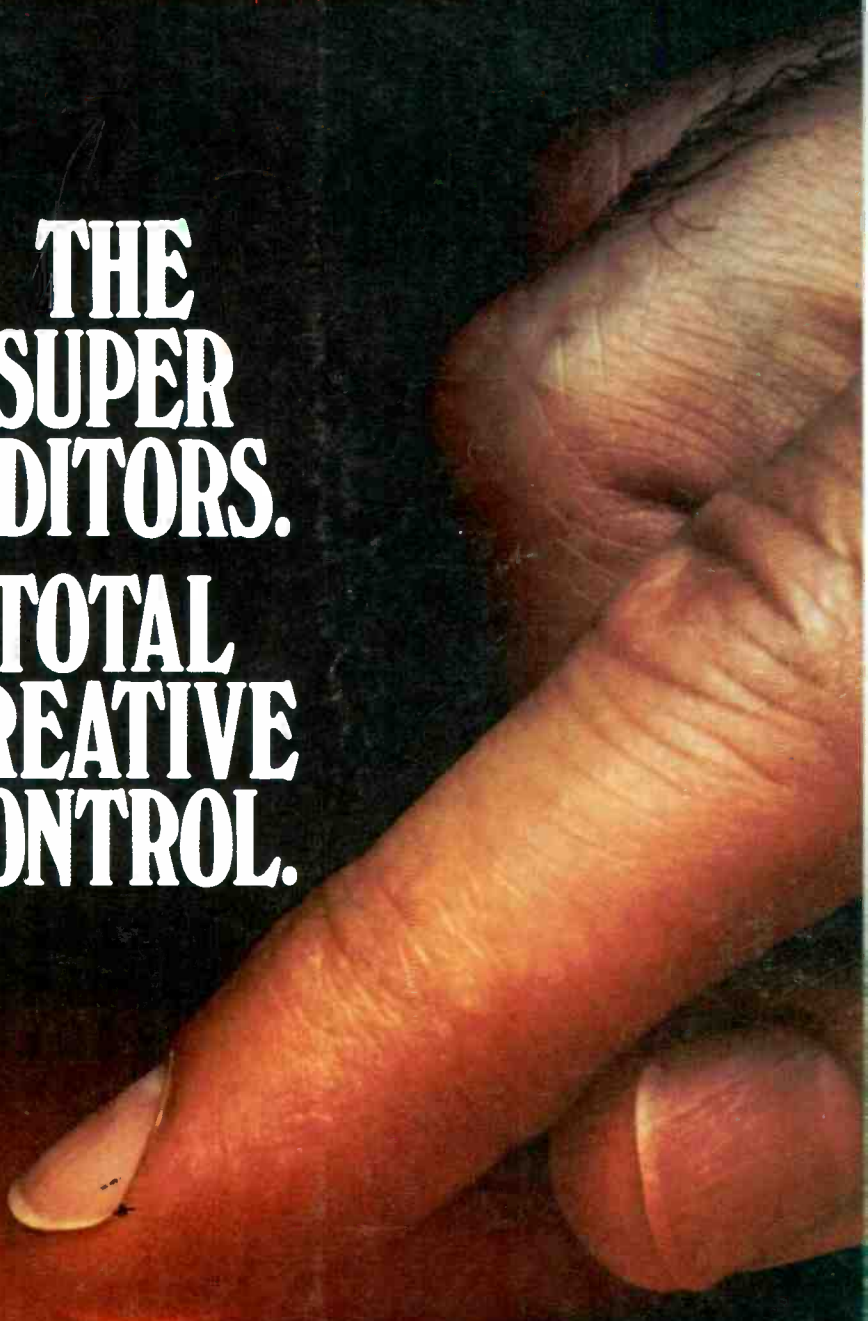


JUNE 1978

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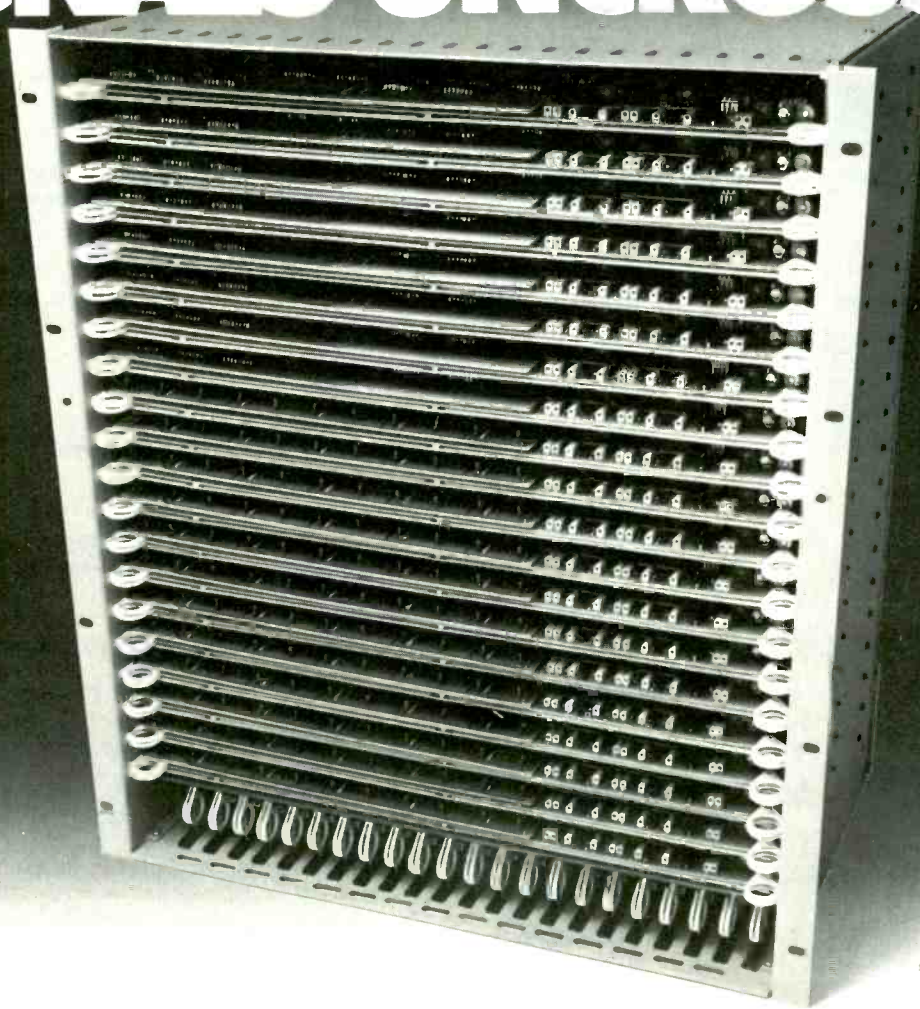
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BROADCAST INDUSTRY NEWS

\$14 Million In HEW Grants To Radio And TV Stations

New grants totalling \$14 million have been awarded throughout the country by HEW's Office of Education to help local communities establish, improve or expand noncommercial public radio and television stations. The grants went to 47 television and 52 radio stations in 37 states, the District of Columbia and Puerto Rico.

Seven of the television grants will be used to establish new stations to serve people who now have no access to public television. The remaining 40 TV awards will help stations expand power to reach a larger population, provide color capacity and otherwise improve operating equipment and output.

Eight of the radio grants will be used to begin new stations, seven of which will bring public radio to people for the first time. The remaining 45 grants will be used to buy broadcast equipment to improve and expand services.

NAB Says CATV Systems Should Continue To Carry Local Signals

NAB has filed comments urging the FCC to continue to require cable television systems to carry all local broadcast signals and to consider waivers only on a case-by-case basis. NAB also asked that the FCC maintain the present priority for local carriage over distant signals and cable origination and access service.

In the filing, the Association said that "permitting cable systems to forego carriage of broadcast stations within their local service areas would undermine and ultimately destroy the concept and reality of local service demanded by the public, envisioned by Congress and the Commission, and engendered by the table of allocations." NAB pointed out that the benefits of local service are "real and substantial" and are essential to maintenance of life and property during severe weather, natural

disasters and other emergencies.

NAB said that cable systems are natural monopolies and must not be permitted to use this position to foreclose competition from local stations with their own program services. Noting that the Commission has considered carriage of distant signals, in lieu of local signals, inherently anticompetitive, NAB said it is even more anticompetitive if the system deletes a local signal in order to place its own program service on the system. Furthermore, if only one of several local channels is deleted, that station is placed at an unfair disadvantage.

With regard to cable systems that are saturated by the carriage of local signals and therefore unable to carry all required signals, NAB believes that the present practice of granting waivers on a case-by-case basis should be retained. NAB suggested that the problem here is not an over-abundance of local signals, but the lack of capacity of some cable systems. This could be solved by increasing capacities. A waiver would be required only where cable systems could demonstrate their financial inability to comply with the rules.

In further support of cable regulation, NAB introduced the results of a study on the economic relationship between broadcasting and cable television. The study was conducted by Wharton, EFA, Inc., Philadelphia. The most significant findings of the report, according to NAB, were that liberalization or elimination of distant signal limitations would devastate independent station audiences and substantially reduce local station audiences in small one- and two-station markets with losses most substantial for network affiliates during the early fringe time period (4:30 to 7:30 p.m.). It was found that tightly regulated cable is beneficial to UHF stations. Importation of distant independent stations fails to substantially increase cable penetration, although additional distant signal carriage does increase viewing in existing cable households. It was also found that cable penetration can be expected to double in upper income areas.

continued on page 8

Duca-Richardson Becomes Ampex Subsidiary

Ampex Corporation has announced the acquisition of Duca-Richardson Corporation of Wheat Ridge, Colorado, a manufacturer of electronic switching systems for the broadcast industry. Arthur H. Hausman, president and chief executive officer of Ampex, said the acquisition "is in line with the company's previously announced plan to move into new areas of technology that are a logical extension of Ampex's current capabilities . . . and will enable Ampex to offer the broadcast industry a line of high-quality production switchers that complement the company's professional broadcast systems."

Duca-Richardson, engaged in the design, development and manufacture of electronic switching systems and other terminal equipment, will be operated as a wholly owned subsidiary of Ampex and will fall under the responsibility of the company's audio-video systems division.

This Ampex acquisition is one of



Ampex president Arthur H. Hausman (seated) signs contract formalizing acquisition of Duca-Richardson, while D-R senior vice president James F. Duca (left) and D-R president Robert F. Richardson observe

many such moves by major industry manufacturers seeking to expand their operations and round out their product lines (see story in this month's Broadcast Industry News).

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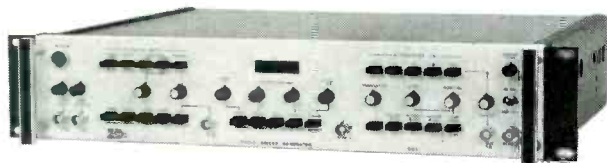


The D-640 is intended for use with the D-630A Video Sweep Generator to provide swept or spot frequency envelope delay measurements. It permits displaying simultaneously on an oscilloscope both amplitude and delay characteristics. Measurements of delay can be made regardless of path length. The D-640 is self-calibrating through the use of crystal controlled digital circuits.

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News

NCTA Tells FCC That Cable Restrictions Are Groundless

In comments filed with the FCC, NCTA cited a nationwide study of the 109 markets with over 33 percent cable penetration and stated that local broadcast stations lose an average of less than eight percent of their audiences to cable television and that there is no evidence that loss of audience produces an equal loss of station revenue.

In releasing the comments, Robert L. Schmidt, NCTA president, said, "The stated purpose of the FCC cable regulations has been to protect continuing service by local broadcasters, but our research shows that cable poses no threat to broadcasters' ability to serve the public. Cable competition may in fact result in improved broadcast service."

Research included in the comments was based on an analysis of cable's impact on nationwide markets and on an in-home diary survey commissioned by NCTA in five television markets representative of a variety of broadcast/cable environments. It showed that: 1) local broadcast stations lose little of their audience when cable is introduced because overall television usage increases (some UHF stations, often thought to be those most vulnerable to cable, actually registered an audience increase averaging 5.5 percent); 2) a decline in viewing audience does not result in a direct and equal loss in station revenues because revenues are influenced by other major factors, particularly market size, availability of advertising time and advertising demand; and 3) local broadcast programming is the least vulnerable to adverse cable impact because of its local popularity and because it delivers higher revenue per minute per viewer than other programming. Local programs make up only 13 percent of a local station's program day, but they contribute 27 percent of station revenue.

NCTA's research also indicates that the FCC regulations have limited cable systems in the 100 major markets to a 12 percent share of total industry subscription growth in the years between 1972 and 1977. In addition, regulatory restrictions on programming make construction of new cable systems in many cities unthinkable. Estimates show that a new urban cable system must reach a 50 percent penetration of the viewing market in order to be profitable. Without the option to fashion diverse programming services, 50 percent penetration is difficult, if not impossible.

Schmidt also said, "Somehow they [the FCC] believe that local broadcast-

continued on page 10

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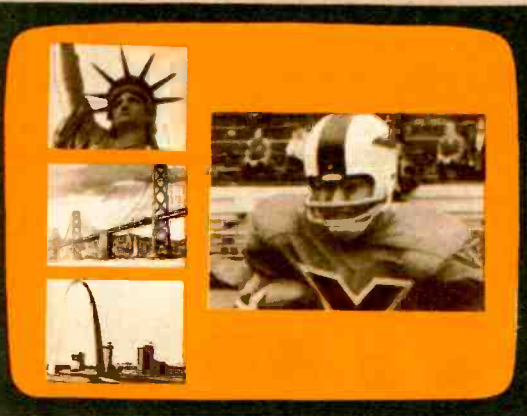
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Los Angeles, California 90048
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ers won't respond to competition, that they will just sit back and take it instead of improving their programming and services to keep their audience. That's simply ludicrous. There is a public good in healthy competition which should spur broadcasters to improve their service. . . . Regulations which do nothing more than limit consumer choices certainly don't promote the public interest by anyone's definition."

NAB Tells House Subcommittee There Should Be No Need For Performance Royalties

A House of Representatives subcommittee was told that broadcasters should not have to pay royalties for the privilege of playing records because the record and radio industries receive value from each other.

John Dimling, NAB Vice President for Research, told the House Subcommittee on Courts, Civil Liberties and

Administration of Justice that the record industry furnishes recorded music that provides an important part of radio's programming, and in return, "the radio industry provides exposure for records that is widely acknowledged by the recording industry to be an essential element in generating record sales." Dimling also said that if royalties were imposed, "many stations will be forced to cut costs in other areas in ways that will adversely affect the service they provide the public, and a few stations may even be forced to leave the air."

A number of broadcasters were also on hand to testify. Peter Newell, general manager of KPOL AM/FM, Los Angeles, said that neither the general public nor the nation's economy would benefit because a performance right is simply a "redistribution of monies from one segment of the private sector to another." He also stated that without radio, the record industry would be a small fraction of its present size; fewer performers would be working and those who worked would be earning less money. "If you want more evidence as to how much importance the recording industry attaches to radio's valuable time," Newell continued, "look at what they do, not just what they say. Record companies give away their product to radio stations free of charge. . . . Radio airplay is the lifeblood of their industry. Our product, our valuable air time, given to them in exchange for the use of their product, is what makes the record industry what it is — a \$2.7 billion a year business. It is a bigger industry than radio, their benefactor, by some 700 million dollars a year."

Willie D. Davis, president of KACE FM, Inglewood, Calif., expressed his opposition, saying that he is in a very tough competitive fight to attract advertisers and saying on behalf of black station owners and operators, "One thing we do not need is an additional payment for the records we play." Major Short, president of KOBH, Hot Springs, S.D. (and a former recording musician) said there is "considerably more greed involved in the promotion of this bill than there is genuine need," and the percentage of performers who would qualify for benefits is very small.

Testimony was also heard from Carl Venters, president and general manager of WPTF, Raleigh, N.C.; W.J. Deane, president of the Arkansas Broadcasters Association; Joseph Rayball, president, Massachusetts Broadcasters Association; and Ted Arnold, vice president and general manager, WHBF, Rock Island, Ill.

Equal Time For Whom?

The FCC has proposed the revision of continued on page 12

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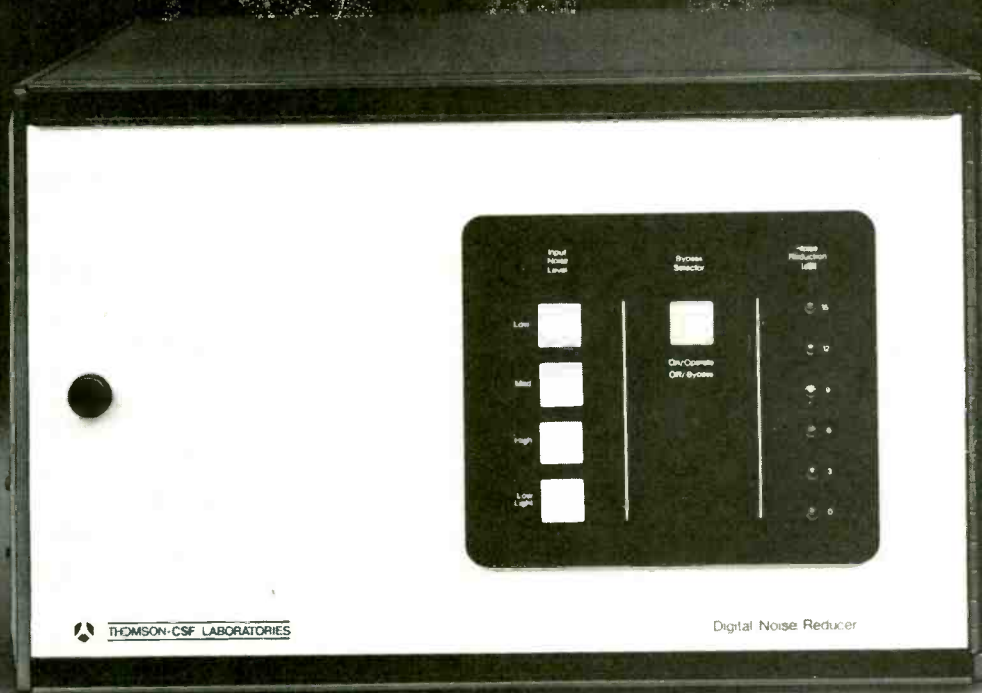
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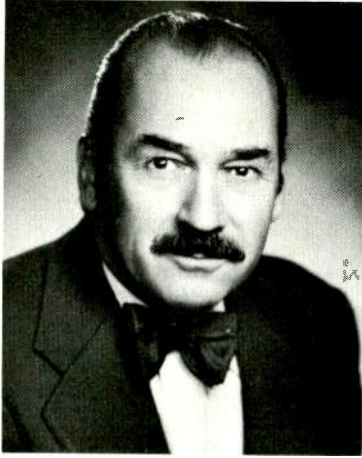
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News

its definition of a legally qualified candidate for equal opportunities and access to air time on radio and television stations. Currently, the definition states that any person who has publicly announced his candidacy, is eligible to hold office, and is a bona fide candidate for nomination is considered a legally qualified candidate.

The commission has found that under this definition, write-in candidates could become legally qualified well in advance of the time when election laws would allow other candidates to qualify for the ballot. It was also found that candidates seeking a nomination by means other than a primary, general or special election were not fully covered under the existing definition.

In order to relieve this situation, the FCC has proposed requiring such candidates, as in the case of write-ins, to make a substantial showing of bona fide candidacy. Some of the elements of this showing would include the issuance of press releases, distribution of leaflets, addresses to political meetings and maintenance of a campaign committee.

CBer Arrested By FCC Agents

In its continuing crackdown on illegal CB operation, the FCC has announced the arrest of a Washington, D.C. CB operator for repeated violation of FCC rules. The operator was arrested April 27 after more than 300 complaints had been filed for his use of a CB radio to transmit music and obscene language, for failing to identify by call sign, and for deliberately interfering with home electronic equipment.

Although the operator's CB equipment had been confiscated by U.S. marshals in a crackdown on April 11, he apparently obtained additional equipment with which to continue his illegal operations. His April 27 appearance before a magistrate in the Federal District Court for the District of Columbia resulted in his release on his own recognizance. If convicted, the operator could receive a two-year jail sentence and/or a fine of \$10,000.

Satellink Asks FCC For Licenses To Operate Hawaii Satellite Antenna

Satellink, Inc., applied for FCC licenses to operate a 10 meter satellite receiving antenna at Kahe Point near Honolulu and to do business as a common carrier offering satellite-communication reception services to Hawaiian users. Robert Wold, Satel-

continued on page 14



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A simple philosophy? Yes. But, one that can save you and your clients many dollars.

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Circle 107 on Reader Service Card

News

link's president, said that the plan would offer a substantial reduction in the cost of receiving TV program transmission from the mainland and should therefore enable Hawaiian TV stations and cable operators to increase their exhibition of same-time or same-day programs.

In its filing with the FCC, Satelink stated that it has obtained three-year business commitments aggregating 1000 hours per year of satellite recep-

tion from three of Honolulu's commercial TV broadcast stations: KGMB (CBS), KHON (NBC) and KITV (ABC).

The Kahe Point antenna is to be supplied by Scientific Atlanta, and will be equipped to receive as many as four TV programs simultaneously. Future plans include the reception of high-quality mainland program signals for Honolulu radio stations. Wold pointed out that use of Western Union and RCA satellites will give Hawaiian users direct access to eight mainland cities: New York, Atlanta, Chicago, Houston,

Los Angeles, San Francisco and Seattle.

Currently, Hawaii's broadcasters have access to mainland programs along only two video paths, one each from San Francisco and New York. Through Hawaiian Telephone Company, mainland-to-Hawaii video transmission is leased at \$1000 per hour plus local connection and delivery charges. Wold said, "Satelink is offering the downlink for as little as \$85 per hour and plans to combine that with uplink and space segments in a total cost that will be far below what the Honolulu TV stations currently pay." An added cost-saving feature in the plan is the introduction of dual capacity to the transmission path. The normal capacity of a satellite transponder is one TV program. Wold plans to double this with a digital system known as STRAP (Simultaneous Transmission and Reception of Alternating Pictures). The STRAP technique was developed and tested successfully in late 1977 by CBS Television, but has not yet gone into use by a carrier.

Wold also announced that Satelink plans to apply for FCC certification as a resale common carrier for the uplink and space segments from the mainland. Satelink will in turn lease transponder time on domestic satellites owned by Western Union Telegraph Co. and RCA Americom, enabling it to offer end-to-end service between the mainland and Hawaii.

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One Stop Shopping? Outgrowth Of New Technology And Marketing Strategies

Recent developments in the manufacturing end of the broadcast industry indicate a significant change in marketing tactics by suppliers. These developments include a spate of mergers and acquisitions and the increased practice of large companies using their marketing power to sell the wares of smaller manufacturers.

Two major recent announcements concerned Ampex's acquisition of Duca-Richardson as a wholly owned subsidiary and Bell & Howell's purchase of the assets of TeleMation's video hardware manufacturing division. The move by Ampex may be seen as the result of resurgent strength fed by a much improved financial position (indicated by record earnings last year). Bell & Howell, long rooted in the film chain and projector market, has a growing Video Division. Their purchase of TeleMation may be seen as an aggressive move to establish a firmer foothold in the broadcast supply business.

continued on page 18

Circle 108 on Reader Service Card



ACTION ON FILM

When lighting is amateur, film should be pro.

Eastman Ektachrome video news film high speed 7250 (tungsten) is a story saver.

With its high-speed (EI 400) and force-processing capability there's plenty of room to maneuver with filters to correct for fluorescent lighting and still use lens settings that give good depth of field.

Back at the station you process it as you do Eastman Ektachrome video news film 7240. Eastman 7250 film is

fully compatible with all process VNF-1 procedures.

When you're covering sports, sometimes the action is a lot better than the lighting. That's when the pro reaches for Eastman 7250 film. At air time it's better to show footage than to just report the score.

For more information, write:
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The Sony BVH series. Consider the accomplishment.

Two years ago, 1" helical-scan recording was just a gleam on the broadcast horizon.

Now, there's the new SMPTE Type C Standard.

We're kind of proud of that. From the start, Sony Broadcast was a leader in the 1" revolution. We pioneered many of the technical innovations incorporated into the 1" helical-scan VTR. And it's good to be part of a movement so beneficial to the broadcast industry.

How does our new SMPTE Type C machine differ from the more than one hundred BVH-1000's already in use across the nation? Frankly, very little.

And we're proud to be able to offer you SMPTE-standard 1" machines that maintain all the unique advantages of the Sony Broadcast equipment already in the field.

Consider the advantages. Advantages like BIDIREX, which gives you full bi-directional search capability in both shuttle and jog modes. And that means 100% post-production creative freedom, with all the ease and flexibility of 35mm film techniques.

Advantages like the incredible economy of the 1" tape format. Far lower acquisition costs. Smaller size, so you save valuable studio space. Lower maintenance costs. Plus major savings in 1" videotape alone.

Advantages like three high fidelity audio tracks. Color framing, to maintain perfect timing continuity during editing and animation

sequences. And more.

Consider the possibilities. Think about the local programming capabilities that open up with the BVH-1000 and portable BVH-500. Capabilities quad can't match. With an economy that leaves film far behind.

Think about creating your own documentaries. Taping your own commercials. Think about taking 1" tape out into the field, then bringing it home and going directly on the air without the need for converting to another format.

Think about the kind of panoramic production once possible only on film. And think about what single-camera film editing techniques will mean to your creative effort.

Consider the source. There's one more thing you should think about as you consider the move to 1".

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And when you consider Sony Broadcast, you'll find benefits no other source can give you.

Like our years of experience in research, engineering, and production of advanced video systems.

And access to a complete family of professional video equipment from a single manufacturer. With the kind of reliability and performance only a single manufacturer system can guarantee.

The BVH Series, from Sony Broadcast.

All things considered, it's quite an accomplishment.

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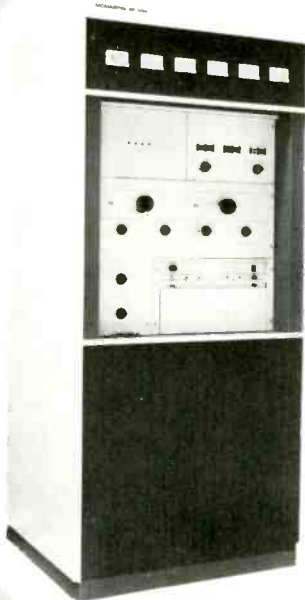


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News

An even more significant trend is an increase in the practice of one company adopting the product line of another. At the NAB in Las Vegas (and as reported in last month's *BM/E*) it became clear that many companies are planning to acquire smaller lines. For example, RCA will market and service Shintron small production switchers, Datatron Tempo 76 edit controllers (for the RCA one-inch video system), Eigen slo mo devices and Spectravision edit controllers for U-type video machines. These marketing deals are in addition to RCA's licensing agreement with Sony for the manufacture of Type C one-inch video machines.

N.V. Philips of Holland and Ampex have also arranged a marketing agreement. In order to enter the ENG/EFP camera market, Ampex will adopt the Philips LDK-14 as part of their range of broadcast cameras. In turn, Philips will market, on a non-exclusive, worldwide basis, the Ampex VPR-2 and VPR-20 videotape recorders and the TBC-2 digital time base corrector.

With such significant mergers, acquisitions and marketing and licensing agreements, the broadcast marketplace looks like the scene for a struggle between titans. One reason for the switch in strategies is the large research and development costs involved in applying digital technology. Years are needed to come up with the necessary software, and the programmer or systems analyst embodies a significant development cost that is hard to pin down and control. Engineering costs are high, too, and companies are trying to spread those costs out, or at least compensate for them by employing a cooperative approach to marketing in order to increase volume.

News Briefs

NAB urged the FCC to **require manufacturers to produce "more compatible" TV sets** so that the public would be able to tune in UHF stations as easily as VHF's. In a letter to FCC General Counsel, Upton K. Guthery, NAB said it is "long past time" for the Commission to act and noted that inferior UHF tuners inhibit viewership. The association said that this is not in keeping with the 1962 all-channel receiver law and charged the FCC with following a "leisurely and snail-like pace" in affording greater parity to UHF. NAB suggested the issuance of a Notice of Proposed Rule Making providing 30 days in which to file comments, with reply comments due ten days later NAB also filed com-

continued on page 20

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News Briefs

ments with the FCC supporting a CBS request that frequencies between 38.6 and 40 GHz be assigned to the Television Auxiliary Broadcast Service in order to accommodate the increased use of ENG equipment at on-the-scene locations. The association said that "in many locations the auxiliary broadcast frequencies are taxed to the very limit while in other areas they are saturated with demands far exceeding the capac-

ity of the bands." NAB added that interference results when a news or sporting event is covered by a number of stations. NAB also said that ENG's popularity and acceptance by the public will increase its use and additional spectrum space will be needed **O'Connor is recalling Model 30 fluid camera heads** with serial numbers 308764175 or smaller due to defective shoes used in the fluid for both pan and tilt action. With an in-plant turn around time not to exceed three days, O'Connor will install new shoes in all Model 30s at no cost to the customer. Ship

UPS Blue Label and O'Connor will pay the freight. In the US ship to: O'Connor Engr. Labs Inc., 100 Kalmus Dr., Costa Mesa, CA 92626; in Canada, Cinquip Div., 41 Scollard St., Toronto, Ont. M5R 1G1; in Europe, 11 Rues des Moraines, 1227, Carouge, Geneva, Switzerland.

Richard M. DeVos, president of Amway Corporation and co-chairman with Jay Van Andel of Amway Communications Corp. and the Mutual Broadcasting System presented a check for \$10,000 to the World Press Freedom Committee. Arch L. Madsen, a member of the WPFC executive committee, accepted the Mutual check with "deepest appreciation and gratitude" Larry Hatteberg, KAKE-TV, Wichita, was named 1977 TV News Photographer of the Year, and KTVY-TV, Oklahoma City was named 1977 TV News Photography Station of the Year in the annual competition conducted by the National Press Photographers Association and the Mass Communications Dept. of the State University of Arizona **Associated Press Radio** has received two awards. The Janus Award for excellence in economic reporting was presented to APR's Business Barometer programs produced by Allan Schaertel. The National Headliners Club Award was presented for the outstanding documentary, "The New South: Shade Behind the Sunbelt," produced by Julie Frederikse **"Earplay,"** an original radio drama series produced for public broadcasting, has been named recipient of a 1977 Peabody Award for excellence in broadcasting (see *BM/E*, October 1977) Four CBS-owned radio stations received San Francisco State University Awards. **WCBS**, New York, **KMOX**, St. Louis, **WBBM**, Chicago and **KCBS**, San Francisco received Broadcast Media Awards in the categories of local news, local news and public affairs, station editorial and information or documentary, respectively.

A European communications Orbital Test Satellite — OTS-B — was launched in May by NASA for the European Space Agency. Its operational descendants are expected to provide satellite links in the 1980s for routing portions of the intra-European telephone, telegraph and telex traffic and television relay services for Western Europe RCA Americom has provided a **full-time satellite transponder** for 24-hour-a-day nationwide distribution of PTL Television Network's religious programming.

Dr. D.B. Keck of Corning Glass Works and R. Boullie of the Centre National d'Etudes des Telecommunications (CNET), France, report that **the widest optical power bandwidth ever**

continued on page 24

Beaucart II.

Our name alone spells quality. And performance. And dependability. And an increasingly broad array of NAB-quality products for broadcasters worldwide.

We were a little afraid that our economically priced Beaucart[®] II audio cartridge tape machines would make a dent in the market for our standard Beaucart units. But something entirely different happened! We found ourselves selling a whole new group of broadcasters who really didn't need the broad capability and highly polished appearance of the original Beaucart. But they still wanted to take advantage of our Beau pancake motor and audio heads in a trim, mono, A-size machine.

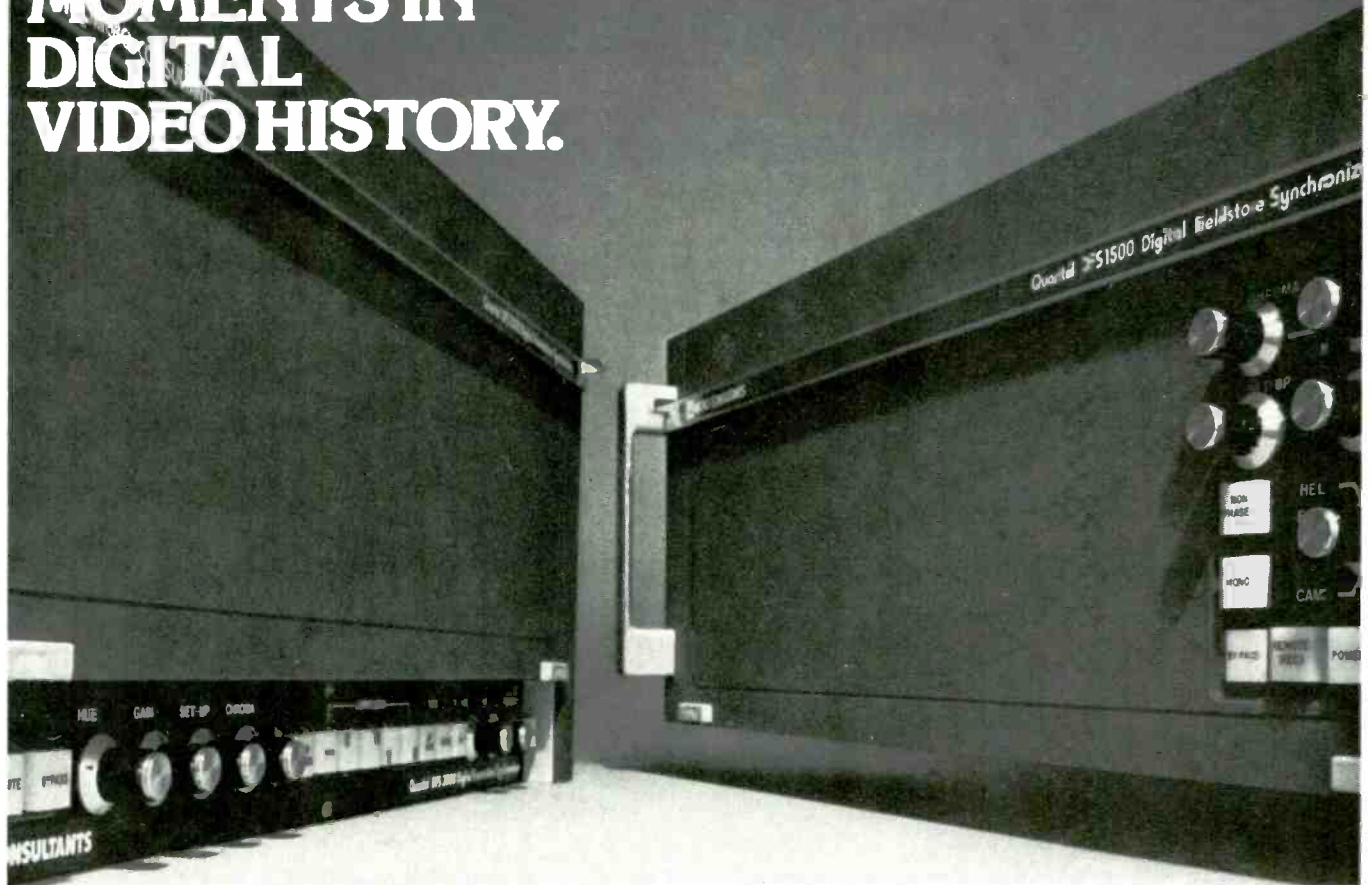
We'd like to say "Thank you" to those savvy broadcasters who have discovered Beaucart II, and invite the rest of you to learn what they already know. That Beaucart II is today's best all-around cart machine value. Write today for Bulletin 104 or call us at (203) 288-7731 for the whole story. We're the Broadcast Products Division, UMC Electronics Co., 460 Sackett Point Road, North Haven, Connecticut 06473.

UMC[®]



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GREAT MOMENTS IN DIGITAL VIDEO HISTORY.



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The new DFS 3100 is the successor to the DFS 3000, the world's most highly acclaimed digital fieldstore synchronizer. But the microprocessor-controlled DFS 3100 is more powerful. Its production control option puts a wide range of effects at the producer's fingertips. Effects like freeze with automatic updating. Video compression. Joystick control of compressed and full frame pictures. Automatic positioning to predetermined locations. Automatic tracking of chroma key for compressed images.

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But if you need **less**, the new DFS 1500 gives you basic fieldstore synchronization and truly outstanding time base correction. It's ideal for broadcasters who don't need all the power of the 3100, as well as those who have a need to use it in **addition** to a 3100.

Both synchronizers are portable and rugged. Both dissipate only 250VA. Both are perfect for studio or OB van.

So whether you need more synchronizer—or less synchronizer—get in touch with Micro Consultants, Inc., P.O. Box 10057, Palo Alto, California 94303, (415) 321-0832.



The digital video people



Circle 147 on Reader Service Card

A Panasonic $\frac{3}{4}$ " direct-drive editing system this good is no surprise.

It doesn't make much sense to build a $\frac{3}{4}$ " editing system around two expensive editing recorders when one editing recorder and one less expensive player/recorder are all you really need. That's why you need the economy and direct-drive performance of Panasonic's Series 9000™ $\frac{3}{4}$ " editing system. The NV-9500 editing recorder, the economical NV-920C player/recorder and the amazing editing controller that goes between them, the NV-A950. Together they give you the kind of performance you expect from Panasonic, along with considerable savings over comparable editing systems.

When used with the NV-9500 and NV-9200, the

NV-A950 will execute frame-by-frame insert and assembly edits, automatically. There's a five-minute memory for entry and exit points of video and audio inserts. And for quick and precise location of the exact edit points, the NV-A950 also has controls for fast play (double speed), search (one-fifth speed), slow rewind and pause. There's also a rehearsal mode that lets you run through an edit before you actually perform one.

And you'll be able to perform an edit in style. Thanks to the NV-9500 and the NV-9200. Especially since both decks give you the precision of direct-drive video head cylinders, the speed



NV-9200



NV-A950

Under \$10,000 is.

accuracy of the capstan servo system and the toughness of patented HPF™ video heads. The results: Excellent stability, low jitter, high resolution (330 lines B/W and 250 lines color) and a video S/N ratio of 45 dB.

And if performance this good from Panasonic doesn't surprise you, then neither will our kind of reliability. Like the strength, stability-of-alignment and long-term durability that our annealed aluminum die-cast chassis gives you.

There's a lot to be said about the advantages of using the NV-9500 and the NV-9200 together, but there's just as much to say when you use them separately. You can use the NV-9200 as a high-quality master recorder. Or for dubs that look almost as good as masters, use it as a high-quality dubbing deck. And with the NV-9500 editing recorder, you'll also get

frame-by-frame insert and assembly edits without tear, roll or loss of video information.

Both decks also include automatic rewind. Auto search. BNC and 8-pin connectors. Chroma level adjustments. Subcarrier and vertical sync inputs. And non-locking pushbutton controls. All in simulated wood cabinetry.

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NV-9500

News Briefs

attained in an optical waveguide has been measured in a Corning filament. Complete copies of their report, "Measurements on High Bandwidth Optical Waveguides," are available from Telecommunications Products Dept., Corning Glass Works, Corning, NY 14830.

"**Diagnosing Common-Cable Television System Faults**" is a 26-minute ¾-inch cassette color tape that turns a television receiver into a sophisticated piece of test equipment. On the

tape, a series of distortions common to CATV systems are identified and their causes described, and ways of clearing the system of these distortions are discussed. Included on the fully narrated tape are examples of color distortions, carrier-to-noise, co-channel, impulse noise, hum, intermod, ghosting, direct pick-up, and cross-modulation. The tape is available only from the Society of Cable Television Engineers, P.O. Box 2665, Arlington, VA 22202. Payment of \$45.00 for each cassette, plus \$5.00 shipping charge must accompany written orders.

Business Briefs

An agreement with the Organizing Committee for the 1980 Moscow Olympics and the Soviet State Committee for Radio and Television named **Ampex the exclusive official supplier** of videotape recorders, slow motion disc recorders, and magnetic recording tape for the broadcast of the games **Cox Cable Communications, Inc.**, an Atlanta-based operator of CATV systems, has selected **Scientific-Atlanta's Series 6500** distribution equipment for use in rebuilding and expanding 1000 miles of its cable systems **Micro Consultants, Inc.**, has sold NBC a package that includes the DSC 4000 (digital standards converter) and DPE 5000 (digital production effects unit). The DSC 4000 will be installed in NBC's London News Bureau, and will ultimately be used to transmit telecasts of the Moscow Olympic Games back to the U.S.

Meredith Corporation will purchase **WPGH-TV, UHF**, Pittsburgh from Pittsburgh Telecasting, Inc. pending the consent of the FCC. Presently, Meredith is the O&O of four VHF stations and six radio stations **NEC** announced the sale of the **100th Frame Synchronizer** sold into commercial TV service **RCA** has announced the sale of its **1000th TK-76**, destined for delivery to **WTVW**, Evansville, Indiana **Audiomarketing, Ltd.**, exclusive distributors for Allen and Heath and HH Electronics, has moved to 652 Glenbrook Road, Stamford, CT **Jerrold Electronics** has been awarded a turnkey contract by United Cable Television Corp. for 148 miles of CATV plant in Bossier City, LA.

Four Philips VHF transmitters purchased by **WNEW-TV, NY** will be installed atop the World Trade Center. Two of the four transmitters will operate in parallel, with the remaining two also in parallel to provide a completely independent back-up system.

Pye TVT Ltd. of Cambridge (distributor for Philips Broadcast Equip. in Europe) will supply the Italian State Broadcasting Network, **RAI**, with television transmitters and cameras in a contract valued at over three million pounds. The order includes 18 LDK 5s, eight LDK 11s and 15 transmitters in the one, two and 40/25 kW range Pye will also supply the **BBC** with 16 LDK 5 color cameras **Arlington Telecommunications Corp.** (**ARTEC**) has selected the **Sylvania 4041** Programmable Converter for optional use with their CATV system. The 4041 is a 40-channel converter which can store and recall, in sequence, up to 10 selected TV channels. **BM/E**

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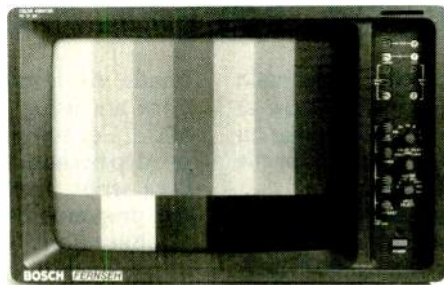
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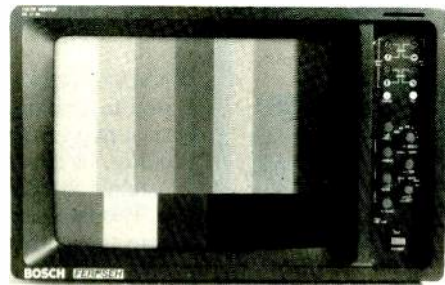
Circle 116 on Reader Service Card

Two in-line monitors from Bosch that will not hide picture defects

A finely textured mask structure in the tube will show you what your VTR is really putting out.



Bosch Fernseh
MC 37 BA



Bosch Fernseh
MC 37 BB

Certain in-line monitors are noted for their stability and pretty pictures. But they also have a reputation for hiding defects.

When you evaluate our selection of Bosch Fernseh in-line units, however, you will be face to face with the reality of your VTR's true capabilities. You will get all the picture stability inherent in the in-line concept.

But you will also get a fine enough texture to help you catch subtle video tape defects such as electronic moire and certain upper frequency noise and ringing problems.

The difference is in the mask

The secret of this remarkable resolution lies an eighth-inch behind the tube face in an extremely fine slotted mask structure.

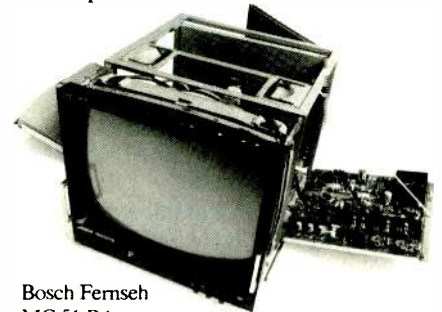
It was designed for Europe's 625-line PAL system. But by applying its fine texture to the American NTSC system, you can often see video tape defects another leading in-line tube might miss. That's because the defect will dissolve in the more coarse mask of the other picture tube.

Similar defects passing through the fine grille of one of these Bosch Fernseh in-line monitors will strike the screen undistorted.

control functions include contrast, brightness, synchronizing mode, chroma and input selection.

High resolution in a delta gun monitor

For exceptionally high resolution in 20-inch CRT, Bosch Fernseh offers the MC51BA system, our top-of-the-line with a superior quality delta gun picture tube. Circuitry covers a band width of up to 6 MHz for a test margin 1.8 million Hertz beyond legal broadcast specs.



Bosch Fernseh
MC 51 BA

For further information on the Bosch Fernseh line of color monitors write: Robert Bosch Corporation, Fernseh Group, 279 Midland Road, Saddle Brook, New Jersey 07662. Or call collect to 201/797-7400. For inquiries outside North America contact: Robert Bosch GmbH, Geschäftsbereich Fernsehanlagen, Postfach 429, D-6100 Darmstadt, Federal Republic of Germany.

The Full Bosch Line		
The color monitors discussed here are only a small part of the comprehensive monitor program offered by Bosch Fernseh. It includes 20 different B/W and color models developed for all television applications.		
Quality	B/W or Color	Type
Precision Monitors	B/W	M 24 BA M 38 BA
	Color	MC 37 BA MC 37 BAB MC 51 BA MC 63 BA
High-quality monitors	B/W	M 24 BB M 38 BB M 50 BB
	Color	MC 37 BB MC 51 BB P12 (67 cm)
Standard monitors	B/W	T 14 BC T 31 BC T 50 BC T 61 BC
	Color	C 21 (67 cm) C 31 (67 cm)
Special monitors	B/W Viewfinder	K BB (2.5 cm) K 14 BB

Precision and high quality units offered

The MC37BA is a precision monitor with a 15-inch CRT and a band width of 4.2 MHz. It has three 75-ohm video inputs, two of which can be superimposed for lining up chroma key shots. A three-position raster size switch gives you large, normal and small sizes. Vector output lets you do phasing and other applications.

The MC37BB is a high quality monitor designed for picture evaluation. It has two video inputs, a two-position raster size switch, and switchable color temperature.

Decoder boards convert both monitors from one television standard to another. Servicing is just as simple. Many PC boards swing out on connector hinges so operation can continue. Remote

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- Standard DA504 systems are supplied with up to six active, balanced AT310 distribution amplifiers, c/w self contained PS855 power supply.
- Each amplifier is supplied with 12 600 ohm output splits.
- Remote, D.C. or computer ramp gain control available.



DA505

- Standard DA505 systems are supplied with up to six AM487 self powered amplifiers.
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- Each amplifier capable of driving a maximum of 75 output splits, 600 ohm, or delivering 20W into 8 ohm load.
- Remote controlled mute circuit in each AM487.
- Front-mounted power heat sinks provide a cool interior operation.
- Larger audio distribution systems are also available.

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RADIO

PROGRAMMING & PRODUCTION FOR PROFIT

Fresh Combinations—Public Affairs/ Entertainment, Service/Profit

A MAJORITY OF THE PROGRAMS a radio station ordinarily puts out combine at least two values, the usual combination being, of course, entertainment for the listener and profit for the station.

The two sets of programs described here carry other combinations. The first puts together public affairs and entertainment. The second set adds service for the listener to profit for the station. Whether or not these particular programs fit into a station's planning, their value combinations may alert station managements to be on the lookout for other programs that can similarly add variety to station output. Stations that produce programming may be stimulated to develop material in like categories.

Forscom: fine music plus the Army story

The US Army Forces Command ('Forscom'), embracing the regular Army, the National Guard and the Army Reserve, is offering free to any radio station two series of weekly 15-minute programs, "Update" and "Country Roads." The programs are distributed on stereo discs — four programs at a time on two discs sent out each month. The station can have either or both series, and can play each program as often as management wants.

"Update" consists of "contemporary" Top 40 material from the most popular artists. There are four or five selections in each 15-minute program, plus from one to two minutes of talk about the Army, stressing its value and service to the community (i.e., emergency help in civil disasters, storm and flood relief, readiness for defense). There is *no* recruiting. The total objective is to alert listeners to the Army's services to the community as a whole.

"Country Roads," as the name indicates, is music from the most popular country artists, again with four to five selections in each 15-minute program, plus the Army story.

BM/E listened to sample programs from both series on the regular discs as supplied by Forscom, and found the technical quality excellent and the handling of the music smooth. A broadcast station can certainly air this music as it

stands. At the moment, about 500 stations are using "Update" and about 400 "Country Roads," with a small overlap because a few stations are using both series. Each station using one of the programs can chalk it up in the "public affairs" column, to satisfy part of its commitment in that category. At the same time, the music can hold its own as an audience pleaser — in fact, one station manager told *BM/E* that he recorded the program in both "public affairs" and "entertainment." The half-dozen station managers *BM/E* talked with all said the music could be fitted readily into their various formats, at least on a once a week schedule. All praised the technical quality and "currency" of the selections.

To get sample records or to order the series, the station management should write Headquarters, US Army Forces Command, Attn. AFPA-C1, Fort McPherson, GA 30330, or call Staff Sergeant Danny Gates, 404-752-3465.

Service programs with sell attached

Programs that serve the listener with specialized information, and include some "handle" for station profit, have been around for a long time. Susquehanna Productions has assembled an especially interesting group of such "feature" programs. They were originally developed for Susquehanna Broadcasting, a chain with 12 major market stations. Susquehanna Productions, a subsidiary of Susquehanna Broadcasting, was formed with the specific assignment of syndicating the programs. Since they originated as regular radio programs and won their way on the air in the 12 markets, they are particularly convincing as feature material.

Along with material on the programs, Susquehanna has prepared brochures advising subscriber stations how to sell the programs to sponsors. This sales advice seems most professional and informative. Many stations, of course, will have their own ideas about selling, based on their particular markets, their sales personnel, etc. The Susquehanna sales material, though, will probably prove to be helpful in a lot

continued on page 28

HEAR FROM US BEFORE YOU HEAR FROM THEM.

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Radio Programming

of cases.

Here are some important Susquehanna programs:

"Farm Profit On the Air," which Susquehanna says is now on about 200 stations, is a three-minute daily program, five days a week, with 10 programs (two weeks' supply) forwarded to the station on tape every other week. The show consists of commodity forecasts in livestock and grains (about 60 percent); statements by representatives of leading farm organizations; and tips on farm business operation from such organizations as Doane Agricultural Service.

Produced by Susquehanna, the series is partly underwritten by Massey-Ferguson, farm machinery maker, and each program carries a short tag referring to that sponsorship. In addition, there is room for a 60-second commercial. The station must offer this first to the local Massey-Ferguson dealer (if there is one). If the dealer turns this down, or does not exist, the station can sell the spot to anyone else, except a direct competitor of Massey-Ferguson. The cost to the station is \$37.50 per month.

"The World of Commodities" is a 90-second to 2-minute program, fed four times daily from Chicago commodity markets over inbound WATS lines to the station, where it can be recorded. Included is space for a local commercial. The material is daily farm commodity market news, plus an analysis and commentary (the fourth program) by research directors of the Clayton Brokerage Co. of St. Louis,

who are partial underwriters and get a closing tag of no more than 10 seconds. Rates for the full series are \$66 to \$131 per month, depending on market size.

"America 2000" is 260 programs of 90 seconds each, dramatizing what America will be like in the year 2000, with room for local sponsorship. Cost is \$260 to \$330, depending on market size.

"Family Health with Dr. William Lattanzi" (of the Yale University School of Medicine) consists of three-minute health tips, discussion of health problems, etc., with a break for a local commercial. It is distributed 65 programs at a time on tape; the fee to the station is \$100. Susquehanna suggests that each program be run more than once because of the high interest, cutting the cost very low indeed.

"Magazine of the Air" combining features, stories and personalities told by Stan Matlock, is distributed in groups of 130 90-second programs on discs. Cost to the station is \$130, again with room for local sponsorship.

"Tips on Flowers and Plants With Susan Wilson," 52 two-minute programs sponsored by the Society of American Florists, is distributed at no cost to station.

Susquehanna has a number of other series of short features, and any station looking for this kind of material should write their marketing division at 199 Wayland Street, Hamden, CT 06518, or call 203-288-3765 for a complete list. As the descriptions show, a variety of payment and sponsorship arrangements can be made for programs of this kind; station program producers may find their ideas about the values of such programs enlarged.

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So Tanner made a smashing entry

into the business in 1977-1978, and the venture already seems a marked success. But Tanner did not really start from scratch. For a number of years Tanner has been the largest producer of customized jingles, IDs and commercials for radio and television, with literally hundreds of clients. The company is also said to have the largest media placement operation in the US.

Tanner has a complete program production plant, with an array of studios and recording equipment, and the personnel to make use of the plant — composers, arrangers, recording producers and engineers, among others. This machinery and talent has been used to produce, for example, custom music commercials, which consist of a musi-

continued on page 30

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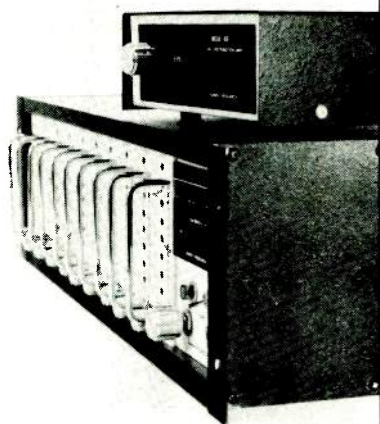
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Radio Programming

cal background arranged to project the desired image of the station and to provide a setting for commercials the station itself will put in final form. The company also produces hundreds of straight commercials for ad agencies and individual clients — it claims to be the country's largest in this field.

Getting into syndicated programming, therefore, started with the advantage of a plant in being. It required, of course, personnel with responsibility for putting together programs devoted to entertainment rather than selling. Tanner could make use of its large marketing group, with hundreds of contacts across radio station managements among the country, to find clients for the syndicated programming.

The 55-station client list for syndication shows how well this has worked out. Keith Lee, general manager of the ID-Library Division, responsible for the syndication operation, believes a substantial part of the reason for Tanner's success is the "customizing" Tanner does for individual stations. In close consultation with each station's management, Tanner personnel discover what style of music is wanted, and what character within that style — contemporary, "middle" or "mellow." The analysis naturally takes into account the competition in the station's market, any evidence from surveys of what the majority of area listeners want, and the specific listener population the station is aiming for.

This analytical prelude to the assembly of the programming becomes convincing to the station management, Lee says, because Tanner personnel are thoroughly aware of station operation and selling problems, and have developed sophisticated solutions to such problems. Furthermore, Tanner consultants have a large measure of flexibility in their recommendations to the station management because each of the four available formats has internal variations that can be incorporated into the final program mix. The programs, as delivered to each station, are put together to achieve the specific aims that were determined in the pre-start analysis.

Tanner's elaborate production facilities also contribute to this flexibility, making it easy to provide special programming arrangements. A plant on this scale might not be justified simply for syndicated programming, but the installation for the commercial, jingle and ID operations provides the syndication team with extremely resourceful technical personnel and equipment.

Tanner calls its syndicated programs the "Tanner Musical Spectrum," and

identifies each format by color as well as name. "Pacific Green" is a beautiful music format. It is unannounced; fees range from \$400 to \$1800 per month, depending on market size. There is a two-year minimum on the contract. The station should have four reel-to-reel machines (although three is possible), plus a cart system for commercials, PSAs, etc.

The programming starts with 96 10½-inch reels holding about 2800 titles; recording speed is 7½ ips. Four update reels are supplied monthly. Reel rotation schedules for each station are prepared with computer help to control the sequence of numbers for a pleasing flow and to avoid too frequent repeats. Tapes are returnable at the end of the contract.

Fees and other requirements are similar for the other three formats. "Bright Blue" is the MOR format, and it comes in three main varieties, with adjustments available in each to meet station requirements. All are available back announced, and are compatible with automated, semi-automated and live station operation. Programming starts with 35 reels, to which are added seven update reels (weekly and monthly) with current hits, "recurrents" (songs off the charts but still strong) and library material.

"Red Satin Rock" is "straight-ahead contemporary," according to Keith Lee: it is neither "mellow" nor "hard." It comes in two varieties, with adjustments within each, and again, it is this flexibility that has recomended it to a number of stations.

"Tanner Country" is the final format, and the content is evident from the title. It is like the others in most respects, and has won a strong following among broadcasters.

The success of Tanner's syndicated programming is just another shining mark for William B. Tanner, president of the company. He built his firm over some 16 years to its present commanding position as a producer of commercials, IDs and jingles, and as a media placement agency, with each operation now reaching multi-million-dollar scale. The success of the syndication operation indicates William Tanner's skill at choosing both creative and management personnel, since excellent musical taste is an indispensable element of choice and sequencing in programming — as mentioned in these columns a number of times. Keith Lee notes that Tanner's creative director, Joe Benson, is the man most responsible for the taste element. Benson has a long background of successful programming for radio stations and a firing-line indoctrination like that of so many of the other successful syndicators described in this series. **BM/E**

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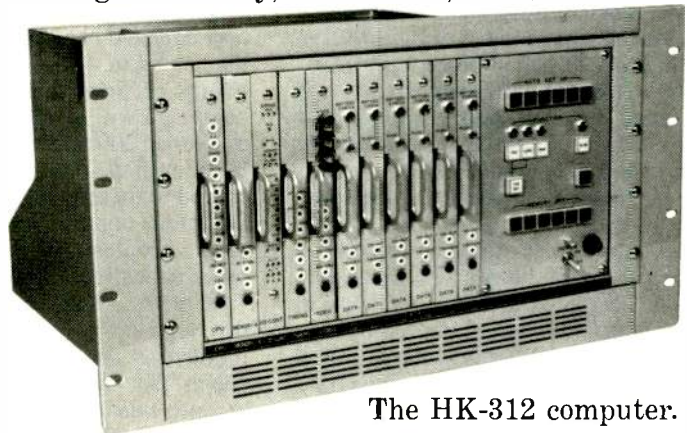
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The HK-312 computer.

Ikegami

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TELEVISION

PROGRAMMING & PRODUCTION FOR PROFIT

WNJU, Ch. 47: Reaching The Spanish Core Of The Big Apple

THERE ARE SOME BROADCASTERS who wouldn't envy anyone who possessed a UHF license in Linden, New Jersey, where the competition consisted of the three network flagship stations, three powerful VHF independents, WNET (one of the nation's leading PBS stations) and seven other UHF competitors. But on the other hand, a built-in audience the size of Columbus, Ohio or New Orleans would make some stations' managements ecstatic.

When Carlos Barba, vice president and general manager of WNJU, arrived at the station seven years ago, he too was less than ecstatic about the proposition of taking over. The 30kW transmitter with its antenna on the Empire State building was in bad shape. Sales were running at just \$1.5 million per year and programming was less than spectacular. Then the exciter blew on the transmitter and Ch. 47 was off the air for seven days. Today, the Columbia Pictures Broadcasting station has a good strong signal aided by three translators in its most critical areas and annual sales are running at \$4.5 million with an average growth of 14 percent per year.

This impressive turnaround was achieved step by step. Barba's first move was to improve the signal. He then began an aggressive policy of building his audience and improving sales. The potential Spanish-speaking audience in the New York area is estimated at 537,000 TV homes. To reach this group, Barba adopted a very strong promotional campaign, backed by programming a careful mix of the strongest Spanish language product he could find. The formula consists of children's programming (mostly Anglo programming dubbed to Spanish), heavy use of the novela (the popular Latin-style serial drama or soap opera), numerous Spanish variety shows produced in Puerto Rico and Latin

America, and a heavy dollop of comedy from the Latin world. This regular programming is rounded out with many musical specials produced for the Latin market here and abroad.

Barba, whose career encompasses sales, promotion and programming positions at stations from his native Cuba to Venezuela, strongly believes that "any television station that cannot sell its own programming through its own medium cannot claim to sell any advertiser's products effectively."

With this in mind, Barba has launched an ambitious program of station promotion. The novelas, for instance, are the basis of "man (or, usually, woman) in the street" type interviews where a passerby is asked her opinion of the forthcoming marriage between two characters in a popular novela. The reactions can be very emotional, with the passerby registering horror that this "wonderful man is going to marry 'that' woman." These bits are aired to help build excitement around the continuing drama. Ch. 47 is now engaged in a new promotion on the theme, "Ch. 47 — in the heart of the homes of Spanish New York." This campaign will involve the recording of more than 200 interviews with Hispanic families in their homes viewing Ch. 47. Added to these types of promotions are numerous contests for the viewers, including contests for children that have a basic educational flavor.

If there is any doubt as to whether this type of promotion sells Barba's product, a special Pulse, Inc. survey shows that WNJU attracts more than twice as many Spanish-speaking homes (some 217,000) on an average weekday night during prime time (6-10 p.m.) as the combined total (98,000) attracted by the three New York network flagships. That fact, in and of itself, might not be too surprising if WNJU had the



Carlos Barba, vice president and general manager of WNJU, Ch. 47, with some of the thousands of letters received by the station for a Libby's campaign it produced

market all to itself. But another UHF station, WXTV, Ch. 41, also programs to the Hispanic market in New York, and Ch. 47 still garners approximately 50 percent of the Spanish-speaking audience during prime time on an average weekday night. There are times, in fact, when Ch. 47 scores higher in the Arbitron ratings for the total market than any of the independent VHF stations, according to Barba.

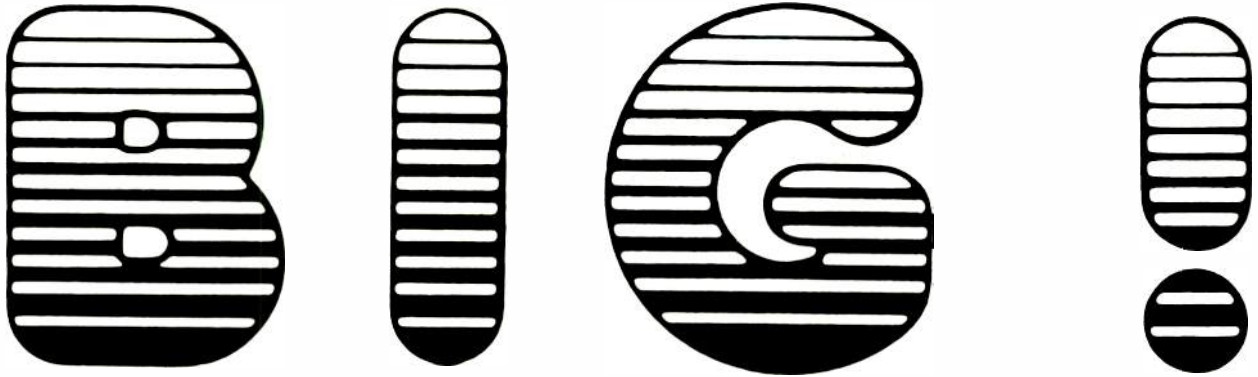
Selling the numbers

It is one thing to have the numbers and another thing to sell them. Barba points out that the Spanish-speaking market is made up of many groups who are here in the U.S. for a variety of reasons. "Some," says Barba, "are here to find work because of depressed conditions in their native lands; others are here for political reasons, like the Cubans, and others, such as the Puerto Ricans, are here for a variety of reasons, mostly economic." Ch. 47's audience is 65 percent Puerto Rican and its programming reflects this proportionately. The national average income for Spanish-speaking people is \$9500 per year, according to Barba, and when these people arrive in the U.S. they are already "active consumers." Generally, Barba says, these people find work as soon as possible and immediately begin to acquire the necessities of life such as housing, clothing and food. They then turn to the acquisition of luxuries such as automobiles, cosmetics, and other common pleasures.

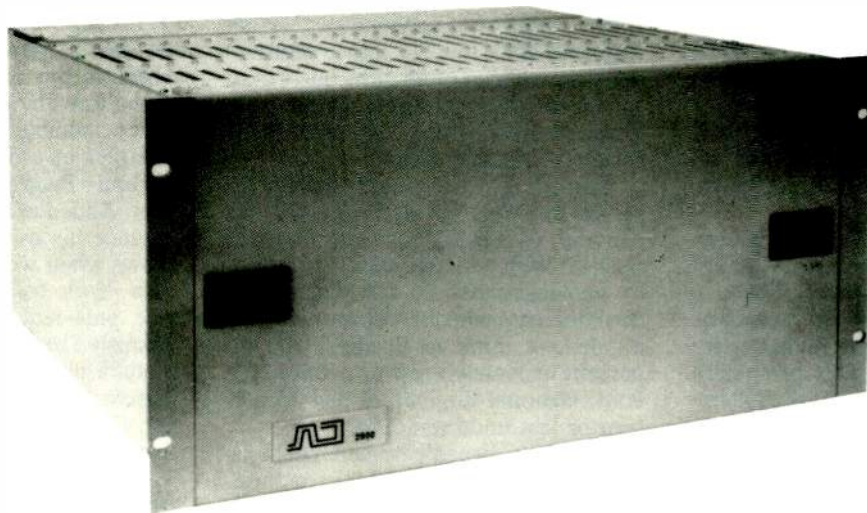
The national Hispanic market is approximately 25 million people (not counting illegal Spanish-speaking residents). When they arrive here, they already have an active knowledge of many U.S. manufactured products which are widely advertised and sold in

continued on page 36

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TV Programming

Latin American markets. Companies such as Colgate, Coca Cola, Gillette and Procter & Gamble need only to reinforce the awareness of the newly arrived in order to keep them in their column as active customers and to prevent their exposure to other brands.

This special audience, however, also represents a challenging new market for the local advertiser, the supermarket and the department store. Whereas the international marketer may already have some expertise in dealing with Latin clients, the new advertiser often needs help. To this end, Ch. 47 is prepared to produce commercials for such clients and will also recommend Latin advertising agencies if necessary. Some large companies, such as McDonalds, spend heavily on Spanish advertising to produce effective commercials. Others only dub their English language commercials to Spanish. Commercials produced off-shore for the Latin market are sometimes used, but this depends on contractual arrangements that sometimes get in the way.

Ch. 47 is also prepared to help with marketing. In a recent case, Ch. 47 came up with a contest for Libby's in which a well known Hispanic actor was masked and viewers were invited to try to guess his identity. This promotion soon started generating almost 2000 letters a day for the client.

Sometimes, says Barba, a client will express some skepticism about the value of the Spanish market. Barba frequently takes such a client to some of the New York area's 5000 bodegas (Hispanic grocery stores) and shows him his product on the shelf, frequently next to that of his competitor who already advertises on Ch. 47. This has proven to be a fairly effective gambit when paired with 47's willingness to provide expertise in reaching the Latin market. If a client elects to have the station produce a commercial, Barba charges only cost to help the client preserve his budget for frequency.

National and local advertisers are discovering this market with increasing regularity. The station's client list now includes more than 36 national advertisers of drugs, cosmetics and toiletries; 21 supermarkets, department and retail stores, both local and chain; 14 beverage companies; seven travel companies including three airlines; 38 food products, most of which are national brands; 24 household products; and more than forty miscellaneous clients such as banks, insurance companies and entertainment outlets.

Though Barba takes no particular credit for it, he notes with some pride

that when Banco de Ponce began advertising on Ch. 47, it had just two branch offices in New York; now it has 11.

Major emphasis on public service helps the community and the station

Serving a Spanish-speaking audience brings with it some unique opportunities and responsibilities. According to Barba, many, if not most, Latin immigrants come to the U.S. with the intention of returning to their native countries after securing economic well being. This dream, for many, never comes true. After a few years of living and working in the United States, the immigrant finds that the family he is raising is quickly becoming accustomed to the North American lifestyle, and plans for returning home get put off indefinitely. Nevertheless, as Barba pointed out in a recent speech in Miami, "When I arrive home at night after work, I arrive in my country." What Barba means is that the plan to return to one's native land often turns into a conscious effort to preserve native customs, traditions, and language in the Spanish American home.

According to a recent survey reported in *Television & Radio Age*, 82 percent of Latins communicate in Spanish with their spouses; 73 percent of persons under 25 use Spanish to communicate with their closest friends; 89 percent think in Spanish, and 56 percent understand few or no words in conversational English, or had 25 percent or less understanding.

Thus, the Hispanic home tends to be a fervent repository of Latin culture. Moreover, non-ethnic media tend to serve their needs only minimally. So stations like Ch. 47 take on a major responsibility for encouraging and reinforcing the pride of the Hispanic community.

One way WNJU does this is with a public service spot which honors a different Hispanic man or woman for community service each week of the year. Each spot is run 15 times during the week. In addition, numerous public service spots are produced using animation or well known personalities to provide vital information to the audience. Ch. 47 also covers important community events live. The annual Puerto Rican Day Parade, for instance, is covered live using a remote production vehicle provided by EUE/Screen Gems, another Columbia Pictures enterprise.

The WNJU news department is also oriented to the community. The department consists of a news director and three reporters, with a recently added female reporter/writer. In addition, a news program from Puerto Rico is flown in and aired daily. News from other Latin nations is provided by OTI, a consortium of Spanish-speaking

countries in Latin America and Europe. OTI also provides entertainment and sports programming.

This summer Ch. 47 will carry live, via satellite, the international football (soccer) championships from Argentina (see story in *BM/E*'s April '78 issue). As a member of OTI, Ch. 47 also participates in co-production efforts. This year Ch. 47 will produce the New York segment of a program called, "The World At Night," which will feature Hispanic stars performing in such places as Paris, Mexico City, Rome, Buenos Aires and San Juan. The program will be carried by all OTI member stations with a potential audience of 300 million people.

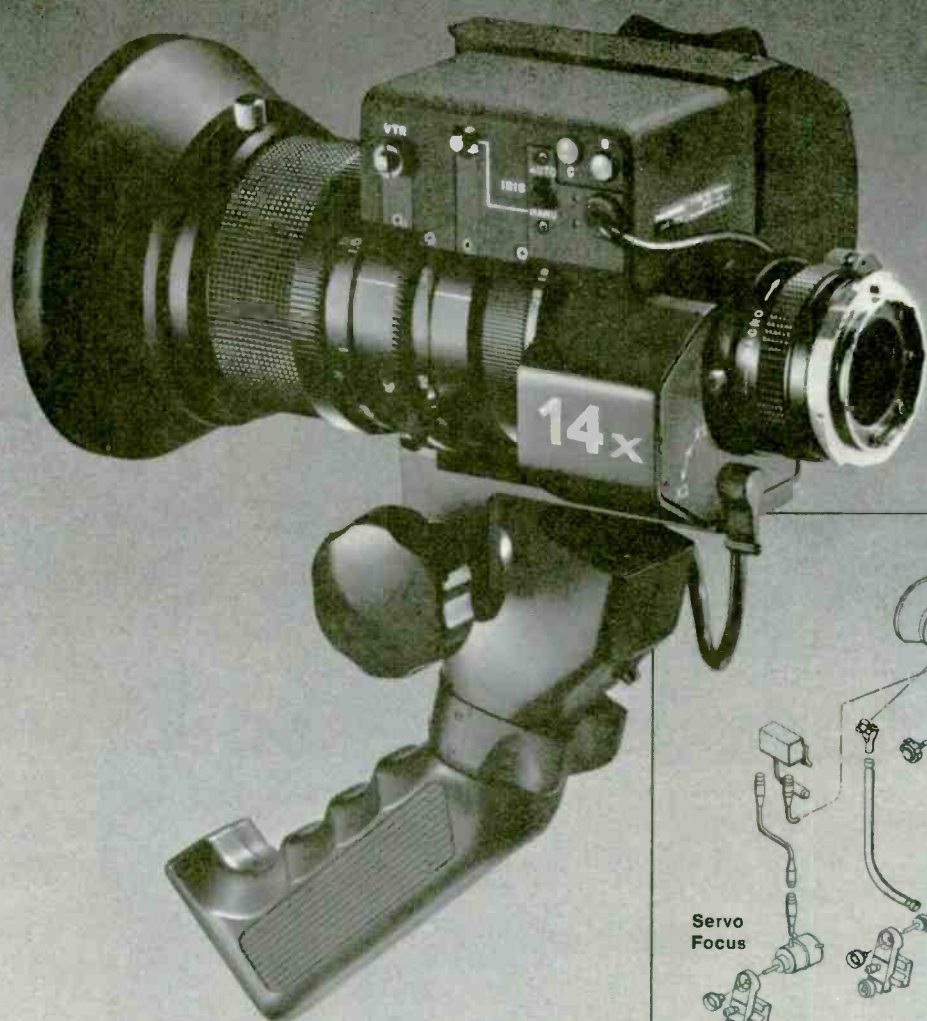
Getting product for the Spanish market

Obtaining high quality programming for this specialized market is not as difficult as it might seem. As a member of OTI, Ch. 47 gets to select from some of the best programming produced anywhere in the Latin world. Moreover, Barba travels widely to screen programs suitable for his audience. He may pick up a Brazilian soap opera one day and a Puerto Rican variety show the next. Added to this are opportunities to produce his own musicals and variety shows when well known stars play the New York nightclubs. Barba is also vice president of Columbia Pictures' Spanish Theatrical Film Division, and as such produces and acquires motion pictures for the Spanish-speaking market. Columbia Pictures' Spanish Theatrical Film Division has exclusive U.S., Spanish and Puerto Rican distribution rights for many motion pictures.

Barba also sees the day in the not too distant future, "maybe five years away," when the entire Spanish-speaking world will be linked by satellite for the purpose of network programming. Predicts Barba, "Latin America will become a network. I am trying right now to work out a deal to run a 'Cantiflas' film by satellite with a live introduction by Cantiflas from Mexico.

"The idea," Barba says, "is to satellite cast the film program to all Spanish markets and to sell the advertising here and collect your advertising revenue in dollars here." Barba says that this approach will be much more efficient since collecting advertising revenue in many Latin American countries is difficult. Barba intends to use six commercial minutes here to pay for the production with other commercial availabilities for the receiving stations. The receiving station will pay for the downlink but the program will be free. The political climate in South America is changing, says Barba, and this type of idea is no longer beyond the realm of possibility. **BM/E**

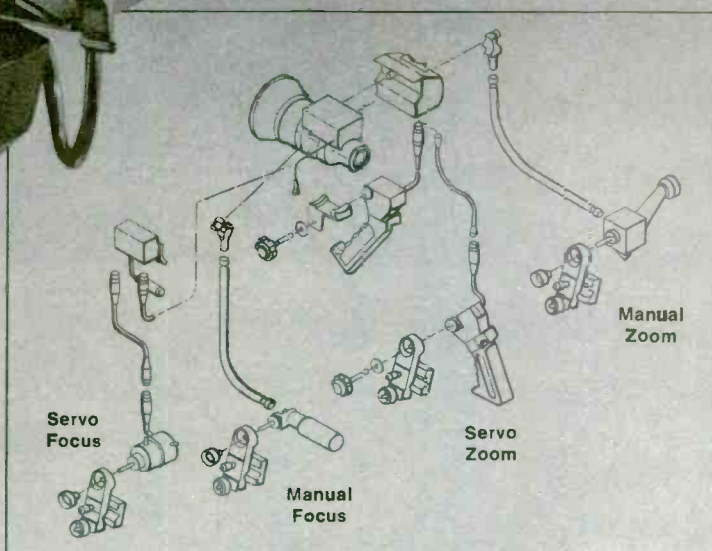
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How else would you describe Fujinon's exclusive 14X zoom lens? It has everything built-in, including a lever controlled 2X extender. Not to mention its dual controlled servo zoom and focus, manual zoom and focus, macro focusing, adjustable back focusing, dual VTR switches, momentary iris switch, auto/manual iris, and optional studio conversion kits.

On a portable camera, it's compact, lightweight and easy to operate. It gives you f/1.9 speed and the flexibility to tackle any field or production assignment. You can zoom from 10 to 280mm. Focus down to 13 inches. And then you can select from Fujinon's conversion accessories to use the same lens on your studio cameras. With any combination of servo and manual

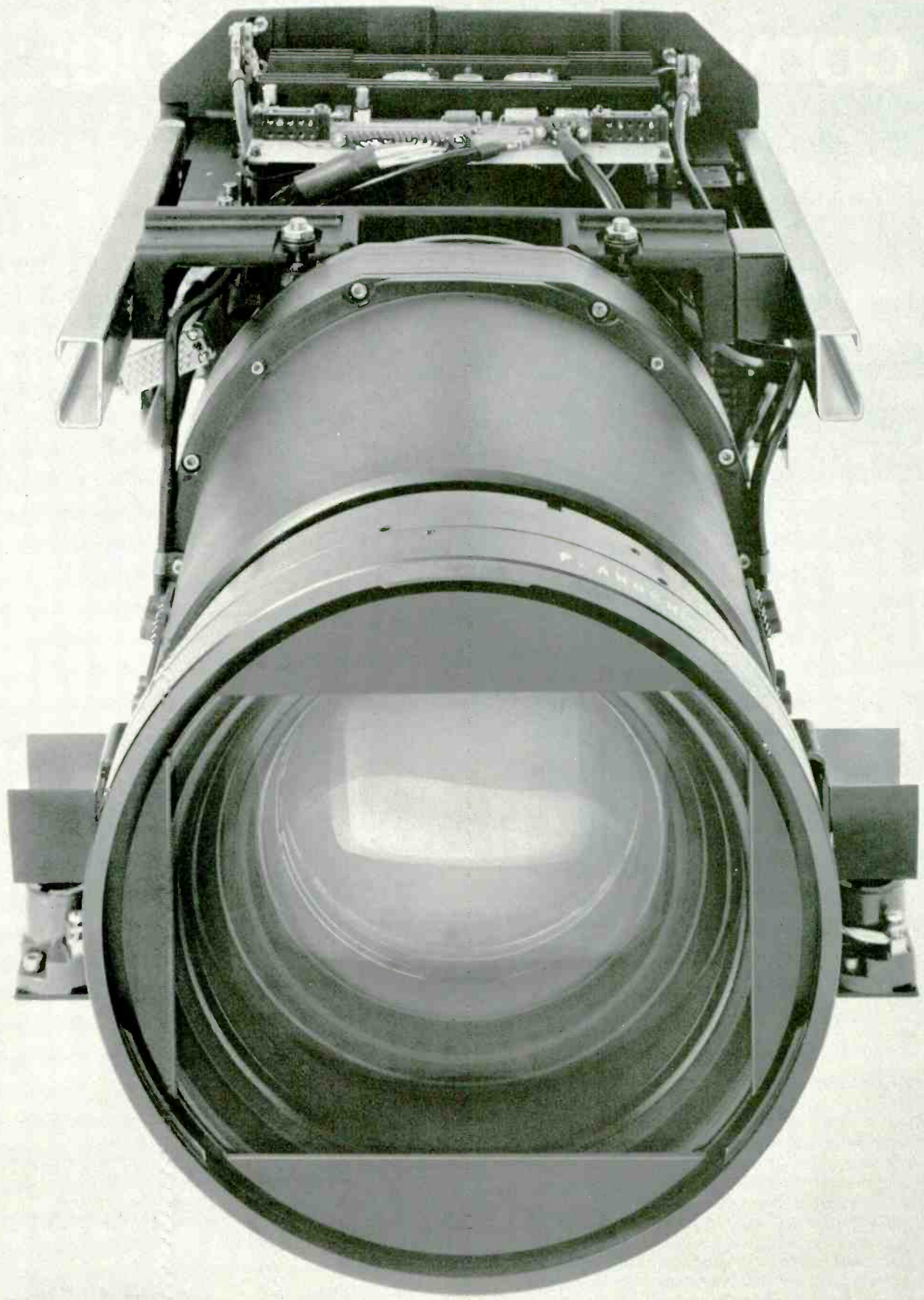
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Photos courtesy of Compact Video Systems, Inc., Burbank, CA

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Just imagine, capturing panoramic scenes with an extremely wide horizontal shot (56°) from 117 feet away, (as shown in the above photos taken at the L.A. Music Center). Then, zoom in continuously for a tight close-up, filling the screen with a detailed view of an individual or object. We call it the ultimate in flexibility, you'll call it the most versatile lens in your studio or on location. Imagine what you could do with a Variety Show or Drama, a Sports Event or a Commercial. Imagine using the 42x for more effective shots, significant time savings and reduced costs.

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Audio Production: Program Backup and Profit Maker

By applying their special audio and creative skills to moderate assemblies of audio production equipment, many stations have built highly profitable sidelines in production of commercials, sometimes on top of program production.

IN TIMES PAST the "production department" was a safety operation, a backup, a way of correcting errors in program material received from the outside and of editing news or other local remotes for broadcast.

Then came the practice of putting everything on carts or reel-to-reel tape for broadcast, and production became a main-line operation for a considerable number of stations. The quality and efficiency of production systems became urgent matters, and station engineering departments had to sharpen their audio skills (see "How To Make Record-

ings That Put A Good Sound On The Air," *BM/E*, November, 1977).

Over the years, though, a third phase in the life story of audio production has been building up: the production of commercials by the radio station, both for its own clients and for ad agencies and other outside clients. In a sampling of radio stations, *BM/E* found a number with excellent audio production equipment. Many are using the equipment primarily for production of commercials; a few do both program and commercial production. The income that in-house commercials bring is to some extent an "extra," developed with skills already available in many stations, and with a small or moderate investment in equipment (stations equipped to produce on-air programs will probably already have a sizeable part of the equipment, perhaps most of it).

But every station manager or program director operating a commercial production department impressed on *BM/E* the fact that the production equipment must be top quality. In medium sized to large markets, the station will be in competition with various kinds of "production houses." What wins for the station is technical quality considerably above that produced in competitive shops. Even in small markets, where the station may be providing a service that can't be had elsewhere, high quality proves valuable in helping the station's sales force sign up new business. A demonstration ad that opens the prospect's ears to new dimensions in sound has proven to be a powerful client persuader.

A further advantage a radio station has in the commercials business is the ability to offer favorable rates to advertisers who, as part of the deal, agree to contract for a number of airings of the ad. This kind of "profit consolidation" benefits both parties.

In Pueblo, Colorado, Frank Provenza, program director of KDZA/KZLO, has put together a production department that illustrates well the profitability of excellent quality. The production equipment includes three Ampex 440s, three Revox A77s, six ITC cart machines, a Sony MX-20 mixer, six turntables (also used for on-air), a programmable timer and a 25-Hz generator for cue tones. This setup is used to make *more than 80 percent of the ads* that run on the two stations. Most often one member of the production staff takes total responsibility for an ad; this may even include creating the original idea, in which case the production department is acting as an ad agency.

Whether the ad is created in or outside of the station, the staffer responsible will usually write the voice copy, record the voice track, choose music from the station's large library of records and special effects and mix the voice and



(Above) Production director David Martin, WFYR, Chicago, edits commercial on Scully tape machine. (Below) Voice track is added to spot in production room of KDZA, Pueblo, Colorado



music onto a cart for the finished commercial. This procedure implies, of course, that the station management has seen fit to hire one or more people with the necessary skills. Otherwise, people with the right potentials must be trained by the management. Provenza told *BM/E* that the investment in such personnel has proven to be extremely worthwhile for his two stations.

The station's ads have won numerous awards from the Colorado Association of Broadcasters. An unusual tribute to the quality of the operation is the fact that a local TV station hires Provenza's crew to make the audio part of many of its programs, especially those involving slides and other stills.

The Ampex 440s are used for mastering, the Revox for backup. Especially valuable in this kind of operation, says Provenza, is the sel sync mode on both the Ampex and the Revox machines, which makes it convenient to do voice-over-music or music-over-voice. Also quite useful is the pan pot facility on the Sony mixer. All commercials are done in stereo so they can be used on KZLO, but also because of the opportunity for "effects" that stereo provides.

Essential, Provenza explains, is a staff conscious of top sound quality and the necessity of working hard to achieve it at all times. With personnel skilled in using the machines, making one person responsible for total production of an ad eliminates slippage in quality control. All the machines are heavily used — they are earning their keep nearly constantly during the working day.

Another audio production department in which insistence on top-most quality has paid off is that of KGRA, FM'er at Lake Charles, Louisiana. Chief engineer Randy

Schell reports on his use of MCI tape recorders and custom-built Automated Processes consoles. The station's regular programs are live from discs, so the production equipment is used almost entirely for commercials. A secondary use is for some IDs and PSAs.

Also in the production line is a Technics SP-10 turntable, mounted on a 600-pound concrete block to resist vibration from outside. Schell considered this necessary because the building is an old one, with other offices next to those of the station, and outside vibration was a frequent problem. Schell notes that he can sharply kick the turntable cabinet without the slightest effect on the pickup stylus.

The Sennheiser 421 mics have equalization and compression on line. Ampro cart equipment is used for the final commercial mix. The whole audio setup of the station, including the production department, was designed with the aid of the well-known consultant, Harvey Rees.

The MCI tape machines are used for mastering and editing. Schell particularly likes the "built-in" sync system which allows one MCI machine to slave another one: the generator driving the capstan in one machine can be bridged over to the other. This extends to having the slave track exactly any speed adjustments on the master. It is worth emphasizing that Provenza, Schell and the others included here do original recording and editing on tape machines of top-most grade; it has been a part of recording wisdom for a long time that to get to the end of a production process with good quality, you have to start with superb quality.

The production lineup also includes several graphic

continued on page 42

CHOOSE YOUR ROUTE.



Model 101 — a 10 x 1 stand-alone routing switcher featuring:

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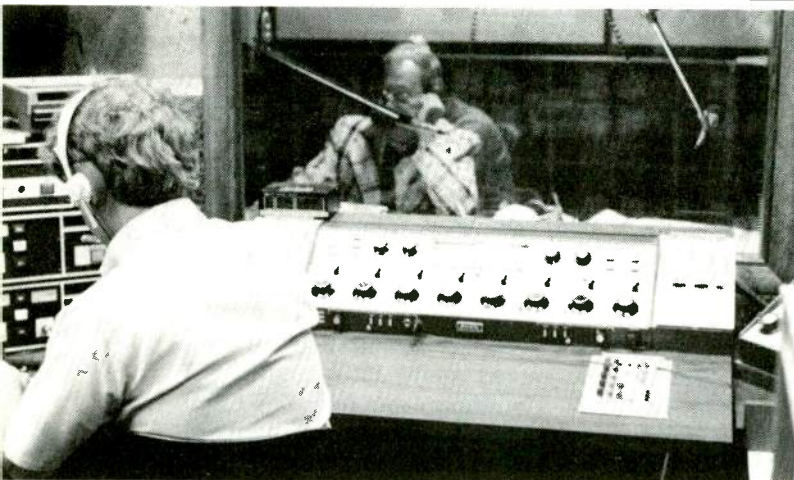
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Audio Production



Production studio at WCCO has cart machines next to operator for easy handling of spot production. The room can act as on-air studio if master control is not useable



News-gathering production center at WCCO has two identical units, like the ones shown, for versatility recording in and assembling news shows from submitted material

equalizers, but these are not used for material mastered at the station. From time to time a client or ad agency hands Schell a recording in some form which must be incorporated into an ad. A fair proportion of these, says Schell, are technical disasters, and heavy use of a graphic equalizer has "saved our lives a number of times."

Schell reports frequent experience of the value of his top-grade equipment in selling new accounts for the station. "We do things with spots that other production operators in the area can't do," he says. He would like to be able to do even more, and hopes before too long to install a four-channel MCI machine for the great increase in editing flexibility it will bring.

At WROK/WZOK, Rockford, Illinois, chief engineer J.E. Sheppler has thoroughly functionalized production departments, one for AM and one for FM. Both are used primarily for commercials. A lot of the work is for ad agencies. Ampex 440s are used for mastering, and many commercials consist of voice tracks, produced with station personnel and then mixed with the music, which may be supplied by an ad agency or come from the station's library.

After mastering and editing on the reel-to-reel machines, the commercials go onto carts, as in the other stations described here. Sheppler has a multiple-start con-

trol on the production console, which will start tape recorder and cart machine simultaneously. There is a battery of turntables for pickup of music from discs, and included with them is a variable-speed accessory. Sheppler reports that this has proven very handy both for making music come out just right, and for some special effects.

Shure variable equalizers and other processing equipment can be cut into the audio line for special effects. The processing can also be used to achieve minimum acceptability in the often poor recordings brought in by ad agencies for incorporation into ads; this method parallels the similar operation at KGRA.

All cart equipment in the station is ITC, including a new, still experimental ITC cart recorder of advanced design. For WZOK, the 50 kW FM operation, the format has recently been shifted from automated beautiful music to "live" album-oriented rock, with automation still used only late at night. The music is dubbed from disc to cart, as chosen by the station's programming staff. As already noted, suggestions for handling the disc-to-cart operation, in the interest of the best sound quality, appeared in the November, 1977 issue.

An elaborate audio production operation with a somewhat different look is that at WCCO-FM in Minneapolis. Chief engineer Chuck Kunze reports on the rebuilding operation that gave them a multi-room production capability (and won the station one of the awards in *BM/E*'s "Best Station Contest" of last December). The need for several production rooms arises from the station's high volume of special news broadcasts, including several varieties of farm news. There are many news features with actualities or other materials edited in. In addition, the station takes highlights out of the daily news shows for summaries on a daily or weekly basis.

Then there are the frequent telephone talk shows, which may go on live but later are rerun in edited versions. The station's music format, MOR, is primarily aired directly from discs, but a certain proportion of current hits are put onto carts for semi-automated use. This library, another production operation, is kept up to date. And there is also commercial production which in many respects parallels that of the other stations covered here.

WCCO-FM's new master control has a custom-built Ward-Beck console with 27 inputs. The main production control room has a Ward-Beck console which is a duplicate; it can be switched over to on-air if necessary. These two consoles are interfaced to what may be the most elaborate live telephone input in the country: fifteen lines, each with beeper, and with facilities for five-spot conference hookup. As noted, the talk shows can go on the air live but are also recorded and edited for later "feature" material.

There is a "news editing room" for putting together news cuts and clips; and there is the "cart room" for putting commercials on carts. All cart equipment is ITC. Mastering and editing are on Ampex 440s and ITC 850s. Processing equipment is available to ameliorate poor recordings as in the other stations described.

Chief engineer Kunze says that when the plans for the new operation were completed, it might have seemed that there were more high quality (and expensive) production facilities than the station could use. But it hasn't turned out that way — all the equipment has proved to be valuable, and the high quality of the equipment has paid off, too, in very low maintenance and top-grade results. *BM/E*



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video professional,
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If you're a video professional today, you're a tougher customer than ever. So JVC's rugged professional line delivers the quality and features you demand at prices you want to pay.

We know you've got a lean new attitude about the video equipment you buy, no matter how long you've been in the business. Or whether you're in broadcasting...a sophisticated corporate A/V operation...a top production house...or building your first video capability.

And that attitude is, with all the people vying for your video dollar, you want more state-of-the-art technology in equipment

that costs you less to own and maintain.

JVC's attitude is basic too. We build in engineering innovations—we don't add them on later. And we do it first. Which means you enjoy better picture and sound quality, easier operation, and sophisticated features you may not even find in equipment selling for twice the price.

For instance:

You wanted faster performance and greater accuracy in 3/4-Inch video editing.

And JVC's new CR-8500LU Recorder/Editor System offers bi-directional fast/slow search from approximately 10 times to 1/20 time, with editing accuracy to ± 2 frames.

It's a new generation of 3/4-Inch VCR editing—the fastest, surest way to get the frame-by-frame accuracy you need.

But JVC's CR-8500LU is still priced well below its closest performing competition.

With a single unit, you can edit with full functions and broadcast quality. Even if you don't happen to have special technical knowledge.

With a complete editing system of two CR-8500LU units and the new RM-85U Control Unit, you can perform the most advanced editing feats at approximately 10 times actual speed, then stop on a single frame.

Here's how the CR-8500LU gives you that kind of precision:

- **Frame to frame editing** is made possible with the capstan servo/built-in rotary erase head/blanking switcher frame servo design. A design that also ensures true assemble and insert editing with no distortion at the edit points. Plus horizontal sync phase compensation to minimize timing error at the editing points.

- **Variable speed auto-search** lets you perform both high speed and low speed search. You can search at approximately 10 times in fast forward or reverse to find edit points faster. Or slow speed search at 2 times, 1 time, 1/5 time and 1/20 time. Or use the special auto-speed shift feature to automatically slow you down from 2 times, real time, 1/5 time, 1/20 time.

- **Automatic pre-roll** enables you to pre-roll tape between edits, with an automatic on/off switch. Which can come in especially handy during successive assemble edits using camera signals.

allowing easy identification of the operation mode.

- **Full logic control** for direct mode change without pressing the stop button.

- **Remote control** of all operations, with the optional remote control unit RM-85U.

- **Audio level control with meters**, preventing over-level recording without audible distortion, with attenuator. Also, manual audio level controls let you adjust the audio recording level by checking the level meters.

- **Auto/Manual selection for video recording level control**, adjustable by the automatic gain control circuit or manually by referring to an independent video level meter.

- **RF output** to connect an external drop-out compensator.

- **Patented color dubbing switch** for stable color multi-generation dupes.

- **S.C./sync input connector** allows connection of time base corrector and allows for two second pre-roll.

- **Chroma level** can be controlled man-

ually for convenient connection to an external system.

- **Built-in comb-filter** for playback (switchable on-off).

- **Servo-lock indicator** to check the tape transport condition.

- **Counter search mechanism**, permitting Auto-Search of a particular section of the tape.

- **Solid construction for easy maintenance**: both side panels, top and bottom panels are detachable for easy access to the inside.

- **Tracking control meter** for maximum

tracking adjustment.

- **Heavy fan motor** for better circulation.

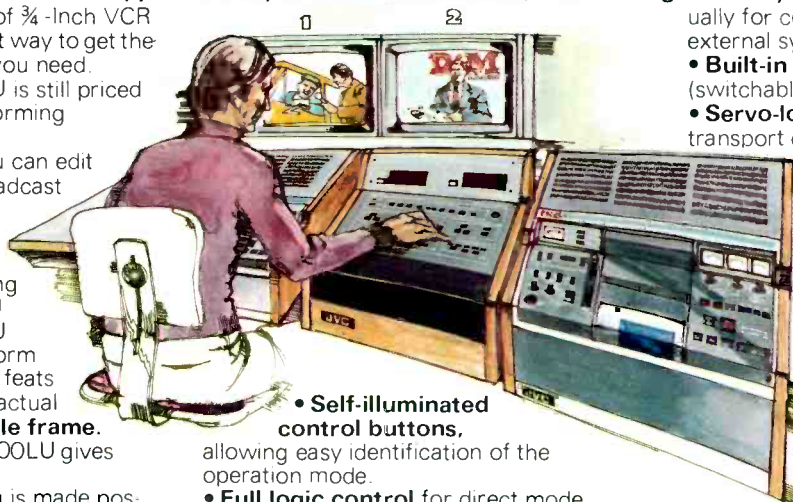
All that with one editing unit. But when you combine two editing units with our new RM-85U automatic editing control unit, you'll enjoy all the benefits of a total-performance system.

Starting with the kind of control only JVC's RM-85U can give you:

- **Independent LED time counters** for player and recorder, read out edit points in minutes, seconds and frames.

- **Edit-in and edit-out automatic control**. Four built-in memories let you control edit-in and edit-out points of both the player and recorder. And once starting and ending points are determined, accurate editing is memory-controlled automatically.

- **Edit shift control** allows frame-to-frame edit point correction.

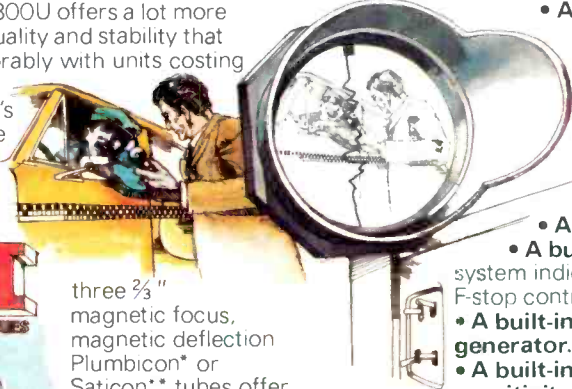


- **Lap time indicated** for each insert edit length by LED display.
- **Edit preview mode available**, for "rehearsals" of actual edits.
- **Edit-in point search mechanism.** After each edit, a Return button rewinds the tape automatically to the edit-in point, so it's easier to check edit conditions.
- **Auto-shift search mechanism** to step down the tape speed automatically, and ensure quick and accurate location of the editing point.
- **Tape safety guard circuit.** Because leaving the unit in the still-frame mode can eventually cause damage to tape or video heads, a tape safety guard circuit places the unit into the stop mode automatically.

You demanded more versatility in a moderate-priced, broadcast-quality camera.

And JVC's value-packed CY-8800U goes with you from studio to location.

Our CY-8800U offers a lot more than picture quality and stability that compares favorably with units costing twice as much. Thanks to JVC's technology, the CY-8800U camera, utilizing



three 2/3" magnetic focus, magnetic deflection Plumbicon* or Saticon** tubes offer total flexibility. And a rugged die cast chassis in front and back to hold up under the toughest conditions.

With the **Basic** configuration, it's a compact ENG/EFP camera that's completely self-contained—no CCU required. It's easy to operate, ready to plug into our CR-4400LU/CR-4400U portable recorder, with optional cables available up to 66 feet.

With the **Studio** configuration it's a hard-working studio camera. Just add the RS-8800U remote Synchronizing unit and the large screen, top mounted viewfinder.

And as for big-ticket features, we've built in what the others would let you add on later:

if it is left in the still-frame mode for more than 10 minutes.

- **Selective editing modes**—assemble editing, insert editing for audio channel-1, audio channel-2 or video.
- **Versatile editing capability** offering techniques like "edit-in/out," pre-roll, and automatic pre-roll.

You'll find that nothing in its price class performs anywhere near the CR-8500LU/RM-85U videocassette editing system. And that you'd have to spend a lot more on the competitive unit that offers many of the same features.

That's what we mean by giving video people more of what they want, for less than they expect to pay.

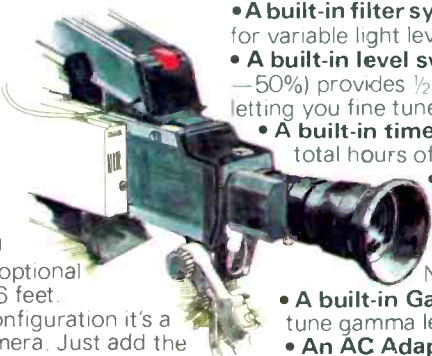
- **A built-in 1.5 Inch adjustable electronic viewfinder** for the convenience of the operator.
- **A built-in battery warning system.**
- **A built-in tally light.**
- **A built-in VSI**—video system indicator for precision F-stop control.

light level applications.

- **A built-in auto white balance.**
- **A built-in fast warm-up capability.**
- **A built-in electrical color temperature adjustment** for different applications (variable from 3000°K to 10,000°K).
- **A built-in filter system** (neutral density) for variable light levels.

- **A built-in level switch** (+50%, 0, -50%) provides 1/2 F-stop adjustment, letting you fine tune for added contrast.
- **A built-in time lapse meter** to show total hours of camera use.
- **A built-in intercom system** for studio applications.
- **An RGB output**, and NTSC encoding (Y, I, Q).

- **A built-in Gamma control** to fine tune gamma level.
- **An AC Adaptor**—standard.
- **Lightweight—17.4 lbs.—portability.**
- **Optional 12-to-1 zoom lens** with automatic iris and power zoom.



- **Built-in horizontal and vertical contour correction circuits.**
- **Signal-to-noise ratio of 49dB,** F 4/3000 lux.
- **Resolution of 500 lines at center.**
- **Return video** in the viewfinder.
- **A built-in -G circuit** for registration.
- **Minimum illumination F 1.9/300 lux** (+6dB switch on).
- **A comfortable hand grip** to stop and start the recorder. With a switch to operate iris control and a switch for return video.
- **A built-in CCU.**

And that adds up to a lot more features than you'd find in similarly-priced cameras.



You needed studio quality recording in the field.

And JVC's field-tested CR-4400LU

Portable Videocassette Recorder with automatic editing lets you bring your recording/editing capability wherever you need to shoot.

If you spend time on location in either ENG or EFP applications, you need a portable video system that can shoot, edit, and give you something to show in no time flat. Without awkward equipment hassles.

JVC's CR-4400LU is the one to take along when you can't bring a studio.

Because it's the lightweight machine with heavyweight features:

- **Weighs in under 27 lbs.** So you can take it anywhere, and assemble edit on the spot. You enjoy total flexibility. Complete freedom. Fast results.
- **AEF (Automatic Editing Function)** gives you clean assemble edits.
- **Built-in, full color recording and playback circuitry.** No need to buy an adaptor.
- **Low-power consumption** that lets you operate on a miserly 13.5 watts, for longer battery life. A multi-purpose meter checks battery, audio, video and servo levels for precise control of all functions.
- **Flexibility to record with the CY-8800U** or other high quality color cameras.

So if you need a field-tested recording system with the features you want at a price you can afford, check out our CR-4400LU Portable Videocassette Recorder.



*registered trademark of North American Philips Corporation.

**registered trademark of Hitachi Corp

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Backed by an old tradition of JVC quality
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Those New Super Editors

At the NAB Convention in Las Vegas it became clear that television was entering a new era in post production. Where once there was a large gap between the low cost editors used with U-type machines and the high end of the CMX line, there is now a virtually unbroken range of choices and capabilities in editing devices.

THE DEVELOPMENT OF VIDEOTAPE EDITING SYSTEMS is a complicated business. To some extent, we are looking at a number of separate developments in broadcast technology at one time. VTRs, time base correctors, large scale integrated circuits (LSI) and computers have all undergone significant changes in just the past five years. Quad videotape editing has gone from razor blade splices to crash edits to various degrees of computer assisted editing, most of which were very costly. Helical videotape editing went virtually nowhere for a long time as editors sat around using timing schemes, grease pencils and patience. Then came the U-type electronic edit controllers and the ENG explosion got underway.

In addition to viewing technological developments, we are also looking at developments in demand. If television stations had not been ready and willing to adopt the videocassette recording system for news, the development of adequate editing controllers might never have been possible.

So, this rapid growth in editing technology at the high end of television production is as much an expression of confidence by manufacturers that the industry is ready to move to videotape as a major medium for prime-time program production as it is an outgrowth of technological advancement.

Is there something here for everybody?

Initially, it might appear that these new advances will only be important for the major networks, Hollywood production houses and large independent producers or teleproduction houses. A closer examination of the new systems, however, reveals that at least a few of them are probably suitable to a large number of needs in applications common to many medium and large market television stations, in addition to commercial production houses and high end industrial television producers. Add to this the as yet unassessed impact of the new one-inch helical VTRs and we may be looking at a quite sizeable market for these editors.

One more thing that will be essential to a reasonable discussion of the new systems is a cleaning up of some of the language used. All of the systems claim to be on-line as well as off-line systems. In *BM/E*'s survey of the manufacturers it became clear that there are no generally applicable definitions for these terms. For the sake of discussion, then, we will impose our own defi-

nitions. "Off-line" is to be read as a preliminary editing stage, the result of which will be either a punched paper tape, hard copy printout of an edit list, floppy disc edit list and/or a videotape, on whatever format, that *will not* constitute the master for airing or distribution. "On-line" will be employed whenever the result of the editing process is a finished tape intended to be used for airing or distribution. As you can tell from the foregoing definitions, it may be hard for an editor to know precisely whether he is working on-line or off-line until such time as the producer or client tells him that he is satisfied with the product.

Using these definitions, only two of the new systems truly fit the off-line category. The Videola™, from CMX Systems, is a true off-line machine in that its only output is a floppy disc recorded edit decision list and a work-tape on ¾-inch videocassette. Since the ¾-inch videocassette coming off the Videola will contain none of the effects described on the edit list, it would not be suitable for airing. The other truly off-line system comes from Datatron, in the form of their Edimate I, the sole output of which is a punched paper tape edit decision list, suitable for controlling a large computer-assisted editor.

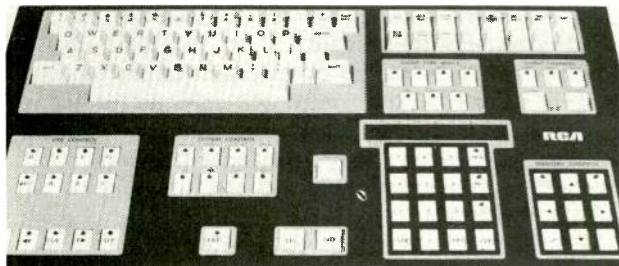
Another phrase that can use some cleaning up is "CMX-compatible," sometimes written, "industry standard compatible." In the above cases, both the punched tape produced by the Edimate I and the disc produced by the Videola format their decision lists in a way that contains all instructions and data in the same format that is used by the CMX System's 340X. In fact, most of the new systems produce such edit decision lists on either punched paper tape or disc and most are formatted to "the industry standard." The reason for doing this is two-fold. The CMX format has become the industry standard by virtue of having the field almost exclusively to itself. The manufacturers of the newer systems would like their clients to have the option of adopting one of the newer systems without automatically obsoleting their libraries of CMX-compatible edit decision lists. Moreover, compatibility means that a list can be generated on one manufacturer's system and final conforming can be done on the other's. In this sense, CMX-compatible edit decision lists work both to the advantage of the newcomer and CMX.

The fact is that not every manufacturer is happy with the CMX format of edit decision lists, and there is now

New Super Editors

some effort being made to establish a SMPTE committee for the purpose of writing a standard edit decision list format. Some of the newer systems do some things the CMX format does not account for and vice versa. Moreover, the basis upon which the CMX format was predicated has also changed. For instance, the original CMX system for numbering its wipes was based on the wipe pattern identification system used in the Grass Valley Group's 1400 Series production switchers, which have since been superseded by the 1600 series.

A number of manufacturers have also expressed interest in having SMPTE establish standards for floppy disc formats and switcher interfaces. Whereas the motivation for standardization on disc format is roughly equivalent to the motives behind edit list standards, the switcher interface is a somewhat different matter. Many of the systems will interface to any of the computer-compatible switchers for the purpose of effects. The switchers, on the other hand, achieve the specific effect requested in a variety of ways depending on the make of the switcher. This means that the editor manufacturer has to do some very expensive software work for a variety of switchers in order to be certain that the effect requested is the effect executed. The answer to this dilemma is obviously not getting switcher manufacturers to perform their effects identically, since the



The keyboard control panel of the RCA AE6000 shows logical groupings of function oriented keys. "Yes" and "no" keys (lower middle of panel) are used to execute most decisions



Dialogue with operator of the AE6000 and other editing data is displayed on CRT. Dual mini floppy disc is main mass storage facility

differences exist for valid reasons. Rather, the idea is to get them to agree on a descriptive language with sets of common terms that can be used by the editors to designate specific effects. This would involve the development of some sort of "black box" that would translate the common language into the dialect used by the specific switcher manufacturer.

The desire for standardization is not unanimous in any of the areas. Unlike the recent one-inch helical videotape recorder standards, the standards being proposed for editors do not have the obvious appeal to the manufacturers or the sense of urgency on the part of the end users. While traffic is heavy in the exchange of videotapes, it is not so heavy in the exchange of edit lists, nor is it clear that switcher manufacturers would be inclined to develop a common language for the benefit of editor manufacturers. On the west coast, however, where production schedule pressures can get extremely tight, end users are very anxious for establishment of standards so that long lines do not form in front of the precious few facilities.

Another reason for the promulgation of standards is the extremely high cost of software development. This area is one that may take some getting used to for station management. Although there has been a steady decline in price for the microprocessor and LSI hardware, the cost of software continues to climb. Software, of course, is the product of expensive expert talent, the programmers. A manufacturer might have been able to control cost in a hardware-based system by substituting a cheaper component, but the substitution of a cheaper programmer could be disastrous to a software-based system. Standardization does offer the manufacturer (and therefore the end user) the hope of some cost benefits by reducing the amount of original software design required.

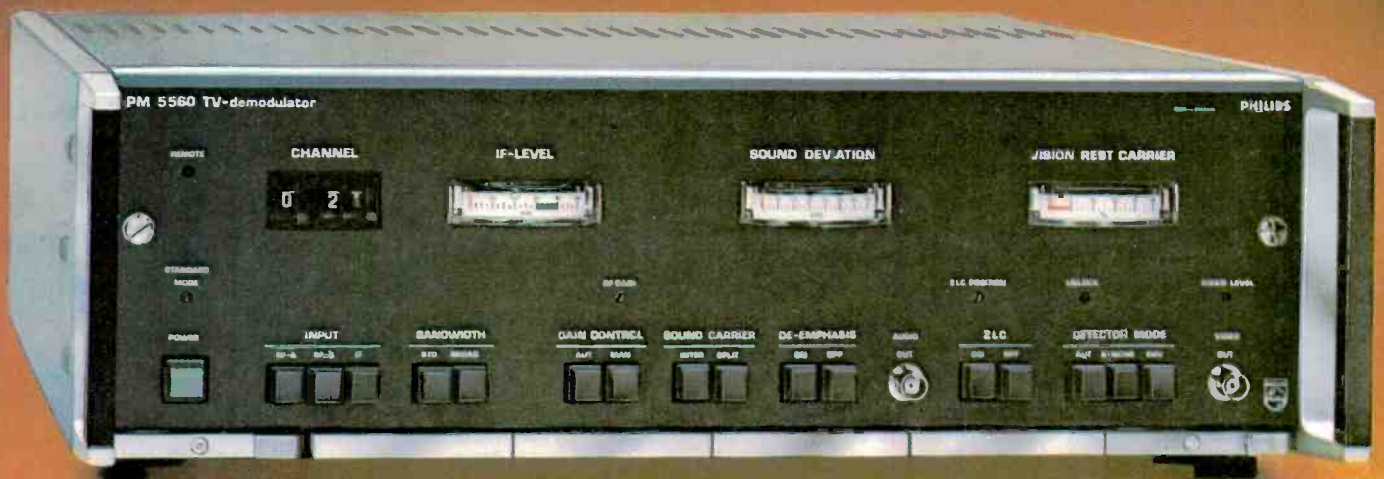
What some of the systems will and will not do

Some of the systems will control virtually any type of VTR from quad to $\frac{3}{4}$ -inch U-types. These are the CMX 340X, the CVS EPIC system, the Datatron 2000 and the Mach One, from Mach One Digital Systems. The RCA AE6000 works with only the TR600 quad recorders, though an option for interfacing a one-inch VTR or multi-track audio recorder is available. The Sony BVE5000 is designed to work with the Sony Type C one-inch VTRs. Ampex's EDM-1 will work with most modern quad VTRs as well as the one-inch VPRs. The Ampex HPE-1 will work with either the VPR recorders or $\frac{3}{4}$ -inch recorders, though the U-type configuration is being left up to Convergence Corp., manufacturers of the ECS-100 series editors, upon which the HPE-1 is based. HPE-1 also handles the three audio tracks available on the VPR systems. On the other hand, Convergence's ECS-100 series will presently interface with $\frac{3}{4}$ -inch U-type systems, as development of a one-inch interface continues. RCA is taking a wait and see approach to development of the AE6000 for their one-inch VTRs, but is marketing the Datatron Tempo '76 in the meantime as their primary one-inch system controller.

All of the systems mentioned so far will perform automatic assembly under the instruction of an edit list on either floppy disc or punched tape. The exceptions

continued on page 50

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New Super Editors

are the AE6000, which may offer punched paper tape in the future, and the Convergence ECS-102 and 103, which provide a TTY or tape punch as an accessory but will not read the tape for auto assembly. In this way, the ECS-100 series editors are effectively off-line machines if the intention is to conform on one of the larger systems using the paper tape. The same is true of the HPE-1.

Where compatibility is concerned, those systems that do offer punched paper tape peripherals are industry standard compatible. In some cases, however, the full CMX vocabulary is not available to each system; in other cases the vocabulary does not encompass descriptions of all functions available to the individual editor. An example of this is the Convergence ECS-103, which does not have the full descriptive powers needed to use all of the wipe pattern instructions available to the CMX, while CMX, on the other hand, has no language to describe Convergence's Liplock™ or Cut/Lap™ functions.

Another area of potential confusion is the number of VTRs each of these editors will control. In theory, the larger systems will control almost any number of VTRs, depending on the number of interfaces and VTRs the operator cares to assign. The outside limit is estimated at 64 VTRs. But then, one has to consider whether all these machines can be record or playback VTRs. In some cases, yes, each machine in the system can be designated playback or record. This allows multiple masters to be made, thus reducing the number of generations required to make subsequent dubs. In other cases, the number of machines dedicated to recording is limited by the output channels on the edit controller. One obvious caveat is to consider the reasonable need for the number of source VTRs. What is the likelihood of ever needing 64 source VTRs? What multi-talented editor is ever going to be able to keep track of this many sources? The manufacturers are well aware of this and therefore play down this capability, usually limiting their basic claim to eight or fewer VTRs. Therefore, the minimum VTR handling capacity feasible for such sys-

tems is three: two source VTRs and one record. This configuration would at least make these systems' ability to A/B roll and carry out special effects useful.

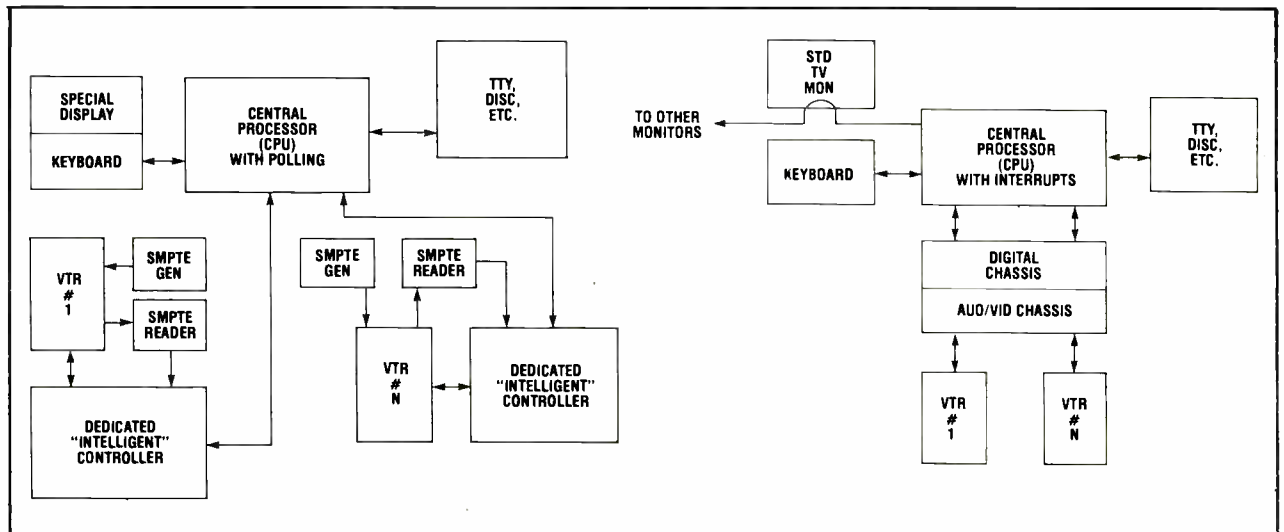
All of the systems discussed here will interface to production switchers in varying degrees. The EDM-1, for instance, comes with an integral switcher, while the Convergence system uses its own switcher for effects but does not use a switcher control panel. The RCA system interfaces with the Grass Valley 1600 series production switcher and uses its E-MEM (Effects-Memory system) to learn switcher functions. (See box with this article for details on E-MEM.) EDM-1 also learns switcher functions. The other systems will interface with such "smart" switchers if the customer so desires.

The super editors equipped with auto assembly and "look ahead" cueing could therefore assemble a finished tape, complete with special effects, in a single pass of the edit decision list. The only requirement to do this would be that the various cues on the source tapes be dispersed enough to allow the VTRs to search, locate and cue before the actual edit was called for. Though such fortuitous arrangements of edit points are unlikely to occur often, the larger systems will still complete the editing in a single pass by merely holding the record VTR until the designated source machine is cued, and then proceed with the editing.

Operation control

Up until now we have been discussing, pretty much, the similarities between the machines. They are multi-format for the most part, multi-machine control, and all are capable of some degree of switcher interface. The differences begin to appear when one starts looking at how they do what they do. The most apparent difference is whether the machines use distributed intelligence or centralized processing. Some systems, like the RCA AE6000, use microprocessors located at the VTRs in conjunction with a central microprocessor. Others, like the CVS EPIC, use minicomputers as central processors without the aid of distributed intelligence for the VTRs. Still others, like the Datatron 2000, use a minicomputer, the Nova II, as a central processor, and distributive processing at the machine

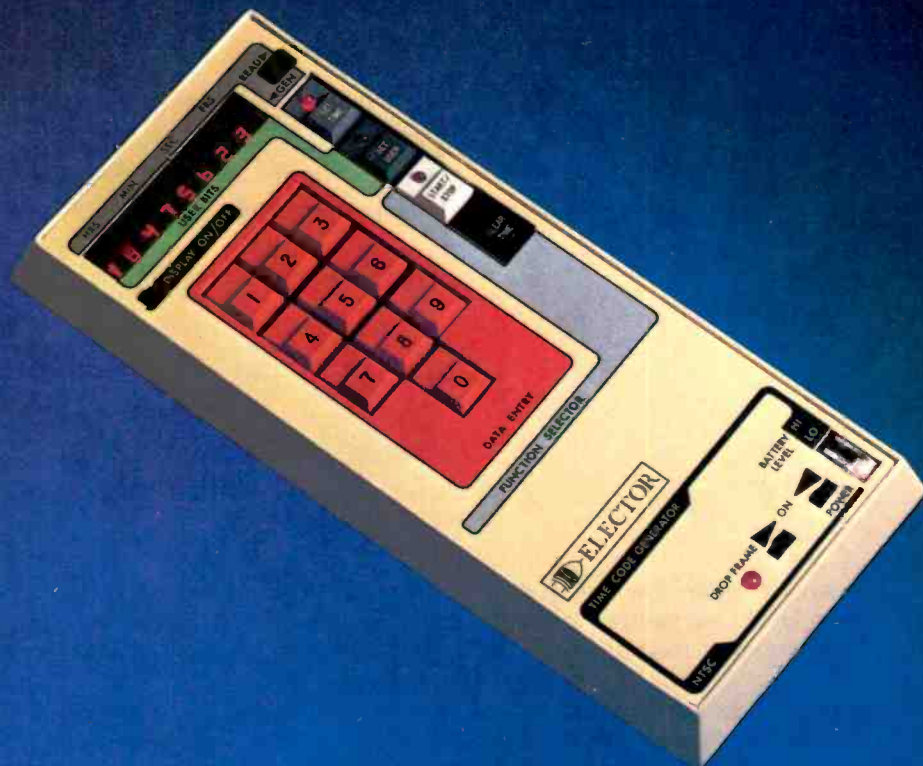
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Block diagram compares a "hardware-oriented" system (left) to the CVS EPIC "software-oriented" system. CVS claims that this approach improves cost effectiveness

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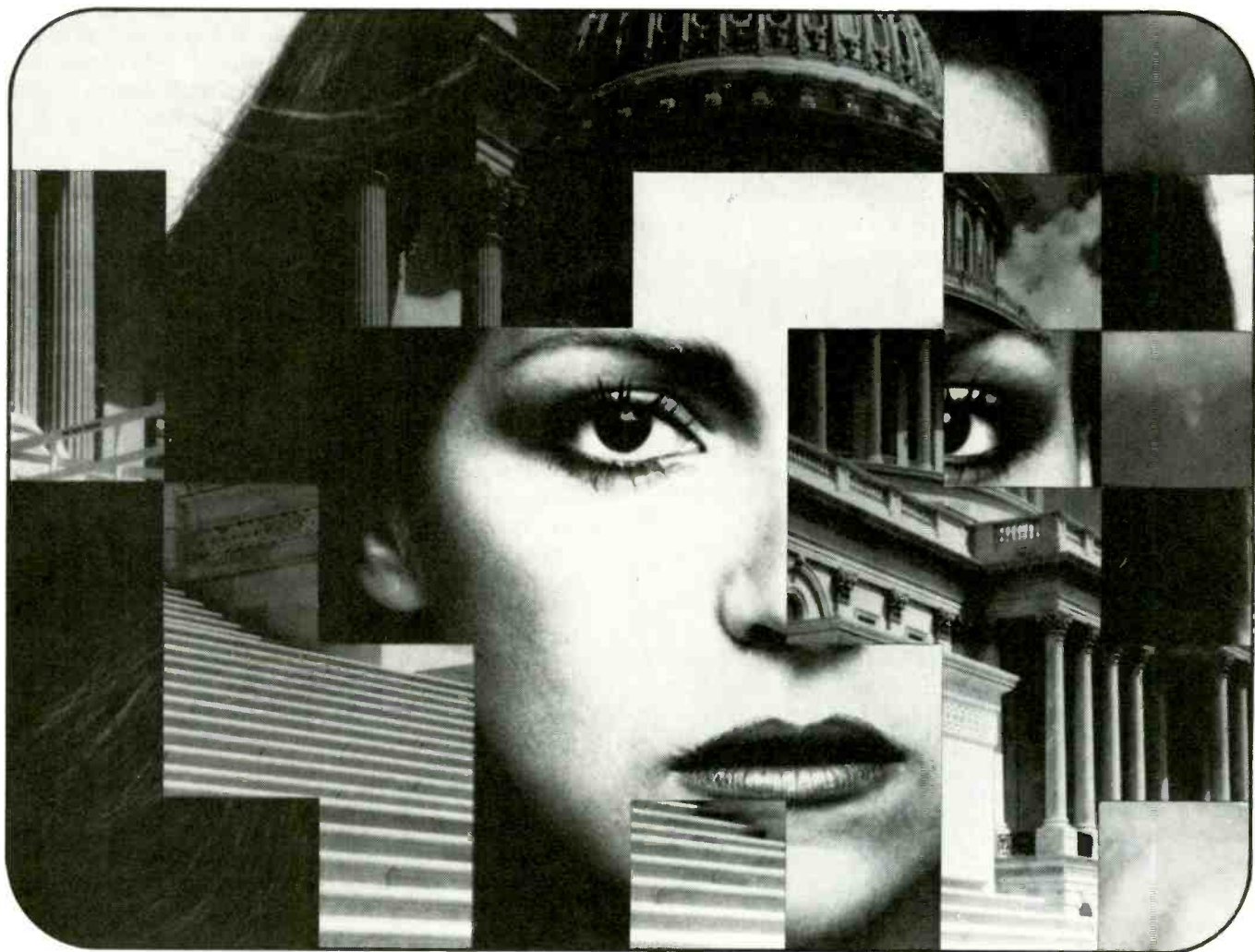
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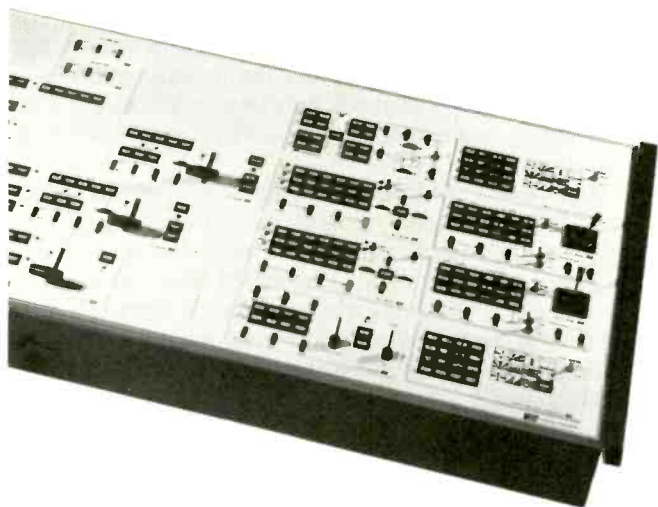
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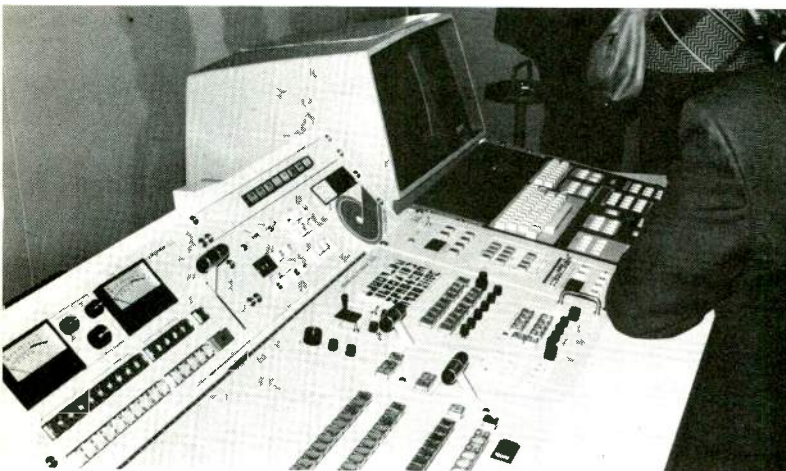
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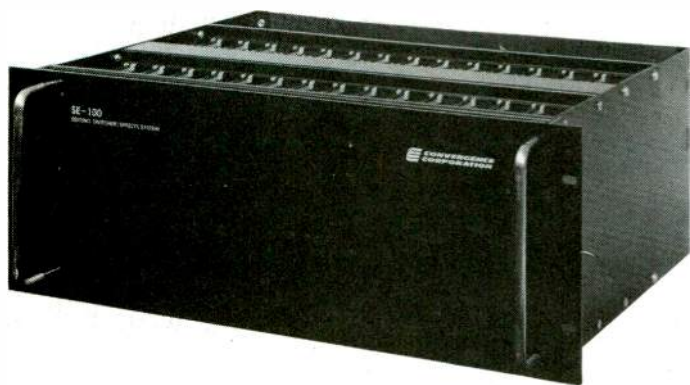
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New Super Editors



Most of the new systems, like the AE6000 above, offer interfaces to any of the computer compatible switchers. The switcher interfaced here is the GVG-1600 with E-MEM



Convergence Corp. uses its own switcher which is addressable through the control panel of the editor

Operator errors are handled in a number of ways. Some of the systems will prevent the editing process from continuing until an invalid entry has been corrected; others allow the entry to be made and then inform the operator during a cleaning routine that the instruction he has given can not be executed. The purpose for allowing illegal data is so that some operators may, if they wish, use an illegal entry to automatically stop the machines during auto assembly so that some modification can be made. All of the systems provide some sort of visual or audible warning of invalid instructions. The Convergence system beeps and flashes, while most of the others simply blink the questionable data.

Another common error is the entry of some non-existent time code or a call for a reel not actually mounted. In all cases, this type of error will result in a warning to the operator. All of the machines seem to have adequate precautions programmed into them. Since data entry from keyboards has been a source of both confusion and errors, all of the systems have reduced the need for such entries and moved to function-oriented keys instead. Alpha numeric keyboards have been retained largely for the purpose of making editing notes. These notes, which may include comments such as "color correct this scene,"

remain tied to the associated edit. In some of the systems, notes can be flagged so that their presence will halt the auto assembly until some action is taken, such as in the case of the note previously mentioned. Other notes that require no action, such as reminders to the operator to do something, will be ignored by the system.

Editing on the fly

CMX, RCA, Datatron, EDM-1, EPIC and Sony will all permit the operator to edit "on the fly," that is, to run several VTRs in sync and execute the edits in real time just as though he were calling a live show from the control room. Moreover, the systems permit the various source machines to be off-set or even to have uncommon time code. The off-set is usually established during the initialize stage by merely identifying the start point for each reel. Thereafter, the tapes will remain locked in the established relationship. A couple of the systems permit the operator to establish his reaction time during initializing procedures for editing on the fly. With the RCA AE6000, for instance, the operator can register his reaction time by estimating the number of TV frames it takes him to execute a switch. From that point on, the computer will subtract that number of frames from each edit to accommodate the individual's delayed reactions.

This edit-on-the-fly mode is given a number of names by the various manufacturers. Mach One calls it Sync Mode, CMX calls it Sync Roll and RCA has yet another label for it.

Memory capacity

There are two basic types of memory available in these systems. The operating program is frequently stored in core on E-PROMs, erasable, programmable read only memories. Some of the systems, such as Mach One and EPIC, will provide software updates for a limited time, usually one year, with improved operations programs available routinely. The manufacturers also differ on whether they will customize software. Whereas Mach One and CVS say they will as a matter of course, RCA says it will not. The others maintain that they will cross that bridge when they come to it. Software is expensive, they point out, and in some cases their programs are considered proprietary and they will not risk divulging their listings. Nevertheless, all of the manufacturers maintain that program changes that represent corrective or operational improvements to their systems will be available to customers.

The other type of memory is the edit list storage. Here capacity varies widely. Systems that use core storage will store several hundred edits. Those using disc storage can, in theory, store an unlimited number of edits. The need for such massive edit storage is questionable since few programs ever require more than several hundred edits, but those systems using disc point out that the extra storage is really gratis.

Systems and what they cost

The Convergence ECS-100 series consists of three basic system configurations. The 101 is a basic edit control panel which includes the Superstick and uses either tape time or time code editing. The Superstick permits variable speed control in both directions for either the source machine or the master. A cruise control button on

continued on page 58

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New Super Editors



The use of microprocessors as part of intelligent interfaces was pioneered by CMX to make multi-machine, multi-format editing systems possible. The CMX 340X shown above is interfaced to three BVU VCRs, an IVC-9000 Helical scan 2-inch VTR, two quad TR-600s, and a Grass Valley Switcher. Dedicated interfaces are housed in the rack located in the middle rear of the picture

the stick permits the establishment of any available continuous speed on one machine so that the stick can then engage the other machine and establish a search speed for it. ECS-101 will handle two U-type or BVU VTRs and costs \$5000. Numerous options are available, including LipLock™ and Cut/Lap™. Cut/Lap is essentially a method of performing simulated dissolves by fading out one image to black while fading up the other image. The actual switch takes place during the black segment, but varying the fade rate provides the illusion.

ECS-102 adds an insert edit selector control, timer set controls and edit trim controls. Options at this stage include a status display generator for a customer supplied CRT, an edit decision lister with output channel for TTY or paper tape puncher and a transition programmer for soft or hard transitions without a TBC or switcher. This level of the system is priced at \$6500, exclusive of options. ECS-103 brings the device up to the level of a multi-source controller with additional machine interfaces. Also optional at this stage is a dedicated five-input, two-bus audio-follow-video switcher with 46 patterns. The system starts out at \$11,000; with the addition of options such as the \$9500 switcher, it could eventually cost in excess of \$35,000. All machine interfaces are optional, as are time code readers/generators and other features. The system currently interfaces to U-type VCRs and BVU machines. A one-inch helical VTR interface should be available in the coming months.

Ampex's HPE-1, which is based on the ECS-100 Superstick editor, has all the same functions of ECS with

the additional ability to interface to the VPR series of one-inch VTRs and handle the three available audio tracks. Pricing is similar to ECS, with a Series A configuration going for \$5500, Series B for \$7000 and Series C for \$12,000.

The EDM-1, also from Ampex, is a computer-assisted editor capable of controlling up to eight VTRs, either quad or VPR. Intelligent interfaces to VTRs are considered additional to the basic price of \$95,000 (except when AVR-3s are used, since they require no additional interface). The system includes a switcher and will learn switcher operations for auto assembly. The CPU is a PDP-1105 minicomputer, and Intel 8080s are used in the interfaces for VTR housekeeping. Edit list storage is on floppy disc, which holds 16 files of 200 events each. All software is supplied and no customizing or listing is provided.

The Datatron 2000 is another computer-assisted editor using the Data General Nova II minicomputer as the CPU with distributive processing to the Z80 microprocessors in the VTR interfaces. The basic system includes CRT, keyboard panel and software. It will use any combination of U-type, one-inch or quad VTRs. The basic system price is \$50,000. The unit will interface to virtually any switcher.

CVS EPIC also interfaces to a number of VTRs in any format from 3/4-inch to quad. The basic system consists of the CPU minicomputer with interrupts, keyboard, CRT, digital chassis and audio/video chassis. One unique fea-

continued on page 60

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New Super Editors

ture of the EPIC is its ability to multi-task. That is, machines not actively assigned to editing can be assigned to other jobs or returned to local control. For instance, EPIC uses integral time code generator/readers rather than outboard systems like some of the other editors. The EPIC system can, therefore, be generating time code for tapes on some machines while simultaneously using other machines in the editing process. Software updates and customizing can be provided. A firm price has not been established for the system, but it will be priced competitively with systems like the CMX 340.

The Mach One from Mach One Digital Systems, to be priced at approximately \$45,000, is a full-featured computer-assisted editor capable of working with up to six VTRs of any format. The basic system consists of the keyboard, CRT and LSI 11 microcomputer. All operational programming is in semiconductor memory. Edit list storage is also core, though an optional floppy disc is available. The editor can be interfaced to any of the "smart" or standard switchers.

The RCA AE6000 uses the Intel 8080 as a CPU, with distributive processing at the 8080s employed in the AE600s which are the basic interface devices for the 6000. The basic setup includes the AE6000 CRT, keyboard and software for \$35,000. The AE600 is priced at \$12,000 and the TR600s, eight of which can be used in the system, cost \$94,500 each.

The Sony BVE-5000 is still in developmental stages, but should be on the market before the end of 1978. Like a couple of the systems, it was taken to NAB with the primary aim of obtaining feedback from broadcasters. Details on the system are sketchy at this time, but we do know that it is intended to control up to six one-inch Sony VTRs. It will use SMPTE Time Code in the traditional fashion and Vertical Interval Time Code as well. Auto assembly is a feature, as is look ahead search and most of the other advanced editing functions described for the other systems. No price information was available at the time of writing.

The CMX 340X has been on the market for some time now, and most of its features are generally known. Auto assembly, look ahead, reel summary, sync roll, master/slave operation of external audio or video recorders, multiple record machines, asynchronous code features, jam sync, etc., are all standard features with this system. It will control up to 32 (and more) external devices. While it is not fair to say that the newer systems have imitated the CMX 340X, it is clear that the 340X has at least set the conceptual pace and provided much needed field experience on which the newer companies could elaborate. CMX originated the intelligent interface with its I² concept of microprocessor intelligence for machine control and housekeeping functions. The 340X system continues to develop, as will the other basically software-based systems, and will probably remain the so-called industry standard against which the newer systems will compete.

All in all, the recent addition of numerous advanced editing devices tends to validate the premise upon which the CMX was conceived. In the coming years these various systems will vie for position and offer unequalled power to the practice of video post production. The present systems are costly, but no other alternative in video post production can compare to their power. **BM/E**

Intelligent Switchers Offer New Power In Post Production And Production

by Bruce Rayner

A few of the new computer assisted editors offer a "learn mode" as part of their switcher interface. All of them could work with a switcher that has its own learn mode. GVG has developed such a "learn" approach with its E-MEM system, explained below.

Production switchers continue to increase in size and complexity as more special effect features become available. However, very little has been done to make it easier for the operator to actually use these effects. Live shows frequently are limited to shots that can be preset or set up easily during the show. More complex effects can be used in post production, but the setup time and lack of easy repeatability often discourage the use of more creative effects.

For the past three years The Grass Valley Group has been developing a system that could offer a solution to the operational complexity problems associated with switchers. The result is an intelligent option called E-MEM (Effects Memory) based on the ability of a microcomputer to "learn," store and recall all operational controls and crosspoints for complex switcher setups.

Aside from the capability of remembering specific effects, the new system also can reproduce the operator's movement of the lever arms, provide frame accurate automatic transitions, and perform a special function called Effects Dissolve. In addition, E-MEM can be used as an intelligent interface for use with video tape editors or other "smart" peripheral devices.

To determine just what functions E-MEM should have, a study was made as a part of the project development. Operation of production switchers was looked at closely in a variety of areas, such as news and post production. Operator techniques were studied to determine just what made a switcher easy or difficult to operate.

The results of this study were incorporated in the design of the Effects Memory system, with the goal of making the operation of a switcher easier and more effective.

What does it do?

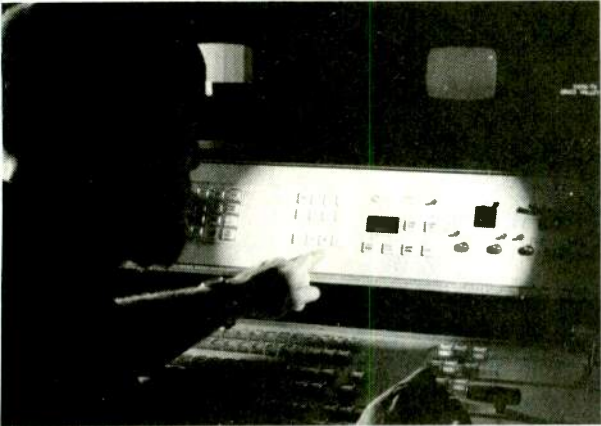
The primary function of an E-MEM system is to be able to store, then recall any effect that a single switcher effects system can create. Storing the transition is done easily at any time during normal, manual operation. When the desired effect has been created on the screen, the operator selects "LEARN EFF" (Figure 1), then chooses one of 22 registers to store the effect. Eleven registers are accessed directly; 11 more are selected with a shift key.

"Learn" is really the correct term to use for the memory storage process. There is no data entry keyboard or readout for the E-MEM system; E-MEM monitors the control panel and "learns" the positions of all switches and controls that the operator has selected or set.

While a Learn Effect command stores preset or a switcher configuration in memory, the second category of learn modes deals with dynamic effects, usually transitions. A Learn Rate command stores the value set on the thumbwheel as a transition length (in TV frames) in a register (selected next). Recalling the register will start an auto transition (same video effect as moving the lever arms manually) of a particular length.

An interesting concept of the design appears here. Note that the function of the register buttons can be changed by the learn process; one button may recall a preset effect, and another button may be used to start an auto transition. Thus, the operator can "program" the functions of the control panel to suit his needs and style.

Bruce Rayner is a Senior Design Engineer for The Grass Valley Group, Inc.



An E-MEM control panel is shown in use on a typical Grass Valley production switcher. The Effects Memory system can considerably ease the task of setting up complex special effects

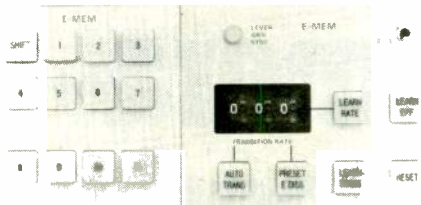


Fig. 1. Panel configuration shows storage registers on the left, with the various selectable learn modes and operating functions on the right. One of these panels is required for each mix/effects system on the switcher

The Learn Transition command is used to tell the microcomputer to take the last manual transition done by the operator and store it in a register for exact repeatability later. The transition may use a variety of motions, or can stop in mid-travel if desired, all motions being duly recorded.

"Effects Dissolve" is the one function which cannot be duplicated manually. It is used during recall to cause a dissolve to take place between all analog channels in two different effects; for instance, wipe a bordered box out of one corner to a full screen; change size, position, aspect, border width and border color during the transition. Manually, this effect would require the coordination of more operators than could fit around the panel. With E-MEM, learn the beginning effect in one register and the end effect in a second register, then use the Effects Dissolve command. The resulting effect will be a smooth transition of all the controls involved.

As E-MEM takes control of the switcher during the recall of various functions, how is the control returned to the operator for manual operation? One of the requirements of the system from the operator's standpoint is that there be "no surprises." The operator should never find himself locked out or be forced to select between manual and automatic modes.

The E-MEM system meets this requirement by using its microcomputer to maintain the switcher so that it is simultaneously available to computer and manual commands.

How does it do it?

The secret in making a computerized system easy to use is to make the computer smart enough to anticipate the needs of the operator. In the example above, maintaining auto and manual control, the biggest problem occurs with analog control settings. A recalled effect will offset the control setting to a new value, but the operator is free to trim the value by operating the control normally.

What if, due to the offset condition, the control reaches its mechanical limit with, say, the wipe still in the middle of the screen? In this case, the microcomputer senses the control position and smoothly moves the setting to the actual position desired by the operator. Thus, the control has been

returned to its original manual setting without any conscious effort on the part of the operator.

The microcomputer that contains all the E-MEM functions and logic is located on a single plug-in circuit board. The program is contained in plug-in ROMs (Read Only Memory), which can be changed easily in the field to update the system or provide custom modifications. All switcher functions are stored digitally in the CMOS memory, which insures a high degree of accuracy when recalling effects. It also means that the voltage level of each of the 15 analog channels on the effects system must be run through an analog-to-digital conversion process before it can be stored.

When a recall is made, the memory dictates which crosspoints are to be set and outputs new analog levels via a reverse digital-to-analog process. While this sounds complicated, all these "housekeeping" functions are taken care of by the microcomputer's program, which keeps the system's hardware relatively simple.

The E-MEM system is modular throughout. One microcomputer and its associated interface modules is used for each effects system in a switcher. The switcher around which the system was developed is the standard GVG 1600 Series. Since the system is designed as a plug-in option, users can decide how many E-MEM systems are required for their operations, and even add the E-MEM option to earlier switchers. Thus, a modular approach allows switchers several years old to be updated to the present standards of microcomputer technology.

Just as the microprocessor has taken over the microwave oven, it is inevitable that microcomputers will become firmly entrenched in production switchers. One good reason for this rapid advance is the high degree of flexibility that they offer in design. They also allow easy expansion of a basic system and updating of equipment through firmware exchange.

Where are intelligent switchers going from here?

We have barely finished defining what an intelligent switcher is, but some trends already are predictable. In the following areas, development programs are putting prototypes of these new systems through their tests:

E-Card: After using E-MEM to assist production of the 6:00 o'clock news, it would be desirable to save the contents of the registers in hard copy form so the switcher can be set up in the same way the following night. One approach is to magnetically record the contents of the register on a credit card-sized "E-Card." With the card reader located at the switcher control panel, the switcher programming can be changed easily between or even during shows.

Peripheral Interface: When an effect is learned that uses a character generator or still store device as one of the video inputs, E-MEM can learn the memory location in the peripheral device of the present page displayed, using an intelligent interface between switcher and peripheral. Recall will then recall the proper video source, as well as the switcher settings. Standard protocol for this type of serial communication has been developed and is currently being tested.

Editor Interface: E-MEM has provided an intelligent interface to a production switcher that functions much like an intelligent interface to a VTR. Commands to and from the switcher travel as serial data on two pairs of wires. The need exists to expand tape editing control to the production switcher, and this is now being done.

One thread runs through all the development work done by GVG on this project. That is the necessity of designing the system for the creative user, the operator, who is currently overburdened with control panels, gadgets, whistles, and bells. Much planning has gone into the E-MEM system to keep it free of the conventional keyboard and CRT display. This approach to automation, dubbed "learn mode programming" by the test instrument manufacturers, has proven to be a superior approach to the ultimate "man-machine" interface. Applied correctly, learn mode programming can be used as a tool in production switchers, to allow more effective and creative use.

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STUDER



Solving AM Bandwidth Problems

By Grant W. Bingeman

AM bandwidth is often misunderstood and even more often mistreated. Some AMers think that if the transmitter sees the EIA's standard impedance load, everything's fine. But standards set forth are incompatible and often inadequate for new technology coming down the pike. Here's how to set things right with your transmitter.

HOW IMPORTANT IS BANDWIDTH? If you're presently satisfied with your far-field signal and with your transmitting equipment performance, then read no farther. If you're not satisfied with your overall audio frequency response and distortion, if you're buying a new transmitter, if you are concerned with AM stereo, if you were recently cited for overmodulation — then you need some help. It's most important to know how to recognize a bandwidth problem, and how to solve it.

There are five problems associated with limited bandwidth in an AM antenna system:

- Finding a valid RF sample for equipment performance measurements.
- Improper reflectometer operation during modulation.
- Audio harmonic distortion.
- Degraded audio frequency response.
- Spurious radiation.

If you cannot obtain an acceptable set of equipment performance measurements when working into your antenna, but have no problems when working into a flat, resistive test load, then you may very well have an RF bandwidth problem. Generally, if your ± 10 kHz sideband VSWR is less than 1.2 (referenced to a carrier VSWR of 1.0), you do not have a serious bandwidth problem. If sideband VSWR is higher, modulation could cause excessive demands on the transmitter power supply, calling for excessive RF currents or voltages. Also, if your transmitter has a VSWR or power supply protection circuit, the transmitter may trip off during modulation peaks.¹

New transmitters can look bad

Did you know that your system audio performance could look worse with a new transmitter which has better factory specs than your old transmitter? This does not

Rms vs Rss

While we have indicated measurements in rms values throughout this article, many of you may be using integrating meters to make your measurements. For all intents and purposes, rms = rss (root sum square) which is the integral of rms, as defined in the equation in footnote 5. So whether your meter integrates or not, consider the results valid as long as you make the measurements properly.

Grant W. Bingeman is senior engineer with Harris Corporation's Broadcast Products Division. He is intimately involved with AM transmission design and the proposed new stereo-AM system, and has been invited to present papers to major engineering groups.

mean that there is something wrong with your new transmitter. The problem could very well be your antenna, or it could simply be the result of the standard definition of distortion.

The EIA definition of standard broadcast transmitter audio distortion as contained in *TR-101A*, Paragraph 14a, is: "The audio frequency harmonic distortion is the change in harmonic content of the signal contributed by the transmitter." Assume your old transmitter has a five percent factory distortion spec, where your new transmitter has a three percent spec. Also assume that the test tone going into the transmitter has two percent distortion. Measured at the transmitter output, the apparent system distortion could be three percent with the old transmitter (five percent minus two percent), and five percent with the new transmitter (three percent plus two percent).

Different transmitters have different phase shifts across their output networks, and employ different RF sampling techniques. These differences can vastly affect the apparent system performance, as well as the real system performance.^{2,3} By randomly tinkering with the RF sampling circuit, it is possible to obtain superficially good equipment performance measurements, yet wreak havoc with far-field performance.⁴ Some people feel that as long as their transmitter is looking into a load which falls within the impedance limits set forth by the EIA publication *TR-101A*, everything will be fine. Unfortunately, the distortion specifications set forth in the same publication are not compatible with the impedance window.

Distortion standards

The EIA specifies a five percent rms distortion "minimum performance standard" for a 7500 Hz tone at 95 percent modulation; a perfect transmitter working into an EIA "standard load" of $50 + j0$ at the carrier frequency and $46.3 + j13.3$ at the 7500 Hz sideband frequencies yields 7.3 percent rms distortion⁵ (see Figure 1).

Note that an RF current sample is used because a voltage sample would not show any distortion.⁶ With this particular load, when the positive peak depth of modula-

¹Grant Bingeman, "Reflectometer Operation in Limited Bandwidth Systems," Harris Broadcast Products.

²W.H. Doherty, "Operating AM Broadcast Transmitters Into Sharply Tuned Antenna Systems," July, 1949, *Proceedings of the IRE*.

³Grant W. Bingeman, "AM RF System Distortion," Harris Broadcast Products.

⁴Grant W. Bingeman and C.V. Clarke, P.E., "AM Antenna System Bandwidth vs. Harmonic Distortion," June, 1977 *IEEE Transactions on Broadcasting*.

⁵Audio harmonics: H1 = 1, H2 = .062, H3 = .032, H4 = .015, H5 = .0065.

$$\text{rms THD} = \frac{\sqrt{H_2^2 + H_3^2 + \dots + H_n^2}}{\sqrt{H_1^2 + H_2^2 + \dots + H_n^2}}$$

⁶If you have a transistor PA, use an ideal current generator as your model, and sample with a voltage divider.

AM Bandwidth Problems

tion reaches 95 percent, the negative achieves only 73 percent. If the audio level is increased in an attempt to bring the negative modulation up to 95 percent, distortion would increase tremendously. In fact, it is very doubtful that it would even be possible to achieve 95 percent negative modulation with this particular load. If you want the best and most valid distortion values, you may need to measure distortion as a function of positive modulation, *not* negative modulation.

Since the FCC requires that only the second harmonic of 7500 Hz be measured, the resulting distortion value for the perfect transmitter would be 6.2 percent rms. When only the first through third harmonics are measured, as recommended by *TR-101A*, the result is 7.0 percent rms. If the transmitter is not perfect and has an internal distortion of two percent, the final result could be 9.0 percent rms distortion. There would be no distortion associated with this particular load if the sideband reactances were of opposite sign, and overmodulation is not allowed to occur.

When making distortion measurements, be aware of the type of detector that the distortion analyzer uses. An rms detector will yield results which differ from those obtained with an averaging detector. If your distortion analyzer has a scale marked "rms volts," this is no assurance that the distortion values will be rms. Most distortion analyzers use an averaging detector because in the past they were more economical, and yet FCC rules call for an rms detector. An averaging detector is affected by the phase of the harmonics and background noise. The true rms technique eliminates the noise present between harmonics. The Hewlett-Packard 339A is a true rms distortion analyzer.

Lacking an rms detector, it's possible to sweep the recovered audio signal with a tunable voltmeter, record the magnitudes of all the harmonics, and then compute the rms distortion. Alternatively, you could use an audio spectrum analyzer, being careful to convert from dB to volts. It's quite possible to have two identical tones with the same rms distortion, but different coloration. Some people feel that high-order harmonics are more objectionable, yielding a raspier sound. Thus, it's a good practice to measure each harmonic individually.

Most of us are aware that sideband impedance-pair symmetry⁷ is a desirable thing to have at the PA of an AM transmitter. Symmetry removes any harmonic distortion caused by antenna system bandwidth limitations, but may still allow a frequency-response problem to exist. The best way to obtain sideband symmetry is to adjust the phase shift of the input matching network in the case of a directional antenna or to change the phase shift of the antenna coupling unit in the case of a non-directional antenna. This avoids the additional expense, losses, and space requirements an external phase-shifting network would entail. However, your present ACU or common-point matching network may require some component changes in order to obtain the desired phase shift. This is definitely the case if you are presently using an L network,

⁷Equal sideband resistances, equal and opposite sideband reactances.

⁸By external I mean on the transmitter side of the RF ammeter used to determine antenna power.

⁹Divide by the carrier frequency impedance; in this case the impedances are normalized to 1000 ohms.

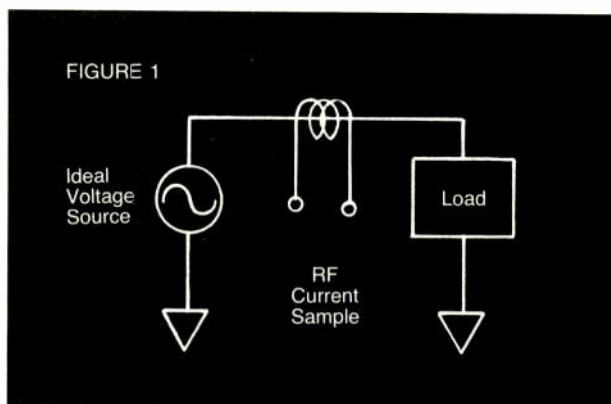


Fig. 1. Measuring rms distortion with ideal voltage source and RF current sample

since there is no independent adjustment of phase shift possible with an L network. When making changes to the existing common-point matching network, keep in mind that a specific procedure must be complied with per FCC Rules 73.43, 73.45, and 73.54. If an external⁸ circuit is added which complies with 73.43(a), then the procedure need not be followed. If you have made occasional maintenance adjustments to the phase and power divider controls, and were careful to maintain the licensed common-point carrier impedance, were you also careful to maintain the sideband impedances? If your sideband impedances changed, so did your distortion and modulation depth. It might be a good idea to remeasure those common-point impedances.

Assume these impedances are seen by the final stage (PA) of the transmitter:

Freq. (kHz)	Z (Ohms)	VSWR	Z Normalized
990	700 + j200	1.53	.7 + j0.2
1000	1000 + j0	1.0	1.0 + j0
1010	1200 - j300	1.39	1.2 - j0.3

- Plot the normalized⁹ impedances on the Smith Chart (see Fig. 2) and draw circles through these points. The VSWR can be determined from the intersection of the circle with the resistance axis. Of course, VSWR can never be less than 1.0.
- Draw a line through each impedance point from the center of the circle to the rim of the Smith Chart.
- Move these lines equal amounts around the rim of the Smith Chart until the intersection points on the circles fall one directly above the other. This is where the sideband resistances will be equal. The sideband reactances should be opposite in sign, and approximately equal in magnitude.
- Count the distance traveled from the old line to the new line on the rim scale, "angle of reflection coefficient in degrees." Divide this value by two. For a phase shift of about 25° toward the generator (clockwise on the Smith Chart), these impedances exist:

kHz	Impedance
1010	900 - j310
1000	1000 + j0
990	910 + j400

- In order to bring these impedances to the final stage of the transmitter, the transmission line must be lengthened by 25°. This can be done by subtracting 25° of phase shift.

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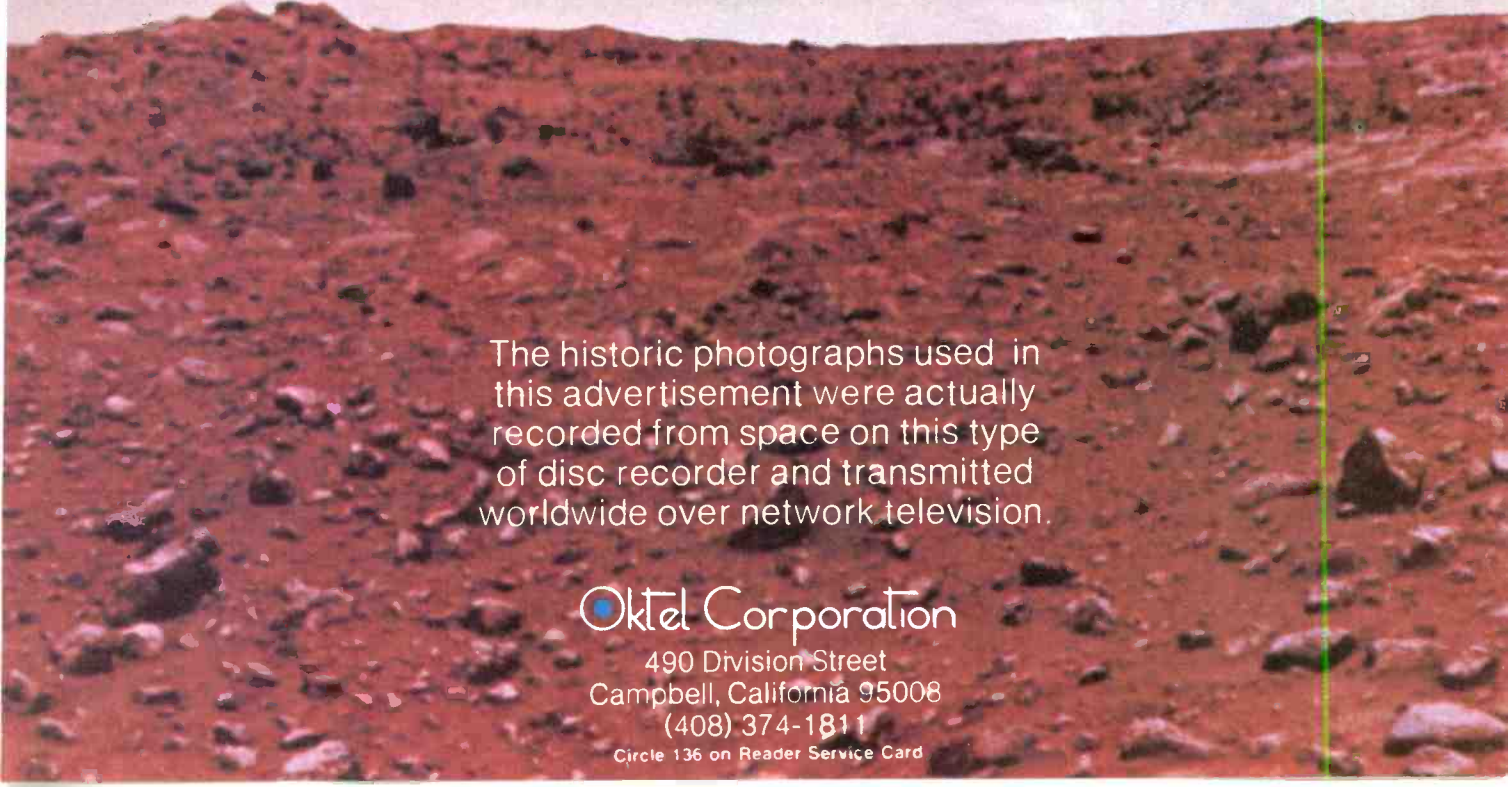


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AM Bandwidth Problems

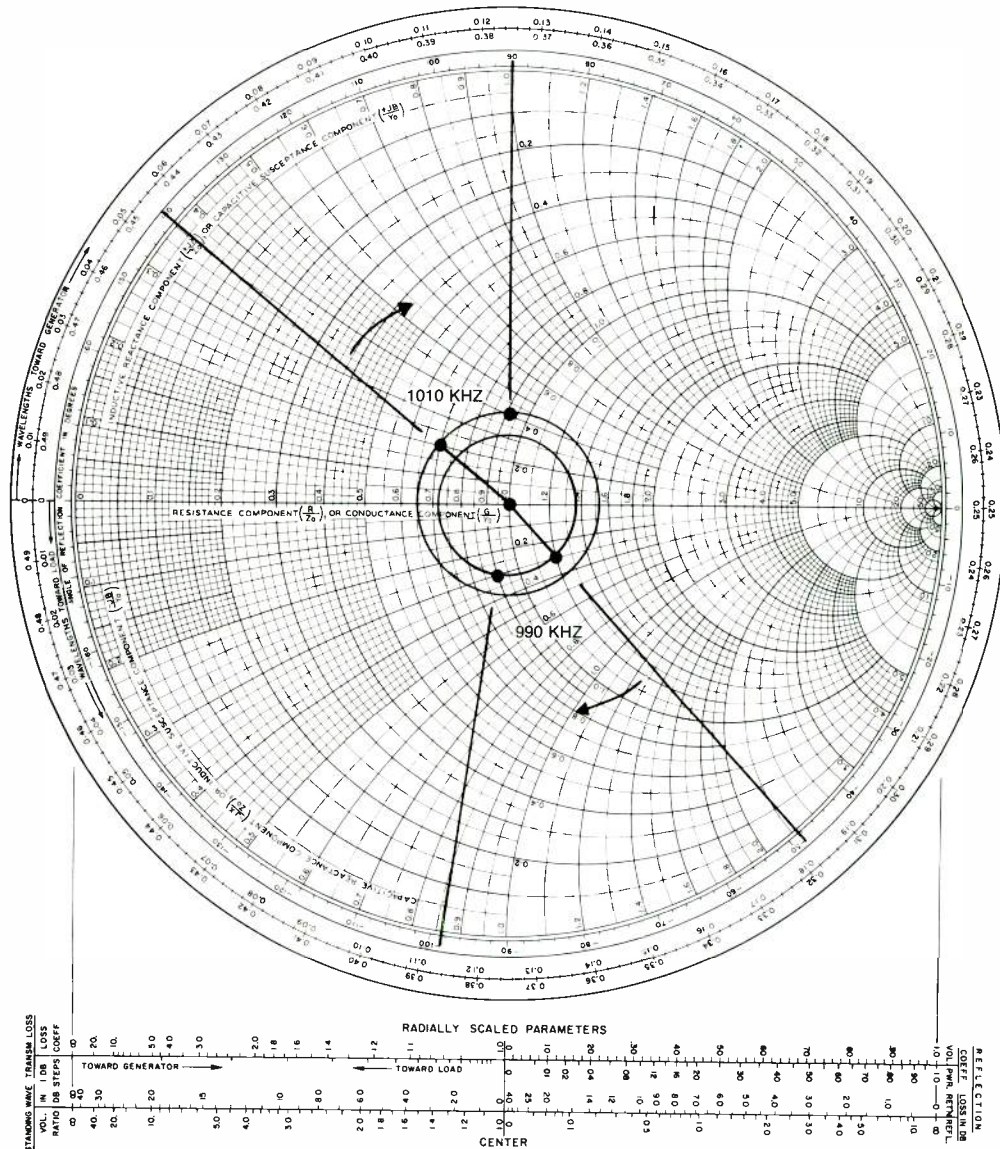


Fig. 2. Smith Chart. You may wish to use your own blank Smith chart to follow along with the article

If the network were presently adjusted at -80° , a new phase shift of -105° would be indicated. The Smith Chart is a model of a transmission line. The phase shift along a transmission line is negative, by convention.

Keep in mind that the Smith Chart "phase rotation" technique is only an approximation when using lumped-parameter networks. Some iteration of the network adjustment may prove to be desirable if the initial adjustment does not bring the sideband impedances to within five percent of the desired values. Finer adjustment is usually a waste of time.

If you have adjusted for symmetry, but find that you cannot meet the FCC performance requirement of ± 2 dB at 5 kHz referenced to 1 kHz, the other area of symmetry may solve this problem. The FCC requires that the transmitting equipment meet the ± 2 dB response specification from 100 to 5000 Hz without the use of any filtering in the audio line. It is not likely that the antenna will affect your frequency response by much more than one dB, but remember that this is additive. If your test tone is already

down 1.5 dB before it gets to the antenna, then the overall system may have cumulative problems.

The far-field depth of modulation depends on the amount of power developed in the resistive portion of sideband impedances. Assume an ideal voltage source as shown in Figure 1.

Freq. (kHz)	Voltage Source Output	RF Voltage Sample	Load Impedance	Load Current	Power	Relative Far-Field Signal Strength
990	1120	1.12	$600 - j375$	1.58	1500	1.23
1000	2240	2.24	$1000 + j0$	2.24	5000	2.24
1010	1120	1.12	$600 + j375$	1.58	1500	1.23

The voltage source sideband levels were chosen for 100 percent modulation as indicated by an RF voltage sample. Note that the sideband current is relatively high, and the total load power, 8000 watts, is higher than the 7500 watts that would exist in a flat 1000-ohm load. This could result in a far-field 10 kHz pre-emphasis of $20 \log(1.23/1.12) =$

continued on page 70

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AM Bandwidth Problems

Fig. 3. Series-resonant circuit with adjustable coil and capacitor

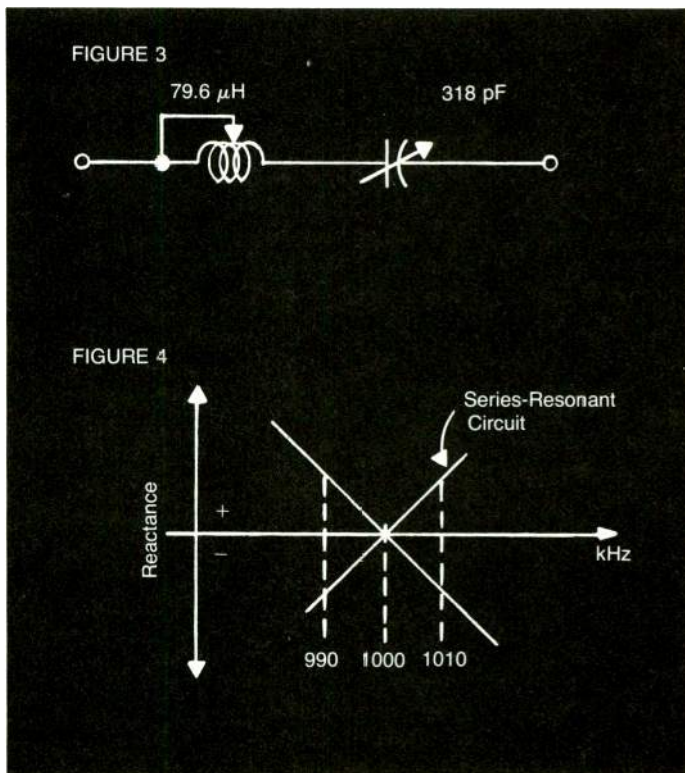


Fig. 4. Mirror-image reactance characteristic

0.8 dB. Using an RF current sample per Figure 1, the apparent pre-emphasis at the transmitter would be $20 \log(1.58/1.12) = 3.0$ dB. So you can see the need to calibrate the transmitter readings with the far-field readings.

On the other side of the Smith Chart (-90° away) another situation could occur. The far-field 10 kHz de-emphasis is -2.2 dB, while the current sample yields a figure of -3.0 dB. Since -2.2 dB is worse than $+0.8$ dB, in this case one would tend to choose the original area of symmetry.

Freq. (kHz)	Voltage Source Output	RF Voltage Sample	Load Impedance	Load Current	Power	Relative Far-Field Signal Strength
990	1120	1.12	$1200 + j750$	0.79	750	0.87
1000	2240	2.24	$1000 + j0$	2.24	5000	2.24
1010	1120	1.12	$1200 - j750$	0.79	750	0.87

There are other techniques available for treating limited bandwidth antenna systems besides providing a symmetrical load at the PA of the transmitter. The next step is broadbanding.¹⁰

There are several techniques of broadbanding, some costing more than others. The simplest is sideband reactance cancellation. By using the phase rotation technique, the antenna equipment is adjusted to present a negative sideband reactance slope to a series-resonant circuit (see Figure 3) having the mirror-image reactance characteristic (see Figure 4).

kHz	Common-Point Impedance	Series Resonant Circuit Impedance	Resulting Impedance	Old VSWR	New VSWR
990	$43 + j10$	$1 - j10$	$44 + j0$	1.29	1.16
1000	$50 + j0$	$1 + j0$	$51 + j0$	1.0	1.0
1010	$43 - j10$	$1 + j10$	$44 + j0$	1.29	1.16

¹⁰Grant W. Bingham, "A Bandwidth Flattener for AM Transmission Systems," Harris Broadcast Products.

Avoid stray capacitance

When using relatively large coils in broadbanding applications, it is very important to avoid stray shunt capacitance to ground. In order to minimize spurious impedance transformation caused by stray capacitance, it's important to space the coils adequately from the walls. It's useful to have an empirical understanding of a particular coil's performance in various mounting configurations. The coil and wall losses will contribute a certain amount of resistance to the circuit, $R = X/Q$. To allow for all these spurious effects, note that both the coil and the capacitor of Figure 3 are adjustable.

If you are able to obtain equal sideband resistances, but the sideband reactance magnitudes are *not* equal, an additional component may do the trick (see Figure 5). This circuit is series resonant at 1000 kHz, and anti-resonant at 970 kHz. Note that the coil series resistances are included. For a Q of 300 at 1000 kHz, $R_1 = .07$ ohms and $R_2 = 1.12$ ohms.

Figure 6 displays a somewhat different characteristic. Series-resonance occurs at 1000 kHz, and anti-resonance at 1030 kHz. As can be seen in both cases, coil resistance has a significant effect on the impedance. Larger diameter tubing will reduce the resistance. It is important to note that if the coil is not mounted far enough from the cabinet walls, an induced current in the wall may cause a significant increase in the effective resistance of the coil; that is, the coil's Q will drop. The Q will also drop if the electrical connections to it are poor.

A more complicated circuit can provide a flatter bandpass. An L network with each leg tailored to provide a specific reactance characteristic may look like Figure 7 or 8.

continued on page 73

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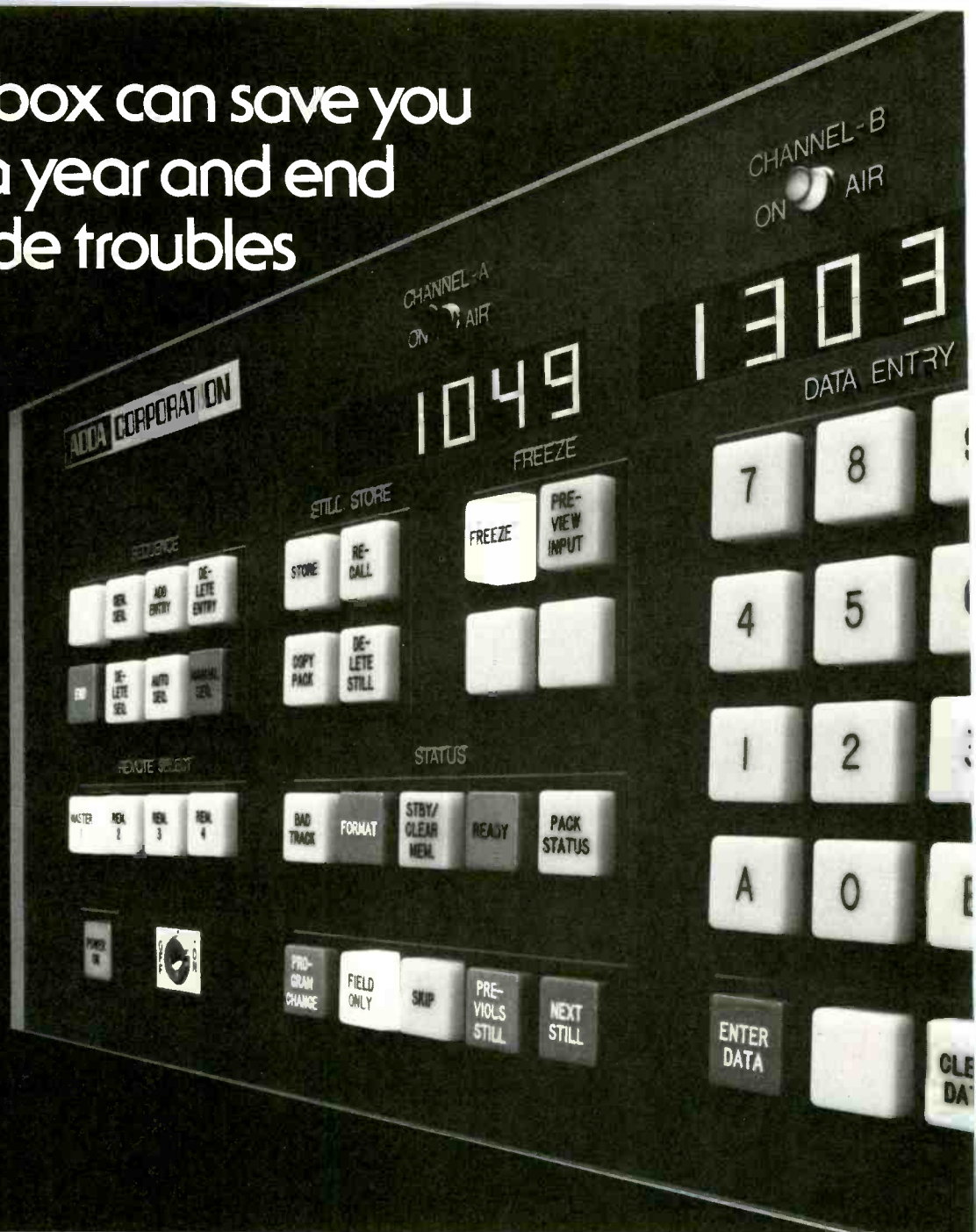
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AM Bandwidth Problems

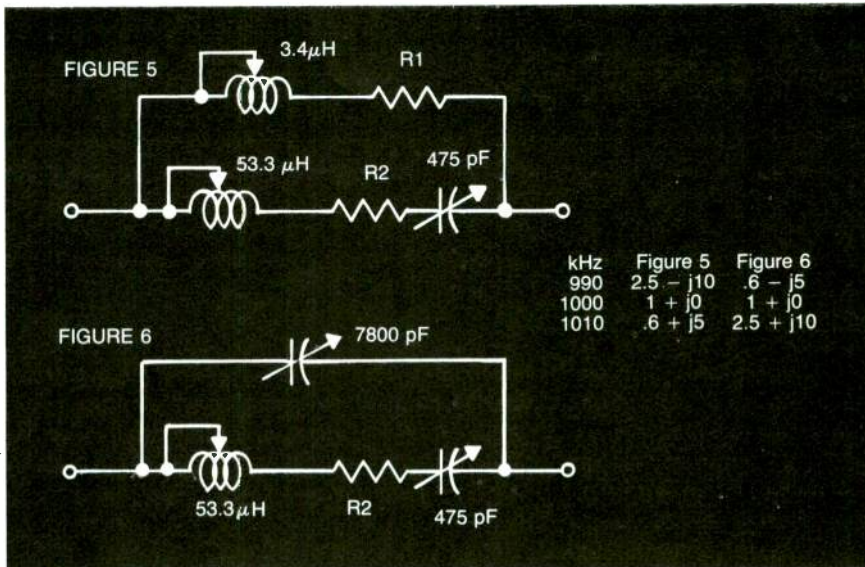


Fig. 5. Additional component to be used if sideband reactance magnitudes are not equal

Fig. 6. A somewhat different characteristic

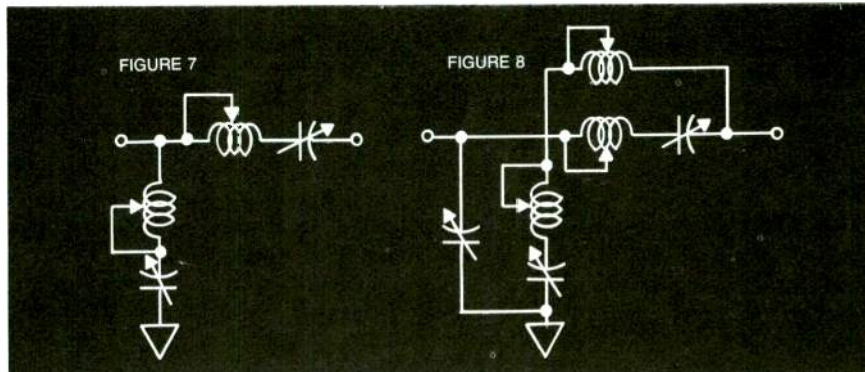


Fig. 7. An I network with tailored legs to provide a specific reactance characteristic

Fig. 8. Another approach to the I network

Broadbanding techniques become less practical with increasing power levels and increasing circuit complexity. Keep in mind that additional coils mean additional power losses. Although I^2R losses may create some unlooked-for bandwidth improvement, a measurable reduction in field strength may also occur. The return on the investment must be carefully considered, if the intent is only to improve the station's air sound when it already complies with FCC performance standards.

Sometimes it's possible to readjust existing antenna networks for increased bandwidth.¹¹ This is especially true of a phased array which was initially adjusted for the correct pattern, with no particular regard being given to bandwidth. Take a look at your common-point impedance measurements. Compute the VSWR at the ± 10 kHz sidebands. Now look at your non-da (non-directional antenna) tower base impedance measurements. If the resonated non-da tower sideband VSWR is substantially less than the common-point VSWR, there may be room for improvement through readjustment of the antenna networks. Let's look at some examples:

Here are the non-da tower data (this analysis assumes that all the towers in the array have the same self base impedance):

kHz	Self Base Z	Resonated Z	VSWR
740	$37.7 + j77.9$	$37.7 - j10.2$	1.31
750	$39.4 + j86.9$	$39.4 + j0$	1.0
760	$43.3 + j97.9$	$43.3 + j12.2$	1.36

Here are the original common-point data:

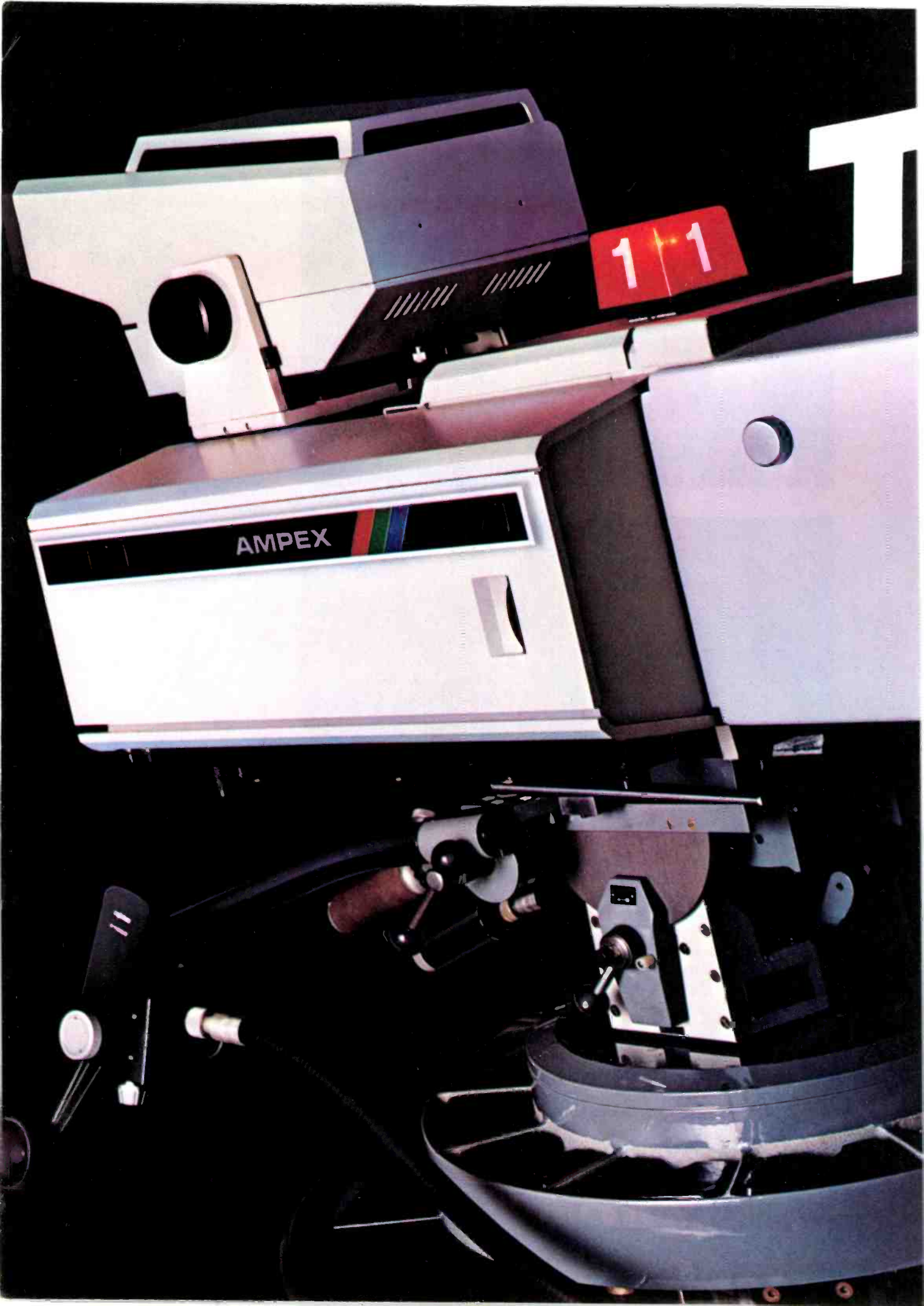
kHz	Common-Pt. Z	VSWR
740	$58.6 - j25.0$	1.62
750	$50 + j0$	1.0
760	$56.6 + j20.1$	1.42

As you can see, an attempt has already been made to provide symmetry at the common-point, with fairly acceptable results. We can assume that the chief engineer also made sure that symmetry was simultaneously achieved at the PA of the transmitter. However, the common-point sideband VSWR is substantially higher than the non-da tower sideband VSWR.

The first thing to investigate is the input matching network. Temporarily detach the matching network from the common-point side of the power divider. Measure the impedance seen looking into the power divider at the carrier frequency and ± 10 -kHz sidebands. Figure what these impedances are when the carrier frequency reactance is resonated. Now figure VSWR (it might be easiest

continued on page 77

¹¹Grant W. Bingeman, "Harris AM Stereo Compatibility With Phased Arrays," Harris Broadcast Products.



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AM Bandwidth Problems

to do this on a Smith Chart).

If the VSWR at the power divider is higher than at the common-point, the input matching network is creating some reactance cancellation, and/or adding substantial losses. If the power divider VSWR is less than the common-point VSWR, then the phase shift across the input matching network may be too high. The higher the phase shift, the greater the sideband VSWR of a tee network (see Figure 9). To determine phase shift, you can use your antenna monitor or compute it from Equation 1

and Figure 10 (for a tee network). Be sure to keep track of minus signs.

$$\text{Eqn. 1 } \theta = \tan^{-1} \left[\frac{R_1}{X_1 + X_3} \right]$$

Do not use Equation 2, because it gives ambiguous results. In the past, some people have wasted a lot of time thinking they had a low phase shift when it was actually quite high.

$$\text{Eqn. 2 } \theta = \sin^{-1} \left[\frac{\sqrt{R_1 R_2}}{X^3} \right]$$

continued on page 78

Fig. 9. The higher the phase shift, the greater the sideband VSWR of a tee network

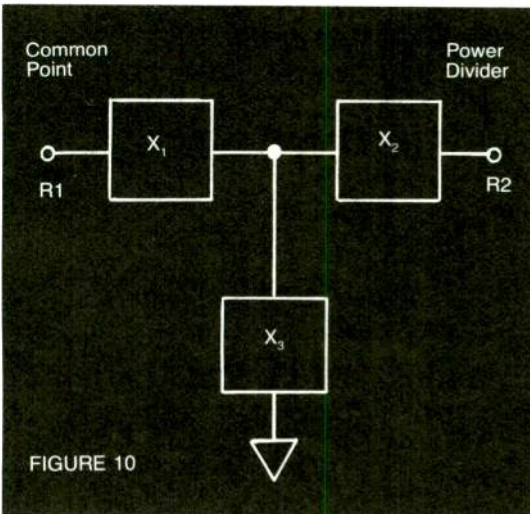
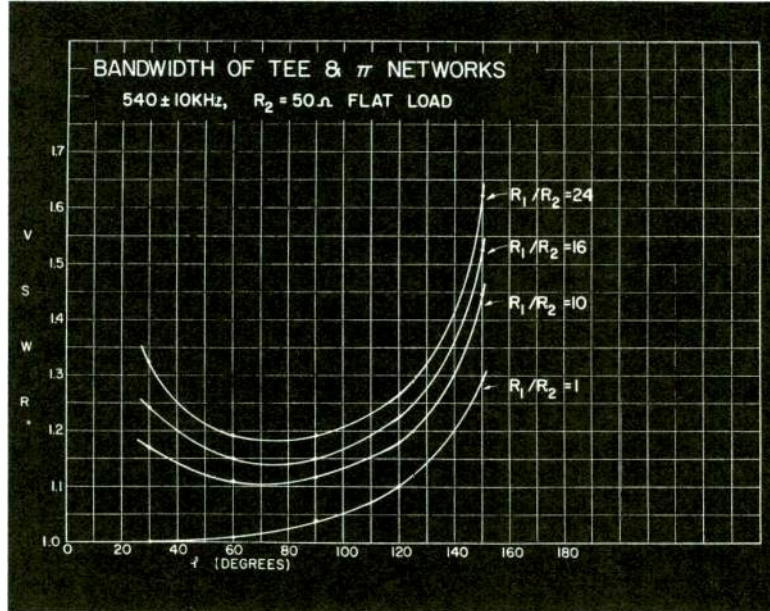


Fig. 10. Use equation 1 to determine phase shift

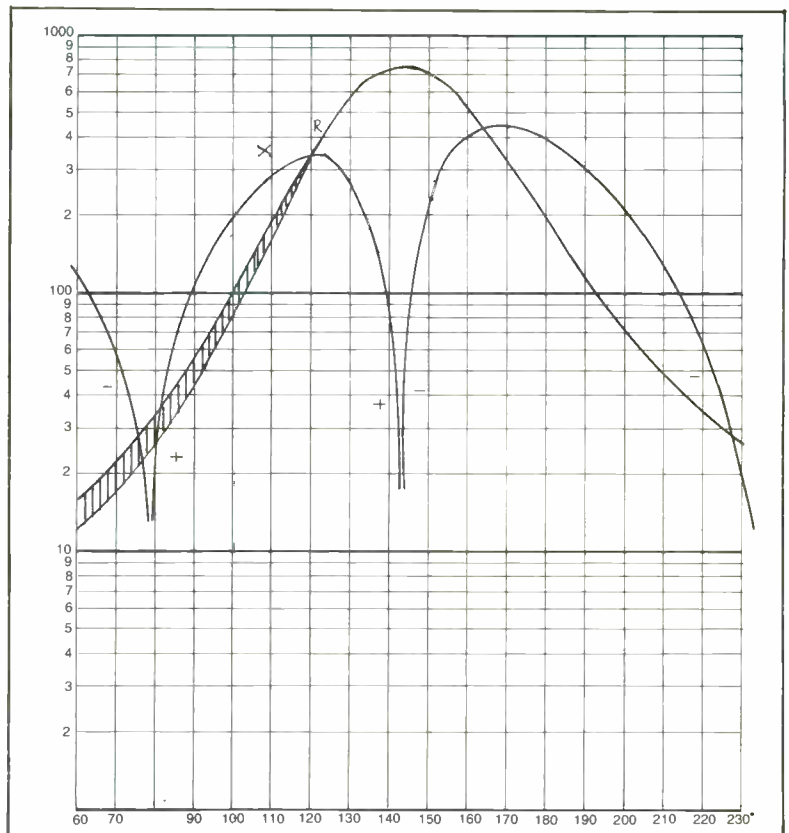


Fig. 11. Indicates an area of possible reactance cancellation for tower heights between 120° and 170°

AM Bandwidth Problems

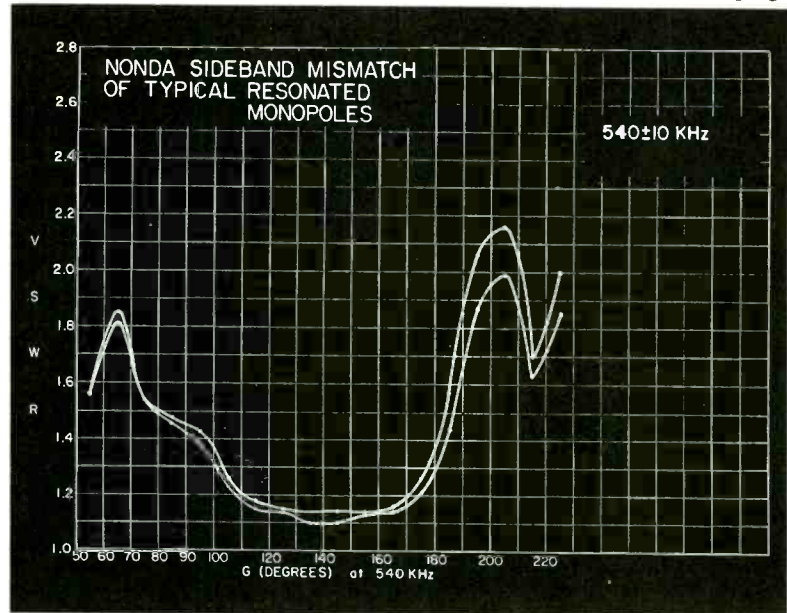
These equations assume that a lagging phase shift is indicated by a negative value of θ .

It turned out that the phase shift of the input tee matching network was near -155° for the original common-point impedances. The same area of symmetry exists 180° away. Therefore it was apparent that a phase shift near $+35$ degrees would be suitable. A $+30^\circ$ input tee matching network yielded the following results:

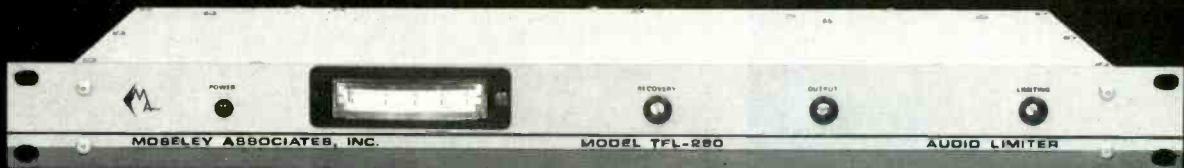
kHz	Common-Pt. Z	VSWR
740	$55.7 - j13.2$	1.31
750	$50 + j0$	1.0
760	$59.1 + j13.4$	1.35

By decreasing the phase shift magnitude of the matching network, a significant improvement was obtained in system bandwidth. However, in some systems an *increase* in the phase shift magnitude of the input matching network may improve bandwidth through reactance cancellation or increased losses. Each system must be carefully measured and analyzed. When changing the phase

Fig. 12. Resonated bandwidth of towers this height is already quite good because resistance is so much greater than reactance



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shift of tee networks, be careful not to exceed the voltage or current ratings of the shunt-leg components (as in Equation 3).

$$i_3 = \sqrt{i_1^2 + i_2^2 - 2(i_1 i_2 \cos \theta)}$$

Symmetry Networks

It should be apparent that the performance of a transmitter into the non-da antenna system can be similarly affected. There are several networks which can provide sideband symmetry, but only one which will simultaneously provide the lowest sideband VSWR.

Figure 11 indicates an area of possible reactance cancellation for tower heights between 120° and 170°, where the base reactance decreases with increasing frequency. However, according to Figure 12, the resonated bandwidth of towers this height is already quite good. The reason for this is the fact that the resistance is so much higher than the reactance. Thus, the reactance cancellation technique would not yield a significant reduction of sideband VSWR.

After making impedance measurements, there is a simple way to check validity. Plot the impedances on a Smith Chart, and draw a curve through the points. If the curve does not move in a clockwise direction with increasing frequency, then at least one of the measurements is in error. If any of your network components is running hot, it's also wise to consider making impedance measurements before the components have time to cool off.¹² Other than this consideration, there is no impairment of measurement validity when using a low-power generator,

¹²Although the resistivity of copper increases with increasing temperature, skin depth also increases. The resulting increase in conductor cross-section counteracts the increased resistivity somewhat.

as long as the interference levels are reasonable. This is because the antenna is linear.

Don't forget that different networks have different effects on carrier harmonics. It's wise to consider what will happen to the relative field strength of your harmonics before changing from a low-pass to a high-pass configuration. Also keep in mind that the effectiveness of harmonic filtering can be impaired by a change in terminating impedance. Whenever you make changes in your antenna, the terminating impedances will change. A transmitter normally will show good suppression of spurious frequencies when operating into a perfect test load, and yet may fail to comply with 73.40(a) (12, 13, and 14) when operating into an antenna.

Don't expect to be able to optimize your signal performance along every azimuth of a directional pattern.¹³ The best you can expect to obtain is an improved signal quality in your major coverage area(s). With regard to stereo performance, if the Harris CPM system of AM stereo is adopted, you need not worry about treating your antenna bandwidth if you have already done so for mono. This is not the case with the other AM stereo proposals, because their bandwidth requirements are much more severe.¹⁴

In conclusion, if ± 10 kHz sideband VSWR is less than 1.2, your antenna is in good shape. If not, you should determine if your far-field signal quality is suffering. Then you should decide what techniques are appropriate to improve your signal quality, and whether or not the investment is justifiable. **BM/E**

¹³Clifford H. Houlton, "Signal Distortion by Directional Broadcast Antennas," May, 1952, *Proceedings of the IRE*.

¹⁴For details, refer to the Harris reply comments to FCC Docket 21313.

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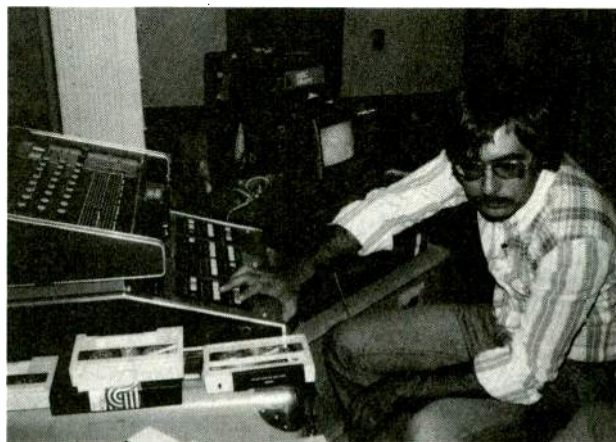
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Nets Provide Superb ENG Coverage of Sadat In Israel

With just two days advance notice of one of the major news events of 1977, the three major networks were able to put together a remarkable ENG operation that did the job. The move to ENG for overseas operations got an unexpected boost from this surprise visit.



Departure ceremony for Egyptian President, Anwar Sadat, is recorded by Israeli television and network pool at Ben-Gurion airport on November 21. Playing of Israeli and Egyptian national anthems concluded historic visit



Mike Tcherkassky, electronic journalism editor for NBC News, Washington, D.C., editing story on Sony BVU edit package shipped in from Miami Bureau. Story for Nightly News

THE ORIGINAL VISIT TO ISRAEL by Egyptian President Anwar el-Sadat caught the world by surprise. But for the three American networks, the event was more than a surprise; it was a challenge. In fact, the timing of the visit presented one of the most rigorous tests so far of Electronic News Gathering techniques.

"We've never before had to cover so major an event on videotape on such short notice," said Tom Wolzien, director of NBC's News Broadcast Services. "With one of Carter's tours we usually have from three weeks to a month to prepare. With Sadat it was only two days and we weren't sure until the last minute that it would come off."

There were other problems that made matters worse. Although ultimately cancelled, Carter's international tour was scheduled for the same time as Sadat's unexpected visit. Thus, broadcasters had to be prepared to simultaneously cover two major news stories. "The possibility that Carter's and Sadat's trips might overlap was almost more than we could handle," said Gideon Fiat, ABC's director of Electronic News Gathering. "But the whole year's been like that. We've been deluged."

The situation also stretched NBC's capabilities: "All our equipment in New York had been earmarked for Carter's visit," said Garfield Ricketts, manager of NBC's New York Electronic Journalism operations. "But when the Middle East business hit us we had to send it all there. To cover Carter then, we pulled ENG hardware and crews out of our domestic bureaus in Atlanta, Chicago, Boston, Washington D.C., and Miami."

CBS was in the middle of converting its European bureaus from film into electronics when the Middle East situation burst upon them and accelerated their plans. "We had planned to equip the camera crews in Rome and then give them a couple of weeks to learn the equipment," recalled Casey Davidson, vice president of Operations, CBS News, "and then do the same thing in Paris and so on. But Sadat's trip forced us to accelerate our schedule. It meant that we had to put people into action who didn't have quite as much knowledge as necessary, and back them up with American crews."

Travel in the Middle East can be difficult under the best circumstances. But it gets much worse if, like network broadcasting personnel, you have to travel from Egypt to Israel or hurriedly process masses of technical equipment past suspicious customs officials. ABC left some of its equipment in Paris and chartered a private jet to fly it from

continued on page 82

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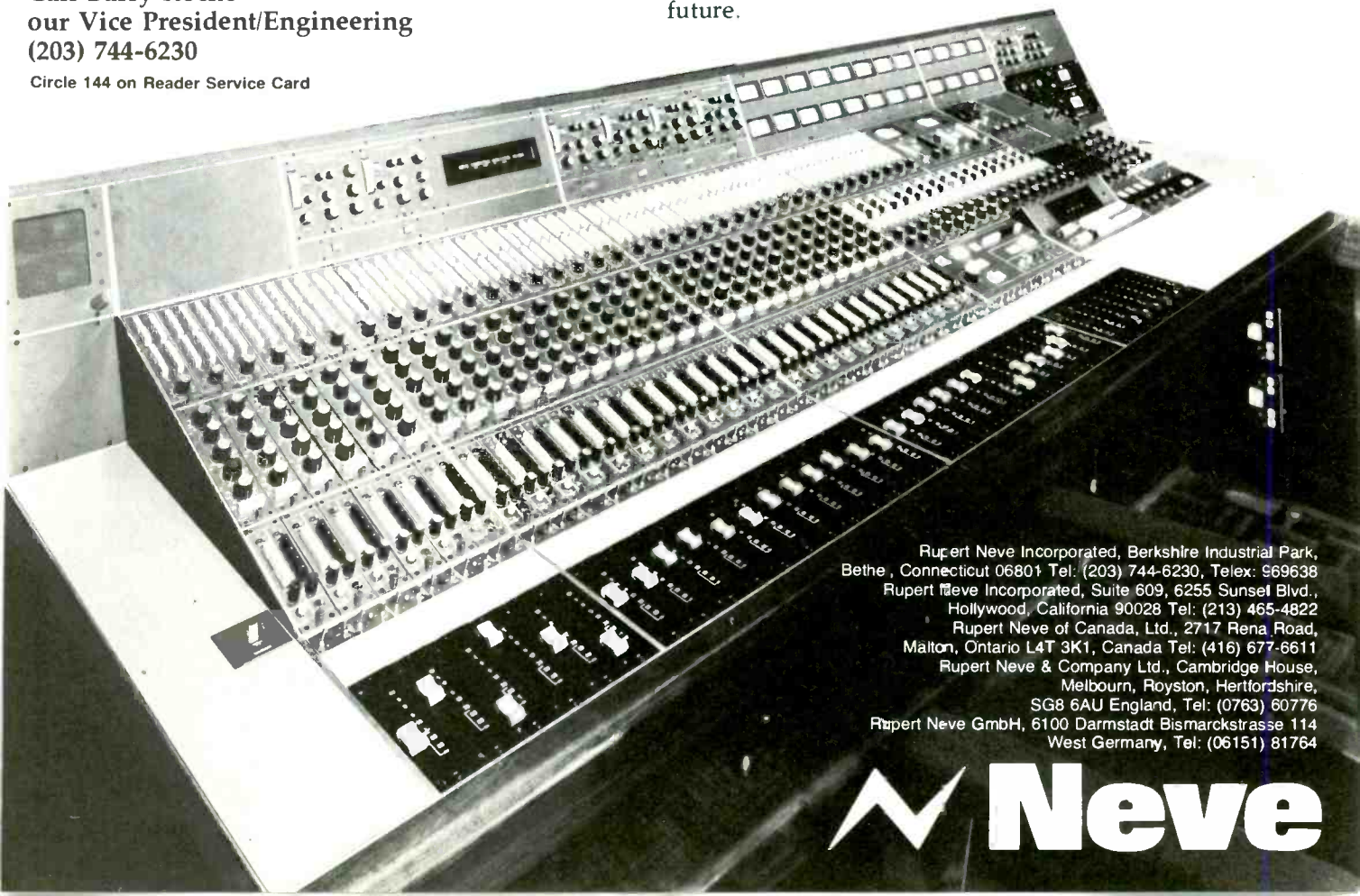
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ENG Coverage of Sadat

Paris to Tel Aviv. But before the plane could take off, special permission had to be secured from both France and Israel for an unscheduled night flight. "It was touch-and-go as to whether they'd make it in time," said Fiat ruefully.

Networks blanketed coverage with minicams

Each network covered Sadat in its own way. NBC's facilities were the most elaborate. The organization used five camera crews, each with a cameraman and sound technician. Each team was equipped with an RCA TK-76 minicam and portable Sony BVU-100 VCR. NBC also deployed three editing packages which included three Sony BVU-200 editing decks and a BVE-500 editing console.

From 70 to 75 percent of the network's footage was shot on minicams and then edited in the field. Most of the remaining footage depended on Israeli television's live broadcast of Sadat's arrival, departure, and address to the Knesset.

CBS relied even more heavily on live Israeli television. During the flight from Egypt one cameraman was permitted on the plane to tape Walter Cronkite's interview with Sadat. Subsequently reunited with a technician, this crew was joined by a French team in Tel Aviv. Two editing systems were set up, one in Tel Aviv and the other in Jerusalem. Instead of RCA cameras, CBS used Thompson 1515s, but otherwise its technicians were equipped similarly to NBC. In production a BVU-100

was dedicated to each minicam. Post production systems were based on two BVU-200s with the complementary BVE-500.

Like NBC, ABC depended heavily on its ENG capability. But ABC suffered from a shortage of equipment and trained personnel. It dispatched three ENG crews and three editing systems to cover Sadat, and its technicians had to work around the clock. ABC's camera teams were equipped either with BVU-100s or VO-3800s, a somewhat older, industrial version of the 100. The editing systems were based on pairs of Sony VO-2850 editing decks, an industrial videocassette unit.

As ABC rapidly builds up its ENG capability, the network is gradually replacing its old equipment with state-of-the-art hardware. Ultimately, VO-2860s will replace the 2850s and the VO-3800s will be completely phased out in favor of BVU-100s.

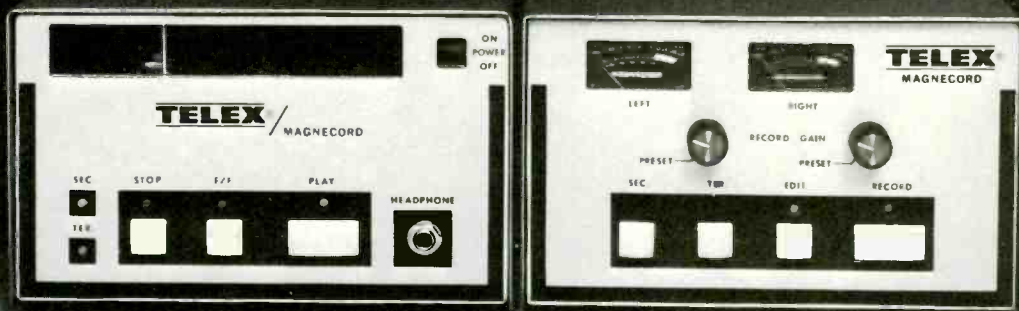
ABC backed up its electronic crews with film, but otherwise that medium played only a limited role in covering Sadat's visit to Israel. In so far as this type of coverage is concerned, ENG's live capability has made it the medium of choice for the networks. Film equipment will be kept on hand by some of the overseas bureaus for the foreseeable future.

"It was good that we didn't have to use film," said Fiat. "The quality of film processing in the Middle East is not high. As time passes, there are fewer and fewer film processing facilities available."

"When we used film," said Ricketts, "we never could be certain about going to air because of problems in processing. But that's not the case with videotape: if we

continued on page 85

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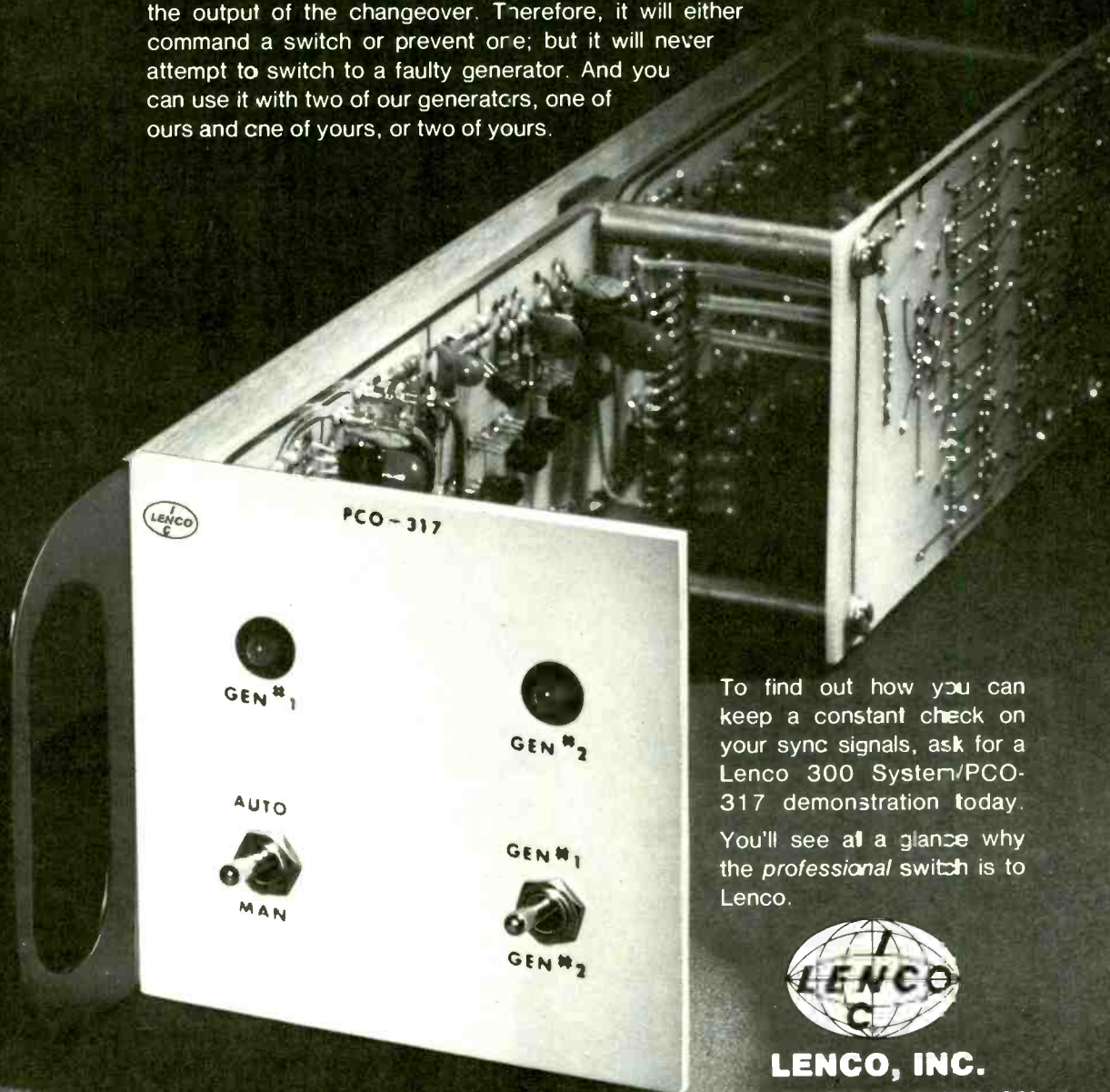
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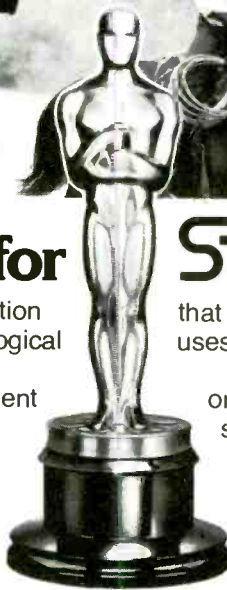


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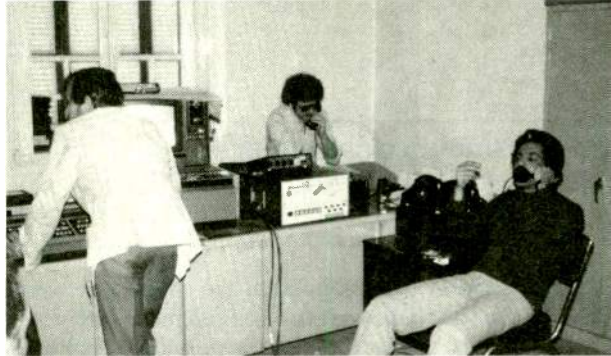
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ENG Coverage of Sadat

don't have access to an editing system, we can always go to air with the BVU-100."

Lightweight equipment essential

Of course, the portability of the 3/4-inch videocassette equipment is what made the transition possible, but broadcasters are still looking for lighter equipment. "Although our equipment is small and light," said Fiat, "it still gets heavy when you have to run with it for a few hundred yards. We're hoping that, one of these days, we'll have a 1/2-inch or even a 1/4-inch tape."



Network producers (Jim Lee, NBC Washington center, background) on phones. During early days of peace offensive, no coordination circuit was available from Cairo to U.S., so coordination of feeds handled by phone when possible. Often phones broke during middle of feeds, or calls never went through, so at times feeds were coordinated by telex located four miles away, or sent blind



NBC News producer Larry Marrone (foreground) from New York, and electronic journalism editor Barry O'Brian from NBC News, London editing Today Show story in Cairo

Sine the equipment is vulnerable to dust, and to mishandling during shipping, all the networks carried spares. Because this adds weight and bulk to the operations, broadcasters are always looking for ways to reduce the additional weight. NBC, for example, used 8-inch Sony Trinitron® receivers (modified into monitors) with its editing systems instead of larger sets in the Middle East. This saved 100 pounds for each field editing package.

Although Sadat's trip to Israel raised many behind-the-scenes problems, none of these were apparent to the millions of home viewers. Technical, logistical, and production obstacles were overcome, and coverage of the momentous state visit went off without a serious hitch. It was, in Ricketts' words, "another big news event, another job. Something we handle." **BM/E**

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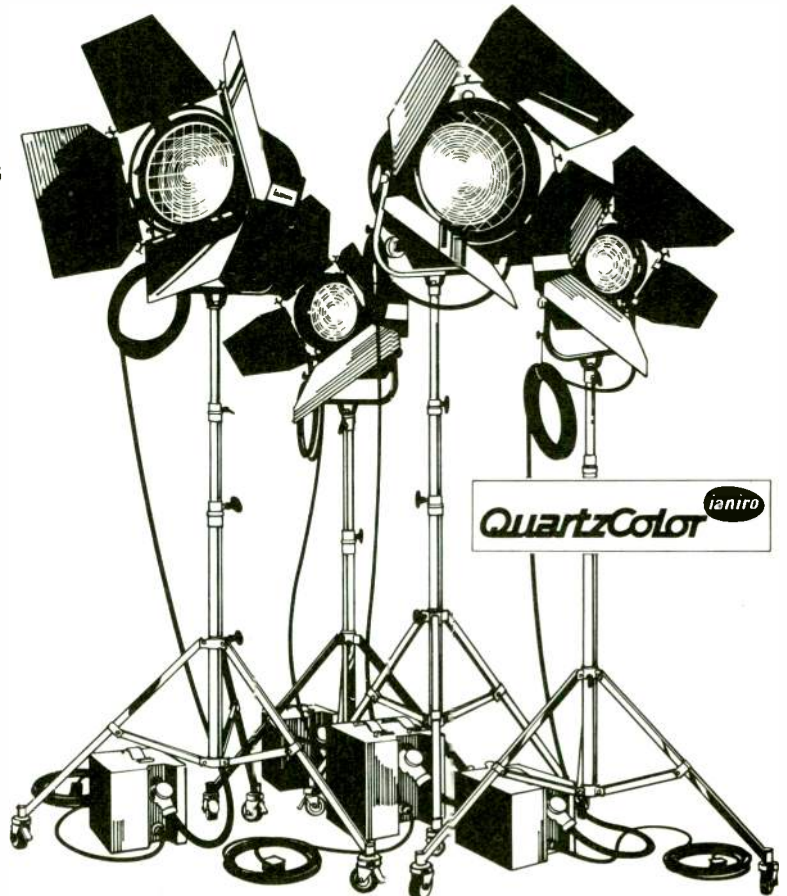
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The Pocket Calculator And The D.A.

By George W. Ing

This is Part 3 of a series of articles on the use of the programmable calculator for solving broadcast engineering problems. Part 1 appeared in July '77 and Part 2 in January '78.

NOWADAYS THE CONSULTING ENGINEER saves a great deal of time by using a computer in the design of directional antenna systems. The station engineer, however, seldom has access to a computer, but if he has done some studying on his own, or has attended one of the directional antenna seminars, he usually develops a keen interest in the workings of his own D.A. as well as others. One drawback to pursuing this interest is that D.A. calculations are tedious and time-consuming.

In the past year or so, the drop in price of programmable calculators has brought their cost within reach of the average pocketbook, and although they are no match for the computer in speed, they are a great improvement over the laborious slide-rule methods of the past.

The explanation of the use of the calculator will be preceded by a brief review of the theory involved in calculating the relative field strength at specified azimuth angle observation points around a simple two tower array. Then the development of simplified formulas will be discussed, followed by the application of programmable calculators to their solution. A prerequisite, of course, is that the user have a working knowledge of high school algebra, trig and vectors, plus some exposure to D.A. theory.

As an example, we will determine the horizontal plane pattern for the two tower array in Figure 1 (p. 88). The towers are 90° in height and separated 90° on a north-south axis. The south tower is selected as reference. The north tower radiates a field whose magnitude and phase compared to reference are such that when the two fields are combined, the degree of reinforcement or cancellation varies with the azimuth angle in a desired manner. At any receiving point along a circle around the system, a field meter will measure the sum of the two arriving sine waves. They may differ in magnitude and phase but the field meter reads the vector sum. (The radius of the circle should be large enough so that the paths from the two towers to the observation point are assumed to be parallel.

George W. Ing is director of engineering at Mission Broadcasting Company in San Antonio, Texas.

A one mile radius is appropriate if the spacing between towers is one tenth mile or less.) The reference sine wave may be shown as an electrical vector with unit magnitude and zero phase angle, and may be written $1.00 \angle 0^\circ$, in polar form. The other vector has a magnitude and initial phase which may be written $.45 \angle 96^\circ$.

As an observer starts to circle the array with a field meter and has reached a point due north of the array at 0° azimuth angle, the received field from the #2 tower is advanced 90° in phase because #2 is 90° closer than the reference tower. When the observer is due east at 90°, both towers are at the same distance and there is no change in the initial phase of the fields as they arrive at this point. This is also true due west of the towers at 270°. When the observer is due south of the array at 180°, the phase of the #2 tower field is retarded 90° from its initial phasing because #2 is 90° farther away than the reference tower.

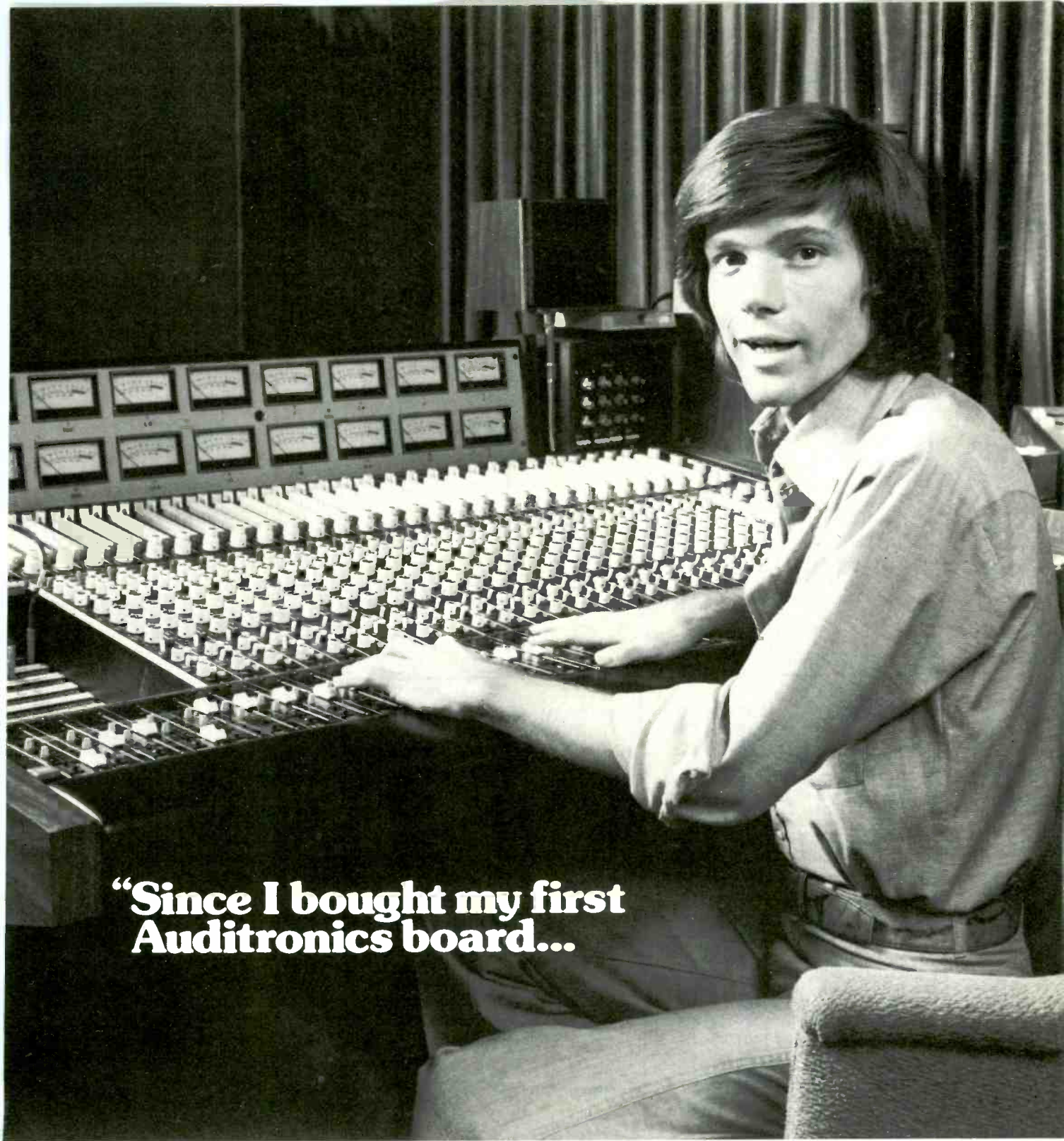
Thus, it can be seen that the spacing of the towers has caused a "space" phasing factor to be introduced into the #2 vector. Fortunately, the space phasing at any azimuth angle can be accounted for by simply adding the space phasing factor " $S \cos \phi$ " to the initial phasing. The #2 vector may now be written $.45 \angle S \cos \phi + 96^\circ$, where S is the spacing between towers in degrees and 0 is the azimuth angle of the observation point. If, for instance, we want to find the relative field at the 60° azimuth observation point, the two vectors to be summed are:

$$\begin{aligned} \#1 & 1.00 \angle 0^\circ \\ \#2 & .45 \angle 90^\circ \cos 60^\circ + 96^\circ \text{ or, } .45 \angle 141^\circ \end{aligned}$$

Usually, vectors in polar form are changed to rectangular form for addition. Then the sum is changed back to polar form:

$$\begin{aligned} \#1 & 1.000 + j 0.0000 \\ \#2 & - .3497 + j 0.2832 \\ \hline & .6503 + j 0.2832 = \text{Sum of vectors.} \end{aligned}$$

Converting the sum of vectors to polar form and finding
continued on page 88



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Pocket Calculator

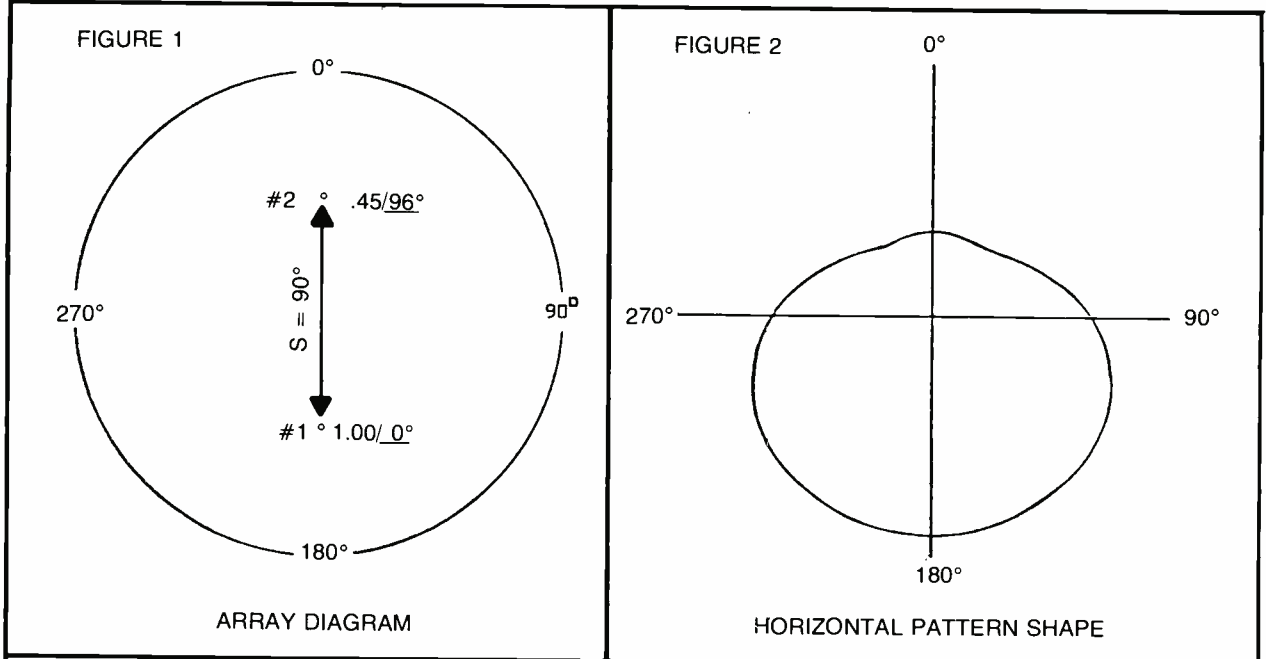
the magnitude:

$$\sqrt{6503^2 + .2832^2} = .7093$$

The magnitude of the polar vector is the relative field at 60° azimuth. The phase angle is not required.

To make this calculation manually for each azimuth angle would be extremely tedious. Many years ago it was found that by various trig manipulations it was possible to simplify calculations somewhat by eliminating the imaginary or "j" components. The "cosine law" formula is an example. (See "Theory And Design Of Directional An-

continued on page 90



PROGRAM #1:				PROGRAM #2:				PROGRAM #3:			
LOC	LRN	PROGRAM EXECUTION RESULTS:		LOC	LRN	PROGRAM EXECUTION RESULTS:		LOC	LRN	PROGRAM EXECUTION RESULTS:	
00	COS			00	STO			00	COS		
01	X	ϕ	MV/M	01	1	θ	$f(\theta)$	01	x	ϕ	MV/M
02	9			02	SIN			02	9		
03	0	0	99.80	03	x	10	.9779	03	0	0	72.18
04	+	10	99.48	04	9	20	.9143	04	x	10	72.65
05	9	20	99.00	05	0	30	.8165	05	.	20	74.23
06	6	30	99.82	06	=	40	.6946	06	7	30	77.28
07	=	40	103.93	07	COS	50	.5589	07	6	40	82.21
08	COS	50	113.07	08	÷	60	.4178	08	6	50	89.26
09	x	60	127.67	09	RCL	70	.2766	09	+	60	98.29
10	.	70	146.63	10	1	80	.1374	10	9	70	108.85
11	9	80	167.97	11	COS			11	6	80	120.21
12	+	90	189.51	12	=			12	=	90	131.60
13	1	100	209.38	13	R/S			13	COS	100	142.31
14	.	110	226.24	14	RST			14	x	110	151.78
15	2	120	239.40		LRN			15	.	120	159.66
16	0	130	248.78					16	9	130	165.85
17	2	140	254.81					17	+	140	170.42
18	5	150	258.23					18	1	150	173.56
19	=	160	259.89					19	.	160	175.54
20	*√x	170	260.54					20	2	170	176.62
21	x	180	260.69					21	0	180	176.95
22	1							22	2		
23	8							23	5		
24	0							24	=		
25	=							25	*√x		
26	R/S							26	x		
27	RST							27	1		
	LRN							28	2		
								29	5		
								30	=		
								31	R/S		
								32	RST		
									LRN		

TABLE OF COSINES:

0°	1.0000
10	.9848
20	.9397
30	.8660
40	.7660
50	.6428
60	.5000
70	.3420
80	.1736
90	.0000

NOTES: *Indicates 2nd function of key.
LOC is program memory location number.

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Pocket Calculator

tennas" by Carl E. Smith, for an explanation of the derivation.)

Cosine law formula

For the relative field in the horizontal plane, the cosine law formula may be stated as follows:

$$\text{RELATIVE E} = \sqrt{1 + F_2^2 + 2F_2 \cos(S \cos \phi + P_2)}$$

Where

- F_2 = Field ratio of #2 tower (.45)
- S = Spacing between towers in degrees (90°)
- ϕ = Azimuth angle of selected observation point.
- P_2 = Phase angle of current in #2 tower ($+96^\circ$)

Solving this formula for points all around a circle will give us the shape of the pattern only, and this may be all that is desired. However, if we want to predict the actual field strengths, and therefore both the shape and the size of the pattern, we must multiply all answers by the "K" factor, which is the field strength at one mile from the reference antenna while it is operating in the array.

Determining the "K" factor for this array is beyond the scope of this article. (Refer to the Smith text or the NAB Handbook for several methods.) However, for one kilowatt radiated power, the K, or E_1 factor as it is often called, has been found to be approximately 180 mV/m. If we substitute the parameters of our array in the formula and use a K factor of 180, the formula can be written as follows:

$$E = 180 \sqrt{1.2025 + .9 \cos(90^\circ \cos \phi + 96^\circ)}$$

Where E = Inverse field strength at one mile in mV/m

This is the formula we will program into the calculator. Notice that although it appears complicated, there is only one variable, the azimuth angle ϕ .

Programmable calculators

Two of the leading programmable calculators are the TI SR-56 and the HP-25. Either one may be used equally well, although the procedures differ. The writer happens to have an SR-56. (This model has been superseded by the TI-57 and TI-58, but the procedures are similar. One

difference is that some operations that are first function of a key on the old model are second function on the new, and vice versa.) To program the formula into the SR-56, the calculator is first cleared and then placed in the "Learn" mode (LRN). After the LRN key is pressed, the calculator, in effect, leaves a slot for the azimuth angle when it is entered at the time of program execution.

Next, instructions may be entered in the following order. Find the cosine of whatever azimuth angle is later entered, multiply it by the 90° spacing and then add the phase angle of the #2 tower to form another angle. Find the cosine of this angle, multiply by .9 and add 1.2025. The square root of the result is taken and then multiplied by 180. After these steps are entered, the R/S, RST and LRN keys are pressed to take the calculator out of the "Learn" mode and prepare it for program execution. The sequence of key operations is shown under "Program #1." The column headed "LOC" shows the program memory location numbers.

The calculator has now "learned" the steps to be used in the calculation. To execute the program, the calculator is first reset by pressing RST. Then, if we want to calculate the field from 0° to 180° azimuth angle in 10° steps, 0 is entered first, and on pressing the run/stop key (R/S), the answer will be displayed. Next 10 is entered and R/S pressed again. Pressing R/S each time after the angle is entered will display the predicted field for that angle. It is not necessary to continue from 180° to 360° azimuth angle because an in-line array pattern is symmetrical about its axis. The results are tabulated under "Program Execution Results." If we had wanted the shape of the pattern only, the "X 180" steps would have been omitted. Figure 2 (p. 88) shows the shape of the pattern. All results may be plotted on polar coordinate graph sheets.

Vertical radiation patterns

For determination of the pattern at various elevation angles, two additions dealing with the elevation angle " θ " must be included in the cosine law formula. One is the vertical radiation characteristic " $f(\theta)$," and the other is the cosine of the elevation angle. First, the vertical radiation characteristic is considered. Since the array is composed of 90° height towers, the vertical pattern will be influenced by the vertical radiation characteristic of a single 90° antenna. Program #2 (p. 88) will solve for this factor by using the following equation:

$$f(\theta) = \frac{\cos(90^\circ \sin \theta)}{\cos \theta}$$

Here the elevation angle " θ " is the variable. In the "learn" process, the calculator is instructed to store in Memory #1 whatever elevation angle is later entered, find its sine and then multiply the sine by the 90° height of the tower. The cosine of this result is found and then divided by the cosine of the elevation angle. During this last process, the calculator is instructed to recall the elevation angle from Memory #1. The key steps are shown under "Program #2." The execution of the program is similar to that used for the first program. This time we reset and then enter elevation angles from 10° to 80° (radiation is unity at 0° and zero at 90°), pressing R/S for the display after each angle is entered. Tabulated results for the vertical radiation characteristic are shown in the box associated with "Program #2."

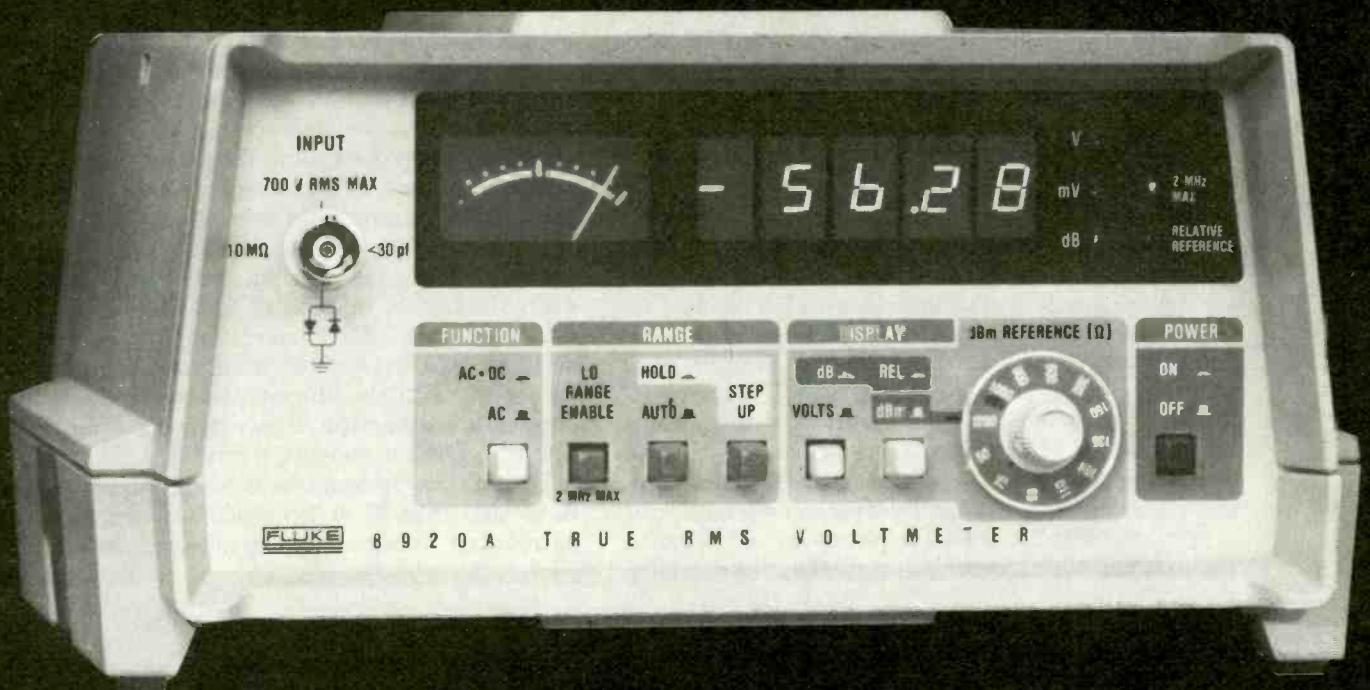
A table of cosines is readily obtained by repeatedly
continued on page 92

HP-25 Program For Two-Tower Patterns

LINE	PRGM ← KEY ENTRY	→ RUN KEY ENTRY	DISPLAY
00	f PRGM	90 STO 1	90 (S)
01	f COS	96 STO 2	96 (P ₂)
02	RCL 1	.45 STO 3	.45 (F ₂)
03	X	180 STO 4	180 (K)
04	RCL 2	f PRGM	180
05	+	0°	0
06	↑	R/S	99.80
07	RCL 3	10°	10
08	f → R	R/S	99.48
09	1	20°	20
10	+	R/S	99.01
11	g → P	30°	30
12	RCL 4	R/S	99.82
13	X	ETC	ETC

Illustration B

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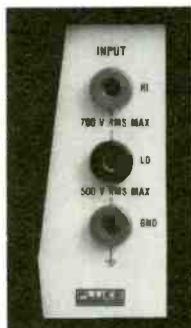
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entering an elevation angle and then pressing "COS" for the display after each entry. The cosine of the elevation angle is used to multiply the cosine of the azimuth angle, and in this way account for the effects of space phasing at elevation angle observation points. With the two additions the complete formula is:

$$E = f(\theta) K \sqrt{1 + F_2^2 + 2F_2 \cos(S \cos \phi \cos \theta + P_2)}$$

Suppose we want to determine the complete pattern at an elevation angle of 40°. We have found that $f(\theta)$ for 40° is .6946, and that the cosine of 40° is .766. These two values are substituted in the formula along with all the other known values:

$$E = \frac{.6946 \times 180}{\sqrt{1.2025 + .9 \cos(90^\circ \cos \phi \times .766 + 96^\circ)}}$$

Where E = Inverse field strength at one mile in mV/m.

Note that the azimuth angle " ϕ " is still the only variable in the formula. If we substitute angles from 0° to 180° in the formula, we will obtain the information required for plotting the complete pattern at 40° elevation angle. You will recall that the pattern is symmetrical about the array axis. The program steps are shown under "Program #3" (p. 88). (Steps can be saved by first determining that $.6946 \times 180 = 125$.) The program execution is the same as for Program #1. The results are tabulated under "Program Execution Results" in the Program #3 box.

We now have the complete pattern at 40° elevation angle. If this same procedure is carried out for elevation

angles from 10° to 80° by inserting the appropriate $f(\theta)$ and $\cos \theta$ values each time the elevation angle is changed, we can arrive at a three-dimensional model of the system. The pattern for 0° elevation angle is, of course, the horizontal plane pattern calculated in Program #1.

HP-25 program

Now we will describe an alternate solution for the horizontal pattern using an HP-25 calculator. Instead of the cosine law formula we will use polar/rectangular coordinate conversion, for which the HP calculators are well-suited.

As shown at the beginning of this article, the field at each observation point around the array is the sum of a reference vector, and a #2 vector which changes with azimuth angle. The two polar form vectors are changed to rectangular form for addition. Then the sum of vectors is changed back to polar form. Only the magnitude of this vector is required. Multiplying by the "K" factor gives the predicted inverse field strength.

In this particular program, the array specifications are not entered into the program keystroke sequence, but instead are stored in memory registers 1 to 4 just after switching to the "RUN" mode and prior to running the program. With this method, you may change any parameter, or enter entirely different parameters and re-run the program to see the effect. If only the shape of the pattern is desired, store 1 in memory register 4.

Here is a description of the HP-25 steps (see illustration B, p. 90). Lines 01 to 05 calculate the angle of the #2 polar vector, based on the azimuth angle selected when

continued on page 94

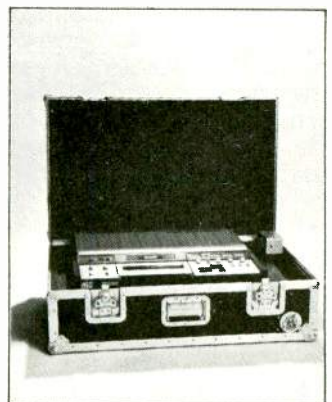
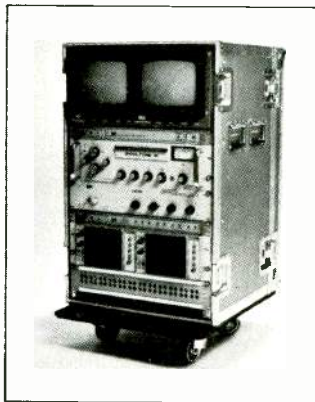
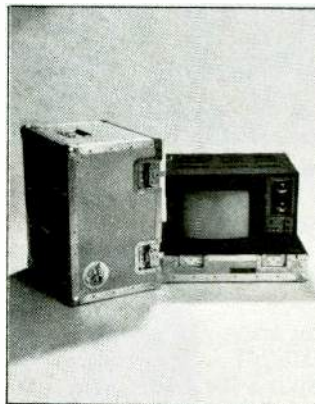
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the program is run. Line 06 enters the angle. Line 07 recalls the magnitude of the #2 vector. At line 08, the polar vector has been converted to rectangular form, with the cosine and sine components placed in separate registers. Lines 09 and 10 add the cosine component of the reference vector to the cosine component of the #2 vector. (The sine component of the reference vector is zero.) Line 11 converts the sum of the two rectangular form vectors to a polar vector. Lines 12 and 13 multiply the magnitude of the polar vector by the "K" factor.

With a few more steps, the program readily may be expanded to solve for the field at a horizontal or elevation angle, recalling that the cosine of the azimuth angle must be multiplied by the cosine of the elevation angle, and that the "K" factor must be multiplied by the vertical radiation characteristic.

Array specifications

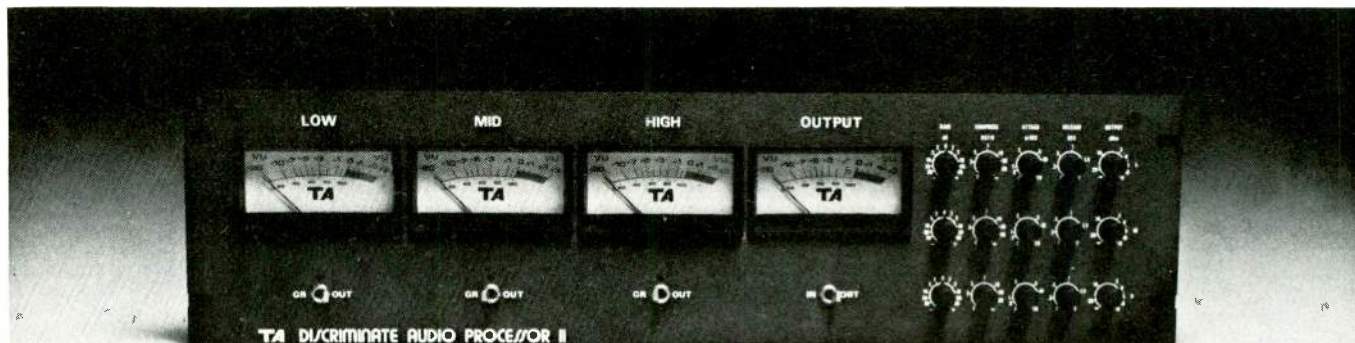
To simplify the pattern formulas, we have placed the reference tower at the space reference point and the #2 tower on the 0° azimuth line. An actual array is seldom on this exact north-south axis. However, when calculating the pattern, it is often convenient and less confusing to locate the towers in this manner. After calculations are completed, the line of towers and the pattern may be rotated to the proper bearing, using the reference tower as a pivot. For example, if we had desired maximum radiation toward the west, the line of towers would be rotated 90° clockwise. The #2 tower then would be east of #1.

To use the procedures in this article to plot the horizontal and vertical patterns for any other two-tower array using 90° height towers, the specifications should be arranged as in the example given. The vector for the tower at the space reference point should have unit magnitude and zero phase angle. The initial phase difference between towers is assigned to the #2 tower vector, making sure that the sign of the angle is correct. The #2 tower should be on the 0° azimuth line at the proper spacing. Its field ratio may be equal to, or more or less than, unity. After calculations have been completed, rotate the line of towers and the pattern to the desired bearing and change the computational azimuths to actual azimuth angles. If towers are other than 90° in height, the general form of the equation for the vertical radiation characteristic must be used. This may be obtained from the reference sources mentioned earlier.

Other programs

There are many other programming possibilities. For instance, by adding more steps you may calculate the pattern in a computer-like fashion. After you set the azimuth angle increment desired, each azimuth angle around the circle is flashed momentarily before the answer for that angle is displayed. Programs may be devised for any number of towers. The only limitation is the number of program memory locations available on the calculator. In conclusion, it may be said that gaining an insight into the theory of the basic two-tower array helps in understanding multi-element arrays, since the patterns for most of these systems are the result of the multiplication of two or more two-tower patterns.

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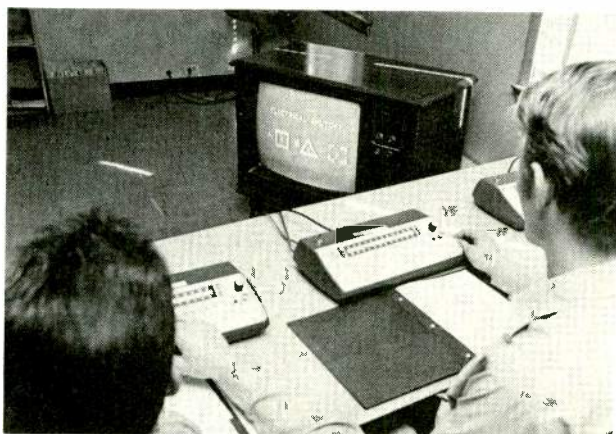
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TV/Computer: Teaches, Tests

Two-way interactive TV system proves effective

AN EXPERIMENTAL TWO-WAY TV teaching system in which trainees are instantly scored after responding to multiple choice questions via a pushbutton terminal has proven effective in Rockford, IL. Results indicate that firefighters whose responses were scored and fed back to them do better than do those who were trained by a one-way system only.

The unique teaching system, funded by the National Science Foundation, went into operation last spring at Rockford. The videotape program on prefire planning* was prepared by Michigan State University. The computer tabbing and scoring system was designed by MSU working with Broadband Technologies Inc. and engineers at Rockford Park Cablevision. The program and trainee



After viewing video tape a multiple choice question is presented. Trainee presses button corresponding to his selection on modified Jerrold converter



Answers of all respondents are then flashed on screen. Each student sees his answer and that of others

*Prefire planning involves a complete survey of major buildings so that in the event of fire, the firefighters will know where the occupants are located, understand the floor plan and recognize potential hazards (such as concentrations of flammable materials) inside and outside the building.

responses were delivered and received via Rockford's two-way cable TV plant, which served the four fire stations involved.

Four different modes were tested to measure the effectiveness of two-way instruction. Altogether 200 fire fighters took the course with 50 in each group. All got the same videotape instruction. Every two to five minutes the tape was stopped and questions were asked. The variables in the experiment were the means of responding and feedback to trainees.

The program was played several times each day to accommodate various shifts. At any one session 4 or 5 firefighters per station would be taking the course for a total of 16 to 20. Attendance, incidentally, was kept track of by the computer. More on this later.

Group A (Two-way, individual). Each firefighter had his own terminal. When multiple choice questions appeared on the screen, each trainee could record his answer by pressing the appropriate button on his response terminal (a modified Jerrold converter). His choice was transmitted to the computer at the head-end control point.

Group B (Two-way, group). A group of 4 or 5 firefighters had only one terminal. Before a choice was recorded, the group had to reach consensus on what their joint answer would be. Their group choice was tabbed by the computer.

Group C (One-way, paper response). Individual firefighters received the questions via videotape as did others but they could not respond via a terminal. Instead, they were asked to record their answers on a paper response pad.

Group D (One-way, mental response). Individual trainees had no terminal and no pad to mark. They were asked to make a mental response to each question.

After all the responses to a question were made by Group A and Group B, the computer scanned the terminals and recorded the individual answers. All answers were then displayed on the screen informing each participant whether or not he was correct. (Each firefighter could see how he compared to others.) The computer controlled a character generator to produce this visual feedback. During the response period, the videotape player was stopped. Starting and stopping the player was controlled by the computer. The computer also took attendance of the A and B groups; firefighters "logged in" by punching their own three-letter code into the response terminal (code identified the individual, his station and shift.)

After the responses were fed back for all enrollees to see on the screen, the videotape started again. Using positive reinforcement concepts, MSU designed the programs so that the correct answer was amplified upon when the tape started again. Getting correct answers to multiple choice questions was not difficult if the trainee paid attention.

continued on page 98

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Thus a high score was to be expected.

A line printer is a part of the system and following a short quiz at the end of each lesson, the computer prints out the percentage score for each participant. The computer also keeps track of accumulated scores as the course

progresses.

Results at the end of the course showed that those who were in the two-way mode learned the most. But all did well, indicating the tapes were prepared skillfully. And, as mentioned, the course was designed to promote mastery — not to weed out weaker students. Nevertheless the scores of those in the two-way mode were significantly higher (in the statistical research sense) proving the superiority of two-way.

Actual scores as provided by Dr. Tom Baldwin of MSU were as follows (best possible score was 76):

Group A (Two-way, individual)	69.02
Group B (Two-way, group)	68.60
Group C (One-way, paper & pencil)	66.31
Group D (One-way, mental response)	63.85

There was no significant difference between Groups A and B.

Rockford's fire chief James Cragan has been pleased with the results. He feels the two-way system is highly motivational. (Among other things, competition between stations entered in largely because scores of individuals and stations were known instantly.)

More than this, the computer was a useful management tool since it kept the records.

In a continuing-phase of the program, three different teacher in-service training programs are now being tested by University of Michigan researchers. These programs will do less grading of teachers (too threatening?) but the feedback system will reveal teachers' attitudes on a number of subjects. In this series, heavy use will be made of the computer driving a character generator to provide feedback.

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The two-way cable TV plant performed flawlessly, according to John Bower, engineer. The computer played a key role in preventing downtime. This came about as a result of locating electronic local oscillators at three points in the system: at the end of each line (Rockford is layed out as a hub system), within each terminal, and at the point where a branch line entered the trunk (secondary code-operated switch points).

The computer could sweep the output of these oscillators and pinpoint low output levels. Thus if readjustments were necessary, they could be made before a lesson began.

The cable plant was swept in sections. Four Primary Code Operated Switchers opened up return channels one at a time. Secondary code-operated switch points were located on those hub legs serving fire stations (or schools). Feeding into these secondary COSs were discrete crystal



John Bowen, Rockford Cablevision engineer, looks at oscillator signals from various terminals on spectrum analyzer

Two-Way Video Speeds Justice

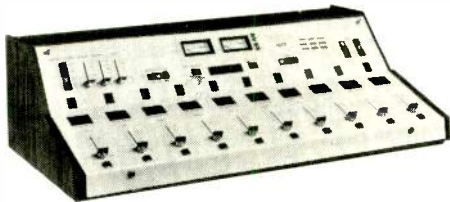
A two-way 35-mile video cable system operated by the Philadelphia Police Dept. is helping to speed justice and train policemen. Pennsylvania now has a law that calls for a suspect to be arraigned within six hours of arrest. A two-way television hook-up between the judge, prisoner and arresting officer substitutes for an in-court appearance. If the prisoner needs a public defender, the latter can consult with his jailed client via a "videophone."

The \$5 million system is also used to deliver conventional 30-min. to one-hour training tapes to policemen. Every morning several minutes of the network's time is taken for the various stations to put out descriptions, photos, drawings, etc. of "wanted persons."

controlled frequencies identifying the different terminals. During a sweep, each oscillator frequency was printed out by number and its output recorded as normal or low. A low would suggest a maintenance call although the actual output could be observed on a spectrum analyzer to determine just how low it was. The system operates satisfactorily through a wide temperature range: -20°F to $+125^{\circ}\text{F}$.

Do these applications justify the installation cost of a two-way plant? Not by themselves, but if the same system is used to bill pay TV reception on a per viewing basis, for meter reading, or for utility load control, accumulated revenues would make the investment worthwhile in Baldwin's view. MSU will be testing these uses. **BM/E**

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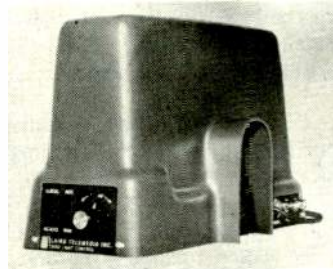


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INTERPRETING THE **FCC** RULES & REGULATIONS

FCC Grants Waiver of Ascertainment Rules to a Small Community Licensee

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

TWO YEARS AGO, THE COMMISSION EXEMPTED small market broadcast stations from mandatory compliance with the community ascertainment rules. A small market station is exempted from the community ascertainment documentation and reporting requirements.¹

Specifically, a broadcast station licensed to a community with a population smaller than 10,000 (pursuant to the 1970 U.S. Census) and located outside of any Standard Metropolitan Statistical Area (SMSA)² is not required to comply with the formal ascertainment procedures and methods promulgated by the Commission for other broadcast licensees.

In short, small market stations do *not* have to do the following:

- (1) Conduct ongoing Community Leader Interviews throughout the three-year license period.
- (2) Place written records of each Community Leader Interview in the station's public inspection file within a reasonable time after the interview has taken place.
- (3) In conjunction with the Community Leader Interviews in the city of license, contact leaders representative of the 19 or more institutions/elements located in most communities (e.g., agriculture, business, charities, civic, neighborhood and fraternal organizations, etc.).
- (4) In conjunction with the Community Leader Interviews in the rest of the service area, interview leaders who are generally representative of all significant communities within that service area.
- (5) Place a copy of a community leader checklist in the station's public inspection file prior to filing of the renewal application.
- (6) Place the written results of the Community Leader Interviews in the station's public inspection file.
- (7) Conduct a survey of the general public in, at least, the station's community of license.
- (8) Place in the station's public inspection file a narrative statement concerning the method used to conduct the general public survey, including the number of persons contacted and the ascertained needs.

¹ First Report and Order in Docket No. 19715, 57 FCC 2d 418, 35 RR 2d 1555 (1975).

² As designated by the U.S. Census Bureau.

Although a small station does not have to comply with these procedures, the Commission made abundantly clear that a small station will continue to be held responsible for *ascertaining* community needs within its city of license and service area and for the broadcast of programs designed to meet those ascertained needs.

The Commission noted that this small market exemption from the formal ascertainment requirements was being instituted for an "experiment period." There is no specific time limitation for this experiment period. Instead, the Commission concluded that a sampling of smaller broadcast stations should be excluded from the FCC's ascertainment requirements to determine whether the detailed and sometimes burdensome requirements are really necessary for stations to ascertain community problems, needs and interests.

During the rulemaking proceeding, as would be expected, the broadcasters argued that their station personnel were, of necessity, extremely well-informed in respect to the problems, needs and interests of their stations' communities of license and the rest of their service areas. Not only do broadcast stations devote time to local news and community events, the broadcasters argue, but station personnel must get involved in the community in order to become known and sell sufficient advertising time to maintain the station's financial viability.

Also understandably, proponents of the ascertainment requirement for all stations argued that certain less responsible stations would cease ascertainment of community needs altogether if the Commission's formal requirements were abolished.

Recently, a Michigan broadcaster (licensee of an AM and FM combination) requested that the Commission grant it waiver of the ascertainment requirements. This station, located in a community with a population of only 5,200, fell within the Detroit SMSA, making formal ascertainment mandatory. However, the community was located nearly 50 miles away in a predominantly rural community with few or no ties of identity to Detroit.

The licensee argued that its community felt itself in no way a part of metropolitan Detroit. Further, station management were extremely familiar with community leaders in the small town. The formal ascertainment requirements imposed, according to the station, an unusually substantial burden on the small number of station personnel.

The Commission granted the waiver request, stating that the licensee had presented a set of "unique circumstances," and the public interest would be served by a

waiver.³ Despite grant of this waiver request, station managers should not quickly move to request a similar waiver. The Commission went to special pains to place broadcasters on notice that:

“... We do not intend by this very limited action to announce a change in the policies espoused in Docket 19715 [the Commission action granting the small market ascertainment exemption for the experiment] or to make further inroads on those policies until we have had an ample opportunity to test the hypothesis which engendered the exemption, based on an adequate sample.”

In other words, the Commission will grant a waiver of the ascertainment rules in only *very limited circumstances* for small community stations located within an SMSA.

How can a small market station within an SMSA determine if it, too, can secure a waiver of the ascertainment rules? If a licensee finds itself in a nearly identical situation to that of the Michigan broadcaster, the chance of a waiver, albeit small, may be improved. The Commission came to the following conclusion in respect to the Michigan broadcaster's waiver request:

“Based on the unique circumstances of this case (i.e., a population of approximately only 5,000 in a community nearly 50 miles removed from the urban core of an SMSA with markedly different characteristics, a station staff so small that compliance would be a major burden, and your alleged personal familiarity with all pertinent aspects of your community), it is believed that the public interest argument made here supplies us for the requested waiver for this license term.”

The more similar a licensee's situation, the better the chances of securing a waiver. Of course, the less similar, the more improbable the chances of receiving a waiver. In any case, station management should take a long hard look at its situation before requesting a waiver from the Commission.

In a dissenting statement, FCC Chairman Charles D. Ferris and Commissioner Tyrone Brown pointed out that:

“We have exempted no stations from the requirement to ascertain their communities — only from the precise *methods* of ascertainment which we require of other licensees.

The station whose application for ‘waiver’ is before us in this case is, in effect, either seeking waiver of our existing ascertainment requirements *per se* — since those requirements still reflect our basic policy — or else is requesting inclusion in the exempted category under our experiment.

Neither course is feasible or desirable. The purpose of our experiment is to determine what types of stations should be exempt from our ascertainment documentation and reporting requirements. Until we evaluate the results of that experiment and determine criteria for exemptions, we are not properly in a position to grant a ‘waiver’ of our present rules.”

It is apparent that the Commission is not anxious to deal with a flood of waiver requests from small market stations. A careful review of the burdens of community ascertainment on station personnel should be made before going to the expense, time and trouble of seeking a waiver.

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³ FCC letter to B & H Broadcasting Company, FCC 78-260, April 6, 1978.

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"SQ Quadrphony Leaves All The Options Open For The Broadcaster And The Listener," Says Ben Bauer.

In January, Richard Dean, president of WFMZ-FM and WFMZ-TV in Allentown, Pa., strongly spoke out in favor of the discrete quad approach to quadrasonic FM broadcasting. This month Benjamin Bauer, vice president and general manager of CBS Technology Center, Stamford, Conn., has prepared a "Speak Out" in favor of the SQ system proposed by CBS. Bauer has played a major role in the development of the SQ matrix approach. Because of the great importance of this topic, BM/E hopes that others in the industry — even in the FCC — will send us their views for follow-up publication.

BROADCASTERS ASK, "Which is the better way to broadcast quad — matrix or discrete?" Let's review the issues.

CBS has petitioned the FCC to establish its SQ system as the quadrasonic matrix broadcasting standard. An SQ-coded record, tape, or live broadcast is transmitted via any FM or AM stereo transmitter in the very same way as any stereo program — as a two-channel audio signal. It is received by stereophonic and monophonic listeners just like any stereo broadcast is. Quad listeners simply employ a "decoder" to convert the received pair of signals back into the original four-channel program.

In addition to SQ, other matrix systems also have been proposed; but recent FCC tests showed that SQ is, by far, the most compatible with stereo and mono reception and produces the best quadrasonic results. This relieves us of the necessity of concerning ourselves with other matrixes.

The FCC tests

The FCC matrix performance tests provide us with a most significant body of information. Three matrix-with-logic systems ("4-2-4") were submitted to the FCC as candidates for matrix broadcasting — SQ of CBS, QS of Sansui, and H of BBC. A fourth "semi-discrete" matrix of the so-called "4-3-4" variety (which requires the transmission of one added secondary signal) was furnished by RCA. A most pressing question facing the FCC was to determine how compatible these systems are with stereo and mono and how



Benjamin Bauer, vice president and general manager of CBS Technology Center, Stamford, Conn.

closely they match the performance of a four-channel master tape. Presumably, if a matrix system was found to provide as good, or virtually as good, a performance as the master tape, then obviously there would be no need to adopt any of the more costly and potentially less effective "discrete" ("4-4-4") systems.

The tests, described in the FCC's comprehensive report (No. 2710-1) issued in August 1977, are models of meticulous research. The source of signals was a 1/2-inch, 15-ips, four-track master tape furnished by NQRC — an idealized discrete system (no discrete discs or broadcasts were used). The four matrix system proponents furnished their own encoders and decoders. Listeners were comprised of musicians, music students, hi-fi technicians, engineers, and just plain music lovers — an interested and perceptive audience. The four matrix systems and the master tape were compared with each other in pairs, in random fashion, and on an A-B basis to avoid bias. Five different musical selections were used. Each listener made some 150 preference decisions, spread out among four 1/2-hour test sessions to prevent fatigue. All results were computer-scored and tested for statistical significance.

The results astonished almost everyone. There were two reasons. In quadrasonic tests, not only was SQ preferred by 58 to 42 percent of the

listeners' votes over H, 51 to 39 percent over 4-3-4, and 77 to 23 percent over QS, but it came so close to the master tape in listener choice as to virtually equal this idealized source, receiving a 48 to 52 percent preference vote — i.e. within two percent of the perfect 50 to 50 percent score.

And perhaps even more important from the point of view of the broadcaster, SQ won the stereo and mono compatibility test over *all* other systems *including* the discrete four-channel master tape. The order of preference was (1) SQ, (2) Master Tape, (3) H and (4) QS. The 4-3-4 system was not tested for compatibility because it has precisely the same stereo and mono fold-down as the master tape.

Matrix vs. discrete

It is often assumed that a discrete quad broadcasting station transmits the four-channel signals independently. This is not so. Prior to being put on the air, every discrete program must first be converted to a pair of matrixed signals — "primary" matrix signals, as they may well be called — otherwise the stereo listeners would hear only two of the four channels. There is, however, a significant difference between the SQ signals and the primary matrixed signals of discrete.

With SQ, the encoder uses complex coefficients embracing both amplitude and phase relationships. These coefficients allow the received coded pair of signals to remain fully compatible with stereo and mono and also to be convertible to quad signals by the decoder. The received signals also contain directional information used by an electronic logic in the decoder to assure that the decoded channels are correctly placed in their intended locations.

By contrast, the discrete systems commonly use simple coefficients for their primary matrixed signals, which results in a loss of most of the information needed to decode them into a four-channel program. Consequently, to then "discretize" this primary pair, two "secondary" matrixed channels

are needed, resulting in the expense to the broadcaster of now having to transmit four matrixed channels over the airwaves. To do this, he will need a new exciter for the transmitter. He will also have to provide a matched four-channel link to the studio, and he will have to procure one or more quadrasonic program sources and a quad control console for the studio proper — a significant investment estimated by some to run to about \$20,000. Then, on the audience end, the discrete quad listener will have to purchase a new "discrete" receiver, when (if they are destined to be) they at some future time become designed, debugged and placed on the market, and he still will have to purchase decoders and demodulators to play quadrasonic records in his home.

"But wouldn't one obtain much improved performance for this additional investment?" you may ask. Considering all the aspects, the answer appears to be "no." The National Quadrasonic Radio Committee (NQRC) has studied and reported to the FCC on five different discrete systems. It did not recommend a specific discrete system, leaving the task of weighing the result of its studies to the FCC. And the NQRC report is discomfiting for a number of reasons. First, it leads the reader to conclude that discrete will result in a 4.7 dB increase in noise for the monophonic listener (thus, in fact, effectively reducing the station's coverage). Second, the multipath distortion question, a likely added problem with discrete quad, is not covered by the NQRC report; thus far only bipath distortion has been studied. Third, the fate of SCA with discrete is still uncertain. Furthermore, the new information uncovered by the FCC in its tests raises serious doubts about the capability of any of the discrete NQRC systems to provide fully stereo- and mono-compatible broadcasting service. And, of course, discrete quad is impossible with the now-anticipated AM stereo broadcasting.

The proposed solution

The results of the FCC tests have not only established SQ as the matrix system of choice, but also have posed a clear dilemma respecting the proposed discrete NQRC systems: despite the facts that they are known to degrade the S/N, that they demand substantial capital investment, that they do not provide optimum reception for today's stereo and mono listener, and that no discrete receivers exist, they nevertheless appear to offer a tantalizing promise of the "ultimate" in discrete quad performance. On the other hand, there already is the SQ matrix system which offers superior compatibility for stereo and mono listeners, is broadcastable *right now* over existing stereo stations with-

out any equipment changes, boasts of an already available and ample catalog of recorded music and innumerable quad buffs equipped with decoders, and, which the FCC tests have told us, virtually matches master tape performance.

Which is the preferred course of action?

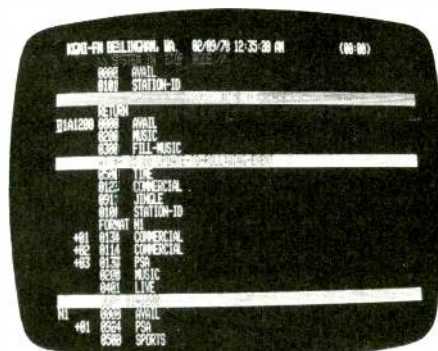
Fortunately, the dilemma has a resolution. As a first step, implementation of the FCC test results in rule-making for SQ broadcast specifications is in order. This will at once act as a spur to the industry in the production of quad hardware and software for which the consumer is now ready, judging from the overwhelming response to the FCC Notice of Inquiry.

The next step is to devote serious study to a proposal we made at the fall International Convention of the Audio Engineering Society in November 1977: we showed that for the benefit of those who insist on discrete regardless of all other consequences, the SQ matrix system also can be fully "discretized" by adding two auxiliary conjugate matrixes to the transmitter as with conventional discrete. Such a system, which we call SQB (for "SQ on the Basebands") employs the conventional SQ matrix on the FM basebands and places the conjugate auxiliary matrixes on the added sub-carriers, as with conventional discrete. The SQB features SQ's proven stereo and mono compatibility for existing listeners, continues to provide quad to all present SQ equipment users, and offers fully discrete transmission to those who wish to purchase the new SQB receivers if, as, and when they become available. In this manner, discrete broadcasting will not become a revolutionary, but an evolutionary process safeguarding the interests of all present broadcasters and listeners — quadrasonic, stereophonic, or monophonic.

Conclusion

There simply is no question about the public enthusiasm for quad as expressed by countless letters which have been received by the FCC from engineers, artists, producers, and the general public. From both the technical and audience viewpoints it has become clear that prompt standardization of the SQ system would benefit broadcasters, equipment manufacturers, and listeners. As stereo was a leap beyond mono, so can quad provide a quantum advance over stereo. Standardization on SQ will invigorate quad without affecting the station's existing service to its present listeners. And it will open the door to future broadcasting progress through SQB or other novel approaches yet to be envisioned.

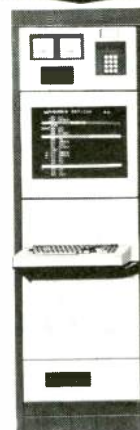
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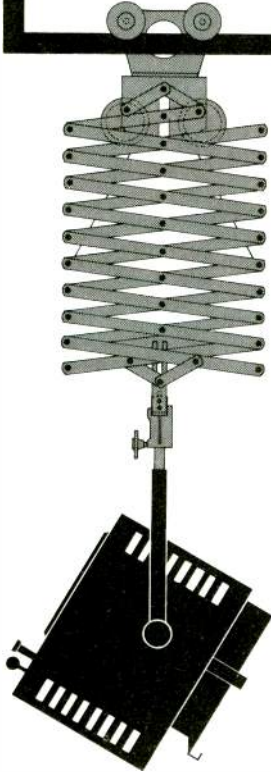
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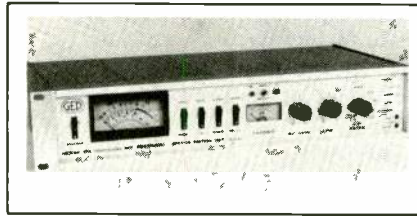
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battery pack, carrying case and demodulator probes. \$750. DYNASCAN CORP.

Cassette Recorder 252

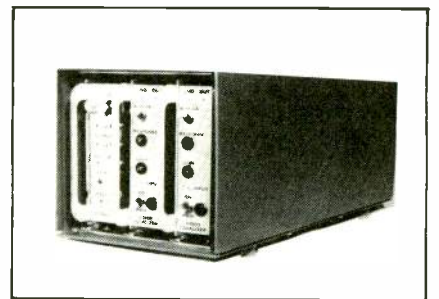
The Model CR240 is a portable stereo cassette recorder designed for field use. The unit has a full range of input/output connectors including mic and aux inputs, headphone jack and an accessory socket for remote control. CR240 features include a three-position tape selector, twin illuminated level meters (ranging from -20 to +3 dB) for record and playback, LED function indi-



cators for record, start and stop, and built-in condenser mic. Frequency response is 30Hz to 16kHz, SNR is better than 65 dB w/Dolby in. Power supply: six dry cells, rechargeable battery, 12V car battery or 115/230V AC. \$780. UHER CORP.

Video Cable Equalizer 253

The new 9800 Series offers equalization up to 30 dB at 10MHz on lengths up to 6000 feet of RG-11/U cable, with



hum and noise level 50 dB RMS below 0.7VPP. Inputs of either 75 ohm unbalanced or 124 ohm balanced produce an equalized 75 ohm unbalanced output. The unit has an operating temperature range of -20° to +60°C (-4° to +140°F) and will perform in 90 percent

**For more information
circle bold face numbers
on reader service card.**

humidity. Each equalizer module is self-contained with an integral regulated power supply and may be ordered in a vertical or horizontal configuration for mounting in either position. Power requirement is selective 100/130 or 200/260V AC, 50 to 60Hz, 10W max. COHU INC.

Transceiver

254

Model GMR-2 was designed for communications in the 460 to 470 MHz General Mobile Radio Service FM-CB band. This hand-held unit has a power output of two watts and provides two crystal controlled channels for point-to-point or direct communication with another hand-held unit or base station. The second channel is to key up a repeater station which extends coverage up to 100 miles. The unit uses a rechargeable Ni-Cad battery pack. Available accessories include carrying case, small flexible antennas, chargers and tone encoders. STANDARD COMMUNICATIONS.

FM Transmission Channel System 255

The FV43-02 enables a broadcast quality audio signal to be simultaneously transmitted or received with an NTSC



or CCIR TV signal over microwave radio, video cable or satellite system. SCA channel frequency is 5.8 MHz, with the option of adding a second sub-carrier in the 5.8 to 8.59 MHz range for the broadcast of stereo audio. It is a uni-directional system but each terminal diplexer shelf can be fitted for transmit or receive. Incorporated in the FV43-02 are wideband amps, low ripple filters and equalizers. The unit is Bell System compatible and operates on 115/220V AC or -24 or -48V DC. FARINON ELECTRIC.

Demodulator

256

The Commander III has an amplitude response of ± 1 dB maximum from 30 Hz all the way to 4.18 MHz. Features include front panel test points, "electronics-in-a-drawer design," plug-in modular construction with hybrid ICs and 100 percent crystal control
continued on page 106

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Important Notice For Manufacturers and Suppliers To The Broadcast Industry:

We at BM/E are compiling "The Source," our annual directory to equipment and services for broadcasters.

—If your company was listed last year but has not yet received our questionnaire for this year's "Source," . . .

—Or—

—If your company was not listed last year, but wishes to be listed this year . . .

—Complete and mail the coupon below or call us immediately at (212) 685-5320.

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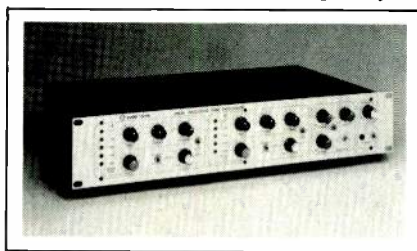
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Broadcast Equipment

for maximum stability of broadcast quality signals. Specifications: two percent maximum K-rating, 12.5 T pulse chroma delay at ± 25 nanoseconds, 12.5 T chroma/luminance at ± 0.25 dB and a guaranteed video output of 2V peak-to-peak. Signal to noise ratio is 56 dB VHF, 53 dB UHF at 10 dBmV. Cross-mod and intermod are both -80 dB at 10 dBmV. JERROLD ELECTRONICS CORP.

Analog-Time Processor 257

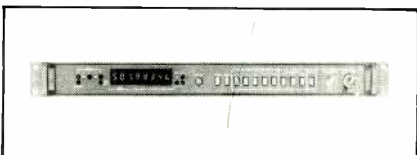
The DN 36 is a 19-inch dual channel multi-effect device with a frequency re-



sponse of 20 to 15 KHz and less than .2 percent distortion. It offers a number of effects including phasing, flanging, reverb and doppler shift, and with an external ramp generator, can also provide harmonizing. \$1499. HAMMOND INDUSTRIES.

Frequency Counter 258

Model 6043A measures frequencies from 20Hz to 1250 MHz and features an eight-digit LED readout. Front panel pushbuttons offer selection of resolu-



tion from 0.1 Hz to 1000 Hz in decade steps, x1, x10 and x100 input attenuation for inputs to 100 MHz, plus reset and hold controls. Sensitivity is rated at -15 dBm for the RF input. Option 32 allows for rear panel inputs and Option 08 is a high stability temperature-controlled crystal oscillator offering an aging rate of one part in 10^6 per year. \$1395. SYSTRON-DONNER.

TV Demodulator 259

The PM 5560, a new transparent demodulator, features direct channel selection for easy shifting to other RF sources and AFC. The AGC compen-

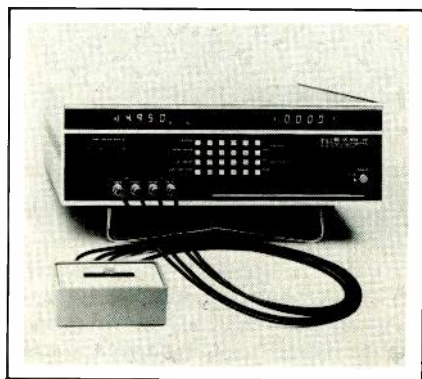
sates for possible drift of the transmitter/demodulator. Synchronous and envelope detection provide accurate demodulation at high modulation levels. The unit also features built-in rest carrier and sound deviation meters. Ranges are 40 to 300 MHz VHF and 470 to 300 MHz UHF. PHILIPS TEST AND MEASURING INSTRUMENTS INC.

Long Life Duplicator Head 260

New cassette duplicator head is designed for use with all Pentagon two and four channel cassette duplicators. It is reported to last six times longer than heads now widely used, and is completely interchangeable. It can be factory or field installed, without modification to the duplicator's electronics. Although the head may not have the life expectancy of a Ferrite head, the quality it produces will remain constant over its entire lifetime. PENTAGON INDUSTRIES.

Component Tester 261

A one MHz test frequency LRC meter Model 410 provides simultaneous readout of reactive and loss components of the unknown on dual digital



displays of this microprocessor-based instrument. Eight functions can be measured: L, R, C, G, D, Q, X and B. The unit features 10 programmable limits, absolute or percent deviation, 100 ms to 200 ms measurement speed, 0.1 percent basic accuracy, auto-ranging and three selectable test signal levels. Options include IEEE, handler and teletype interfaces. ELECTRO SCIENTIFIC INDUSTRIES, INC.

Video Filters 262

A new line of L-C filters, including Delay Equalized NTSC Lowpass Filters with sharp rolloffs and good passband delay linearity; cutoff frequencies from .1 MHz to 10 MHz; NTSC Reject Filters; and NTSC

Bandpass Filters. From \$125.00.
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Shot Gun Mic 263

The model SGM-2 is designed for use with hand-held video cameras when conventional or miniature mikes are impractical. Allows for quality voice recording up to 25 feet away and features a super-cardioid electret generating element. SNR greater than 45 dB. Weight 5½ oz. Windscreen and an AA alkaline battery included. \$69.95. COMPREHENSIVE VIDEO SUPPLY CORP.

Equipment Racks 264

A full line of racks designed to hold all standard 19-inch wide equipment. Coming in a variety of colors or wood grain finish, they are available in 14 different heights from 21 to 70 inches at increments of 3½ inches. Custom building is available for users who require racks over 70 inches high. Delivered completely assembled on easy move casters. RUSLANG CORP.

Turntable 265

The Custom 2 has a low rumble of -52dB and uses the same drive train as the QRK-12C. It features a tone arm isolation plate and a speed indicator light. Speeds, 33⅓, 45 RPM; line voltage, 115V, 60 cycles, standard (230V, 50 cycles, optional). \$315. QRK.

Cassette Changer 266

System 9 is an automated video cassette changer with a nine tray capacity that allows for 10 days of programming of 16 events per day. It features a master panel for programming and monitoring, LED displays of real time and program schedule and "Intermission" display (12 character) for graphics during change and standby. It has a crystal controlled sync output for input to NEC VC 8700 and a cue tone generator for inserting tones on tape with the new NEC VC 8307. Other features are a burn-out protected motor, solid state memory, time and logic powered by rechargeable battery and infrared sensory devices, requiring no micro switches. THE TELEMINE CO.

Booster Amplifier 267

Model LB-1A is a microphone continued on page 108

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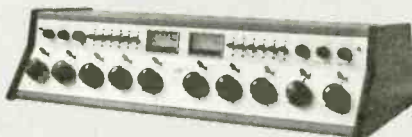
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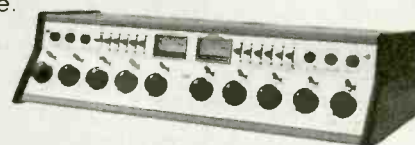
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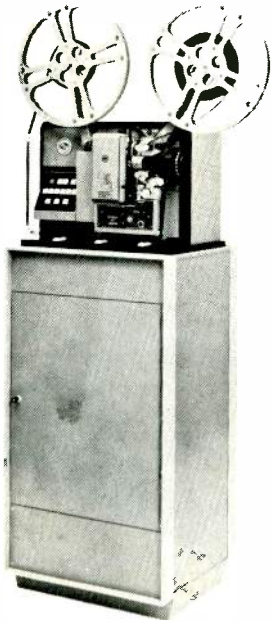
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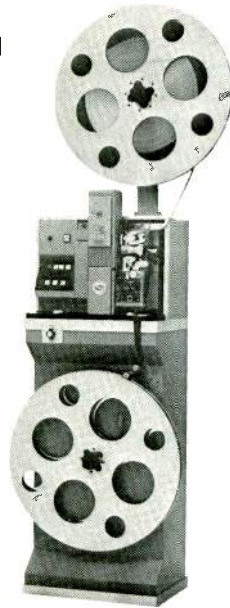


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GPIB Converters

268

Models 3910 and 3911 allow for the programming of the level and frequency of all 3000 Series signal generators with Options 01A via IEEE 488-1975 GPIB. The output consists of a six-digit and a four-digit BCD word (TTL Neg-True logic). The 3910 has power, unit select and remote operation indicator lamps. The 3911 also includes six-digit and four-digit LED displays indicating the frequency and attenuation being programmed. Either unit attaches directly to the side of 3000 Series units, expanding the converter/generator combination to fit the standard 19-inch rack. \$775.00 to \$975.00. WAVETEK INDIANA INC.

Audio Op-Amp

269

The model 5002 incorporates low noise, fast slewing IC Op-Amp coupled with transistorized output driver. Features excellent operating stability vs. time and temperature, built-in short circuit and input overload protection, and pin-for-pin compatibility with MAP models 5000 (1731A) and 1731 and similar makes including API, Holland, RCA and Melcor. The unit operates off a wide range of bipolar supply voltages. MODULAR AUDIO PRODUCTS.

Noise Reduction

270

Model 155 was designed to provide four independent channels of tape noise reduction for the small studio or A/V house to make noise-free recordings. The unit eliminates tape hiss and the noise build-up from "bouncing" material from track to track and combining tracks in the mix-down. (It cannot remove noise present in the original signal). The 155's features include 30dB broad band tape noise reduction, 10dB added system headroom, true RMS detection for accurate encode/decode tracking, linear decibel compression/expansion over 100dB range and user changeable modular circuit boards. Under \$500. DBX.

Rules for BM/E's Great Idea Contest

1. Eligibility: All station personnel are eligible. Consultants to the industry may enter if the entry indicates the specific station or stations using the idea or concept. Manufacturers of equipment or their representatives are not eligible.

2. How to Enter: Use the Official Entry Form on this page or simply send *BM/E* a description of your work. State the objective or problem and your solution. Include diagrams, drawings, or glossy photos, as appropriate. Artwork must be legible but need not be directly reproducible but not exceeding three in number. Camera reproducible material is preferred. Length can vary, but should not exceed 500 words. *BM/E* reserves the right to edit material. Entry should include: Name, title, station affiliation, and the class of station — TV, FM, AM. Indicate if idea is completely original with you.

3. Material Accepted for Publication: *BM/E* editors will make all decisions regarding acceptability for publication. If duplicative or similar ideas are received, *BM/E* editors will judge which entry or entries to accept. A \$10 honorarium will be paid for each item published.

4. Voting: Every reader of *BM/E* is entitled to rank the ideas published. This can be done on the Reader Service Card in the magazine or by letters or cards sent to the *BM/E* office. To vote, readers should select the three ideas they like best and rank them 1, 2, or 3.

5. Winners: Top rated entries in the year long tally will become winners in each of the three major categories (AM, FM, TV). Final winners will be picked in February 1979 and announced in the March 1979 issue of *BM/E*.

6. Prizes and Awards: Three top prizes will be awarded: a programmable electronic calculator will be awarded for the highest rated entry in the respective categories of AM, FM, and TV. Ten engineering slide rule calculators will be awarded as second prize for the highest rated entries in the following additional categories (top three winners are not eligible for these prizes): audio (three prizes, one each in the AM, FM and TV categories); RF (three prizes, one each in the categories of AM, FM, TV); Control (three prizes, one each in the AM, FM and TV categories); Video (one prize in TV).

Mail to: Editors, *BM/E*
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1978
Entry Form

Name _____ Title _____

Station Call Letters _____

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Class of Station at which idea is used (check one) TV _____ FM _____ AM _____

Category: Audio _____ RF _____ Video _____ Control _____

Objective or Problem: (in few words; use separate sheet for details) _____

Solution: (Use separate sheet—500 words max)

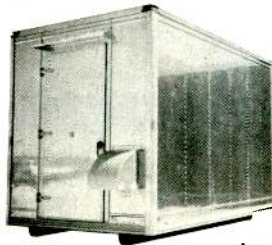
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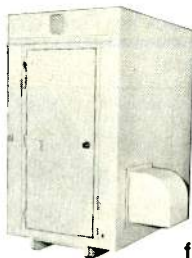
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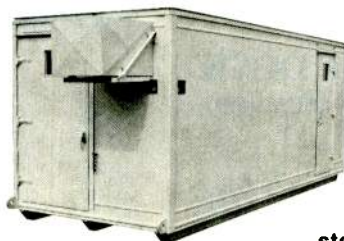
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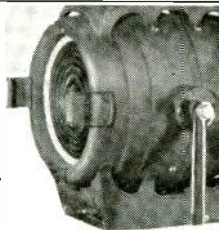
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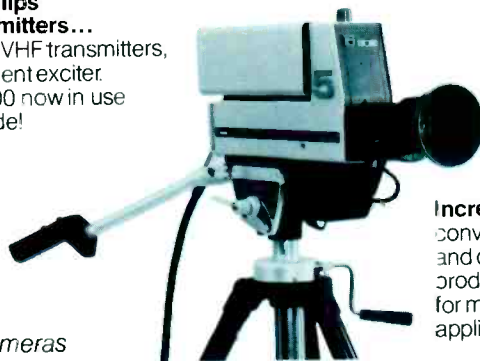
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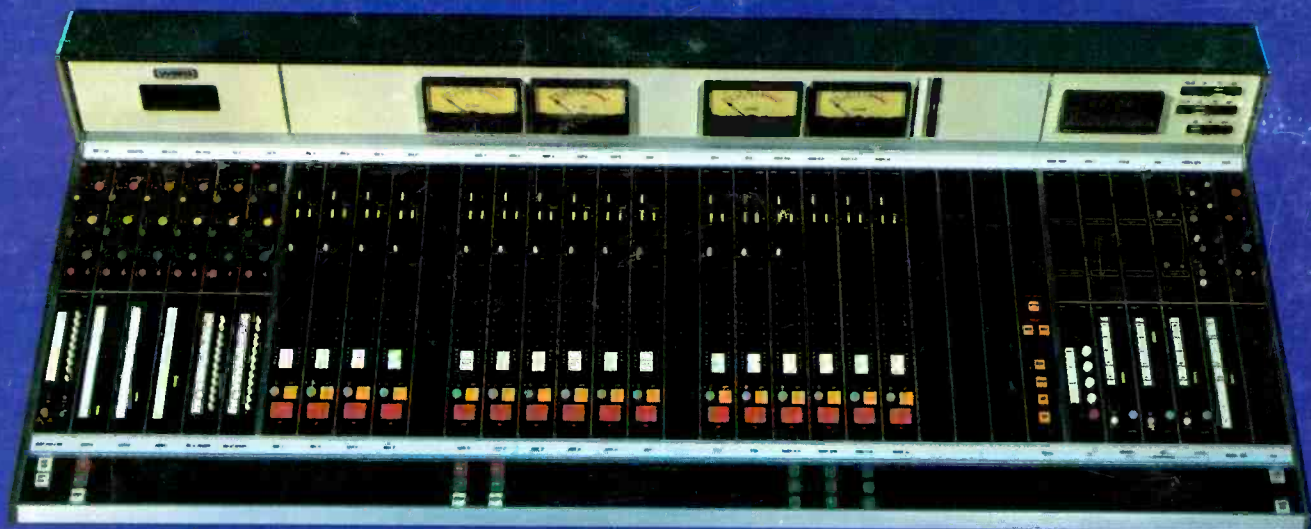
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