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February, 1978 □ Volume 20 □ No. 2

BROADCAST engineering

The journal of the broadcast-communications industry

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About the cover

WKBW News Director Jim McLaughlin communicates with air personality Beverly Burke. For more on RENG, se article on page 38. (*Photo by Peter Burk.*)

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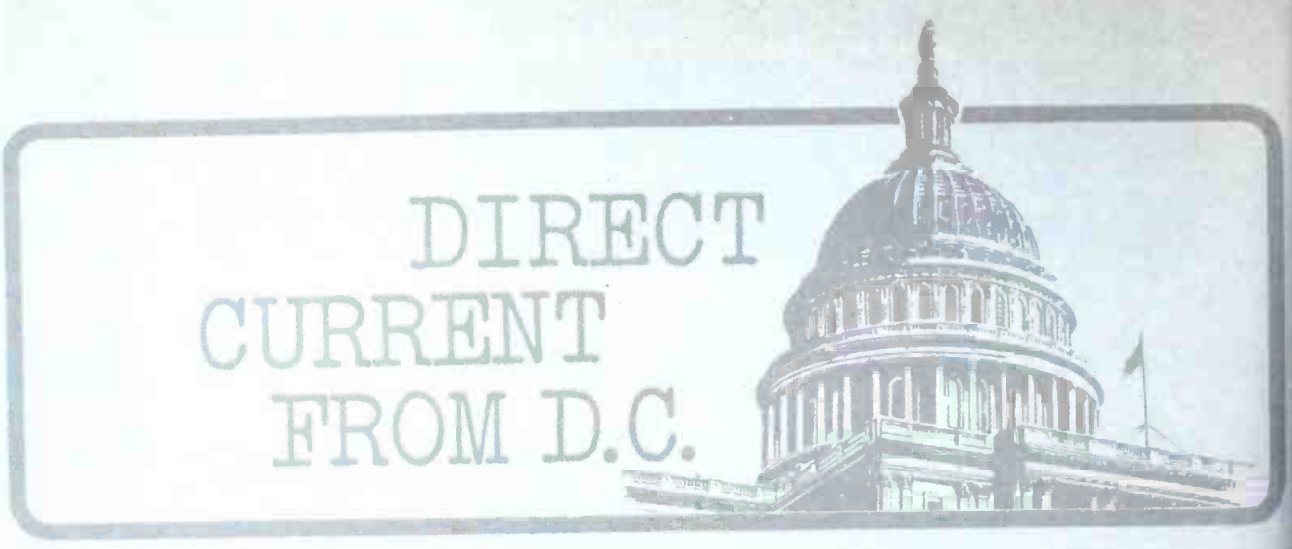

February, 1977/By Howard T. Head and Harold L. Kassens

Canadian UHF-TV Allocation

The Canadian Department of Communications has been taking a new look at its allocation of UHF spectrum space in anticipation of the 1979 World Administrative Radio Conference. In a report released in December 1977, the department proposed to retain the band 470-806 MHz (UHF channels 14-69) exclusively for TV broadcasting (except for channel 37 reserved for radio astronomy). The band form 806 to 890 MHz would be held in reserve for the next few years awaiting improvements in the allocation of mobile services. In the interim, no TV assignment will be made in the band 806 to 890 MHz unless the assignment cannot be accommodated lower in the spectrum. The report indicates that the Department of Communications is opposed to sharing with land mobile in channels 14 through 20 such as is done in the United States.

The report indicates that the UHF-TV spectrum in Canada is being reduced in the hope that the new Texas Instruments receiver developed for the FCC will permit the elimination of most UHF taboos so that all Canadian TV channel requirements can be provided in the smaller spectrum space. It should be recognized, however, that most taboos merely restrict the area within which the transmitter may be located and elimination of most taboos will not provide additional channels.

Meanwhile, in the U. S., the commission returned "the receiver of the future" to Texas Instruments because it could not duplicate the measurements made by the firm.

Nine Kilohertz Tests To Continue

The cooperative tests between New Zealand and the U. S. (whereby KFI, Los Angeles, operated temporarily on 641 kHz in lieu of 640 to provide a 1 kHz beat with a New Zealand station and likewise a New Zealand station operated on 1071 kHz to produce a 1 kHz beat with KNX in Los Angeles on 1070 kHz) were conducted in the early

continued on pag

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Quick-disconnect rear barrier strips allow fast removal of the 7601 from the rack without disconnecting any of the interface wiring between the remote terminal and the transmitter or alarm sampling points.

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In addition, 10 status indicator functions may be factory or field installed to provide instant status display and alarm.

The Model 7601 is just one of a full line of field-proven, reliable, fail-safe remote control systems offered by TFT. Other remote control systems designed for AM, FM and TV include the Model 7610, 120-channel digital telemetry/status/control system, the TELESCAN* auto-logging multi-channel CRT display and tolerance alarm system, and a complete line of remote control accessories. They're all available now from TFT. Call or write:

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DIRECT CURRENT FROM D. C.

continued from page 4

morning hours of December 13th and 14th. The reports from the various monitoring locations are not yet in but CBS reports that a noticeable 1 kHz beat between KNX, Los Angeles and 1ZB, New Zealand, was observed along the coast of California north of Los Angeles. Discussions are now under way to repeat the tests in March 1978. Meanwhile, reports have been received of interference to a Class IV station on 1400 kHz in Savannah due to a station on 1403 kHz in Africa. The commission is interested in receiving additional reports of off-frequency interference from stations in Asia, Africa or Europe. (They already know of the interference from Central and South America).

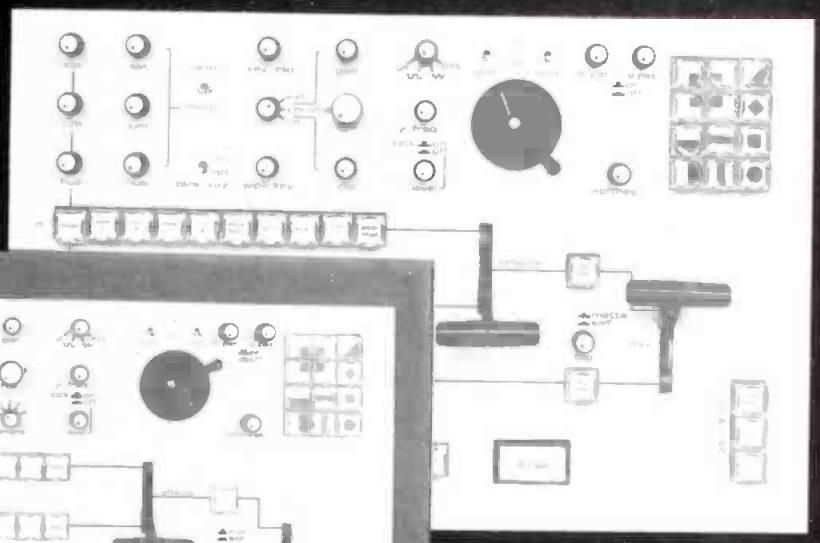
Commission FM Decisions

The FCC granted an application permitting an FM station to move its transmitter site from 3.3 miles to 38 miles from town and to reduce the city grade signal to 2.8 mV/m (the required is 3.16 mV/m). The reason given for the waiver of the rules is that 51,000 persons in an area of 6000 square miles will receive the new service. In another case, an administrative law judge denied an application of a Class A FM station to change transmitter location where the new site would be 23 miles from an adjacent-channel station. The rules require a 40 mile separation. Also involved was a violation of the IF spacing. The rules require that stations separated in frequency by 10.6 or 10.8 MHz be at least ten miles apart. Here the separation would be 7.2 miles. However, the commission's engineer made observations at 10 locations in the affected area during a temporary operation and could observe no interference.

Short Circuits

The commission's computer in Gettysburg, Pennsylvania, which processes most applications for non-broadcast licenses, appears to be complaining of overwork. It recently issued approximately 100,000 CB call signs which had previously been assigned to others. The computer was ordered to correct its error and issue corrected call signs...A new numbering system for FCC dockets was started January 1st. For the Broadcast Services, the first docket in 1978 was BC-78-1...The rules are changed to permit TV translators to receive and rebroadcast "any suitable source of signals, including use of TV auxiliary microwave stations, common carrier microwave stations, and Cable TV Relay Stations on an incidental-use basis." ...The FCC has been upheld by the courts in its order to prohibit the sale of 23 channel CB sets after January 1, 1978.

Something for everyone!



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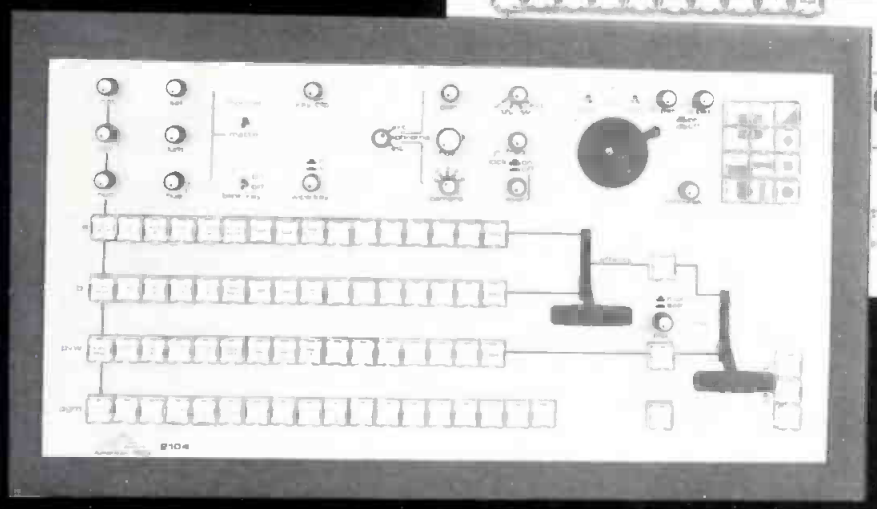

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No matter what your company's production specialty, news, commercial programming, or instructional television, the *American Data Model 2104 Production Switcher* has the features you'll need to do the job. Human engineering and uncompromising quality make the *2104* ideally suited for use in either studio or ENG/EFP remote applications. Plug-in solid state componentry enables the engineer to service and maintain the *2104* easily and quickly.

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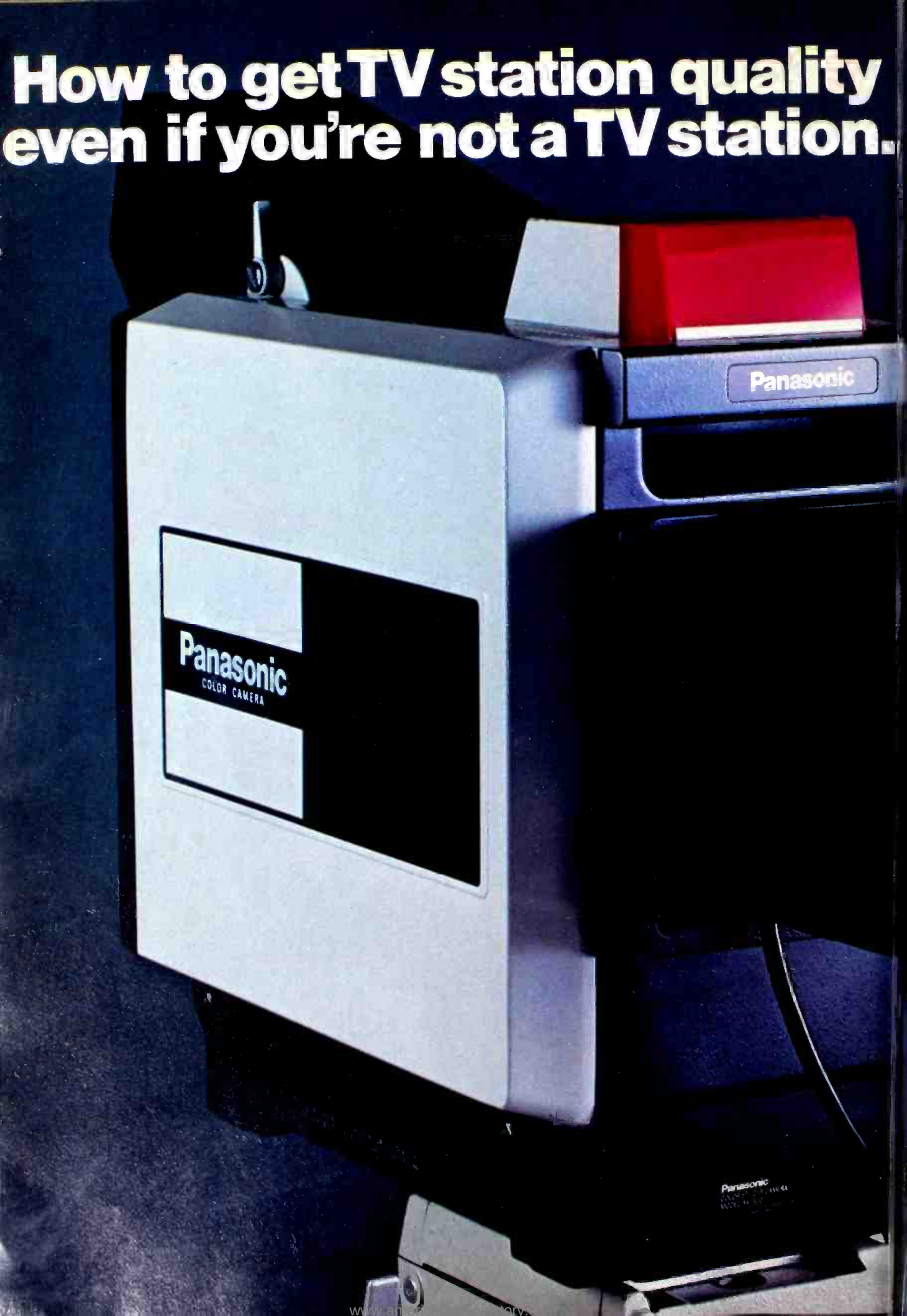
How to get TV station quality even if you're not a TV station.

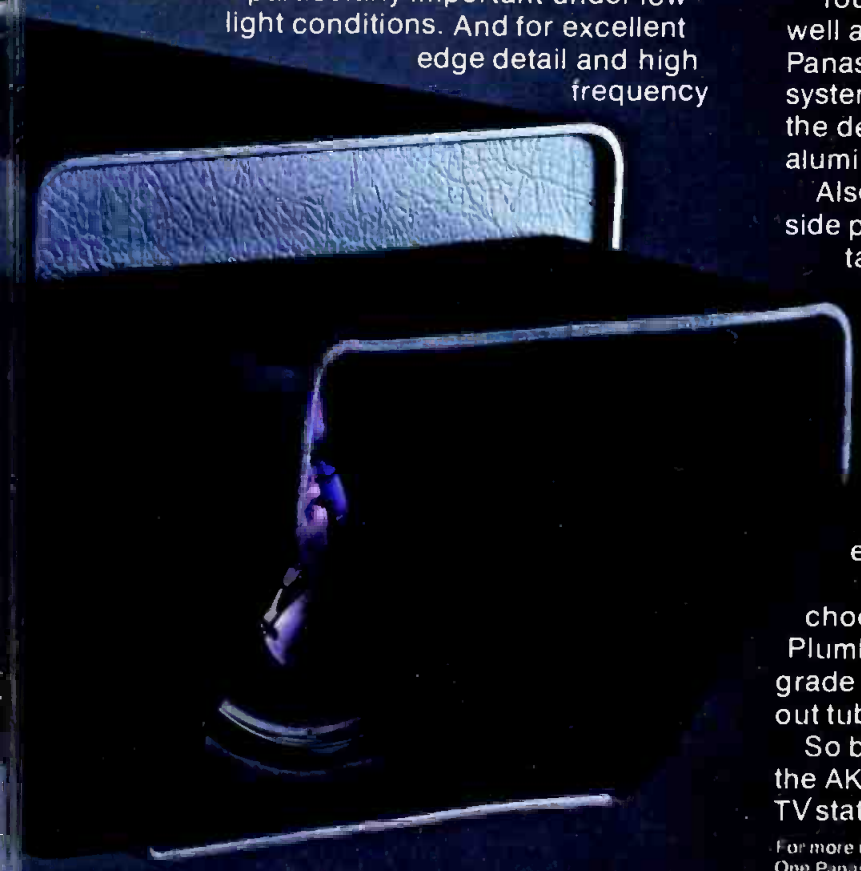


Introducing the Panasonic AK-920.

There are many ways of getting TV station quality from a Plumbicon® color camera. You can either own a TV station. Own a lot of money. Or better yet, own Panasonic's new Plumbicon color camera, the AK-920.

Not only does it give you TV station quality in the studio, it gives you TV station quality almost everywhere else. That's because it's fully self-contained, with the YI/Q encoder and the RS-170 sync generator built into the camera head.

But perhaps the best part about the AK-920 is the technology that has been put into it. Like a new color-trap circuit in the encoder and level-dependent circuit for reduced color noise, which is particularly important under low-light conditions. And for excellent edge detail and high frequency response, there's an adjustable horizontal aperture circuit built into the camera head.



And since the AK-920 is a Plumbicon camera, you get performance that's hard to beat. Like low noise, low dark current and lag, high sensitivity, as well as the capability to reproduce high brightness details without burn-in or blooming.

The result of all this very impressive technology is equally impressive performance. Like horizontal resolution of more than 500 lines at center. A S/N ratio of 48 dB with recommended illumination of 150 footcandles at F/4. And a + 6 dB gain switch for minimum illumination of just 15 footcandles at F/1.8.

You also get precise stability of alignment as well as the reliability that you expect from Panasonic. Because the prismatic optical system, the three one-inch pickup tubes, and the deflection coils are mounted on an aluminum die-cast chassis.

Also included are removable camera head side panels for easy maintenance. A self-contained, multi-function viewfinder. Color bar generator. And focus-wobble and saw-tooth-generator test circuits. Plus some rather impressive options. Starting with the AK-9220 remote control unit. To a 10:1 zoom lens with built-in 1.67X and 2.5X lens extenders for versatility in location shooting. To a vertical aperture corrector, AK-9620. To the AK-9720 cable equalizer for the RBG signals.

There are also three different versions to choose from. The AK-920ST with studio-grade Plumbicon tubes. The AK-920IT with industrial grade Plumbicon tubes. And the AK-920 without tubes.

So before you buy any color camera, audition the AK-920. It's Panasonic's way of giving you TV station quality, even if you're not a TV station.

For more information, write: Panasonic Company, Video Systems Division, One Panasonic Way, Secaucus, N.J. 07094

In Canada, contact Panasonic Video Systems Department, 40 Ronson Drive, Rexdale, Ontario M9W 1B5.

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industry news

Women and minorities subject of FCC proposal

Now under consideration by the FCC is a proposal to amend the Annual Employment Report (Form 395) particularly as it pertains to the status of women and minorities in broadcasting.

The FCC would modify the form's job categories and definitions to reflect more accurately job positions in the broadcast industry. In addition, the FCC proposed changing the designation of racial and ethnic categories to conform with an executive directive issued by the Office of Management and Budget.

This action was in response to a rulemaking petition by Dr. John Abel and Judith Saxon of Michigan State University, and comments from the National Organization for Women (NOW), the American Women in Radio and Television (AWRT), the American Federation of Television and Radio Artists, AFL-CIO (AFTRA), and numerous other parties.

The FCC said a recent study which compared *Broadcasting Yearbook* employment statistics with those received in Form 395 submissions found several contradictions.

For example, of the 1,717 executive positions listed in the *Yearbook* for all television stations in top-50 markets, only 90 (5.2%) were held by women. Moreover, although television stations in the top-10 markets reported 267 women as Officials and Managers on Form 395, they listed only 26 of those women as executives in the *Yearbook*.

In a more recent study, the U.S. Commission on Civil Rights (CCR) found that employment categories on the Form 395's were interpreted so that almost three-fourths of all employees at the stations were classified in upper-four categories (Officials and Managers, Professionals, Sales Persons, and Technicians), while many of these so-called upper positions, in practice, were little more than clerical in nature, particularly those occupied by minorities and women.

Therefore, the FCC said, the CCR study apparently underscored and confirmed the confusion surrounding employee classification.

Based on the petitions and studies discussed, the FCC said the public interest would be served by inviting comments in a rulemaking proceeding on possible revisions to Form 395, the possible inclusion of additional information which could be relevant to its industry equal employment opportunity program, and the means by which such information could be solicited.

While the FCC was reluctant to recommend a requirement that broadcasters file a statement of reasons for termination of minority and women employees or the listing of individual salaries, it said it did not wish to foreclose comment on any of the various recommendations before it.

The commission said that if any of the changes were adopted, a new Broadcast Annual Employment Report Form would replace the common Form 395 now used by broadcast, common carrier, and cable entities. It said common carrier and cable entities would continue to use the existing form.

FCC amends broadcast power maintenance rules

The Federal Communications Commission has amended its rules dealing with power maintenance for AM, FM and television stations, to specify the use of indicated values for determining power and antenna current ratios.

Prior to this action, it had been FCC and industry practice to accept indicated or calculated power as the actual transmitter output or operating power as long as the determinations of power were made according to established commission procedures with indicating instruments meeting minimum specifications.

However, the FCC said because current language in the rules specifies that the "actual" antenna input power of each station must be maintained as near as practicable to the authorized antenna input power, this accepted practice was challenged in the U.S. District Court of the Eastern District of Virginia by Rust Communications Group, Inc., licensee of WRNL, Richmond, Virginia.

That challenge followed an FCC action to recover a forfeiture assessed against the station for repeated operation with excessive power in violation of Section 73.52(a) of the rules.

Subsequently, the court ruled against the commission and noted an inconsistency in the rules pertaining to maintenance of "actual" power and those allowing for instrument error in determining power.

The licensee used this margin of error to operate with values above those permitted, but successfully argued to the court that in using this margin of error, its operation was within the rule's tolerance. The FCC said its intent in the rule was not to permit this mode of operation.

As a result of the court's decision, the FCC said it was rewriting the power maintenance rules with greater specificity to recognize the long-accepted intent and practice of maintaining power and antenna current ratios as near as practicable to authorized values, within specified limits, as determined by designated procedures utilizing instruments of specified minimum accuracies.

The commission said it was the licensee's responsibility to ensure that the accuracies of these instruments comply with minimum standards so the power and antenna current ratios determined would

continued on page

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tomatic frequency nulling and auto set level features the 339A speed your total harmonic distortion mea- ements (THD). And true-rms detection means curate measurements as low as 0.0018% (−95 dB) m 10 Hz to 110 kHz. Just select the frequency of the lt-in oscillator and the 339A's "turn signal" indicators ow you how to make the proper range settings. Whether 're testing transceivers, sophisticated audio equipment broadcast performance, here's how the 339A, priced $1900*, can help you make quick and accurate asurements.

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news

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as close to the actual values as practicable.

Whenever the accuracy or reliability of any indicating instrument was suspected, it said, the licensee must have that instrument promptly calibrated, repaired or replaced. And, during the interim, it must use prescribed alternative procedures for determining and maintaining operating power.

BBC sends color TV over STC optical fiber link

The BBC, in collaboration with Standard Telephones and Cables (STC), recently completed a series of color television test transmissions over a 12-mile optical fiber loop.

The optical system was manufactured and installed by STC in normal post office cable ducts between the towns of Hitchin and Stevenage, 20 miles north of London. The optical link has a capacity of almost 2,000 simultaneous telephone conversations. Although it was officially inaugurated June 1977, it has undergone extensive testing with the TV trials since November.

The objective of the tests has been to explore fundamental aspects of transmitting highly structured signals (a characteristic of television) over the new medium of fiber optics. After analysis, the test results will provide useful guidance for the specification and design of production equipment.

No basic problems have been identified in the use of fiber optics as a medium for transmitting digital TV. Its real potential inevitably will be realized in trunk transmission of television, since microwave channels will not meet all future growth requirements. Other TV transmission applications of a short-haul and/or a temporary nature will be able to utilize the extreme flexibility of optical fiber systems.

Log Entries

February

22-24—Synergetic Audio Concepts, San Francisco area sound engineering seminar. Holiday Inn, Belmont, California.

27-28—Worcester Polytechnic Institute, Project Management seminar. WPI campus, Worcester, Massachusetts.

March

4-8—National Association of Television Program Executives, annual conference. Bonaventure hotel, Los Angeles.

6-9—Interface (data communications) annual conference. Las Vegas Convention Center, Las Vegas.

13-16—Electronics Industries Association, annual spring conference. Washington, D.C.

13-17—IEA/Electrex; International Electrical, Electronic and Instrument Exhibition. National Exhibition Centre, Birmingham, England.

17-19—Intercollegiate Broadcasting System, national convention. Biltmore hotel, New York.

27-28—Worcester Polytechnic Institute, Project Management seminar, Hotel Sonesta, Cambridge, Massachusetts.

April

4-7—Communication Equipment and Systems Exhibition. National Exhibition Centre, Birmingham, England.

5-8—National Honorary Broadcasting Society, Alpha Epsilon Rho, annual convention. Alladin hotel, Las Vegas.

9-12—National Association of Broadcasters, annual convention. Las Vegas.

12-26—MIP-TV, 14th annual international marketplace for producers and distributors of TV programming. Palais des Festivals, Cannes, France.

May

2-6—High Fidelity '78 Spring Exhibition. Cunard International Hotel, London.

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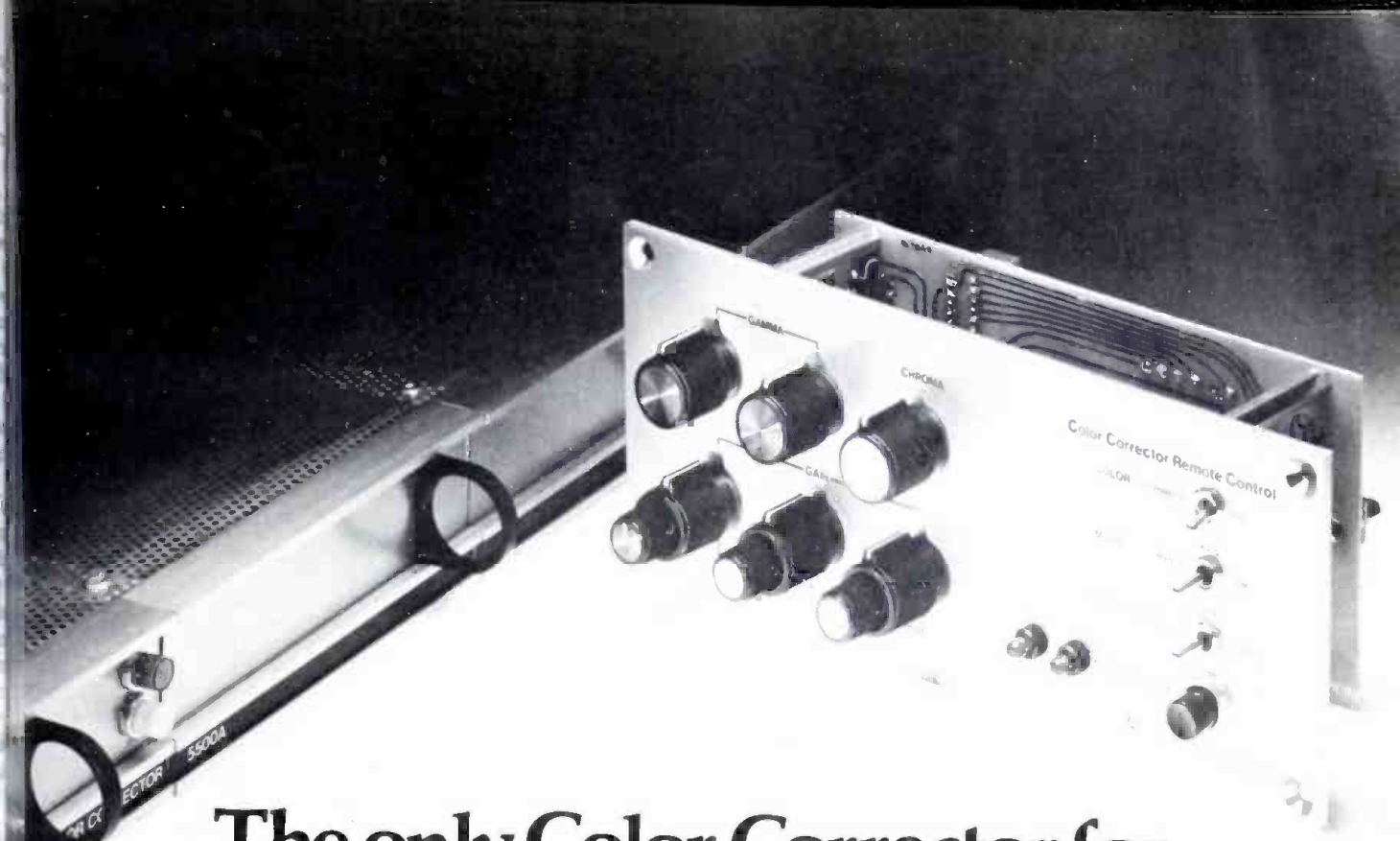

The only Color Corrector for Electronic News Gathering.

Electronic News Gathering makes tough demands upon the broadcaster. Color imbalance and colorimetry problems are frequently encountered. Matching remote camera shots to indoor studio programs or assembling tapes from different locations or cameras is "chancy" at best. Often that fast-breaking story doesn't allow for camera rebalancing!

Thomson - CSF Laboratories provides a solution to such difficult encoded signal color problems. With the Model 5500A Color Corrector, you'll be able to rebalance and match video signals *after* encoding. It can be used either after the play-back tape machine or following the microwave receiver during live coverage. In most cases, a noticeably improved color picture will result. For ease of operation, a Remote Control unit is included as standard equipment.

As an added feature, an optional automatic Sensor unit is also available to control the Color Corrector for telecine use.

Whether for Electronic News Gathering, tape production or telecine use, the Thomson-CSF Laboratories Color Corrector System should be working for you. Interested? Give us a call.

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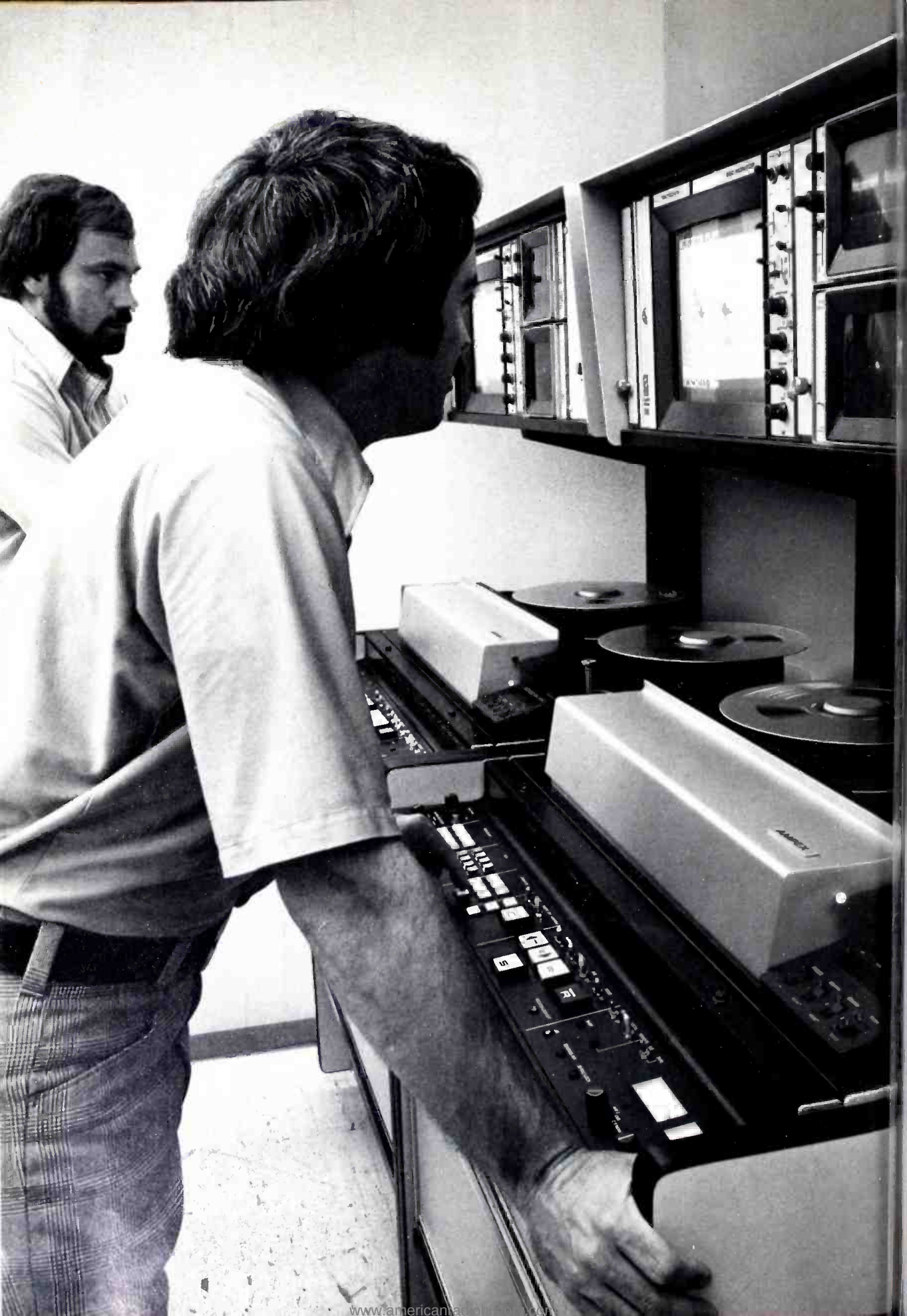

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If you already have a complete production/editing setup, you probably don't need a lot of accessories for your AVR-2. Order it with basic manual controls, and it's ready to go to work.

You might want Super High Band Pilot. It comes with optional switch selection to augment the standard High Band Color circuits, and it adds valuable depth to your multi-generation production work.

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This complete, sophisticated stand-up time code editing accessory can put you in command of as many as seven additional (similarly equipped) machines working in any combination of master/slave for production or multiple dubbing service.

Modular construction means an easy fit for your AVR-2, no matter where you want to use it—at a remote location, in your tape room, or out in the mobile van.

AVR-2 is the quad recorder that grows. Every accessory for this machine is available upon initial purchase or at any time in the future when you're ready. Tell us what it has to do, and we'll recommend the model that suits your needs.

AMPEX

Ampex Corporation, Audio Video Systems Division, 401 Broadway, Redwood City, California 94063, 415 367-2011.

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Great market potential in optical communications

The optical communications market will exceed $600 million by 1987, according to a new study by Frost & Sullivan, Inc.

The study divides the market into two distinct categories: 1) free-space, or atmospheric communications, in which a laser beam propagates a message through the atmosphere directly between a transmitter and receiver; and 2) bounded, or guided, systems that transmit modulated laser signals within optical fibers or light pipes.

Many new companies, trying to gain a share of this market, are entering the field to offer optical communications systems and components. These companies are particularly interested in commercial telecommunications, a market expected to be $350 million by 1987 compared to $11 million currently. However, the study warns that the giant industrial companies will supply much of their own needs.

Computer applications, in which optical fibers are used to interconnect mainframes and peripherals, will grow from $500,000 in 1977 to $75 million in 1987, the study reports.

The move to optical computer links has already begun, in fact. Several companies offer such links in computer interconnects, and at least two major computer companies shortly will offer such links to be compatible with existing machines and peripherals.

Despite the expected growth potential in optical communications the study says these projections are based on engineers resolving certain problems. These include the adverse effects of moisture and temperature on some optical glasses over the long term, and the limited lifetime of injection lasers and other critical components.

April conference to discuss new satellites

More than 100 technical papers on new telecommunications satellite systems will be presented at the Seventh Annual Communication Satellite Systems Conference, scheduled for April 23-27 in San Diego. The conference is being sponsored by the American Institute of Aeronautics and Astronautics (AIAA).

Papers will be presented by scientists and engineers from 1 countries. Attendees will include representatives of suppliers, regulators, and telecommunications satellite users from many nations.

Highlights of the conference are to include:

- Detailed description of the newest satellites, such as Intelsat V, LES 8 and 9, Anik C, 5B5, TDRSS, Synco IV and DSCS III.
- Technology sessions featuring ne large antenna designs, microwa and millimeter wave compone advances, and development of di tal processes for a wide variety on-board spacecraft functions.
- Three panel sessions debating k issues facing the industry in t 1980s, including the crowding parking space in the best orbi locations caused by successi launch of more than 60 satellites geosynchronous orbit.

For further information, conta Dr. S. J. Dudzinsky, Jr., The Ra Corporation, 1700 Main Stre Santa Monica, CA 90406.

PROBLEM SOLVERS

There are two kinds of suppliers in this world: (1) those who don't want any part of your problems and (2) those who want to help you solve them. All the first group is interested in is getting your order. Get in and get out is their motto.

We belong to the group that wants to help you solve your problems. If one of our standard consoles or audio systems won't solve your problem, we'll custom-engineer one that will and we'll stick with you until we've got the answer. We've been doing it this way for more than ten years.

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news briefs

Television seminar/workshop

Imero Fiorentino Associates will conduct its eighth regional television lighting and staging seminar/workshop March 27 and 28 at WGBH studio facilities, Boston. The company's staff will provide instruction covering the spectrum of current techniques to improve video picture quality. Lectures and demonstrations will be of value to those engaged in both broadcast and non-broadcast television production operations. The firm is currently accepting reservations. For information, write: Education Division, Imero Fiorentino Associates, 10 West 66th Street, New York, NY 10023; (212) 787-3050.

Communications transmission seminar

A communications transmission seminar is scheduled for March 20 at Princeton University's Woodrow Wilson Auditorium. The one-day seminar, sponsored by IEEE and Princeton, will review the latest techniques in some important areas of digital transmission and switching technology. For more information write: M. A. Carrio, USACENCOMS DRDCO-COM-RX-5, Fort Monmouth NJ 07703.

FCC issues technical memo

Technical Memorandum #6, "Conversion of the TV and FM Broadcasting Field Strength Curves to the Metric System," offers a means of adapting the field strength curves found in Part 73 of the FCC Rules to metric distances and antenna heights. The FCC invites comment on the increments chosen, axis and curve annotation, the wavy nature of some of the curves and any inaccuracies in the memo. For a copy, send a self-addressed label (not envelope) to: Research and Standards Division, Room 7202, Federal Communications Commission, Washington, DC 20554, attn: Tech Memo #6.

Laser recorder developed

A pulse code modulation recording system using laser beams to record and later reproduce sound of high-fidelity purity has been developed jointly by Mitsubishi Electric Corp., TEAC Corp., and Tokyo Denka Company. The new system, called the PCM laser recorder, projects an extremely small laser beam onto a disc, converts time to 1/40,000th of a second segments of sound, and then records them. The reproduced sound is not a function of amplitude or groove depth in the record.

Bonneville International sells KSL-FM

Bonneville International Corp. has sold radio station KSL-FM, Salt Lake City, to Simmons Family, Inc. This move, recently approved by the FCC, stemmed from the acquisition by Bonneville of KAFM(FM), Dallas, formerly owned by KRLD, Corp. In related action, the FCC granted transfer of control of KRLD, Corp. from Philip R. Jonsson, Margaret Charlton and Kenneth Jonsson to Metromedia, Inc., and granted assignment of the license of KRLD (AM), Dallas, from KRLD, Corp. to Metromedia.

NPR endorses proposed legislation

National Public Radio's board of directors has endorsed the public broadcasting legislation proposed

continued on page

The finest multi-core studio and field camera system ever produced by Philips.

Which means the finest multi-core studio and field camera system ever produced.

In the decade since Philips re-invented color with the 'lumbicon' tube, its PC-60 and PC-70 have successively tood as *the* reference standard for broadcast performance. 'ehind Philips leadership, that standard has steadily imroved to today's ultimate—the LDK-25.

That Philips has again leapfrogged the competition can ırprise no one who knows broadcast cameras...since we reated Plumbicon technology. After a decade of refineıent and improvement Philips is still the *only* company ıat manufactures all of the critical picture determining omponents—computer-matched yokes, beam splitting rism, deflection circuitry and Plumbicon tubes. The *only* ompany that can design each component for optimum erformance of the entire camera system. These advanges, of superior Philips design and in-house component vailability, offer you unsurpassed stability, picture quality ıd value.

Further, at Philips, we offer you options that *are* opons. The LDK-25 you buy is a custom unit, equipped with the automatic features you select...not a 'loaded' factory package.

But you can't just read about the LDK-25...you've got to experience it.

Only a demonstration can show you how our anti-comet-tail Plumbicon tubes handle highlights up to 32x normal peak-white level without blooming or streaking—and without loss of our famous color rendition and resolution. 'Live' is the only way to learn what our Color Line-Up Equipment (CLUE) can do for ease of balance... what electronic color temperature control, auto white balance, flexible auto iris and contrast compression mean in use.

Only after you've seen it all—after you've actually handled this remarkable camera—will you understand why the Philips name is a guarantee of incomparable stability ...why no one else can match our 1000-hour performance.

To get your hands on an LDK-25 or to get more information, call us today at (201) 529-3800, or write: Philips Broadcast Equipment Corp., 91 McKee Drive, Mahwah, N.J. 07430.

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news briefs

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President Carter and pending in Congress. The President suggested that Congress increase spending on public broadcasting to $200 million annually by the fiscal year beginning October 1, 1980. Of this total, he asked that $100 million go to the creation of "high-quality domestic productions," including complete congressional hearings that commercial radio and television rarely offer.

Fiber optics and communications

Papers have been invited for FOC 78, the United State's first fiber optic and communication exposition to be held September 6-8 in Chicago. Objectives of the program include: providing a forum solely devoted to fiber optics, digital and satellite communications; a yearly review of FOC technology and applications; an exploration of regulatory and policy implications of FOC developments; and market potential. Two-hundred-word abstracts of papers relating to the field are due March 15, and should be mailed to: Dr. Paul Polishuk, Information Gatekeepers, Inc., president, 167 Corey Road, Brookline, MA 02146.

Marconi to distribute Orrox editing systems

Marconi Communication Systems Limited and Orrox Corp. have reached an agreement giving Marconi worldwide distribution rights for Orrox's CMX series of videotape editing systems. Marconi, a GEC Marconi Electronics company, also obtained exclusive U.K. distribution rights for the Orrox modular CMX340X system. This follows the agreement announced early last year for Marconi to manufacture and market Ampex 1-inch videotape recorders.

New electronics organization formed

Manufacturers of sound and audio equipment, meeting recently in Chicago, formed the Creative Audio and Music Electronics Organization (CAMEO). The new association will develop active programs for its members, dealers and consumers. In addition, CAMEO will work cooperatively with other trade groups, gather recommendations for standardization, market research and product safety, and amass statistical data.

3M Company acquires COMTEC

3M Company has acquired Communications Technology Incorporated (COMTEC) of Huntsville, Alabama. COMTEC manufactures and markets audio and video routing switchers and video production switchers for the broadcast and industrial/educational markets.

Call for papers announced

A call for papers has been issued for the International Microcomputers, Minicomputers, Microprocessors '78 Conference, to be held June 20-22 at the Palais des Exposition in Geneva, Switzerland. The conference will cover microcomputer technology; software technology; industrial control and automation applications; small business systems; communications applications of microcomputers and LSI devices; and more. Abstracts are due February 15, 1978. Announcements of selected papers will be made March 1. For more information, write: Industrial & Scientific Conference Management, 222 West Adams Street, Chicago, Illinois 60606; (312) 2[illegible] 4866.

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JVC INTRODUCES THE CR-8300U FULL EDITING VIDEOCASSETTE RECORDER...

FOR FASTER EDITS

Now you can significantly cut the time you spend editing 3/4U-format tapes, thanks to JVC.

The unique bi-directional search control of the CR-8300U Electronic Editing Recorder lets you fast-forward at 7 times normal speed. Reverse at 10 times normal.

And you can do it while the tape is threaded on the head. You don't have to stop to rethread.

The unique preview feature lets you pass the signal from a second source through the CR-8300U while it's playing, without erasing the tape. You'll cut down on false starts by knowing what your edit will be like.

FOR MORE ACCURATE EDITS

Accuracy is what the JVC CR-8300U is designed for.

The unique built-in Pre-Roll rewinds tape for about 4 seconds from the actual editing point, and puts the recorder in stand-by mode. When you push "Edit Start" the CR-8300U first plays back about 4 seconds of rewound program, then goes automatically into the recording mode at the edit point. You're assured of the highest accuracy.

When you assemble edit, video and audio signals are edited simultaneously. When you insert, you can edit video and either audio channel independently or in any combination. Either way, accuracy is ± 5 frames.

You want still frame and slow motion? You've got them. The forward speed can be adjusted from 0 to 1/15th normal speed. You'll always find the exact frame you want.

And the tape counter doesn't just count. It has a memory. When you know you'll want to find a particular point again you reset the counter to "000". Then when you rewind, it will automatically stop the CR-8300U right there.

No other moderately priced videocassette editor has this combination of features to give you the accuracy you're looking for.

FOR THE HIGHEST QUALITY PICTURE

But speed and accuracy are nothing without quality. And quality is what the JVC CR-8300U has most of. It has everything you need for NTSC-type color video *built-in*.

Automatic Phase Control and patented Color Dubbing assure generation after generation of duplicates with stable color lock and highest quality.

There's a built-in Dropout Compensator. There's a video S/N ratio of better than 45dB (unweighted) on the Rohde & Schwarz noise meter. An audio S/N ratio of better than 45dB. Independent Audio VU Meters and Controls for both channels (which can be operated either automatically or manually) help you upgrade the quality of low-level audio recordings.

Black & white resolution is better than 320 lines; color, better than 240.

And if "flag-waving" turns you off, all you have to do is turn on the CR-8300U. The frame servo locks on the odd field, so every edit is smooth and clean.

JVC WORKS WITH YOU

JVC has worked with broadcasters and producers to give you what you want, what you say you really need. Speed, accuracy, quality. And the features you need to get them.

Features like an external sync input for V-locking other sources. A built-in capstan servo mechanism for jitter-free, stable tape speed. An internal time-lapse meter to make regular maintenance easier. And a new remote-control system you can learn about by reading the next pag

AND...TO TIE IT ALL TOGETHER... THE JVC RM-83U REMOTE AUTOMATIC EDITING CONTROL UNIT.

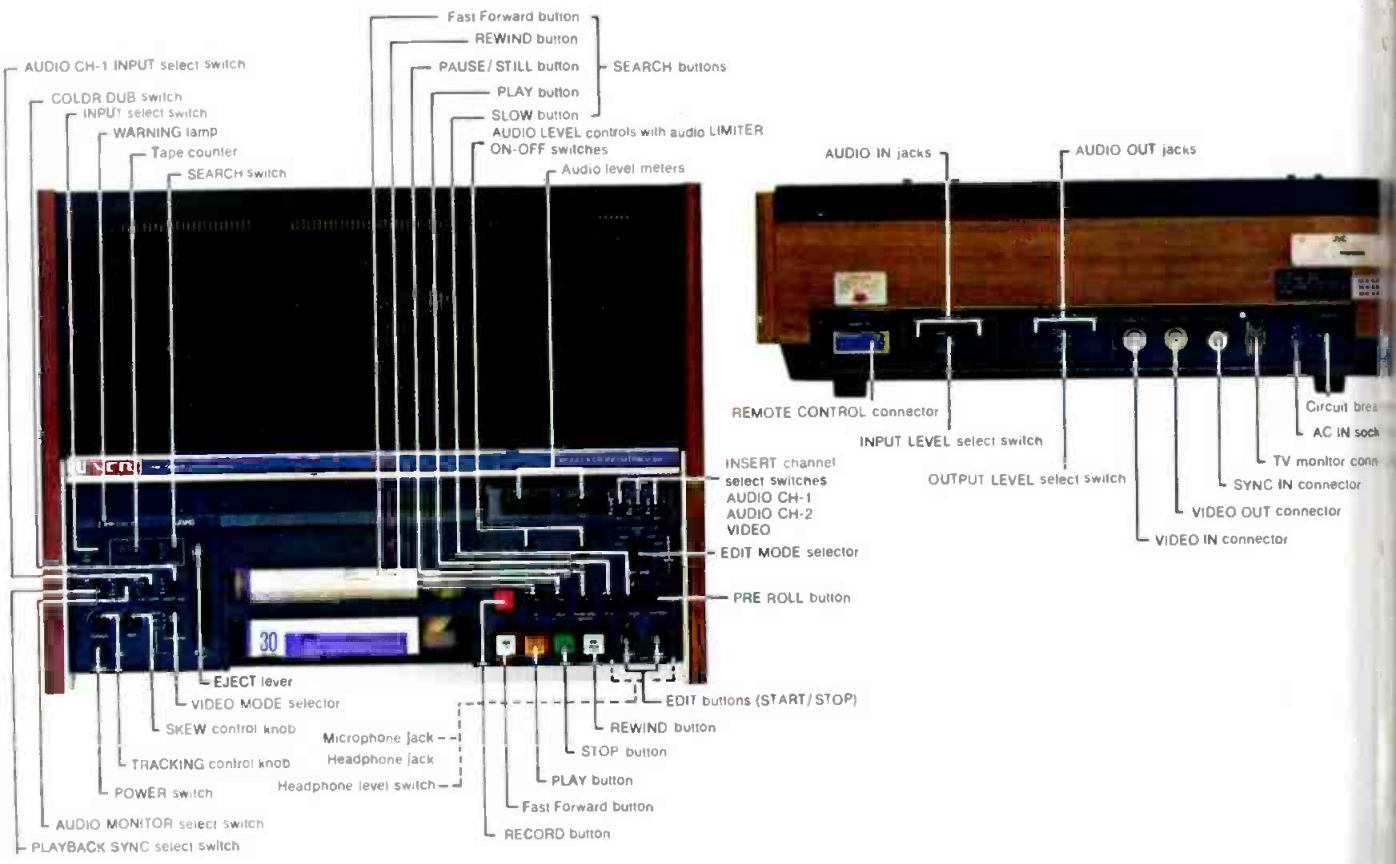
The RM-83U completely controls two JVC CR-8300U recorders for fast and accurate insert and assemble editing.

Its two independent LED timers (indicating minutes, seconds, and tenths of seconds) can be put on "Hold," so you can precisely identify the edit point. They then return to real time. "Hold" again at the end of the edit, and you've timed the length of your insert. Both clocks memorize the edit point—for fast and accurate review, you quickly return to it by touching "Search".

Not only can you *review*, you can *preview*. A unique rehearsal editing feature lets you see your edit without putting a signal on the tape. You can be sure you've got exactly what you want, exactly where you want it. After you've previewed, both machines go back to the edit point automatically. If you like what you saw, just push "Start" and you have it.

There are many more great features, such as the automatic safety device that shuts off both recorders if a tape is left in still-frame for 10 minutes. Get all the details on both the RM-83U and the CR-8300U by writing today to the address listed on the back page.

SPECIFICATIONS OF THE CR-8300U EDITING COLOR VIDEOCASSETTE RECORDER



GENERAL

Video Recording System	:	Rotary two-head, helical scan system
Luminance	:	FM recording
Color Signal	:	Converted subcarrier direct recording
Video Signal System	:	NTSC-type color signal
Power Requirement	:	120 V AC, 60 Hz 120 watts
Temperature Operating	:	41°F to 104°F (5°C to 40°C)
Storage	:	−4°F to 140°F (−20°C to 60°C)
Operating Position	:	Horizontal only
Weight	:	67.5 lbs. (30.6 kg)
Dimensions	:	24-1/16" (W) x 7-11/16" (H) x 17-3/4" (D) (610 mm x 195 mm x 450 mm)

Tape Transport

Tape Speed	:	3-3/4 ips (95.3 mm/s)
Fast Forward Time	:	Less than 6 min. for 60 min. tape
Rewind Time	:	Less than 5 min. for 60 min. tape
Wow & Flutter	:	Less than 0.2% RMS

Video Signals

Input	:	0.5 V to 2.0 Vp-p, 75 ohms unbalanced
Output	:	1 V p-p, 75 ohms unbalanced
Signal-to-Noise Ratio	:	More than 45 dBs (Rohde & Schwarz noise meter)
Horizontal Resolution	:	Color 240 lines Monochrome 320 lines

Audio Signals

Input	:	Mic −70 dBs 600 ohm unbalan
	:	Line −20/0 d 10k ohm unbalan
Line Output Level	:	−20/0 dBs (600 ohms unbalanced lo
Headphone Output	:	−28 dBs/−37 (8 ohms unbal
Signal-to-Noise Ratio	:	More than 45 d (@ 3% distorti level)
Frequency Response	:	80 Hz to 15 kH

Be sure to write today to JVC for more information on the CR-8300U Electronic Editing Color Videocassette Recorder and also for a copy of JVC's new Glossary of Video Terms.

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people in the news

FCC

William J. Tricarico was named secretary of the Federal Communications Commission. Tricarico, 34, has been a management analyst with the FCC's Management Systems Division, Office of the Executive Director, since joining the commission in January 1972.

Three additional regional directors recently were approved under the Field Operations Bureau reorganization plan. They are: **Carl E. Pyron**, Atlanta; **Kent T. Crawford**, Chicago; and **William E. Johnson**, Seattle.

Harry Fine, FCC deputy chief engineer, died December 5 at George Washington University Hospital. He was 65. Fine, who was with the FCC for 37 years, played a leading role in the development of domestic and international communication systems, including radio, TV, telephone and satellites, and in solving difficult communication problems. He was appointed deputy chief engineer in 1974, a position he held at the time of his death.

Radio/Television

Dina Kern, **Bill Rodgers** and **Loren Kayfetz** have joined the staff of public radio station KWIT, Sioux City, Iowa, as announcer/producers. Kern comes to KWIT from WMMM/WDJF, Westport, Connecticut. Rodgers has worked with various Sioux City media, most recently for KBCM-FM. And, Kayfetz has done radio work in Michigan, Tennessee, and Maine.

LLER

PLUMMER

HOFFMAN

W. "Fran" Miller, assistant to the director of engineering, Fisher's Blend Station, Inc., owner and operator of KOMO Radio/TV, Seattle and KATU-TV, Portland, Oregon, has retired after 31 years with the broadcast corporation. **Robert H. Plummer**, electronic maintenance engineer for KOMO-TV since 1972, is the new chief engineer for KOMO Radio/TV, assuming Miller's responsibilities for the two Seattle ABC affiliate stations.

Bob Connelly, vice president and general manager of WNNH in Rochester, was elected president of the New Hampshire Association of Broadcasters at their annual convention. **C. Palmer Dante**, owner of WECM-FM and WTSV-AM in Claremont, and **Stuart**

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people in the news

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Flanders, general manager of WFEA in Manchester, were elected vice presidents. **Richard Morse, Jr.**, president and general manager of WPNH in Plymouth, was re-elected director of the association.

Tim Rand has been elected president of the Arkansas Associated Press Broadcasters Association. Rand, VP and general manager of KDRS, Paragould, succeeds **Dixie Lewis**.

Al MacMillian has resigned as radio vice president for the Georgia Association of Broadcasters to become general manager of WAAX, Gadsden, Alabama. **Tom Lloyd**, vice president and treasurer of Clarke Broadcasting and general manager of WLAQ, Rome, Georgia, has been named to succeed MacMillian.

Barbara Benkowski has joined the sales staff of radio station WEAW 1330-AM, Evanston, Illinois. Benkowski has produced and hosted several radio talk shows and has served as continuity director for WUIC-AM.

Manufacturers/Distributors

R. Terry Hoffman was elected to the board of directors of TeleMation, Inc. Hoffman joined TeleMation in 1969, and has been a vice president since 1973. He is president of TeleMation Productions, Inc., a subsidiary of TeleMation, Inc. which operates a video production facility in the Chicago area.

SUTHERLAND

GOGA

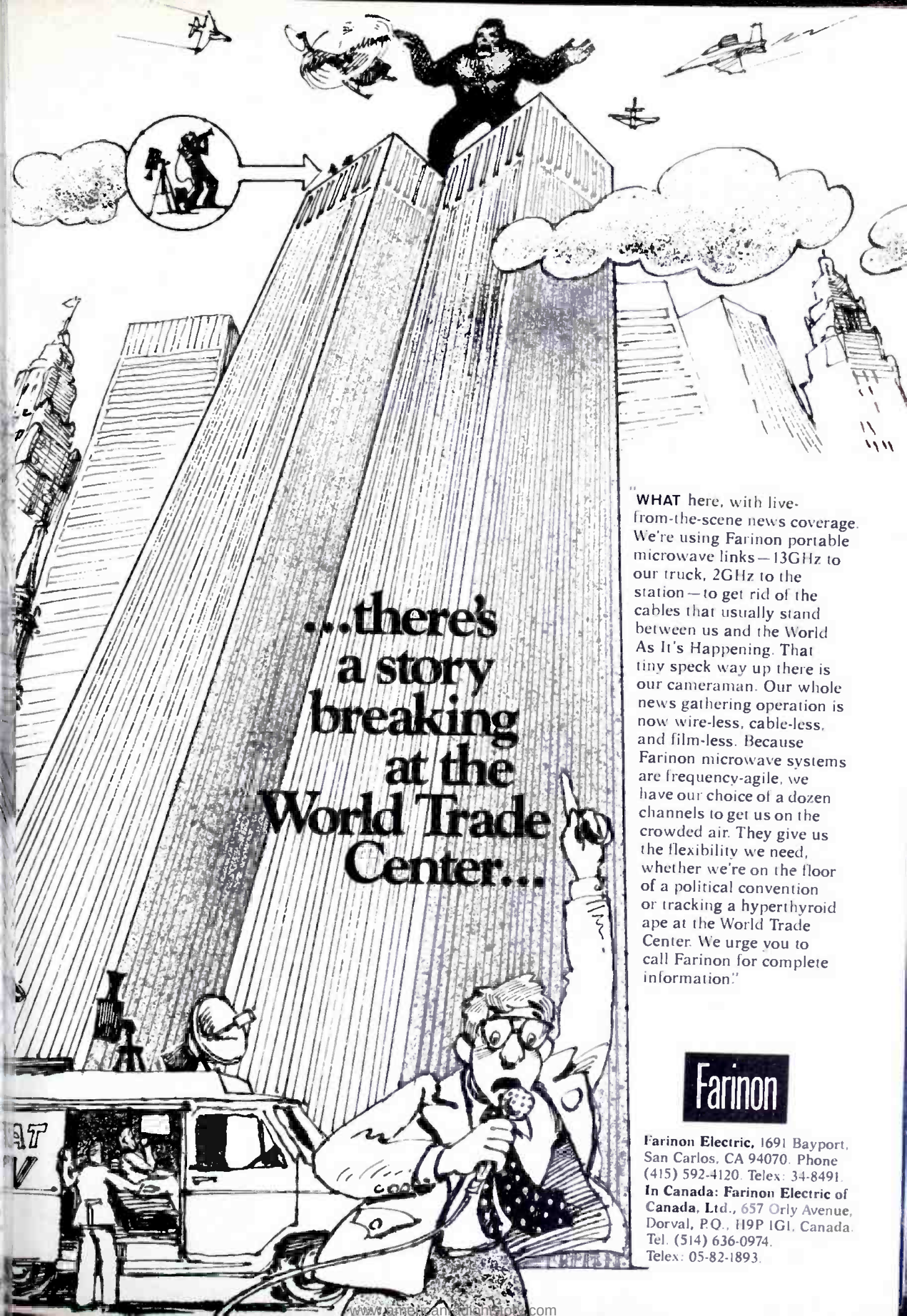
DURNWIRTH

William Sutherland moves from Electro Voice, Inc. to GC Electronics, where he becomes advertising and sales promotion manager. Sutherland has held similar communications positions with other manufacturers of audio products, musical instruments and electronic components.

Ron Goga is the new general marketing manager of Amperex's Slatersville Division. Prior to this appointment, Goga had been marketing manager for Discrete Semiconductors.

It was announced recently that **Roy K. Durnwirth** is the new general marketing manager of Amperex's Hicksville division. Durnwirth joined Amperex in 1975 as marketing manager, microwave and scientific products.

John E. Leonard, Jr., becomes vice president and general manager of Moseley Associates. Leonard has been with Moseley for nine years, the last three of which he has served as vice president, marketing.



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The Sony BVT-1000. Consider the logic.

A time base corrector is part of a system. A system that includes a video tape recorder.

Isn't it logical that a company which manufactures video tape recorders would have an inside track on what it takes to correct time base error in a VTR signal?

We're talking, of course, about Sony Broadcast.

The company that pioneered professional U-matic video recorders. And introduced the BVH-1000 1" High Band Video Recorder, that has the whole broadcast industry moving in a new direction.

Sony Broadcast has matched these impressive video recorders with an equally impressive digital time base corrector. The BVT-1000.

And before you face up to the difficult decision of which TBC is best for you, consider the logic of the BVT-1000.

1. The economy of a complete package. Sony Broadcast knows that line-by-line velocity compensation, complete video processing with advance sync, drop-out compensation, and the ability to handle both direct and heterodyne color are not just "options."

They're requirements. Requirements that broadcasters need and use in day-to-day operations.

So we make all these so-called options standard built-in features of the BVT-1000. And you save dollars in our greater production efficiency.

2. The advantage of superior technology. The economy of the BVT-1000 doesn't mean you sacrifice quality.

Far from it.

The BVT-1000 incorporates unparalleled technological excellence. Excellence demonstrated by a unique A/D converter that expands the effective number of bits per word, resulting in a higher signal-to-noise ratio than theoretically expected in an 8-bit system. Which leads to transparent picture quality.

With the Sony Broadcast BVH-1000 1" recorder, the BVT-1000 provides locked recognizable color pictures from still-frame to seven times normal speed. And to greater than thirty times normal speed in monochrome. So your editing techniques are faster and more critically accurate than ever before possible.

And for use with U-matic format recorders, the BVT-1000 offers special advantages. A wide 4H window and special anti-gyro circuitry compensate for wide errors and maintain both color and luminance stability.

Advance sync control allows phase correction using LED indicators at the TBC, for system integration. And the video level can be monitored by LEDs that show at a glance high or low level relative to one volt peak-to-peak.

3. The logic of a systems approach. If you are into electronic news gathering, or if you're part of the new revolution in 1" high band machines, the chances are very good that you're already using Sony recorders.

The BVT-1000 gives you an opportunity to add new logic to your broadcast equipment. The logic of an all-Sony system.

For full information about the BVT-1000 or any of the other professional video products in the Sony Broadcast family, call your nearest Sony Broadcast office.

Sony Broadcast

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1-inch VTRs clear their biggest hurdle

Part 1/By Joe Roizen, Video Editor, Broadcast Engineering, and President, Telegen

For more than a decade the 1-inch VTRs available to the television industry could be compared to the perennial bridesmaid who never made it to the broadcast altar.

Somehow, regardless of the claims on the glossy brochures and the 50,000 such machines sold for closed-circuit applications, few of these 1-inch recorders went into TV studios for on-air use. It certainly wasn't for lack of variety that the one-inchers didn't catch on with broadcasters.

By the mid-1970s the chief engineer of every house or studio had available a gamut of Ampex, IVC, NEC, Panasonic, Recortec, Sony, (and other) 1-inch VTRs whose model numbers and configurations spanned a wide range. Why then all the current fuss about the new 1-inch helicals and their potential role in becoming the TV broadcasters replacement for the well-entrenched quadruplex VTR that is now the industry standard?

There were, of course, some valid reasons for the low penetration that the previous 1-inch VTRs made on the major TV operations. They might be categorized this way:

• *Performance.* Unitll a few years ago, the 1-inch VTRs which had been designed primarily for the CCTV user and upgraded to attract the broadcaster, never quite gave the technical performance that was possible with a properly operating quad. In particular, multiple generation on 1-inch machines didn't meet acceptable studio levels.

• *Formats.* Few manufacturers made machines which would interchange tapes with the others. Consequently, any user adopting a specific 1-inch format might have problems in exchanging tapes with another studio that had adopted a different one. There was no such limitation on quad tapes that were circulating freely between all broadcasters.

• *Quad Improvement.* Over the past 20 years the versatility and technical performance of the quad recorders was constantly augmented both by the major manufacturers and by upgrading kit suppliers, to where picture quality, multiple dubbing, editing, and automated operations became common. The addition of quad cart machines for commercials gave a further validation for the quad format.

Nevertheless, the situation could not remain static. New technical advances in tape, heads, servo systems, and other areas of video recording made possible the development of 1-inch recorders which now rivaled or surpassed the performance and versatility of the quads. These new 1-inch formats also promised lower initial cost and lower operating expense.

The only dilemma remaining was that the new 1-inch machines still had no common format, and the confusion of choice still made the broadcaster reluctant to pick one or the other. The result was that 1976 was a peak year in quad sales, even though high-performance 1-inch VTRs were available.

Broadcast Engineering has reported the recent developments in standardization work by the SMPTE committees which have resulted in two major 1-inch formats being established for broadcast use. Currently three such formats have achieved SMPTE ratification for television video recording purposes.

1. **Type A.** A 1-inch single-head system with a signal dropout gap in the vertical interval which occurs when the head is crossing from one edge of the tape to the other. This format is recommended primarily for non-broadcast applications.

2. **Type B.** A 1-inch two-head system which segments the image into groups of horizontal lines (like the quad) and provides high-quality video performance and three audio channels for program sound, stereo audio, cueing or time code use. This format is generally referred to as "segmented."

3. **Type C.** A 1-inch, 1½-head system which records the full video and sync information by using a separate auxiliary video head. This system records and replays the vertical interval during the period that the main video head is crossing over from one edge of the tape to the other. It was generally referred to as "non segmented," but recently has been officially called "continuous field" recording by the SMPTE.

Of the three formats, the first (Type A) is only of academic interest to the broadcast industry as it represents a 1-inch helical VTR that has been available for many years from at least two suppliers Ampex and Recortec.

Type B and Type C are the formats now receiving attention from TV studios and production houses because they represent the wave of the future in videotape recording.

Type A Format

The Type A Format describes a 1-inch helical VTR introduced by Ampex in the early 1970s with a sequence of models ranging through the 5000, 7000, 7800 and 7900 series. A second supplier of the same format was Video Memory, now part of the Recortec product line.

The SMPTE's Type A Working Group has been deliberating on this format since mid-1975. The more recent introduction of the Type B and C formats has led to an acceleration of the specification and ratification of Type A. (**BE** is including a detailed revue of the Type A Format for purely informational purposes.)

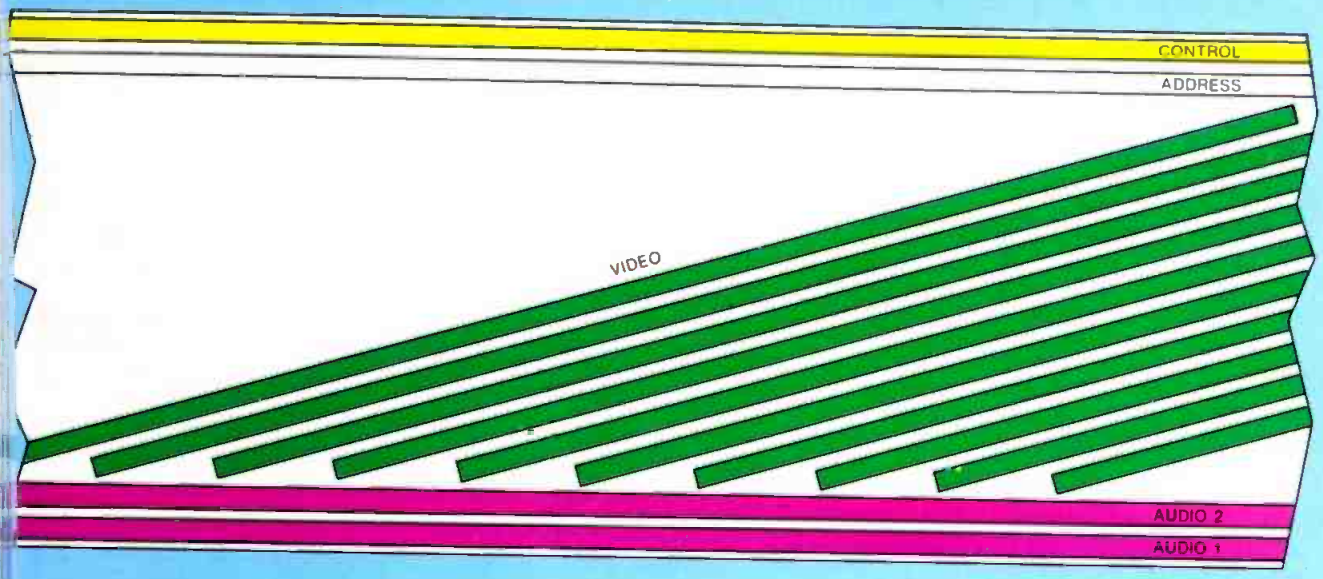
The Type A Format provides one video track with a dropout period located in the vertical interval. Video processing circuitry regenerates the missing vertical sync and blanking information and re-inserts it at the output of the VTR to form a complete composite video signal.

There are two audio channels for program sound at the bottom edge of the tape and a control track at the top edge. An additional track at the top edge can be used for cueing signals or as a frame address track for editing purposes.

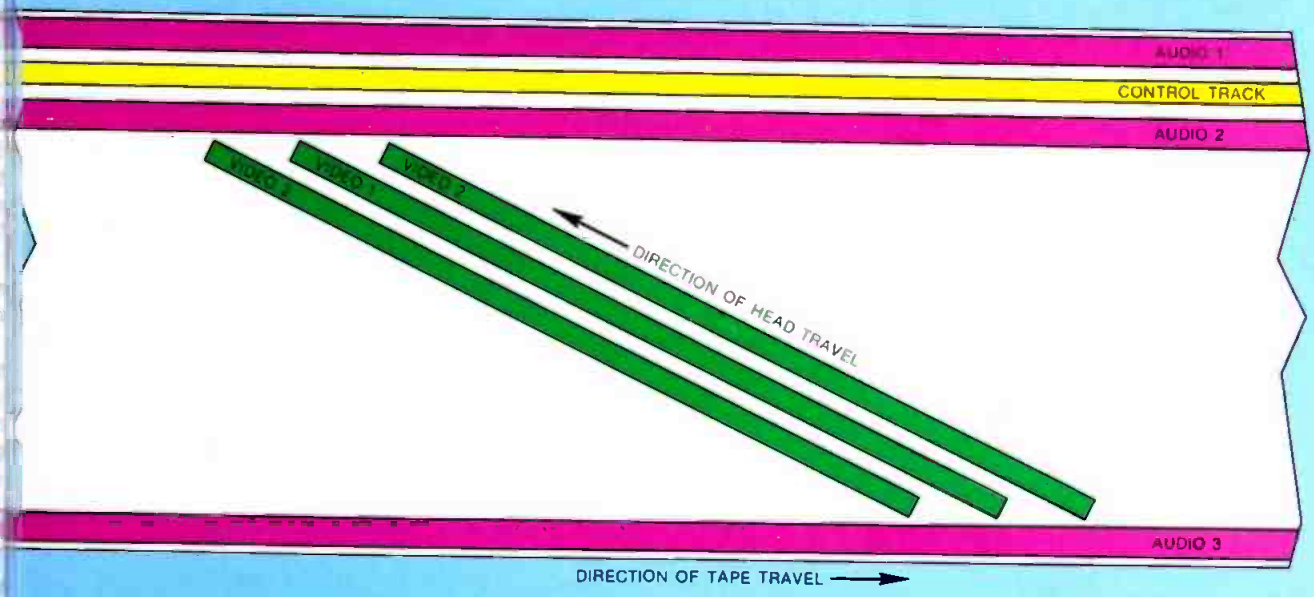
Electrical characteristics for this format permit three modes of operation called Low Band Monochrome (3.5 to 5.5 MHz), Low Band Color (5.5 to 6.6 MHz), and High Band (NTSC) where the reference white carrier frequency is at 10 MH

continued on page 3

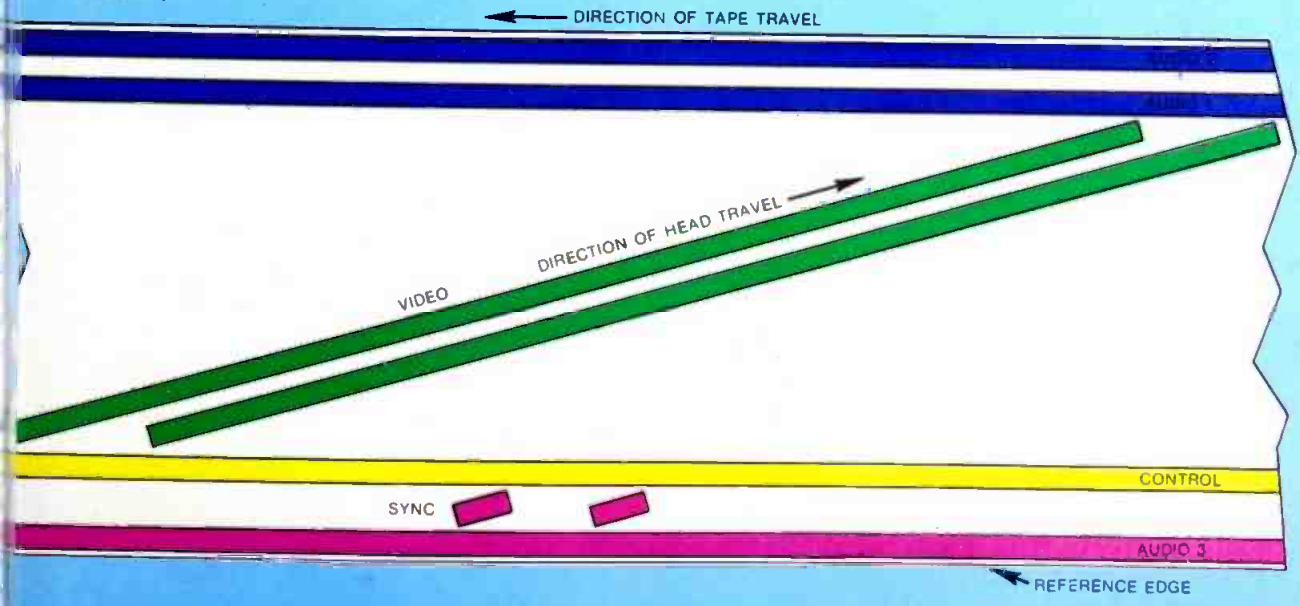
TYPE A FORMAT



'PE B FORMAT



'PE C FORMAT



1-inch VTRs

continued from page 30

These VTRs are currently used in the High Band mode.

Type B Format

The Type B Format was introduced several years ago by the Bosch-Fernseh Company under the trade name of BCN. It is a 1-inch segmented helical recorder using two video heads, and its operating principles are similar to the Echo Science Pilot series and the IVC 9000 2-inch helical VTR. Fernseh has licensed other manufacturers to build and sell the BCN; various configurations are currently available from Philips, IVC and RCA.

The Type B Format uses two heads that each scan a 52-line segment. The wrap angle is only 190° and the scanner diameter is kept small. This reduces the amount of tape surface on the scanner and minimizes friction, differential stretch, and other factors that adversely affect interchangeability.

Since a single head scan cannot produce a full image, there is no easy way to do slow or stop motion. This condition has been overcome by the use of new digital field store devices which provide slow- or stop-motion images even though the tape keeps moving at normal speeds. Digital field stores are still relatively expensive devices and make this feature on the BCN a costly addition.

The Type B Format does provide the broadcaster high-quality video signals capable of multi-generation dubbing and three audio tracks which can be used for program sound or cueing and address code operation. The two main audio tracks at the top edge of the tape have a Dolby A Noise Reduction System for further enhancement of the sound capabilities of the BCN. Electrical characteristsics include high-band FM recording frequencies of 7.03 to 10.00 MHz for NTSC. The signal specifications are commensurate or superior to quad VTRs operating in the High-Band mode.

The Type B Format recently received the SMPTE VTR Committee's approval and five drafts for American National Standards have been published.

Type C Format

This format of a 1-inch helical VTR, using a "1.5 head" system, was the subject of the greatest controversy among the members of the Working Group set up to study it. Fortunately, it was possible for the Working Group to arrive at a workable compromise that resulted in a single Type C Format rather than remaining with the variety of non-interchangeable 1-inch continuous field recorders offered a few years ago.

Type C, as defined by the committee, has the following mechanical and electrical characteristics:

- a full-field video record and reproduce head on a single track;
- a second short video track near the bottom edge of the tape which contains the vertical interval information not covered by the main video head; and
- three audio tracks which can be used for program sound or cueing and address code for editing.

Ampex and Sony now are producing 1-inch helical machines (VPR and BVH series) that can be modified (for a reasonable price) to meet the Type C Format. Both companies expect to be making fully interchangeable Type C models before the end of 1978. In addition, Sony has licensed RCA to produce and sell the BVH series. It also is expected that other VTR manufacturers with experience in constructing 1-inch helical machines (such as Recortec and NEC) will join the parade of suppliers in this growing market.

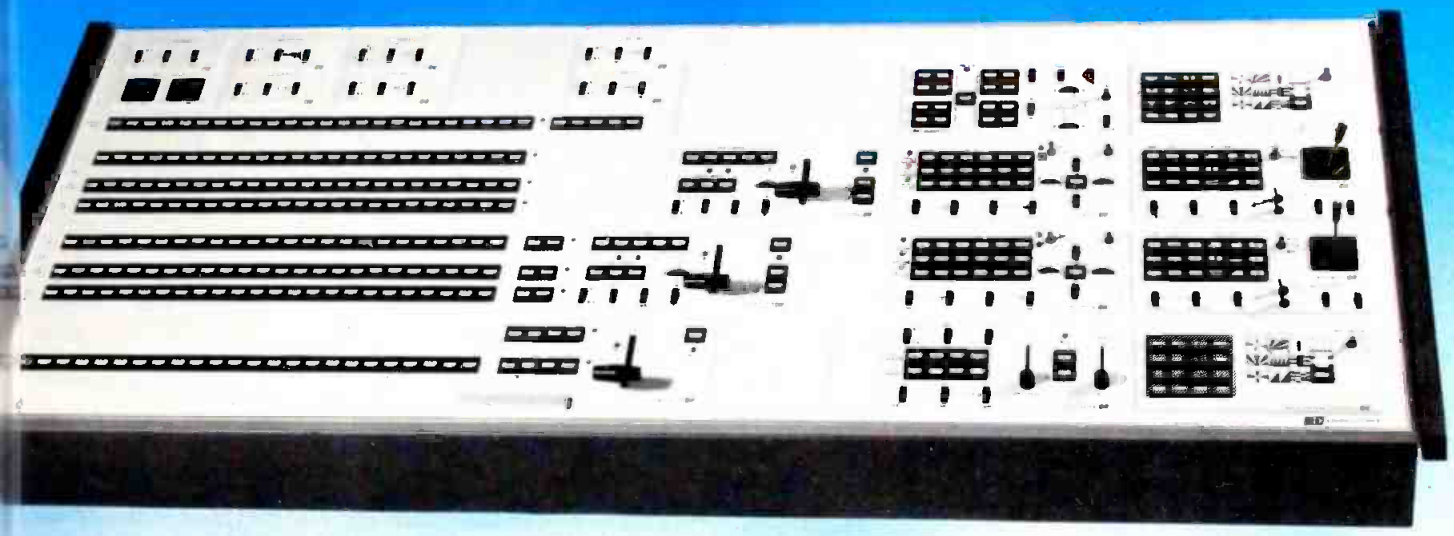
The Type C Format offers broadcasters a number of advantages unique to that configuration. Continuous-field scanning by a single head means that stop-, slow- or fast-motion playback is possible for search and cue purposes. This is a very useful feature for editing and general operation of the recorder.

In the case of the Ampex VPR machine, an additional option called AST (Automatic Scan Tracking) actually produces broadcastable images in slow or stop motion without the familiar noise bar going through the picture. This is done by a servo system and video-head deflection mechanism which causes the reading head to follow the recorded tracks with great accuracy, from one end of the track to the other. Sony has indicated they will provide a similar feature on future BVH machines now called "Dynamic Tracking."

The Type C Format was approved by the SMPTE VTR Committee and submitted for ANSI ratification in five documents. These documents will be issued as recommended practices for the industry as soon as they have gone through the normal procedures associated with such standardization.

continued on page 3

The CD-480 "Smart Switcher" is here.



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1-inch VTRs

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General considerations

The introduction of the Type B and Type C 1-inch Helical VTRs to the broadcast industry will result in a significant change in video recording operations. The impact was already evident in 1977 when more than 200 of these machines went into service in North America and at least an equal number (mostly Type B) began appearing in European broadcast applications.

The major TV networks have already had satisfactory experiences with the latest 1-inch helicals. In fact, they have declared themselves out of the market for further acquisitions of new quad recorders. It is easy to see why this is so even with a cursory comparison of what the Type B and C machines offer over their quad counterpart. These advantages are:

- The initial purchase price for a 1-inch helical, even when comparably equipped (to a quad) with a monitoring console, is still well below the cost of a transverse VTR.
- The operating cost for the 1-inch helicals is significantly lower, especially in the areas of tape consumption, head refurbishing, and routine maintenance.
- Size, weight and power consumption are all adequately scaled down on the Type B and C, and these factors figure more and more in an era when space and energy are at a premium.
- More and better audio is something all quad users have consistently asked for, but it was inherently difficult to achieve because of the magnetic particle orientation on the tape which favored the video. The new helicals use longitudinally oriented tape with wide audio tracks which provide more than adequate audio quality, on more tracks than ever before.
- Flexibility of operation is a big factor in the new 1-inch helicals, especially in relation to editing. High-speed search of up to 30 times normal tape speeds or frame-by-frame fogging down to stop frame, all with a recognizable image, is an advantage that production and post-production houses recognize as the only way to go on future program generation.
- The configurations of the 1-inch helicals are growing rapidly. Studio-version consoles, mobile-use compacts, and lightweight portables are already being offered in Type B and C formats. Cassette systems in Type B are on the market, no doubt to be followed by equivalent Type C devices as the demand grows.
- New production methods also will be encouraged by the 1-inch helicals. With less expensive, more portable, recording gear, the assembly of programs will move further away from traditional TV studio environments. This syndrome has begun with growing EFP activities and the electronic "film style" production now being employed by CBS (December, 1977 **Broadcast Engineering**).
- Distribution and storage of program material is another beneficial fallout of 1-inch helicals in broadcasting. The volume and weight of a program recorded on 1-inch tape is less than 40% of its quad predecessor. Duplication and shipping costs will be lower and the archival storage of master tapes will also take up a lot less space. None of these facts will long escape the administrative and accounting departments of television studios embarked on re-equipping or modernizing their facilities.

continued on page 36

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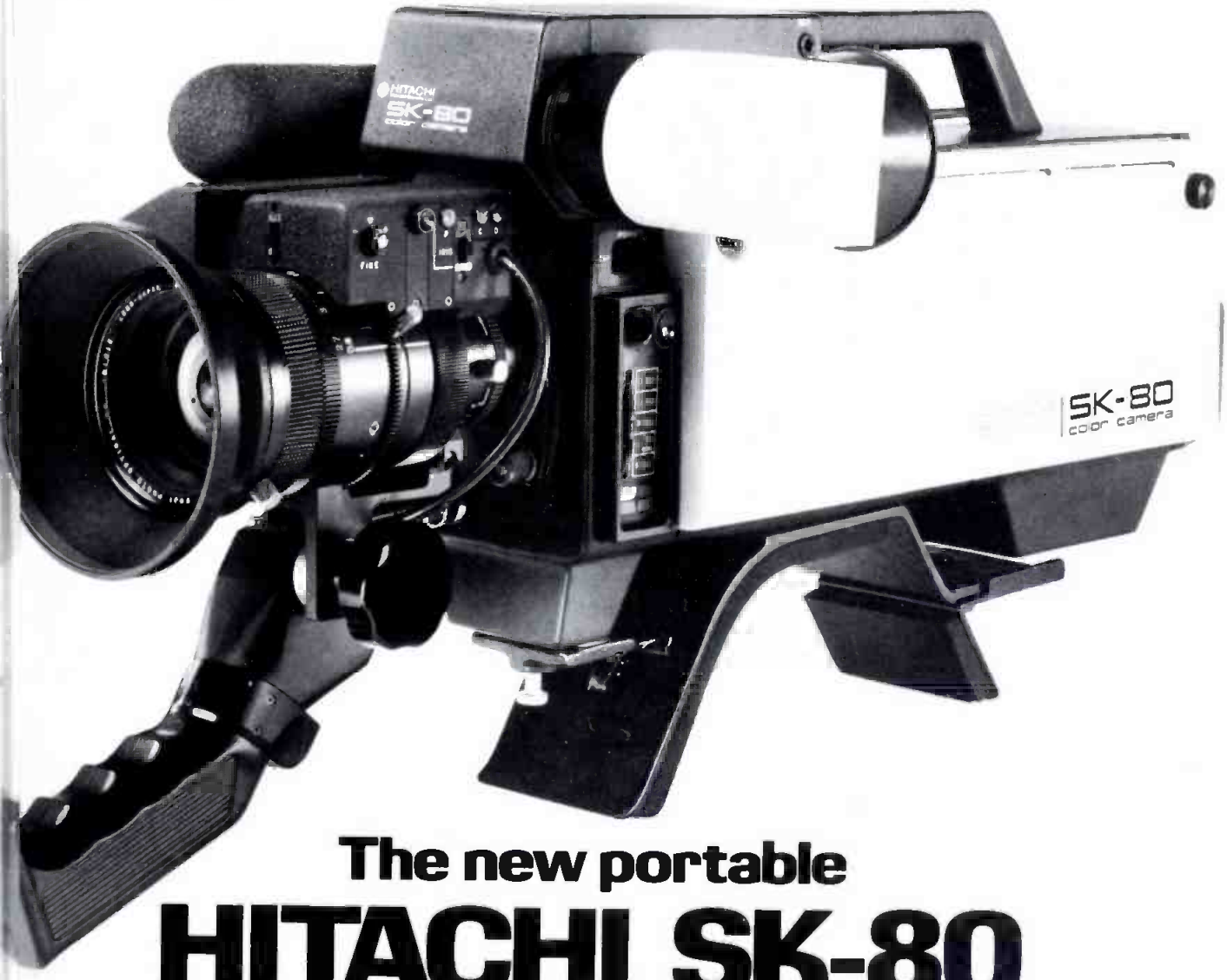

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We urge you to check out the performance features of the SK-80, as well as its low price, before specifying any other camera. Arrange a demonstration with your local Hitachi dealer or call the Hitachi regional office nearest you.

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Score one more for SMPTE

While the subject of 1-inch tape interchangeability was a problem obvious to everyone, it was the prompting of letters from Joe Flaherty of CBS and Julie Barnathan of ABC that got the SMPTE involved and gave the industry hope for a practical standard.

There was a diversity of video track parameters, and virtually none of the audio, control or cue track locations would match up. About the only thing compatible was the transverse dimension of the tape.

When the echos of non-compatibility complaints were ringing throughout the industry, the SMPTE set up the Type B and C Format Working Groups. There was hope that at last a compromise standard would be worked out. Fred Remley, Jr., director of engineering for the TV department at the University of Michigan (Ann Arbor), was named chairman of the Type C Working Group. And it's of some consequence that the chairman was a user.

In fact, if there is applause due for the accomplishments of the Type C Working Group, the first round should go to those who conceived its makeup. The chairman was a user, and the group itself included manufacturers and representatives from the major networks, including PBS, the BBC, CBC, as well as members of the CCTV fraternity. This was vitally important, because any agreement would need to be acceptable to all sides.

After reviewing the 1-inch needs—as the broadcasters saw it—the priorities became: (1) a recorder with two studio-quality audio tracks; (2) one studio-quality cue track; (3) one field per video track; (4) a separate control track; and (5) recording of entire vertical interval.

Several other requests were made, and among them, it turned out that broadcastable slow- and stop-motion images were of prime interest.

Through the workings of this group, a compatible standard has been agreed to. The recorder Type C should now be referred to as "continuous field" (to tell what it is instead of what it is not).

When the dust settles, 1-inch will have 2-inch surrounded on several fronts. And we will all have seen the hard evidence of how a professional association can help the industry it serves.

Ron Merrell
Editorial Director

1-inch VTRs

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Summary

Twenty-two years ago, when the first Ampex VR 1000-X machines began their program-delay functions in network centers, it would have been ludicrous to predict the rapid growth and all-encompassing effect that magnetic video recording had on the broadcast industry. In fact, at that time market projections for world sales of these gray monsters was less than 100 machines.

The latest count puts the global population of quad recorders at over 10,000. A large proportion of these are more than 10 years old and still aging. Television production continues to grow to meet the expanding needs of broadcasting and non-broadcasting applications.

To cope with these current and future needs the 1-inch helical have begun, and will continue, t replace quad recorders. At th same time, new areas of T program production now emergin in the industrial, educational an consumer fields also will benef from the capabilities of the Type and C machines.

NOTE:
Next month **BE** will cover the technical details of these two formats and compare their similarities and differences.

Part 2/By Peter Burk

Last month, we looked at one station's way of implementing radio electronic news gathering (RENG), and passed on some suggestions for a smooth operation. This month, we'll look at another successful RENG operation, using a different approach. The beauty of RENG is that you can pick and choose as you like, molding a system that matches your needs.

RENG in Boston

WBZ in Boston has been using RENG for more than two years, and reports good results. Their objective was to integrate hand-held portable units with an existing two-way system to provide good-quality news pickup from anywhere in the metropolitan area. Norm Graham, WBZ chief engineer, worked closely with Comrex to develop a system that best fit their needs.

How it works

Each newsman wears a Sam Browne belt that has a low-power 161 MHz transmitter on one side and a three-way receiver package on the other side. The receiver monitors the station's AM signal and two 450 MHz channels used by the mobile units. Audio from the three receivers is fed to split headphones, and can be mixed to suit the taste of the newsman.

The portable transmitter is a high-quality wideband unit supplied by Comrex which accepts a conventional microphone input and a tape input. In addition, several tones can be transmitted by pushing the appropriate button. These tones are used to put a mobile repeater on one of two frequencies, and turn the mobile transmitter on and off.

In each mobile unit, a 161 MHz receiver is interfaced with the existing 450 MHz dual frequency two-way unit. The necessary decode logic is provided to control the frequency select and push-to-talk by tones from the portable transmitter.

The newsman hears everything including his re-transmitted signal so he knows instantly that his transmission is clean. Even as he's transmitting, he can receive additional cues from the station on the unused channel. Another mobile unit can, in fact, talk to the station or even talk to the on-air field reporter on the second channel.

The portable transmitter will operate for three to five hours continuously, and allows the reporter to move three-quarters of a mile or more from the car. Two power levels are available, so that battery life can be extended when the

continued on page 4

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RENG

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newsman is fairly close to the car. Graham reports that the newsmen are conscientious about using the low power mode where possible, primarily because they can hear the re-transmitted signal and can tell instantly if it's neccesary to increase power.

WBZ uses one base-station location to cover the entire area. A new site has been chosen to provide better coverage of the metropolitan area, and will provide about 20 miles range with the 70-watt mobile units.

Quality vs. Range

Obviously, the communications type mobile units don't provide the same quality that a wideband RPU transmitter would, but several trade-offs led WBZ to the decision to use this concept.

Since the mobile equipment was already installed and operating, the cost of all new units was saved. In addition, the performance of the units was already established.

On the debit side of the ledger, communications quality is not really satisfactory for broadcast. Comrex and WBZ partially offset this liability by making several system modifications. The most significant is the elimination of the typical communications type microphone. The Comrex portable system with its inherent fidelty, fed into the two-way unit, makes a considerable improvement in quality.

The communications type units offer several advantages over RPU equipment, which also must be considered. Generally, higher power levels are available in narrowband units. A 70-watt mobile unit with a 5/8-wave whip antenna provides 140 watts ERP. This combined with much better noise immunity in a narrowband receiver means a considerable increase in range.

It should be noted that the WBZ system is used strictly for news. Graham says the quality is comparable to a schedule D telco loop. For sports broadcasts and music pick-ups, WBZ uses wideband RPU equipment.

What's right for you?

The choices are many. As we've said before, no one method is right for every station. Some of the factors to consider are format, market size, terrain, available equipment, frequency congestion, and, of course, budget.

If you intend to use the system strictly for news, as WBZ did, communications equipment might be the right choice, especially if the equipment is already on hand. If you plan to do program remotes especially if music is involved, by all means use a broadcast-quality RPU system.

The size of your market and the terrain will play an important part in selecting appropriate equipment. The range of a wideband system will be less than that of a narrowband system with similar power and antenna locations. If you presently have a narrowband system that is marginal in coverage area, you'll have to do some fancy footwork to make a wideband system do the job.

Budget considerations may affect the amount of equipment originally purchased, but shouldn't affect the total systems concept to any great extent. This may sound a bit idealistic, but the point is that the system should be expandable if the operation calls for more equipment and the budget allows for it later on. One high-quality mobile unit is probably a better choice than two or three cheapies that don't really do the job.

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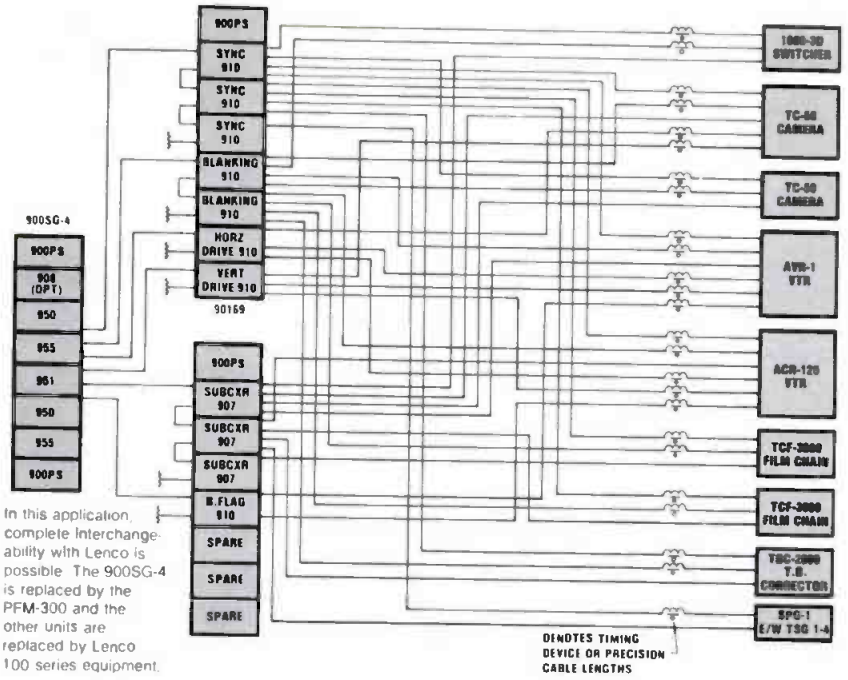
Their Pulse Distribution System.



In this application, complete interchangeability with Lenco is possible. The 900SG-4 is replaced by the PFM-300 and the other units are replaced by Lenco 100 series equipment.

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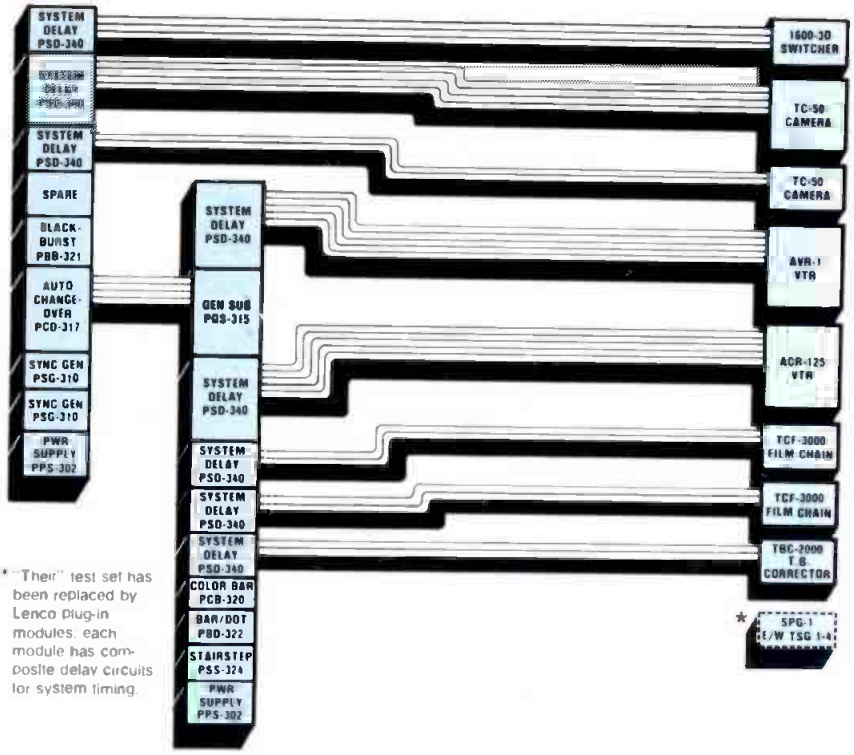

* "Their" test set has been replaced by Lenco plug-in modules: each module has composite delay circuits for system timing.

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RENG

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Improving two-way quality

If you choose to use communications two-way equipment, there are a number of improvements that can be made in the audio quality. The first step is to throw away the original microphone. They are designed for limited-bandwidth communications and maximum intelligibility in the presence of noise. That's great for a fire chief ordering hose runs at a three-alarm fire, but not really terrific for an interview with the mayor. If you don't plan to include a portable unit at this time, you might want to feed the two-way with a small portable mixer so that you can feed tape reports with live wrap-arounds.

Another typical quality bottleneck is the phone line linking the two-way base station with the studio. If you're using a remote on the two-way base station, split the audio out of the receiver and feed it into an equalized loop back to the station. You'll be amazed at the difference. If that's not feasible, consider a second receiver at the studio. The range won't be as good, but when the signal is adequate, you can use it instead of the base-station receiver and get much better quality.

The bandwidth limitation of the communications unit is only part of the struggle. Of perhaps even greater significance is the distortion produced by the deviation control circuit in the transmitter. Maybe someday someone will market a type-approved modification for some of the popular two-way units. In the meantime, some reduction in distortion can be realized by reducing the level of the audio going in.

On the subject of levels, many operations suffer needlessly by not having some means of monitoring the level at the transmitter. A typical conversation between the reporter and the newsroom goes something like, "One, Two, Three.. how's that?" "Turn it down a bit it's too loud." All that monkey business can be solved by putting a VU meter on the audio at the transmitter.

Two-way limitations

If you have chosen to use communications equipment for RENG be aware of several less obvious limitations. One item that gets some newsmen in trouble is *duty cycle*. Typically, communications gear is designed for short tidbits of information. Some popular units only allow for a maximum of two minutes of key-down, and require a five-minute wait to cool off. A long-winded newman can burn up a transmitter pretty quickly. RPU equipment is designed for 100% duty cycle which more closely approximates the talk *vs.* listen ratio of many news types.

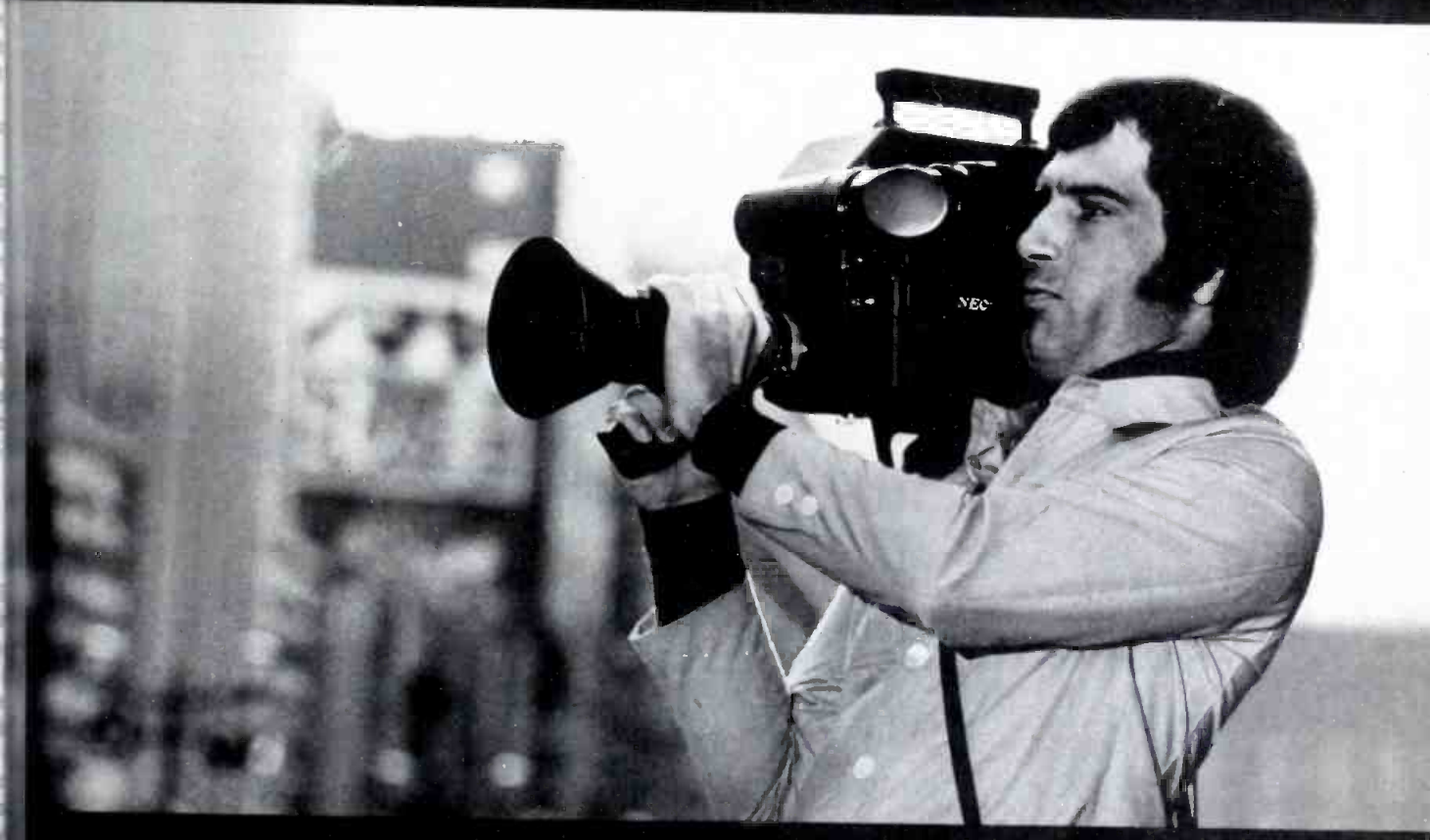
Another new consideration is type acceptance. Any new equipment purchased will have to show up on the commission's list. This rules out some of the inexpensive alternatives that were available in the past.

Keep it flexible

Whatever method you choose for RENG, make sure it can be adapted for different requirements. Formats change...sometimes quite suddenly. If your system is only capable of short speech reports, it won't be much use if your station suddenly wants to do a three-hour sports remote or live music broadcast.

Plan carefully to allow for the future. If RENG is implemented intelligently, it can increase the prestige of your station, as well as provide additional revenue. Isn't that the object of the exercise?

More performance per pound for ENG from NEC.



In a pinch you could use NEC's portable MNC-61A color camera in your studios. It delivers that kind of quality. Yet this field-ready, backpackless camera weighs less than 20 lbs. And the weight is evenly balanced for easy shooting from the shoulder.

Use of large-scale integration keeps power consumption at only 25 watts, so you can shoot extra hours if necessary. And you have a choice of Plumbicon* or Saticon** tubes.

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Stereo studios for AM, Part 1

By Dennis Ciapura

The advent of FM stereo in the early 1960s heralded a whole new type of broadcast studio design to accommodate dual-channel audio transmission. By now most FM stations are transmitting stereo, and those with AM affiliates will easily accomplish AM stereo conversions based on their FM experience.

But what about the multitude of AM stations around the country with no stereo background at all? An equally interesting question is whether AM stereo facilities should be designed just like their FM counterparts or should AM stereo conversion benefit from a different approach tailored to suit the medium more exactly?

Beginning this month and concluding in the next issue, **Broadcast Engineering** will present a special two-part series covering everything from microphone selection to signal processing. We think that stereo audio systems for AM deserve to be born of fresh thinking on the subject and not simple transplants from FM stereo designs.

First of all, let's look at how typical AM stereo audio parameters will differ from FM audio and also where there may be some similarities. After all, to attain the best possible marriage between the stereo studio facilities and the AM stereo transmission system, we must know where the system's relative strengths and weaknesses lie.

Since the FCC has yet to decide which of the proposed AM stereo schemes will become the national standard, we must estimate what the key audio parameters are likely to be based on a composite analysis of all of the proposed systems. Fortunately, all the proposed systems will yield roughly the same audio performance and differ mainly in how the dual-channel transmission is achieved. Actually, the AM stereo broadcaster will be more at the mercy of AM stereo receiver manufacturers than system limitations.

Once again, we are forced to estimate what the receivers will be capable of, because they are yet to be produced and sold. However, it is the nature of the broadcast game

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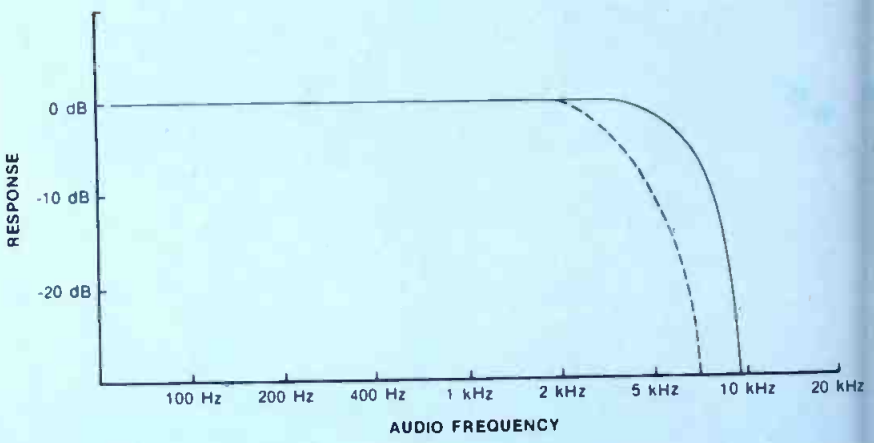

Figure 1 Audio response estimate of lower cost category of stereo receivers with bandwidth extending to just below 10 kHz. Dashed lower curve is typical of contemporary mono radios.

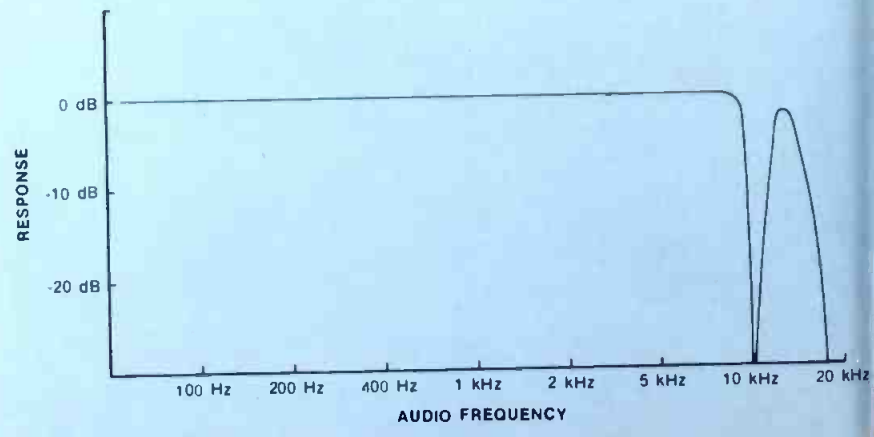

Figure 2 Audio response estimate of high-quality AM stereo receiver with 10 kHz notch filter switched in. These are usually defeatable so that smooth high end response can be restored when beats are not present. Sharper notches than the one shown also can be achieved.

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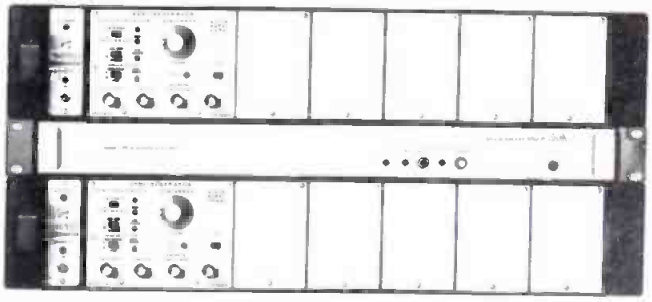
- Automatic Changeover Unit provides switching to back up sync generator
- Systems available for NTSC, PAL and PAL-M



Typical NTSC sync generator system comprised of two 1410R Option 01 mainframes with SPG2 sync generator modules, and one GVG 3257A Automatic Changeover Unit.

Tektronix quality, performance and reliability in a sync generator. Get the whole story from your nearest Tektronix Products Field Engineer. Or circle the reader service number below for more information.

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Stereo Studios

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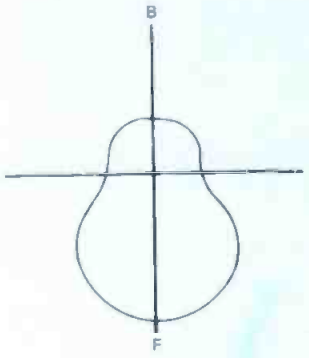

Figure 3 Check the microphone polar response chart for indications of high back and side rejection as shown in the example above. Several curves for various audio frequencies are sometimes shown on the same graph and it is normal for the directivity of these microphones to deterlorate somewhat at the higher frequencies.

that we must design the egg before the chicken lays it! As a matter of fact, many stations have already completed their stereo studios and, at least in the more competitive markets, the first stereo AMs will definitely enjoy some degree of increased audience. It is necessary, therefore, to base our efforts on an educated guess if we are to have a stereo program chain ready on the day AM stereo generators become available.

Flat to 10 kHz

Ideally, audio facilities for AM stereo transmission should be absolutely flat up to at least 10 kHz. However, most of the less expensive stereo receivers probably won't be capable of 10 kHz audio bandwidth due to the relative complexity of a flat-topped IF bandpass and the need for a 10 kHz whistle filter. Anyone who has listened to AM on broadband equipment, particularly in the evening, can attest to the need for a 10 kHz notch filter. The very best AM receiving equipment will provide reasonably flat response to 15 kHz with only the 10 kHz notch and skirts a few hundred cycles wide missing.

Stations operating in areas where a pretty good audiophile audience is expected will probably want to maintain all parts of the system flat to 15 kHz. It is not likely that many receivers, as a percentage, will be capable of 10 kHz or greater response; it just gets to be a very expensive proposition. After all, most AM receivers in use today begin to roll off at 2 kHz and are already several dB down at 5 or 6 kHz. So, a stereo receiver with reasonably flat response to 10 kHz is yielding a whole additional octave and would be sujectively judged as excellent by contemporary standards.

For these reasons, the most cost-effective design criteria for simple stereo receivers would be an IF bandpass falling off sharply just before 10 kHz, thus eliminating the need for a notch filter; this is the type of response characteristic that we most generally expect to find in use. At this point, you may wonder why anyone would even question

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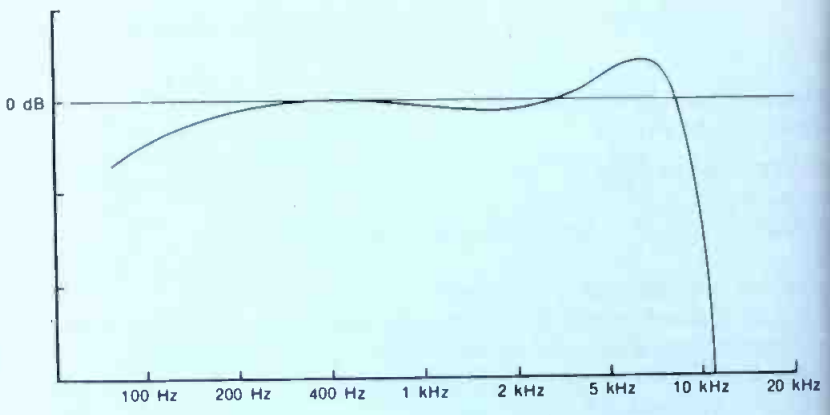

Figure 4 Avoid microphone with severe peaks in the response characteristic as shown here. On a high-quality receiver an "essy" or nasal quality may come through.

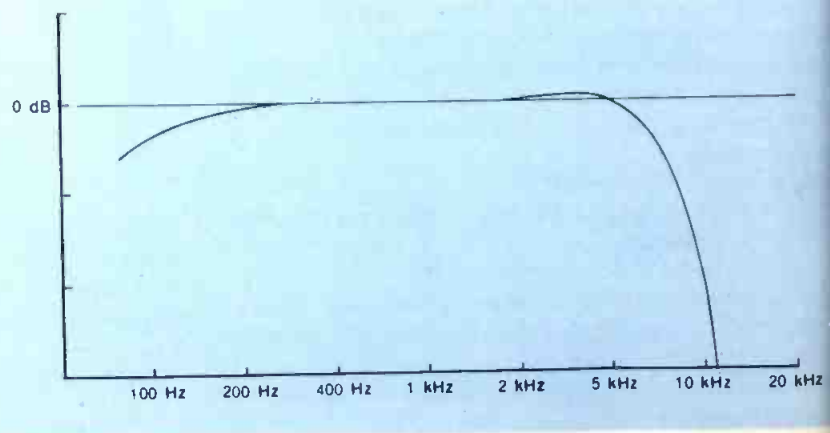

Figure 5 A smooth response like the one shown here will sound more natural and warm on the air.

KIRO KNOWS EXACTLY WHAT THEY WANT IN A 50 KW AM TRANSMITTER.

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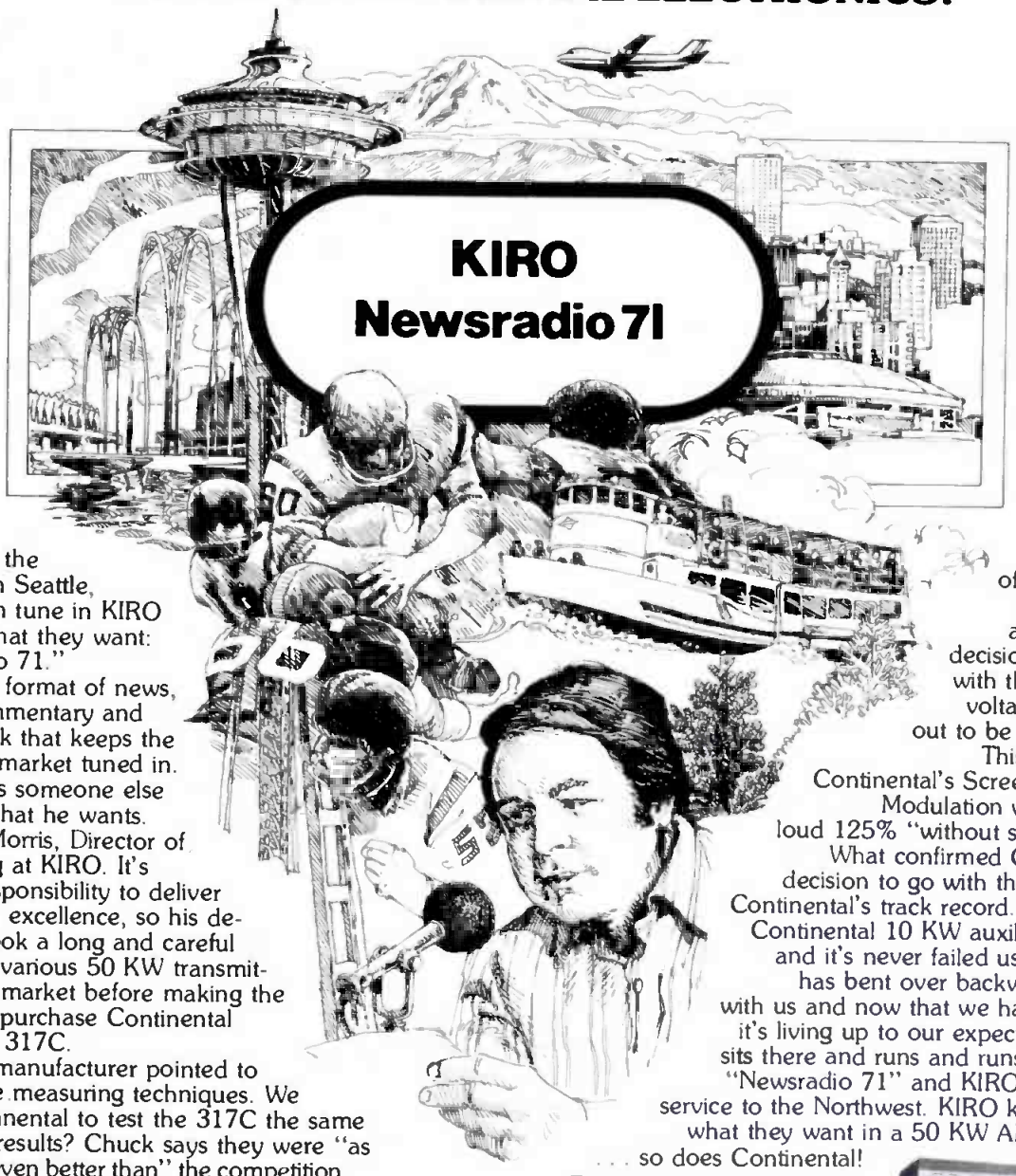

When the
e folks in Seattle,
Vashington tune in KIRO
hy get what they want:
'lewsradio 71."
Adynamic format of news,
sprts, commentary and
a night talk that keeps the
rthwest market tuned in.
There's someone else
o gets what he wants.
C. R. Morris, Director of
gineering at KIRO. It's
uck's responsibility to deliver
gineering excellence, so his de-
rtment took a long and careful
k at the various 50 KW transmit-
s on the market before making the
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"One manufacturer pointed to
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ntinental builds-in state-of-the-art performance
m the start. Like high efficiency in a small space.
nd I'm really impressed with how easy it is to get
the 317C for maintenance.

"With some of the problems other stations are having our decision to go along with the lower plate voltage has turned out to be a good one." This is a result of Continental's Screen/Impedance Modulation which yields a loud 125% "without special effort." What confirmed Chuck Morris' decision to go with the 317C? "It's Continental's track record. We've had a Continental 10 KW auxiliary for years and it's never failed us. Continental has bent over backwards to work with us and now that we have the 317C it's living up to our expectations. It just sits there and runs and runs." We salute "Newsradio 71" and KIRO's continuing service to the Northwest. KIRO knows exactly what they want in a 50 KW AM transmitter . . . so does Continental!

For information on the 317C, write Continental Electronics Mfg. Co., Box 270879, Dallas, Texas 75227.

Continental Electronics

For More Details Circle (34) on Reply Card

Stereo Studios

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the advisability of extending system response to 15 kHz when virtually all consoles, tape decks, and phono equipment have response extending at least that far. The answer will become obvious when we talk about microphone selection and later in the series when we cover telco loops.

Low distortion required

In anticipation of cleaner demodulation circuits like product detectors, rather than the more conventional envelope detectors now in general use, the AM broadcaster should be prepared to offer a low-distortion stereo signal. As we go through the program chain, we will reflect on some of the routine sources of AM audio distortion.

It may be necessary to alter your thinking in some areas because better frequency response and lower distortion at the receiver also mean that your station's distortion will be much more obvious. Remember, those odd and even order audio harmonics won't be rolled off anymore, and there is always the guy next door who will sound cleaner if he can.

AM signal-to-noise ratio will also become more important as better receivers arrive. All the accumulated hum- and noise-producing additions to the program chain which were patched out at proof time will make their presence obvious. FM broadcast engineers have had to learn to live with a 60 dB signal-to-noise requirement and so there is no reason why AM audio systems cannot be quiet, too. Actually, it is more a question of keeping the system noise-free than any special design effort, since all modern broadcast audio gear easily exceeds even the FM requirement.

Be as stereo as possible

Now that we have reviewed some of the areas that describe the performance goals that we would like to achieve, let's start going through the system, beginning right at the microphone, and see what factors need to be considered as we select equipment and plan for its installation.

Stereo immediately offers the programming department one gimmick new to AM: stereo microphones. Some FM stations install two microphones, usually on separate booms, which, due to random phasing effects, give an illusion of spaciousness to the mike sound as well as some stereo effect when the announcer moves his head or moves about.

Depending upon the format in use, your programming department may find that this effect is desirable, as it will definitely make the voice parts of your programming different than the mono AM stations. At least until the novelty wears off, everyone doing AM stereo will want to be "as stereo as possible."

Choosing microphones

In choosing microphones, you probably will want to select units with as much back and side rejection as possible to keep ambient noise to a minimum, particularly if the stereo mike scheme is used. Bear in mind that the better fidelity receivers will also reproduce air noise and room rumbles, too. Be looking at the frequency response chart for the mikes you are con-

continued on page

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DYNAIR's RX-4B
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Model RX-4B Solid-State Off-Air Professional TV Demodulator
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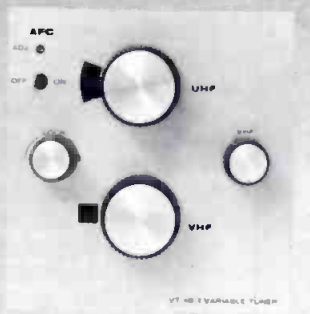

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Stereo Studios

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sidering, be sure to check for any high mid-range peaks. Although this may have added a little presence to your signal as reproduced on a mono receiver with lousy response, it may make your mike sound too "essy" on better bandwidth sets. It is unlikely that any extra dollars spent to buy microphone response beyond 10 kHz for AM stereo is justified, unless you expect a healthy AM audiophile population in your area.

In general, omni-directional microphones are not desirable because they tend to pick up all the little solonoid operations in nearby cart machines, as well as paper noises; and, they require a very sound proof studio environment.

How about cart machines?

Selecting cart machines for the new AM stereo studio is a project requiring some serious advance thinking. The big question is whether all the carts, some of the carts, or none of the carts should be stereo. Few commercial masters are supplied in stereo from the advertising agencies, so unless an appreciable percentage of your production is done in-house, you may lack sufficient raw material to warrant the purchase of stereo cart decks.

You also must bear in mind the fact that stereo tape systems must be carefully and frequently serviced to be sure that phase-shift errors do not mar the mono sound of the station. This is a very important point because most of your audience for quite some time is going to be listening in mono. In general, the best approach is to do whatever you can to entertain the growing stereo audience while never doing anything to turn off your mono people. So, if you decide to get into stereo production, you must be prepared to handle an increased maintenance work load.

Most stations will probably retain their mono cart machines for playing the bulk of mono spots that come from outside production sources while adding a stereo machine or two so that stereo promos, IDs, etc. and occasional stereo spots can be aired. This scheme keeps cart machine maintenance to a minimum and gives you stereo capability when you need it. It would be a shame to have to maintain six stereo cart machines day in and day out to keep everything in phase if only 20% of all the carts played contained stereo material.

If you are adding stereo carts to our system, you will probably also want to invest in some premium tape cartridges. The final air product will, of course, be as good as the cartridge and cart machine combined.

If your music comes from reel-to-reel tape, the same attention to stereo phasing is required. Since all your music is likely to be stereo, you will probably be working with all stereo decks and these will have to be tested (at least) weekly to be sure the mono audio is not degraded. A complete treatise on stereo tape phasing is beyond the scope of this article, but a review of past issues of *BE* will provide several articles on the subject for reference.

Some FM stations with all stereo tape gear have installed switching systems so that when a mono cart or tape is played on a stereo machine, only the left channel of the tape is used, that being split to feed both left and right channel console inputs. This eliminates unnecessary phasing problems when playing mono tapes on stereo decks, but proper stereo performance still depends upon frequent tests and maintenance.

Pickups and preamps

Many AM stations already employ stereo phono pickups wired for mono reproduction because the vast majority of disc product is in stereo these days. The addition of a stereo phono preamp and some minor rewiring will put you in the stereo phono business, but we recommend that you take things a step further. If you aren't already doing so, it would probably be a good idea to convert to a phono pickup with an elliptical stylus, which will result in significantly less second-harmonic distortion at the higher audio frequencies compared to the common 1 mil conical stylus.

Also, if you are considering buying a mate for your existing older mono preamp to convert to stereo, try to fit one of the newer high-overload stereo preamps into your budget instead. The better stereo AM receivers will make these distortion reducing decisions worthwhile.

Now that we have discussed the selection of signal source equipment for the new AM stereo system, we'll take a break to review the manufacturer's ads and brochures until next month's issue of *BE* and Part 2 Stereo Studios For AM. We'll be taking a look at consoles, signal processing and STLs. □

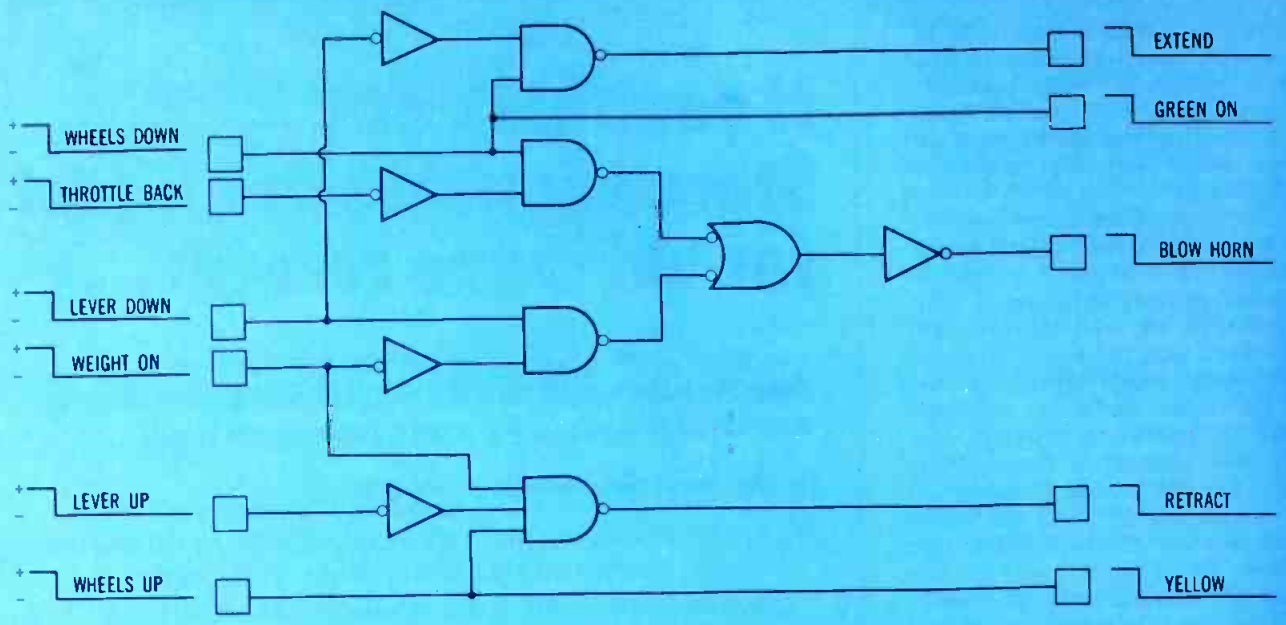

Figure 1 Combinational logic for landing gear problem.

LOGIC DEVICES: An update on functions and applications

By E. S. Busby, Jr., Engineer, Ampex Corp., Redwood City, California

Figure 2 Logic sequence for landing gear problem.

Step	Test	What to do	Next step if yes	Next step if no
0	Gear lever down?	----------	2	1
1	Weight on wheels?	----------	4	2
2	Wheels down?	----------	5	3
3	Throttle back?	----------	4	5
4	----------	Turn on horn	6	6
5	----------	Turn off horn	6	6
6	Wheels down?	----------	7	8
7	----------	Green on and stop extend	10	10
8	Gear lever down?	Green off	9	10
9	----------	Start extend	10	10
10	Wheels up?	----------	11	12
11	----------	Yellow on and stop retract	0	0
12	Gear level up?	Yellow off	13	0
13	Weight on wheels?	----------	0	14
14	----------	Start retract	0	0
15	Spare	Spare	0	0

This article is intended to update and extend past logic articles appearing in **Broadcast Engineering**, as well as pave the way for some future ones. These will not deal with logic devices, but with whole organizations of devices arranged to perform some well-defined, popular and complex tasks.

Despite the fact that microprocessors are invading the broadcast equipment business, neither this article nor its successors will do more than just mention them. If you are into microprocessors now, you already are aware that enough has been written and is being written about them. And, if you aren't, and want to be, you should start with Volume 1 of Osborne's *An Introduction to Microcomputers*, and/or the excellent series by Carol A. Ogdin in *EDN Magazine* published during the last year or so.

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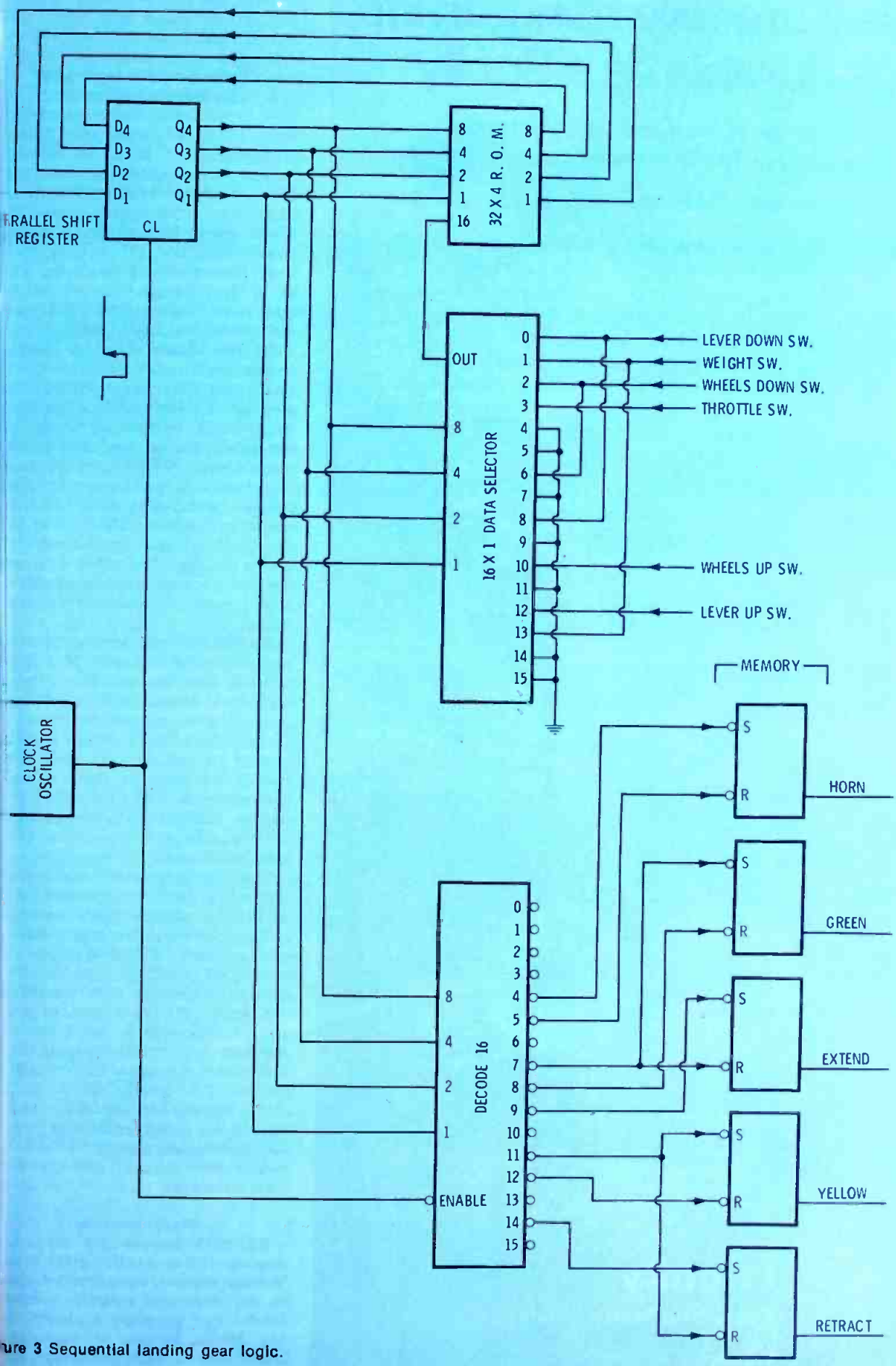

ure 3 Sequential landing gear logic.

LOGIC DEVICES

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By the time you learn one, there's another

In new designs, resistor-transisto logic (RTL) is dead, and diode transistor logic (DTL) is certainl passé. Transistor-transistor logi (TTL) is approaching senility and i being supplanted by low-power TT where speed isn't needed and low power Schottky TTL where it is Very high-speed applications, suc as in digital time base correctors still use high-speed TTL an emitter-coupled logic (ECL).

All the above share a commo characteristic: current is alway flowing in the device through on path or another, even when ther isn't much going on. They ar current-controlled devices. Anothe logic family which has risen t popularity is voltage controlled CMOS...complementary MOS. It output is similar to TTL in that bot the "pull-up" and "pull-down" ar active devices. The input, however has such a high impedance that t DC it can be considered ope circuit.

A CMOS circuit, in a static state uses almost zero power. If it jiggle around, the outputs must charg and discharge wiring and inpu capacities, and power is then con sumed. If the CMOS circuit thrashe around as fast and as often as can, it can dissipate about as muc power as a TTL circuit. CMO devices can use a wide range supply voltages...typically thre volts to 15 volts.

The "decision level," the voltag separating highs from lows, aut matically adjusts itself to abou halfway between the supply voltag and ground. CMOS devices ar often used in battery portable equi ment, and are also easy to apply "tack-on" modifications to old equipments which don't have separate logic power supply. If does share the same supply voltag as the TTL familiy, it is (with limits) compatible with TTL. CMO logic is not noted for blazing spee the lower the supply voltage th slower thay go, so read specific tions carefully.

Static warning

All MOS devices are subject damage from static discharge Moving around on carpeted floo on dry days and wearing synthe fabrics can generate a charge th can jolt a human or vaporize board full of semi-conductor jun

ions. Ground yourself before han-lling.

MOS chips often come packed vith their pins stuck into a con-luctive foam or wrapped in con-lucting foil. Keep them there until he last minute. CMOS circuits have urrent-limited connections. Any-hing over about 10 mA is danger-us. An unpowered CMOS circuit an be damaged by applying an nput to it from a low-impedance ircuit. This can happen if you ersist in plugging and unplugging ircuit boards with the power on.

Somebody will make it if everybody wants it

Virtually all common logic func-ons (gates, counters, registers, dders, etc.) are available in TTL, w-power TTL, low-power Schottky TL, CMOS and ECL, and new nctions continue to be announced. Many of the new functions reflect ie influence of the popular micro-rocessor. Some of the new devices e the same as old ones, with emory latches added to the inputs ad/or outputs. These are useful ecause the microprocessor is by ature a sequential device, whose oving finger writes and moves on to kle some other memory. Any evice which needs a steady drive, ch as a lamp, solenoid or motor, ad which is controlled by se-uential logic, must have its own rivate one-bit memory. Sometimes is convenient to combine this emory with a logic function in the me chip.

Busing without controversy

Microprocessors speak to and ten to the outside world on a set two-way wires called a data bus. ch wire is like a party-line nversation with the rule that ly one party speaks at a time. dinary logic outputs are either lling up hard or pulling down rd and are, in effect, talking all e time. They are not suitable to de the bus.

Many logic functions are now ailable with three-state outputs. separate control pin "enables" e chip, and its outputs pull up or wn according to the rules of its gic. At other times, when dis-led, the outputs are open circuit they won't disturb other outputs hich are enabled.

The concept of many devices ne-sharing a single wire is not nited to microprocessor designs. any logic designs use it, but it was mputer technology which made it, d the devices suitable for it, pular.

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LOGIC DEVICES

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The most popular microprocessors today use an eight-bit data bus. So now on the market are logic packages containing eight inverters, eight latches, eight buffers, etc., even though it takes an 18 or 20 pin long, skinny package to contain them. These help in the ceaseless struggle to cram as much logic into as little space as possible.

Memories

Microprocessors require memory in which are stored instructions and data. They want *addressable* memory. They want to send out a bit pattern representing a location where some data lives and get the data sent back right away. A huge number of memory chips have been designed for use with microprocessors and some of these find uses in ordinary logic designs. Here are some of the memory family you might meet:

RAM [Random Access Memory]

The word "random" differentiates this memory from the shift register or sequential type. Given n address pins, there are 2^n different combinations of ones and zeros that can be applied to them. Each combination is a unique "address" of a "location." At each location you may store a word or read some data that was stored there before, usually using the same input/output pins. The direction of flow is decided by a read/write pin.

A memory described as 1024x1 means 1024 one-bit words. A 256x4 means 256 four-bit words, having eight address pins ($2^8=256$) and four input/output pins.

There are two basic kinds of RAMS: static and dynamic. The static ones store each bit in a flip-flop. Dynamic ones store data as capacitive charges. In these it is necessary to periodically address (access) groups of words to refresh the charges lest they dribble away. The dynamic kind can pack more storage into a given space. The static kind is more likely to be found in non-microprocessor designs.

ROM [Read Only Memory]

Like a RAM, access to each location is gained by supplying an address. Unlike a RAM, you can only read from it, and also, data is not lost when the power goes off. Like RAMS, they are offered in various arrangements of N words of M bits each.

At some point in life a ROM must have data put into it. It is the way this is done that defines these three kinds of ROMS:

Ordinary ROMS have their contents defined in the last stages of manufacture, when the last layer of metal is deposited through a mask to define which connections are made and which are left open. If there are thousands of identical chips to be made, this is the way to do it. A typical application of a popular ROM is in video character generators having a fixed font.

Programmable ROMS (PROMS) come with all locations connected. The circuit designer decides what data he wants where, plugs the virgin PROM into a special PROM programming box, and one location at a time, irreversibly overloads each connection he doesn't want until it melts open. For small production runs, or when infrequent changes are expected, they are ideal. If you want to use one, you will find that most large supply houses have "PROM burners" on site.

Eraseable PROMS (EPROMS) can be written into non-destructively

but slowly. The contents (*all* the contents) can be erased by shining ultra-violet through a window on top of the chip. They are more expensive and are used mostly during the debugging phase of circuit development.

FPLA [Field Programmable Logic Array]

A designer is sometimes tempted nto using a PROM to solve a complex gating function. A 256x4 PROM can be used in place of four eight-input gates and save three pieces of real estate. There is a better way. An FPLA is an array of "and" gates which are fed by all he inputs and inversions of all the nputs. The outputs of all the "and" ates connect to the inputs of a umber of "or" gates, each of which drives an output pin. If there re 10 "and " gates, then each utput can be taught to respond to s many as 10 of the possible ombinations at the input pins. This s done in the same way that ROMS are programmed: by zapping open all the connections that on't make sense for the logic you re trying to accomplish.

IFO [First In First Out] MEMORY

This is an N bit wide memory arranged like a water bucket with a spigot at the bottom. Data pours in the top whenever it comes and can be taken out at the bottom whenever you want some. To help you control the pouring in and the trickling out, it comes with dipstick pins which tell the world whether the bucket is empty, half full or full. It is very useful in applications where data arrives at random and must be removed synchronously, (or vice versa) and the order of arrival is important. (It usually is.)

FILO [First In Last Out] MEMORY

FILO is similar to a FIFO except that it is organized like an "in" basket on a desk: the last thing put in lies on top, where it will be removed first. It is useful chiefly in computer systems to store the present state of affairs when the computer is interrupted to perform some high-priority task.

SEQUENTIAL LOGIC

Sequential control is nothing new. Traffic lights and car washes do it all the time, using a *fixed* sequency: green, yellow, red over and over.

Logic problems can be solved sequentially if the sequence includes a test of some external event, and the sequence can be *altered* depending on the outcome of the test.

Here is a trivial logic problem. The whole thing could be done with switches and wire, and is simple enough to serve as a non-befuddling example.

Assume that an airplane has landing gear that can be extended by running a motor one way and retracted by running it the other way. There are three switches on the landing gear:

A. Wheels are fully down.
B. Wheels are fully up.
C. Wheels are bearing weight.

In the cockpit there is a landing gear lever and an engine throttle. These have switches:

A. Lever is fully down. (extend the wheels)
B. Lever is fully up. (retract the wheels)
C. Throttle is retarded. (let's go down and land)

Also in the cockpit is a green light to indicate that wheels are full down, a yellow light to indicate wheels are full up, and a warning horn to warn of two circumstances:

A. The throttle is back and the wheels aren't down. (This can

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LOGIC DEVICES

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lead to runway damage.)

B. An attempt is made to retract the wheels before becoming airborne.
(Very embarassing.)

Don't laugh...both of these foul-ups have happened more than once.

Figure 1 shows (for reference) a straightforward combinational logic solution. Figure 3 shows a sequential approach. The output state of the shift register at Q1-4 drives three things:

1. A decoder whose 16 outputs can make something happen at each step.
2. A date selector which selects one of the 16 inputs to be "tested."
3. A ROM or PROM—whose output depends on the current step number and the test input. This output will determine the next state to be assumed by Q1-4 after the trailing edge of the clock.

Figure 2 shows the sequence in tabulated English. Steps zero and one jump to step four and sound the horn if there is danger or to step two if not. Two and three also have a chance to sound the horn or to turn off the horn if all is well. Six through nine handle extension and 10 through 14 retraction.

At each step there is an opportunity to do and/or test something. Extreme care must be taken if you are doing something to the very thing you are testing. An ugly timing program can develop. That is not the case at steps eight and 12. Step 15, although not used, causes a jump back to zero in case the shift register wakes up at step 15.

Now figure out at which step the logic absolutely prevents the wheels from coming up while they are on the ground.

This sequential solution was not intended to be efficient or elegant. The most complex sequential logic device with which the author is familiar is the electronic editor in the Ampex AVR-3 video recorder. It has 256 steps and seven 256x4 PROMS.

Unlike the example, its centre element is a presettable counter which can, at clock time, do nothing, advance one, or be preset to a new number dictated by the ROM.

Sequential logic solutions, like computer programs, can range from the obvious and straightforward to the sly and devious. Sometimes the approach taken by the designer is for a good reason.

DIRECTIONAL ANTENNA BASICS

rt 4/By **Robert Jones,** *Consulting Engineer, La Grange, Illinois and Facilities Editor for BE*

This is the fourth in our series of the design of rectional antenna systems. In this chapter I'll bring e reader through the basic formula used in the velopment of three-tower and four-tower patterns.

Three towers

Three-tower arrays are usually required when a o-tower design will not provde enough nulls, or here the protection required must be over a wider c than can be achieved with a single null. There are o common methods of computing typical three-tower tterns. These are, like the two-tower patterns, the dition method and the multiplication method. There several variations of these.

Addition formula

Like the two-tower formulas, the addition form for ee towers consists of mathematically adding up the spective tower vectors, and employing basic gonometry steps. In fact, what we have done is to d a third tower into our two-tower pattern at the d-point or reference spot. This can be represented follows:

$$E = K\ f\ (\Theta)\ (E_1 + E_2 \angle \Psi + S \cos O \cos \Theta + E_3 \angle \Psi - S \cos O \cos \Theta)$$

In this formula E_1 is assumed to be the center tower a three-tower in-line array. The most common proach says that each end tower is equally spaced m the center (reference) tower, (this is more by stom than necessity); and that each has the same ase angle, but opposite signs. Typical three-tower tterns will produce at least two nulls on each side the tower line. If these two nulls are to be of ual depth, then the magnitude of each end tower $_2$ and E_3) must be equal. When this occurs you have special case that can be computed by the following rmula:

$$E = K\ f\ (\Theta)\ [F_1 + 2F_2 \angle S \cos \Theta + \Psi]$$

ere are similarities between this formula and the e in Part 3 for the "half angle formula" except that re spacing is S instead $\frac{S}{2}$, and the phasing is Ψ stead of $\frac{\Psi}{2}$. One special advantage to this formula is at the nulls can be filled equally by changing the ase of the center (reference) tower. The greater the mber of degrees introduced, the greater will be the nount of null fill. There are no sine terms because they cancel, being equal and of opposite signs.

The example of Table 1 shows the step-by-step calculation of a typical three-tower pattern by this method. Figure 3 is a graphic representation of the vectors of the three towers in Table 1 and Figure 2. At Bearings A and B the reader can see that all three vectors add up to zero, hence there are the two null bearings.

The size of the minor lobe is represented by the amount of overlap of the three vectors at C. By use of this vector plot it is easy to see that the angle or arc between the two nulls can be changed by increasing or decreasing the magnitude of the end vectors. It must be recognized that the size of the minor lobe will be affected by the arc between these nulls. The wider this arc, the larger the size of this lobe. It should be pointed out that the nulls can be moved forward or backward along the tower line by rotating the

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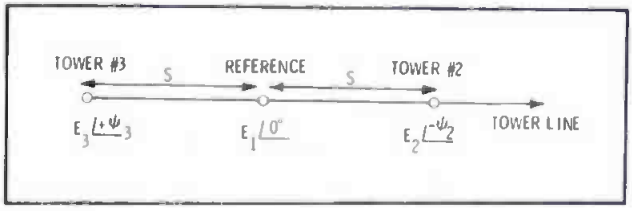

Figure 1

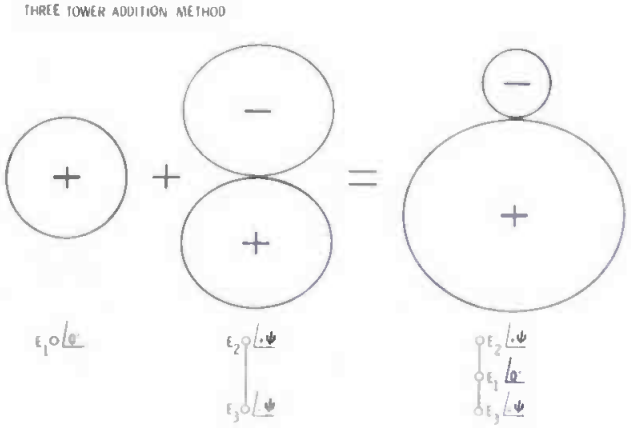

Figure 1A

Antenna basics

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beginning point of the end vectors.

Seldom used method

In addition to the general method outlined abov there is a way of considering a three-tower design a being the sum of a non-directional tower added to two-tower pattern. Figure 1-A shows the relationshi of how this is accomplished. As with the four-towe addition methods, signs of (+) and (-) are assigned t each lobe. This method works only for a case of thre towers being on the same plane (straight line).

Three-tower multiplication formulas

This is a very interesting way of designing three-tower pattern. It consists of literally taking tw separate two-tower patterns and multiplying them s that the result is an equivalent three-tower pattern. I using this method you must make certain assumptions

One assumption is that the spacing between th towers of each individual two-tower pattern is equa to that between adjacent towers on the fina three-tower array. Another assumption is that th

TABLE I
THREE TOWER SPECIAL CASE

$$E = Kf(\Theta)(F_1 + 2F_2 \cos \angle S \cos \phi \cos \Theta + \Psi)$$

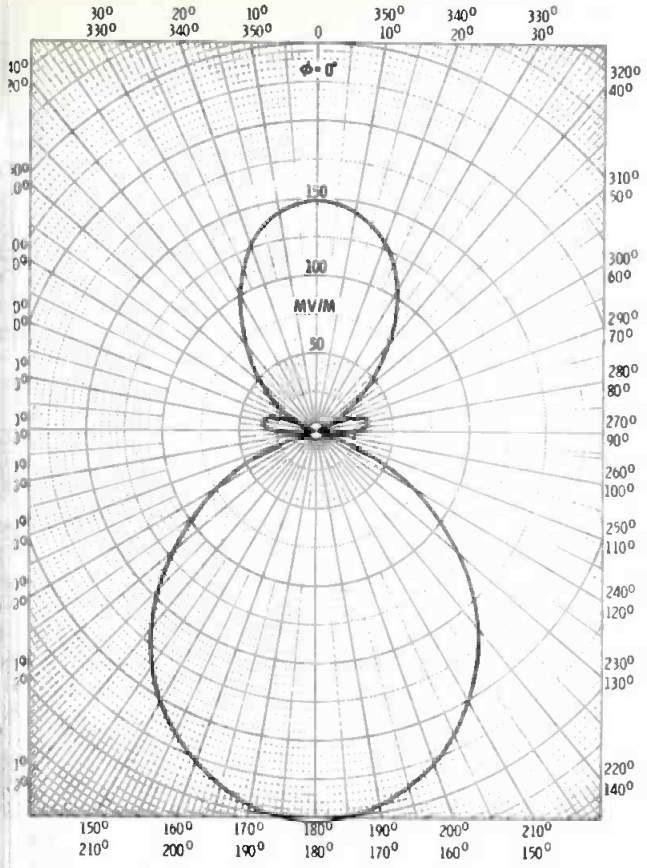
Where

$F_1 = 1.7$, $F_2 = 1.0$, $S = 90°$, $\Theta = 0°$, and $\Psi = 167.6°$

$$E = K[1.7 + 2.0 \cos \angle 90 \cos \phi \cdot 1 + 167.6°]$$

A	B	C	D	E	F	G
ø	90 cos A	B + 167.6	2.0 cos C	1.7 + D	E^2	mv/m
0	90.0	257.6	-.429	1.270	1.613	149.3
10	88.6	256.2	-.477	1.222	1.495	143.6
20	84.5	252.1	-.615	1.085	1.178	127.5
30	77.9	245.5	-.829	.870	.758	102.2
40	68.9	236.5	-1.104	.596	.355	70.0
50	57.8	225.4	-1.404	.295	.087	34.6
60	45.0	212.6	-1.684	.015	—	1.7
70	30.8	198.4	-1.897	-.198	.039	23.3
80	15.6	183.2	-1.997	-.297	.088	34.9
90	0	167.6	-1.953	-.253	.064	29.7
100	-15.6	152.0	-1.765	-.065	.004	7.6
110	-30.8	136.8	-1.458	.242	.058	28.4
120	-45.0	122.6	-1.077	.622	.387	73.0
130	-57.8	109.8	-.677	1.022	1.045	120.0
140	-68.9	98.7	-.302	1.397	1.953	164.1
150	-77.9	89.7	.010	1.710	2.926	200.9
160	-84.5	83.1	.240	1.940	3.765	227.9
170	-88.6	79.0	.382	2.081	4.333	244.5
180	-90.0	76.6	.463	2.163	4.680	254.1

$$K = \frac{129}{\sqrt{\frac{43.36}{36}}} = 117.5$$



gure 2

ference tower line for each two-tower pattern is the me as the reference for the final pattern. Also, all wers are assumed to be of equal height.

If Formula 3, of Part 3 of this series is used to present a typical two-tower pattern, and the radical rms are multiplied together, you have:

$$= K^1 f(\Theta) \sqrt{1 + \frac{M_1^2}{2M_1} + \cos(\Psi_1 + S \cos\Theta \cos\varnothing)} \times \left[\frac{1+M_2^2}{2M_2} + \cos(\Psi_2 + S \cos\varnothing \cos\Theta)\right]$$

Atually there was an extra K f(θ) term from the cond pattern, but since f(θ) was the same for each, e f(θ) will suffice. Also, the K term from the second uation combines into a new K^1 term.

In Figure 4 I have shown how two two-tower tterns can be used to produce a three-tower array. e next step is to show how one moves from the sic design values of each individual pattern to rive at the final three-tower value. In Figure 4 I've itten the design values below each of the two-tower tterns. The end tower is assumed to be the ference tower, hence it is taken as having a value of 0/0°.

e center tower is calculated as follows:

$$\text{No. } 2 = F_1 \angle \Psi_1 + F_2 \angle \Psi_2$$

d for the other end tower we use this formula:

$$\text{No. } 3 = F_1 \times F_2 \angle \Psi_1 + \Psi_2$$

The terms are those shown in Figure 4. These o-tower design values are combined by the usual ctor mathematics to achieve the final values. For an

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example I've chosen a two-tower pattern with nulls a 90° and a second with nulls at 135° off the tower line The calculation results in the pattern plotted i Figure 5.

One advantage of using this multiplication method i that each null can be placed separately, and th depth of each null is independent of the other nulls. I the foregoing three-tower addition formula, there i no such design flexibility. For this reason almost a design engineers use the multiplication method.

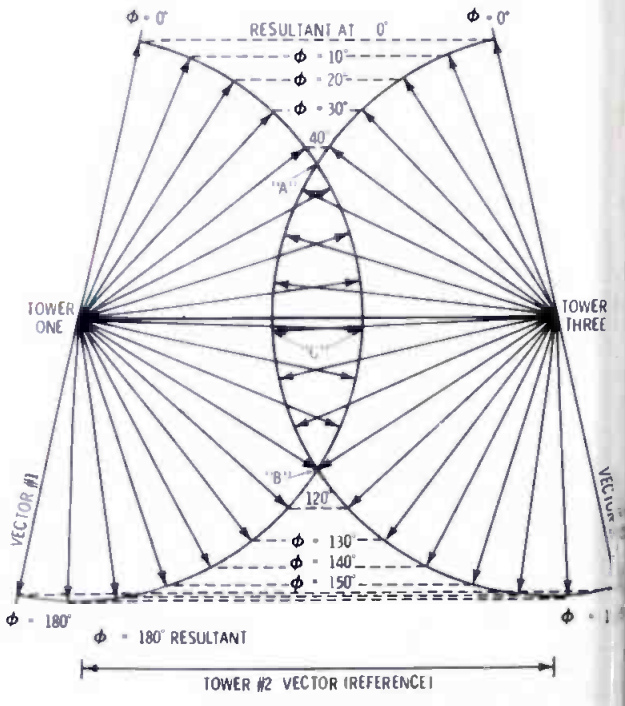
A special case of the three-tower multiplicatio formula occurs when the magnitudes of tower F_1 an F_2 are equal to the reference tower. In such a cas Formula 3 can be rewritten as follows:

$$E = K\ f\ (\Theta)\sqrt{[1 + \cos\ (\Psi_1 + S\ \cos\ \Theta \cos\ \Phi)]}$$
$$\times\sqrt{[1 + \cos\ (\Psi_2 + S\ \cos\ \Theta \cos\ \Phi)]}$$

For this condition zero nulls are produced in the fina three-tower array. It will be customary to change th reference tower, of the final pattern, from the end t the center tower. The phase angle of the center towe is then changed to 10° by subtracting out a $\frac{\Psi_1 + \Psi}{2}$ from each term in formula four and five. The en results is as shown on Figure 6.

This special case can be refined even one mor step, if the center tower of our new pattern is mad equal to unity. Equation 6 then can be written a follows:

$$E = K\ f\ (\Theta)\ [\frac{1}{2E} + \cos\ (\Psi + \cos\ \Theta \cos\ \Phi)]$$



VECTOR PLOT OF TABLE I

NULLS OCCUR AT POINT OF OVERLAP

Figure 3

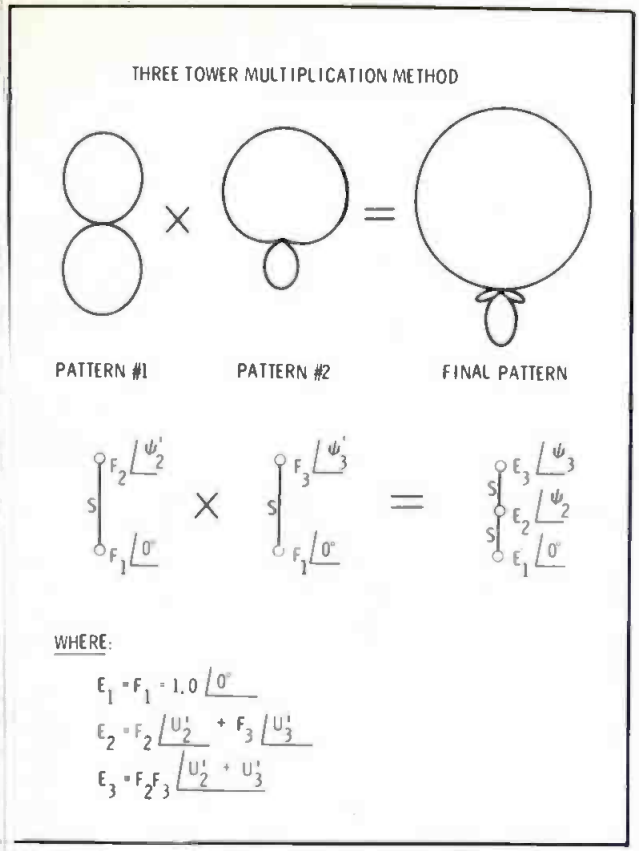


Figure 4

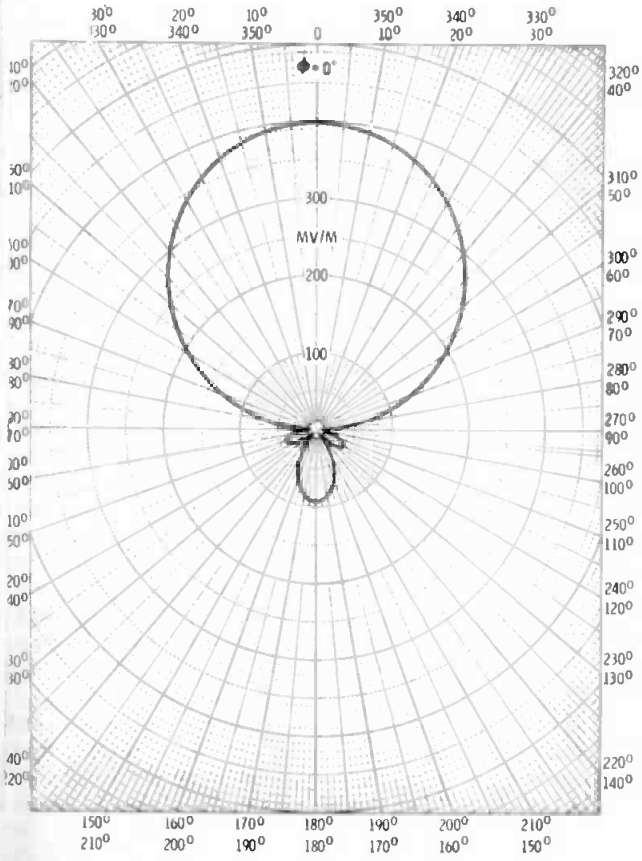
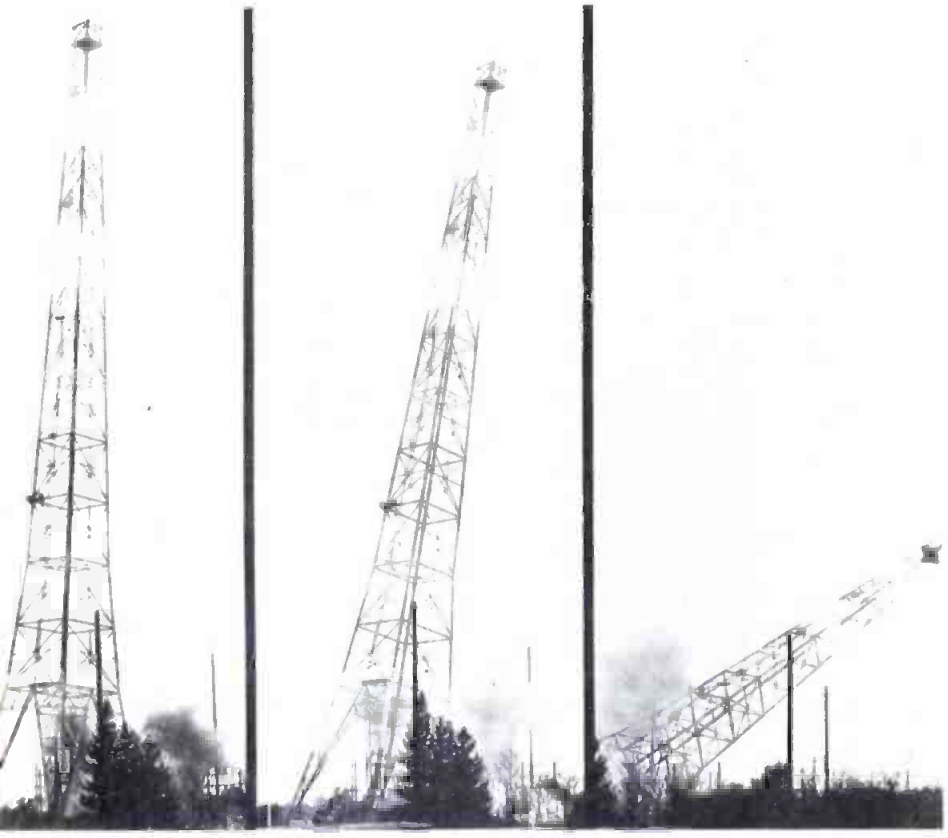


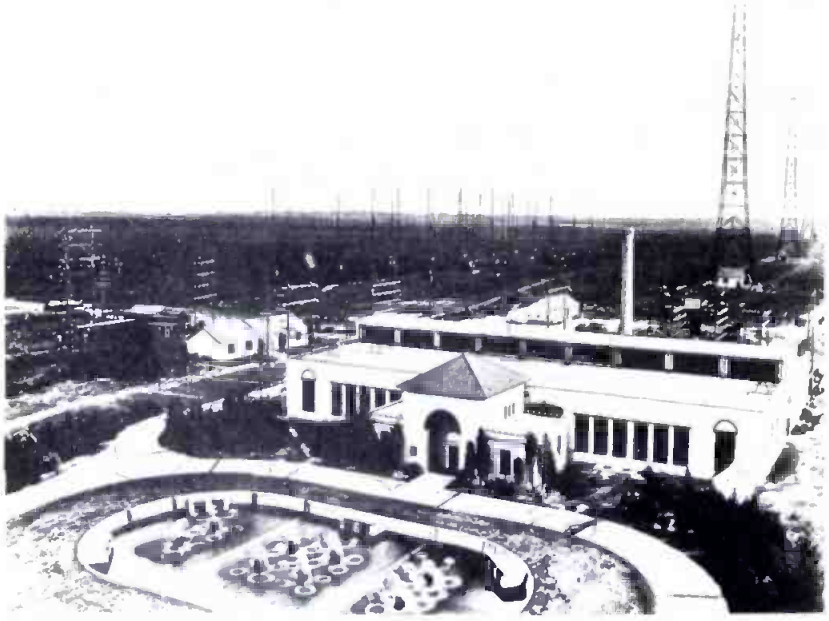
Figure 5

In this formula E represents the field ratio of each of the end towers, as compared to unity for the center tower. All the other terms are as previously explained. □

RCA demolishes last antenna tower at historic Radio Central



Dynamite charges toppled the 410-foot radio transmitting tower at Rocky Point, New York, on December 13, ending a colorful era in communications history. The tower was the only remaining structure of "Radio Central." (*Courtesy of RCA Corp.*)



Rocky Point transmitting station opened in 1921. Photo shows 410-foot long-wave towers and the "swimming pool" which was used as a cooling system for vacuum tubes and transmitters. (*Courtesy of RCA Corp.*)

By Cindy Nelson, *Editorial Assistant*

The 410-foot antenna tower at Rocky Point, New York, which was heralded at birth by a United States president, has been relegated to the scrap heap.

Although it was once part of RCA's "Radio Central," the most powerful radio station in the world, during the past few years it served only as a microwave antenna and beacon light support for Kennedy airport.

But, as James C. Hepburn, vice president and technical director of RCA Global Communications, explained, "We are using satellites, and aeronautic technology has come so far that the tower is no longer necessary."

So, the tower that took two months to build and stood for 56 years, was demolished in a few seconds.

The official opening of Radio Central on November 5, 1921 was hailed by President Harding as a milestone in wireless progress. The President put the station into operation by throwing a switch which had been rigged-up in the White House. Stations around the globe had been alerted to tune in for a congratulatory statement by the President.

The message from the White House was personally telegraphed by the late David Sarnoff, then general manager of RCA. It was acknowledged by 19 countries, four of which replied within 15 seconds.

"For about a decade, Radio Central was the only means of direct communication with Europe," Hepburn said. It was also the "hopping off" point for messages transmitted by RCA to Central and South America.

The Rocky Point site was not only famous for its role in communications, but also for the pioneers of the radio age who regularly visited there. The guest book at the location lists such men as Guglielmo Marconi, Lee DeForest, Charles P. Steinmetz, Nikola Tesla, David Sarnoff, and many others.

"At that time," Hepburn said, "the international telegraph service was quite young and Radio Central

as a major development in trans-lantic communications. RCA was ite new at that time also, having en founded in 1919."

The Rocky Point station was built ortly after RCA, then known as e Radio Corporation of Amer-a, was organized at the end of orld War I. The radio facilities of A's predecessor, The American arconi Company, were being re-rned to private control by the U.S. vernment following wartime oper-ons. RCA was formed to handle b nation's international communi-tions.

"Long-waves" were necessary for ng-distance communications in se days, and the state-of-the-art tated the use of high steel towers support massive antenna struc-es. There were originally two enna units, each with six towers 0-feet high and weighing 150 tons. ese towers stretched over a ee-mile area on the eastern end Long Island.

"For a period of time one of the ge antennas was leased to AT&T the first overseas telephone mmunications. Of course, with the e of satellites, the tower is no ger necessary," Hepburn said.

As communications technology de-oped, the long-wave system also came obsolete. The vacuum tube, ich made shortwave transmis-ns possible, made the two giant xanderson alternators and anten-"farms" a thing of the past.

"Now, in the 1970s, shortwaves e all but discontinued," Hepburn d. "I am quite certain that by the d of this decade, the Rocky Point ility (still utilized for shortwave mmunications to South America) longer will be necessary."

RCA demolished a group of six vers in the 1950s; five more were troyed in the early 1960s. One of 200-kilowatt alternators is now the Smithsonian.

The last steel tower was in-cted for structural integrity on a heduled basis and was repainted ry six years. This required a w of four riggers in bosun airs. A complete paint job re-red 225 gallons of paint and mer.

But the tower outlived its use-ness. December 13 signalled the d of a colorful era in communi-ions history. □

zoom in!

This is the official column of the American Society of TV Cameramen (ASTVC). The ASTVC can be contacted by writing to: P.O. Box 2 Sparkill, NY 10976. (914) 359-5985.

We really need to promote the ASTVC at all levels

(Ed. note: From time to time, this column presents articles submitted by members of the ASTVC. The following was written by Bob Brooks who is our Southeast regional director, working out of WPEC-TV, West Palm Beach, Florida. Correspondence regarding this column may be sent directly to him at: Fairfield Dr., West Palm Beach, FL 33407.)

On November 2-5, it was my pleasure to attend the Theatre, TV, and Film Lighting Symposium sponsored by the Illuminating Engineering Society. The symposium, held in Miami, consisted of three and a half days of lectures and product demonstrations. Discussed were subjects such as architectural lighting, with substantial emphasis on proper use and energy conservation; the concept of "dimmer-at-the-lamp," which, its proponents claim, results in an overall cost reduction of 21%; and, lighting for major rock concerts.

The third day consisted of a field trip to the Dade County Auditorium and the studios of WPBT, the local PBS outlet, and various committee and organizational meetings. The fourth day consisted of a joint meeting with the Florida-Caribbean Theatre Design Conference, with two very interesting lectures by Peter Edwards, supervising lighting director, CFTO, Toronto and Stan Miller of Rosco Labs.

One of the most interesting things shown at the symposium was the Parellipsphere framing spotlight. This one unit can replace a six-inch ellipsoidal with a pair of nine-inch focal length plano convex lenses, or a pair of 16-inch focal length plano convex lenses, without changing lens or lens tube.

Some of the other advantages are: by using a combination of parabolic, elliptic, and spheric reflector sections, this unit collects and reflects a higher percentage of light and reduces hot-spots; the framing shutters are designed to prevent warping, burning, discoloration, burning of hands, etc.; color media life extended 500% through the use of die-electric "hot mirror" which rects the unusable, infrared (heat) energy downward, throu special ducts, thus preventing t majority of the heat energy fr reaching the color media, or, in dentally, the talent. Without tryi to sound like a salesman, I have say that the Parellipsphere is one the best lighting instruments to l the field in some time.

Also shown were a myriad lighting control packages rangi from equipment suitable for a sm rock group, to disco lighting s tems, film and tape location pa ages, and, finally, to major, 100,0 seat rock concert set-ups. Dimm boards looking like something out *Star Wars* were displayed. Many these consoles utilized internal an or external memory systems prov ing greater versatility and increas capability. Wherever compute assisted lighting boards were monstrated, there was always group of onlookers.

Another item that had peo standing in line was the Gre American Scene Machine. This probably the most versatile spec effects instrument that I've seen the lighting industry. Interchan able lenses; interchangeable patt holders; and interchangeable, versible, motor drives result projection of moving cloud patter flames, and an almost endl variety of special lighting effects.

Lighting is something that affe every cameraman. At the very le it is going to affect the quality your shot, and many markets quire lighting experience as a p requisite for the job. Our creati often is not increased, because in television walk down our "TV Alley," never looking to right or left to see what associates in film and theatre doing.

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station-to-station

Filament circuit modification

By Walter C. Jamison, P.E.

The need for well-regulated fila-ent voltage supply for transmitter ower tubes is well known. Many ransmitters in use today have rovision only for manual adjust-ent of filament voltage. Most of ese transmitters are operated by combination" operators or are cated at remote sites, making areful monitoring of filament volt-ges impractical. Many remote sites ave particularly bad voltage regu-tion. In some cases the solution is regulate the power to the hole transmitter.

I have installed automatic voltage gulators in several transmitters, regulate the voltage on the ament primary bus. A further finement is to install a separate bwerstat-type variable transformer in the primary of each of the filament transformers for the larger tubes. Each tube can then be set for optimum life and performance.

In many transmitters this can be done by connecting the regulator in series with the filament contactor, as indicated in the diagram. Each transmitter will have to be analyzed and the best solution selected.

In one transmitter it was necessary to connect all the filaments to the same phase because a suitable three-phase regulator was not available. This actually improved the noise performance of this transmitter, and the power amplifier tube life was doubled as a result of careful filament voltage management.

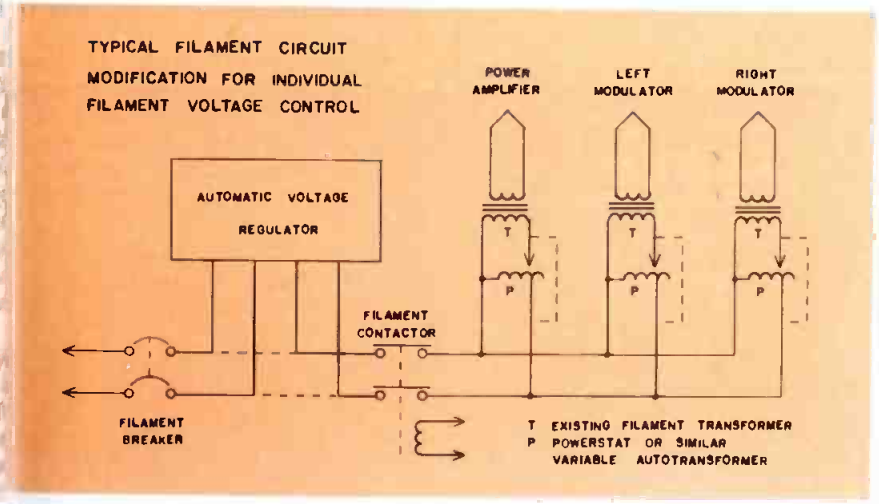

Figure 1

Modification for noiseless editing

By Mike Langner, KHFM, Albuquerque, New Mexico

News editing is a process where st-paced contemporary radio op-ration demands comprehensive verage of the day's events and mediate airing of taped "actu-ities."

A simple modification to the lenoid of nearly any tape cartridge achine will permit noiseless, quick liting as actuality material is corded onto the cartridge.

If the solenoid circuit is broken ith the SPST switch's NC contacts, the solenoid will drop out, stopping tape motion while leaving the machine in "Record" mode. The ability to start and stop tape motion independently from the generation of cue tones (and from starting and stopping the bias oscillator) permits split-syllable editing directly on the cartridge machine while recording. No tape splicing, no wax marker, no mess.

I have installed this switch (with

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a .02 uf capacitor across its contacts for arc suppression) in several models of ITC, ATC gates, and RCA audio tape cartridge machines with excellent success. Normal operation of the deck is completely unchanged. The switch positions are labeled "Edit" and "Normal." This simple modification will save 50% to 75% of the time normally spent editing tape in a radio station newsroom...to say nothing of saving the tape itself.

Building a cable tester

By Bruce V. Bradfield, KIMM,
Rapid City, South Dakota

The cable tester shown in Figure 1 is a small, self-contained, simple unit that is very effective. It will test for opens and shorts between any of the conductors of a shielded balanced-type cable. Almost any type cable can be accommodated by providing the correct connectors for your use.

On the one I built, I used standard Amphenol mike connectors because of their wide usage, and also provided four ¼-inch phone jacks in groups of two, spaced 5/8 inches apart for testing audio patch cords.

If J1 and P1 are both mounted on the chassis, they should be mounted on phenolic or some similar insulat

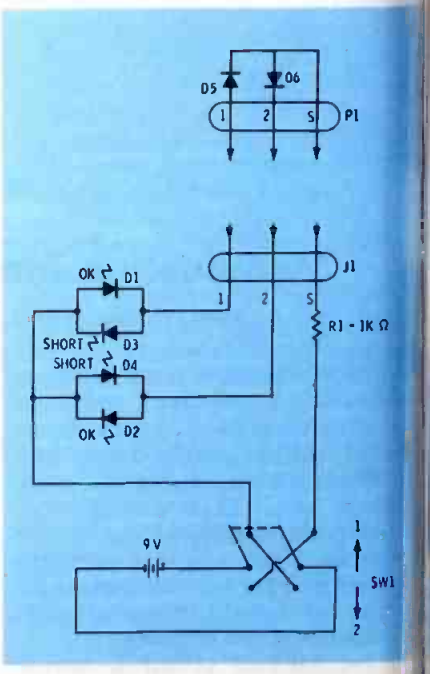

Figure 1

Table 1. TRUTH TABLE FOR LED CABLE TESTER

CABLE CONDITION	SWITCH POSITION	D1	D2	D3	D4
NORMAL	1	ON	OFF	OFF	OFF
	2	OFF	ON	OFF	OFF
1-2 SHORT	1	ON	OFF	OFF	ON
	2	OFF	ON	ON	OFF
1-S SHORT	1	ON	OFF	OFF	OFF
	2	OFF	OFF	ON	OFF
2-S SHORT	1	OFF	OFF	OFF	ON
	2	OFF	ON	OFF	OFF
1-2-S SHORT	1	ON	OFF	OFF	ON
	2	OFF	ON	ON	OFF
1 OPEN	1	OFF	OFF	OFF	OFF
	2	OFF	ON	OFF	OFF
2 OPEN	1	ON	OFF	OFF	OFF
	2	OFF	OFF	OFF	OFF
S OPEN	1	OFF	OFF	OFF	OFF
	2	OFF	OFF	OFF	OFF

ıg panel. Otherwise, an open aield will not be detected. I ounted J1 on the chassis and used a Amphenol cable connector with 5 and D6 wired inside for P1. I found this to be a handy arrangement for instances where a long mike cable is stretched out into position and then found to be bad.

To save having to drag the two ends together, the cable can be plugged into the tester on one end and the diode-equipped cable plug into the other end. You can use whatever scheme you find useful in your operation. If the cable is ok, only the two "OK" LEDs should light, one in each position of the switch. If either "SHORT" LED lights, the accompanying chart can be consulted to discover the nature of the short.

If you are interested primarily in a bench tester, the 9-volt battery and switch can be replaced with a 12 VAC filament transformer. This scheme would test both inner conductors of the cable at the same time. Battery life in the battery model should be quite long unless you consistantly leave cables plugged in for periods of time.

If you want a bit more brightness from the LEDs, decrease the size of R1, keeping the current drain below the maximum rating of the LED in use. Most types of LED should work. You may wish to use one color LED for D1 and D2, and another for D3 and D4. D5 and D6 can be almost any general purpose diodes which will handle the current drawn by the LEDs.

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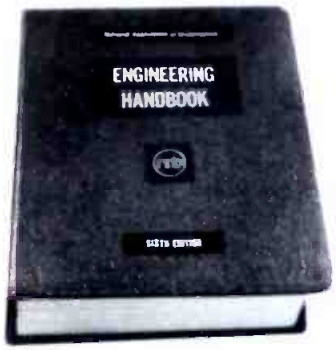

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Building a basic remote amplifier

By John Gaboury, KVOY, Yuma, Arizona

I wanted to upgrade our Telco remote (October 1971 *BE*) and find a better amplifier for all remote broadcasts. My goal was to find an inexpensive unit with excellent frequency response, low distortion, and simplicity.

After experimenting with some intractable ICs and silicon circuits, I arrived at a discrete circuit which is really inexpensive—about $11 plus output transformer. It has excellent frequency response (30 Hz - 100 kHz ±2 dB) and low distortion (under 1% at 60 dB gain). And, it uses small 9V batteries with a 12 MA quiescent drain and a full on 35 MA drain. It has excellent battery life in use, and can be improved by bypassing the battery with a 500 ufd capacitor. Headroom (and gain) is sufficient when used with an EV-635A or 654A mike; input impedance is just right for any 150-ohm broadcast mike with a near -55 dB output.

With 60 dB gain and a 4 dB output pad, it can be used on most Telco lines without a volume control. Where one is necessary, a 10K pot can be added from pin 2 of the XLR jack to ground, wiper to C1. Upper frequency response is governed by C3; if 100 kHz is too much, make C3 an .03 or larger capacitor. In applications where the 30 Hz low end allows too much room rumble (as in a gym), C1 can be decreased.

It is not RFI prone, and has excellent temperature compensation. One of our units worked seven hours directly in the Yuma sun—in an ambient temperature of 117°F. It also has been used (rarely) in 30° temperature.

It can be miniaturized; with "ends up" construction it can be put on a 2½-inch square board. With a phone jack mike input, and a miniature transformer, I have built one into a 2¼"x2¼"x4" Bud box (with VU meter and volume control). Thus, it makes an excellent main, or redundant remote amplifier.

Gain, distortion, frequency response, and battery drain are all dependent on the output transformer used. With an A67J the parameters will be close to those stated, but because of the feedback and bias configuration they may vary with the other transformers. However, the choice is not too critical. Any transformer with a 50-ohm to 150-ohm primary and a 600-ohm secondary usually will work. Or, hook up a 30-45 ohm speaker to C4, and you have a low-power utility or cue amp.

Again, although not too critical, R9 and R10 should be a close match, and Q3 and Q4 also should be a matched complementary pair (germanium!) for best results.

We've been using the units for more than five years without any problems. (Well, that's not really true. The amp that our sportscaster took into the showers, during a victory celebration, did develop a nasty hum).

I will be glad to answer any questions, but remember the builders motto, "Try it and see."

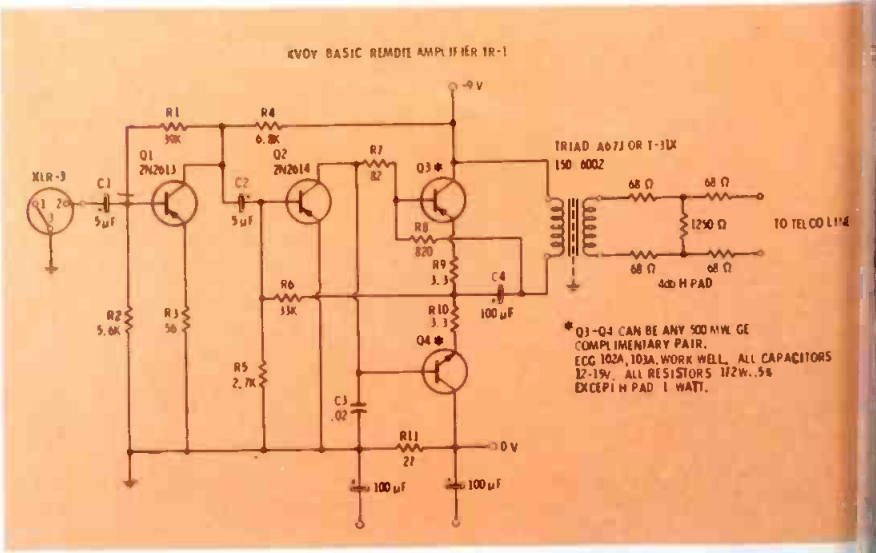

Figure 1

new products

Reproducer

A new feature of *Otari's* ARS-)00 automated radio station repro-ucer is a 25 Hz cue tone sensor nd variable time delay. The model a rack-mounted reproduce ma-ine designed to meet the needs of te automated radio broadcaster for ng term reliability under con-nuous operation. Features include vo speeds—7½ and 3¾ ips, two annel stereo (half track) head acks, recessed front adjustable tput level and head azimuth, ug-in professional grade PC boards d relays, IC preamp in head sembly for improved S/N, simple eration plus remotable play and p, ready light to indicate proper pe threading, special long-life poly-opylene pinch roller and ball arings.

For More Details Circle (75) on Reply Card

Automatic information system

System Concepts' new Merchan-er I™ is an automated informa-n system based on microcomputer nagement. It features a high-solution character generator, ital cassette mass memory, and a chine controller.

Video sources such as VCRs, mm slide projectors, 16mm film jectors, messagewheels, and data hannels may be automatically con-lled and selected to the cable rator's desired program sched-

The Merchandiser I uses a macro-chine-management approach to plify program source access and trol, taking into account each que machine personality.

For More Details Circle (76) on Reply Card

Cassette cleaner/evaluator

The *Chyron* cassette cleaner and luator, CCE model U-1, a self-tained unit, is said to clean and luate ¾-inch videocassette tape times faster than real time hout altering the pre-recorded nal.

The unit removes dirt and em-ded particles from tape surfaces, detects surface and edge dam-which may cause VTR head clog d video dropout. A 30-minute sette can be processed in less n three minutes.

The unit can be made to auto-tically stop on major tape damage y, stop on minor tape damage only, or continue until the entire playing surface of the tape has been cleaned until evaluated. Two LED numeric counters on the front panel indicate the actual tape length in minutes and tenths to 99.9 minutes, and provide a count of accumulated major and minor tape damage. Eight message lamps reflect the tape and system status at each stage of the operation.

For More Details Circle (77) on Reply Card

Flexible counter

Most counters available today are either frequency or events counters. The new lineup of *Heath* 4100 counters will do both. To see how accurate and functional these units are, we tested the IM-4110 on our bench.

The IM-4110 comes in a kit or wired version, and on the frequency side, it will cover anything from 5 Hz to 110 MHz. Two interesting features are the function hold and attenuation controls. The function hold control is adjustable, and will hold the eight-segment display on the number measured after the signal is withdrawn. The attenuation control divides the incoming signal by 1, 10, or 100.

Strictly state of the art and designed for easy kit construction, the 4110 uses TTL, MOS, and ECL logic circuits.

Additional functions include events, period, and period averaging. Aside from counting events, the unit can read the period of a signal. In the period averaging mode, the counter displays the time of a single period based on a 1000-period average.

On our bench, the 4110 proved flexible, accurate, and a good buy for the money. Other 4100 series models cover 5 Hz to 250 MHz, and 5 Hz to 1 GHz.

For More Details Circle (78) on Reply Card

Portable video backpack/cart

K and H Products' Porta-Brace™ "Series B" video backpack and cart system is designed for use with the Sony DXC-1610 camera, and any of the new portable VCRs, including the Sony SLO-340.

Features include a camera support which redistributes the weight of the camera from the right shoulder to the back and hips,

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new products

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independently positions the camera at eye-level, and allows it to b swung away from the eye fo walking convenience.

Another feature is the foam padded canvas nylon video recorde case, with shoulder strap an accessories case. Both cases attac to the Porta-Brace backpack/wheel base system, the modular desig which provides the user with backpack and a cart.

For More Details Circle (79) on Reply Card

Three-signal generator

Shintron's model 383 (CB)^3 is sai to be a precision, broadcast-grade three-signal generator in one rack mount package. The unit require standard NTSC sync, blanking, an subcarrier signals.

It generates color bars, colo background, and color black simul taneously. These output signals ca be delayed from 200 nS to 1.0 uS t match the delay in color cameras.

The color background generato can be used as an additional colo source for keying, matte, etc., i production applications. For switch ers not equipped with color blac the unit adds fade-to-black capabi ity. Some cameras also can lock o to color black to simplify distr bution.

For More Details Circle (80) on Reply Card

Audio products catalog

Whirlwind Music's new "Aud Products Catalog" features its cabl and connectors. Included are plug jacks; cordsets for amplifier speakers and microphones; impe ance matching supplies and bu accessories.

Also featured are Medusas, f simplifying the multiple wiring of systems and recording set-ups. Medusas feature cast aluminu stage boxes, riveted chassis-mou ed jacks, and wire mesh str reliefs. Medusa is available in fi basic configurations, or with seve connector options.

For More Details Circle (81) on Reply Card

Digital antenna monitor

Gorman-Redlich Mfg. Co. has new FCC type-approved (#3-2 digital AM antenna monitor, mo CMR, which is fully remotab Priced at $1990 for two towers, monitor features true ratio read stability with unsymmetric modu

employs screw-type terminal blocks for all inputs and outputs. Switching is solid-state integrated circuitry. Minimum crosstalk is -65 dB and maximum output level is +18 dBm.

For More Details Circle (83) on Reply Card

Mixing system

Rupert Neve's computer-aided mixing system (NECAM) is an integrated system that has removed the real time barrier by an independent storage medium keyed to a time code recorded on one track of the master tape. An engineer can interrupt, recycle over short segments, and operate at half-tape speed while the computer looks after the "joins."

Many "mix" attempts may be stored and recalled at will. "Update" is the instinctive improvement of a recalled mix which requires no action by the operator other than correcting fader movements. The faders are servo-driven and touch-sensitive, preserving the combination of control and indication.

A mixdown undertaken in segments may be assembled into one mix without moving the tape. Mixes may be subdivided into tracks by instructing the keyboard. This key-

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in, and compact size.

The monitor has DC outputs for note phase and ratio readings. ds LED displays with continuous hase sign, and BCD outputs. It has 19-inch rack mounting panel 5¾ nches high, and 6 inches deep. wer consumption is 6 watts.

For More Details Circle (82) on Reply Card

Routing switchers

The *Di-Tech* series 5500, 5501 and 02 routing switchers provide a ans of routing any input signal to y output buss without disturbing er inputs.

The standard control panels ich house the momentary illumi-ed pushbuttons are located sep-ately from the electronics. Should ter means of addressing the itcher be required, thumbwheel itches with readouts or Touch ne Control can be utilized.

The video inputs to the switchers in groups of four and BNC type nectors are used for all inputs d outputs. Inputs are hi-imped-ce, with loop-thru bridging and tput expansion. The switching se for video is vertical interval, ndard with models 5500 and 01.

The audio switcher model 5502

new products

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board controls all functions and is backed up by a line alphanumeric display which tells the operator what is going on. Incorrect or impossible commands are politely refused, and when an operation is carried out in stages, the next step is announced.

For More Details Circle (84) on Reply Card

Bandpass filters

A family of active bandpass filters featuring third, half and full-octave responses is available from *Frequency Devices, Inc.* Requiring no external compensation or offset trims, the 765 Series consists of finished filters specifically designed for ANSI Standard signal analysis. All models meet the ANSI Specification over the 0°C to 70°C operating temperature range.

For More Details Circle (85) on Reply Card

Compressor/limiter

Broadcast Electronics has designed the model AM-400 AM compressor/limiter for smooth, noise-free control of transmitter input levels. The model protects against overmodulation while automatically maintaining average modulation at optimum levels.

The unit features an adjustable compression release time of 5 to 40 seconds for 20 dB release, symmetrical or asymmetrical processing, one microsecond attack time, and a ±20 dBm output capability.

For More Details Circle (88) on Reply Card

Timer

DT-3 by *Pacific Recorders and Engineering Corporation* is a functional, compact timer. It is designed to be built into a console meter panel but can be purchased as a table top unit. The DT-3 has complete remote control capability. Start, stop, reset, display hold and display blanking may be programmed by normally open switch contact to ground, or digital interface by open collector gates.

For More Details Circle (86) on Reply Card

Color balancer

TeleMation's CA-3000, an accessory to the TCF-3000 broadcast color film camera, automatically improves the color balance of poor-quality film and slides by continuously sampling and correcting selected portions of the signal.

For More Details Circle (87) on Reply Card

Help!

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Microphone mixer

A newly designed 4-channel mic mixer, M41, and a companion expander, M41X, are available from Edcor. A stereo jack and cord allows expansion to 10 channels when wanted.

The units feature solid-state design allowing a variety of input and output impedances without switches or extra transformers.

For More Details Circle (89) on Reply Card

Monitor speaker

A new stage monitor speaker has been designed by *Shure Brothers* inc. to accommodate entertainers eager to hear themselves clearly and cleanly while performing on stage.

In the model 702, wide-angle high frequency dispersion is provided by a new tweeter configuration that disperses the sound in a broad pattern, allowing free stage movement without sound loss or distortion.

Features include: shaped frequency response, with boosted midrange and controlled bass roll off; and sensitivity of 97 dB SPL at 4 feet with one watt input.

For More Details Circle (90) on Reply Card

Automatic dialogue replacement module

Convergence Corporation has introduced the ADR-8 automatic dialogue replacement module. When added to the ECS-1B Joystick videocassette editor and PC-3 program computer the unit allows the operator to automatically replace prerecorse audio segments on ¾-inch videocassettes with a live microphone. Typical applications include foreign language sound track dubbing and lip-sync dialogue replacement formerly possible only in film sound dubbing studios.

For More Details Circle (91) on Reply Card

Color sync generator

A new color sync generator, model SY-5990A, and a companion genlock, model SY-5995A, add NTSC capability to *Dynair's* 5900 Series distribution equipment.

The sync generator has an oven stabilized crystal oscillator and meets all FCC part 97 requirements over the temperature range of 0-50°C.

For More Details Circle (92) on Reply Card

Remote mixer

Ramko Research has introduced a portable (2 pounds) remote broadcast mixer with built-in limiting/compression. The DML Series mixers feature low distortion amplification, mixing, limiting/compression, tone generator for level set, internal battery and optional AC operation, phone monitor/talk-back function, and XLR type input/output connectors.

The "set and forget" controls give the operator freedom from meter watching and knob twisting. The DML mixers are available in a stereo mike version, a two mono mike version, and a two mono mike with one high-level input unit.

For More Details Circle (93) on Reply Card

Stereo headphones

Burwen Research has introduced a new family of five stereo headphones. Two models, PMB 8 and PMB 6, are orthodynamic; and the PMB 4, PMB 40 and PMB 20 utilize a dynamic driver.

PMB 6 specifications include: 16-23,000 Hz frequency response, less than 0.3% total harmonic distortion, 121 dB maximum sound pressure level at 1 kHz, and 140 ohm impedance.

The PMB 4 is the highest performance dynamic unit, with 20-20,000 Hz frequency response, less than 0.3% total harmonic distortion, 114 dB maximum sound pressure level at 1 kHz, and 400 ohm impedance.

For More Details Circle (94) on Reply Card

Hi-fi generators

A high-fidelity signal generator for the radio industry and a companion stereo generator modulator are available from Radiometer Electronics through their U.S. representative, *The London Company*. Both generators feature a wide range of capabilities necessary for AM, FM and FM stereo receiver testing and design in R&D, production, Q C, and service activities.

The RE101 RF generator features a digital display of FM and AM carrier frequencies from 150 kHz to 30 MHz and 86 MHz to 130 MHz in six ranges, plus a special 10.7 MHz range. Sweep capabilities are provided on all frequencies together with two sweep widths and center frequency marker. FM and AM modulation may be supplied from internal or external source.

For More Details Circle (95) on Reply Card

Zoom In!

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Our job would be easier and our product better if we would only remember that many techniques will carry over into television with only minor variations. Let me encourage you to make yourself aware of practices in use in these other two fields.

After sitting in on various staff and committee meetings, it is obvious that a professional organization can, and should, be a powerful lobbying force in the area of the industry which affects that organization. In other words, the ASTVC could have a great deal of influence in the area of design and manufacture.

Our opinions, suggestions, and recommendations could affect the design of the next camera your station purchases. Therefore, we strive to be recognized by the industry as an organization that is composed of professionals: people concerned with furthering professional standards in the interest of producing the best possible product.

As regional director for the Southeast states, let me address myself now to those members. I realize that, in areas such as this, where membership is comparatively low, attendance at ASTVC-sponsored activities might be less than we would hope for. But that makes your efforts that much more important. The ASTVC requires your help if it is to expand its activities in the Southeast. If I can help you in any way in organizing a chapter in your city, please contact me directly.

The one question that I was asked the most in Miami was: "Who (or what) is the American Society of TV Cameramen?" You can provide a lot of needed publicity within your own station. Further, we need publicity on ASTVC-sponsored technique product presentations, seminars, product information sheets, and other activities/services made possible through the cooperation of our various industry corporate sponsors.

The success of the ASTVC is going to be proportional to the amount of effort expended by its members. So, let me encourage you to take full advantage of opportunities to participate in activities sponsored by the ASTVC; not also for the sake of the ASTVC, but for your own benefit as a professional with a stake in this industry and its future.

professional services

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PASS FCC first and second class exams with new 21-lesson, 450-page course. Starts with basic electricity. Over 600 FCC-type, multiple-choice questions and sample exams included. No previous technical knowledge required. Commercial Radio Operator Theory Course, #15-01. Only $5.95. Ameco Publishing, 275G Hillside Ave., Williston Park, N.Y. 11596. 8-72-tf

PASS FCC EXAMS with Ameco books. Each book contains FCC questions plus simplified answers plus FCC-type exams and answers. 3rd class includes broadcast endorsement $1.25. 2nd class $2.50, 1st class $1.60. Free catalog. Ameco Publishing, 275G Hillside Ave., Williston Park, N.Y. 11596. 8-72-tf

REI offers intensive but quality instruction for 1st and 2nd class FCC license preparation. State approved for Veterans training. Student housing. Free brochure. 2402 Tidewater Trail, Fredericksburg, Va. 22401 or Phone 703-373-1441. 7-77-8t

GRANTHAM'S FCC LICENSE STUDY GUIDE—377 pages, 16 FCC-type practice tests, 1465 questions with answers and discussions—covering third, second, and first class license exams. $13.55 postpaid. GSE Publications, 2000 Stoner Ave., Los Angeles, CA 90025. 10-77-tf

ELECTRONICS DEGREE by correspondence. No commuting to class. Study at your own pace. Begin with basics and continue, first for A.S.E.T. and then for B.S.E.E. For free brochure, write: Information Desk, Grantham College of Engineering, 2000 Stoner Avenue, Los Angeles CA 90025. 10-77-tf

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FREQUENCY MEASURING SERVICE—WE'RE #2 —MONITOR REPAIRS—MOBILE UNIT—covers Northern ⅔ Ill., Eastern Iowa, Eastern Minn., Southern ⅔ Wis., Western Mich., and Western Ind., monthly. Radio Aids, 528 Ravine Ave., Lake Bluff, Illinois 60044, (312) 234-0953. 2-74-tf

COMMERCIAL RADIO MONITORING CO. Precision frequency measurements since 1932. Local and mobile service covering entire midwest plus. Test instruments, counters, monitors repaired and certified. Lee's Summit, Mo. 64063. (816) 524-3777. 9-74-tf

ONE STOP FOR ALL YOUR PROFESSIONAL AUDIO REQUIREMENTS. Bottom line oriented. F.T.C. Brewer Company, P.O. Box 8057, Pensacola, Florida 32505. 7-71-tf

SERVICES (Cont.)

BUILD YOUR OWN TV AND RADIO PRODUCTION EQUIPMENT. Easy, inexpensive, (mostly IC). Plans or kits: Special Effects Generator, Automatic Logger, Vertical Interval Video Switcher, Solid State Lighting Board, Preset Audio-Video Board, Preset Lighting Board, Crystal Controlled Wireless Mikes with Matching receivers. Subsonic Tone Control for audio tapes, 8MM SOF Cameras and Projectors, Distribution Amplifiers (Sync, Video, Audio), Audio Control Boards (Studio & Remote) Proc-Amp with compensation and regeneration for adapting Helical Scan VTR's to broadcast standards. PLUS specialized correspondence courses in TELEPHONE Engineering ($39.50), and Integrated Circuit Engineering ($49.50). Plans from $5.95 to $15. SUPER CATALOG plus years updating of new devices Air Mailed $1.00. Don Britton Enterprises, P.O. Drawer G, Waikiki, Ha. 96815. 5-77-32t

CARTRIDGE RECONDITIONING SERVICE: CLEANING—NEW PARTS—NEW TAPE. 12 Years Experienced Personnel. Write for additional information & price sheet. MASTERTONE COMPANY, 1105 Maple, West Des Moines, Iowa 50265, 515-225-6122. 8-77-tf

SAVE HUNDREDS OF DOLLARS on high quality, dependable, American Made, MATV Head-Ends, V/V, U/V Converters, Camera Modulators, at factory-direct prices. Send $5.00 (or your MATV Installers Letterhead). "Information," Box 809, Boynton Beach, Fla. 33435. 1-78 e.o.3

TOWER PAINTING AND LIGHTING: Service and maintenance contracts offered. Pioneer Tower Service, P.O. Box 253, Carrollton, Missouri 64633, (816) 542-0840. 9-77-tf

AUDIO JACK FIELD WIRING. Standard or custom configurations. 26-jack panel wired to terminal block including materials $180. Phone or mail us your requirements for prompt quote. Centennial Manufacturing Company, P.O. Box 1056, Hurst, Texas 76053. 817-589-2512. 2-78-1t

HELIAX-STYROFLEX. Large stock—bargain prices—tested and certified. Write for price and stock lists. Sierra Western Electric, Box 23872, Oakland, Calif. 94623. Telephone (415) 832-3527. 1-73-tf

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BROADCAST CRYSTALS for AM, FM or TV transmitters, frequency change, repair or replacement of oven types. Also vacuum types for RCA, Gates, Collins, etc. transmitters. Quality products, reasonable prices and better delivery! Don't be without a spare crystal. Frequency change and service for AM and FM monitors. Over 30 years in the business. Eidson Electronic Co., Box 96, Temple, Texas 76501. Phone (817) 773-3901. 12-74-tf

BROADCAST AND STUDIO EQUIPMENT. New and used. Cart and reel recorders, consoles, limiters, monitors, mic's, turntables, preamps, speakers, racks, furniture, reconditioning services, parts (including PT6). Authorized Spotmaster distributors. Contact us for best prices and trade-in deals. AUTOMYNE, P.O. Box 13036, Orlando, Fla. 32809, (305) 855-6868. 9-77-tf

ONE-THIRD OCTAVE FILTER SET, General Radio #1925. Thirty filters, 20Hz-20kHz, each with 50dB attenuator (1dB/step), graphic display. Thirty Parallel outputs; and summed, weighted, or serial remote-controlled scan outputs. $5500 new. Like new, $4000 or best offer. Contact: R. Koziol, GAF Broadcasting, 1180 Avenue of Americas, NY 10036. 212/626-1043. 2-78-2t

FOR SALE: Large variety of used equipment. Camera, Sound, Editing, Projection, Staging. Send for list. Telecine Film Studios, 654 Busse Highway, Park Ridge, IL 60068. 2-78-1t

TK-27 WITH ALL MODIFICATIONS. Three PC-70 Cameras, COL Model VSA-102 audio video switcher. Bill Orr WBNS Stations 614-460-3912. 2-78-2t

EQUIPMENT FOR SALE (CONT.)

EXCEPTIONAL OFFERING, like new: (24) Ampex 351 Electronics, both masters and slaves, operational, last alignment was for Ampex 406 tape. (12) Scully 280 B's. EMT 930 turntable with extras. Revox A-77 2-track deck. (13) Dynaco Mark III power amps. (4) Dynaco model 70A stereo amps. (2) Dynaco Mark IV amps. Cinema Eng. type 9205-A degausser, ten inch reel size. Sony 1 inch color video recorder model EV-320 plus CLP-1B video color pack. (1) JBL 5306 Pro-mixer. The original NORDEN BOMBSIGHT. (1) Philips Sound Delay Machine model EL 6911/02. (5) Technics turntables SL 110 A. Contact: CINEMA/SOUND LTD. 212-799-6940. 2-78-1t

MICA AND VACUUM transmitting capacitors. Vacuum relays. Large stock; immediate delivery. Price lists on request. SURCOM ASSOCIATES, 305 Wisconsin Ave., Oceanside, Ca 92054, (714) 722-6162. 3-76-tf

RAZOR BLADES—Single Edge. Tape Editing, Raltec, 25884B Highland, Cleveland, Ohio 44143. 4-77-12t

CARTRIDGE LABELS: New, non-smear pressure sensitive labels. Fits all cartridges. Comes white & 4 colors. Write for FREE sample—MASTERTONE COMPANY, 1105 Maple, West Des Moines, Iowa 50265, (515) 225-6122. 8-77-tf

VPR7900, excellent condition Best Offer 305/624-4252. 2-78-1t

REPLACEMENT PREAMPLIFIER for OTARI ARS-1000 tape deck. Highest quality, multiturn level adjustment, American I.C. in socket, glass P.C. board. $80.00. Iowa Development Labs, Box 1913, Iowa City, Iowa 52240. 1-78-2t

TWO SONY 2850A's and TRI EA-4 and EA-5 EDITING CONSOLE—One year old. VTR's are broadcast modified, XLR audio, rf, and sc jacks. Serivce manuals. Sony training tapes. Spare parts. $9,500. Montana Media, Box 7093, Missoula, Montana 59807. (406)-543-6441. 2-78-2t

WANTED

WANTED: All surplus broadcast equipment especially clean A.M. & F.M. transmitters, capacitors, 112 Clark & Potomac Phase monitors, Field Strength Meters, etc. High prices. All custom duties paid. Surplus Equipment Sales at 2 Thorncliffe Pk. Dr., Unit 28, Toronto 17, Ont., Canada (416) 421-5631. 1-76-tf

WANTED: 4W20,000A tubes. Lloyd Erickson, Phone 701/282-0444. 1-78-1t

WANTED: 250-500 watts FM stereo transmitter. WTAO-FM, Rt. 5, Box 286, Murphysboro, Ill. 62966. 1-78-1t

WANTED: Pre-1926 radio equipment and tubes. August J. Link, Surcom Associates, 305 Wisconsin Ave., Oceanside, Ca. 92054, (714) 722-6162. 3-76-tf

WANTED 300' tower, 3KW FM Transmitter, Studio used. Joy Broadcasters, 608-723-7628, Lancaster, Wisconsin. 2-78-1t

AMPEX 1200, prefer OH with EDITEC. Call O. Zulli 213-466-5441. 2-78-2t

WILL PURCHASE FOR CASH ANY OF YOUR EXCESS TUBES—transmitting, camera types; anything in good condition, including lamps and electronic parts. Write to: S & M Associates, 1231 Waterview Street, Far Rockaway, N.Y. 11691. 4-77-eot-6t

HELP WANTED

CHIEF ENGINEER—quality oriented—for AM Directional and High Power FM station. Formal electronics training required. Send detailed resume and salary requirements to: Director Engineering, Box 6002, Roanoke, Virginia 24017. 1-78-2t

HELP WANTED (CONT.)

ENGINEERING POSITIONS ($15,000-$40,000)—Openings at all locations coast to coast—all levels and disciplines. Over 1,000 firms represented. To cover ALL your immediate job possibilities in the "unpublished" market, send your resume with salary requirements now. No fee, confidential, professional. KEY PERSONNEL NATIONAL HEADQUARTERS, South Main Towers, Wilkes-Barre, Pa. 18701, (717) 822-2196 1-78-TFN

WE ARE LOOKING FOR A FIRST RATE EXPERIENCED TECHNICIAN capable of caring for a wide range of modern equipment in a large network affiliate. Must have a solid technical background and be heave on **EXPERIENCE** in most of the following: cameras, switchers and production facilities; transmission equipment and microwave; quad and helical VTR; audio mixing and recording equipment; digital devices; E.N.G. etc. First Phone required. Swing and some night shifts. Send full resume to Bob Plummer KOMO-TV, 100-4th Ave. No., Seattle, Wa. 98109. (206) 223-4027. Equal Employment Opportunity Employer. 12-77-3

TV STAFF ENGINEER with production and light maintenance experience. Should have critical eye for quality. Broad advancement possibilities. Good pay, good area, good working conditions. An Equal Opportunity Employer. Call Don Vest, Director of Engineering, Hernreich Broadcasting Stations, (501) 783-4105. 2-78-1

MAINTENANCE SUPERVISOR for established AM/FM installing new, modern state-of-the-art studios. Must be quality conscious. Good benefits and environment. Moderately low cost of-living. An Equal Opportunity Employer. Call Don Vest, Director of Engineering, Hernreich Broadcasting Stations, (510) 783-4105. 2-78-1

CHIEF ENGINEER for University telecommunications center. Will have technical responsibility for modern broadcast TV, FM and CCTV facility. Qualifications include: BS in related field, demonstrated state of the art technical knowledge, leadership ability, and FCC first. Equal Opportunity Employer. Send resume, references and salary requirements to: Dept. 407, Broadcast Engineering, P.O. Box 12901, Overland Park, Kansas 66212. 1-78-2

ENGINEER—Indiana Higher Education Telecommunication System has immediate opening for experienced engineer to plan and execute preventive maintenance program or its television and special electronic systems (ITFS, VTFs, RF, digital). Requires First Phone. Work with university personnel. Digital experience helpful, degree desirable. Send resume, references, and salary requirements to: Jim Potter, IHETS, 1100 W. Michigan, Indianapolis, IN 46202. EEO/AA Employer. 2-78-

"CHIEF ENGINEER WANTED for 5,000 day, 1,00 night directional, Pueblo, Colorado, KIDN, Box 293, 81002 (303) 542-5570." 2-78-

NEEDED—CHIEF ENGINEER strong on processing and construction to join West Virginia winning radio team. Good money for the right man. A truly great place to work and live. Send full resume and requirements at once if you can make the best sound better. Garry Bowen WCLG FM/AM, Morgantown, WV 26505. 2-78-

WANTED: Combo-man with engineering ability FCC First Class, able to maintain automatic system and stereo FM operation. Contact Manager, WDBI-FM, Tawas City, Michigan. 1-78-

CHIEF ENGINEER—Experienced with directional and remote control. Spanish speaking California operation. Good working conditions and fringe benefits. Must have good technical background. Send resume and salary required to Dept. 40 Broadcast Engineering, P.O. Box 12902, Overland Park, Kansas 66212 2-78

TELEVISION—CCTV Video Maintenance Technicians. Full Benefits. Greater New York, Suffolk County or New Jersey Area. Send resume to VPC, P.O. Box 268, New Hyde Park, N.Y. 110- 6-7

HELP WANTED (CONT.)

DEO PRODUCTION ENGINEER Offers travel, eresting work with Midwest based tele-pro-ctions company. Requires First Phone, exper-ce in operation and maintenance of cameras d VTR's. Good salary and benefits. Send ume to: Bob Binderup, Black Hawk Com-nies, KWWL Building, Waterloo, Iowa 50703. O Employer, M/F. 2-78-1t

GINEER-TV MAINTENANCE: RCA 2-inch VTR. R Cart Studio Cameras. TK 27 film. Solid state ble shooting. FCC first phone required. Top sunny Southwest. Salary $248-$300 commen-ate with experience. Submit detailed resume Dept. 408. Broadcast Engineering, P.O. Box 01, Overland Park, Kansas 66212. An Equal portunity Employer. 2-78-1t

AINTENANCE ENGINEER THREE TO FIVE ARS' PRIOR MAINTENANCE EXPERIENCE L PUT YOU ON THIS UP-TO-DATE facility's n. Excellent benefits future with a #1 in ket, CBS southeast affiliate. Equal Opportun-Employer. Contact Jack Becknell, V.P., ineering, WCSC-TV, P.O. Box 186, Charles-SC 29402 (803) 723-8371. 2-78-2t

ENSED TV TECHNICIAN experienced in ation and maintenance of studio and trans-er equipment for commercial midwest mar-Latest equipment, pleasant environment, full fits. NBC network/heavy local production. Jerry Merritt, WICS-TV, 2680 E. Cook, ngfield, Ill., 62703 or call (217) 753-5665. 2-78-2t

EVISION OPERATIONS ENGINEER needed new corporate television production studio. ate and maintain the latest ENG/EFP video ms. 30% travel throughout U.S. Salary mensurate with experience. Excellent bene-s Send resume with salary history to R.J. e, Air Products & Chemicals, Inc., P.O. Box Allentown, PA 18105. 2-78-1t

HELP WANTED (CONT.)

REMOTE TV ENGINEER. For studio and remote operations. FCC license required. Must have technical and operating background. Send resume and salary requirements to: Chief Engineer, WTCG-TV, 1018 West Peachtree St., Atlanta, Georgia 30309. 1-78-2t

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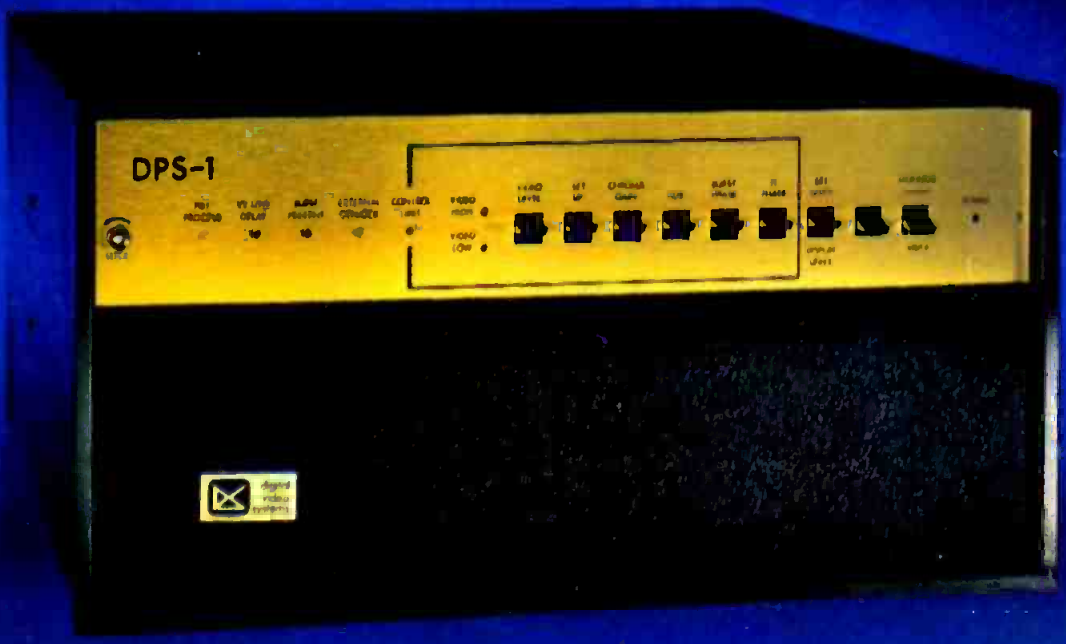

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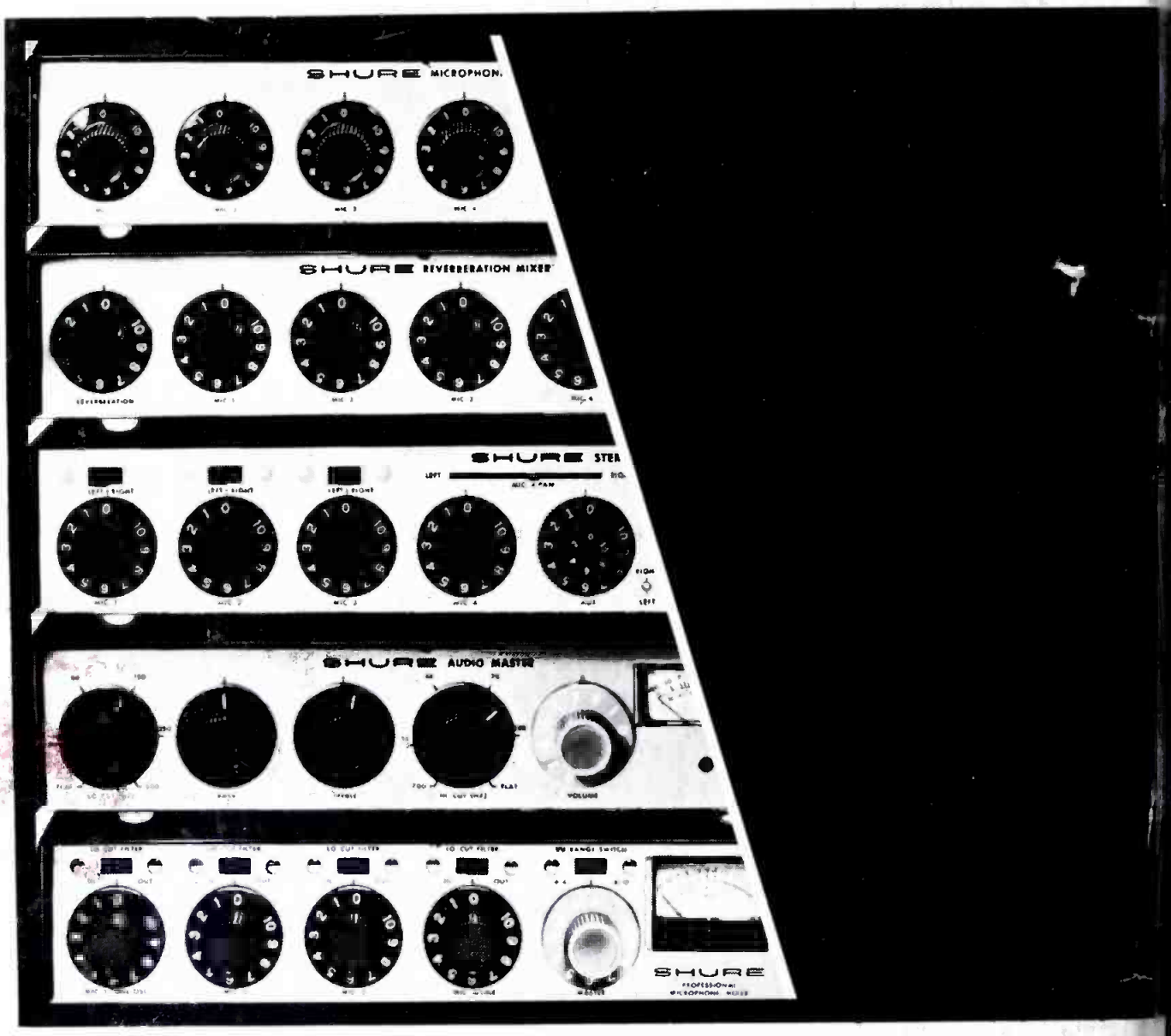

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