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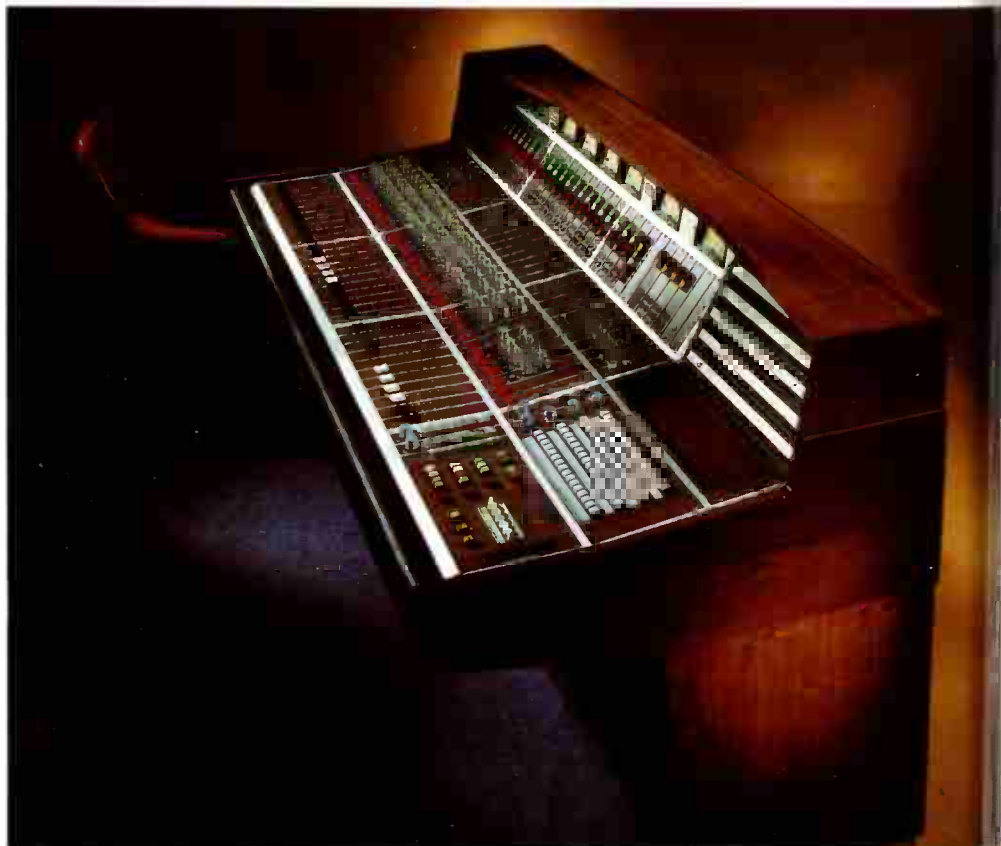
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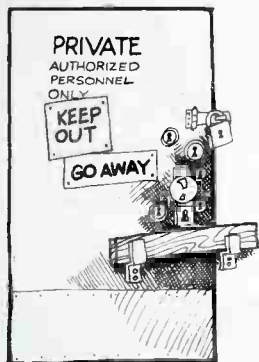
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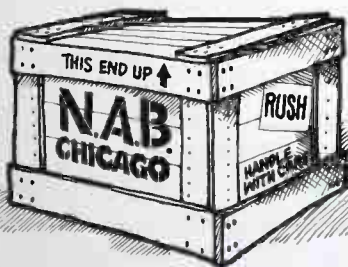
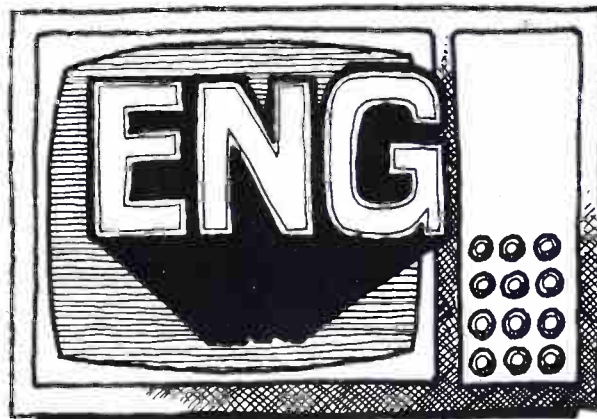


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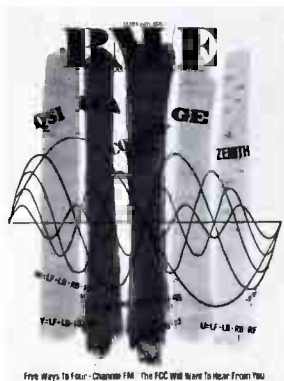
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Circle 101 on Reader Service Card

BM/E

BROADCAST MANAGEMENT/ENGINEERING



This month's cover depicts the choices before the FCC—and eventually you—in deciding what kind of discrete four-channel broadcasting system to adopt.

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It is fully practical with present technology and the five proposed systems for achieving it all work well. But now the FM broadcaster must match the promises and problems of discrete four-channel stereo against his own interests.

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The National AM Stereo Committee of the EIA is beginning its evaluation of proposed systems.

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Offering complex control capabilities in a tiny, low-cost package, microprocessors are cost effective and efficient. The next step will be interconnecting networks of small processors to achieve more automation of technical operations.

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Electronic News Gathering for TV has dominated the spotlight this past year. But radio has been pushing ahead, too, and this report shows how WBZ Radio, a Group W station in Boston, can go on the air live from almost anywhere to deliver instant news.

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The problems in establishing a good microwave signal for ENG are entirely different from those in setting up a fixed microwave link.

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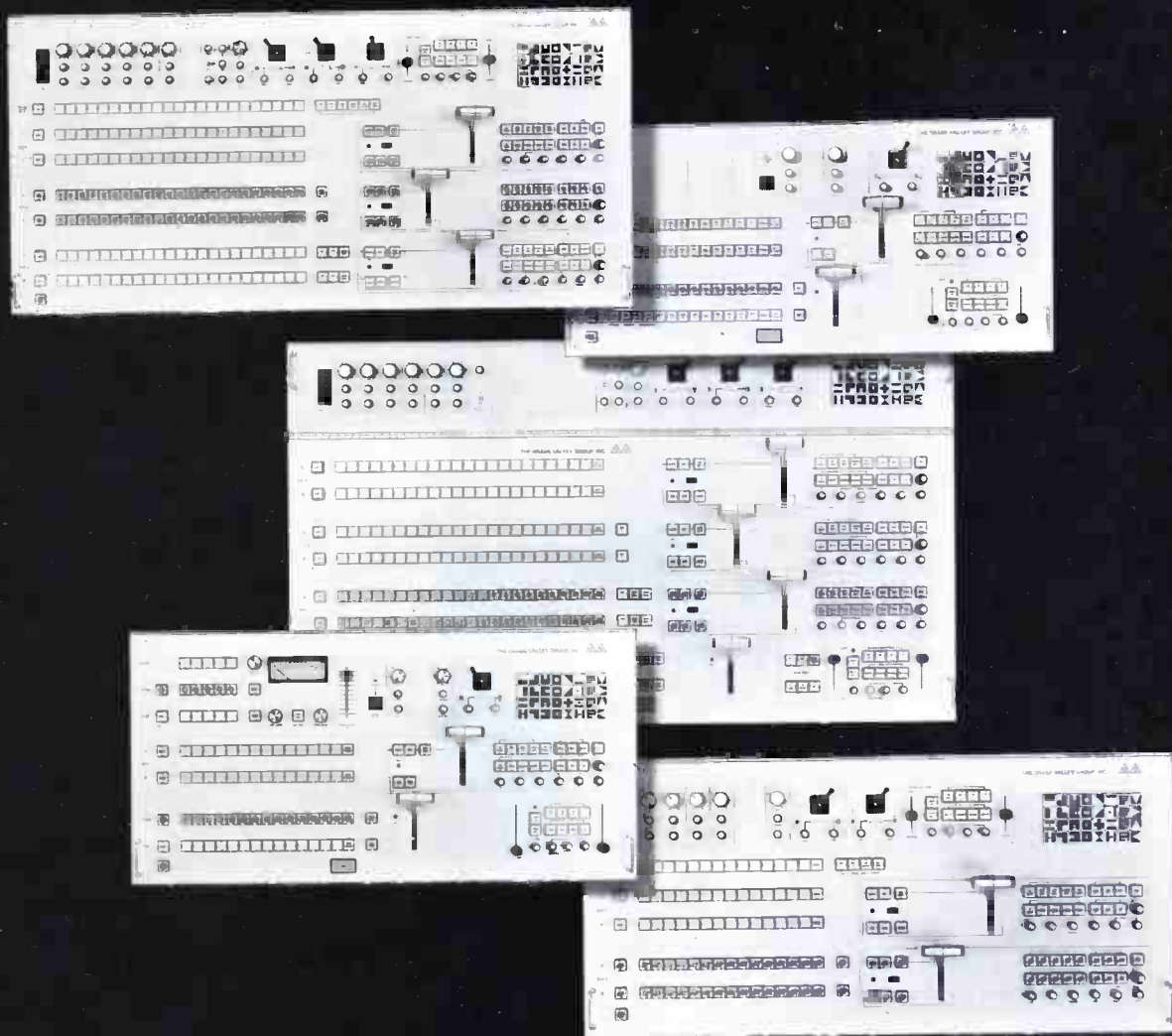
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BROADCAST INDUSTRY NEWS

Satellite News Service For Independent Stations Off And Running

Out of the ashes of the now defunct Television News Inc. operation, which discontinued its service last October, has sprung a brand new TV news service. It's the Independent Television News Associates, headquartered at station WPIX, New York. Whereas TVN lost large sums, the new operation is in the black according to managing director Reese Schonfeld. That's primarily because ITNA is a cooperative effort and revenues must equal or exceed costs. The present ten members kick in a fee ranging from \$3000 a week each in the New York City market and \$500 a week in smaller markets.

Each day members get a daily feed emanating from New York between 6:30 and 7 p.m., Eastern standard time. Seven to ten stories a day are sent. Material is originated by the UPI Film

Service and members themselves. Quite a bit is originated in Washington, D.C. by WTTG and New York (WPIX and WNEW) as might be expected, but there are stories fed from West to East for incorporation in the daily feed. The cross country hop is via satellite (Westar) and the economics of satellite distribution make the whole thing feasible. The major drops are New York City, Chicago and Los Angeles.

Several stations microwave from these drops to their stations. KTVU, Oakland, Calif. and KTXL, Sacramento, Calif. share a service. KPLR, St. Louis pays for a feed from Chicago but expects to put up an earth receiving station atop an apartment building in St. Louis. It's seeking FCC permission to use a compact horn antenna produced by AII systems rather than the conventional 10-meter parabolic dish for size considerations but the FCC so far has denied a waiver request.

INTV gets the lowest possible satel-

lite and microwave charges now by virtue of tying in with the Robert Wold Co. which is already a big satellite and microwave user because of its sports distribution network.

Success of the ITNA, as described by several speakers at the Third Independent Television Stations Inc. convention, Los Angeles, last month was attributed to the fact that the stations had a real need. They were beginning to increase ratings with their TVN service and could not stand by and let the service drop.

Success of the cooperative effort in news and the spectacular drawing power of the first exclusive programming for independents, the soap opera *Mary Hartman, Mary Hartman* (from Norman Lear's Tandem Productions), excited many delegates to INTV into considering a cooperative to buy programming. John T. Reynolds, Golden West Broadcasters, moderating the

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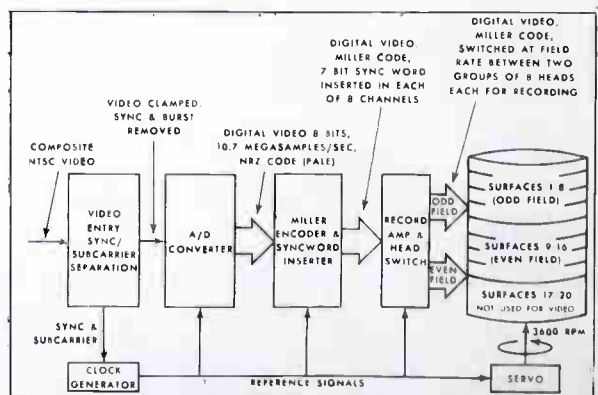
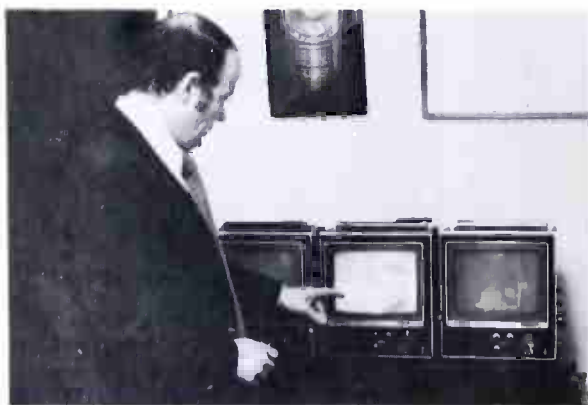
Digital Storage Of Stills Brings Big Advance In TV

The use of digital video recording to store still pictures and slides, and allow their injection into video programming on a fast random access basis, promises to improve television practice radically. The Ampex Corp. and the Columbia Broadcasting System, announced in mid-January, the joint development of such a system.

The system, called "Electronic Still Storage" (ESS), uses digital magnetic recording on computer disc packs. The basic system will hold up to 1500 video frames, with access time to any frame of less than 100 milliseconds. The system storage is expandable, and shelf storage of

the disc packs is virtually unlimited. Recording into the system will be through standard video cameras and film chains. The stored frames can be rearranged into any sequence for automatic projection.

Joseph A. Flaherty, see photo, manager of engineering development for the CBS network, said: "The new ESS system will have a dramatic effect on the presentation of slides and stills in television operations. The device will be a key element in the design of future television stations." A paper on the system was delivered at the SMPTE mid-winter television conference in Detroit.



Block diagram of the electronic still storage system.

The COHU 1550

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Compare features of telecines available in today's market and you will quickly see why Cohu's 1550 "Performer" is proclaimed the standard in the industry and stands as a GIANT in terms of performance.

8 SMPTE slides look great on the 1550, and more importantly its superior performance can be verified by its ability to handle the typical everyday quality of program source material.

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Cohu's new color encoder/image balancer/auto balance unit, the Model 1550, is standard equipment on the 1550. It provides automatic two-level horizontal and vertical detail enhancement and adjustable detail coring with both manual and automatic detail gain including remote control of level. The encoded color signal meets all applicable NTSC, EIA, and FCC specifications. Other user advantages are vertical interval reference insertion, full or partial color bars, plus remote control of line burst, color bars and chroma.

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AMONG TELECINES

NEWS

programming session at the convention, was optimistic that the time might now be ripe for such an endeavor.

Satellites For RCA And CTS Go Into Orbit

Both commercial communications and experimental communications services got new, advanced satellites in separate launches in December and January.

RCA's Satcom (domestic satellite network) will be expanded and made more efficient with the RCA Satcom I, a 24-channel "bird" sent up December 12th at Cape Kennedy. It is designed for coast-to-coast service, with special emphasis on the large network of earth stations being built in Alaska. Eventually more than 80 such stations will carry voice, data and video signals to remote areas of the largest state. Two more RCA satellites will further enlarge Satcom later this year.

A Cape Kennedy launching on Janu-

ary 13th put up a new satellite, the most powerful so far orbited, for the Communications Technology Satellite program (CTS), a joint project of NASA and the Canadian Department of Communications. CTS, following along the lines pioneered by the ATS-6 program last year, will explore many aspects of the technology of satellites for a host of services to remote areas. At power levels 10 to 20 times those of commercial satellites, the new CTS bird allows experimentation with simple, inexpensive earth stations for tele-education, tele-medicine, community interaction, broadcasting, etc. American and Canadian investigators in these fields will use the satellite on a 50%-50% time basis.

Leapfrog Rules Quashed, Cable Gets Freer Choice

The cable industry got all it was asking for in one area, at least, when the FCC swept the boards clean of all "leapfrogging" rules, late last December. Under those rules, in effect for several years, a cable operator was required to carry out of town stations in order of priority always choosing the nearer station when there was a choice. With the total elimination of leapfrog restrictions, cable operators can carry any station their antennas or microwave systems will bring in.

Cable is not by any means totally free in choice of programs, though. There are still the non-duplication rules and the restrictions on sports programs, which by and large represent compromise between the desires of cable and those of the broadcast industry.

Robert L. Schmidt, president of the National Cable Television Association, said that the removal of the leapfrogging restrictions is "a major positive development for the cable TV industry and its subscribers" and that "the FCC action makes development of CATV in some larger markets viable."

Clear Channels Up For Study In FCC Inquiry

An inquiry that could stimulate substantial changes in allocation patterns, power levels, nighttime radio service in many parts of the country has been opened by the FCC, under the title "AM Clear-Channel Proceeding."

A reactivation of a proceeding that was terminated in 1961, the new inquiry was started, says the FCC announcement, because of the finding that a number of areas in the country are still under-served with clear-channel nighttime radio. The FCC asks for industry comment on a long list of questions, among them the following: Should additional Class II stations be authorized for nighttime operation on

continued on page 12

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Circle 103 on Reader Service Card

Kodak salutes the NPPA "Newsfilm Station of the Year"



Left to right: Ernie Schultz, Information Director and anchorman for the noon news, Gene Allen, Assignment Editor, Jack Ogle, News Director and anchorman 6 P.M. news, and George Tomek, anchorman 10 P.M. news.

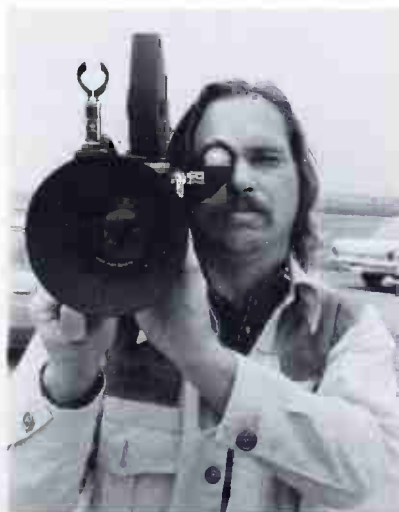
This is the heart of WKY-TV.

For the second time in seven years, WKY-TV's newsfilm department has broken the bank. Oklahoma City's Channel 4 was again named "Newsfilm Station of the Year" at the National Press Photographer's Association (NPPA). This time, for 1975.

Featuring locally originated film from all over Oklahoma, the station broadcasts three half-hour news reports a day, with three 5-minute news breaks as well. When that news is gathered, the camera crews come out shooting, with four

CP-16 cameras. And Kodak Ektachrome EF film 7242 (tungsten).

And this is the backbone.



Darrell Barton, chief photographer.

Without good people like this, Channel 4 could be just another spot on the dial. Take Darrell Barton, 1974's "Newsfilm Cameraman of the Year." Or Director of Information Ernie Schultz.

"We have a strong commitment to telling local stories in depth on film," says Schultz. "We'd rather tell four good stories than have eight talking heads." This philosophy pays off. WKY-TV News won six out of nine Associated Press awards for superior reporting this year. All of them are trained to originate newsfilm, and most of them carry portable cameras.

Where do they stand on ENG?

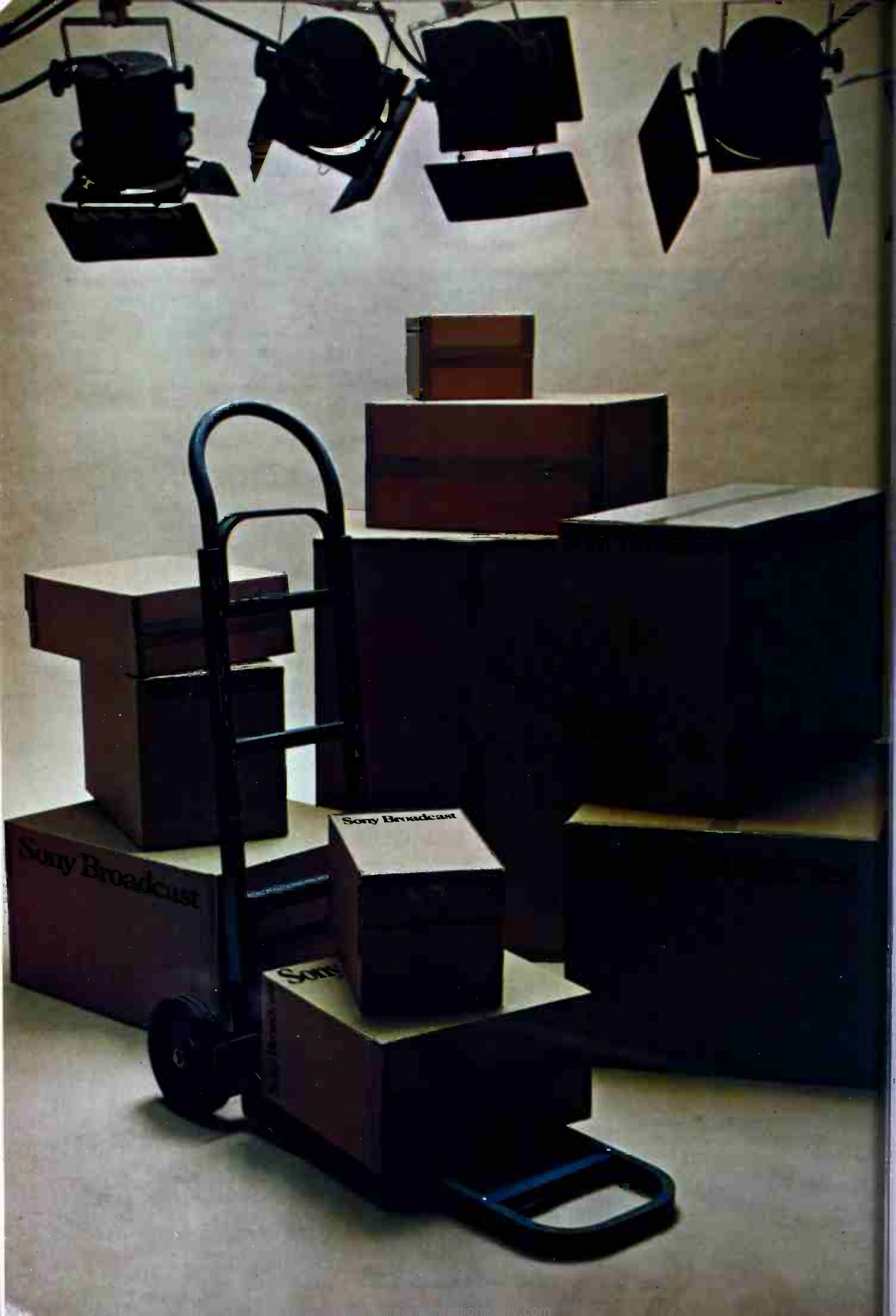
"There are some real benefits in seeing appropriate stories as they are happening," says Schultz. "But we think the audience would become bored quickly if we tried to give that kind of urgency to most stories."

Good film. Good people. The best reporting. That's what we call good news.

Film. The Basic Medium.



Circle 120 on Reader Service Card



On March 21, Sony will reveal a major commitment to the broadcast industry.

That date is the opening of the 1976 National Association of Broadcasters convention in Chicago.

At the show, Sony will exhibit eight new video products specially designed for the broadcast industry. They represent the largest investment in broadcast equipment ever made by Sony.

But the new products are only part of the important things we will introduce at N.A.B.

A new organization. Formed specifically by Sony to serve the broadcast industry and headed by Dave MacDonald, our team of broadcast specialists is knowledgeable, experienced and eager to apply our technological leadership to your problems.

A new service policy. Sony recognizes that the broadcast industry cannot afford "downtime." At the show, we'll explain how we plan to service our equipment quickly and efficiently.

A new name. Sony Broadcast will begin to appear in many places. It's there to assure you that we're dedicated to the product and service standards necessary for the broadcast industry.

What this all adds up to, of course, is a major commitment on the part of Sony to the broadcast industry.

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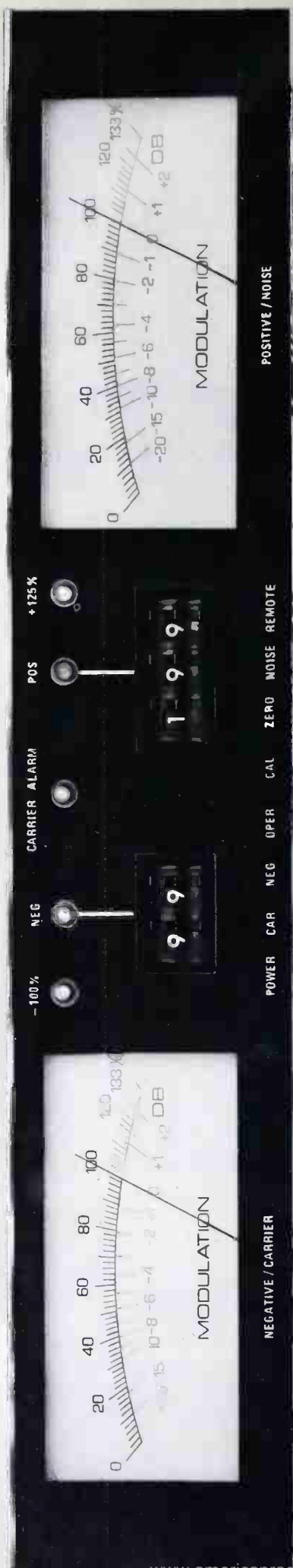
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NEWS

clear channels? Should there be expanded use of some or all clear channels by many local or regional stations?

The FCC also invited parties to participate in studies aimed toward full use of FM for nighttime service in all parts of the U.S.; toward analysis of the economic and social effects of high-power operation; in studies on the sources and levels of interference to existing Class I-A stations. Broadcasters interested in this major inquiry are strongly advised to get the complete description (Docket #20642) from the FCC, to aid them in preparing comments, due on or before March 18, 1976, with reply comments by April 18, 1976.

FCC Affirms April 15 For EBS Two-Tone Start

The Federal Communications Commission has denied requests from the Louisiana Association of Broadcasters and from the National Association of Broadcasters that the deadline for switch-over to the new two-tone EBS signal be postponed beyond the April 15th date previously set. Thus the requirement stands that every broadcast station be ready to switch to the new signal at midnight of April 15th. If you haven't bought your two-tone equipment, your time is short! At least 14 brands have FCC approval (see the January BM/E for a complete list).

Beep Tone Yes For Private Calls, No For Radio Nets

The FCC in January strongly reaffirmed the requirement that any recording of a telephone call (with certain exemptions) must be accompanied by the "beep tone" to inform the caller of the recording process.

Communications Certification Laboratory had urged an elimination of the requirement on the grounds that there were existing legal safeguards against any invasion of privacy. The FCC replied that the rule was not intended merely to provide an after the fact remedy, but to have a "prophylactic" or deterrent effect. However, the FCC did, in December, extend to broadcast nets, not themselves licensed broadcasters, the exemption from the beep requirement granted to broadcast stations. The net or "cooperative programming effort" must be composed entirely of licensees to merit the exemption.

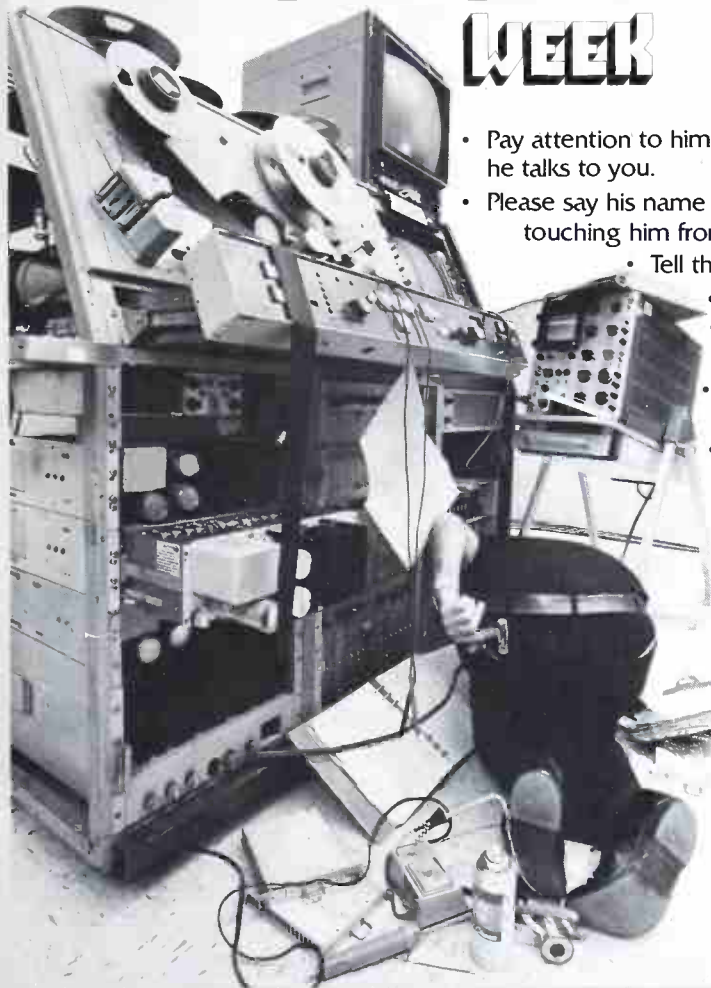
Vinyl Coat Protects Top Of CN Tower

The CN Tower in Toronto, the world's tallest free-standing structure, has had

continued on page 14

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NEWS

its steel transmission mast protected by the application of high-performance vinyl coatings. The reinforced concrete structure which stands 1,815 ft. will be exposed to Toronto's freezing rains and high winds which can cause severe icing at the antenna mast's high elevation and create a serious hazard at ground level.

This problem was solved by design-

ing a 1½-in. thick glass-reinforced plastic shield, called a radome, whose shape and slippery surface will prevent ice accumulation. However, because the radome will surround the antenna mast and greatly restrict maintenance access, corrosion prevention became a prime consideration. The mast was constructed of a special slow-rusting alloy steel, sandblasted and flame-spray metalized with eight mils of zinc at the shop.

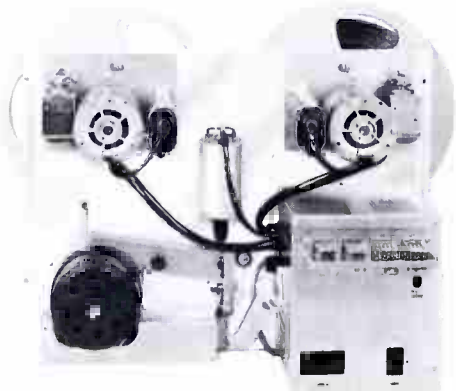
In addition, long-lasting paints were

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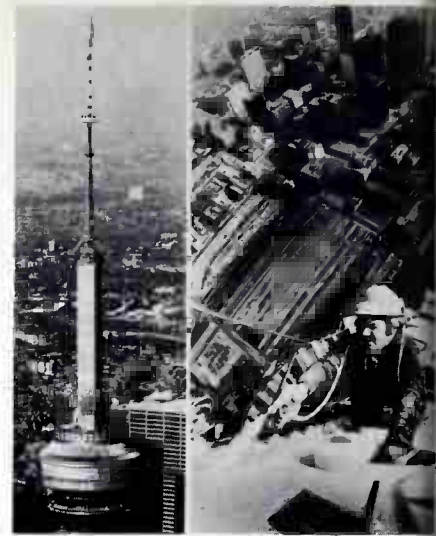
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required which could be field applied to the mast at the highest altitudes. An all-vinyl paint system was selected, consisting of wash primer, anti-corrosive primer, and topcoat, specified to meet Canadian government standards. The paints, manufactured by Mobil Paint Co., Toronto, were based on vinyl resins supplied by Union Carbide.

The vinyl coating system was field-applied to the CN Tower antenna mast by four painters in 10 days. It is expected to protect this skyscraping steel structure for 20 years.

10th Anniversary of 1st Master FM Antenna

The 10th anniversary of the first broadcast from the world's first Master FM



Antenna atop the Empire State building was commemorated on December 16, 1975.

The antenna was first installed on December 15, 1965 to permit numerous FM stations to broadcast simultaneously. The antenna was omnidirectional and provided a substantially circular pattern with both vertical and horizontal polarization that vastly improved the FM broadcasting through-

continued on page 17

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*No top wire.
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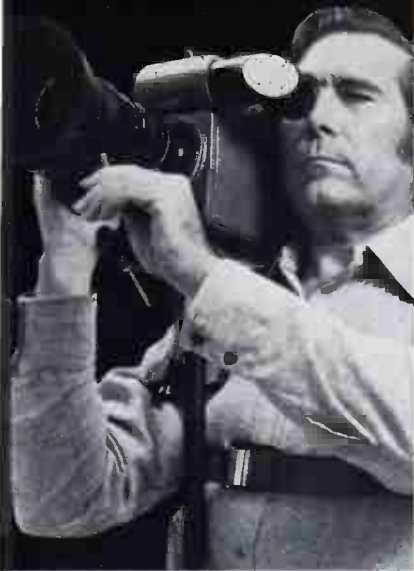
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NEWS

out the New York area and doubled the range of the stations using the facilities.

Another result of the installation was better radio reception in cars equipped with FM sets. When the first broadcast was made in 1965, only 5% of the nation's cars were equipped with FM sets compared to 60% today.

NCTA's 25th Anniversary Convention To Be Held

The National Cable TV Association's 25th annual convention will be held in Dallas from Sunday, April 4 to Wednesday, April 7. The NCTA has selected "CATV '76: Our Silver Year" as its theme.

The emphasis of this year's convention will be on system management and operations and on major federal, state and local regulations affecting the industry. Key subjects will include pay cable, political cablecasting, and financial administration. For more information contact Gary Arlen, NCTA, 918 16th St. NW, Washington, D.C. 20006, 202-466-8111.

PAL/NTSC Standards Converter In U.S.

Ron Gunning, President and Chief Executive Officer of Image Transform, Inc., North Hollywood, Cal., has announced that the company now has a fully operational PAL/NTSC Standards Converter—the first and only one in North America.

The machine's primary use is for the conversion of PAL 625-line 2-in. high band quadruplex videotapes to NTSC 525-line videotapes and the reverse—525 lines to 625 lines. The company expects to be able to convert from SECAM and 3/4-in. cassettes in about six months time.

Its "AD TV" Not "Free TV"

The National Cable TV Association's Board of Directors says that the NAB anti-pay campaign is designed to "eliminate subscription cablecasting's ability to compete." Through the campaign, "the oligopolistic TV Broadcasters" are attempting to eliminate "the public's desire for an alternative to 'AD TV'." The NCTA defines "AD TV" as the term most aptly suited for commercial broadcasting which NAB refers to as "Free TV."

Interactive CATV System Dedicated

The New York University-Reading Consortium introduced its experimental two-way CATV system in

continued on page 19

Spotmaster[®]

VERSA CONSOLE



Compact rack-mount single channel mixer ideal for CATV, CCTV, film studios and remote broadcasts. Transformer coupled inputs with externally switchable levels. Line and PA outputs.

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And I can measure it in 5 seconds.

That's because Sound Tech's new 1700B is push-button controlled—and it nulls *automatically*.

What's more, the 1700B is both an ultra-low-distortion signal source *and* a total harmonic distortion analyzer—a *complete distortion measuring system*.

You'll like these other 1700B features, too:

- Covers 10 Hz to 110 kHz
- Has differential input
- Measures signal ratios up to 100 dB
- Measures 30 microvolts to 300 volts as a high-sensitivity ac voltmeter
- Reads power into 8 ohms

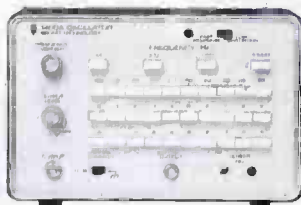
I'll be at NAB to show you how easily the 1700B measures.

Booth 123 — it's easy to remember.

See you there.

—Rosemary

Ultra-low-distortion oscillator



See this at NAB, too.

It's an ultra-low-distortion oscillator for use in measuring lowest distortion amplifiers. Has less than .001% distortion. Covers 10 Hz to 110 kHz. Push-button frequency selection. Output variable from less than 1 millivolt to 3 volts.

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NEWS

Reading, Pa. on January 9, 1976. Officials on the federal, state, and local levels will participate on the interactive system with senior-citizens and representatives from the public agencies.

The system consists of three interconnected neighborhood communications centers (NCCs) to which senior citizens have ready access. These centers have the capacity for both transmitting and receiving broadband video and audio signals. One NCC is in Horizon Center, a multi-service center for the entire elderly population of the county. The second is in Kennedy Towers, a high-rise building exclusively for senior citizens. The third is in the community room of Hensler Homes, a mixed-population garden apartment complex, with about 25% elderly residents. In addition, the homes of 200 senior citizens, which are beyond the range of easy access to any of the centers, will be equipped with converters that enable them to receive one-way transmission of the interactions of the system and to join in by telephone.

Programming for the system will be unusual because there is no audience, there are only participants. There are no TV programs, as they are usually known; there are types of teleconferences. Two basic forms of programming are planned: regular, daily, open-ended sessions; and special large-scale telemeetings. In the latter, the elderly population can communicate directly with decision-makers.

Studies Analyze Content, Frequency Of Kid's TV Ads

According to two studies of children's programming on network and independent stations which were commissioned by Action for Children's Television (ACT), commercial messages interrupt programs directed to the under-12 viewing audience "on an average of once every 2.9 minutes." An analysis of advertising practices revealed that "almost half of all commercial announcements were for cereals, candies, and sweets."

The patterns emerged during an investigation of "Weekend Commercial Children's Television" and "Television in the Afterschool Hours" conducted by Dr. F. Earle Barcus, Boston University School of Public Communications.

Tocom Sees Cable Turn-Around

After a loss of \$1.6 million in the year ended June 30, 1975 (largely the result of inventory writedown), Tocom, Inc., of Dallas, reported a profit of \$620,000

for the three months ended September 30th, 1975.

The company report also pointed to other signs of renewal of customer activity in cable, including the increase of pay-cable subscribers from 30,000 to about 400,000 during the past year.

Tocom's major product line, two-way cable, got a satisfying demonstration in an incident in Woodlands, Texas, a "new town" which has a Tocom cable installation including police, fire, and other customer-to-

headquarters services. A fire in the attic of a home set off an alarm in its very early stages, bringing the fire fighters in time to prevent large-scale damage.

NAB & Nets Defend "Family Viewing" In Calif. Suit

"Family viewing" was adopted voluntarily and does not violate the free-speech rights of program producers, the NAB and the three major networks say

continued on page 20



Out In Front

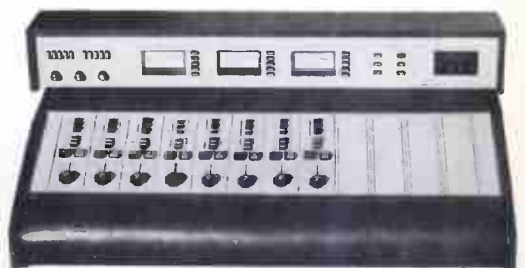
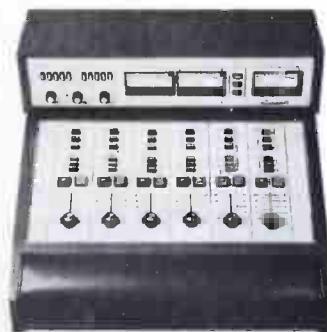
Our Western heritage taught us it's the only place to be. And today that's where we are . . . out in front with audio console CHOICE and PERFORMANCE!

The choice of eleven models leads the industry. Choose from four to twenty-four mixers. Four to seventy-two inputs. Choose mono, stereo, quad-capable . . . for radio, TV, recording and special applications.

And performance? State-of-the-art performance above industry standards. Performance so outstanding that we GUARANTEE YOUR SATISFACTION.

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NEWS

In a motion filed in U.S. District Court in California. The motion asks for the dismissal of two suits, brought by the Writers Guild of America and by Tandem Productions, which charge that "family viewing" was dictated by government, abridges the First Amendment rights of program writers and others, and violates anti-trust laws. The NAB-network action made it seem likely that family viewing would prevail, although the court's action cannot, of course, be predicted.

NAB Sues To Bar New Cable Duplication Rule

The National Association of Broadcasters in January filed a suit in the U.S. District Court of Appeals to reverse an FCC relaxation of the non-duplication rules for cable. The new rules, adopted last fall, have among other changes substituted a fixed mileage zone for the former contour area, in determining the "local" zone for non-duplication of local signals. In addition, the reference point for the "local" determination is moved from the transmitter site to the community center.

Another change exempted a one-hour period of a live sports broadcast from the rule. The NAB charged in the suit that the FCC gave no reason for the changes, which according to the NAB will increase unfair cable competition with local broadcasters.

TM Group Orders Ten IVC-9000's

Ten IVC-9000 Broadcast Videotape Recorders have been ordered by the World Plan Executive Council-U.S., the Transcendental Meditation Movement, from International Video Corp., Sunnyvale, Calif.

The recorders are being installed at the Academy for the Science of Creative Intelligence, Livingston Manor, N.Y.; the Maharishi European University, Weggis, Switzerland; in a mobile teleproduction van that will produce videotaped material throughout Europe; and at the organization's broadcast TV outlet KSCI, Channel 18, Los Angeles, all of which are part of the Transcendental Meditation Movement.

Company Uses Moog to Create Radio ID Jingles

Syndicated Productions, a new division of WAY Audio Creations, has been formed and will initially offer two syndicated radio ID jingle packages. Entitled Synapellas and Concept III, available on an exclusive market basis,

continued on page 22



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Choosing the right automation system for your station is not easy. We know that.

That's why Schafer offers a wide range of different models, each with different capabilities.

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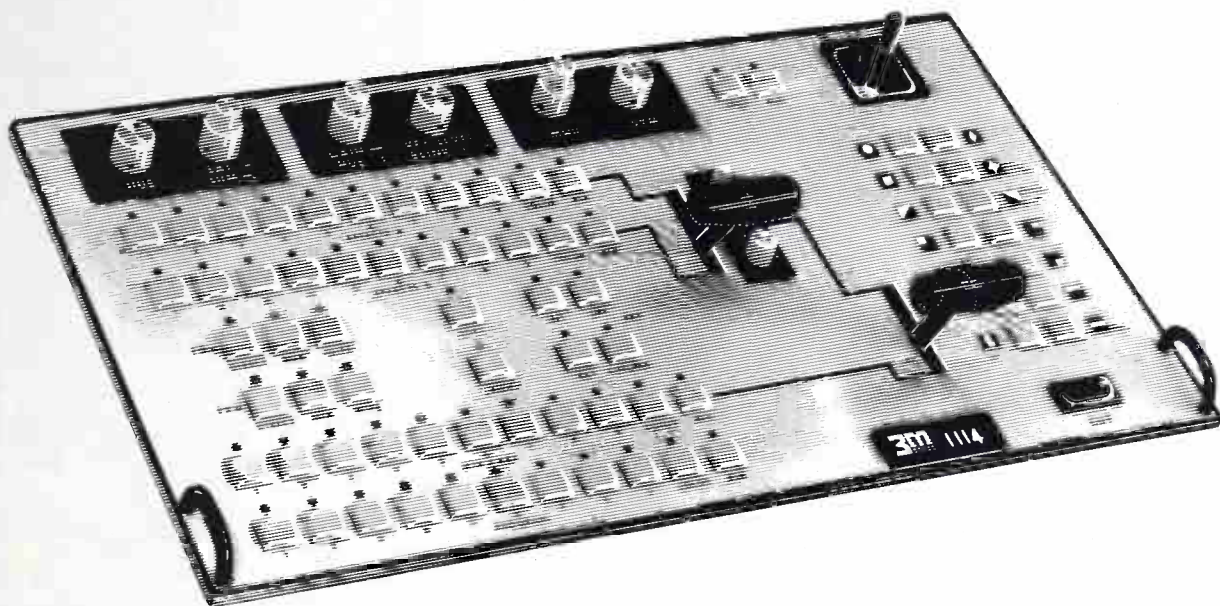


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NEWS

both packages feature music played on the world's largest Moog synthesizer.

The syndications are designed for any uptempo music format including MOR, contemporary, rock, country, and R&B. Prices, which depend on market size according to 1975 Standard Rate and Data figures, range from \$60 to \$125 per cut for Synapellas and \$70 to \$150 per cut for Concept III. Free demo tapes are available to radio stations by writing c/o P.O. Box 21, Station "B," Buffalo, N.Y. 14207.

Staffs Up At TV Stations But Minority Hiring Slow

A study of employment practices in TV conducted by the United Church of Christ says that although the nation's TV stations are steadily increasing their work forces in spite of the economy, the hiring of blacks and other minority people for new jobs or vacancies in old ones has slowed sharply. According to the report, commercial stations added 730 new full time jobs between 1974 and 1975, a 2% increase, but the proportion of minority employees increased by only .03%, rising from 12.4% to 12.7% of the work force.

News Briefs

Chiron Telesystems Div. of The Computer Exchange, Inc. has changed its name to **Chyron Telesystems Div. of Chyron Corp.** and is in the process of moving its corporate headquarters to 223 Newtown Road, Plainview, NY 11803

Cable Program Services, an organization devoted exclusively to serving the local origination needs of the CATV industry, has been formed and is located at 39 W. 16th St., NY, NY 10011, 212-242-8566

John Snell Professional Sound Service, a new production and recording company, is located at Suite 610 295 Madison Ave., NY, NY 10017 212-949-7668.

The CATV Installation & Equipment Operation of **GTE Sylvania** has moved its Southeast Regional Sales Office to 3046 Covington Road, Marietta, GA from Dayton, OH

Cox Data Services hopes to move into a new, expanded location on Marcel 1st in The Prado, a modern office and shopping complex in suburban Atlanta

Satori Productions, Inc. has moved to expanded new quarters at 250 W. 57th St., Suite 2105, NY, NY 10019, 212-581-8450.

Ground breaking took place in mid-November on the site of the new

continued on page 2



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At the heart of the station is a CDL Operations Computer System, which handles all the program switching, effects, material verification, run-sheet printing, FCC logging and machine control.

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CDL's New System 100 Operations Computer System may be configured for "Total" control or may be used initially to perform automatic switching and later expanded into a fully integrated system, with business computer link-up and ACR-25 closed-loop control.

CDL's latest news . . . a System 100 with *direct-link* capability to a DCC "BIAS" Traffic/Accounting System.

A truly modular approach, the CDL System 100 is today's answer to **Total Broadcast Automation.**

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INTERPRETING THE **FCC** RULES & REGULATIONS

Broadcaster—Citizen Group Agreements

By Frederick W. Ford and Lee G. Lovett; Pittman, Lovett, Ford and Hennessey, Washington, D.C.

The plethora of recent petitions to deny license renewal applications has given rise to re-doubled attempts by broadcasters to reach agreements with public interest groups concerning programming, employment, and station operation. Some agreements have aroused significant Commission concern because they purport to bind the broadcast licensee's programming discretion, contrary to the dictates of the Communications Act of 1934, as amended.

Proposed Policy Statement

The Commission began an inquiry into the subject on June 10, 1975¹. The Commission found that "... some agreements attempt to yield licensing control to essentially private interests, contrary to the scheme of the Communications Act, which requires that the licensee must assume responsibility for insuring that its station operates in the public interest." The Commission went on to give examples of *improper* agreements including:

- (1) An agreement with provisions which bind the licensee to broadcast a fixed amount of programming directed to a particular segment of the community or a particular number of citizen-initiated or issue-oriented messages at stated periods of time (i.e., an abdication of licensee responsibility by improper infringement upon the licensee's discretion in the matters of programming and program scheduling);
- (2) a provision requiring a licensee to hire an individual from a list of employment candidates supplied by a citizen group;
- (3) a provision conditioning a licensee's selection of a particular program host upon the approval by a citizen group;
- (4) an agreement provision expressly precluding the filing of a petition to deny by a citizen group.

¹*Proposed Policy Statement And Notice of Proposed Rulemaking Re: Agreements Between Broadcast Licensees And The Public.* Docket No. 20495, FCC 75-633, 40 Fed. Reg. 25689 (May 29, 1975).

²*Report and Order in Docket No. 20495, FCC 75-1359, adopted:* Dec. 10, 1975; released: Dec. 19, 1975.

The May 29th *Proposed Policy Statement* was based in part upon the assumption that the licensee as well as the public interest group will conduct discussions in *good faith*, and upon the principles of: (a) "the value of local dialogue," (b) "the purely voluntary nature of agreements," (c) "the preservation of the licensee's non-delegable responsibility to serve the public," (d) "the advantage of minimum government presence in local discussion."

With this as background, the Commission proposed to limit its perusal of licensee-citizen group agreements only insofar as:

- (1) A substantive agreement is incorporated into a broadcast (renewal) application and assumes the status of a licensee representation to the Commission (which will be subject to the Commission's promise vs. performance test—whether the licensee has made a reasonable and good faith effort to effectuate its proposals);
- (2) a citizen group seeks a declaratory ruling to determine if an agreement is contrary to the Commission's Policy Statement.

Policy Statement and Rulemaking

Broadcast licensees and public interest groups filed comments and replies regarding the *Proposed Policy Statement*; the Commission issued a *Report and Order*² adopting a *Policy Statement* and amending one of its Rules.

Nearly all parties who made comments endorsed the importance of a continuing dialogue between broadcasters and local citizens as a means of identifying community interests to be served by broadcasters' programming. More than one broadcaster commented that very often alleged "citizens groups" were *not* representatives of the public at large or even of a particular minority which some groups purport to represent. Further, said the broadcasters, the demands of some of these groups have often been contrary to the public interest.

continued on page 26

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FCC RULES & REGS

At the opposite end of the spectrum, public interest groups that submitted comments argued that the mere refusal of a broadcaster to meet with a citizen group without explanation should raise an issue of inadequate ascertainment of community needs.

Many comments urged the Commission to defer as much as possible to the discretion of the licensee regarding what agreement terms are in the public interest. For instance, one commenter suggested that tests for evaluating agreements should turn upon whether the agreement constitutes an *egregious abdication* of the licensee's responsibility to make continuing program judgments.

The Commission began its discussion of its *Policy Statement* by noting that the Communications Act mandates that the licensee *alone* must bear the ultimate responsibility for planning, executing and supervising programming and station operation. The Commission summarized:

"This responsibility cannot be delegated, and a licensee cannot (even unilaterally) foreclose its discretion and continuous duty to determine the public interest and to operate in accordance with that determination."

The *Report and Order* took pains to point out a fine distinction that broadcasters must keep in mind: a licensee has a non-delegable *responsibility*, and not simply a non-delegable *accountability*, for programming and station operation. Thus, for a licensee to delegate its

programming responsibility of its own free will and without any outside urging to a public interest group, is unacceptable by Commission standards, *even if the broadcaster believes that the public interest group would discharge the duty of programming responsibly and in the public interest.*

Holding a licensee strictly accountable for retention of control over programming matters at all times is not new. The Commission has already proscribed network agreements which overly restrict the carriage of programs from other networks³.

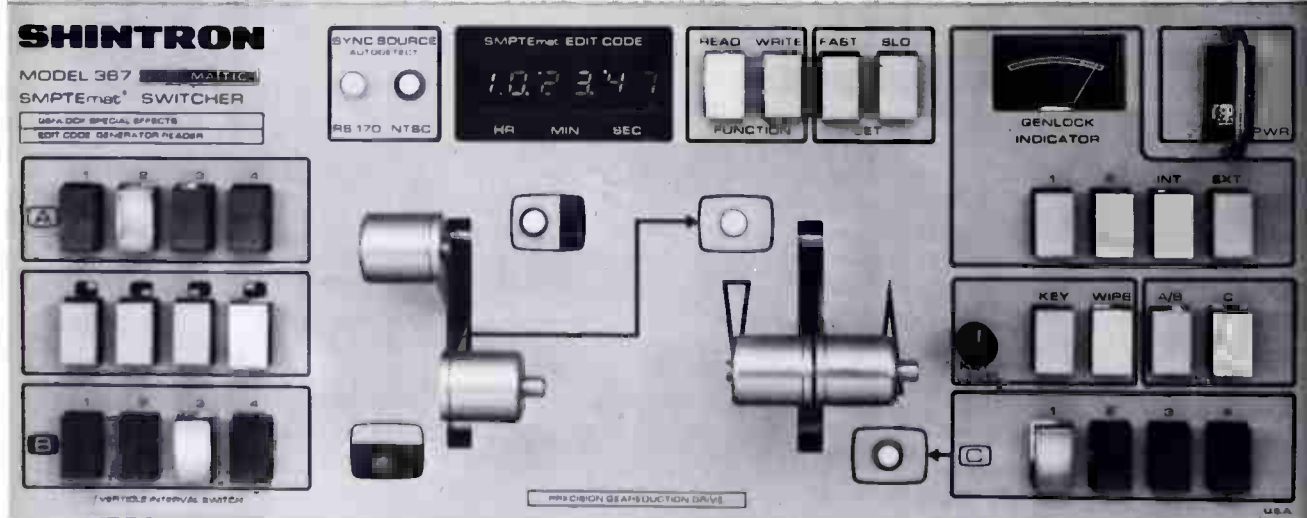
Based upon this tenet of national policy, the Commission formally adopted its *Policy Statement*. Formal rules were not adopted because the Commission felt that broadcasters and public interest groups would become entangled in a morass of complex rules that would be needed to adequately deal with the issue.

The first conclusion of the *Policy Statement* is that a licensee is *not* obliged to negotiate toward an agreement with a community group. *The rationale of this policy is grounded in the licensee's obligation to enter a continuing community dialogue to ascertain community needs and interests to enable it to better serve the public interest.* Community needs ascertainment is required for initial broadcast applicants and renewal applicants alike (Recently, the Commission amended its Rules to require renewal applicants to ascertain community needs throughout the period of license and not just in the six months prior to license renewal.) Thus, even though the

continued on page 3

³Filing Agreements 33 FCC 2d 653 (1972).

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See the new lightweight champ at the NAB Convention.



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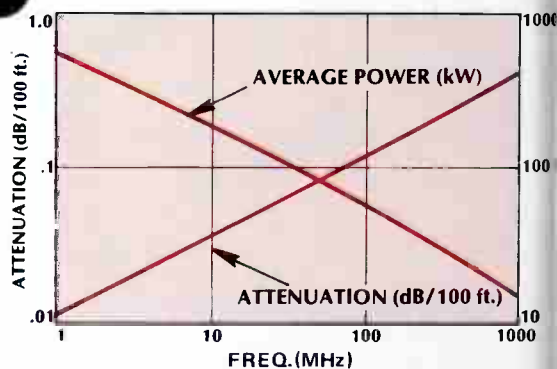
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This 3 1/2" air dielectric Wellflex consists of a corrugated tubular copper center conductor, unique polyethylene locked vertebrae helix dielectric, copper corrugated outer conductor and black polyethylene jacket. It is remarkably flexible, has excellent mechanical stability and extremely low attenuation.

SPECIFICATIONS:

Velocity of Propagation	96%
Attenuation at 100 MHz	0.110 dB/100 f
Average Power at 100 MHz	50.06 kW
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CC RULES & REGS

Commission has stated that it encourages extensive local dialogue, it has left to each licensee's discretion whether to enter into separate discussions and/or agreements with community interest groups.

The Commission went one step further by saying that licensee should *reject any* group's proposals that it feels are not in the public interest. On the other hand, if a group's individual members do not appear to be representative of the community of license, but the group has raised problems, interests and views that the licensee feels should be dealt with, the licensee should do so. "It is the proposals themselves—rather than their proponents—which the licensee ought to consider in relation to its public interest duties." Further, when the licensee feels that it must consider problems and views that are raised, it need *not* enter into negotiations looking toward an agreement with the group that raised these issues.

The *Policy Statement* goes on to specify that no broadcaster-citizen group agreement may immutably bind the licensee's discretion in the area of programming and station operation. The underlying rationale is that a licensee is obliged to (and must have unfettered opportunity to) modify any programming practice or proposal "when in the reasonable exercise of its good faith judgment, it believes that the public interest so requires." The Commission is on record as stating that it will attempt to construe provisions of broadcaster-citizen group agreements in a manner favorable to their implementation, where possible. Everything will be done to avoid forcing parties to redraft agreements. To do so for the purpose of correcting ambiguities in language would not only become a potentially intolerable burden to broadcasters dealing with a variety of citizen groups, but may well inhibit full development of local dialogue, a primary goal of national communications policy. The *Policy Statement* makes clear that improper *binding* of the licensee, rather than improper *content* of broadcaster-citizen group agreements, is to be avoided. Thus, an agreement may contain a great amount of specificity and will not be improper. Broadcasters are cautioned, however, that "detail may give rise to *expectations* of inflexibility which, if imposed, would be improper."

The *Policy Statement* also dealt with "savings clauses," which purport to void any agreement provisions which the Commission concludes abridge licensee responsibilities. While the Commission will not require that each agreement contain an express savings clause, a "blanket" savings clause will *not* be implied. As the Commission plainly stated:

We will not strain the plain language of agreements to construe away provisions inflexibly binding licensees, nor to strengthen inadequate savings clauses, since these are matters for the parties.

Agreement in Public File

The one rule amendment that the Commission did make regarded the filing of agreements. Henceforth, licensees that enter into written agreements with citizen groups must file these agreements in their local public file. The licensee need not *publish* notification of the

continued on page 32

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FCC RULES & REGS

agreement locally, nor file the agreement with the Commission.

The Commission added a note to its Rules⁴ defining exactly what agreements must be included in the public file:

... a citizen agreement is a written agreement between a broadcast applicant, permittee, or licensee, and one or more citizens or citizen-groups, entered for primarily non-commercial purposes. The definition includes those agreements that deal with goals or proposed practices directly or indirectly affecting station operation in the public interest, in areas such as—but not limited to—community ascertainment, programming, and employment. It excludes common commercial agreements such as advertising contracts; union, employment, and personal services contracts; network affiliation, syndication, and program supply contracts; and so on. However, the mere inclusion of commercial terms in a primarily noncommercial agreement—such as a provision for payment of fees for future services of citizen-parties . . . would not cause the agreement to be considered commercial . . .

Licensees are *not* required to place summaries of, or notes concerning, oral agreements in their public files. Further, the Commission will not examine *oral* agreements because of the difficulty of defining the exact content of same.

Commission Review of Agreements

The Commission intends to review written citizens group agreements only if (1) the agreement terms are incorporated into (a) a potential licensee's initial application or (b) an existing licensee's renewal application. Such agreements will constitute a representation to the Commission by the licensee and will be judged pursuant to the Commission's *promise-vs.-performance* test (i.e., whether the licensee has made "reasonable and good faith efforts" to effectuate its proposals).

In the event that the Commission determines that "substantial questions" of unsatisfactory performance are raised by specific allegations, the licensee's renewal application will be designated for hearing on this issue⁵. Forfeitures will not be imposed because the Commission presently lacks authority to do so with regard to agreement violations.

Conclusion

The main point to be made by the Commission's *Policy Statement* is that the broadcast licensee may not delegate its programming and station operation responsibility (including employment practices). Licensees do have a duty to ascertain community needs and interests via a local dialogue, but need not do so by negotiating and/or concluding an agreement with a citizen group. Being watchful not to violate these parameters, licensees are free to enter agreements with community groups aimed at optimizing broadcaster service in the public interest. Agreement terms not conforming with policies enunciated in the *Policy Statement* will have no force or effect before the Commission. Further, serious abdication of licensee responsibility will raise a question concerning the licensee's basic fitness. **BM/E**

⁴Section 1.526 (Note 2) of the Commission's Rules.

⁵Section 309(e) of the Communications Act. 47 U.S.C. 309(e).

Harris' MW-50 keeps some very fine company.

These pace-setting AM stations are now, or soon will be broadcasting, with Harris' MW-50, 50 kilowatt PDM (Pulse Duration Modulator) transmitters.

And here are a few of the reasons why:

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For more reasons why the MW-50 is at home in so many top stations, write Harris Corporation, Broadcast Products Division, Quincy, Illinois 62301.



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 WGN KGO WABC WCAU



... AND IN BRAZIL, ECUADOR, INDONESIA, IRAN, LEBANON, MALAWI, NIGERIA AND VENEZUELA.

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NAB Will Outdo Itself Again; Biggest Hall, Biggest Show In Chicago

The 54th Annual Convention of the National Association of Broadcasters, opening March 21 for a four-day stand at McCormick Place in Chicago, will continue a long NAB tradition—a bigger show every year than the last. As this magazine went to press, some 200 exhibitors had signed up for 95,400 square feet of exhibit space, which easily tops all earlier figures. And that is not likely to be the final figure, because the vast floor of McCormick Place will allow the NAB to sell even more space—probably nobody will be turned away this year

because he came to the door after the house was full.

In a moment we'll describe a few of the exhibitor's plans, based on preliminary information sent to BM/E. As this "early morning line" indicates, it will be a lively show on the hardware front.

Attendance will be high

Just as there will be an exhibitor record in 1976 there will be an attendance record. It's virtually certain that attendance will soar to new heights this year. BM/E polled its annual

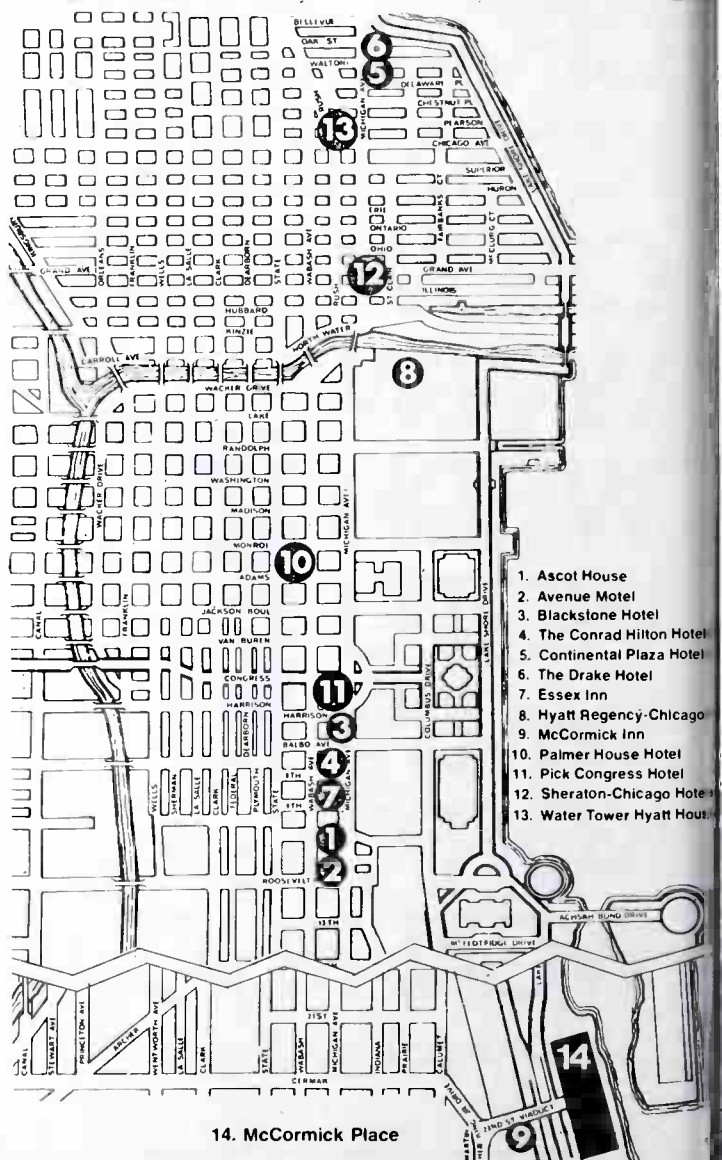
"Panel of 100" and found that 69% planned to attend. This is up from the 57% who planned to attend the most out-of-the-way Las Vegas Convention. TV managers will be going to Chicago in about the same numbers as they went to Las Vegas (85% of those polled) but there will be many more radio managers at Chicago than at Las Vegas. (Our poll shows 60% are headed for Chicago. This is 20% better than last year.)

The attendance of radio chief engineers at Chicago will be better than last year. continued on page 3

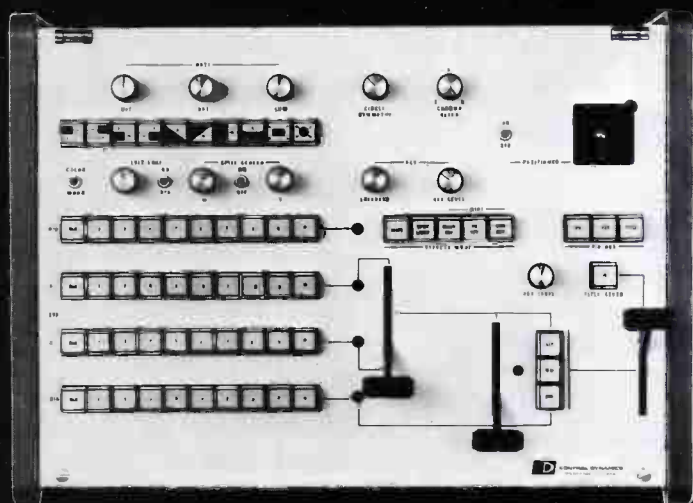
Downtown Chicago and Hotel Listing

Downtown Hotel	Address	Tel. No. (Area 312)
Allerton Hotel	701 N. Michigan Ave.	787-4200
Ambassador Hotels	1300 N. State Parkway	787-7200
Ascot House	1100 S. Michigan Ave.	922-2900
Allerton Hotel	701 N. Michigan Ave.	787-4200
Ambassador Hotels	1300 N. State Pkwy.	787-7200
Ascot House	1100 S. Michigan Ave.	922-2900
Astor Tower Hotel	1300 N. Astor St.	943-1111
Avenue Hotel	1154 S. Michigan Ave.	427-8200
Bismarck Hotel	171 W. Randolph St.	236-0123
Blackstone Hotel	636 S. Michigan Ave.	427-4300
Chicago Downtown Travelodge	1240 S. Michigan Ave.	427-4111
The Churchill	1225 N. State Pkwy.	944-5000
Conrad Hilton Hotel	720 S. Michigan Ave.	922-4400
Continental Plaza Hotel	909 N. Michigan Ave.	943-7200
Croydon Hotel	616 N. Rush St.	337-6700
Delaware Towers	25 E. Delaware Pl.	944-4245
Drake Hotel	140 E. Walton Pl.	787-2200
Eastgate Hotel	162 E. Ontario St.	787-3580
Essex Inn	800 S. Michigan Ave.	959-2800
Executive House	71 E. Wacker Dr.	346-7100
Hampshire House	201 E. Delaware Pl.	943-5000
Harrison Motor Hotel	65 E. Harrison St.	427-8000
Holiday Inn-Kennedy		
Espressway	1 S. Halsted St.	829-5000
Holiday Inn-Lake Shore Drive	644 N. Lake Shore Dr.	943-9200
Hyatt Regency Chicago	111 E. Wacker Dr.	565-1000
Lake Shore Drive Hotel	181 E. Lake Shore Dr.	787-8500
Lake Tower Inn	600 N. Lake Shore Dr.	787-4700
LaSalle Hotel	10 N. LaSalle St.	373-0700
LaSalle Motor Lodge	720 N. LaSalle St.	664-8100
Mart Inn	545 N. LaSalle St.	467-0800
Midland Hotel	172 W. Adams St.	332-1200
Oxford House Motor Hotel	225 N. Wabash Ave.	346-6585
Palmer House	17 E. Monroe St.	726-7500
Park Dearborn Hotel	1260 N. Dearborn St.	944-5620
Pick Congress Hotel	520 S. Michigan Ave.	427-3800
Playboy Towers	163 E. Walton Pl.	751-8100
Ramada Inn	Congress Expwy. at Canal St.	427-6969
Seneca Hotel	200 E. Chestnut St.	787-3280
Sheraton Chicago Hotel	505 N. Michigan Ave.	944-4100
Tower House Hotel	1229 S. Michigan Ave.	427-9180
Water Tower Hyatt House	800 N. Michigan Ave.	943-5600
Westbury Hotel	160 E. Huron St.	787-2900
The Whitehall	105 E. Delaware St.	944-6300
YMCA Hotel	826 S. Wabash Ave.	922-3183
NORTH SIDE		
Acres Motel	5600 N. Lincoln Ave.	561-7777
Chicago Travelodge-North	5201 N. Sheridan Rd.	334-5600
Tlde-Sands Motel	5235 N. Sheridan Rd.	275-2100
Webster Hotel	2150 N. Lincoln Park West	348-6800

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- Mix Amplifier
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- Soft Keys
- Vignettes
- Color Matte Generator
- Chroma Keying & External Key*
- Mask Key
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- Spotlight
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and they're all Standard!

The combination of a MIX AMP, WIPE/KEY/MASK KEY AMP and a DOWNSTREAM KEYSER allows easy execution of a complex effects sequence... such as... dissolve from the source to a masked chroma key*... then dissolve a color matted title over a chroma key, and finally dissolve out of the chroma key to a different source while retaining the title.

*CDL RGB Chroma Keyer Module is optional

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CDL will change your impression of what small switchers can do.

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NAB CHICAGO

Las Vegas but only about two out of five are going. Heads of engineering at TV stations, on the other hand, will be at Chicago in strong force. For some reason, this group didn't go to Las Vegas but at least 85% of those polled will be going to Chicago. (This compared to 61% for Las Vegas and 70% for Houston.)

Interest in types of equipment is shown in the accompanying tables. As

might be expected, ENG is the hottest area for TV broadcasters. In radio the interest in tape recorders and consoles remains high (the former was hyped in 1975 because of many new model entries in '74-'75) but the product of single most interest is EBS. Apparently half the industry hasn't yet placed its order!

Our Panel of 100 poll indicates broadcasters will be spending more money in 1976 than in previous years. The average radio station budget is up

only a modest 8% but TV broadcasters report budgets 50% higher than last year.

A relevant program

This year radio broadcasters will have many sessions devoted to their vital interests since the Radio Advertising Bureau has been invited in to work with the NAB in coming up with in-depth sessions on radio programming and radio sales/management. Engineering sessions will hit many topical areas: ENG (both radio and TV), AM stereo, audio cueing on SCA, wireless microphones, and a great many sessions on digital broadcasting including papers on PCM and electronic still frame storage.

Among the outside speakers already announced for the Convention are FCC Chairman Richard E. Wiley, for the combined radio-TV luncheon on Tuesday, March 23; and Paul Harvey, noted radio commentator, for the radio luncheon on Monday, March 22. The NAB has also announced that the Engineering Achievement Award for 1976 will go to Frank Gregg Kear, consulting broadcast engineer, who has had a very distinguished career as a technical pioneer in radio, going back to the 1930's.

A full exhibit floor

It's a little early to report precisely what will be shown at Chicago (we'll have a near-final fix on that in the March issue of BM/E) but a few patterns are emerging. New ENG cameras will be all over the place along with other ENG products such as tape recorders, editors, microwave gear and ENG "accessories."

There will be a new source for audio tape cartridge players: UMC Electronics. Some new transmitter models are promised by AEL. McMartin says it will be introducing an "impressive expansion" of its AM/FM transmitter line. Radio automation equipment will be in prominent display. IGM, Schafer and SMC all showed new systems at the National Radio Broadcasters convention at Atlanta last fall and this equipment will be highlighted at Chicago.

New ENG cameras

At this moment we suspect the most talked about camera will be the new Thomson-CSF Microcam described briefly last month in BM/E. In the full-broadcast-quality category, this unit boasts the lowest power drain (22

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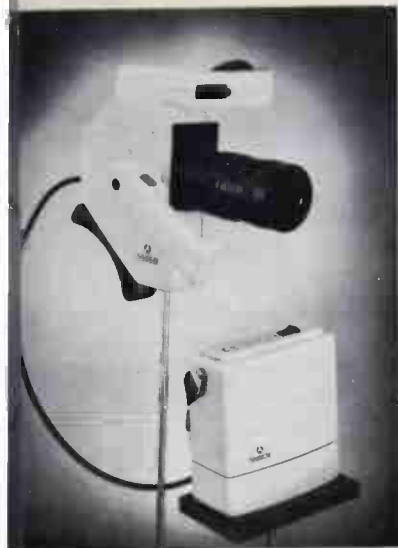
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Thomson-CSF Microcam that will be exhibited at NAB for the first time.

acts) and lowest weight (11-lbs.) of any unit introduced to date. The winner as far as price is concerned is likely to be the Toshiba CK-38. This three-tube Chalnicon-equipped unit is priced at about \$12,000.

Our prediction may go sour as a result of some new entries from Japan. Sanyo says it will have a new camera and we don't have details. The moment of truth will take place at Chicago. We're into the third round of ENG camera design and what can be expected in terms of power, weight, size and prices is nothing short of phenomenal.

As we mentioned in January, Sony will unveil a new line of ENG equipment which is expected to include recorders, editors and maybe TBCs and cameras. Hot on Sony's heels as a source of ENG U-matic equipment will be JVC.

At the recent National Audio Visual Association meeting, JVC declared its 1976 goal was simple—to be the number one firm in the video equipment market. It has singled out the broadcast field as its primary focus for growth in 1976 and claims "dollar for dollar, feature for feature," its new line the most attractive available. At the top of the video cassette recorder line is the new JVC CR-8300U priced at \$5,495. It offers smooth and stable video insert and assembly editing. It also has the editing versatility of being able to select any combination of video, audio channel 1 and audio channel 2 signals. For editing it has a rapid tape search speed and a tape count memory control for easy search. Although the unit does not backspace as indicated in a BM/E footnote last

month, the location of a specific edit frame is facilitated through a still/slow motion control including a slow motor speed of 1/15. Automatic assembly and insert control is a feature and a remote control unit is available.

JVC also has a new battery-powered portable VCR, the CR-4400U weighing 25½-lbs. (with a rechargeable PBP-1 battery and KCS-20 cassette). Power consumption is claimed to be "approximately 50% of that used by other portable units." The CR-4400U

has a capstan servo system and there is no need for a separate color adaptor. Unit has fast forward and rewind after pushing stop button. There is also touch feather control for Pause and Still framing. Price is \$2,945.

Another recorder system of unusual interest to NAB visitors will be the Bosch-Fernseh BCN 1-in. system introduced last year at Montreux (BM/E Aug. p. 44). This unit will be at Chicago. Included in the series is the BCN 20 portable unit. Bosch reports



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NAB CHICAGO

sales to Berlin, Paris, New Dehli and Peking and it will be testing the American market at Chicago.

Some brand new items from Harris

The Broadcast Equipment Division of Harris will unveil some brand new

products at Chicago. One is a new studio camera the TC-80. It's described as a state-of-the-art system with many automatic features. Use of triax cable is optional. Harris will also show a new TF-100 color film camera which has many new features and is simple to install.

A new circular polarized TV an-



JVC's new Total Video System.

Overall Interest In TV Equipment

	Percent Interested 1976	Percent Interested 1975
TV Cameras, Portable (ENG)	70%	44%
Time Base Correctors	61	64
VTRs, Portable	50	32
Character Generators	47	46
Test Equipment	47	44
Microwave for ENG	40	N.A.
Picture Monitors	38	40
Video Cartridge/Cassette Players ..	35	40
VTRS (quad)	33	44
Video Tape Editors	28	32
Remote Control Equipment	28	28
Audio Consoles	27	42
TV Cameras (top-of-line)	26	22
Production Switcher (large)	25	30
Production Switcher (small)	25	22
Transmitters	25	32
Film Chains	24	34
Master Control Switcher	24	32

Switching Automation	21	N.A.
Routing Switchers	19	32
TV Cameras (medium price)	18	16

Overall Interest In Radio Equipment

	Percent Interested 1976	Percent Interested 1975
Tape Recorders/Players	55%	78%
Consoles, Mixers	54	53
EBS Equipment	51	N.A.
Cartridge Players	48	49
Audio Processing Equipment	43	43
Automation Equipment	40	46
Remote Pickup & STL	38	32
Microphones, Accessories	38	N.A.
Noise Reduction Systems	36	32
FM Monitoring Equipment	33	19
AM Monitoring Equipment	27	28
AM Transmitters	27	25
FM Transmitters	25	18

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na will be shown by Harris. It fea-
s excellent axial ratio, and a pat-
that can be tailored to user's re-
ements. (See article on Circularly
arized Antennas next month for
e information on this antenna.)

**Electronic Still Store System be
own?**

One of the hottest new items to
ak in recent years is the new
pex/CBS system for storing slides
digital form on computer disc
ks. First paper on the subject was
livered at the Winter TV SMPTE in
roit last month by CBS personnel.
NAB, it is expected that Ampex
ngineers will deliver a paper on the
stem. Whether or not the system will
shown on the exhibit floor is not
own at this time. The system should
ve Redwood City to get to CBS
ew York in time for use at the
omocratic Convention. It may be
opped via Chicago, but Ampex is not
aing.

will be a big video show

As always, the exhibit hall will be
ed with video equipment. Telemet
l be featuring the Model 7960-A
udio Production Switcher. This unit
a be purchased with 9, 15, or 21
uts. Options include color matte
t black burst generator, positioner
h circle, square and diamond
oes, 6 X I preview bus, downstream
ert keyer with optional color matte
d non-synchronous inhibit for Mix
A B.

Vital will show total automation for
7 and a new switcher with a star spe-
el effects will be introduced. Vital,
well as Grass Valley and CDL, will
ve master control switchers working
om BIAS log information.

Dynasciences will show something
ew in downstream chroma keyers,
mely its model 7200. Also to be
own is a new Vibra Stop low cost
rotation stabilized lens. Matthey (at the
E.A. booth) will show an automatic
video equalizer. IVC will have a new
me base correctdr.

There will be something new in
ynamic graphics from Chyron but we
an't say more until March.

Other products to be seen

An economy open reel tape record-
r, the 750 Series, will be introduced
y International Tapetronics. ITC will
lso feature an automatic cartridge
ape Splice Locator/Eraser.

continued on page 82

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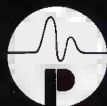


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Do We Want Discrete Four-Channel Stereo For FM?

It is fully practical with present technology, and the five proposed systems for achieving it all work well, says the report of the National Quadraphonic Radio Committee, recently delivered to the Federal Communications Commission. But now the FM broadcaster must match the promises and problems of discrete four-channel stereo against his own interests: Will the cost be worth it in a preferred position with his listeners? Will there be enough good software? Which system is best? This article supplies some of the background facts for this crucial analysis.



K101 antenna, used in air tests.

The FM broadcaster had better be ready, by spring or early summer of this year, to express himself on two questions: Is discrete four-channel FM going to be worth the cost? What system of discrete four-channel transmission, if any, should be authorized for optional use in FM?

Until now we have left all questions on these topics to the National Quadraphonic Radio Committee of the Electronic Industries Association, set up in 1972 with the express purpose of getting data to help answer such questions. The NQRC has made its report, and our reliance on its guidance turns out to have been a splendid idea. By common consent this is the fairest, most complete, most factual study ever made to help the FCC in a major broadcast decision. Veterans of the NTSC, NSRC, and other earlier ad hoc committee efforts are unanimous in putting the NQRC study at the top.

The report went to the FCC in early December. It includes exhaustive analysis of discrete four-channel FM in general, and comprehensive tests of five specific, competing systems proposed to implement it. Proponents of each system built operating models which went through the most complete over the air and closed-circuit tests that a flock of the industry's top talents could devise.

The overall conclusions of the report were previewed at the NAFMB convention in Atlanta, as reported in BM/E in November. The highlights are (more detailed below): discrete four-channel FM is thoroughly practical with present FM broadcast technology; all five of the proposed systems worked well; in a direct comparison, listeners strongly prefer discrete four-channel reproduction to matrixed or two-channel reproduction.

On the face of it, the report is going to do just what it was intended to do: save a year, or maybe two, in the FCC's deliberations on four-channel FM by making a notice of inquiry unnecessary. It is hard to imagine that more testing is needed when one looks over the summaries of the tests in this report.

The FCC, of course, can disagree and issue a notice of inquiry calling for more data. But the best guess is that the next move will be an FCC notice of rule making, proposing a decision and inviting the comments of the

industry. This notice might come, staff members at the FCC have said, by late spring or early summer; but broadcasters will recognize that this is a best-hope forecast, vulnerable to the well-known clogging in the FCC pipeline.

Thus with comments, reply comments and rebuttals all due, it is realistic to assume that, at best, the rest of 1976 will be taken up in the FCC-industry dialogue, with a final decision coming, at best, early in 1977.

But the FM broadcaster cannot forget about four-channel FM until 1977 (or later). What happens at the decision point will depend in large measure on what he does now, in 1976. As suggested at the beginning, the decision will be heavily influenced by what the broadcaster tells the FCC he wants, expressed either individually or through the broadcast associations around the country. The NQRC report demonstrates, most convincingly, that discrete four-channel FM is *practical*. The industry must decide on a broad basis whether it is *desirable*.

It is particularly important that the individual broadcaster make his position known, because there will be heavy pressure on the FCC from a number of special interests. Each of the five proponents of specific systems will naturally be pushing hard for that system (one member of a Committee panel estimated for BM/E that some system proponents had spent several million dollars apiece to underwrite their demonstrations).

To take another example: it is in no sense being derogatory to point out that firms with heavy investment in matrix systems will like it best if *no* discrete system is approved. The solution there would be a highly desirable but extremely unlikely industry move toward total compatibility of four-channel recording systems.

The main questions the FM broadcaster has to satisfy himself about over the coming months are the obvious ones:

- Is any of the proposed systems clearly superior to the others?
- What will it cost the broadcaster to get into discrete four channel?
- Will his investment give him a clear advantage with his listeners?

• And, most important, *where is the software coming from?*

Here BM/E can only suggest, in the briefest terms, where some of the answers might lie. Conclusive answers or even reasonably convincing ones must come from discussion among many elements of the industry. Hopefully, conventions and other industry meetings during the coming year will provide forums for such guidance.

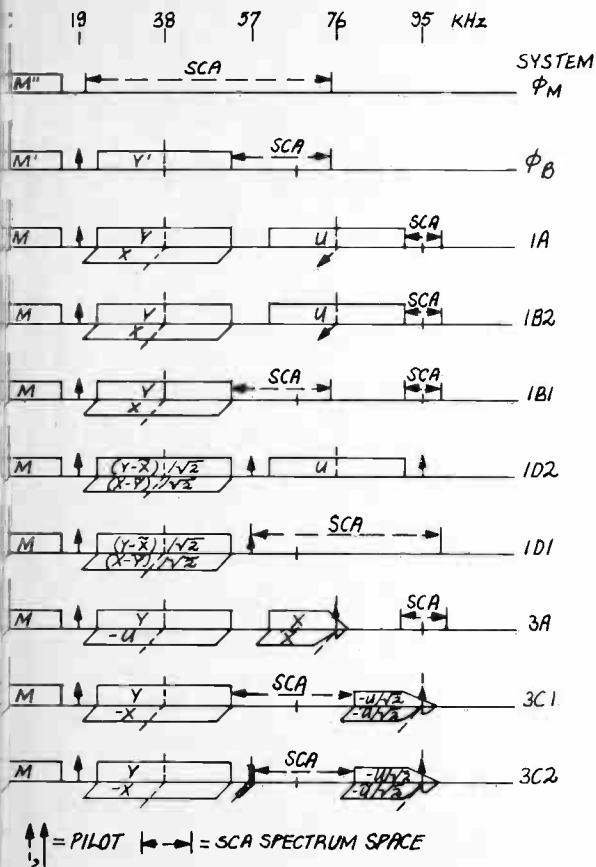
Overall: it is practical, compatible, and needed

The report puts it this way: "The tests clearly demonstrated the viability of quadrasonic services both from the practical and the quality aspects." This judgement includes the complete transmitter-receiver system, using presently-common technology at both ends. Present transmitters are fully adequate, as are present antennas.

Present receiver technology is also fully satisfactory, with the quality of the results depending on receiver quality, a factor dependent in turn on cost/consumer choice.

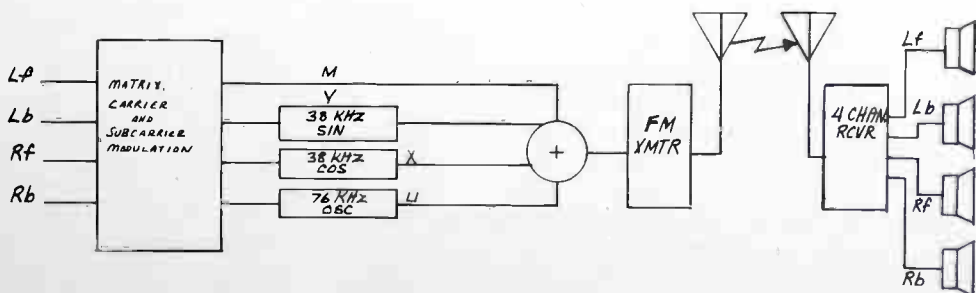
The clean bill of health on "compatibility" includes a no-increase-in-interference finding, as well as maintenance of protection ratios.

The one negative finding (one widely anticipated) was the reduction in SNRs caused by the necessary reduction in modulation levels. This is on the order of 6 to 10 dB (apparently it varies somewhat among the systems) as compared with stereo FM. On that the report says: "(This) . . . is not large enough to significantly reduce the coverage of existing (two-channel) FM services." For *four-channel reception*, some broadcasters may experience some coverage loss at the fringes, as compared to two-channel. Note, however, that mono

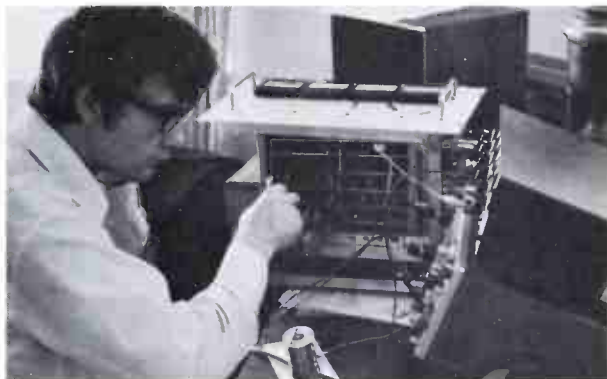


Diagrams show spectrum assignments in all proposed four-channel FM systems. Two at top are mono and stereo M, for comparison. IA is a Quadracast; IB1 and IB2, RCA; ID1 and ID2, Cooper-UMX; 3A, General Electric; 3C1 and 3C2, Zenith. Combination signals used by all are: $M = LF + F + LB + RB$; $Y = LF + LB - RB - RF$; $X = LF - LB - RB + F$; and $U = LF - LB + RB - RF$. First three systems use double-side-band carrier-suppressed modulation on all sub-carriers; last two use vestigial SSB on upper sub-carriers.

General scheme used by several systems includes matrixing into the four combination signals, M, Y, X, and U, their application to main, 38 KHz and 76KHz subcarriers, and their combination to modulate transmitter.



Four-channel signal generating equipment is set up in center and right racks in this laboratory at the College of San Mateo, California. In left rack is the Cooper-UMX system, undergoing tests.



Tom Davies, one of technical assistants to the NQRC, sets up for tests of a decoder. (Note: all photos accompanying this article made by Eric Small, Cooper-UMX).

FOUR-CHANNEL STEREO

Test equipment which was used in field trials is installed in trailer, later used to determine signal characteristics throughout coverage area.



A delay line consisting of 4,000 feet of coaxial cable, shown here on drums, was part of test system for simulating multipath effects.

and two-channel listeners will suffer a small loss (about 4dB) because of the installation of four-channel transmission.

On the desirability of the results, the report sums up the subjective tests (described in *BM/E* for November) as follows: "The subjective aspect results clearly indicate the need for a quadraphonic service." We go into this very basic point in more detail further along.

Battle of five systems—the "polite" period is over

The system proponents are the following:

Quadracast Systems Inc. (The "Dorren Quadraplex" system);

RCA (with two options);

Cooper-UMX (two options);

General Electric;

Zenith (two options).

The five systems are remarkably similar in overall design, as can be seen from the spectrum charts reproduced here. These charts are taken from Volume 1 of the NQRC report, which gives a detailed description of each system as prepared by its proponent. Volume 1 of the report is available free from EIA. *BM/E* strongly recommends that every FM broadcaster get a copy: address the EIA at 2001 Eye St. NW, Washington, D.C. 20006, or call them at 202-659-2200.

Note first the four signals "M", "X", "Y" and "U", used universally in these systems, as shown in the caption. Every system uses a "main" channel which carries the sum of all four stereo signals, the "M" signal. This assures mono compatibility. Every system uses the 38 KHz subcarrier of stereo FM to carry two of the signals in phase quadrature. Every system uses double sideband suppressed-carrier AM modulation for this subcarrier, which takes up the spectrum from 23 to 53 KHz. And every system uses a 19 KHz pilot as a reference for all the signals.

By putting the left-minus-right (LF + LB - RF - RB, or "Y", signal) on the 38 KHz subcarrier at the zero phase, two-channel stereo compatibility is provided: stereo receivers will get L+R on the main carrier and L-R on the subcarrier, as they do now with two-channel FM. The other signal on the 38 KHz subcarrier can be the "X" signal—front-minus-back—or the crisscross, "U".

From this point on, the systems tend to differ. QSI, RCA Option 2, and Cooper-UMX Option 2 put the fourth stereo signal on a subcarrier at 76 KHz, again

double-sideband AM carrier suppressed. QSI and RCA allow for an SCA subcarrier at 95 KHz with 4 KHz bandwidth; Cooper, Option 2, omits SCA. Zenith puts the fourth signal at 95 KHz, but with vestigial SSB modulation. GE puts the fourth signal at 76 KHz, also with vestigial sideband AM modulation. The charts show the varying disposition, or omission, of an SCA subcarrier.

Fortunately for all of us, the NQRC's studies include exhaustive tests of the noise characteristics, distortion, coverage, interference potential, etc., etc. of each system. These results are shown in Volume II of the report, now being sold by EIA for \$100 a copy (note to EIA: could some summaries be issued?). In any case, persons familiar with the results say that all the systems worked well: the differences are reasonably small.

But there were *some* differences, and the very fact that they were not overwhelming makes it certain that they will be emphasized by the various proponents when the competitive struggle begins. Up to now, everyone agrees, all the competitors have been eminently cooperative in their effort to get a complete, factual report.

But, now, as one observer put it to *BM/E*, comes the lunge for the jugular—each proponent will naturally push his strengths and the others' weaknesses as strongly as possible. This can have a highly educative value for the FM broadcaster and should be welcomed on that score.

To sum up on this question: right now it is possible only to get tentative opinions, many tinged by self interest, on the comparative merits of the systems. But as the exhaustive test results are made widely available, are analysed and summarized, and as the claims of the various proponents are advanced and evaluated, it seems highly likely that preferences will emerge. One possible outcome suggested to *BM/E*: a combination of two or three systems, which might avoid giving a strong paten position to one proponent—or might avoid lengthly legal squabbles in an area of patent complexity.

The broadcaster's cost: moderate

If and when it comes, the FM broadcaster will need only moderate additions to his plant to get into discrete four-channel broadcasting. As already noted, a major conclusion of the NQRC report is that present transmitters, exciters, antennas, are fine for the job. The major additions, therefore, will be the encoder, some four channel monitoring gear, four-channel control consoles

continued on page 4

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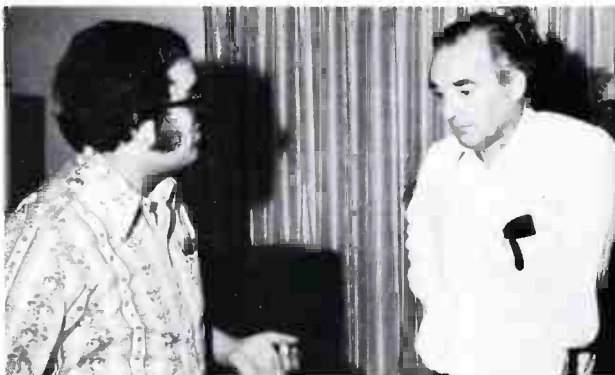
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FOUR-CHANNEL STEREO

Dr. Duane Cooper, co-developer of Cooper-UMX system, adjusts unit in system prior to one of test runs.



Typical of multi-company cooperation and joint effort that animated NQRC tests is this scene showing, from left, H.P. Lee of General Electric, Mark Broder, NQRC technician, and Christy Davidge, secretary of Cooper-UMX, working together on analysis of some test results.



Another inter-company consultation during the tests is this one between Lou Dorren, left, developer of the Quadracast system, and James J. Gibson of RCA, who served on several of the NQRC panels.

and four-channel origination equipment. The last will depend heavily on the software that develops—more on that below.

Cost of the encoder is likely to be somewhere in the \$1500 to \$3000 range, according to estimates given BM/E. Four-channel monitors will be essentially stereo monitors multiplied by two. Four-channel consoles are, of course, already in use in large numbers. The broadcaster can choose over a wide range what he wants to pay for such a console: it depends on many factors besides the number of output channels.

Altogether, it appears that an entry to discrete four-channel will be available for \$15,000 to \$20,000—it can be more, but it doesn't have to.

Does the FM listener want it?

Here we move onto the battlefield. On the one hand there is the sad fact that four-channel reproduction has not taken off in the consumer hi fi field. BM/E talked to several nation-wide merchandisers of consumer hi fi equipment. They agreed that four-channel—whether matrixed or discrete—is still a fringe enterprise; one of the largest distributors is, in fact, abandoning four-channel equipment entirely in 1976.

However, a spokesman at Lafayette Radio, as gloomy about present four-channel sales as the others, was still totally enthusiastic about the basic attractiveness and salability of four-channel reproduction when properly presented to the listener. He blamed the competition between systems for a major part of the failure of this “thrilling” listening experience to win buyers—that and an apparent lack of commitment on the part of important software producers to full production of four-channel material.

The attractiveness of four-channel reproduction has been apparent in the substantial success of a number of FM stations with matrix systems, as reported over the last few years in BM/E and elsewhere. Although hobbled, again, by competition between systems, a significant number of stations have stirred highly worthwhile listener excitement with matrix broadcasting. There is simply no question that, under favorable conditions, four-channel reproduction has strong attractions even in matrix form.

So why go beyond matrix systems?

And that brings us to the most contentious question of all—why abandon matrix systems, which are so much cheaper, simpler, requiring no FCC action of any kind?

Every broadcaster has read reams of argument on both sides of this question. The NQRC's subjective tests do supply a direct listener-preference determination, as already noted, between discrete four-channel and a matrix system: discrete won hands down. This tends to confirm a step-by-step point of view held by many: good matrix reproduction does step up to an important improvement, as compared with two-channel; good discrete carries this a large step further. The only unfortunate fact about the NQRC tests is that the two main matrix systems, Columbia's SQ and Sansui's QS, were not included in the tests. This came about because the two firms did not enter their systems in the NQRC trials.*

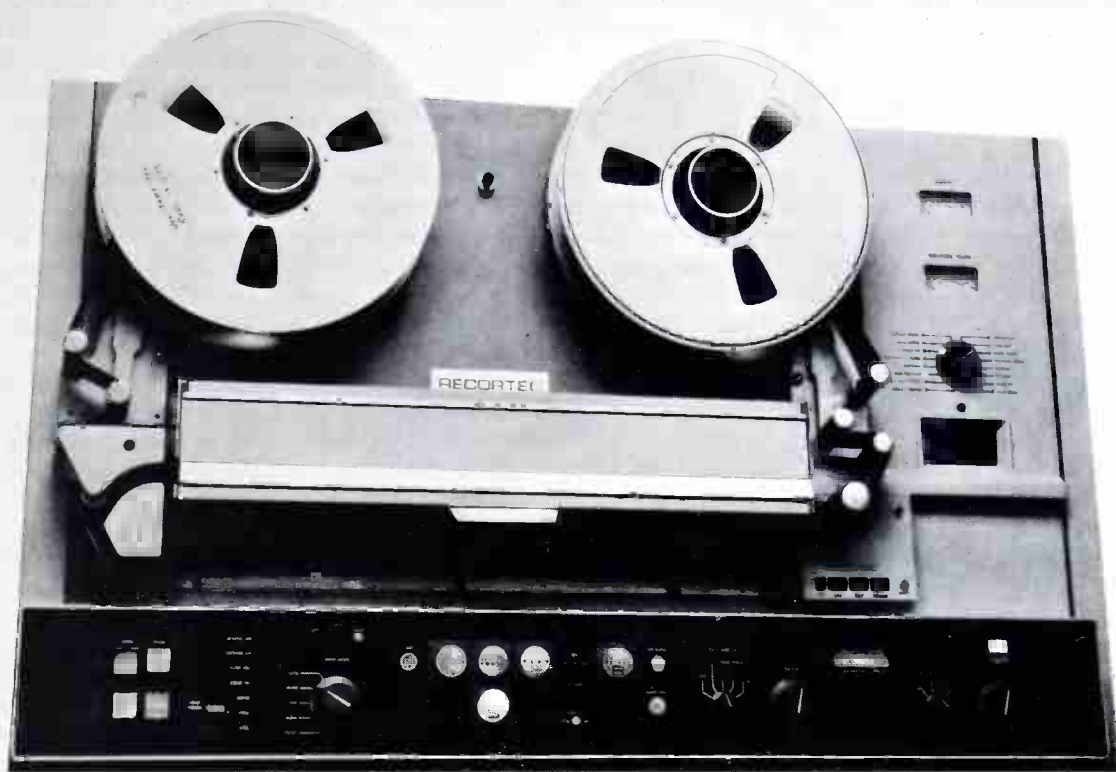
It would be easy to conclude that discrete four-channel FM should simply be given a trial to find out if the margin of improvement is worth the cost to broadcasters—software producers, receiver manufacturers, listeners. But the decision involves more than that. It is the explicit hope of the proponents of discrete four-channel that the choice of an FM system will force the industry, at last, to close ranks behind one overall system for four-channel.

This has its bad aspects: it means that some of us are going to “win” and others are going to “lose”, at least

*The matrix system used in the comparison tests did not include decoder logic like that available in both the SQ and QS systems. Presumably either or both, could have made a better showing; whether decisive or not is open to question.

continued on page 46

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FOUR-CHANNEL STEREO

initially. But it has the excellent promise of putting the industry finally in a rational relation to the consumer, so that four-channel reproduction can grow at a normal, healthy rate. In the end everyone in the industry will benefit from that.

Where is the software?

The foregoing suggests the answer to this paramount question. The optimists see a "follow the leader" effect: once a single system is established, the four-channel software will start to flow from many industry sources. The industry is in better position to do this than when two-channel stereo came, in the late 1950's. Then every piece of material had to be recorded anew. Now practically every recording on industry shelves is in a multi-channel form readily mixed down to four discrete channels, if that is wanted—any record company can do that today.

At the start, the burden is clearly going to fall on RCA's CD-4 system for disc program material. But we can hope that others will come along with discrete systems that are compatible, if not identical. We can hope that, whatever system is used, the software producers will move into full-scale production, on the grounds as already noted, that the FM experience will start a broad move by the public into four-channel stereo.

There is a minor but highly intriguing subsidiary possibility. Discrete four-channel in FM might resuscitate high-quality four-channel tapes. The quality-minded FM

broadcaster would certainly prefer—though he may not be able to do it on a large scale—getting his four channels directly from a tape, to getting them at the output of a CD-4 decoder, with an elaborate re-encoding still to come.

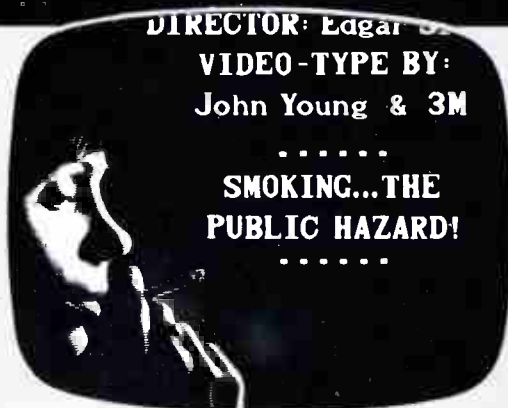
Many broadcasters already have such tapes, from various sources. There is little or no hope that any of the main body of four-channel programming will be available in this form—the big record companies can see no worthwhile return from four-channel tapes.

But independent companies, specialists of various kinds, that have put out four-channel tapes in the past—to a very slim market, indeed—will certainly welcome any enlargement of the market. Vanguard Records, for example, a pioneer with four-channel tapes nearly a decade ago, recently issued additional tapes, plans to continue building their catalogue of such tapes slowly. A spokesman there suggested that if and when a market developed among FM broadcasters, Vanguard might consider accelerating four-channel tape production. This company has a very large, attractive catalogue of music of all kinds, perhaps the finest of any "independent" record producer.

There is, of course, "live" four-channel programming, which could be the most exciting of all benefits from discrete four-channel FM. It can make up only a tiny fraction of the programming available to us, but several station executives BM/E questioned said they would certainly do it from time to time, when the new system comes. For the quality-conscious listener, an occasional "live" pickup could make it all very worthwhile.

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The Road Ahead Looks Smooth For AM Stereo

The National AM Stereo Committee of the EIA is beginning its evaluation of proposed systems. Three proposals have already been made; field tests of one system have already indicated that AM stereo is practical. The regulatory and competitive difficulties seem a lot less fearsome than they are with four-channel FM.

Some AM broadcasters are going to be surprised by this statement, but plenty of them are going to be pleased: AM stereo could come in a lot faster than FM stereo did, more easily, spreading through the industry quickly with

large benefit to many station operations.

Technically, AM stereo appears to be readily adaptable to existing AM installations at moderate cost. A number of systems are being put forward (more on that below), and the techniques look no more difficult—perhaps less so—than those of FM stereo. Receiver technology will be equally straightforward. A leading manufacturer of car radios (highly relevant to AM stereo, as discussed in a moment) has said that a car system that already includes FM stereo could have AM stereo added at an additional cost to the manufacturer of around \$2.00.

On the regulatory front, which will be the scene of AM stereo action through the near future, we have the organization of a National AM Stereo Committee (NASC) by the Electronic Industries Association, to function just as the National Quadraphonic Radio Committee did for four-channel FM, and as the NSRC did 15 years ago for two-channel FM. More details on the NASC appear in the accompanying box.

The NASC will receive proposals from developers of AM stereo systems, will evaluate them by whatever means seem desirable, and make a report to the Federal Communications Commission. As this was written three systems had already been submitted to the NASC, and there were a number of others in the offing. One of those systems, that of RCA, has been demonstrated and described at recent industry meetings, and is covered in some detail in the article by Arno Meyer which appears on another page.

The other two proposed systems, those of Sansui Electronics and Comm. Associates, are described very briefly in the accompanying box. A fourth system, that of Kahn Communications, had not been submitted to the NASC at press time, but was used in a comprehensive series of on-the-air tests late last year at station WFBR, in Baltimore. Some highlights of the results are described below.

We can appreciate better the smooth road that seems to be ahead for AM stereo if we consider some of the questions and difficulties hanging over four-channel FM, covered in the article on the NQRC report elsewhere in this issue. Discrete four-channel FM has not won a clear consensus as making matrix systems obsolete in FM; it will be moderately expensive; the proportion of listeners

The NASC Opens For Business, Gets Three AM Stereo Proposals

With the success of the National Quadraphonic Radio Committee to inspire them (see story in this issue), the Electronic Industries Association has set up the National AM Stereo Committee (NASC) to evaluate proposals for AM stereo and report on them to the FCC. Pressure from AM broadcasters for a stereo system has been more and more evident as FM stereo stations in many communities have won strong competitive positions with their two-channel operations. Proposals for AM stereo have been made over several decades, and some systems brought to the operating point in the lab. It seems likely that a number of systems will be advanced to operability and submitted to the NASC; three proposals are already in, from RCA, Sansui Electronics, and Comm. Associates, respectively.

Chairman of NASC is Harold Kassens, formerly Assistant Chief of the FCC Broadcast Bureau and now with A.D. Ring Associates, engineering consultants in Washington. At press time not all the various panels had been organized, but Panel 1, concerned with overall system specifications, has as chairman Carl Eilers of Zenith (who had a similar position with NQRC). Panel 1 was scheduled to meet on February 3rd in Washington to receive detailed descriptions of the RCA, Sansui and Comm. Associates systems from their respective developers.

The RCA system is described in the accompanying story by Arno Meyer of Belar Laboratories. Comm. Associates uses a very different method called "Frequency Aperture Modulation." In this the L+R signal is put on one subcarrier a little below the main carrier, the L-R on another subcarrier a little above the main carrier. Then a filter system selects the band centered on the main carrier and including just the upper sideband of the L+R subcarrier and the lower sideband of the L-R subcarrier; this is the transmitted signal. The receiver responds to the two sideband signals separately.

Sansui Electronics also uses the two sidebands separately, distinguishing between them by introducing a 90° phase difference. Full details on the Sansui system were not available at press time but will be supplied in later stories on AM stereo.

with four loudspeakers in their living rooms, or cars, is quite small, and there is no reasonable way of estimating how fast the public would adopt quadrphony; above all, there is presently no sure indication as to where large-volume software would come from.

In every one of the areas noted, AM stereo seems to be getting pretty. Once a system is adopted by the FCC, there would be no competition of any kind. The cost of additional monitors, limiters, consoles, etc., will be very much less in going from one channel to two than in going from two to four. Two-channel stereo is already installed, of course, in most homes and in a sizeable proportion of cars. The program material is here, has been here for 10 years, in the greatest abundance.

In addition to these plus signals, the AM broadcaster in many cases will have good motivation for getting into stereo. As noted in this magazine and elsewhere recently, many local AM stations have a competitive disadvantage as against FM stereo stations in their communities. AM stereo looks like the way to get back in the game.

A broadcaster who has been actively investigating AM stereo points out to BM/E that in hilly areas, or in large cities with many tall buildings, FM stereo tends to instability in car reception. Thus AM stereo would solve an important listening problem, winning audiences for the AM broadcaster.

Beyond that, even in areas where FM works well in

cars, the AM broadcaster will welcome AM stereo as a way of keeping and enlarging the car audience, which is essential to many AM broadcasters. On this point, there is plenty of evidence that the acoustic effects of stereo, which can be emphasized in car installations, have a very strong attraction for car owners whatever the quality of the signal.

Good evidence that AM stereo can be a practical system comes out of the experiments at WFBR, in Baltimore, mentioned above. The system of Kahn Communications was used. This, in effect, puts one channel on one sideband of the AM carrier, and the other channel on the other sideband. Instrument and listening tests showed stereo signals of low distortion and noise, good separation, available throughout the station's coverage area. The equipment added at the transmitting end, besides the necessary doubling of audio lines, monitors, etc., consisted solely of the Kahn encoder. Two kinds of receivers were tried: one consisted of a dual receiver, with each section detuned slightly, one above and one below the carrier. This provided about 15 dB of separation. A receiver incorporating Kahn's special decoding system averaged 35 dB of separation, far more than enough.

As noted in the box, the NASC is just beginning its deliberations. AM stereo is some distance off—but every fact suggests that it is not going to take nearly as long as four-channel FM has taken to get to the decision point. **BM/E**

A Compatible AM Stereo System

By Arno M. Meyer, President, Belar Electronics Laboratory, Inc.

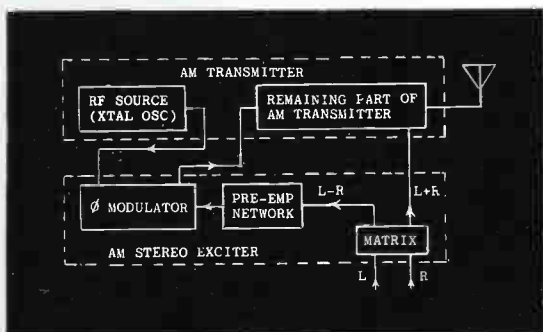


Fig. 1 Block diagram of AM stereo transmitter.

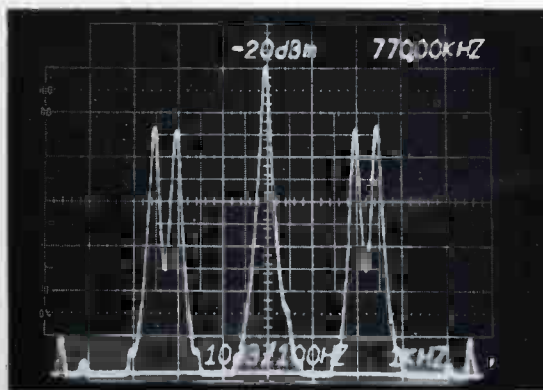


Fig. 2 AM sidebands with L+R, 2 KHz and 2.5

RCA and Belar Electronics demonstrated a compatible AM stereo transmitting system at the 1975 NAB Convention held at Las Vegas. Both demonstrations used the same system which was based on the AM-FM system developed by RCA and proposed to the FCC in November, 1959. Needless to say, this 1959 system fell by the wayside with the advent of FM stereo.

The AM-FM system of generating a compatible stereo signal is fairly simple. A block diagram of the system is shown in Fig. 1. The left and right audio channels are first matrixed into a L+R and L-R. The L+R or sum signal is applied to the audio input of the AM transmitter to produce the amplitude modulated signal. Note that this is the same type of signal that the FM broadcaster uses now in deriving a mono signal from a stereo sound.

The L-R or difference signal contains the stereo information. This signal is pre-emphasized and applied to an angle modulator which provides the new carrier for the AM transmitter.

This "new" carrier, containing all the FM sidebands of the L-R signal, is applied to the remaining part of the transmitter. The "new" carrier is amplified and processed to add the AM sidebands to the carrier so that the output of the transmitter now contains two information channels—the AM containing the L+R or monaural information and the FM containing the L-R or stereo information.

Fig. 2 shows the spectrum of the AM sidebands produced by a L+R only modulating signal. The L signal is 2 kHz and the R signal is 2.5 kHz. Their amplitudes are

continued on page 50

COMPATIBLE AM STEREO

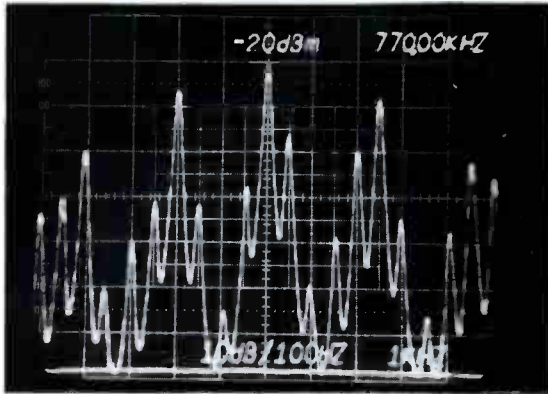


Fig. 3 L-R (FM) added, with 2 KHz deviation.

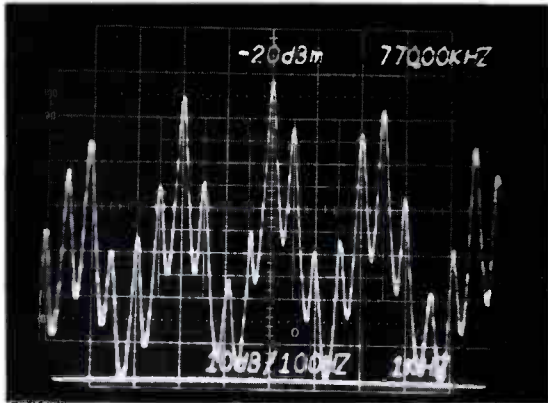


Fig. 4 L-R (FM) added, with 3 KHz deviation.

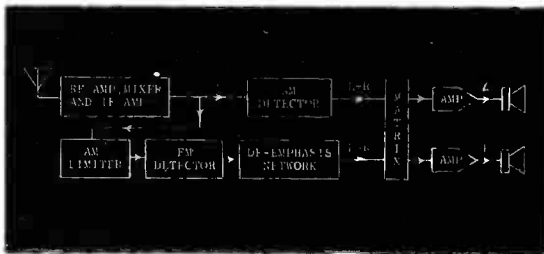


Fig. 5 Block diagram, typical AM stereo receiver.

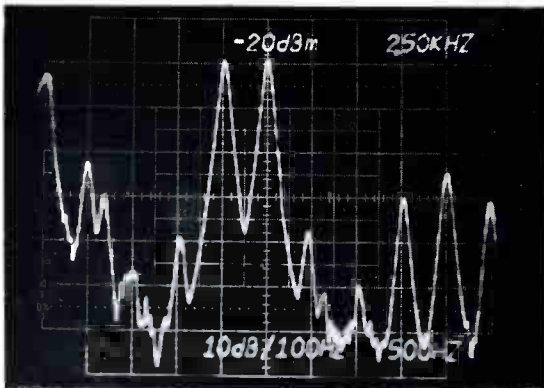


Fig. 6 Output of AM receiver with L+R signal only.

equal and set to 80% peak modulation. Fig. 3 and 4 show the spectrum when the L-R (FM) is added at 2 kHz and 3 kHz deviations respectively.

An ordinary AM receiver will demodulate the AM sidebands only to produce the L+R or mono signal. To demodulate the L-R sidebands, the receiver must contain an FM detector. A block diagram of a typical AM stereo receiver is shown in Fig. 5.

The AM envelope is demodulated in the normal manner to recover the L+R signal. The IF is limited to remove the AM components and detected by an FM detector to recover the L-R signal. The L-R must be de-emphasized to match the transmitted signal in order to preserve the separation. The L+R and L-R are matrixed to form the L and R outputs.

The question most asked is what happens when an ordinary AM receiver is tuned to an AM-FM stereo signal? And is the distortion increased?

Fig. 6 shows the output spectrum of an inexpensive AM receiver taken at the speaker terminals when the L+R only signal (Fig. 2) is applied. The wanted signals are 2 kHz and 2.5 kHz respectively. Harmonic distortion components are shown to be 30 dB down at 4 kHz and 5 kHz and major intermodulation components are shown at 500 Hertz (22 dB down) and at 4.5 kHz (25 dB down). When the L-R signal is added at 2 kHz deviation (Figure 3), the output spectrum of the receiver is shown in Fig. 7. The harmonic distortion increases but the intermod at 4.5 kHz decreases and the intermod at 500 Hertz remains the same. A further increase of deviation to 3 kHz is shown in Fig. 8. These distortions are caused by the very narrow band-pass characteristics of the receiver and not by the detector.

Higher quality receivers produce much less distortion due to their better band-pass characteristics. Tuning to the "best sound" with the L-R component on will also lower the distortion.

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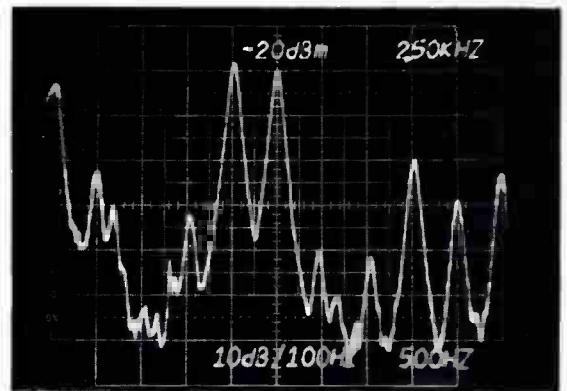


Fig. 7 Output of receiver, L-R added at 2 KHz deviation.

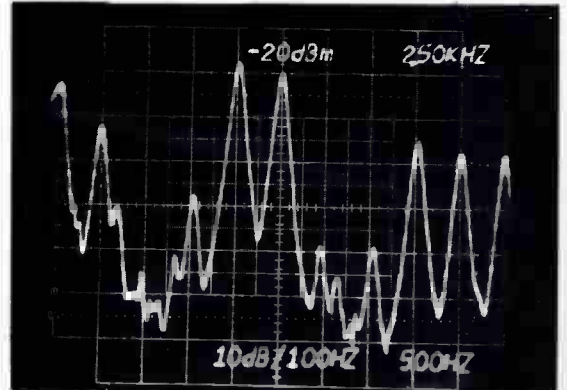
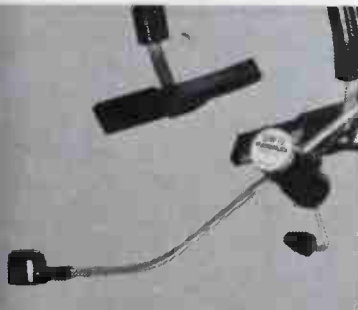


Fig. 8 Output of receiver, L-R added at 3 KHz.



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COMPATIBLE AM STEREO

Laboratory measurements of an AM stereo receiver without bandpass filters yield distortion figures of under 1% and channel separations of better than 25 dB. Proper receiver design can retain much of this performance to provide more than acceptable stereo performance.

Fig. 9 shows a fully modulated L+R only signal of L=5 kHz and R=8 kHz. Fig. 10 displays the signal with the L-R added at 4 kHz deviation. The spectrum is well within the emission limits set forth in Par. 73.40 of the FCC Rules and Regulations.

The AM-FM system is one example of a compatible stereo system that will not obsolete present day monaural receivers. Sufficient interest has been shown in AM stereo that the National AM Stereophonic Radio Committee has been formed under the sponsorship of the EIA, IEEE, NAB, and NRBA with Harold Kassens as chairman. At the present time three systems are being proposed: Comm Associates, RCA, and Sansui. It is clear that the time is right to seriously consider AM stereo as a viable broadcast service.

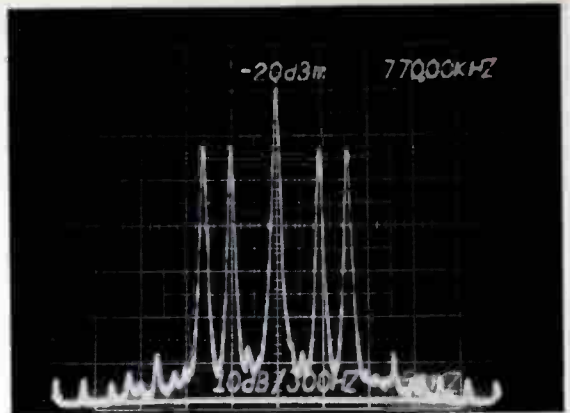


Fig. 9 Fully modulated L+R signal, L=5 KHz, R=8 KHz.

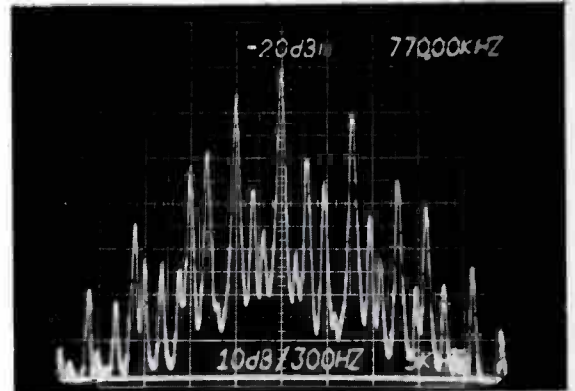


Fig. 10 Above signal, L-R added at 4 KHz deviation.

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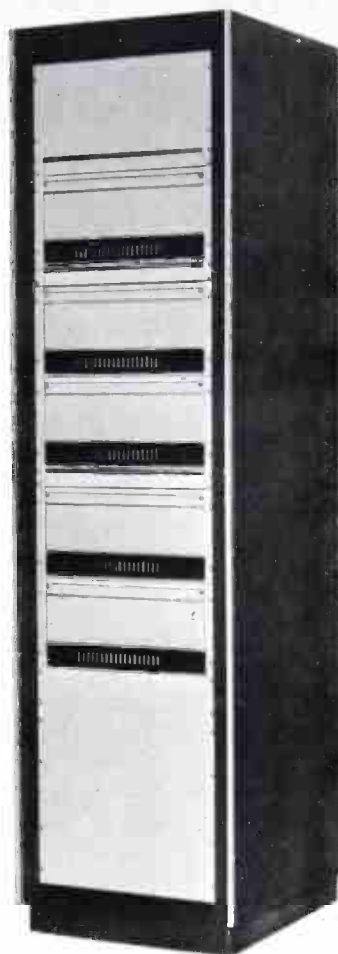
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The Microprocessor And Its Application To Broadcast Control

By Kenneth P. Davies

Offering complex control capabilities in a tiny, low-cost package, microprocessors are cost effective and efficient. They are finding their way into broadcast equipment. The next step will be interconnecting networks of small processors to achieve more automation of technical operations. The article that follows is based on a presentation made by the author at the 9th International Television Symposium, Montreux.

The microprocessor provides inexpensive computer power at the point where it is needed or is going to be used. Since its introduction in 1970, primarily as a memory as an alternative to large logic packages, the microprocessor has found its way into a number of new applications. It has taken over certain areas of control logic previously performed by conventional networks of gates. The microprocessor has already found a place in broadcast equipment: in automation controllers, editors and cameras (as automatic test systems) to name a few.

The microprocessor is a close relative of the devices found in pocket calculators and provides a level of capability, in conjunction with other devices, midway between there and simple mini-computers.

Basic concepts

While generalizations are dangerous in a rapidly developing area such as this, a typical microprocessor looks like the Intel 4004 (a 16 or 40 pin DIP) and contains the key elements illustrated in Fig. 1. In passing it should be noted that this particular microprocessor is among the simpler ones, but illustrates well the techniques involved. Packed into the LSI chip are the basics of a computer system:

- The instruction register whose decoded output controls the flow of data inside the unit.
- The arithmetic unit which provides the basic capability of binary addition, subtraction, comparison and testing.
- A control stack program counter to control and monitor the flow of data to the instruction register from memory.
- A register stack to store data and intermediate results lying between memory, arithmetic section, and input/output devices.
- A timing and control section which interprets the output from the instruction decoder, in conjunction with the clock generator, to provide an orderly flow of data inside the microprocessor. Inputs are provided in addition to this area for a test input (to allow simple program branching on a polling basis), an interrupt input to allow an external timing signal to be recognized, and a

halt input that can be used to suspend processing in an orderly manner.

- External data bus buffer which operates in a bi-directional mode to supply instructions and data to the processor as demanded by the program, and which carries away the results of the processing to memory or to external devices.

In short, the microprocessor contains the essentials of a fairly conventional small computer. It is also obvious that the device is small and hence operates in a register-to-register mode to minimize memory access congestion. Frequently the microprocessor employs multiplexing of the bus interconnection inside the chip and hence some clock cycles are not available for processing, resulting in rather slow instruction cycles in the region of 6-12 microseconds.

Most microprocessors are built using large-scale integration techniques using PMOS in the early units, or NMOS in units developed later. Higher speed technologies giving acceptable device densities such as silicon on sapphire or IIL have not yet been successfully applied though the IIL technique will undoubtedly be the one to watch very closely in the near future.

Application of microprocessors

By itself the microprocessor is a useless device, and only when teamed up in a small system, as in Fig. 2 with instruction memory, data memory, and input/output capability, can it begin to produce useful work. The details of interfaces for memories, clocks, input/output and external devices vary widely from one design to another, and the lack of these hardware components in a consistent and economical format has been a major stumbling block to the development of microprocessor systems.

The microprocessor performs its tasks through the interpretation of a fixed program stored in the memory, generally read-only, and dedicated to the current task. This is quite different from the general computer approach and the *program* here is essentially part of the hardware or, shall we say, firm-ware rather than software.

The generation of this instruction code is also quite different from the mini-computer case. In a microprocessor the capability is quite limited and hence code

Mr. Davies is Director of Engineering, Central Dynamics Ltd., Montreal, Canada.

must make very efficient use of storage space. It must also meet very firm rules (which vary widely) in regard to timing, instruction sequence, memory capability and input/output procedures. The designer must also pay very close attention to the capability of the processor, particularly if nested routines are allowed which take up large amounts of temporary storage.

Design of the control program is, to a large extent, an exercise in very detailed hardware type decisions, with the results expressed in very tedious assembly level code. Specialized programs run on large computer systems can help in the generation of this code and can also help by providing a simulation of the microprocessor to remove gross errors that are not time-dependent. (Debugging of the code in realtime is a difficult task due to the problems in examining registers and memory locations to view the intermediate results).

A couple of examples will probably best illustrate the parallels and differences between the TTL logic and microprocessor solutions to the same problems. Fig. 3 shows a hardware solution to provide the functions of filtering an input from the pushbutton to eliminate noise and contact bounce, synchronizing it with the system, and directing the flow of another signal to one of two outputs dependent on the state of the switch. Viewed as an incremental cost, and neglecting system overhead costs, this represents a simple cost of approximately \$5.00 and produces an answer in 200 nsec plus the filter delay, usually of the order of 5-10 msec.

The equivalent microprocessor version is shown in Fig. 4 as a flow chart. This arrangement takes approximately 100 microseconds to obtain an answer plus the integration time of approximately 16 msec. It occupies 2 locations in its basic format and can easily be put into ROM by noting that the two major program loops are actually duals of each other and can be accommodated by a single sub-routine. Storage of this program represents a cost of about \$3.00. It should also be noted that the bulk of the sub-routine can be used again to de-bounce other switches and hence, in a real system, this cost will drop considerably.

A second example of a fairly common operation in television is the addition of two 8-digit numbers such as might occur in time-code operations. Fig. 5 shows a standard high-speed BCD adder with appropriate storage logic that yields a design that will add the two numbers in approximately 8 microseconds and present the answer in the 8 x 4 RAM memory. It has an approximate hardware cost of \$60.00.

The software version, shown in simplified form in Fig. 6, occupies at most 40 memory locations having a cost of approximately \$5.00, but it takes approximately 900 microseconds to complete the calculation.

Application criteria

From this it can be seen that the microprocessor approach has some obvious economic advantages in situa-

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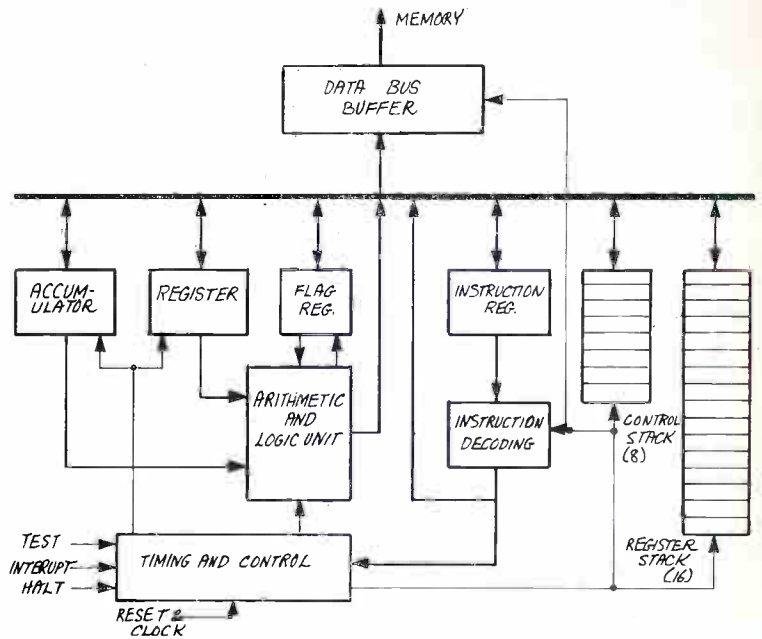


Fig. 1 Block diagram of a microprocessor unit (MPU).

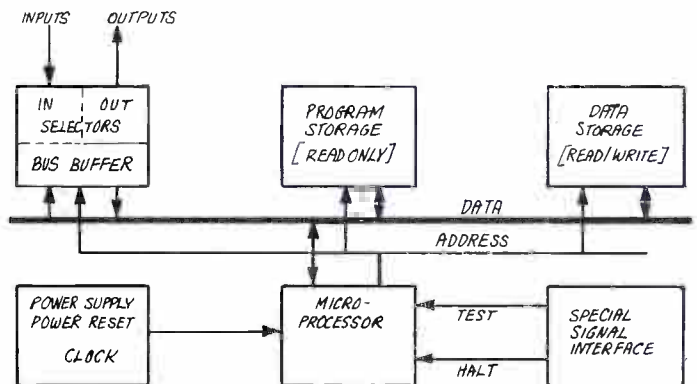


Fig. 2 Block diagram of a complete system using an MPU.

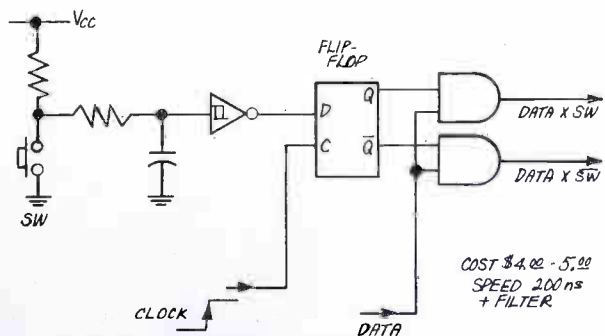


Fig. 3 Logic diagram of hardware branch decision.

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tions where:

- The data to be processed is in BCD (4-bit machines) or bytes (8-bit machines) format.
- Large numbers of single wire random inputs are absent as the cost of interfacing signals of this nature is quite high.
- Output timing is not critical to delays of a millisecond or so.
- Response to an input stimulus can tolerate delays of 100-150 microseconds without producing erroneous data.
- The basic overhead cost of the system—that is, the microprocessor, power supply, and operating memory—is not overwhelming.
- The volume of the application is not high enough that a custom-designed LSI module is economic.

The MPU will find its way into many facets of broad-

casting and will also spawn a variety of new products not currently available. The following list represents areas of current application.

- 1) Logging and reduction of transmitter and presentation data.
- 2) Specialized keyboard interpreters.
- 3) Film processing control.
- 4) Intercom routing.
- 5) Small presentation systems (radio and TV).
- 6) Script editing and display.
- 7) Cassette and reel tape controllers/editors.
- 8) Control assignment systems.
- 9) Timers and stop clocks—address code generators.
- 10) Video test systems.
- 11) Automatic test systems.
- 12) Network synchronization controls.

How a microprocessor works in a tape controller system

To illustrate the application of the device, consider that of the small tape controller shown in Fig. 7. This controller is required to interpret data from the command keyboard in order to perform operations of cueing, synchronization, rehearsing and recording on the machines and to maintain up-to-date data in the operational stores. Data enters the system from the data keyboard, time-code recovery, constant registers and remote data bus, with data leaving to command the machines and to write displays. From the previously discussed criteria we can readily partition the tasks into hardware and software and define the interface between them.

Time-Code Recovery At wind speed the bit interval is 6 microseconds and the frame interval is 1 msec in the worst case. The demodulation of the bi-phase signal and

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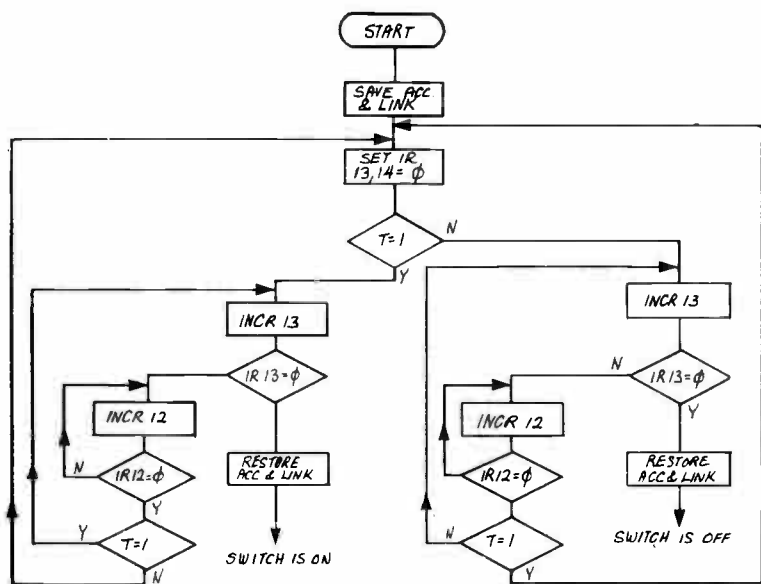


Fig. 4 Flow chart of MPU software branch decision replacing Fig. 3.

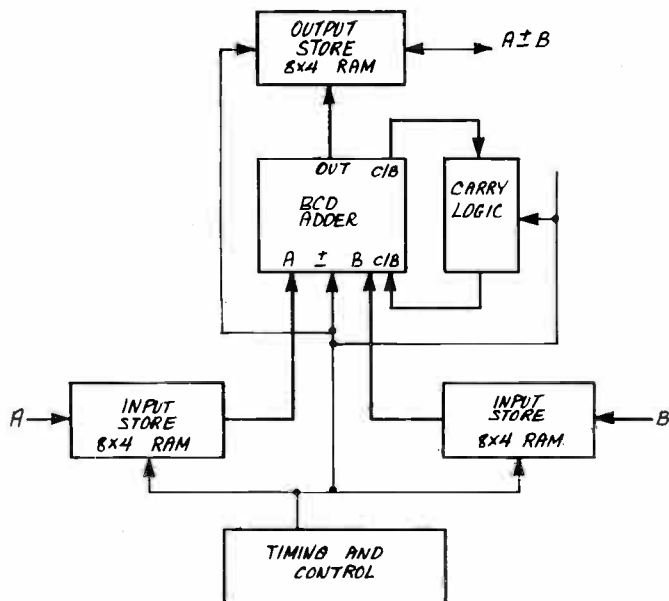


Fig. 5 Logic diagram of hardware adder (8 digit).

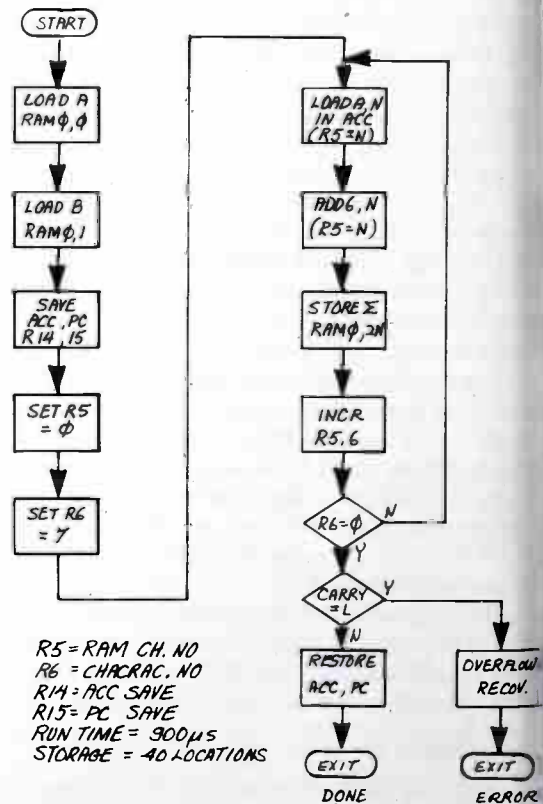


Fig. 6 Flow chart of equivalent software adder (8 digit).

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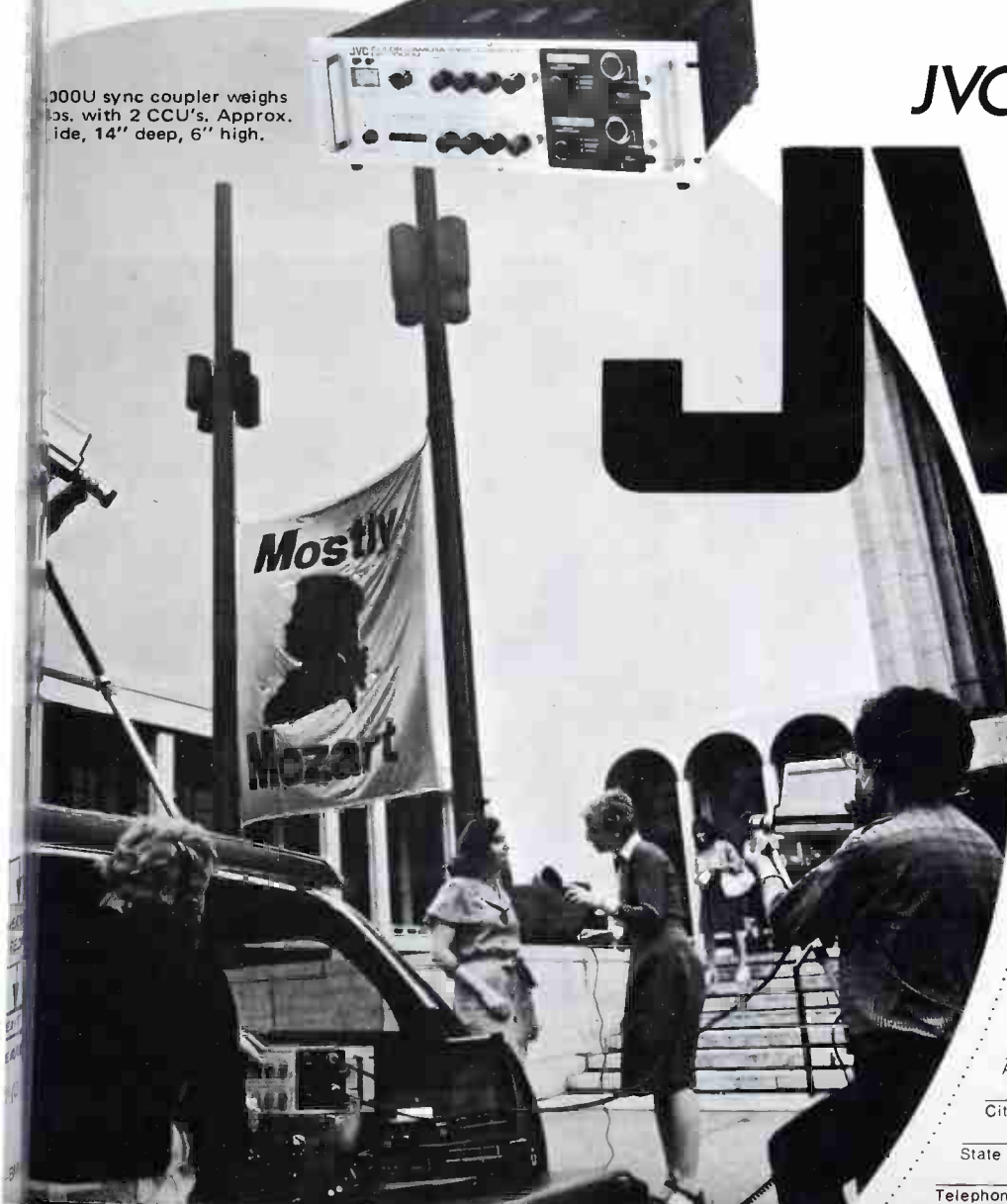
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serial-to-parallel conversion is a hardware task, and the program would then be able to read in the resulting eight 4-bit digits that are generated every frame along with a velocity character. Incidentally, with parallel data available in hardware, a very simple readout of current address is possible without processor overhead to generate output.

Command Keyboard The keyboard can readily generate the 4-bit characters (to generate 16 possible codes), and hence a minimum hardware configuration is desirable—continued on page 60

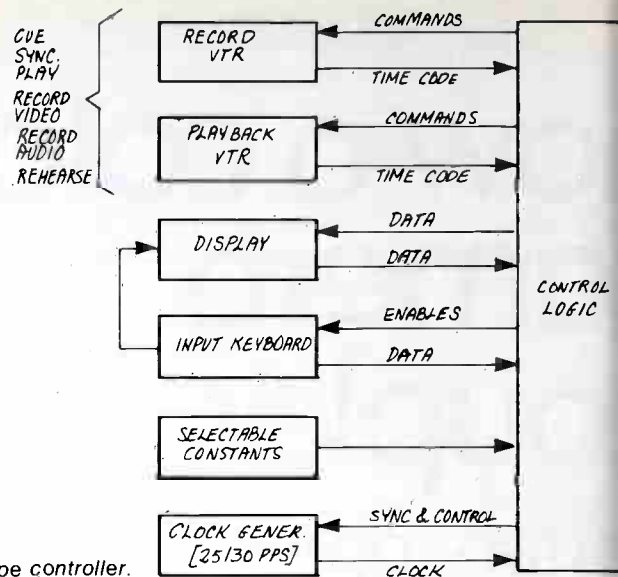


Fig. 7 Task outline for a tape controller.

Broadcast Equipment Makers Take Advantage of Microprocessors

The number of components that can be economically placed on a single silicon chip seems to double each year. A chip today can incorporate as many as 20,000 components (although 5,000 is more typical) and the cost per component is a fraction of a cent. Furthermore, semiconductor manufacturers are forever improving their yields and prices are now 1/10th that of a few years ago, meaning one can buy 8-bit N-channel devices for \$20-\$30. More suppliers are moving into the field and a price war will persist for some time. Fortunately, as prices drop, usage goes up and many users are now broadcast equipment manufacturers. In addition to Central Dynamics Ltd., a few companies that have been stressing the fact that their products include microprocessors have been EECO (see below), Harris (System 90 automation), SMC (DP-2 automation) and Ikegami (HK-312 studio camera).

Since a microprocessor is equivalent to the central processing unit (CPU) of a computer, it is a small step to a complete microcomputer: just add some memory, a master clock and input/output devices. Microcomputers are not merely smaller computers. Taking advantage of previous experience, microcomputer designers use the concept of the "stack" in which electronic registers are organized so that the subroutines called in by a program are handled on a last-in-first-out basis; i.e., after exercising one subroutine (or more) the microprocessor returns to the main program sequence. This means lots of computer power in a small package.

EECO has developed a very unique precision Electronic Audio Synchronizing/Editing System for Teletronics International in New York. The system conceived by Teletronics and designed by EECO is a "first" in the industry, providing automatic control of up to eight audio or video transports for searching, cueing, synchronizing and programmed audio editing.

Utilizing the SMPTE Edit Code and incorporating the latest technology in microprocessing, the system has the capability of controlling several different type transports (sprocketed and non-sprocketed) simultaneously from a remote control and display console.

The heart of the system is the microcomputer Model 8080 by Intel. With the microcomputer associated programmable memories and various interface circuitry, the entire system is housed in only two standard card files 7-in. in height.

This is EECO's second application of this technology. The BE460 Dual Cue Controller (designed for use with EECO's BE450 Wide Range Synchronizer) provides individual or simultaneous automatic cueing of two video or audio transports. The Dual Cue Controller incorporated the microcomputer.



EECO BE 460 dual cue controller uses microcomputer.



Harris System 90 Automation Controller uses microcomputer.



SMC DP-2 automation system uses microcomputer.

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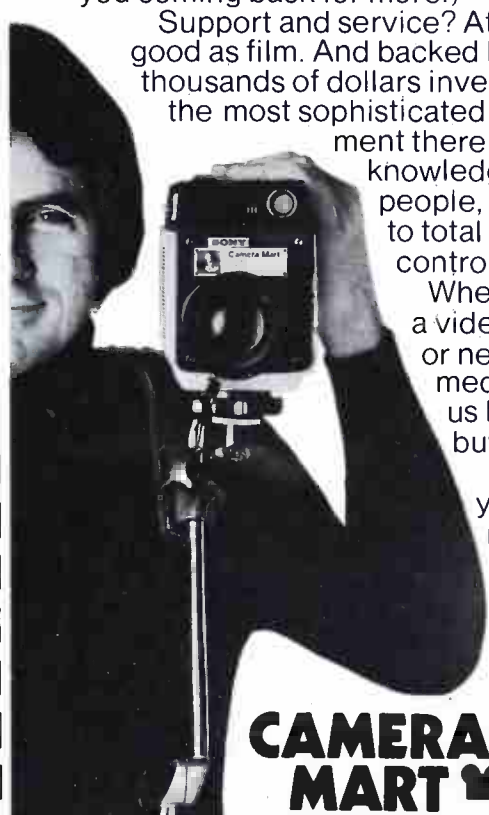
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able to drive a decoder table in the program such that branches to the correct routines are performed. Speed of response is not critical to 10 msec or so, due to the noise elimination delays mentioned previously.

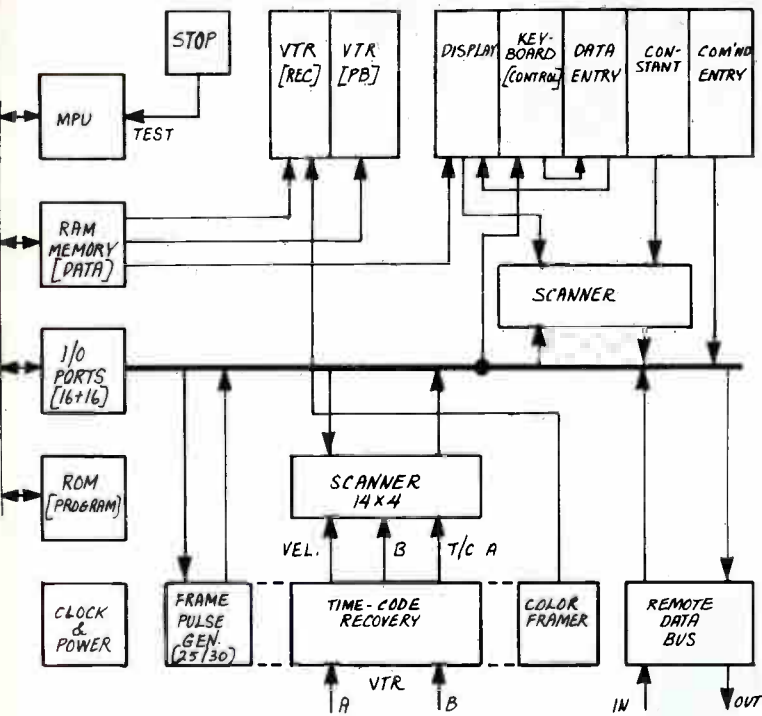


Fig. 8 Block diagram of tape controller hardware approach.

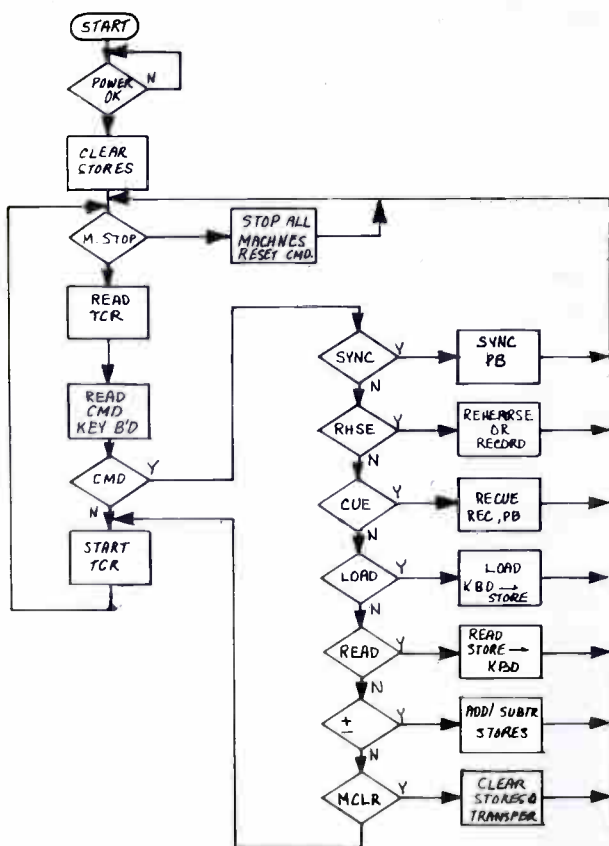


Fig. 9 Block diagram of tape controller software approach.

Data Keyboard and Display For consistency of software interfacing and simplicity of display, the data keyboard assembles 8 character messages in hardware which match, in format, the time-code, and, in fact, are handled in software in an identical manner. In this way the processor only requires a rather simple data handler program to read data and to load it into the various stores, making more efficient use of memory space. The processor unit can read the display very easily and echoes the data back to the display or shows new data in the normal time-code 8 format.

Constant Register For the reasons mentioned previously, the constant register is handled similarly to time-code in eight 4-bit characters.

Frame Pulse Generator The period of the frame pulse generator is 33 msec or 40 msec dependent on the system standard. To avoid the overhead of the program counting clock cycles, and to improve the precision (an accuracy of approximately one part in 10^5 is required), a hardware counter is used to count the crystal controlled clock used by the computer which operates at a rate of 750 KHz. The frame pulse generator is started by the program to achieve an initial positional accuracy of better than a millisecond and thereafter frame pulses are read by the program periodically in a manner generating a maximum jitter of approximately a millisecond.

Machine Commands A total of 14 commands is required for each recorder at a variety of levels and timings. The most critical timing relationships are those concerning synchronization and color-framing where a closed-loop on/off type of servo is established through the time-code and the program to bring the two machines close enough together that normal capstan servo locking can be restored while maintaining synchronism. To provide good performance a response delay of better than 5 msec is required, and this the program can readily achieve. The discrete commands are generated by the program as 4-bit characters which are decoded and processed in hardware to the appropriate timings and levels required by the outside world. To further simplify machine commanding, the program storage is so arranged that the commands and significant address storage locations for each of the two machines are stored at identical locations in the two RAM chips making programming very simple and fast using common routines.

The final hardware configuration is shown in Fig. 8, with the associated software shown in Fig. 9. The hardware consists of 6 module cards and a power supply mounted on a plug-in basis into a 5 1/4" high rack frame. Approximately 250 TTL chips are used in the design to provide the necessary random logic and data multiplexing. The program itself occupies eleven 256×8 read-only memory chips providing a total program storage of almost 3,000 8-bit words. The program contained in these chips operates in either the PAL or NTSC mode, selection being made by one of the programmable pre-set switches on the keyboard card. By substitution of alternate memory cards, programs for other applications such as synchronization, extended mathematics or diagnostics, can readily be used with the microprocessor.

The normal operating program operates without interrupts in a monitor loop, and interrogates the major inputs on each pass or in the appropriate task routines. The program is also self-starting at power-up as if the MASTER STOP button had just been pressed. Each task

continued on page 62

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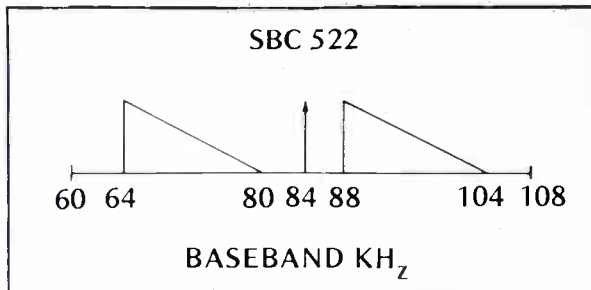
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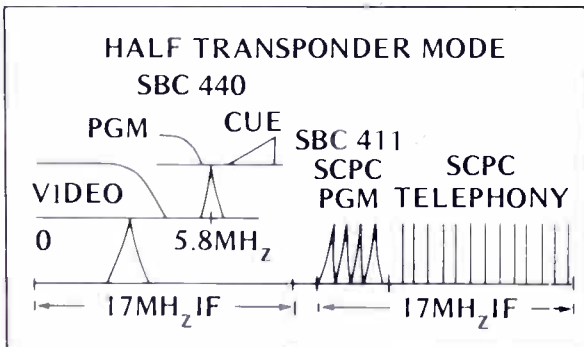
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program is built up from various common sub-routines used by the other programs, and branches to the various tasks occur as a result of command inputs from the keyboard.

As a matter of interest, if a comparable hardware-only design were effected it would total approximately 800 equivalent chips, thus doubling the size of the system, doubling the power consumption, and significantly reducing the overall reliability.

As a result, the microprocessor-based design achieved is small, very easy to operate, flexible, and requires a minimum of staff training. The Fig. 10 shows the simple front panel controls that are used for most of the command and data entry functions.



Fig. 10 EDS-200 editor/synchronizer incorporating microcomputer.

The microprocessor-based design is also highly acceptable from a maintainability point of view, due to the minimum package count that the design can achieve, coupled with the basic simplicity of a bus-oriented system. All components are readily accessible by the extraction of the plug-in modules.

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The microprocessor can produce a very cost-effective and efficient system. Unquestionably it will find an ever increasing spectrum of applications in our industry for control and data reduction purposes. We have already designed it into a number of commercial systems manufactured at Central Dynamics and in all cases have been very pleased with the performance achieved. Some of these packages have now been in service for periods of up to 18 months and, apart from normal start-up problems, have proven to be thoroughly reliable and readily serviceable once the technicians involved have acquired a basic knowledge of bus-oriented processing.

We are certain that this is only the beginning and once the initial design is mature, the next step is to establish interconnected networks of these small processors to achieve, in a most economical fashion, larger processing job systems as more complete automation of the entire operations. There is no doubt that a network of interconnected intelligent controllers can provide the basic economy, high level efficiency, and freedom from domino-effect breakdowns that the professional broadcaster requires. Hardware and software will become available to perform the large task soon and we must soon consider standards for communications. Stand-alone intelligent controllers are already here. **BM/E**

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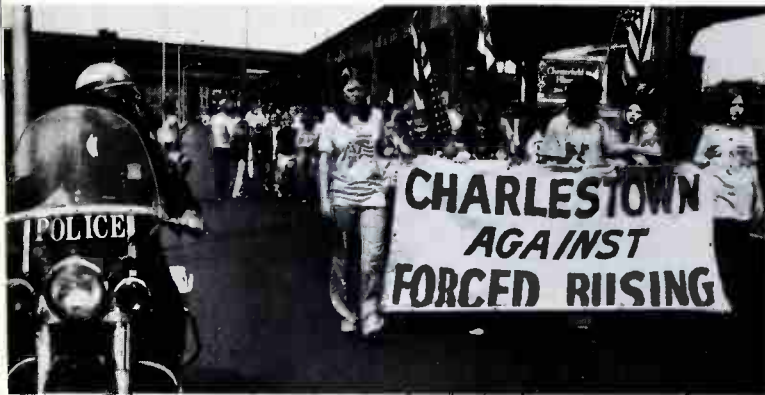
Radio's ENG

By Dave Graves

Electronic News Gathering for TV has dominated the spotlight this last year. But radio has been pushing ahead, too, and this report shows how WBZ Radio, a Group W station in Boston, can go on the air live from almost anywhere to deliver instant news. Says author Graves, "With TV moving in—and surpassing—radio's ability to bring a story to its audience as it happens, it's about time some stations woke up to the fact that telephone beepers don't make it."

Our reporters call it "the magic box."

It's WBZ Radio's answer to TV's ENG—a studio-quality remote broadcasting system that you can hold in one hand and use anywhere.



Protestors march against busing in Charlestown, providing the station with the first chance to test the new units.



From left to right, WBZ Radio Chief Engineer Norm Graham, WBZ News Supervisor Edward Bell and Comrex President John Cheney, testing prototype system in front of the station.

Comrex repeater unit, temporarily mounted in WBZ mobile unit during testing period.



The "magic box" is a custom-designed prototype, manufactured for WBZ by the Comrex Corporation of Sudbury, Massachusetts. It will shortly be followed into the field by four finished versions.

"We were looking for a system that would allow reporters to broadcast studio-quality sound while remaining completely mobile," explains WBZ News Supervisor Ed Bell.

"Up to now, radio reporters have had to put up with a variety of inadequate means of communication," says Bell. "There already are mobile units, but how many stories can you cover from a car? Walkie-talkies aren't even as good as telephone quality, and they're tough to use for interviews."

The Comrex system works by triggering the station's mobile unit radios, from up to a mile away. It has even been able to transmit from the center of Boston's steel and concrete City Hall. The unit itself is on the high VHF band, while the cars are on UHF.

Combined in the unit, which attaches easily to belts or a shoulder strap, are: a transmitter, cassette recorder, tone control unit and two receivers. It weighs about 1½ lbs. and it's 3¼ × 6 × 2-in. without the cassette; receivers are separate.

In a typical operating sequence, a reporter would turn on the Comrex, transmitting a tone burst. This would first turn on his mobile unit's 70 watt transceiver, then key its transmitter. The Comrex is set by the reporter at .1 watt for short distances, 1 full watt for longer ones.

The reporter can verify that the car radio is transmitting by listening to channel one of his receiver, then switching over to channel two, to hear the editor answer him. If for some reason the primary transmit channel is busy, another tone will switch the mobile unit radio to a clear channel.

The reporter tells the station what he wants to do. If he's going live, another control mixes WBZ air and his UHF receive channel. That way, he can talk to whoever's on the air and hear off-air cues from the editor at the same time.

The repeater unit in the car can also be attached to a telephone. A tone from the reporter will cause the repeater to automatically dial the station's hotline. This will allow the station to use the units outside the Boston area they plan to do so during the New Hampshire Primary.

The Comrex unit received a baptism of busing this

Author Graves is a member of the programming department at WBZ Radio, Boston, Mass.

All photos by James Nachtwey.

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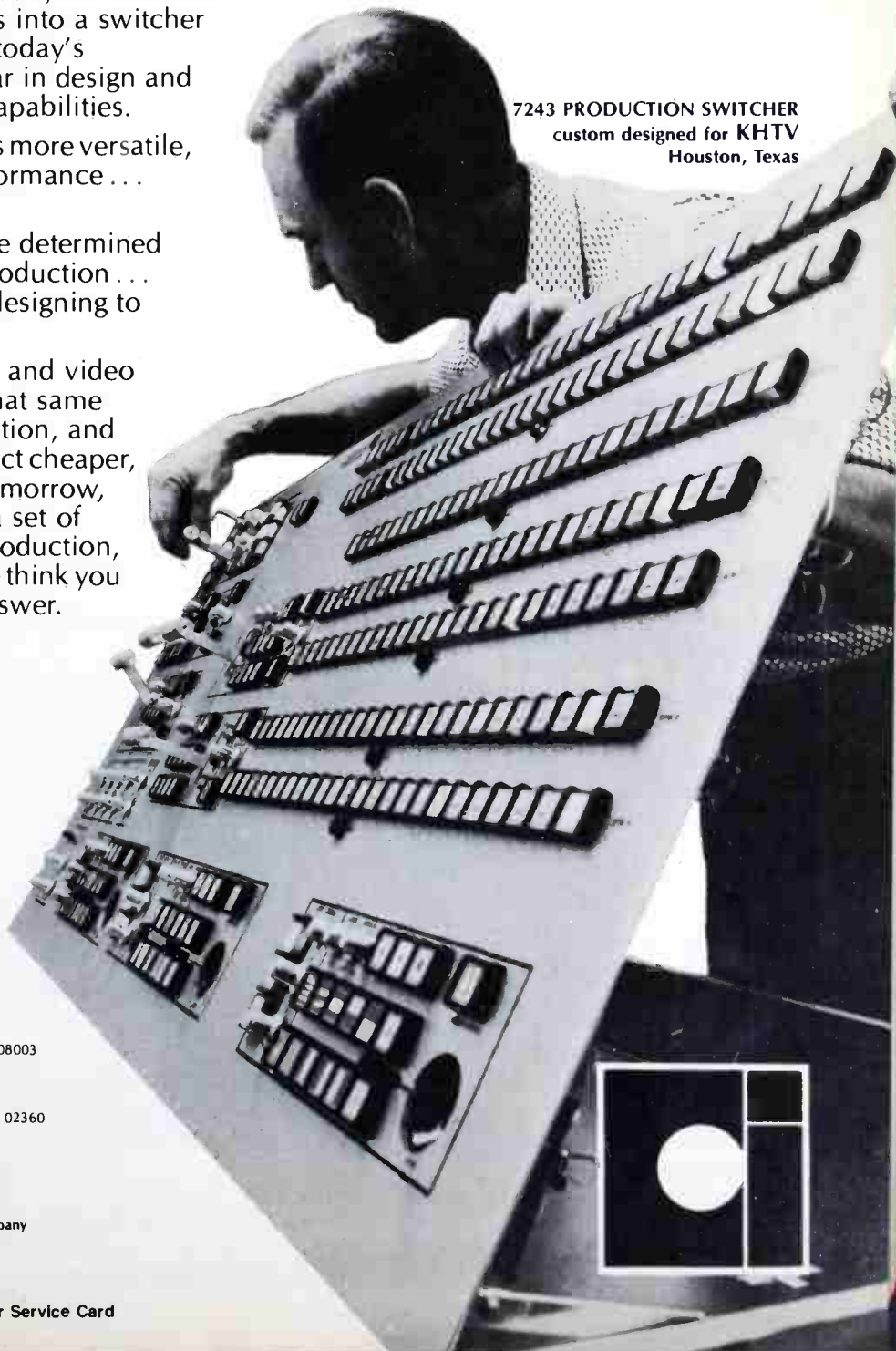
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past September. Its first day of operation was also the first day of Phase Two desegregation in Boston. The unit was assigned to the station's education reporter, Harry Savas, who was covering Charlestown High School.

Security was tight around the schools where trouble was expected, particularly Charlestown, which was about to see its first bus. Federal Marshalls, State Police, Metropolitan Police and the Boston Tactical Squad were all there, dedicated to preventing anything—including reporters—from impeding the opening of school.

Cars had to be parked some distance from the school for safety reasons. It would be necessary for most reporters to leave their vantage points and dash to their cars in order to file.

The first buses rolled into sight about seven that morning, and the "magic box" got its first test. It passed with flying colors. Savas' live report, against the sounds of Charlestown and the rumble of the buses, was crisp, clean and studio quality. It literally put the listener into the middle of the story.

Later, when Charlestown mothers marched in protest, Savas was able to broadcast the confrontation between marchers and police. The sound was better than most cassettes—and it was live on the air.

"Immediacy is a radio's forte. It's about time we discarded the collection of telephone clips, inadequate walkie-talkies and the like. This system really makes our reporters a walking radio station, with the quality of sound, and ability to get to a story, that our listeners have a right to expect," says News Supervisor Bell.

Boston was still reeling from the impact of busing, when the Boston Teachers Union went on strike. A

negotiating room on the 9th floor of the Holiday Inn became the focal point. The lack of phones made elevator-riding the reporters favorite sport—except for Savas, who was able to score with repeated live interviews at the flick of a switch. When a negotiator would poke his head out the door with some new information, WBZ listeners would hear it live.

The station has discovered other things, beside new to use the Comrex on. When the Boston Red Sox held rally in City Hall Plaza the day after losing the seventh game of the World Series, the station was about to carry it live with almost no prior notice. The Comrex quality was good enough that a microphone stuck into a P.A. speaker delivered excellent sound.

WBZ's Chief Engineer, Norm Graham, who worked with Comrex President John Cheney to develop the units, points out that there's nothing extraordinary about any particular component of the system.

"A high power wireless mike, a tone control system, a mobile repeater—none of these things is revolutionary by itself. It was the idea that we were going to sit down and put together a total system, with nothing left out—that's the real innovation," says Graham.

WBZ's reporters are excited about the new system.

"The built-in cassette makes it a snap to do flawless wraparounds from the field," says education reporter Savas. The unit can mix sound from the tape recorder with that from the microphone live. It's a feature of the system which was added to the completed versions.

"It really frees you to concentrate on a story," says Savas, "Everything you need is right on your belt."

BM/1

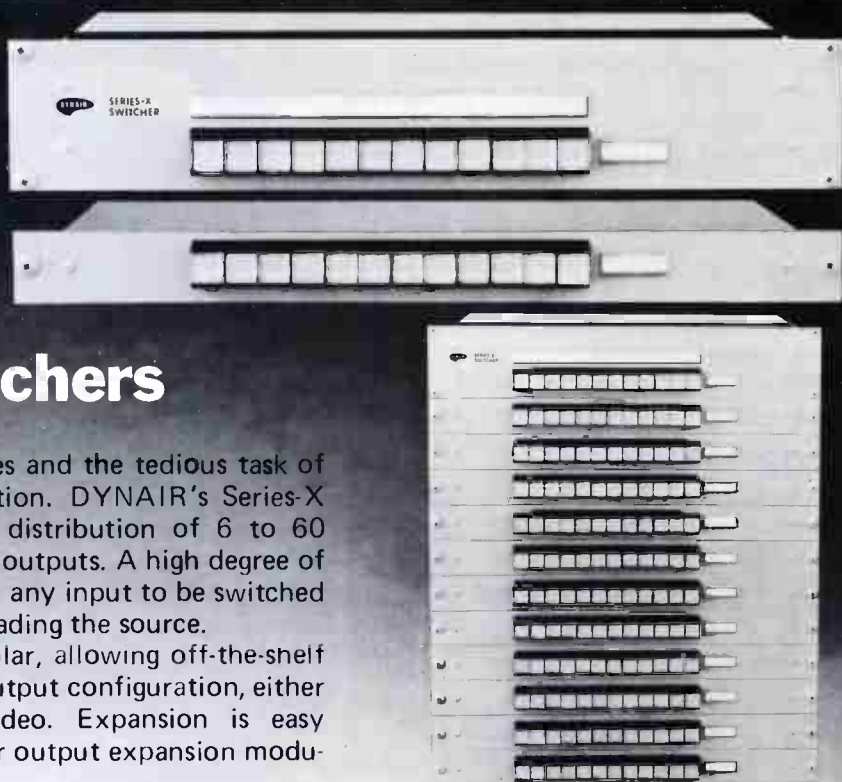
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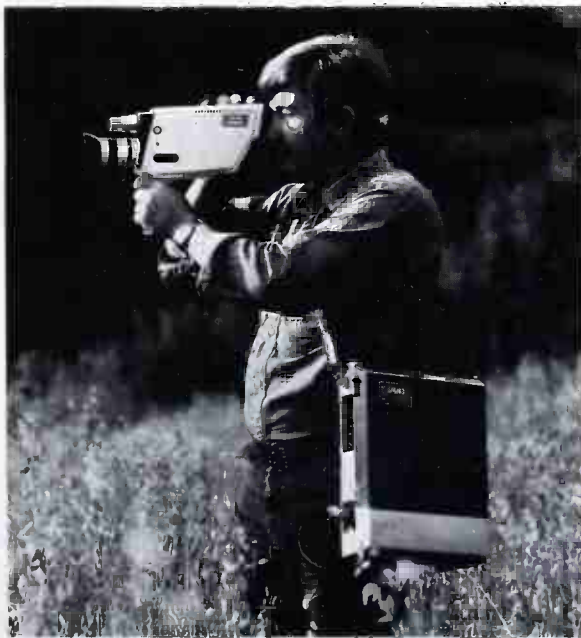
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How To Set Up A Good Microwave Antenna System For ENG

by T.J. Vaughan

The problems in establishing a good microwave signal path for ENG are entirely different from those in setting up a fixed microwave link. This article describes the ENG problems, and their solutions.

Electronic News Gathering (ENG) has produced a requirement for a better understanding of the problems of transmitting TV signals from one location to another.

The ENG system consists of a microwave dish at the location of the news or remote origination point which transmits the signal to another microwave antenna centrally located in the city or community. The received signal is then connected directly (usually via telephone lines) to the studio for monitoring or editing and is either taped or fed directly to the transmitter for live transmission.

The ENG user would like the transmission of this microwave signal to be of the same high quality that he normally obtains with two microwave antennas used in a fixed path microwave communication link.

This is never the case. There are problems that are

peculiar to the typical ENG communication link. I want to discuss the main problems here, along with some solutions.

Establishing an ENG communication link

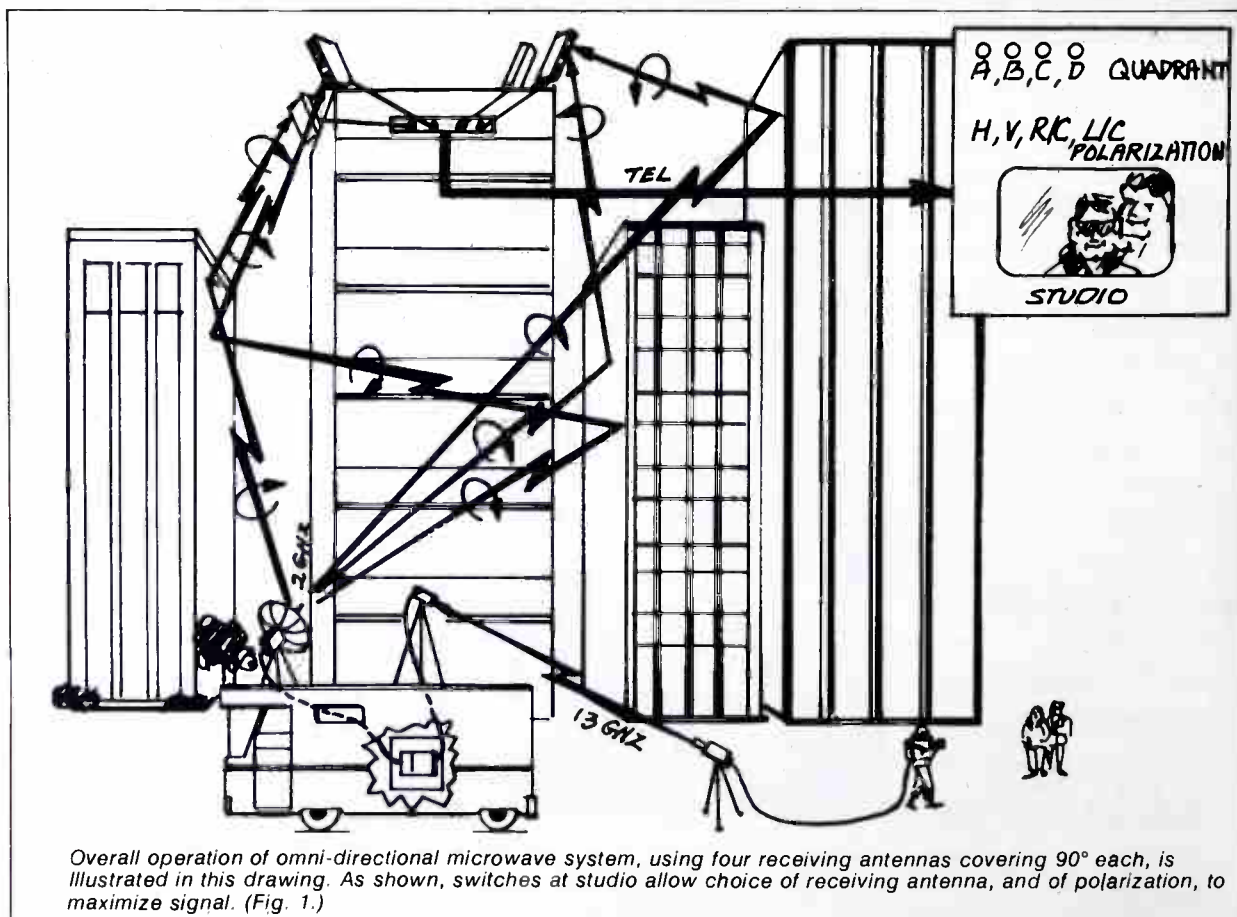
To establish a *fixed* microwave communication link you should follow several precise rules, for a good clean microwave path.

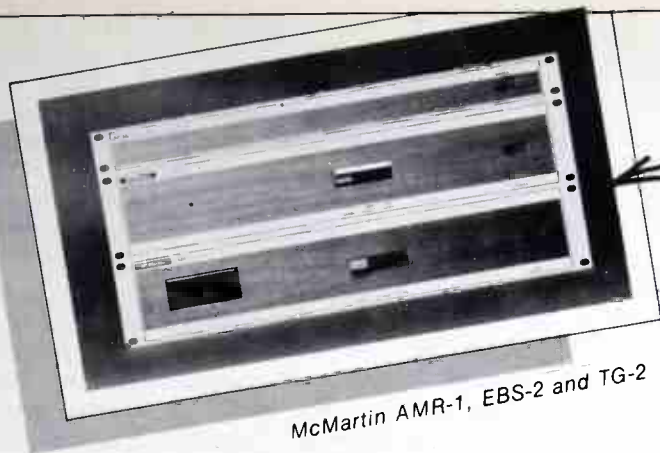
First the path length is established. Then a system gain analysis is performed. Transmitter power, receiver sensitivity, transmitting and receiving antenna gain is then determined to insure a satisfactory system fade margin. The site is surveyed first with maps and then with on-site inspections. An allowance is made for atmospheric refraction and the amount that the beam is "bent" is determined.

The path is analyzed using the "bent" beams to determine if objects (buildings, trees, etc.) within the beam will cause reflections or diffractions. This is called Fres-

continued on page 7

Mr. Vaughan is President, Micro Communications, Inc., Manchester, N.H.





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nel zone clearance and will result in a loss of signal. In many installations a preliminary microwave survey is made over the path to determine the extent of actual fades and how well the design parameter can be met. An RFI study must then be made to determine the extent of any interference and how to cope with it. Finally the antennas are installed and each antenna carefully bore-sighted to insure maximum transmission. In some installations this may include optimizing the polarization.

When setting up an ENG microwave system one does not have the *time or facilities* to establish an ideal path as just described. The basic philosophy of ENG or Live News is that the system must be set up quickly and a path established at almost any location in the city.

It goes without saying that this path may be anything but ideal. If the path is from the street to the receiving antenna located on a tall building the main beam may be partially or completely blocked by other buildings. The signal can experience severe degradation (as much as 20 dB), and in many cases depolarization (as much as 10-20 dB).

It should also be pointed out that just because you can see the antenna at the other end does not necessarily mean you have a good path. If the beam just grazes an obstacle (e.g., there isn't sufficient Fresnel zone clearance) there can be a loss of from 6 to 20 dB depending on the type of surface over which the diffraction occurs.

The path will usually be set up in a multiple reflection environment (see Fig. 1) and techniques must be used to extract the maximum signal from the air.

Two of the newer problems reported by ENG users are: depolarization and frequency selective cancellation. Both of these problems can be helped by using circular polarization.

Overcoming propagation problems

The standard practice for a fixed microwave communication link is to transmit linear and receive linear polarization. This has two distinct *disadvantages* for ENG:

- If the signal is depolarized due to multiple reflection, the received signal could be cross-polarized and there could be *no* reception.
- Two signals at the same linear polarization could arrive at different times (due to building reflection) resulting in severe ghosting.

Both of the above disadvantages can be overcome by using circular polarization.

Maximum reception will occur for like polarization e.g., right circular to right circular or horizontal to horizontal. Gain for a circular polarized antenna is defined relative to the polarization of the same sense as is being transmitted. However, circular polarization can be received on a linear polarized antenna and a linear polarized signal received on a circular polarized antenna. In these two cases there would be, however, a 3 dB loss of signal as compared with the condition of maximum reception.

The most significant advantage of using circular polarization springs from the fact that the sense of circular polarization reverses when it hits a reflecting object (e.g., right circular becomes left circular and vice versa). This is not true of a linear polarized reflected

signal. Therefore if both ends of the link are of the same circular sense all first order reflected signal (ghosts) will be cross-polarized and discriminated against.

The law of reciprocity permits, in a multiple reflected environment, the roles of the transmitting and receiving antennas to be reversed.

This means that for any given path transmitting horizontal, vertical, right or left circular and receiving right circular will be identical to transmitting right circular and receiving horizontal, vertical, left and right circular.

Depolarization problems. It is possible to experience a complete loss of power if the signal at the receiving antenna is cross polarized from the transmitting antenna. The depolarization occurs because of reflection and edge diffraction and is not common to fixed microwave communication links. It is therefore necessary to: (a) Change the polarization of the receiving antenna until it is oriented with the polarization that exists in space; or (b) Change the polarization of the transmitting antenna so that after it undergoes depolarization it is then oriented with the fixed polarization in the receiving antenna.

Most ENG antenna systems have means of remotely controlling the polarization at either the transmitter or receiver and permit the station to optimize for not only the strongest signal but the cleanest from a ghosting point of view. Solid state RF switches using microwave PIN diodes are available making it possible to accomplish optimization so fast that it can be done while carrying program with no flicker or interruptions.

The availability of different polarizations for the transmission path will increase the path diversity and hence the probability of receiving a good signal.

Frequency selective cancellations. There is another problem peculiar to ENG systems. It is possible to have a path with a good video signal but a poor audio signal. The audio signal is usually on a sub carrier 7.5 MHz above the video carrier. The difference in frequency between the two carriers is sufficiently large so that reflections can be in phase at the video carrier and out of phase at the audio carrier, causing loss of audio. This in-an-out-of-phase condition will usually occur many times in the video pass band, but because of the wide video bandwidth the effect is not as severe as it is with the audio signal and its narrow band. Aggravating the audio problem is the fact that reflected signals of any magnitude will produce a shift of the carrier causing harmonic distortion. Both of these distortions can be reduced by conversion to circular polarization, eliminating either the even or odd reflections.

Three types of systems

There are three types of antenna now used with ENG systems: 1. fixed microwave dish, 2. rotating microwave dish, 3. omni-directional array.

A complete ENG system includes the 13 GHz link between the camera and the van and the 2 GHz link between the van and receiving antenna. The following discussion is based on a remotely-controlled multipolarized feed in either the transmitting or receiving end of the link.

Fixed receiving antenna. The microwave transmitting antenna is located on the van with a fixed microwave dish centrally located on a tower or building. This system can only be used when the tower is located far enough away from the city so that all possible locations

continued on page

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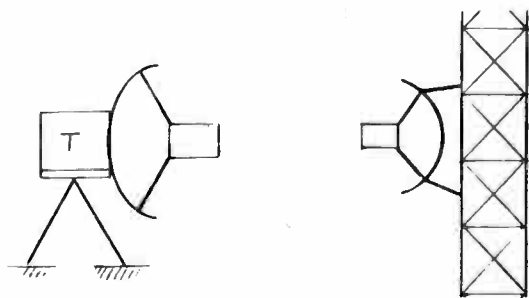
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MICROWAVE ANTENNA SYSTEM

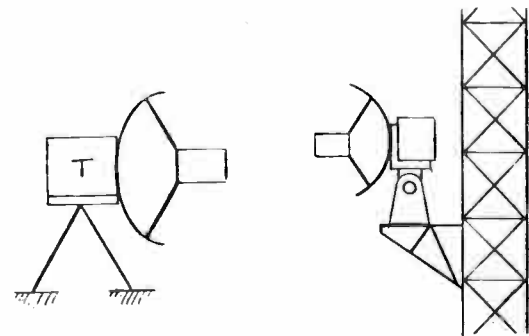
in the metropolitan area will be within the beam width of the antenna. The distance across the city the beam will cover (4 foot dish at 2 GHz) is ¼ mile at 5 miles, 1½ mile at 10 miles, and 3 miles at 20 miles distance.

Since the grazing angle will be very low, blockage can occur from low obstructions and homes.

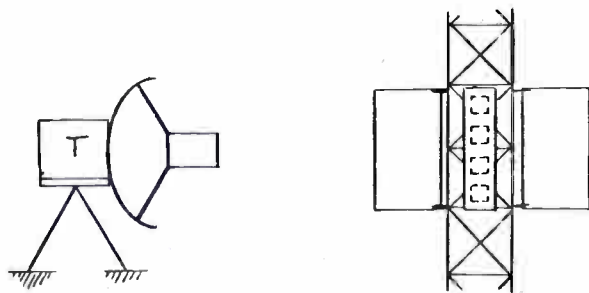
Some solutions to this have been to use a Cherry Picker or to bring the 2 GHz transmitter up to the roof of



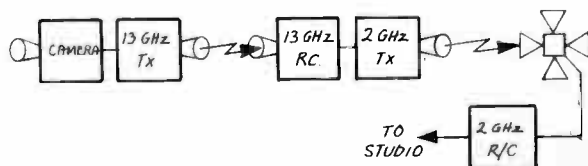
Systems for organizing ENG antennas are shown in the top three drawings. System in first (above) uses a fixed antenna on van, fixed antenna on central tower or building. It is usable only if all transmitting locations are within receiving antenna beamwidth.



Second system, using rotating microwave dish at central receiving location, allows use of narrower beam, higher antenna gain, with more discrimination against multiple reflections. However, wind loading is more serious, control and drive must be on tower, insurance is more costly, tower will shadow out at least 90° coverage.



Omnidirectional array at receiving position gives 360° coverage, with four antenna systems, each covering 90°. Choice of antenna and of polarization are by switch at receiving location. There is no need for personnel to climb tower for maintenance.



Typical ENG microwave system today, shown in simplified block diagram, includes a 13 GHz system from camera to van, a 2 GHz system from van to central receiving location, telephone lines from there to studio.

a tall building and radiate the 13 GHz signal from the street to the roof. This is sometimes done even in large cities like New York where the blockage is severe enough to prevent transmission from the street.

This is of course not an instant set-up and requires some preparation including permission from the building owner.

Rotating receiving antenna. The microwave receiving dish is mounted on an azimuth-over-elevation pedestal which in turn is side mounted on the tower. This has the advantage of remote positioning of the narrow beam to any azimuth angle. The control is from the tower base by means of a local/remote control unit (if personnel are at the location) or from a decoder (if unattended) connected via telephone lines to the studio.

The high gain and the increased high directivity will help discriminate against multiple reflections. Some of the disadvantages with this system are:

1. Survival wind loads are much less than the wind load of the tower alone.
2. Drive against wind is limited.
3. Output torque must be great enough to break away ice.
4. Insurance problems are associated with a rotating drive on the tower.
5. The tower will shadow the coverage area by at least 90°.
6. Control and drive must be located on tower.

Omni-directional array. The omni-directional array allows 360° coverage with no mechanical movement (e.g., complete solid state control). Four antennas are mounted about the tower with the pattern from each antenna overlapping.

It should be pointed out that in many remotes the maximum signal is not always in the direction of the mobile van. The reflected signal from the side or back can be stronger than the direct signal.

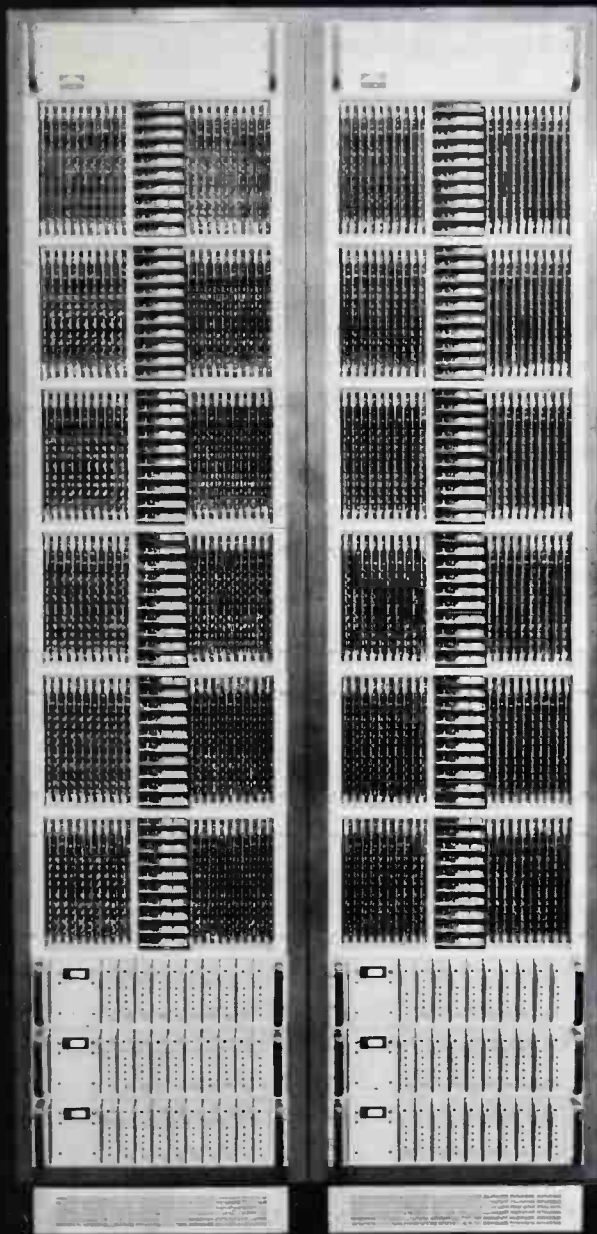
The location of the polarization selection can have a significant effect on cost and reliability in this system. If the polarization selection is performed at the transmitting antenna, as is possible with MCI series 94000, the receiving antenna will have fixed polarization. No switching will be required and all of the electronics can be removed from the tower. The signal from each receiving antenna would be connected to the quadrant selection switch at the base of the tower via separate RF lines. The quadrant switch at the tower base can be controlled by the operator viewing the picture; or if the location is unattended, the switch can be activated by an encoder/decoder combination.

The principal advantage is that station personnel or unqualified riggers would not be required to climb the tower to do periodic maintenance. RFI, environmental and lightning problems are greatly minimized and the reliability of the system is improved.

If the polarization selection is at the receive end only one RF line would be required from the quadrant switch to the receiver (assumed to be at the tower base). The switching matrix, driver circuits, logic circuits, an power supplies are all located in an interface junction box on the tower at the height of the transmitting antenna.

This approach is less expensive for very tall tower. The cost difference between one coax line and four lines can be significant.

BM/



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National Public Radio Sends Signal Tones On Program Lines

by Michael Weiss

"NetCUE," a special tone-sensitive receiver using a phase comparison, can pick out the signal tones even if they are 10 dB down in the noise.

Rapid transmission of emergency announcements to radio and television stations has long posed a number of problems to networks of interconnected broadcast stations. Guaranteed fail-safe reception of fast-breaking news, program advisories, and schedule changes has been rare for two basic reasons: restrictions imposed by traditional equipment on the one hand, and the cost of the operation on the other.

As a result, alert systems now in use have been characterized by major flaws. In systems employing single tone cues, reception at stations generally has required interruption of network programming. In systems employing electromechanical relays, hardware usually has included slug-tuned coils that easily detune in transit to stations, demanding high-cost adjustment and maintenance at installation sites. And with three-tone systems currently used, operation has also proved too costly.

Now there is an answer to these problems in "NetCUE"—an alert system developed and recently patented by National Public Radio (NPR). The NetCUE system was designed by NPR Senior Engineer Wayne Hetrich as an inexpensive and reliable method for alerting stations of programming and operational changes. By sending a series of audio tones along normal program feed lines, decoders at member stations activate indicator lights and tape machines for recording the unscheduled announcements or program feeds. And the cost totals a mere \$100 per station for a NetCUE detector device.

The key to the NetCUE system is an electronic solid

state receiver that utilizes a phase-locked loop process for decoding the transmitted signals. When a desired input tone matches a reference tone inside the receiver, a control signal is generated, activating the lights and tape machines. Additionally, the control signal keeps the loop in lock, remaining super sensitive to the input tone's particular frequency, amplitude, and period.

To carry out these dual roles, the NetCUE receiver analyzes incoming transmissions using four basic building blocks: a phase comparator, a low pass filter, a DC amplifier, and a voltage controlled oscillator. The phase comparator matches the input signal from the interconnect line against the reference signal being generated by the voltage controlled oscillator. When the phases of the two frequencies are identical—indicating the presence of a cue tone—an output signal is created that, after filtering and amplification, becomes the control signal.

The precision of the NetCUE receiver permits translation of the desired signal even though it may be buried within the program content. In the presence of unwanted noise, the phase lock filter can effectively reduce side-band amplitudes while remaining locked on the fundamental frequency. Thus the NetCUE device can detect a cue tone from an environment that is as much as 10dB louder than the desired signal . . . even on low-quality class "C" telephone lines.

In contrast to the unique character of the NetCUE receiver, NPR's signalling unit is a triple-tone generator that can be replaced by any of a number of standard units. When sending the cue tones, three precisely controlled master oscillators are switched—independently o

Mr. Weiss is a staff writer for National Public Radio.



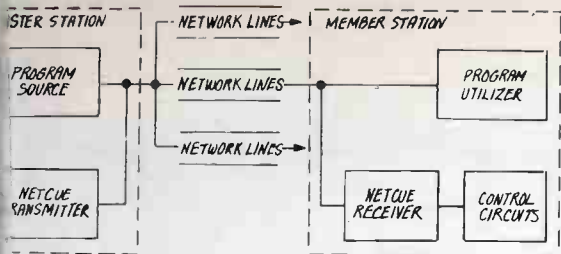
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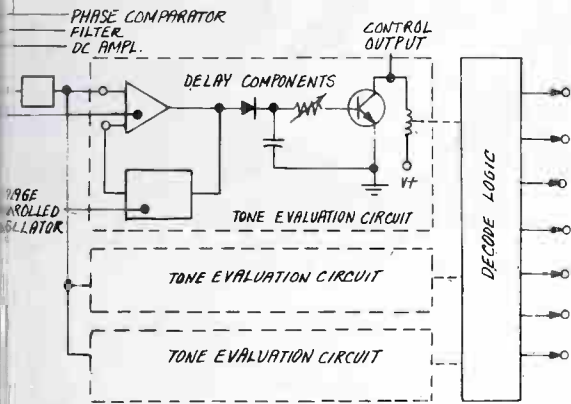
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Block diagram of NetCUE system shows how the signalling tones are sent over program lines to the special receivers at member stations. Phase comparison circuit allows receiver to pick signal tones out of noise or program material.



Block diagram of NetCUE receiver, with arrangement of the phase comparator, filter dc amplifier, tone evaluation circuits, and decoder logic. Incoming single tone is compared with reference tone in receiver.

combinations—to a mixer, buffer, line amplifier, and into the NPR interconnect lines. The result is a set of ten different cue tones from which to choose.

To prevent the false triggering of the NetCUE receiver in the presence of normal audio program, the signal frequencies are based on multiples of non-musical tones. The One tone (Q1) is at a frequency "in the crack" between the notes F and F# on the music scale. The Two tone is located an octave lower, and Q3, an octave higher than Q1. Though other formats and levels may be used, NPR sends normal NetCUE transmissions in five second bursts at +4dB.

What's the effect of each tone?

The Q1 tone activates an indicator light at each station to advise personnel that a program advisory announce-

ment will soon follow. The lamp remains on until it is manually turned off: even if no one is present when Q1 arrives, someone returning to the station's control room will be alerted to monitor the NPR feed line.

When the Q2 tone is transmitted, the NetCUE receiver closes a set of contacts which start the station's tape recorder. This automatic triggering relieves station personnel of monitoring daily performance tests or messages sent after the station's regular broadcast day. The Q4 tone cuts off the tape machine at the end of the feed.

Of the other four NetCUE tones, only two have been designated for specific functions. The Q3 tone activates an indicator light to denote an upcoming advisory on technical matters, while the Q6 tone notifies stations of upcoming transmissions from the Emergency Broadcast System (EBS). At present, the Q5 and Q7 tones are still available for other applications.

The history of the NetCUE operation dates back to January, 1973, when National Public Radio completed its first performance test of the system along NPR's "East Round Robin" interconnect of 60 member stations in the central and northeastern United States. Simulating a worst-case transmission mode, a signal was sent from NPR Master Control in Washington, D.C., along more than 3,000 miles of AT&T cable back to a NetCUE receiver located in the NPR Master Control. For two months, the receiver was subjected to cue tones in a variety of noise environments. Throughout this period the receiver continued reliably to detect the NetCUE signals, and conversely, *not* to respond to normal program audio, discrete tones, or slow frequency scanning sweeps.

Following these tests, NetCUE receivers were sent to NPR's then-150 interconnected stations for installation. Each station was sent a receiver kit with an accompanying instruction manual for assemblage, much like a "Heathkit" package. Directions were geared specifically towards stations with limited technical resources.

Once assembled, the units weigh approximately three pounds, and fit onto a standard 19" by 3.5" rack panel. The completed units are then bridged across NPR's 600 ohm interconnect line, with circuit contacts connected to station indicator lights and audio recorders. Some stations have utilized ancillary circuits for providing indicator lights in rooms outside the engineer's control

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NET CUE

center—for example, the station manager and program director's offices—to be certain that emergency announcements are always monitored.

Today the NetCUE devices are in operation at the 175 interconnected stations in the NPR system, and used daily on a regularly scheduled basis. In the morning, a news feed from the British Broadcasting Corporation is transmitted following the sending of Q1 and Q2 tones, with the Q4 signal stopping the recorder after the last news outtake. This process is repeated during the afternoon for a conference call that details scheduling information and programming advisories.

When irregularly-scheduled announcements require transmission during NPR's programming feeds (approximately 30 hours weekly over the interconnect), the NetCUE system is used during one-minute station breaks on the hour. There is still the capability to send barely-audible cue tones simultaneously with a program feed, but that emergency power has never had to be implemented.

Outside of NPR, the NetCUE system may soon prove compatible with new EBS plans for signalling AM, FM, and TV stations about the broadcasting of national emergency announcements. In 1971 the National Industry Advisory Committee (NIAC) recommended the replacement of the present EBS (formerly CONELRAD) Attention Signal by a two-tone transmission standard. This proposal was repeated during NIAC deliberations last year, with officials defining tones at frequencies of



Inventor of NetCue system, Mayne Hetrick of NPR, holds a completed receiver ready for rack mounting.

853 and 960Hz under specified time and amplitude characteristics.

As these requirements set for the EBS appear to be met by NPR's NetCUE system, it is likely that NetCUE will find acceptance in an even wider variety of network usage than the one currently enjoyed by National Public Radio. **BM/E**

Map at right shows member stations of National Public Radio with the various network assemblies in use.

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The P-50 shown here is an extremely flexible television camera pedestal that allows an unprecedented range of vertical motion. From 21" low to 57" high (measured at the pan head mount), the P-50 provides 36" of height range.

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Available with a wide variety of options (shown here with cable guard side skirts), the P-50 is the ideal instrument for the modern television studio.

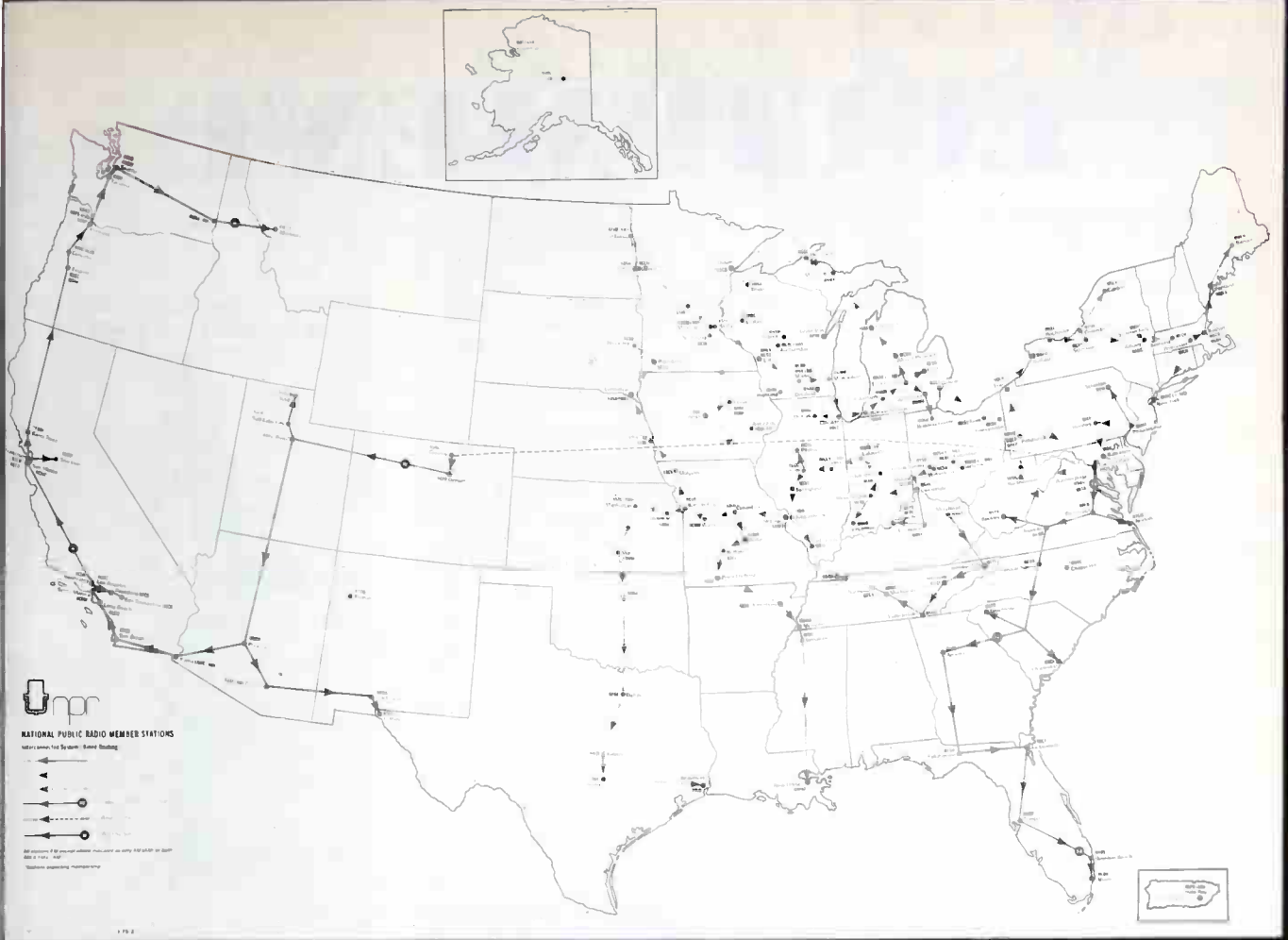
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- **MODEL S8422** Studio Monitor Module
- **MODEL T8422** Communications and Cue Module
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- **MODEL 3000** Variable Parameter Equalizer
- **MODEL 3100** Graphic/Shelf Equalizer
- **MODEL CL-20** Compressor-Limiter



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SMPTE TV edit code reader automatically reads and decodes time code data over a range of 1/5 real time to 40 times real time, in both forward and reverse directions and provides front panel display of time code. Model SP-425 operates with both b&w or color (drop frame) formats. Some standard options: parallel outputs, generator mode of operation, combined reader/generator. \$2,000. DATAMETRICS, INC. **300**

WWVB time synchronizer, Model SP-465, provides a method for disseminating time and frequency information in sync with NBS station WWVB. Time sync accuracy of 1 ms and frequency synchronization of 1 part in 10^{11} is obtainable. DATAMETRICS, INC. **301**

SMPTE miniature time code generator, the model SP-105, enables video tape recording on portable VTR equipment (reel-to-reel and cassette) via time-code-editing systems. The generator includes display, preset control and operating controls. The unit derives power (+12 Vdc ± 3 V @0.1

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A) and an NTSC video input for synchronization from the recorder. The output code is in standard SMPTE drop-frame format and is compatible with the normal tape audio track input. \$1,795. DATAMETRICS, INC. **302**

Transmitter load package covers range 60 Hz-2 GHz, continuous power up to 40,000 watts. Model CPTC-30K requires 208/220 VAC, single phase. VSWR is 1.1:1 from 60 Hz to 1 GHz, 1.15:1 from 1-1.5 GHz, and 1.20:1 from 1.5 to 2.0 GHz. A spare resistor is supplied; additional resistors are priced under \$100. ELECTRO IMPULSE INC. **303**

Audio-visual programmer dubbed the Universal Pulser functions as a: sinewave generator, audio-visual programmer, pulse control and counter circuit and low-frequency filter. The programmer is compatible with all single-pulse film/slide show formats.



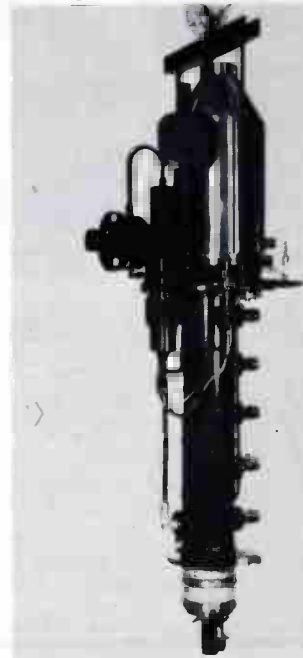
including audible systems (700 Hz, 1 kHz), inaudible systems (50 Hz, 120 Hz), and systems which require a 150 Hz stop pulse. \$399.95 TAPEHEADS **304**

Dynamic headphone, the DT100 series, by Beyer, is available in two versions. The DT100.1 leaves one ear open for monitoring ambient noise necessary under certain live performance situations; the DT108 uses a similar headphone and includes a directional boom microphone. Prices: \$45 (DT100.1); \$63.50 (DT108). REVOX CORP. **305**

Background music library called the Index Series, is a recompilation of the Chappell Background Music Library with the selections organized on one LP per subject. The series includes 36 12-in. discs. \$145. plus \$5 for postage and handling. MUSICUES CORP. **306**

Integral-cavity UHF-TV klystron line includes three series of tubes delivering from 10 kW up to 44 kW of peak-of-sync, video-carrier output power. Tube bandwidth (-1 dB) is 8 MHz; load VSWR is rated at 1.1:1. The

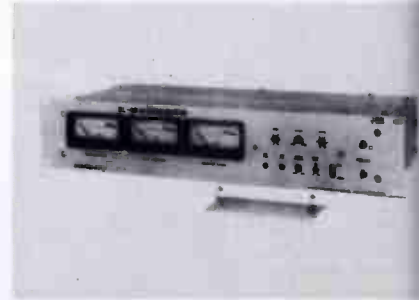
tubes have electrically-isolated modulating anodes. For a given beam cur-



rent, only the cavity frequency and the focusing-electromagnet current are adjustable. The tubes are cooled by circulating water and vapor-phase techniques. THOMSON-CSF **307**

Audio Switcher for mono or stereo uses a card frame construction with two 24 x 10 matrices per frame. Optional remote gain control is available with six outputs. COMMUNICATIONS TECHNOLOGY, INC. **308**

AM broadcast limiter, Model BL-40, provides adjustments for tailoring the modulation envelope to any program format or transmitter characteristic. Independent adjustments are provided for rms and peak limiting and for variable



positive overmodulation up to 125%. All critical adjustments are located behind a removable security panel. A limiting by-pass switch is furnished. URI **310**

Color Monitor, Model UMT-1206, has a 90° one-gun color picture tube. All color set-up controls are located on the front panel. Standard features include loop-through BNC connectors with termination switch and a parallel connected 8-pin plug for VTR monitoring. Pulse cross is provided as an option for viewing the vertical and horizontal display of sync, burst, blanking, test and reference signals. Bandwidth of the monitor is 4.2 MHz. \$25. UNIMEDIA 309

Color production console, Model PC-1, is self-contained and can be interfaced with Sony tricon color cameras. The console includes four in-line monitors for camera 1&2, pre-view and master, a special effects generator with six inputs, matt, key, colorizer, diamond, circle, and corner inserts. An audio mixer offers four



output channels with built-in audio monitor amplifier. The console package includes tripods, headsets, and all cables. \$19,995. LINES AUDIO-VIDEO SYSTEMS 311

HF television transmitter, the TT-20FL, outputs 50 kW visual power plus 1 kW aural power on channels 2-6 from a pair of 25 kW transmitters operating in parallel. The units may be operated independently. RCA BROADCAST SYSTEMS 312

Bandpass filter, the Model BPFa, is available for each low-band, high-band and mid-band VHF TV channel. Six-stage bandpass filter plus two phase-cancellation traps provide a bandpass specification of 5.3 MHz on channels 2-6 and 5.0 MHz on channels 7-13. Trapped-carrier attenuation is 60 dB. LONDER-TONGUE LABORATORIES, INC. 313

Automatic Pay-TV programmers, the Telepro series 300, provides cassette-recorded programs of greater than 30 minutes in length without interruption. The programmers cycle either two or three VCR's for auto operation. Features include: pre-roll; check rewind before play and auto rewind after play; clean audio and video switching; operation according to VCR manufacturer's suggested sequences.

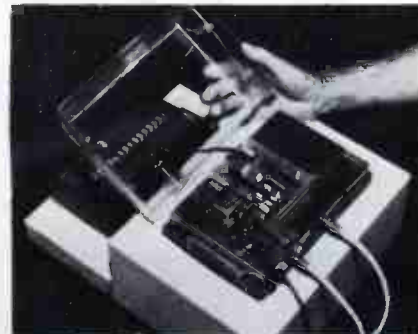


The programmers operate with most VCR's. \$1,120. Delivery in stock to 30 days with quantity discounts available. CHANNELMATIC ELECTRONICS 314

Phantom powered studio condenser microphones are acoustically similar to the other MKH series mics with A-B powering but now operate with 48 V. Three models with different directional characteristics are offered—MKH 416: 40 to 20,000 Hz frequency response, narrow supercardioid/club-shaped directional pattern, signal-to-noise ratio of 73 dB at 94 dB SPL, \$529; MKH 406: cardioid pattern; 132 dB SPL, \$495; MKH 816: shotgun, confined club-shaped pickup pattern, 50 to 20,000 Hz frequency range, \$629. SENNHEISER ELECTRONIC CORP. 315

Dynamic unidirectional moving coil microphone, the Model 3500, has a 40 to 18,000 Hz frequency response. The mic may be used either stand-mounted or handheld. Overall dimensions are 6.3 in. long x 0.945 in. dia. Termination is via Cannon XLR type connector; impedance is 600 ohms. \$165. REVOX CORP. 316

Single-channel mid-band converter/descrambler, the Model DST-



1C, will convert and descramble channel H to channel 2 or 3. The converter is crystal-controlled and the terminal is continued on page 80

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PRODUCTS

field retrofitable to permit descrambler operation in conjunction with CATV set converters in the future. Delivery is March 1976. JERROLD ELECTRONICS 317

Sub-miniature concentric twinax-triax (TPS size) family of connectors, jacks, plugs and receptacles are designed for digital, video pair, carrier base-band and noise-free guarded circuits. TROMPETER ELECTRONICS, INC. 318

Modular electret condenser microphones are built around a common power module which houses part of the electronic circuit, battery and LED voltage monitor. The system features three screw-on heads with shotgun, cardioid and omnidirectional characteristics which may be purchased separately. Mic power module uses a 5.6



volt battery or draws power from a phantom setup. Price of the ME 80 Shotgun head is \$108; cardioid (ME 40) is \$78; the omnidirectional (ME 20) head is \$55. SENNHEISER ELECTRONICS CORP. 319

Universal female coaxial connector, type GF, mates with conventional F- and G-style connectors. The connector consists of an outer conductor with combined threaded fore section and smooth rear section with spring flaps to make contact with push-on connectors.



The inner conductor uses a clip-style contact. BLONDER-TONGUE LABORATORIES, INC. 320

Voice frequency transmission test set, the Model 8002, is designed for checking reference test levels on voice frequency channels and determining idle noise on these channels. A 1 kHz oscillator with switchable output levels of -16 dBm, 0 dBm, +7 dBm from a 600-ohm source is built in. The meter ranges from -60 dBm to +20 dBm in 10 dB steps and may be used in F1A or C message weighting. \$410. DANTEL 321

Low noise audio tape cassette, the series FL, is said to measure 3 dB less noise over a spectrum ranging from 100 Hz to 20 kHz. Prices start at \$2 for the C30FL (15 minutes/side). FUJI PHOTO FILM U.S.A., INC. 322

Monochrome 17-in. video monitor, the Model 17M922, features 15 MHz video bandwidth and a horizontal resolution above 800 lines. The 114° deflection crt is equipped with a standard P4; other phosphors are available. SC ELECTRONICS, INC. 323

Audio Interference Filter, the LINX-60L, is a digital comb notch filter which operates by removing each element of noise (the fundamental and harmonic frequencies of the ac line) from the desired audio signal. The comb consists of 1 Hz notches attenuating the input up to 55 dB at up to 250

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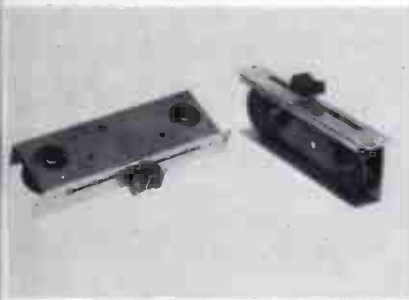
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separate points. Notch bandwidth is switch selectable (0.5, 1, 3, or 6 Hz); the reference input is switch selectable from the line, external, or extracted from an audio input source; the lock range is rated at 40 to 80 Hz. XETRON CORP. **324**

Coaxial cable stripper, the Cablematic Coax Cable Stripper, comes in three models for preparing RG-58/U, -59/U and -6/U cable sizes having solid or foam dielectric. Stripping is a two- or three-step process. ANIXTER-RUZAN **325**

Rechargeable power pack, the Porta-Pac II, is a dedicated battery system for RF Communications front-mount radios. The cells power a 5-watt radio for 9 hours between charges; an integral 115/230 Vac charger restores the cells as the radio operates. Typical recharge time from full discharge to 90% full charge is 4 hours. HARRIS CORP. **326**

Quadraphonic rotary-slider fader consists of two sealed potentiometers driven by a common linear slide mechanism. Model F66820 (1,000



ohms) and F66821 (10,000 ohms) are stock items; other resistance values from 100 ohms to 5 megohms with linear, audio clockwise and counter-clockwise, modified linear, modified log and special tapers are offered on special order. Working attenuation is

65 dB, tracking is rated at ± 1.5 dB between elements (0-40 dB range) at a maximum continuous power of 0.5 watt. A cue switch is available as an escutcheon panel and a colored control knob. ROBINS/FAIRCHILD **327**

Self-compensating signal-to-noise audio squelch operates directly on the audio signal. Sound Off is inserted anywhere in the audio line and will squelch the signal whenever speech or



other information is removed. An ac power supply is built in. KAHN COMMUNICATIONS, INC. **328**

Multimeter features 3½ digit capability, is designed to measure true rms AC voltages. A circuit-breaker current overload protects the instrument. The Model 7003 has 5 functions, 26 ranges, 2000-count capacity, 0.4-in. 7-segment LED display. An internally-mounted battery is optional. \$295. Battery option, \$45. SYSTRON-DONNER CORP. **329**

Low-mass phono cartridges, designated MK II, is offered in three series: the Super XLM MK II with Shibata stylus, the XLM MK II, and VLM MK II with elliptical stylus. The induced-magnet cartridges track as low as 0.75 grams and are offered with stylus brush, screws, screw driver, warranty registration and specification sheet. Retail prices are: \$125 (Super XLM MK II), \$100 (XLM MK II), \$75 (VLM MK II). AUDIO DYNAMICS CORP. **330**



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Modern recording capability for new or old machines. 3-speed EQ, separate EQ for optional SYNC amp. "Linearized" record amp and phase-corrected reproduce circuitry for lowest distortion. Self-contained, fully remotable. Adaptable to most professional recorders. Model 375, \$690.

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end. Lowest prices. Guaranteed quality. And immediate, personal attention to every video tape product or service you need.* And we'll pay the freight anywhere in the continental U.S. with each order of 6 or more reels! (In California, add 6% for sales tax.)
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NAB CHICAGO cont. from p. 39

As mentioned earlier, there will be a new audio cartridge system at NAB. The Beucart Division of UMC Electronics, long a supplier of motors for this application, has decided to produce a complete machine. Units are extremely compact. Type 10 for A-size carts measures 5¾-in. wide by 3½-in. high. Type 20, for up to C-size cartridges, is 10½-in. wide.

Stereo phase performance and stereo phase enhancement will be the theme of the exhibits of Fidelipac and Rapid-Q, respectively. Micro-Trak will feature a compact 6444 stereo console for remote work and System D audio control consoles.

At least two companies will be intriguing broadcasters with head-worn microphones. Shure has a new model, the SM-12, for sports and news announcing. The mike boom can move 20° in any direction and length adjustment has a 3½-in. range. T.E.A. will be showing the Amplivox headset-microphone combination. New in this line is the Traffic Watch headset for on-air commentary from a helicopter or light plane.

Belar sent in an interesting announcement that said it would show new devices "deemed necessary for the accurate analysis of the broadcaster's on-the-air signal."

In lighting, Mole-Richardson will display some new 1200 W to 4000 W BMI Mole Solar Arc lights.

Many broadcasters can also get their first glimpse of DICE (Digital Inter-Continental Conversion Equipment). This all-digital system for NTSC/PAL/SECAM conversion will be shown by Marconi.

Getting Around Chicago

Chicago's seven and a half million residents simplify directions in their city by dividing it into the North, West and South Sides. You would do well to follow their example. At the same time, Chicagoans long ago dubbed the downtown area, "The Loop," referring to the encirclement of the city's business district by an elevated rail route.

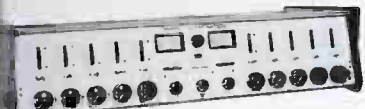
Since McCormick Place—at 23rd Street and Lake Shore Drive—is nearer the South Side, chances are you'll be staying in the Downtown area, or in one of the several hotels

on Managers:

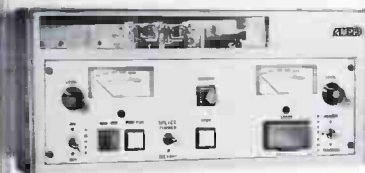
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NAB CHICAGO

located within a few minutes of the convention center, e.g. McCormick Inn.

The following listings do not comprise all the hotels in town—a recent count yielded some 127 hotels offering nearly 40,000 rooms—but as a representative selection it should prove helpful in making your advance plans:

Getting To Downtown Chicago

Chances are you will be arriving in Chicago by air at O'Hare International, the world's busiest airport, which is served from all over the country by Allegheny, American, Braniff, Continental, Delta, Eastern, North Central, Ozark, Piedmont, TWA and United Airlines, as well as by more than a dozen international carriers. The city's other gateway, Midway Airport, also handles various flights of Delta, Piedmont and Southern.

Meigs Field, located on a man-made peninsula just off-shore from McCormick Place handles private traffic plus various commuter and local service carriers such as Air Illinois.

Continental Air Transport runs a regular limousine service to downtown Chicago from O'Hare (\$2.60 one-way) and from Midway (\$3.00 one-way). Taxis run about \$10 one way from either O'Hare or Midway, and about \$2.50 from Meigs Field.

If you feel like splurging a little, Chicago Helicopter Airways, located in Concourse H-K of Terminal 3 at O'Hare operates regular service to Meigs Field for \$10.80 one way, and it's a dramatic introduction to the city.

Taxi rates are comparable to those found in other major cities, i.e. 50¢ for the first one-tenth mile, and 10¢ for each additional one-fifth, which means that the meter keeps clicking off 10-cent increments via a secret communication system it has with the wheels and the clock, all of which is totally unverifiable by the passenger anyway!

When you arrive at McCormick Place, be certain to pick up your complimentary copy of BM/E's **Chicago Survival Guide**, the latest in our continuing series of guides to convention cities. Supplies were limited in Las Vegas last year, but our subsequent Atlanta Survival Guide, prepared for the NAFMB Convention was more widely distributed and very well received.

The Chicago edition will serve you as a program guide for the convention, as well as an invaluable source book chock-full of shortcuts and insider's tips all aimed at making your stay in Chicago as rewarding as possible. In the meantime, make your reservations early!

BM/E



Disco use challenges a cartridge... that's why Stanton is the overwhelming first choice of disco pros

Discotheques represent one of the most grueling professional situations for a pickup that can be imagined. Not only must the cartridge achieve a particular high level of sound excellence, it must do so in the "live" environment of back cueing, slip cueing, heavy tracking forces, vibration and potential mishandling... where a damaged stylus means much more than lost music, it means lost business.

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Stanton has two cartridges eminently suited to Discotheques, both designed with optimum ratios of vertical stylus force, compliance, stylus shank strength... the calibrated 681SE, which possesses superb audio performance, and the more modest 500AL. Both are tough. Both perform beautifully, and dependably. And that's what a Discotheque needs.

Whether your usage involves recording... broadcasting... disco or home entertainment, your choice should be the choice of the Professionals... STANTON.

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STANTON

All Stanton cartridges are designed for use with all two and four-channel matrix derived compatible systems.

Circle 163 on Reader Service Card

full-time **KGBS-AM**, Los Angeles 50,000 Watt transmitter . . . **Multi-point Distribution Service (MDS)** will be utilized to deliver pay-TV programming to viewers in Memphis, TN and New Orleans, LA beginning early this year . . . **Scientific-Atlanta** from has completed arrangements for a 15-year loan for \$6 million the Equitable Life Assurance Society . . . **Data Communications Corp.**, oper-

ators of the Broadcast Industry Automation System (BIAS), have opened an "Instruction and Training School" to provide courses for new station personnel unfamiliar with the BIAS system, refresher courses and in-depth training . . . The **National Video Center** has joined the Videotape Production Association.

The first Canadian high power VHCM (AML) system, purchased by Alberta Government Telephone Co. from **Theta-Com** was placed in operational service within 30 days after

being ordered . . . Two new continuous-wave operated room-temperature aluminum gallium arsenide injection lasers and a continuous-wave operated injection laser system have been announced by **Electro Optics and Devices, RCA Solid State Div.**

Teleprompter Corp. now has pay-CATV service operational in 24 cable systems serving 447,000 subscribers and during December 1975 introduced Home Box Office to seven of its systems . . . **Owensboro Cablevision** and its parent organization, Owensboro On The Air, Inc., have initiated the first pay-TV earth station in the Midwest comprised of an Andrew's earth station antenna package and Jerrold's Scramble/Descramble System.

WNGE-TV, Nashville, began broadcasting 24 hours a day, six days a week on Dec. 31, 1975 . . . **Deluxe Laboratories** has initiated Pickup Express Processing Service from Chicago to Hollywood with free pickup and delivery and 48-hour turnaround. For information call Media Air Cargo 312-649-9337

Teleprompter Manhattan CATV now has live, color cablecast facilities for its public access channels . . . **The Anixter-Pruzan Field Showroom**, a specially outfitted van, is now making calls on CATV systems, telephone and communications firms and electrical utilities around the nation.

F&B/Ceco has a new repair service facility for all editing, projection and laboratory equipment at 1041 N. Highland, Hollywood . . . **The Practising Law Institute** has released "Current Developments in Copyright Law-1975" course handbook, a two-volume set. For information contact the PLI at 810 7th Ave., NY, NY 10019, 212-765-5700.

People

Ronald H. Fried has been elected President and Chief Executive Officer of International Video Corp., Sunnyvale, Calif. . . . **Thomas J. Cel** has been named President of Digital Graphics Inc., a Rockville, Md. based technology firm specializing in, among other things, computerized graphics.

William H. Butler has been named President and Chief Executive Officer of Commercial Electronic Inc. (CEI) . . . **Shigehiko Hori** has been appointed President of JVC America by Victor Co. of Japan . . . **Nyal D. McMullin** has been elected President of Consolidated Video Systems.

Steven A. Bell, General Manager of WLVI-TV, Boston, has been elected Vice President of Kaiser Broadcasting

Lawrence M. Ryan has been elected a Vice President of Conrac.

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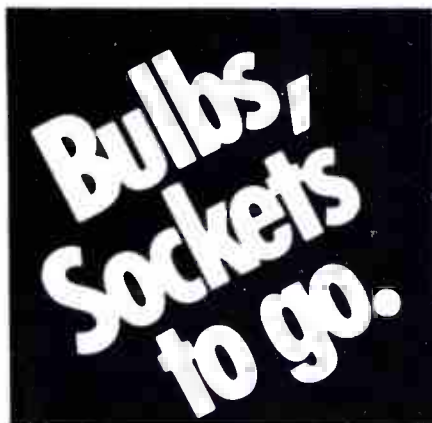
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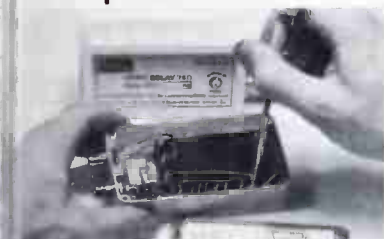
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Circle 168 on Reader Service Card

FEBRUARY, 1976—BM/E

NEW LIT

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

A four-page product information bulletin, EPD MCA 5.06, details an **automatic on-line television image enhancer**. The bulletin lists features, specifications and ordering information for the series 6000 image enhancer. Corning Glass Works **250**

Bulletin No. 292 outlines the features of a new **audio coupler**, Model No. 395P1, which interconnects the standard 1/4-in. phone plug to the mini 9/64-in. plug. Switchcraft **251**

New product bulletin No. 293 highlights a **subminiature phone jack series** which measures 5/16 × 11/16-in. The Micro-D Jax features molded box construction which locks internal parts in place. The terminal configurations are offered in 2-conductor shunted, printed circuit or solder lug styles. Switchcraft **252**

A six-page leaflet describes ways to **protect records** from deterioration through the use of the Lencoclean record cleaning system. Uher of America, Inc. **253**

A revised and expanded handbook on optical characteristics of cathode ray tube screens is offered by the Electronic Industries Association (EIA). The formal title of the 236-page edition of the popular "phosphor book," JEDEC Publication No. 16-C is **Optical Characteristics of Cathode Ray Tube Screens**. This revision, the first since August 1971, updates the phosphor data to include the latest registrations as well as incorporated materials relating to new types of phosphor screens, new color limits, and new measurement techniques. To order, send \$22 (per copy) to Standards Sales Office, EIA, 2001 Eye Street, N.W., Washington, D.C. 20006.

A 16-page condensed catalog covers **high voltage vacuum components and instruments**. Major specifications for vacuum interrupters, vacuum contactors, and high voltage instruments are listed. ITT Jennings **254**

Application Note 192, **Using a Narrow Band Analyzer for Characterizing Audio Products**, is available free of charge and shows how to use low-frequency wave and spectrum analyzers to measure distortion, fre-

continued on page 86

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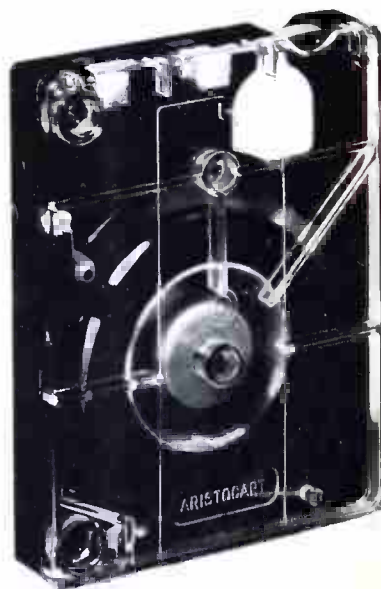
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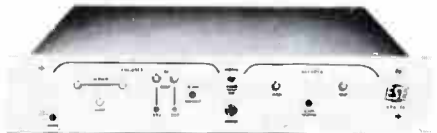
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NEW LIT

quency response, wow and flutter, signal-to-noise ratio and cross talk of high-quality audio products. The 16 page brochure discusses various types of distortion that occurs in audio equipment; methods of measurement are shown. Hewlett-Packard Co. 25

A 12-page booklet highlights **safety equipment** for CATV systems, telephone companies and electric utilities. Products from a number of safety equipment manufacturers are featured. The guide references safety equipment from aerial bucket hardware to wheel chocks. Anixter-Pruzan 25

A guide to training and informational programs in the video format known as the **Video Bluebook** catalogs over 5,000 programs for video users by publisher, title and subject classification, indicating the form in which each program is available. There are also 500 suppliers of video services listed in the directory. Programs for business, government and industry account for half of the subjects in the bluebook. General interest subjects that are business-related represent the other half in the 370-page directory. The guide is available from Knowledge Industry Publications, 2 Corporate Park Drive, White Plains, N.Y. 10604. The cost per copy is \$29.50.

A technical bulletin reports on **low cost doubly-balanced mixers** for communications systems, navigational aids, quality laboratory test equipment and other wideband signal processing applications. The 4-page bulletin provides performance specifications of the model CM-1 as well as theory of operation, complete instructions for use as a balanced modular (bi-phase) amplitude modulator, attenuator, phase detector and pulse modulator switch. Vari-L Co. 25

A 24-page product directory and show form catalog is available on **digital multimeters, voltmeters, thermometers, differential voltmeters, calibrators, ac and dc standards, programmable power sources, power supplies, frequency synthesizers, timers and frequency standards, electronic counters, automatic test equipment and voltmeter accessories.** John Fluke Co. 25

An 8-page brochure describes **cabinets, small cases, racks, consoles and electronic desks** in various combinations of sizes, styles and colors. Optima Scientific-Atlanta, Inc.

A 53-page booklet, ET-1300, contains descriptions, electrical specification diagrams and photographs of the line of CATV **broadband communi-**

tions equipment, including solid-state trunk and distribution amplifiers, multi-taps, modules, power supplies, floor and outdoor passives, pilot carrier generators, and a new series of op line filters. GTE Sylvania 259

supplemental list updates all prices a professional motion picture equipment catalog, No. 10, which is available free. Alan Gordon Enterprises 260

4-page brochure describes a time de synchronization system which automatically locates cue points and controls sync of any two quad or int-track video and multichannel audio tape recorders. Using the SMPTE edit code, some Dual Cue/synchronizing applications are illustrated in test and block diagrams. IBCO 261

Mini-Documentary—Serializing TV News, by Stanley Field, is a 8-page mini handbook written to show the local (and/or independent) television station how to produce this program format. Equipment and techniques for undercover shooting and recording and other news-gathering situations are explained. The advantages and disadvantages of film and videotape are detailed. Aerial photography, crane shots, infrared, miniaturization techniques, and undercover tips are outlined. Written or transcribed air scripts for eight mini-documentary series are also offered for study. The price is \$12.95 hardbound. Tab Books, Blue Ridge Summit, PA 214.

Need a down-to-earth book on logic and digital electronics, but can't hack the formulae found in most texts? Digital/Logic Electronics Handbook, by William L. Hunter, offers explanations and how-to examples for the experimenter. Basic digital circuitry, logic symbols and their meanings, integrated-circuit logic devices, and digital light-emitting diode circuits are covered. The chapter on logic applications delves into simple digital instrument build-its. \$9.95, hardbound. Tab Books, Blue Ridge Summit, PA

Teachers and aspiring students of the film and TV industries may find Motion Picture Market Place a useful reference work. The directory provides the names, addresses and telephone numbers of production and equipment services and professional talent nationwide, including Puerto Rico and the Virgin Islands. Some listings: agencies, literary and talent agents, business managers, camera equipment, major studios and music, props and scenics. Pre-publication price is \$11.50 plus tax. Foothill Press, Box 951, Pasadena, CA 91101.

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LOW POWER CONSUMPTION — less than 45 watts; no damage to your tapes.

STANDARD FEATURES — headphone jacks, transformer output, FET switching, remote control socket.

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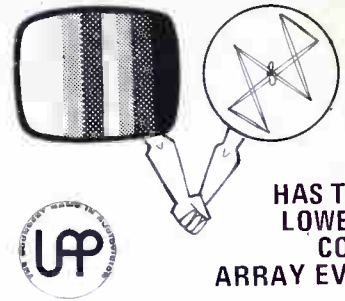
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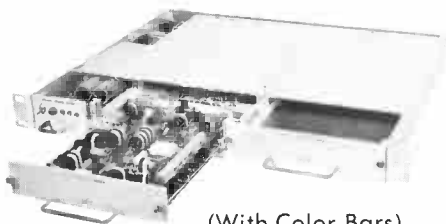


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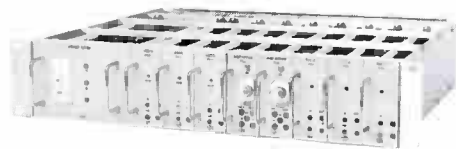
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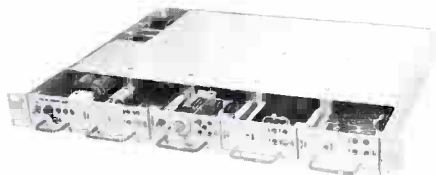


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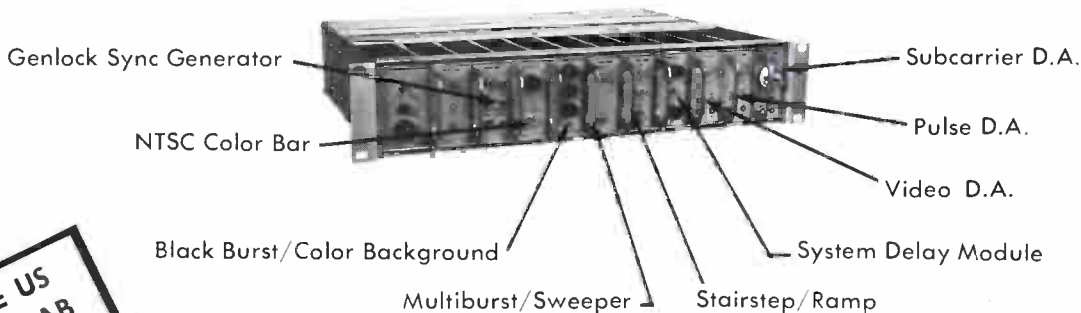
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