vertical row represents an octave-width band and the display covers the full audio spectrum. The peak amplitude in each octave at each instant is indicated by the height of diodes lit. A second model covers the spectrum from 2 kHz up, in ten 1/2-octave bands. Each unit also has two memory banks which will store peaks, with later display avail-



able through a push button.

The Spectrum Display will, for example, let the engineer in charge of high-speed duplication of open-reel or cassette tapes examine the master tape in advance and uncover any of the high-frequency levels that so often cause serious trouble in these applications. The FM broadcaster has much the same incentive to preview program material, whenever possible, to spot high-frequency overload danger.

"Live" Rock Builds an FM Audience

WLIR, Hempstead, Long Island, has won a host of friends in the 18-34 age group with a "stereo rock" format that also includes some jazz, folk, and even a little classical. Key rock concerts are live, but the recorded ones, too, have a "live" sound. WLIR chose equipment specifically to achieve that.

LET'S SAY YOU HAVE MADE AN FM STEREO STATION outstanding (and a commercial success) by emphasizing a "stereo rock" format appealing to a large youth audience (heavily in the 18-34 bracket) that is highly sophisticated about sound quality, as well as very hep in its tastes for music.

There have to be two thrusts to your success: the right choice of program material; and the right technology for a clean, sparkling sound.

WLIR-FM, Hempstead, Long Island, about 20 miles east of Manhattan, has made such a success and has a story to tell on both programming and technology. First, "stereo rock" needs an explanation. In the WLIR version it doesn't mean a total diet of hard-beat music. In accordance with the demonstrated tastes of a large body of young listeners today, it also includes some jazz, folk music, blues, even a little classical material, in a rather free-form mixture brewed up by Ken Kohl, young program director at WLIR.

Sometimes mixed with the music are public service and political announcements aimed at that same audience, the college-age and next older segment of the 15 million people in the New York City-and-environs megalopolis. That is a huge audience, but it has a correspondingly large number of radio and television stations from which to choose: there are more than 50 radio stations in the area.

WLIR's success, therefore, is a result of the quality of its program mixture, and not of an "easy" market

situation: New York's broadcast scene is a battlefield for any station.

An important element of the program mixture are the live rock concerts, the only ones in the east at the time this was written. These broadcasts have stirred strong response, with their spontaneity and excitement of a kind largely missing from studio-made recordings. Top recording stars have been glad to take part, sometimes at nominal fees, because of the expected stimulus to sales of their discs. An audience of about 50 "live" listeners is invited to the Ultra-Sonic Recording Studios in Hempstead, where the weekly live show originates. One result demonstrating the pull of the show is the crowd of up to 300 or more who regularly turn up, unbidden, to hear the music at its source.

A number of other concert-style shows picked up remotely are put on tape (more on that in a moment). And WLIR produces a certain number of musical shows in its own studios. In addition, there is a series of disc jockey shows, with each man required only to mix in a certain number of station-specified recordings among his own choices.

The audience that WLIR is reaching with this broadly-interpreted "rock" programming has a strong attraction for a variety of advertisers. For example, Dr Pepper, the soft drink, recently picked up the tab for the weekly live rock concert. John Rieger, president of WLIR, is happy with the number and character of the station's advertisers.

WLIR started in 1959 as a classical music station,



At WLIR, Ken Kohl, program director, and Joel Moss, public affairs director, plan a series of information spots for the 18-to-34 audience who are the station's main listeners.

and its switch to the present format didn't take place until early 1970. The station's management, which hesitated for some time about giving up the classical format, is now for "stereo rock" 100 percent.

The management agrees on another point: without a top-quality sound, WLIR's impact would be dulled. One center-pin of the sound since mid-summer of 1972 has been the Revox A77 tape recorder. With the exception of the live concert series, every concert-style show is recorded on one of WLIR's Revox machines, and broadcast from that recording. Included are remotes as well as musical shows produced in the WLIR studios. Mr. Rieger and George Sullivan, chief engineer, both call the sound quality they get from the A77 "superb."

Commercials, too, are produced on the Revox machines, edited there, then dubbed onto carts for broadcast. The quality is just as though the original recording had been made on the cart itself, according to Mr. Sullivan.

The microphones used for music pickup are also obviously essential links in the quality chain. WLIR is satisfied with its Beyer mikes, which include both omnis and cardioids.

Just as important as top equipment, says Mr. Rieger, is an engineering staff thoroughly committed to keeping on the air the top quality of sound the equipment can produce. "We have such a staff," he says, "and I recommend that variety to any radio station that wants its sound to be competitive today."

BM/E



WLIR's chief engineer, George Sullivan, cues up a disc for recording on one of the Revox A77's used for origination of most music programs at the Long Island FM station.

Audio Engineers Hear Quad Contestants, See Fancy Consoles and Tape Machines at New York Convention

MORE ELABORATION in multi-channel audio consoles, with automated mix-down from many channels to two or four; more high-performance mastering tapes; some beautiful new instrumentation; increasing attention to problems of the broadcast cart; and a lively rerun of the great quad donnybrook, were happenings of special interest to broadcasters at the 43rd Convention of the Audio Engineering Society, September 12 through 15 at the Waldorf-Astoria in New York.

The quad discussions were covered in the October issue, page 46. The November issue, page 34, included details on some of the new instruments unveiled at the show.

The show itself was highly satisfying from the Society's point of view. First day registration was the largest for any day in the Society's history. Exhibitors liked the attention their products got, and everyone liked the facilities of the hotel and layout of the show. For officials of the Society, the move to the Waldorf was a symbol, as well as a fact, of the growth of the Society's influence and importance.

The technical sessions, while they did not produce any blockbusters comparable to the Teldec disc demo of two years back, were consistently of an extremely high professional level.

Especially interesting were papers at the session on quadrasonics, which continued the strong trend toward establishment of a general theoretical basis for matrixing systems. A review of the leading matrix systems by John Eargle of Altec was discouraging in a sense, showing the lack of compatibility among them, and the failure of what he regarded as the best, the UMK, to get use because of its late arrival. A paper by Gibson of RCA threw new light on discrete quad broadcasting, showing the basics for producing "panoramic sound" with three channels—or more with the addition of a low-fidelity fourth.

The following is a brief rundown of the main products exhibited at the show:

AKG-North American Philips: Microphones and headphones, and **Norelco** electronic-drive turntables.

Allison Research: Voltage-controlled amplifier modules.

Ampex: Emphasis on new low-noise, high-output mastering tape, series 400, available with 1½-mil and 1-mil base, and in all standard widths. Ampex

also showed its multi-channel recorder/reproducers and film-lock units—the latter locks the AG-440 or MM-1100 of film, video, or other audio recorders. A search-and-cue accessory for these units was also shown.

Audio Devices: Pushed hard for a new low-noise, high-output studio mastering tape, available in 1½-mil (type 2506), and in 1-mil (type 3607), made with a new oxide, new binder, and new dispersion process; it has a backcoating with a controlled amount of friction for positive drive, and low resistivity to reduce static build-up. Audio Devices also showed some new broadcast tape cartridges, including the A-2SP, which has a close tolerance on inter-channel phase error to improve mono-stereo compatibility.

Audiotronics, Inc.: Tape to telephone line adaptor.

Automated Processes: Numerous units from their comprehensive line of line amplifiers and signal processing equipment; and also multi-channel consoles with automated mix-down.

BASF: The entire line of tapes, strong attention for a 20-times-enlarged model of their jam-proof cassette.

Bruel and Kjaer: "Reverberation processor" gives a direct reading of early decay time.*

Burwen Laboratories: Noise-reduction units, previously described in the literature, including the "noise eliminator" which is claimed to give a tape machine a 110 dB dynamic range, and the "noise filter" for reducing playback hiss with any program material.

CCA Electronics: New 6- and 10-channel stereo and mono audio consoles, with plug-in modules interchangeable in seconds, and each channel switchable to three inputs.

Columbia Records: Demonstrated recordings produced by the SQ matrix system for quad playback; a wide-range of program material in SQ form is on the market and was available for sampling.

Crown: Their well-known power amplifiers, tape machines; also introduced a line of loudspeakers using electrostatic units for the highs, dynamics for the lows. The speakers will be sold through regular high-fidelity retailers. A new intermodulation meter that approaches a 0.005% residual.*

DEX: Noise reduction units; voltage-controlled amplifiers.

Dolby: For the first time, their new 16-channel noise reduction unit, the M16, which at \$8000 costs about 25 per cent less than 16 separate Dolby A units, and takes about 30 percent as much space.

Duncan Electronics: Introduced at the show a line of plastic straight-line faders, using a new patented material, Resolon, with a guaranteed life of 5 million strokes.

Electro-Dyne Corporaton: A wide range of amplifying and signal processing equipment, audio control consoles, mixing units, modular amplifier-equalizer units.

Electro-Sound: High-speed tape duplication system, which operates at 240 ips.

Electro-Voice: High fidelity speakers, reproducing matrixed quad material using the E-V encoding system; a universal matrix decoder, and also broadcast and recording microphones.

Elpa Marketing: Ferrograph tape machines and associated equipment: Ferrograph recorder test set for many tape machine measurements.*

Epicure Products: Demonstrated their "linear" loudspeakers.

Fairchild Sound Equipment Corp.: Modular units for audio consoles and processing; a new public address unit, the Ambicon 653 SP, which senses the ambient noise level and adjusts the system output to override the noise.

Infonics: High-speed tape and cassette duplication.

JVC America: Demonstrated, in collaboration with RCA, the CD-4 discrete quad disc recording system.

MCI: New 24-input recording console with many automation features, including not only VU meters but also light indicators that show signal peaks at all times.

Maxell: Line of recording tapes for reel-to-reel and cassettes, including a new studio mastering tape.

3M Company: Line of professional "Scotch" brand tapes, including the new 200 series mastering tapes, cassettes, and duplicating tapes; and introducing the Series 79 pro recorders, including 24-channel recorders (Mincom Division). Also: new optional synchronizer using SMPTE time code.

Nagra: Miniature and portable stereo tape recorders.

Neve: New S24/8 automated console for 16-track

recording; also broadcast consoles.

Olive Electro Dynamics: Introduced the Series 2500 consoles, which provide up to 36 inputs, 16 + 4 outputs, adaptable to automated mix-down; also the automated remix programmer, usable with any dc programmable console and other specialty products.

QRK/Rek-O-Kut: Turntables, tone arms, mixers, audio cart machines.

RCA: Microphones, tape machines, custom audio consoles.

Recortec: Cassette tape loader with cue-tone option; cassette tape duplicator, with automatic features.

Revox: Dolby-equipped A77 Mark III tape recorder; FM tuner; stereo amplifier; the new Lamb four-input, two-out mixer, with studio console facilities (equalization, etc.); Beyer microphones.

Sansui: Demonstrations of QS matrix quad system.

Scully/Metrotech: Multi-channel recorders.

Sennheiser: Headphones; condenser and dynamic microphones; introduced at the show the new "Mikroport" wireless microphone operating in the 148 to 175 MHz band.

Shure Brothers: Microphones; mixers; phono pickups.

Spectra Sonics: Line amplifiers, equalizers, filters, power amplifiers for audio systems.

Stanton Magnetics: New dynamic headphones, models Forty and Sixty.

Systron-Donner: A series of spectrum analyzers of outstanding versatility and accuracy (see page 34 this issue).

TASCAM Corp. (TEAC): Mixing consoles; new 8-track 1/2-inch tape machines; TEAC alignment tapes; 4-channel tape machines. A flutter meter with flexible controls, and 0.1% full-scale range.*

United Research Laboratory Corp.: Capstan assemblies and other replacement assemblies for Ampex, Scully, Magnecord, and other pro recorders; AutoTec multi-channel recorders.

Xedit Company: Compact 16-track tape recorder.

In addition to exhibitors that were primarily manufacturers, a number of distributors of professional audio equipment took space at the show, including Audiotechniques, Inc., Stamford, Conn.; Harvey Radio Co., New York; Martin Audio, New York; Gotham Audio, New York.

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*Note: These instruments were described in more detail in the November issue.





ELECTRODYNE



LANGEVIN

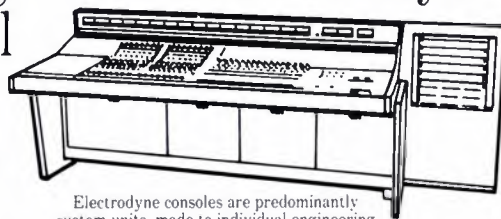


GAUSS

Cētec 13035 Saticoy, North Hollywood, California 91605
INC. A subsidiary of Computer Equipment Corporation

Cē·tec \sē-tek\ *n*: a new word meaning Electrodyne, Langevin and Gauss.

1 : a manufacturing facility where Electrodyne and Langevin audio control equipment and Gauss tape duplicators are designed and built



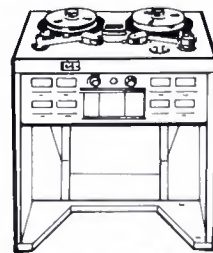
Electrodyne consoles are predominantly custom units, made to individual engineering specifications. They were the prototype for the modern audio control console, and remain among the finest consoles available at any price.

2 : a company which sells these products

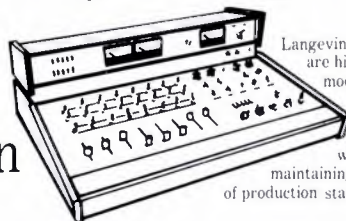
3 : an organization determined to maintain the traditional quality and technical excellence of these products.

If you really want to find out all about us, don't look in the dictionary.

Just call Don McLaughlin, Bart Bingaman or Phil Hanson at (213) 875-1900.



Gauss tape duplicators have been the technical standard of the industry since their introduction in 1966.



Langevin audio consoles are high quality modular units which provide for system flexibility while still maintaining the economy of production standardization

Cētec 13035 Saticoy, North Hollywood, California 91605
INC. A subsidiary of Computer Equipment Corp.

Sophisticated Audio Processing is a Staple of Good Radio Today



CBS Audimax is a compressor with a "gain platform" that reduces noise "pumping" in signal pauses; the gain is held constant during short pauses.



Roh Model 219 is a combination gated compressor and expander which maintains signal symmetrically around 0 dBm, with a 10:1 input/output ratio on either side.

EMT Model 256 (Gotham) is a very compact compressor designed for the microphone channel in a mixing console. It has switchable expansion built in to reduce noise pumping, and a switch to keep bass from operating the compressor.



IN OUR OCTOBER 1970 ISSUE we presented a chart much like that on the opposite page, showing the then current audio processing units of most principal manufacturers. When we came to update this information for the current issue, one main fact emerged: sophisticated audio processing is now an accepted fact of life in a substantial area of today's broadcasting. Many of the same units are still in the forefront of their respective makers' marketing efforts in this field, with perhaps a sharpening of characteristics here and there. But the main technical outline is the same, indicating a mature, effective technology. The major change, as noted, is in the broadening acceptance of this technology as an essential of all FM and a great deal of AM broadcasting.

In the article that accompanied the 1970 chart, we reviewed the main elements of the audio processing art. The following is a very brief resumé: The *limiter* reduces abnormal program peaks but does not reduce the average program level. It needs a very fast attack time for its change in gain. There are several variations on the basic limiter design. For AM, the *asymmetrical limiter* can treat negative peaks differently from positive peaks, to take advantage of the FCC's looser restriction on positive compared to negative. The *frequency sensitive limiter* uses automatic frequency compensation to offset the limiting errors or distortion that strong pre-emphasis can inject into the process. Limiters ordinarily have attack time in the few microsecond range, with release time adjustable because of the varying demands of different program material. Threshold is adjustable.

The *compressor* reduces average program level, with the input/output slope and threshold adjustable to the needs of the program material and the operator's quality decisions. Some compressors include *expansion* which takes effect at low levels to reduce the "pumping" of noise, the raising of the noise level that may occur during short pauses. Other units reduce pumping with a "gain platform" inhibiting gain change in short pauses.

Many refinements on these basic functions can be seen in a study of the accompanying chart. In particular, the combination units testify to the fact that in many applications both limiting and compression, or all three—limiting, compression, expansion—are useful acting in tandem or selectively. Also available are units which adjust release time, for example, automatically according to program characteristics.

BM/E

Audio Processing Amplifiers

Brand	Model	Compression Ratio	Attack Time	Release Time	Attenuator	Other Features	Price
Conventional Limiters							
RCA	BA-43/46	40:1	200 μ s	0.4-3.0 s	MOSFET VVR	mono & stereo	\$629 (m) 1136 (s)
Wilkinson	LA 2-C/S	>35:1	5/4 radians, first cycle	Instantaneous			495 (m) 850 (s)
Asymmetrical Limiters (for AM use)							
CBS Labs	Volumax 4000A	Infinite, 7:1	<1 μ s and/or <2 ms	LF—.15 sec. MF—.01 sec. HF—1 μ sec.	Diode	Auto peak phasing	725
Collins	26U-3	10:1	15 μ s clip 2 ms lim	0.1-0.2 s	IC	Peak clipper	765
Gates	6543	30:1	<10 μ s	3-7 s	Var. Xstr.		695
Frequency-Sensitive Limiters (for FM, TV, recording use)							
CBS Labs	FM Volumax 4100 (mono) (314) 4110 (stereo) (315)		Between 1 μ s and 2 ms, depending on pgm. waveform		Variable reactance Diode	50, 75- μ s curves	895 1595
Collins	26U-3	10:1	15 μ s clip 2 ms lim	0.1-0.2 s	IC	Peak clipper	765
Gates	6631	>50:1	40 μ s	0.2-10 s	Diff. amp.	HP Peak clipper	750 (m) 1550 (s)
RCA	BA46/47	— 40:1	1 μ s	1 μ s	Zeners	HP Peak clipper only	1064 (m) 2254 (s)
Dual-Band Limiter							
Altec Lansing	9473A	20:1, 12:1, 4:1	10 μ s	0.4 s (HF) 3.6 s (LF)	MOSFET VVR	Dual band, f = 250 Hz	735
Compressors, Level Controllers							
Altec Lansing	1591A	10:1, 5:1	30 ms	0.5, 1.5 s		Mike, line inputs	336
CBS Labs	Audimax 4440A (m) 4450A (s)	10:1	12 ms	Gated	Diode	Gated gain stabilization	765 1360
Collins	26J-3	15:1	5 ms	7-11 ms	IC	Gain platform	725
DuKane	2A80	10:1, 5:1	30 μ s	0.5-3 s		Noise gate	
McMartin	LR1004	30:1	5ms	15s			170
Roh	219	10:1 Comp. 10:1 Exp.	10 ms comp 1-10 s exp (adj)	1-10 s (adj)	EL/LDE	60 Hz Filter op.	130 20 filter
Wilkinson	GCA-1	variable, 1 pgm. dep.	variable	variable		responds to average level	475 m 795 (s)
Limiter-Compressors (Rack mount)							
Allison Research	Gain Brain	50:1 lim 40:1 comp	<1 μ s lim 7-40 ms comp	<1 μ s lim 250 ms-5s comp			313
Fairchild	725ACT	3:1	150 μ sec.	1-3 sec	LED/LDR	On Card	70
Philips Broadcast	5752 5753	20:1, 5:1, 3:1, 2:1	1 ms lim 0.2 ms comp	0.1-3.2 s	PDM	Noise gate	650 650
Spectra Sonics	Complimiter 610	100:1- 1:1:1	0.1-2.0 μ s lim 0.1-1.2 μ s comp	90 ns 50 ms-10 s	FET/VVR		585
Limiter-Compressors (Mike channel)							
Automated Processes	525	20:1, 2:1	15 μ s	0.1, 0.5, 2.0, 2.5 s		De-esser, ceiling control	325
EMT (Gotham)	256	2:1-20:1 adj.	app. 2.5 ms.	.25 sec-10-sec-adj.		Exp to prevent noise pump	666
Fairchild	663	2:1	3 ms	0.3-7 s	Lamp/LDR	De-esser available	156.50
Fairchild	692AGC	2:1	3 ms	0.3-7 s	Lamp/LDR	Remote control	115.50
Fairchild	725ALT	40:1	150 μ s.	1-3 s pgm dependent	LED/LDR	On Card	70
Gately	1800	20:1	10 μ s	0.1-5 s	EL/LDR	Rack-mount accessory	299
Melcor	CL-20	20:1-1.2:1	10 μ s	0.1-2.5 s	FET/VVR		272
Expander-Limiter-Compressors							
Allison Research	Kepex	2:1 0 to 15 dB 4:1 at 60 dB	<20 μ s	50ms-6s		Expander only	313
EMT (Gotham)	156	1:1.5- 1:2.5 exp >100:1 lim 1.5:1-4:1 comp	Program dependent 100 μ s lim 1-4 ms comp	1.5-7.5 s exp 0.25-2.5 s lim 0.5-3.5 s comp	PDM	Stereo only	2990
Gates	6629	1:2.5 exp 30:1 comp	7.5-35 s exp 100 μ s- 30 ms comp	4-10 s exp 12-53 s comp	Diff. amp.	Attack/recovery timing control	725 (m) 1490 (s)
Marti	CA-40/A	>10:1 AGC 40 dB	1 μ s lim	800 ms, 2 sec. 5 sec (adj)		Sym-Asym	445
RCA	BA-43/45	1:2 exp 40:1 comp	4 s exp 15 ns comp	6 s exp 3 s comp	EL/LDR		640 (m) 1158 (s)
Loudness Controllers							
CBS Labs	710 (mono) 711 (stereo)	Loudness dependent	100 ms	2.5 s	LDR		900 1800
Presence Equalizers							
CBS Labs	4500		25 ms	1 s	LDR		715
Fairchild	Dynalizer 673						

To Produce "Custom Commercials" For Radio—An Array Of Advanced Audio Equipment

Ralph Stachon and Associates, who built a business on syndicated music packages, station IDs, and custom commercials, put together in Dallas a recording studio that shows how important state-of-the-art audio is in today's radio "sound."

WHAT PUT RADIO on the comeback trail the last few years? There are as many answers as there are successful program formats, but in close support of nearly every one of the good programming ideas is *excellent sound*, particularly for FM stereo stations.

Just how serious knowledgeable radio program producers are about top-grade sound can be seen in a new studio facility built in Dallas by Ralph Stachon and Associates. Formerly based in Memphis, Tenn., RS&A produces: custom commercials, taking the client's ideas or producing from scratch; a large assortment of syndicated music packages for programming and commercials; ID packages to the client's specs, or using music or other programming developed by RS&A.

Creativity is obviously an essential part of the



This studio can readily accommodate over twenty musicians. AKG, Electro-Voice, Neuman, Sennheiser, Shure and Sony mikes are used.



Custom console has 20 inputs and up to 16 outputs. It is capable of doing quadrasonic recordings. Note 16-track recorder. Studio was designed by Welton Jetton.

operation. But the general specifications of the new studios show that top-grade sound is an essential too. The studio itself is 31 ft. x 36 ft. x 14 ft. and has sound-diffusing wall treatment to cut down room resonances. From 20 to 30 musicians can work comfortably in the space. Echo chambers are built in. The Audiotronics console has 20 inputs, up to 16 outputs, with quadrasonic capability. The complement of microphones is varied indeed, with top-of-the-line models from AKG, Electro-Voice, Neumann, Sennheiser, Shure, and Sony. There are 16-track, 8-track, 2-track and 1-track Scully tape machines. There are Dolby "A" units, Spectrasonic and UA limiter amplifiers, Kepex Gain Brain, a ring modulator, a VSO.

Remember, this equipment is used to make programs for radio broadcast. Probably only a few radio stations would want all the flexibility this complement of equipment supplies the program producer, but the quality of sound that equipment of this kind can produce is something an FM station can use to advantage today.

BM/E

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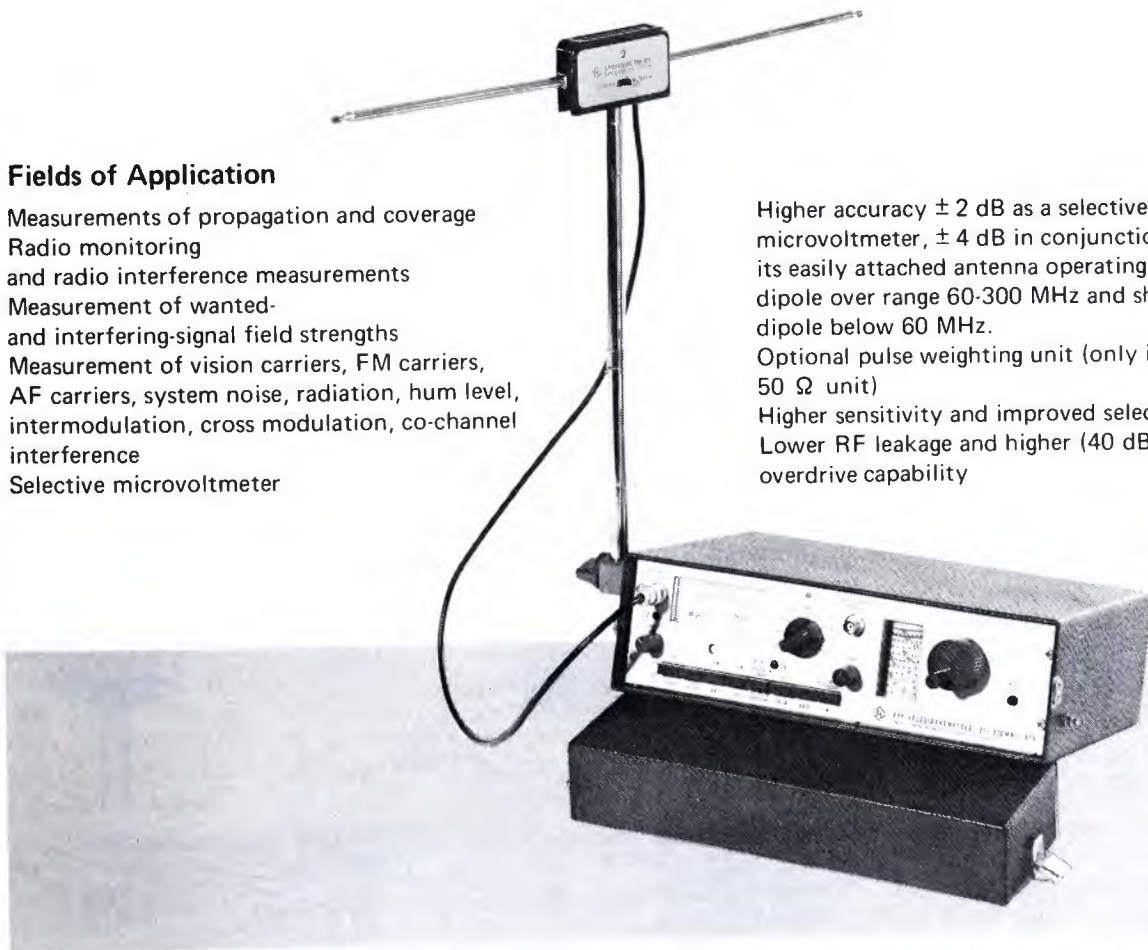
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More and more people are discovering how significantly superior Canon Zoom Lenses are for TV broadcasting purposes. Their outstanding color characteristics, even in dim light, is one of the many reasons why Canon was chosen for telecasting the Munich Olympics. Canon's wide range of excellent zoom lenses encompass three types of operation control— all-servorized, via flexible cables and by effortless push-pull rod control. And it can be attached to

fit and operate with any make of TV camera. Shown on this page are only a few examples of the quality lenses Canon has available to more than meet your particular demands. Specify Canon to stay ahead.

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The Canon TV Lenses Naming System



Applications	Image Format	Pick-up Tubes
P	21.4mmφ	1 1/4" Plumbicon
PV	16mmφ	1" Plumbicon

Apart from the above, Canon has available TV zoom lenses for 3" or 4-1/2" image orthicon cameras and can also build special lenses to fit your requirements.

Canon

Programming The Munich Olympics

By Donna & Joseph Roizen

THE TELEVISION COVERAGE of the Munich Olympics was by all accounts a superb technological feat in which the quality and uniformity of the color pictures seen in almost every corner of the globe was exceptionally good. One could hardly expect anything less from a host country that prides itself on Teutonic thoroughness and attention to detail in every aspect. Part of the credit for good pictures was the use of the most modern cameras and videotape recorders, all interconnected in a web of carefully phase-matched color sources.

Another significant factor was the emphasis placed on good lighting, both through the use of a translucent acrylic roof costing \$63 million in the main stadium (so afternoon shadows wouldn't affect the television pictures) and high-intensity color-corrected lighting, which achieved an excellent balance with solar radiation. Over 3600 people, under the direction of the DOZ, manipulated, measured, and maintained approximately \$30-million worth of color video equipment at its optimum level of performance for the 17 days that global attention was focused on Munich.

The uniform high quality on the technical side was not matched, however, by the production effort of the various different television networks that took their feed from DOZ. This was quite evident from watching the end product of such diverse television services as ABC, BBC, the DOZ home service, the ORFT programming, and the OIRT transmission to

Eastern Europe and the Soviet Union.

The first factor accounting for the differences is the relative value of air time, which is vastly different in our highly commercialized television system, and the virtually non-commercial nature of most of European broadcasting. Second is the differential interest of viewers in specific sports. Obviously, there is no point in using up air time to satisfy the 14 viewers in a given country who are aficionados of archery. The third factor was the difference in program format that is acceptable to the viewer and the producer and director. As an example, it was not unusual, while watching the color set in our apartment in Munich, to see the announcer query the control room while on the air and receive a response over the talkback system in the studio, which also went out to the German public, something one rarely sees or hears on the slick and glossy American networks.

European television in general has a somewhat more relaxed attitude with regard to time and the use of technical innovations, such as instant replay, slow motion, traveling titles, and chroma keying, and is somewhat less "razzle dazzle" than we have learned to accept from our sophisticated coverage of "Wide World of Sports" or NFL football. The description of the different types of programming that follows here will outline the methods used by the different networks to accommodate their home viewers.

American Broadcasting Company's approach

ABC's fast-paced coverage, which warranted a presidential phone call to congratulate the network on a job well done, was mainly the result of a

Ms. Roizen is a free-lance journalist; **Mr. Roizen** is president of Telegen Inc., and was technical consultant at the Olympics.

Opening and closing pageants and most significant athletic events took place in this main Olympic Stadium. Translucent acrylic roof eliminated shadows thus enhancing color TV. Electronic display panels and clock by Conrac posted events and scores. (See box for more details.)



combination of typical ABC sports expertise and some rather unique conditions they were able to negotiate with their German host.

The original position of the DOZ was that no unilateral coverage would be permitted to any of the more than 60 television networks that were applying for origination rights. In order to maintain total control, all origination would be the responsibility of the DOZ, and the participating networks would be given access to all feeds and facilities for recording, editing, and commentary in relation to the size of the network and a complex fee structure.

Since ABC must cater to a highly critical audience, whose attention span is as narrow as the channel spacing on the tuner (a condition not yet prevalent in Europe), it was important that a continuity of images of events of interest to the American public be obtained and those images needed to reflect the loyalty of American viewers to their own competing athletes. If one adds to these facts the value of prime time on a major network and FCC restriction on the amount of network time that can be allocated to a sponsored major event (ABC had planned 67 hours of coverage and later was reduced to 46 hours by an FCC edict), it becomes imperative that some unilateral control of the origination be achieved.

As a commercial network, without similar bilateral pool privileges in the EBU that European broadcasters had, ABC paid the highest single sum (\$13.5 million) for the exclusive rights to games coverage for the United States. Its technical staff headed by the Vice President of Engineering, Jules Baran-

than, and aided by Phil Levens from New York, and Jacques Lesgards, ABC's European manager—all veterans of the Mexican and Grenoble games—recognized several years ago that some special arrangements would have to be made to fully satisfy ABC requirements in a costly and competitive situation.

The DOZ was quite adamant about their position in which they justifiably felt they did not want to complicate an already intricate technical problem. However, ABC was just as insistent and in the end prevailed in obtaining a singular exception to the non-origination rule in which they were given permission to install additional cameras at the major venues of interest to the American viewers. This combined with several origination studios, a few mobile vans under their own control, and a host of VTRs, slow motion machines, and titling facilities, gave ABC the means to do the excellent job they did. It was no small undertaking. ABC employed a large staff of over 400 people to produce, out of the 1200 hours of available sports events, a condensation of less than 50 hours that, even when interspersed with the usual commercials, kept domestic viewers glued to the local ABC outlet.

When Mark Spitz won his medals, ABC-directed cameras could follow the action; when the U.S. basketball team lost, unilateral ABC cameras could maintain an American posture; and when Wottle ran, Ryan stumbled, and Shorter won, an ABC-installed camera down at the edge of the track could bring those crucial video moments in breathtaking close-ups into every United States home.

The combination of careful planning and elegant electronics produced for the viewer interesting images that may have looked easy, but required facilities and skills that stagger the imagination. The simple overlay of a familiar sports announcer on the backdrop of a full view of the main stadium, with inserted titles, required a chroma keyed studio shot from a color camera that could have been in the upper stands of the stadium or at the DOZ center a mile away. The full shot of the stadium came from the world's highest camera unipod, a Fernseh KCU-40, 750 feet above the ground on a platform located just below the rotating restaurant of Munich's tallest landmark, the "Fernsehturm." Character generators or graphic cameras added the legend that went with the picture.

Somewhere in the bowels of the DOZ, or under the grandstand of the stadium, millions of magnetic wiggles were being stored in Ampex AVR-1s or VR-2000s, later to be edited together into the short informative condensation of the day's major events (with room for the commercials), which were routed to the Raisting ground station by microwave. There they were transcoded to NTSC and bounced off the North Atlantic satellite and picked up at Andover, then relayed to New York where ABC spread it on the net. Satellite time is expensive and every minute had to count. With the time difference adding to the problem, it was virtually a round-the-clock process to hit the home viewers with the highlights. Midnight to 3 a.m. was the peak period at ABC's DOZ studios.

There is more to the Olympics than what happens

Acronym Glossary

The intricate complexities of any international activity is often reflected by an endless string of acronyms that serve to brevitize reportorial work by requiring only the repetition of the initials representing the bewildering array of endless entities. The Munich Olympics were no exception. Here is a short glossary that will clarify the terms used.

DOZ	Deutsches Olympia Zentrum, the organization specifically set up jointly by the two German networks to handle the TV and radio coverage of the games.
ARD	Arbeitsgemeinschaft Der Öffentlich Rechtlichen Rundfunkanstalten Der Bundesrepublik Deutschland/German National Television Network.
ZDF	Zweites Deutsches Fernsehen/German second network which is commercial.
RAI	Radio Televisione Italiano
ORF	Osterreichischer Rundfunk, Austria
ORTF	Office Radiodiffusion Television Francaise
ITA	Independent Television Association, U.K.
ABC	American Broadcasting Company
BBC	British Broadcasting Corp.
CBC	Canadian Broadcasting Corp.
NHK	Nippon Hoso Kyokai, Japan
OIRT	East European Network
EBU	European Broadcasting Union
PAL	Phase Alternation Line
SECAM	Sequential and Memory
NTSC	National Television Systems Committee

at the scene. ABC rounded out its coverage with excellent pre-game film and tape recordings of athletes working out in their own home towns, historical reviews such as the Jesse Owens story, and local color about Bavaria and its Herculean efforts to turn Munich into a modern Olympia.

While understandable nationalist pride kept most of the ABC cameras zoomed in on the American athletes competing for the gold, silver, or bronze, there was enough flexibility built into the system to accommodate any sudden change that would attract viewers to the human interest side. When Olga Korbut, the petite Russian gymnast, suddenly became the ballerina of the balance beam and captured the hearts of the spectators with her pert performances

when she won and torrents of tears when she lost, ABC shifted into high to concentrate on a sport in which America usually fares poorly and for which little air time had been allocated. Instead, U.S. viewers not only saw the joy and pathos of a little 17-year-old Russian girl competing in her first Olympics, but also learned a good deal more about this graceful sport from the expanded coverage and interviews that were hastily rescheduled when this event took on significant news value. The tragic events of the latter days of the games also underscored ABC's rapid reaction time, shifting the pace and the pictures to properly project a news story that required a totally different format than what they had been programmed for. If Emmys are given



Commentator monitors in gymnastic hall gave each commentator access to events taking place in front of him as well as those coming from other venues.



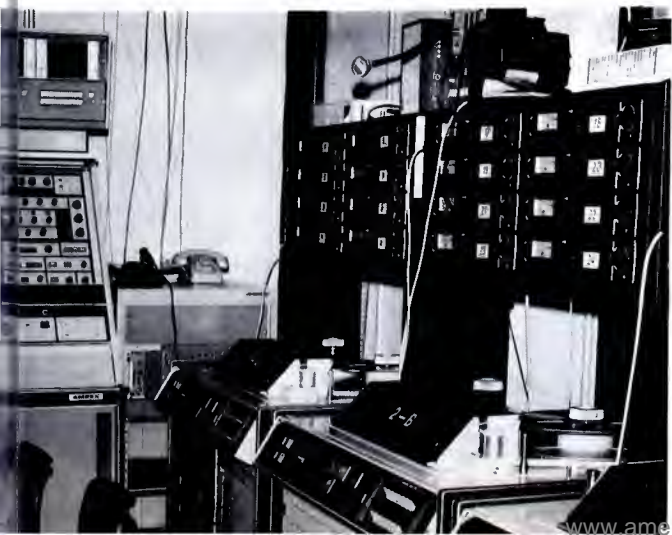
Mobile vans were brought in from all over Germany to help cover games.



Fernseh KCU-40 cameras were used throughout. Two shown here are covering volley ball game between Japanese and Korean women.



Central control switching room included 48 monitors displaying input and output signals from the venues.



Editing the swimming event with the use of the SMPTE 80 bit code and an RA4000 controlling a pair of AVR-1 recorders.

Up to 45 languages that might accompany a single picture could be accommodated in synchronism with the image by the 16 track Ampex MM-1000 audio recorders adjacent to the Ampex AVR-1 in the background.



BBC switching and VTR room containing four VR-2000's equipped with Conrac monitors and a portable VR-3000 for field work.



Off air monitors on top fed by RF cable system gave access to 12 potential feeds. Identification of feed is shown on monitor to the left of Snoopy.



Delegation switcher in VTR control room is tagged with colored stickers, the different colors representing different sporting events. This was to avoid confusion in assigning any of the 17 AVR-1's in the VTR pool.



Monitor wall showing part of the monitors used to indicate VTR feed in the VTR control room. Up to 13 simultaneous programs could be handled.



A little "gemutlichkeit" in the VTR center, left. Local German technicians, often of the female variety, have a beer break while on the job. At the right, the HS-100 slow motion disc in the CBC VTR room at the DOZ center keeps the eternal flame of the Olympics.



BBC commentary studio and adjacent control room showing the British announcer doing his overlay commentary at the medal ceremony of Japanese gymnast.

for program coverage or technical achievement in sports, ABC certainly deserves one this year.

Local German coverage

By far the most extensive coverage in terms of hours was the local coverage in Munich and the rest of Germany. Between the two German networks, ARD and ZDF, they put over 220 hours of sports programming. A special combination of the two networks (one national and one commercial) was formed under a common direction and called the DOZ. Its studios in the main television center and some of the venues were the originating points for interviews, sports round-ups, local commentary, etc. Banks of VTRs, slow-motion machines, and other audio and video recording equipment were pooled for editing and production purposes. Central control and switching rooms gave the DOZ access to their own camera positions at all the venues. Studio 5, DOZ's main operating studio, functioned in a rather unique manner.

The crew of 231 people maintained and operated the four-camera studio which had access to six simultaneous feeds as well as their own production. The cameras were Fernseh KCU-40s all equipped with 10:1 zooms. A boom microphone on a Vinten dolly and individual lavaliers took care of sound. The studio also had a chroma key backdrop and a display bank of six color monitors showing the incoming selected feeds. In the control room, the director had access to an HS-100 slow motion unit. Adjacent to the control room were two VR-2000s where programming editing was done.

Watching the output in our apartment in Munich was a rather unusual experience, until we became accustomed to German program production techniques. Studio television cameras were almost constantly in the picture as was the boom microphone and the studio crew. Apparently this isn't considered a deterrent to pictorial content. When the announcer or commentator ran out of something to say or wondered what was coming next, he inquired, while on camera, and was usually told by the director over the talkback system (studio P.A.) which also went out over the air for the information of the viewers. When titling or character generator overlays were used, the background image was attenuated so that the titles were more visible over a relatively dark video image. Slow-motion utilization started out being rather simplistic. It appeared as though the last ten or 20 seconds of each event were being replayed at about half speed with no stopped images at the critical point. As the games continued, the manipulation of the slow-mo equipment obviously improved, but was never used to the degree American viewers are accustomed to. (It was, however, pleasant to view programs in their entirety without being interrupted by incessant commercials. German commercials on ZDF are grouped into a 20-minute block, sometime between six and eight o'clock, and can be easily avoided by shutting the set off. Interestingly enough, because of this factor commercials are surprisingly entertaining.)

While the program format may have not been tailored to American taste, there was no denying the

Conrac Electronic Display Panels

The two scoreboards for the main Olympic stadium, one at each end of the huge structure, were built by Conrac. Each had 24,000 bulbs which could be lit selectively under manual or computer control. Letters and numbers were formed on 5-x-7 bulb rectangles, or up to four times that size for emphasis. The whole board would accommodate 10 lines of 34 characters each, and the message could be rolled if more space were needed. Characters or words could be underscored, or material could flash on and off at a selected rate.

Not only alphanumerics, but also drawings, emblems, and maps were shown. The operator could preview any material for correctness on a monitor at the control position and edit out errors.

The boards not only gave the "score" immediately for each event, but also showed stylized graphics illustrating the event, or in some cases "illustrated" its progress. For example, the boards showed a map of the marathon run with the positions of contestants indicated by arrows throughout the race.

superb quality and uniformity of the color pictures, whether we saw them on the studio monitors, the RF-distributed press monitors, or off-the-air reception from the Bayerischer-Rundfunk in our apartment on a standard home receiver.

Eastern Europe and Soviet Union coverage

There isn't much doubt that Communist countries tend to look at the Olympic games as more than just an athletic contest. Since their athletes are state supported, the sponsoring governments tend to view their accumulation of Olympic medals as an endorsement of their social system. Against the backdrop of the major confrontation between the U.S. and the U.S.S.R., even smaller nations such as East Germany participated in the games with the avowed intent of surpassing their western counterparts. It was an open secret that East German athletes are given handsome bonuses and extra privileges for bringing home the gold. Evidence that this incentive worked was East Germany's disproportionately high standing at the end of the games in relation to its size.

Television, of course, also served to publicize the athletic achievements of socialistic nations and was used extensively for that purpose. The Eastern Bloc countries have a television network of their own called Inter-vision which operates between OIRT nations. A switching center in Prague relays signals to the rest of Eastern Europe and the Soviet Union. Since most of these countries, including East Germany, use the SECAM process for color, the pictures had to be transcoded in Munich before relaying them eastward. A special OIRT studio was set up by Sudwestfunk (the ARD station in Baden-Baden) at the DOZ center. The studio was equipped with two Fernseh KCU-40 cameras and one graphics camera. Adjacent to the studio was a control room which was in turn connected to a telecine and VTR center containing two Fernseh BCM-40 recorders and a film and slide chain. The studio was used for interviews with athletes and overlay commentary of announcers representing countries such as Poland, Hungary, Czechoslovakia, Roumania, and the

continued on page 68

Sharpening Vertical Resolution In TV With Video Delay Lines

By R. I. Carrington-Smith

By comparing one scan line with the next to be displayed, and generating a correction signal, vertical resolution can be sharpened. Solid-glass delay lines do the trick.

VERTICAL RESOLUTION IN TELEVISION CAMERA SYSTEMS is lost primarily because of the size of the electron beam that scans the face of the camera tube. As the beam scans a horizontal edge between all-dark and all-light areas, the resulting voltage is proportional to the percentage of the beam that covers the dark region. Thus, the vertical transition between dark and light areas becomes softened as viewed on a TV receiver.

The apparent vertical resolution in color TV pictures (black-and-white, too) can be improved with a video delay system using modules consisting of solid glass delay lines with associated input/output circuitry. This is done by comparing the previous scan line displayed with the next line to be displayed and generating a correction signal, which is then subtracted from the line currently on display. This technique sharpens the horizontal edges by darkening the dark areas and lightening the light areas. The familiar term for this process is vertical contour enhancement.

System operation is quite simple

A block diagram of a vertical contour enhancer,

Vertical Contour Enhancement For Everybody

Vertical contour enhancement systems have been around in the broadcast television industry for at least six years—either built into the camera or as part of the camera chain. Many early color cameras were not equipped with an image enhancement system and must be modified to bring them up to acceptable standards. This can be accomplished either by purchasing a complete image enhancer, if a suitable one is available, or by designing one yourself to fit your system's needs.

Designing a vertical contour enhancement system has been vastly simplified since the development of broadcast quality video delay lines. These elements—available in module form—represent the heart of any vertical contour enhancement system and have specifications that far exceed those previously available.

Mr. Carrington-Smith is supervisor of Circuit Design & Development, Corning Glass Works.

Fig. 1, shows two unity gain delay modules, two summing circuits, one variable attenuator (or division circuit), and one subtraction circuit (or one additional adder preceded by an inverter). The main signal entering the system is a normal video signal (Y_{t+1}), and the signal leaving is the corrected video signal (output), which occurs at about the same time as Y_0 . Line Y_0 is the "line presently being displayed," Y_{t+1} is the "next line to be displayed," and Y_{t-1} is the "line previously displayed."

Fig. 2 allows one to follow the signals. The picture being taken consists of adjacent dark horizontal and vertical rectangles against a light gray background, lying between lines 191 and 197 on the camera pickup tube. For this demonstration, all lines are in one field, i.e., successive in time, not space. The interlaced field is processed similarly. Also, voltage polarities were chosen to simplify this illustration.

As the beam scans line 191, only a signal for the gray background is generated. See column Y_{t+1} . On line 192, the signal voltage is increased when it encounters the horizontal rectangle. The signal for line 193 is identical, since the picture content is the same. The remaining signals are similarly described in column Y_{t+1} .

Considering the lines as horizontal sweep periods, the signal Y_0 out of the first delay module is identical to the input, but shifted down one "line." Similarly, the output Y_{t-1} from the second delay module is shifted down one additional time period from Y_0 , or a total of two time periods from Y_{t+1} . Considering Y_0 to be the main signal, Y_{t+1} is the "next line" and Y_{t-1} is the "previous line." To do this, the unity gain delay modules should each have a delay time of exactly 63.556 microseconds for color and 63.492 μ sec for black-and-white.

Adding Y_{t+1} and Y_{t-1} produces signal Y_w in Figs. 1 and 2. The divider that follows is variable, to allow best enhancement under different operating conditions. Typically, the value of gain used is one-half.

The signal from the divider is Y_x . The correction or contour enhancement signal is derived by subtracting Y_x from Y_0 . In transition from light to dark, the correction is positive; from dark to light, it is negative. When this signal Y_z is added back to the main signal Y_0 to produce the output, the line just prior to the first line in the dark horizontal rectangle is made slightly "whiter" than the rest of the background. Compare 192 at the output to 191 at the

put, and the first dark line in the rectangle is made darker. Compare 193 output to 192 input.

For the next output line, 194, only the dark area lying above the gray is made darker; the transition from dark to dark is not enhanced. In line 195, the gray area under the horizontal rectangle is made lighter than the normal background gray; again, the dark portion from the vertical rectangle remains unchanged. From 195 to 197, there are no vertical transitions from light to dark or dark to light, so 196 is not enhanced. It remains identical to Y_0 ; note that the correction signal Y_z for 196 is zero. In lines 197, 198, and 199, respectively, the dark area is darkened, the light area is lightened, and finally no correction is made.

Delay line is the key

The delay line is the critical component. Its function is best realized with a glass acoustic delay line of the type supplied in video delay modules to the U.S. television industry the past five years. The special glass as a nominal temperature coefficient of

time delay of zero.

The unity gain module, Fig. 3, contains the circuitry for interfacing video signals with the ultrasonic delay lines. Since the delay line is a bandpass device, the video frequencies must be shifted into a spectrum that allows storage with minimum attenuation and phase distortion. A radio frequency carrier is modulated at the video rate and the appropriate frequencies are selected by a high-pass filter. After storage, the modulated carrier is demodulated and the delayed video is amplified for unity gain. Figure 4 shows typical implementation.

For a two-horizontal line (2H) delay module, the second delay line does not require an additional oscillator modulator, since it can be driven by the modulated RF voltage from the output RF amplifier of the first delay line. The time delays of the glass lines might be different, however, because of the different circuitry used in each channel. Thus the delay lines must be cut to the exact time delay dictated by TV standards and the specific circuitry used. **BM/E**

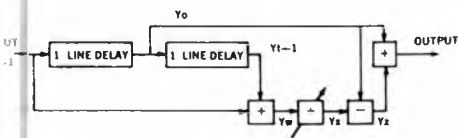


Fig. 2. Block diagram for vertical contour enhancement system for television camera.

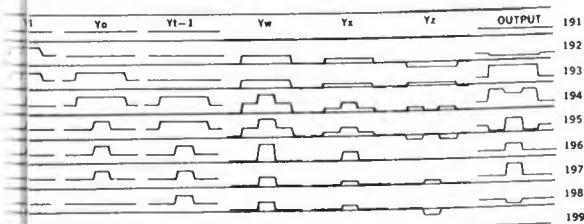


Fig. 3. Contour enhancement signals as camera looks at adjacent horizontal and vertical rectangles, as presented at top.

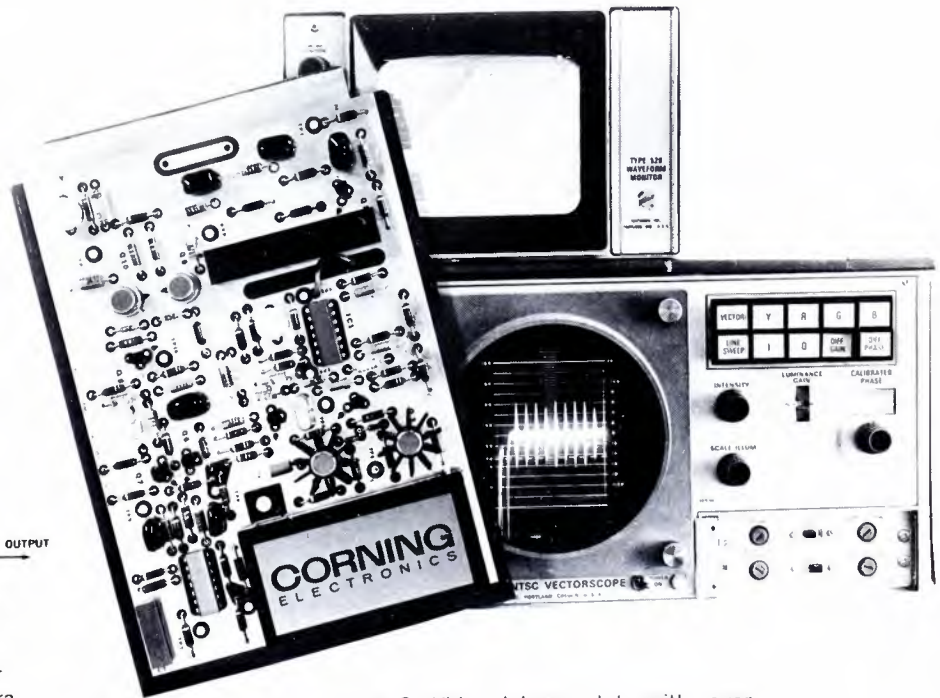


Fig. 3. Video delay module, with cover removed, in front of monitors.

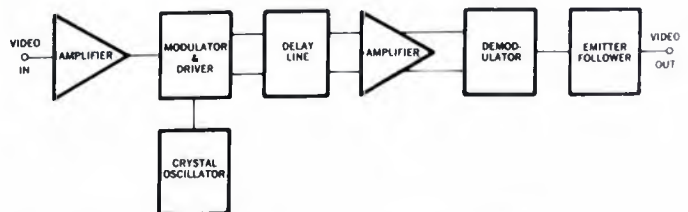


Fig. 4. Typical implementation to interface video signals with glass delay line.

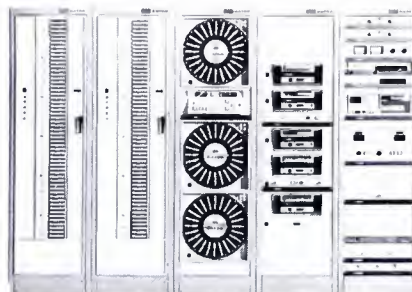
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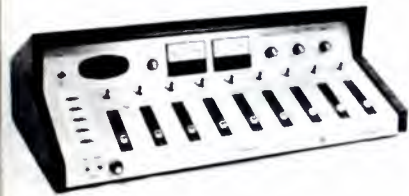


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Circle 131 on Reader Service Card

BROADCAST EQUIPMENT

Audio console has nine channels, six of them high-level stereo, two low-level mono, one high-level



mono. Model TAC-2C uses identical monitor and cue amplifiers for interchangeability. Rated noise is -130 dBm weighted, and harmonic distortion less than 0.25%. \$3195. WILKINSON. **300**

Redesigned turntable has start-up time of 1½ seconds at 33½ rpm; **matching arm** has non-friction magnetic anti-skating control. Thorens TD-125AB Mark II turntable has



new electronic circuitry and motor pulley for fast start, low speed (250 rpm) motor for low rumble (-68dB weighted). Thorens TP-16 arm has tracking error of less than 0.2% per centimeter, honed ball bearings. ELPA MARKETING. **275**

Digital tape cassette has rigid metal frame. Norelco Model DC300 is certified 100% free of dropouts after assembly, meets the standards of ANSI, ECMA, and ISO, and is compatible with all cassette transports used in digital data processing equipment. Tape is tensilized polyester certified for 1600 flux reversals per inch, 282 feet long. AMPEREX ELECTRONIC CORP. **276**

High-speed tape copier makes five copies from a master reel. Model 1056 has a single capstan driving the master and all five copy tapes. is a compact unit, 42½ in. wide x

21 in. high x 17 in. deep; usable on desk or table. GARNER ELECTRONICS. **277**

Quarter-inch videotape is issued in new two-hour lengths. Irish ¼-in. tape is available in 30-, 60-, and 120-minute reels. Prices \$9.95 to \$39.95. IRISH ELECTRONIC ENTERPRISES. **278**

Moderately-priced FM/SCA receiver has crystal-controlled oscillator, high-Q input circuits for low cross talk. Model TR-E2 is completely self contained, is certified to comply with Part 15 of the FCC rules for educational and services-to-the-blind broadcasting. McMARTIN. **280**

Photometer measures light to very low levels (for example the luminance of a dime in moonlight at

1000 feet). The Model 1980 Spectra Pritchard system can be powered in the field of accessory battery pack that runs five hours without recharging. Other accessories include 12X Cassegrain telescope objective that puts angular measurement as low as 0.17 arc minutes. PHOTO RESEARCH. **281**

Cartridge for continuous 16mm projection controls the projector, instead of the other way around, so tension is automatically eased. "Eterna" cartridge has oversized center roller and friction-less feed, can be used with most 16mm projectors. BERGEN EXPO SYSTEMS, INC. **282**

Two substances which reduce cable deterioration are: a spray inhibitor against moisture, salt, acid, and
continued on page 58

Use this unique, complete test facility free for 30 days!

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- Millivoltmeter
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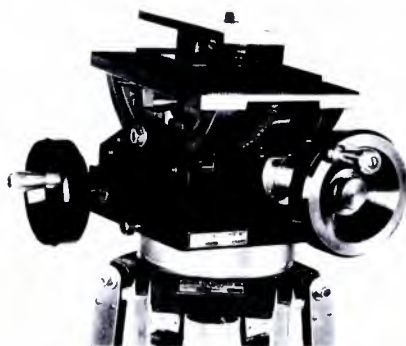
PRODUCTS

other chemicals in soil or air; and an instant cold galvanizer, which puts a zinc coating on metal. The first, LPS-3, also penetrates and lubricates metal parts without harming non-metallic components. The cold galvanizer, LPS, is in aerosol spray form and fuses the zinc to the metal. AMECO. **283**

Cable carrier holds extension cable in coil, allows any length to be pulled out for use. "Cablesafe" allows connection through cable with any length pulled out; remainder is protected within carrier. TENASTIC, INC. **284**

Phono pickup cartridges for CD-4 discrete four-channel discs claim substantially flat response to 45 KHz. Models AT-14S, AT-15S, and AT-20SL have Shibata stylus, and dual magnet design. \$69.95, \$100, and \$150, respectively. AUDIO-TECHNICA U.S. INC. **285**

Cradle gear head for cameras up to 50 pounds weight has fingertip-controlled 2-speed pan-and-tilt. Model



CGH has teflon-coated cradle slides, large-diameter hand wheels, and low center of gravity to improve maneuverability and stability. NATIONAL CINE EQUIPMENT, INC. **286**

Adjacent channel bandpass filters for TV channels 2 through 13 provide 40 dB of adjacent-channel isolation. Units have Type F, 75-ohm connectors and are factory-tuned to designated channel, with no field adjustment. \$150. R F SYSTEMS, INC. **287**

Tape digital numbering system puts identifying code on each frame of video recording, allowing any part of tape to be located to within one-tenth of a second. "Tapecode" can put on the tape elapsed time, 24-hour time, digital counts to 99,999,999 or binary coded output, without alteration of the recorder or in-

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Sony's new condenser microphones; ECM-64P (Uni) and ECM-65P (Omni) handle sound pressure levels up to 137 dB, with less than 1% distortion.

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PRODUCTS

interference with the signal. Digital readout unit reads the code, or an additional unit can be added to operate external switches at pre-settable points. VIDEO ELECTRONICS LIMITED (UK): (U.S. Agent: DENLEN ELECTRONICS CORP.) 279

New computer program for broadcast stations gives quick access to operating information, from sales to air scheduling. IBM System for television and radio uses an IBM System/3 computer, can also do accounting and sales analysis, reports on audience characteristics, commercial costs analysis and other accounting. Monthly charge, \$375. IBM CORP. 288

Compact fill light for studios has a 650-watt quartz lamp. "Minibroad" weighs only 20 ounces, has a pan



and tilt handle, with full 180-degree vertical tilt, is easily carried anywhere. \$36. BERKEY-COLORTRAN. 289

Coaxial cable with expanded polystyrene dielectric has less attenuation than standard aluminum sheathed cable, allows trunk line amplifiers to be 20% further apart than standard cable does. "Styrafoam" cable is made by computer-controlled manufacturing process which automatically adjusts cable parameters for uniform quality. CERRO WIRE AND CABLE CO. 290

Cartridge tape system for data processing and process control reads or writes up to 18,000 bits per second. Cartrifile 20 uses two endless-loop tape cartridges in a player unit. Sig-

continued on page 60

15 day free trial shows you why ITC tape cartridge equipment is an industry leader.



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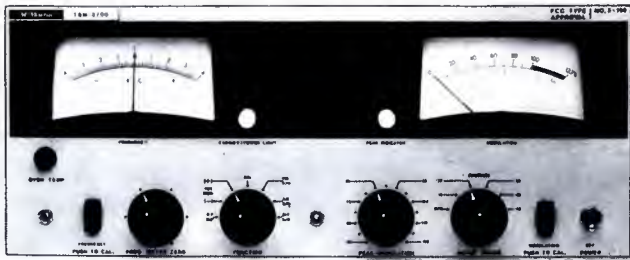
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PRODUCTS

nals can come from most popular minicomputers; two 150-foot cartridges will store nearly 6.5 million bits. \$3650 with computer interface. TRI-DATA CORPORATION. 291

New scope series has 100-MHz performance at moderate cost. Cabinet model 7603 and rack model R7603 accommodate 26 different plug-ins for different measurement purposes. Included are new plug-ins, the 7011 digital delay unit and 7015 counter timer, which measure features displayed with digital accuracy. TEKTRONIX. 292

VHF field strength meter covers 25 to 300 MHz; reads to ± 2 dB as a selective microvoltmeter. Model HFV has linear and logarithmic in-



dication, peak and average value indication, 40 dB linear overdrive capability. It is available with 50-ohm input for transmitters and with 75-ohm input for CATV. RÖHDE AND SCHWARZ. 293

Two-way distribution amplifiers use hybrid integrated circuits. Series 6500 amplifiers send downstream



signals in 54-300 MHz band and upstream in 5-108 MHz band. Single housing holds all circuit modules. SCIENTIFIC-ATLANTA. 294

Maintenance kits for each type of tape recorder include equipment for preventive maintenance of open reel cassette, or cartridge tape machines. "Totokit" kits have the proper maintenance materials for each type of recorder selected for

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PRODUCTS

the user, including all cleaning, de-magnetizing and splicing equipment. \$20.50 to \$24.50. NORTRONICS.

295

Directional wattmeter measures pulsed RF systems, reading peak or average (CW) power. Model 4314 samples forward or reflected power in a precision 50-ohm line section. Frequency ranges (selectable by plug-ins) are 0.45 to 2300 MHz. Power gauges, 1 watt to 10 kw. \$625. Extra plug-ins, \$32 to \$75. BIRD ELECTRONIC.

322

Digital clock system puts time on a video signal for display in studios, CCTV, on tape or on the air. Series 60,000 includes the clock, plus one insert/keyer for each video source, puts time band anywhere on screen, in white numerals on black band. System also has BCD output and is TTL/DTL compatible in parallel or character serial form. \$3200. CHRONO-LOG CORP.

323

Automated mixing console handles up to 24 inputs, records original gain control settings for all inputs in digital form on an audio track, which operates voltage-controlled attenuators in play-back to recreate original mixing pattern. Digilog Mixdown Programmer is marketed as a self-contained unit or can be retrofitted into existing multi-track mixdown systems. AUTOMATED PROCESSES.

324

Clean-air unit puts strong downflow of laminar filtered air on VTR equipment. Isolair hangs from ceilings (no floor space), reduces dust in contact with heads, to extend head life. Particles 0.3 microns and larger are 99.97% removed; air flow is 100 ft/minute. LIBERTY INDUSTRIES.

325

Series of medium-priced receivers uses replaceable modules to cover range of applications, including hf/mf communications, high-quality broadcast with stereo FM, maritime applications, and others. 1000 Series has a basic chassis unit common to all, uses integrated circuits whenever possible. Approximately \$550 to \$1500. MARCONI COMMUNICATION SYSTEMS.

326

Contact cleaner can be sprayed onto electrical contacts continuously during life of contacts. Electro Contact Cleaner leaves no residue, will not cause sparking or arcing during operation, repels dirt and dust as well as cleans. A. W. CHESTERTON CO.

327

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Outstanding sensitivity and near perfect reproduction. RIAA/NAB equalized — 0.5 mv sensitivity @ 1 KHz for +4 dbm out — Balanced 600 ohm out — minus 65 db S/N ratio — -20 dbm out max — -1 db freq. response — Internal power supply — Table top/bracket mount. Shipping weight, 3½ lbs.



MIC/LINE AMPS

MLA-1 (Mono) \$68
MLA-2 (Dual) \$96

Dual function utility amp. Inputs for mic and/or line — 600 ohm balanced outputs — mic input, —65 db for +4 dbm out — -20 dbm out max. — 0.5 db response, 10 Hz-20 KHz — 0.1% or less dist. — Internal power supply — Tabletop/bracket mount. MLA-2, Stereo/Dual Mono. MLA-1, Mono. Shipping weight, 4 lbs.



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6 BALANCED OUT

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One third the cost of comparable units. Six 600 ohm balanced outputs — Balanced bridging input — 26 db gain — -20 dbm out max. — Input level control — 0.1% or less dist. — -0.5 db response, 10 Hz-20 KHz — Internal power supply — Tabletop/bracket mount — Shipping weight, 4 lbs.



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Precision winding without guesswork. Dial in the minute and/or seconds desired, throw switch to run. That's it! The exact amount of tape is fed onto the cartridge hub to the second, and shuts off automatically. No waiting around, no guesswork and 1 sec. accuracy. Also has exclusive torsion control for proper tape pack and winding of various cart hub sizes. TTL digital control circuitry. Shipping weight, 30 lbs.



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One look will convince you that the Gatesway 80 monaural 8-channel console is the best buy for your money. Here's why:

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20-20kHz ± 1dB
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NEW LIT

For copies of these literature offerings, circle number for appropriate items on Reader Service Card.

Comprehensive technical data brochures are issued on the **Sivicon family of TV camera tubes**, with detailed mechanical, electrical and optical characteristics. **Amperex. 200**

"Sound System Design Calculator" is a slide-rule device which solves quickly a number of specialized sound system problems, including the computation of directivity factor, directivity index, room constant, critical distance, average absorption coefficient, etc. \$2.50 each from Altec, 1515 S. Manchester, Anaheim, Calif. 92803

"The IC Troubleshooter," 20-page brochure, describes logic probes, logic pulsers, logic clips and comparators which are used for **in-circuit, in-operation testing of digital ICs**, with application notes for typical operations. Hewlett-Packard. **201**

Data sheet covers **background music master unit** which holds up to six special continuous-loop reels running 10 hours each at 1⅞ ips, with automatic sequencing from reel to reel. Rowe International. **202**

Fundamentals of coaxial cable are treated in 8-page application note which answers such questions as, what is characteristic impedance and how is it related to cable parameters? Included are tables showing electrical characteristics of about 35 cable types. Tektronix. **203**

Interface equipment, including **coaxial switching, patching, cables and connectors** are shown in detail in 64-page catalogue, which includes a general introduction on cable applications in a number of fields. Trompeter Electronics. **204**

Two RFI and field intensity analyzers, covering 10 KHz to 250 KHz, and 150 KHz to 32 MHz respectively, are described, with characteristics, and application notes, in 8-page brochure. Singer Instrumentation. **205**

A new 16-page pamphlet includes detailed specifications on a line of

A single system to grow with, the Roh 200 Series can provide most of your audio equipment requirements. Choose from a dozen popular audio modules; also a variety of equipment enclosures and accessories.



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NEW LIT

electronic stroboscopes. General Radio. **206**

Neumann stereo tape-to-disc transfer equipment, including the computer-controlled lathe, stereo cutterhead, and audio mixing console with tape deck and preview head assembly, are subjects of a new technical brochure. Gotham Audio. **211**

Wide-range synchronizer for video and audio tape, which maintains frame-to-frame lock between any two magnetic tapes using SMPTE edit codes, is described in new four-page brochure. Electronic Engineering Company of California. **212**

"Video Delay Line" is a new product bulletin on a glass-delay-line system which includes all interfacing electronics, and usually provides one horizontal scan time of delay (other times available). Corning Glass Works. **213**

CCTV accessories for commercial and industrial security and surveillance systems are listed in new catalog covering more than 300 items. Vicon Industries. **214**

CATV instrumentation, including an open-match-short indicator, two-channel signal level meter, broadband and single channel RF level meter, etc., are described in technical brochure. Mid State Communications, Inc. **215**

"Cinema Perspectives" is a new 16-page color magazine covering technical and esthetic aspects of motion pictures, in comprehensive articles. Cinema Products Corporation. **216**

"Mastering the Microphone" is a new brochure giving fundamentals of microphone choice and use in various applications; also available are detailed catalogs on the complete microphone line, and on professional microphones and accessories. Shure Brothers. **217**

Time code generators, with new features of nixie display and positive logic BCD output, are the subject of technical data sheet. Chrono-Log Corporation. **218**

Hum stop coil for reducing hum and other interference in video lines, in remotes or in studio systems, is explained in data sheets. Audio-Video Engineering Co. **219**

Electronics catalog for 1973, showing complete line of home entertainment products, audio equipment, CB units, antennas, test instruments, etc., has been issued. Radio Shack. **221**



Engineer Brian Morgan gets ready for on-air disc playback.

Stanton. Everywhere you turn.



Charles Parker, Program Director, and Chief Engineer Wayne Mulligan, auditioning discs.

Hartford's "Top 40" WDRC AM/FM (serving the community for a half century!) relies on Stanton cartridges in a variety of operations.

Chief Engineer Wayne Mulligan says.

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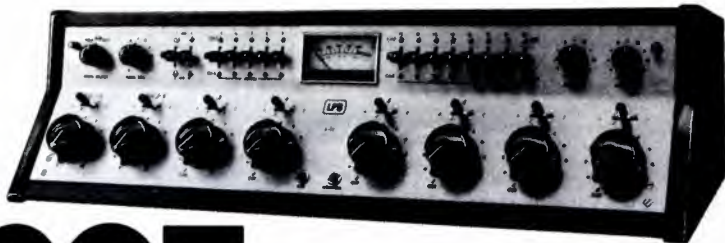
The Stanton Dynaphase headsets seen in both photos, enjoy professional acceptance for their true and full-bodied reproduction. They are lightweight and comfortable.

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... for LPB's S-15, 8-Channel, Dual-Output Mono Signature Line Audio Console with 19 inputs. In addition to moderate price and excellent performance, the S-15 features:

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CROSSTALK

Further Feedback on the Cart Quality Problem

We continue to get letters and articles from people in the industry with advice, concern, or even outrage on the stereo cart quality problem. As articles in a number of earlier issues have set forth, one of the main problems is phase error between the two channels, which can have disastrous effects on quality for mono listeners (still a large majority of FM listeners), and even cause erratic effects on frequency response in stereo.

A fair consensus on the cause is inadequate tape guidance in the NAB standard design as widely interpreted. The main focus of criticism is the corner post just ahead of the playing head. The post, the critics say, has to do too many things: carry the tape around a turn (at least 90 degrees), get its plane parallel to the head, get it at the right height for gap registration, and stabilize the tape in both vertical and horizontal planes. The tape reaches the head with a lot of skew from being pulled off the center and over the reel.

One approach to the problem, the adjustable corner post, has apparently not established itself as a good answer. Two other more recent designs, the IGM Aristocart and the Audiopak cart, rely on high-precision molding plus, in each case, some elaboration of the guidance system. These were described in the article and box in our November issue, and early reports suggest they have taken a promising line.

A vigorous restatement of the cart problem, from the point of view of a maker of cart playing machines, is in a letter sent us by Paul L. Shore, president of Tape-caster TCM, of Rockville, Md., excerpts from which follow: "Broadcasters depend upon cartridge tape equipment to produce much of today's programming. . . . Unfortunately today's prevailing cartridge design is antiquated. . . . "The first cartridges were used in the background music field and in other less demanding fields. Their first use in broadcasting occurred in the late '50's, and the cartridge concept grew at an exponential rate in spite of quality and reliability problems. The early machines were plagued with numerous problems

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both electronic and mechanical, and, to a large extent, the cartridge itself. The first machine on the market suffered from erratic loss of frequency response. This was primarily caused by the unstable front left corner post in the cartridge, and the decision to place the audio head on the left and the cue head on the right. Some agencies and advertisers gave instructions not to dub their spots to cartridges. The second manufacturer in the field had the good fortune of designing its equipment with the audio head on the right. This minimized the problems and gave the broadcasters a practical cartridge system.

"In 1961 a committee was formed by NAB to set standards. This committee compromised and set standards around the existing equipment and the existing cartridges. While the standards were desperately needed, little was done to perfect a better cartridge for broadcast applications. Another compromise by the committee was to standardize recording on the left head and playing back on the right head. This reopened Pandora's Box, and the cartridge deficiencies raised their ugly heads again. In most cartridge designs the tape changes its axis when traveling around the front left corner post. Because this post is located so close to the left head, the tape is unable to stabilize before it passes across this head. . . . Solution to this problem is to change the tape axis and control the tape height inches before the tape reaches the front left corner post. Another problem is the lack of rigidity in the cartridge. This can be improved by the selection of molding material and the designing of ribs and braces within the cartridge. Rigidity will also be improved if the design incorporates tongue and groove mating of the base with the top. Also at least 2 or 3 screws should be used to firmly secure the top to the base. . . . In conclusion, most of the cartridges now available are marginal in performance. A new cartridge has long been needed, preferably one that does not require the user to modify his present equipment. . . . Once the broadcaster becomes aware of the problems with the cartridge, he should demand a cartridge of higher quality. As an equipment manufacturer, this writer realizes that the performance of today's cartridge machines is limited by the cartridge and that any improvements in the design of machines are nullified by the limitations of the cartridge. . . . If the cartridge manufacturers react

and improve their cartridges, the state of the art of broadcasting will be advanced."

Another letter, this one from Kenneth B. Schneider, director of marketing for Garron Electronics of Sunnyvale, California, gives interesting detail on various approaches made by that firm, another maker of cart players, to improving cart performances. Here are excerpts:

"The problems fall into three areas:

1. The phase stability of a single cartridge in a single machine. . . . Obviously the choice of a stable

cartridge, one which experience shows introduces little or no phase error, and correct head alignment will minimize the problem.

2. The phase stability of different cartridges in the same machine. . . . If this problem exists, it is being introduced by the cartridge. Again, careful selection of cartridges will alleviate, or tend to minimize, the problem.

3. The phase stability of different cartridges in more than one machine. . . . This is the maximum problem and is most often encountered. Placing two or more ma-

continued on page 66

**"8" CHANNEL
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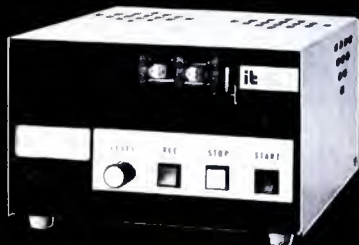
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CROSSTALK

chines in identical alignment is more difficult than optimizing a single machine. Here at Garron, we have conducted extensive investigations into the phase problem and have reached the following conclusions:

1. The NAB cartridge is, at best, a compromise. It provides from 1/2 to 2/3 of the tape guiding. Due to the poor quality of edge guiding, phase problems are likely to occur. In the cartridge portion of guiding, the largest problem area appears to be the guide between the head stations. Investigation was conducted using a behind-the-tape guide in the machine at this point, and experimentally it was shown that phase stability would greatly increase. However, since cartridges vary from manufacturer to manufacturer, this idea was abandoned, since it would force the customer to use a particular brand of cartridge. This is not desirable to the end user or to us as a manufacturer. Dynamic phase-shift (skew) characteristics in a cartridge are a result of changes in tape pack tension and changes occurring at the guide post. Here we must look to the cartridge people to make further improvements.

2. We investigated using a third tape guide in the machine at the head stations, but rejected the idea because it increased edge wear on the tape and also caused intolerable increase in flutter.

3. In our own equipment we developed a stable cast head mount that still offers complete adjustment. This prevents drift in head alignment and assures phase stability limited only by variations introduced by the cartridge. When requested, we recommend certain cartridges which we have found introduce minimal phase errors.

4. Many discs and disc reproduction systems have mono-sum phase problems of their own. If these discs are used as source material for cartridges, the problem is there before the cartridge system even enters into the situation.

"We have concluded that, after precise mechanical engineering in the machines and cartridges, the next step must be to use electronic methods to minimize cart phase problems."

Next month a reply from Fidelipac who says stereo with good mono can be produced, and a letter from D. P. Hebert who says the "Instant Alignment" procedure, (BM/E, November, page 24, is too complex for everyday use.

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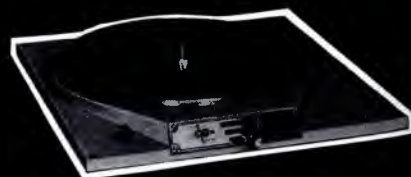
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U.S.S.R. In view of the athletic prowess displayed, there was a constant stream of individual and team winners parading through the studio and frequent requests for replays of the final minutes of events they won.

BBC coverage

The BBC coverage was the second most ambitious in terms of total time on the air, with over 150 hours of actual program time. While the BBC, and all other European networks, was limited from doing unilateral coverage, they were able to arrange for two permanent links with the United Kingdom so that they could carry both the DOZ World Service program and their own separate program production assembled in the studio assigned to them at the DOZ center. The BBC also sent to Munich a rather extensive collection of mobile vans, cameras, VTRs, and studio equipment, which was leased to the DOZ, assigned to ABC control, and provided access for the BBC to coverage beyond that of the DOZ cameras themselves. The BBC studio center was divided into three cubicles. A very small studio with two color cameras and a chroma key backdrop provided the commentator position for interviews or overlays. A small control room adjacent to the studio with access to six external venue feeds provided the director with the same flexibility as in Studio 5. Next to the control room there was a VTR center with four VR-2000s, one VR-3000, editing facilities, and video and audio switching. A nearby graphics room provided insertion of camera graphics in color or slides. The BBC also brought with them a small mobile unit which they call the Minicam, but which was generally referred to as the "Safari" wagon. This mobile unit in a Citroen vehicle with pneumatic levelers was capable of following such events as cycling with amazing smoothness due to the steadiness of the camera platform. The vehicle had a VR-3000 whose tapes were then relayed to the BBC control center for editing. It was also possible to connect the vehicle via a microwave relay using a helicopter as the intermediate link.

In watching BBC coverage in London, we immediately noticed the different character of the coverage as compared to what we had been seeing in Munich. BBC coverage approximates the pace of U.S. coverage with the greater use of slow motion and other video production techniques. However, there appeared to be a higher element of reportorial fairness, with less emphasis on national heroes, and good background information about the events and the athletes from knowledgeable reporters. The interviews with some of the foreign athletes, such as the Russian gymnast, Ms. Korbut, were good in-depth interrogations without leading or dominating the guests and allowing their personalities and viewpoints to come through.

Careful planning was also an element in the success of the operation and an 80-page manual, outlining both the technical and programming details, was prepared in advance of the games and served as the

main guide for the operation.

CBC coverage

Canada could probably have arranged to tie into the ABC coverage of its southern neighbor or allow Canadian viewers, the bulk of whom live within range of television transmitters in northern U.S. cities, to watch ABC outlets. Instead, the Canadian Broadcasting Corporation, which is the national network in Canada (and like the BBC is supported by television receiver licenses paid by the viewer), chose to send its own coverage team and a small mobile van to Munich for the games.

The CBC was faced with yet another problem in that Canada is a bi-lingual country, requiring parallel and equal coverage for both the French and English viewers so as not to arouse any partisan criticism at home. The CBC center in the DOZ building consisted of four AVR-1 recorders and one HS-100 slow-motion unit, which were used to assemble and edit 37 hours of programming that was sent by satellite to Canada, for about one hour a day with extended periods during weekends and opening and closing ceremonies. The Canadian mobile unit (Editel) consisted of a portable color camera and a backpack VR-3000 recorder in a small vehicle. While this unit did not have access to the contest areas at the venues, it did serve as a general coverage unit for local color, interviews, etc.

The CBC center also included a video and audio switching room, with access to 30 venues, and an

adjacent commentary room equipped with two separate audio studios for the French and the English announcers to do their sound overlays. When necessary, the CBC could book live studio time from the DOZ if they wanted to do unilateral pictorial coverage. Satellite transmission between Munich and Canada carried the picture with two accompanying sound tracks to satisfy the bi-lingual requirements. Since Canada is to be the host country for the next summer Olympics in 1976, the technical staff from the CBC was also actively studying the entire coverage problem in anticipation of the load they will be carrying in Montreal four years from now.

Summary

Every major television network had both representation and space allocation at the DOZ center. In some cases, it was simply limited to "off tube" commentary in one of the 61 voice-over cubicles provided. The larger networks had assigned commentary positions at the venues and varying levels of studio installations to accommodate their needs. In addition to the networks themselves, the two companies providing the major portion of the origination and recording equipment, Fernseh GmbH of Darmstadt and Ampex Corporation of Redwood City, California, maintained teams of service personnel to make sure that all of the equipment functioned to DOZ specifications. Some of the rooms within the DOZ complex contained collections of

continued on page 70

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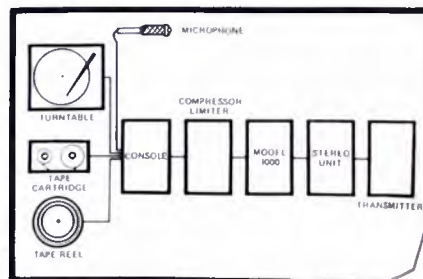
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OLYMPICS continued from page 69

equipment in quantities never before assembled in a single location. The VTR central room housed 18 AVR-1 videotape recorders, three RA-4000 address code editing units, and three MM-1000 16-track audio recorders. The central switching room for video and sound had a wall of 48 color monitors displaying virtually every possible input available to the DOZ. Up to 11 separate studios could be operating at the same time within the building and at least five large mobile units were constantly parked next to the VTR center and Studio 5. Since some of the mobiles also contained quadruplex VTRs and

backpack VR-3000 units, which moved in and out of the building, it was difficult to get an accurate count. There were more than 60 VTRs in use for direct recording, editing, and subsequent transmission in the DOZ center itself, with close to 40 more spread around the rest of the venues. To feed all of this, more than 150 cameras were required. **BM/E**

Credits

The authors wish to acknowledge the help of the following individuals in assembling the material and photographs for this article: Dr. W. Schwarz and Messrs. K. H. Mandl, K. H. Shulte, M. Grape, DOZ; M. Riedel, NDR; E. Alter & H. Wolff, SFB; M. Daigneault & D. Brown, CBC; K. Eichstadt, Ampex Corp; M. Poehl, Fernseh GmbH; N. Taylor, BBC.



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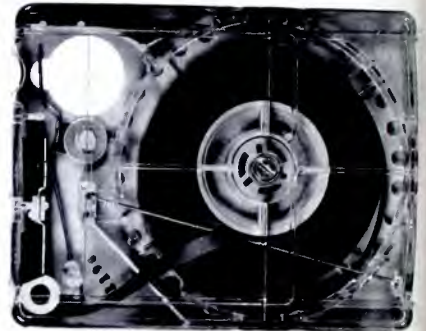
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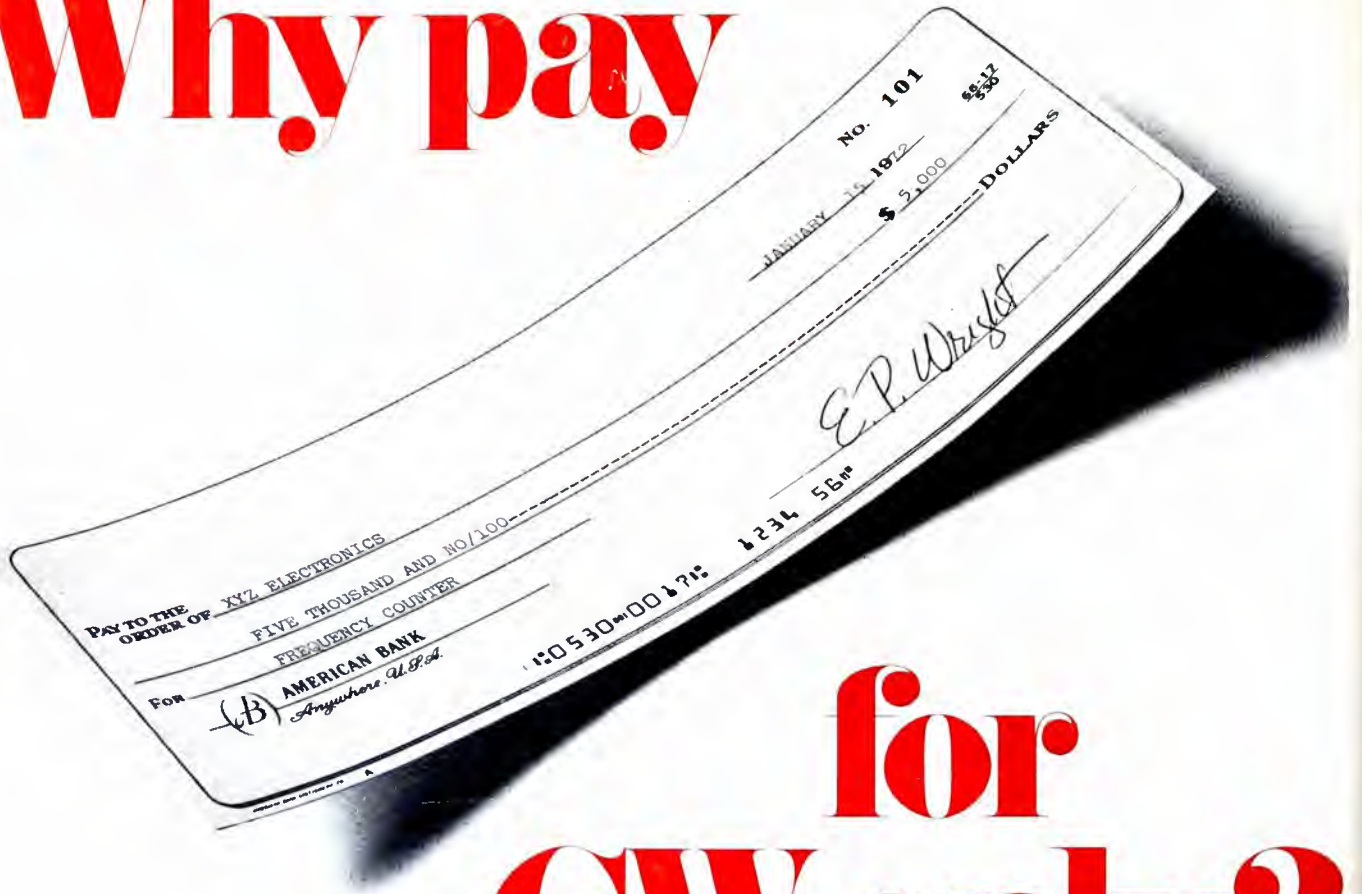
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