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MARCH 1976/VOLUME 12/NUMBER 3



Once again NAB returns to Chicago for its annual Convention—the 54th. The action takes place on new turf, however, McCormick Place.

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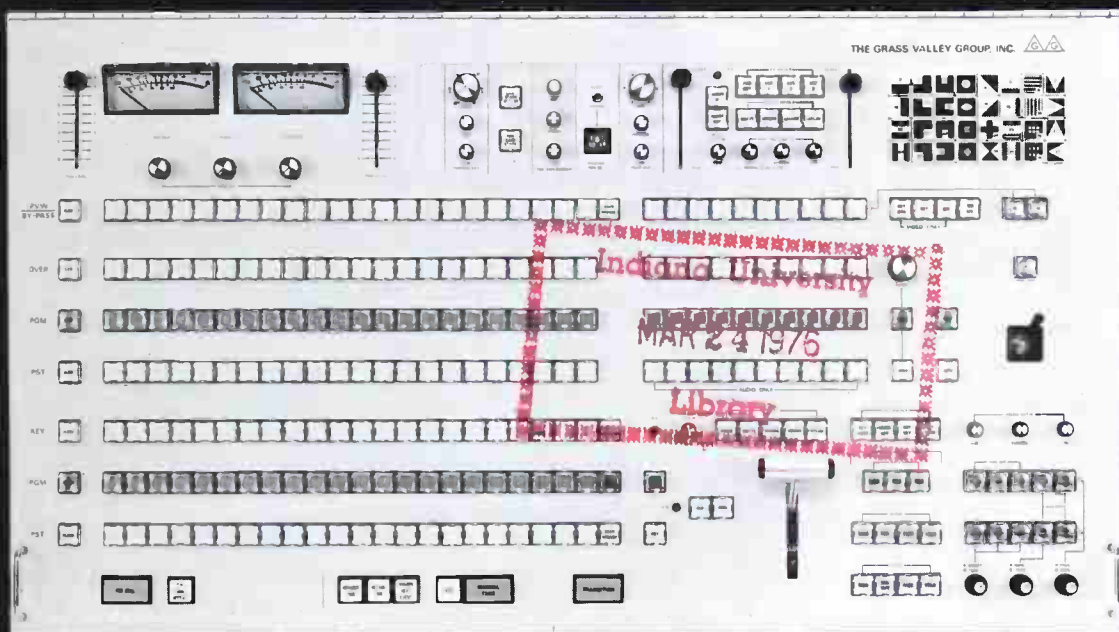
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BROADCAST INDUSTRY NEWS

License Renewal, Deregulation, Given Priority By NAB, NRBA

Two national organizations currently sparring for position in the broadcast field—the National Association of Broadcasters and the National Radio Broadcasters Association—agree on the desirability of at least two things: legislation aimed at stabilizing license renewal and FCC deregulation of radio.

The NAB Board of Directors announced that the NAB “reaffirms its commitment to licensee stability and a lengthened license term for all broadcasters.” The directors of NRBA, as expected concentrating on radio licensing problems, said: “We are hopeful that the latest draft version of our bill (for radio licensee stability) will satisfy all interested parties and go on to early acceptance in the Congress.” NRBA also pledged to fight proposed laws setting up additional performance fees, and to work for significant deregulation of radio.

A further NRBA policy statement, likely to be regarded as controversial by the NAB, was to the effect that radio and TV are very different and should be regulated separately and differently.

“Live From Lincoln Center,” Premier Telecast

Realization of a programming dream that has stirred many people for a long time—the telecasting of actual programs from New York’s culturally super-rich Lincoln Center—got underway January 30th with a concert by the New York Philharmonic, with Andre Previn as conductor and Van Cliburn as soloist. Lincoln Center called it the first in a three year series, being underwritten jointly by the Exxon Corp., several foundations, the National Endowment for the Arts, and the Corporation for Public Broadcasting.

The series has been more than two years in preparation, largely because the Lincoln Center management insisted that the TV pickup not intrude in any way on the performers or audience—no special lights, no obtrusively obvious cameras, etc. Success required intensive experimentation with low-light level cameras and other techniques.

Future programs in the series will be drawn from all sectors of Lincoln Center’s activities—ballet, theatre, operas, etc. Audio of the first program

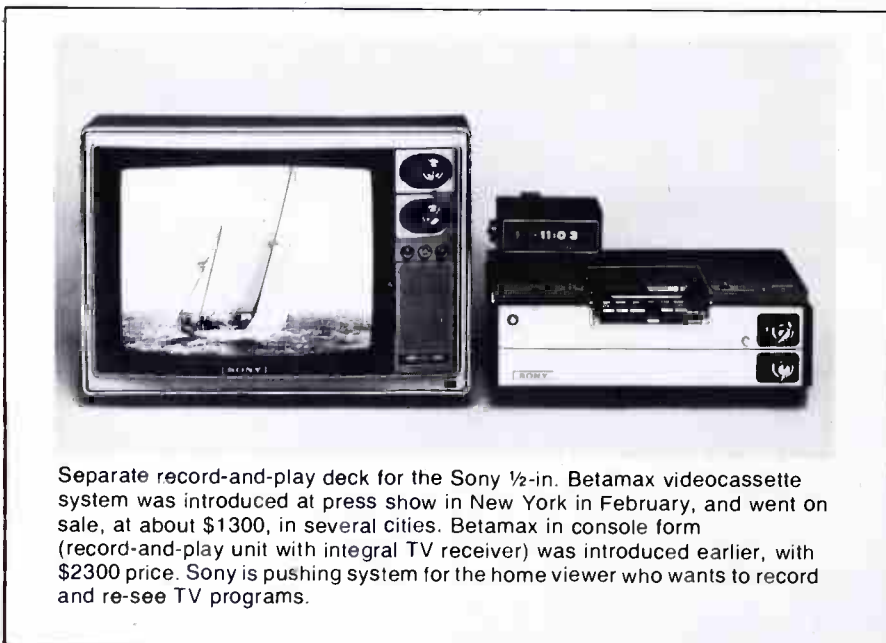
was broadcast simultaneously in the New York area in stereo by station WQXR; similar simulcasts were made in other cities. One New York listener-viewer found the WQXR audio of high quality, as expected, but also found the regular TV audio far above usual quality levels, clearly a tribute to the technicians at Lincoln Center.

FCC Dereg On Several Fronts; Rule Changes Flow Strongly

In a series of rule changes announced late last year, the FCC continued to show that its recent stance on the side of deregulation is more than talk: close examination of all the broadcast rules is clearly underway.

Some of the latest changes are: the requirement that RF currents be measured only with a thermocouple type meter amended to include also “others suitable for RF measurement.” Antenna input power, required to be measured by the direct method (current square times resistance at measurement point) can now be measured by the indirect method if the meter is defective or the antenna was malfunctioning. A five day restriction on the use of auxiliary transmitters when making equipment modifications or changes was removed (it had previously been removed for transmitter changes). Licensees will be authorized to substitute type-accepted AM, FM or TV transmitters for those in use without detailed FCC approval; they must only notify the Commission and the engineer in charge of the distribution within three days of the new installation. The FCC noted that the change would save considerable Commission manpower, as well as administrative detail for licensees. On TV remote pickups, the FCC removed the requirement for 1st or 2nd class licensed operators for low-power 1 GHz links, or where operation is effectively under control of a licensed operator at the receiving point. One rule, however, was reaffirmed—CB equipment may not be used to transmit material for retransmission, live or delayed by a broadcast facility.

continued on page



Separate record-and-play deck for the Sony 1/2-in. Betamax videocassette system was introduced at press show in New York in February, and went on sale, at about \$1300, in several cities. Betamax in console form (record-and-play unit with integral TV receiver) was introduced earlier, with \$2300 price. Sony is pushing system for the home viewer who wants to record and re-see TV programs.

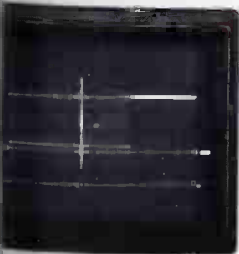


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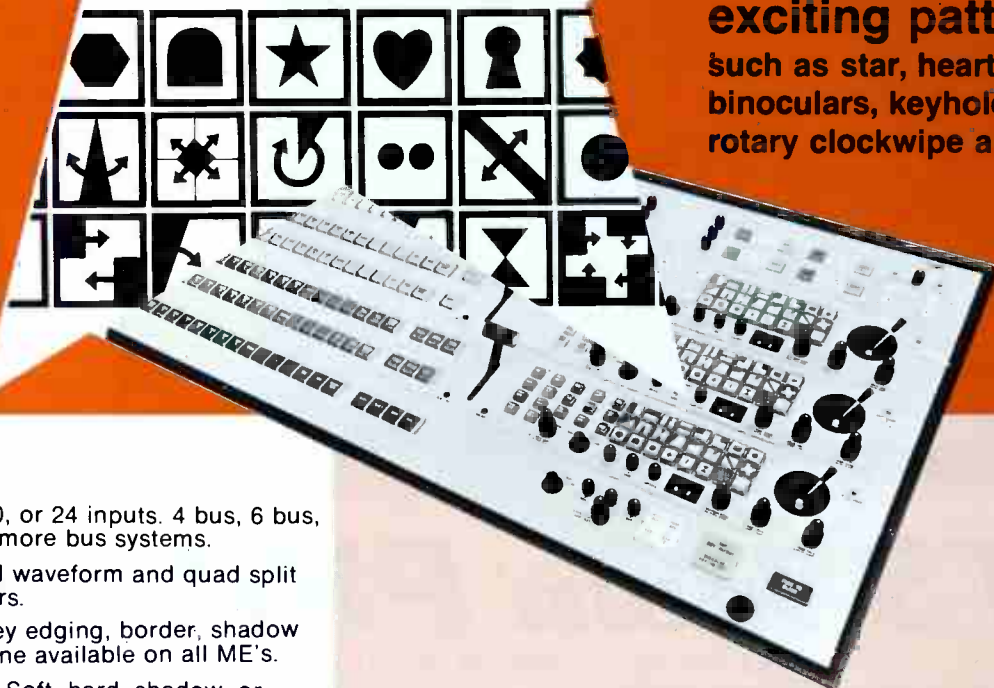
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FCC Clarifies EBS Equipment Requirements

Application of the regulation that every station install the two-tone EBS interstation signal equipment has been clarified by the FCC as it applies to multiple stations under one ownership.

Co-owned, co-located stations (for example, AM and FM stations using combined studios) need install only one set of two-tone units, says the FCC. In the case of co-licensed stations separated geographically, the licensee may by letter request the right to use only one set of EBS equipment at a common point, describing the circumstances in detail; each case will be decided on its own merits.

In any event, the FCC added, "EBS equipment must be installed in such a way that it enables the staff, at normal duty locations, to monitor the emergency message and to act accordingly." As previously reported in BM/E, the time for switch-over to the new two-tone system remains at midnight, April 15th; several requests for extension were denied by the FCC.

IDS Identification Rule Deleted; System Halted

A six-year attempt by International Digisonics Corp. (later called IDS Services) to establish its system for identifying TV programs with superimposed picture data got an official ending late in January when the FCC deleted the rule permitting use of the system. The IDS system, developed to give advertisers positive evidence of transmission of specific programs, used patterns placed in the four corners of the picture, intended to be invisible on a normally adjusted receiver. But IDS was unable to improve technical operation enough to keep the patterns out of view with reasonable consistency. IDS has stopped operating a program identification service.

The FCC, in eliminating the rule, said stations would be allowed to use, until January 31, 1978, material that was encoded with the signals before January 28, 1976. A spokesman at the FCC told BM/E that, at press time, no similar identification systems were before the FCC; a number have been discussed at recent industry technical meetings.

Vertical Interval For Deaf Captions Proposed

Responding to a rule-making petition filed by the Public Broadcasting Service, the FCC has proposed that a part of the vertical blanking interval be used for transmitting captions to aid the deaf

in following TV programs. In the system developed experimentally by PBS, the captions would be encoded digitally at the transmission point, and transmitted on line 21 of the vertical interval. The viewer would need an inexpensive decoder to translate the digital signals and put them on the screen; otherwise they would not be seen. Thus there would be no intrusion of the captions on those not needing them. The FCC asked for comments by March 10th and reply comments by March 24th.

FCC Briefs

Cable operators will get "a modest increase in news availability" through a new rule that allows them to carry network news, not broadcast on TV stations carried by the cable system, when no station in the market is broadcasting a local news program A further reduction in AM-FM program duplication starts January 1, 1977, when it will be limited to 25% (it is now 50%) in markets of more than 100,000 and to 50% (now unlimited) in markets of 25,000 to 100,000, with the latter category dropping to 25% on January 1, 1979.

Educational stations that get Federal financial assistance must make and hold for at least 60 days audio recordings of all programs in which issues of public importance are discussed, and the recordings must be available on a reasonable basis (including payment of copying costs) to requests from the public; stations can delegate the recording task to central program producers such as PBS and NPR Employment of women in broadcasting went up from 25.2% in 1974 to 26.2% in 1975, and of minorities from 12.3% in 1974 to 12.9% in 1975, according to an FCC study.

NCTA Sees Silver In 25th Anniversary

Beset with several years of hard times as a result of over-regulation and high interest rates, the cable industry sees a glint of silver as it travels to Dallas, April 4-7 to celebrate its 25th year.

Interest rates are down, payable is thriving and strong support for the industry is showing up in Congress. The National Cable Television Assn. has taken strong heart from the recent House Communications Subcommittee staff report that says cable TV should be treated as an independent medium. It can hope for legislation that will curb the FCC's zeal for protecting broadcasters from competition.

The Subcommittee report urges a new copyright formula—one based on payments for distant signal carriage

continued on page 10

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Created to meet the stringent requirements of the broadcast industry, the Beyer DT 109 combines a hypercardioid microphone with wide, flat frequency response and a two channel high quality headphone that offers the kind of performance that has made Beyer the overwhelming choice of professionals the world over.

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NEWS

only. If NCTA can manage a switch in its "consensus agreement" stand to support this concept (favored by Tele-Prompter and smaller independents), or if NCTA's official stand is undercut by overwhelming individual operator support for the fee-for-distant-signal-only concept, new ground rules might emerge for the industry that will accelerate growth.

Key legislators/regulators will speak at Dallas: Cong. Torbert MacDonald and John Moss, Sen. Hartke and FCC chairman Wiley.

Thomson-CSF To Sell Cohu Telecines

An agreement has been reached whereby Thomson-CSF will be the exclusive distributor of Cohu TV film cameras in the U.S. and Canada. These cameras will become an important element in Thomson-CSF's full line of broadcast TV equipment.

Three FM's On One RCA Antenna In Miami

A new ring-radiator antenna developed by RCA will radiate circularly-polarized signals for three FM stations simultaneously, the first time such an antenna has been so used, according to the RCA announcement. The stations are all in Miami, Florida: WINZ-FM, WYOR-FM, and WBUS-FM, the first two with 40 kW transmitters, the last with a 50 kW transmitter. R.L.



Rocamora, RCA antenna engineering manager, said that the new design is cheaper than a panel-type unit, has lower wind loading. The antenna will have eight bays, each with radiators more than twice as large as those in previous single-station antennas of the type. The photo shows several of the antenna bays under test at RCA's Gibbsboro antenna facility.

Interface Plan Smooths Road To Total Automation

Total automation of TV broadcasters will be advanced substantially by an

agreement among the three leading makers of automatic switching systems—Central Dynamics, Grass Valley, and Vital Industries—for standard method of interfacing with business automation systems.

Data Communications Corp. makers of the BIAS business automation systems, have already said the BIAS is being equipped for rapid efficient link-up with the new standard interface. Jim Cook, director of R&D for DCC, pointed out that his firm has been actively encouraging the development of such a standard since 1973. He said that each of the three makes of a program switcher already has an order from a station with a BIAS system, looking toward a total-automation hook-up: WNAC, Boston will install CDL; KTLA, Los Angeles, will use Grass Valley; and WPTV, Palm Beach, will use Vital.

The logical goal of automatic progress over the last decade, as described often in BM/E and elsewhere, total automation consists in the direct control of program switching by the business automation system, and the automatic feedback of event data from switching to business. Several television stations have already inaugurated total automation, but in each case the required design and construction of special interface systems for the link-up. An industry-wide interface standard will greatly reduce the cost of total automation; the DCC-Grass Valley-CDL-Vital agreement is a major step toward that.

New Jersey Public TV Sets Program Records

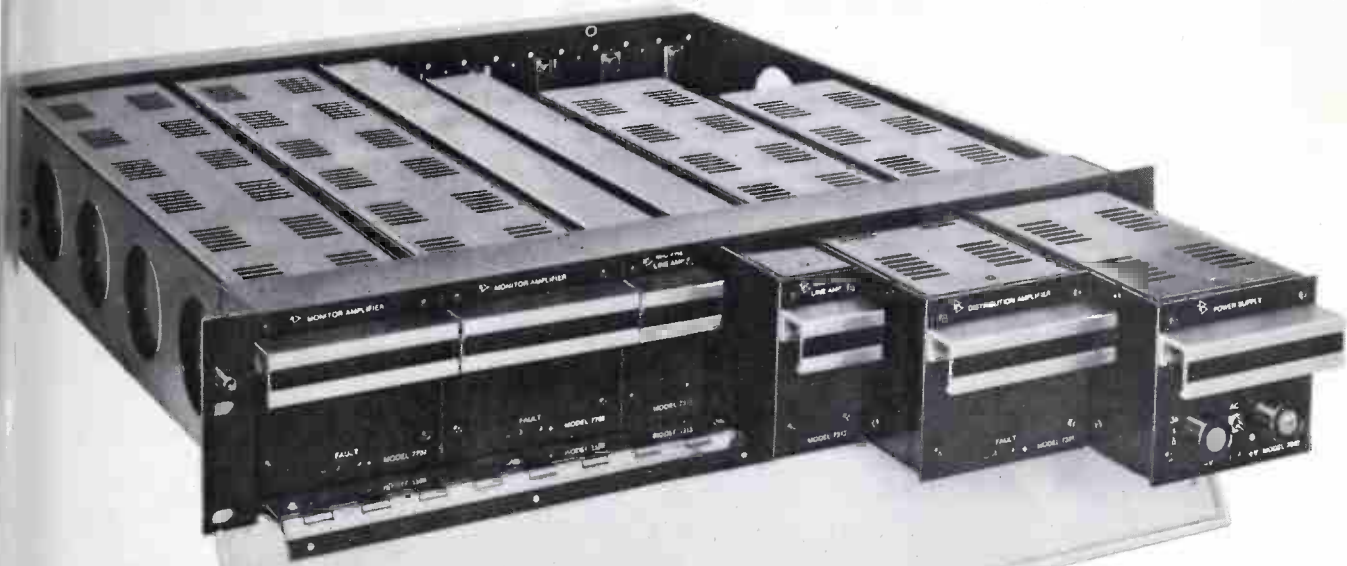
Record numbers of viewers were reached by New Jersey's Public TV network in 1975, and they saw more hours of programming from the station than in any previous year, according to a summary issued recently by D. L. T. Frymire, Executive Director. Instructional programs totaled 120 hours; there were 56 remote broadcasts, including 86 hours devoted to state financial and legislative affairs. Independent surveys found a 33% increase in viewers from the previous year.

Townsend Re-enters Transmitter Manufacture

George R. Townsend, whose Townsend Associates transmitter manufacturer was merged with Ampex Corp. in 1967, said recently that because of the Ampex withdrawal from transmitter manufacturing he would re-establish a separate firm to carry on the function. "Initially we will be offering field service and power increases for users of Townsend Associates and

continued on page 11

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Internal voltage-controlled amplifier.

Remote DC control of output level and muting.

Remotely controllable internal limiter.

Gain Range: 20 dB to 54 dB; microphone strapping
10 dB loss to 24 dB gain, line strapping

Maximum Input Level: 0 dBm, microphone
+30 dBm, line

Maximum Output: +30 dBm, continuous sine wave

Frequency Response: ± 0.5 dB, 30 Hz to 20 kHz

Distortion: Less than .5% T.H.D. at full output, typically .05% at normal operating levels.

Maximum Output Noise: 100 dB below full output, 20 kHz bandwidth

DISTRIBUTION AMPLIFIER, Model 7326

- Six transformer-isolated outputs capable of driving six 150 ohm loads to +30 dBm simultaneously.

Gain Range: 10 dB loss to 30 dB gain

Maximum Input Level: +30 dBm

Maximum Output: +30 dBm (all 6 outputs simultaneously)

Maximum Output Noise: 100 dB below full output, 20 kHz bandwidth

Output Isolation: Greater than 50 dB, 50 Hz to 15 kHz

Frequency Response: ± 0.5 dB, 30 Hz to 20 kHz

Distortion: Less than .5% T.H.D. at full output, typically .05% at normal operating levels.

MONITOR AMPLIFIER, Model 7702

- 20 watts of sine wave power into 150 ohm, 8 ohm, or 25 volt loads.

- Internal voltage-controlled amplifier permits remote DC control of audio level and muting.

Gain Range: 32 dB to 60 dB

Maximum Input Level:

High Gain Strapping: 0 dBm

Low Gain Strapping: +30 dBm

Maximum Output: +43 dBm (20 watts) continuous sine wave

Maximum Output Noise: 85 dB below full output

Frequency Response: ± 0.5 dB, 30 Hz to 20 kHz

Distortion: Less than .5% T.H.D. at full output, typically .05% at normal operating levels.

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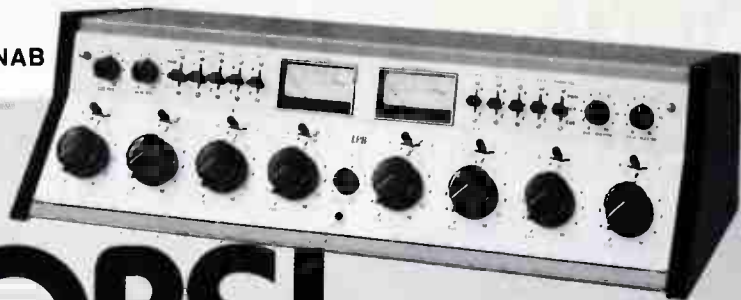


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NEWS

Ampex transmitters . . . later in 1977 we plan to introduce a new line of VHF and UHF transmitter equipment," he added. Headquarters will be in West Springfield, Mass.

Prism Projector To Be Manufactured By Moviola

A radically new motion picture projection device, the "Holloscope," a 2-sided hollow prism which produces fully lighted, flickerless image, was bought by Magnasync/Moviola of Hollywood from Micro-Optics, Danish developers, and will be manufactured by Moviola in the U.S.

L.S. Wayman, president of Magnasync/Moviola, said that primary uses would be in flatbed editors, but other important uses would be in telecine chains, previewing machines, library readers, and transfers from film to tape.

Cohu "Talk" Gear In South African TV

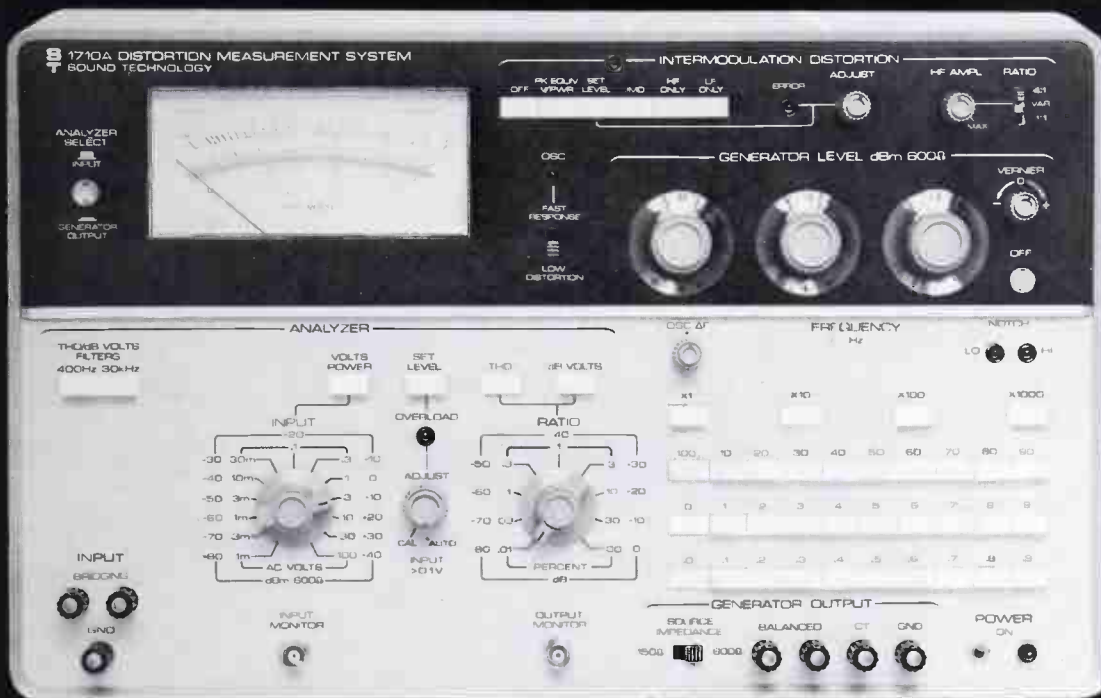
When the South African Broadcasting Corp. finally brought regular nationwide TV to that country early this year ending years of controversy, \$400,000 internal communication system, installed by Cohu, Inc., went into use. The state-supported TV system is highly centralized, with a studio complex in Johannesburg of half a million square feet, roughly twice as large as any single TV complex in the U.S. Cohu's subsidiary, FRL, installed the system for "talk paths" throughout the installation, including about 200 stations, paging, interconnecting telephone systems, and special telephone switchboards in Johannesburg, Capetown, Port Elizabeth, Durban and Bloemfontein.

The programming will consist initially of a single channel, alternating between English and Afrikaans; later there will be separate programs in the two languages, and eventually a third channel addressed to the black population. About 250,000 receivers had been sold before the start-up.

Mobil Officer Says TV Network Control Tighter Than Oil Industry

Where ideas and viewpoints are involved, the U.S. marketplace is only partly open to private business, charge Herbert Schmertz, Mobil Oil Corp. vice president of public affairs. The statement was contained in a speech given to the American Gas Assoc. at its 57th annual meeting in Houston.

Additionally, said Schmertz, the
continued on page 1



Your new automatic distortion measuring system for balanced measurements

REDUCED OPERATOR ERROR

Here's something you'll like — Sound Tech's new distortion measuring instrument for use in balanced work.

The new 1710A is much more than just a distortion analyzer. It's a system.

It contains its own ultra-low-distortion generator tracked with the analyzer. It's a system that greatly simplifies measuring — gives you fast measuring with simple operation that reduces operator error.

For example, push the frequency buttons and you set both generator and analyzer. Push "Distortion" and you have your reading. Automatically. No slow, tedious manual null-searching.

Features in the new 1710A include:

- a balanced, floating output (600/150 ohms)
- a balanced (bridging) input
- a high-level +26 dBm signal

- +26 to -90 dBm attenuator
- distortion measurements to .002%
- fast 5-second measuring speed
- automatic nulling, optional automatic set level.
- both harmonic and optional intermodulation distortion measurements.

SPECIAL OUTPUT CIRCUIT

In the 1710A you get a transformerless audio generator output that's balanced and floating. No transformer means no transformer distortion. Floating and balanced means you can connect to virtually any audio circuit regardless of configuration. And you can set the output from +26 to -90 dBm in 0.1 dB steps.

FAST, SIMPLE MEASURING

Automatic nulling and the automatic set level option (ASL) give you ex-

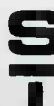
remely fast measuring and little chance for operator error. You can measure in 5 or 6 seconds. *With ASL you can measure distortion vs. frequency, and distortion vs. voltage or power without resetting level.*

IM OPTION

An additional optional bonus is that the 1710A also measures intermodulation distortion. After you've made a harmonic measurement, just push the "IMD" button. In 3 seconds you'll have the IM reading. With this option you'll be ready for future IM requirements.

CALL/SEND NOW FOR LITERATURE

It's worth while getting the information on this major new distortion measuring system. Call Larry Maguire or Bob Andersen now and get our new product brochure. It's ready and waiting.




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The one that's Purr-fect for the price!

The **CAT** is a complete broadcast color film camera system that handles 35mm slides, 16mm motion picture film, has provisions for super 8, and sells for under \$20,000.

Get the **CAT** and you have it all... a ready-to-telecast system with full NTSC color output plus both automatic operation and manual override of black and white balance and level, six-sector color compensation, two-level detail enhancement, electrical focus and dark current compensation. The **CAT** also features instant black and white paint, remote control of detail on/off and detail level override, full or split color bars, cable delay, and intercom.

Contact your local Cohu sales office or Cohu, Inc., Electronics Division, P.O. Box 623, San Diego, CA 92112. Telephone (714) 277-6700.
TWX 910-335-1244.

You expect
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...and you get it.

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• GREAT LAKES Westville, IN 219-874-3333 • NORTH CENTRAL STATES Lincoln, NE 402-467-2900 • SOUTHEAST Orlando, FL 305-896-4881; Huntsville, AL 205-881-6220; Greensboro, NC 919-273-1918 • ROCKY MOUNTAIN Denver, CO 303-623-6447 • NORTHWEST & ALASKA Seattle, WA 206-363-8600 • TEXAS Richardson 214-235-4543, Houston 713-488-0817 • CALIFORNIA San Diego 714-278-8931, Los Angeles 213-926-7002, Palo Alto 415-326-0280

NAB BOOTH 302

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NEWS

marketplace is "anything but free. And where commercial network television is involved, the marketplace of ideas is tightly circumscribed, and it is oligopolistic if not downright monopolistic."

Schmertz's speech followed his company's attempts to buy air time for "idea" commercials to present Mobil's positions on the energy crisis. He said they wanted to convey "some accurate information and our own viewpoints. Our aim was... simply to broaden the spectrum of information—and thus of choices—

available to the American people." Schmertz said the networks have refused to sell time to Mobil for its "idea" commercials.

Projection TV Going To Bars, Clubs; Syndicated Programs Ready

With several projection TV systems being marketed, a major push of larger systems is on for use by bars, discotheques, and night clubs to attract a larger clientele. The Advent Videobeam (\$3500) with 7-ft. screen, is the equipment base for a programming syndication launched recently by Projectionvision, New York entertainment

entrepreneurs. Plan includes installation of Videobeam with high quality sound in clubs not already equipped, with distribution of entertainment acts on U-Matic cassettes. Many programs are produced at The Bottom Line, New York night club which books top favorites in rock and pop fields.

Another large screen system being sold actively to clubs is that of Projection Systems, Inc. of Passaic, N.J., in several models, with screens from 8-ft. to 20-ft.; prices range from about \$5000 to about \$30,000. Projection Systems claims superiority in a wide viewing angle for the screen, uses Schmidt lens system for image enlargement.

A smaller system is aimed at the home by Tele-Pro-Sys of Salt Lake City, Utah. Entire system is within cabinet; by buying projection system and cabinet in kit form, buyer can get 56" (diagonal) screen for around \$400 plus cost of receiver. Base of the system is an unmodified 15-in. Sony Trinitron receiver.

There are **2** great **CHYRON** systems

providing titling...graphics
for television production

CHYRON II Electronic Graphics System,

unquestionably the most advanced and versatile system available today...the one system that offers the highest character resolution and do-it-yourself capability for unlimited type font and logo preparation, plus more features than any other TV graphics equipment.

CHYRON III Electronic Titling System,

At a moderate price CHYRON III provides more flexibility and quality than higher priced units, including unlimited font and logo interchangeability, large message storage capability, and character resolution exceeded only by CHYRON II.

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Meetings

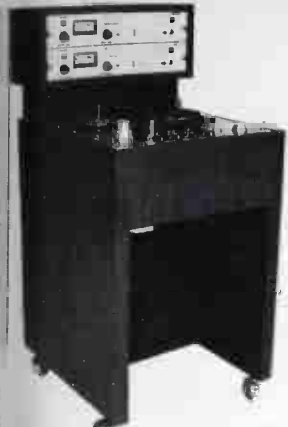
The Video Systems Division of Pierce-Phelps, Inc. has scheduled its **Eighth Annual Video Forum** to be held April 20, 21, 22 in Philadelphia and April 27, 28, 29 in Washington, D.C. Those wishing invitations or information for Philadelphia should contact Ronnie Hill at 215-879-7171. Those interested in Washington, D.C. should contact Debbie Leavell at 301-530-9580. The forthcoming Vidsec 76 (Video Systems Exposition and Conference) will feature the third annual **Video Library** to be held at McCormick Place, Chicago from June 13-16. The Library will be open to all attending Vidsec, and the Summer Consumer Electronics Show, and there is no admission charge. For further information write Vidsec 76, 11th floor 331 Madison Ave., N.Y., N.Y. 10017.

A one-day **Communication Transmission Seminar** on High Speed Digital Transmission Techniques will be held at Princeton University on March 16. Fees are: IEEE member \$40.00, non-member \$45.00. For further information contact Dr. Paul Schnitzler, Bell Laboratories Room 3B-308, Holmdel, NJ 07733 201-949-2216.

The Delaware Valley Industrial TV Society will hold **Video Fair '76** on Wednesday, March 17 in Philadelphia an event aimed at helping local businessmen to better understand the use of TV in company communications. For

continued on page 14

NEW PRODUCTS FROM ACCURATE SOUND HELP SOLVE YOUR AUDIO PROBLEMS

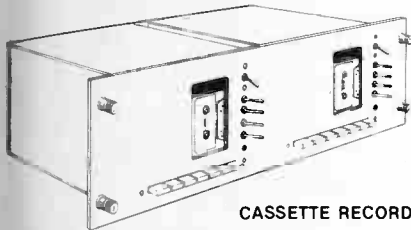


RECORDER/ REPRODUCE SYSTEMS

MIXING CONSOLE



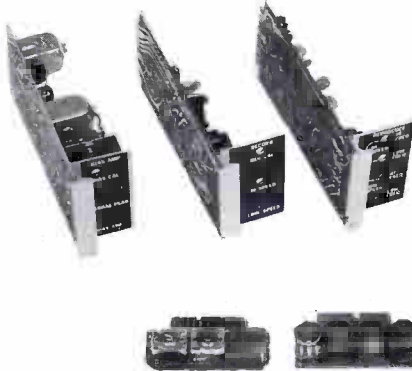
POWER AMPLIFIER



CASSETTE RECORDER



ASCO MODEL 445-M



440 STYLE PC CARDS



NUCLEUS SC100

...Whatever your problems: new equipment, rebuilt equipment, reconditioning or updating. ASCO's "Total Systems" capability can solve *your* problem.

RECORDER/ REPRODUCE SYSTEMS

ASCO provides complete recording systems using Inovonics, three speed electronics, AG-440, Ampex 351, Scully or other electronics. The transport features our new tape motion control box that eliminates the tape handling deficiencies typical of most older tape transports. Contact us about your needs and the system components you would like to use. Price: System shown is an ASCO/Inovonics 375-2C, 3 speed—\$3,700.00.

440 STYLE PC CARDS

We have AG-440B style reproduce, record, bias and EQ cards. Also extender cards for the above.

Price:	
Bias	\$120.00
Record	120.00
Reproduce	215.00
Reproduce EQ	35.00
Record EQ	35.00
Extender Cards	20.00 ea.
	(not shown)

MIXING CONSOLE

The ASCO/ MIXFET DJ-11 Mixing Console is designed for advanced discotheque and broadcast production use. Unique low distortion and noise specification by use of field effect transistor technology. Features include: electronic pan from phono 1 to phono 2, talkback microphone tape ability, equalization on all channels, up to 4 mics and 4 line inputs in stereo or mono and VU meters with + 4 dBm output front panel headphone jack.

CASSETTE RECORDER

This ASCO CRP-4T cassette recorder is designed primarily as an on-line logging recorder for broadcast use. It is a four channel recorder/

reproducer with many transport functions including: skip-forward, skip-back (i.e. automatic fast motion to play mode)—automatic play with either continuous run or BOT/ EOT sense—optional bi-directional play—optional capstan engage for search and cue—digital readout tape position indicator—any speed available between .5 and 20 ips with variable speed option—all functions remote controllable.

The system is packaged in a two module bay with provision for module to module dub function. The package size is 7" high x 19" wide x 12" deep.

Currently ASCO is developing a version of this unit to replace the cartridge format machines already widely used.

POWER AMPLIFIER

The ASCO/ MIXFET M150 is an all-tube single channel professional power amplifier. 150 watts rms, 19" rack mount. Frequency response at 1 watt, 9 Hz to 70 kHz +1 dB. Bass boost continuously from 0 to +12 dB at 50 Hz. Sub-sonic filter—1 dB at 30 Hz; -25 dB at 10 Hz. Price: \$750.00

ASCO MODEL 445-M

Two channel reproduce only electronics, using standard 440 style cards. Available with or without front panel meters, in a 3½" rack mount chassis. Features a built-in power supply and two speed/ EQ settings. Provision is made for remote EQ selection. Transport power is derived from a rear panel jack. Output level +4 or +8 dBm balanced. Price: \$595.00 without meters/ \$695.00 with meters.

NUCLEUS SC 100

Solid state, single channel record/ reproduce electronics designed to replace Ampex 350/ 351

tube type electronics. Includes a built-in power supply and provides transport power via a rear panel jack. Two speed/ EQ choices. Output level +4 or +8 dBm balanced. Input impedance 100k ohms. Price: \$550.00.

TRANSPORT CONTROL BOX

The ASCO 2000 Control Box is a solid state, retrofit modification for older 351 style transports. Features include: fast motion dynamic braking (i.e. braking is accomplished by reverse motor torque until reel stoppage, then normal brakes are engaged)—tape motion sensing that eliminates tape breakage by locking out the play function until tape has stopped—edit function—constant tension holdback with optional constant tension takeup—optional constant torque holdback and takeup—access is provided for search and cue equipment interface—provision for tape lift function—delayed stop for "pop free" bias turn off—torque boost to accommodate high speed fast start—logic design provides access from any transport mode to any other transport mode—provision is made for logic lever control of all function—optional slow start capstan—capable of three speed operation—switch selectable tension settings to accommodate different tape sizes.

TRANSPORT RECONDITION

ASCO reconditions tape transports, motors and head assemblies. Our transport service includes replacing all necessary bearings, guides, rollers, springs, brakes, solenoids, switches, guards and pads.

We completely strip your transport and refinish the top plate, then rebuild the transport like new. Head service includes complete tear-down, clean and rebuild with new springs, guides and recapped heads. Price: \$295.00.

Send for our illustrated catalog with new and used equipment listings.



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FIRST CARTRIDGE

with full internal guidance
with reel-to-reel fidelity
(20 Hz to 15 kHz)

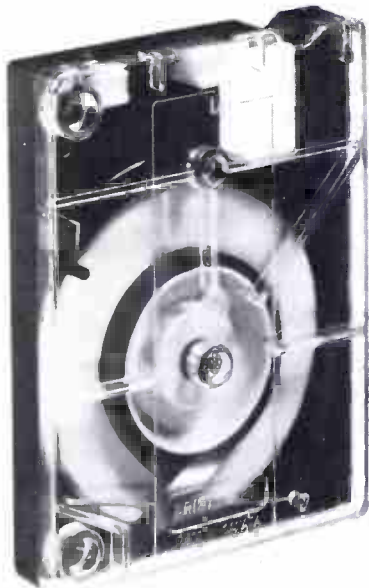
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against any performance
failure within advertised
specifications on properly
aligned equipment.



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DISTRIBUTORS: CANADA - McCurdy Radio Industries Ltd. Toronto, Ont. L. A. Varah Ltd., Vancouver, B.C. GREAT BRITAIN - Selkirk Communications Limited, London, Eng. AUSTRALIA - Syntec Electronic Distributors, Pty., Castle Cove, N.S.W.

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NEWS

more information contact Ron Brown, MarketDyne International, 1600 Arch St., Philadelphia, PA 19101, 215-241-2778 "Effective Programming—The Next Step" will be the theme of the **8th Annual International Conference of the International Industrial Television Association (ITVA)**, March 27-30, Anaheim, CA. For more information contact Herb Wolff, Conference Chairperson, New England Video Services, 501 Boylston St., Boston, MA 02117.

The **Tenth Annual Midwest Acoustics Conference** will be held Saturday, May 1, in the Norris Center of Northwestern University, Evanston, IL. The topic of MAC '76 is "The Measurement of Sound Fields and Their Effect on People." For further information contact H.O. Saunders, Room 24A, 225 W. Randolph St., Chicago, IL, 312-727-4331 Ximark Corp. has begun holding two-day regional **Pay TV and Maintenance Marketing Seminars** across the country. For more information write: Ximark Nat'l Cable Marketing Conference & Training Center, Cazenovia College Campus, Cazenovia, NY 13035.

Programming Briefs

The Progressive Radio Network is now offering **News Blimp**, densely produced 3-minute features using rock music, actualities, comedy and sound effects on a subscription basis. Currently, almost 50 AM and FM rock stations nationwide subscribe and they are available on a market exclusivity basis. For further information, contact Eric Riback, Sales Manager, the Progressive Radio Network, 321 Rider Ave., Bronx, N.Y. 10451; 212-585-2717 **Modern Talking Picture Service** is now offering *In Celebration of Flight*, a 28½-minute film by the Federal Aviation Administration and *Sylvia Porter's Advice For Today's Woman*, a 5½-minute film presented by the American Society of Chartered Life underwriters on free loan throughout the country. Write Modern TV, 2323 New Hyde Park Road, New Hyde Park, NY 11040 for playdates Twenty-one cable systems recently joined the network of cable affiliates for Satori Productions' weekly one-hour variety-talk show **Daytime/Nighttime** bringing the total number to 225 in 375 communities. For information contact Satori at P.O. Box 688, Radio City Station, NY, NY 10019 **Satori** also announced "Celebration," a popular rock music show, has been added to the line-ups of three pay TV

outlets; Atlanta Home Theatre of Atlanta, Ga., Telecinema of Columbus, Ohio, and Macon Cable TV of Macon, Ga. . . . **Trans World International** is now producing a new, 1-night series of sports specials that are nationally syndicated by J. Walt Thompson Co. called "Sportspecial the Month," the 90-minute show premiered last January **Modern TV** is offering three new film "Cathy Rigby's Busy World," about the Olympic gymnast; "LNG: It's C Its Way," describing a project which will provide a fuel supply to an energy-hungry nation; and "The Official 1975 All America Team," highlights of the 1975 college football season. All films are available on free-loan basis from Modern TV, 2323 New Hyde Park Road, New Hyde Park, NY 11040.

A series of 36 weekly radio programs geared to the Bicentennial called **Our Heritage, Our Hopes** is now available free to stations. The 30-minute tape programs explore such issues as the shrinking frontier, First Amendment freedoms, and private enterprise. Information about them can be obtained from Grant Spradling, 287 Park Ave South, NY, NY 10010 **Perspectives On Health**, a weekly 41-minute news interview series is available free to radio stations via tape. Contact Dr. Rawland Cresser, College of Medicine & Dentistry of New Jersey, 100 Bergen St., Newark, NJ 07103. Great Plains National Library has announced two new series available for lease/purchase on video tape or video cassette **The American Economy**, which approaches the study of our economic system from a practical viewpoint, and **Man Builds-Man Destroys**, an environmental series, and information about them can be obtained from GPN, Box 80669, Lincoln, NE 68501 A TV special documenting the life and achievements of actor-singer-athlete-black activist **Paul Robeson** is now available for direct viewing on ¾-in. "U" standard video cassette. The one-hour program can be purchased or leased from the Public TV Library, 475 L'Enfant Plaza S.W., Washington, DC 20024. Modern Television has announced several new 16mm-sound and color motion pictures **Metallic Tales**, presented by The Aluminum Association is available on free loan to TV stations throughout the country. **Harbors** explores some of the East Coast harbors that have played an important role in our nation's development. The 27½-minute film can be obtained free-loan. **The 197: Kemper Open** tells how golf pro Ray Floyd finally captured the title after seven years. The 26 minute TV film is also available free-loan. For more information contact Modern TV, 2323 New Hyde Park Road, New Hyde Park, NY 11040.

continued on page 20

When the chips are down...



Put Your EBS Money On A Sure Thing TFT's MODEL 760

In April 16 the FCC will be calling in all bets on the new equipment for Emergency Broadcast compliance. And *you'll* be putting your hard-earned dollars on the line to meet the new EBS criteria. It's a decision you'll have to make quickly, and then live with for many years to come. So why gamble with your money . . . or your responsibility to this vital service? Ask yourself these questions about the system *before* you buy:

Is it easy to install and service?

TFT Model 760 is a compact, modular system requiring no additional wiring or calibration between modules. It installs in minutes and occupies only 3½ inches of rack space. Built-in system testing pinpoints service requirements and all components are easily accessible.

Is it a complete system?

The modular concept of Model 760 makes it as versatile as your needs require. Compact components include: two-tone EBS generator, two-tone EBS decoder, crystal-controlled dual channel FM receiver and a frequency-synthesized digitally tuned AM receiver.

Is it fully reliable?

All TFT Model 760 systems undergo 3 distinct testing and screening procedures prior to delivery, including 100% I.C. screening and testing, burn-in and computerized circuit board testing.

Is it competitively priced?

Model 760 systems to meet basic FCC requirements are available for as little as \$140. Complete, fully integrated systems cost only \$470.

Is it immediately available?

Your TFT EBS System can be delivered from stock if you order early enough.

Once you've checked the facts, we think you'll agree that your best odds in EBS are Model 760. For detailed information, call toll free 800-538-6884 or call collect in California.

TFT

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www.americanradiohistory.com

NEWS

information on the films write Modern TV, 2323 New Hyde Park Rd., New Hyde Park, NY 11040.

News Briefs

The National Cable TV Association and Continental Cablevision of Ohio, a member company, have petitioned the FCC to revoke the industrial radio license of the Toledo Edison Utility Company for engaging in abusive monopoly practices in the provision of CATV pole attachment services. The

petition, if successful, could have broad ramifications for other electric utility companies providing pole attachment service to CATV companies **RCA Corp.** has announced that it will close its receiving tube plant at Harrison, N.J., by July 30, 1976 affecting approximately 1,100 employees.

The Bible Broadcasting Network of Norfolk, Va. has received permission from the FCC to proceed with the transfer of WAVO-AM in Decatur, Ga. The new station serves the greater Atlanta area, and becomes the fourth station in the network Robert Precht, President of Sullivan Productions, Inc., and Jerry B. Greene, President of **Classic Cablesystems Corp.**,

have announced agreement for sale of Sullivan's New York CATV systems to Classic. The acquisition will be the first for Greene who has been active in the cable industry for more than 11 years. He recently resigned Vice President—Finance and Treasurer of Teleprompter Corp.

WMUK-FM, Western Michigan University, has begun programming "The University of the Air," a series of radio instructional offerings which can be taken for credit toward degree programs at WMU **WPSX-TV**, University Park, Pa. has received a grant from the Pennsylvania Public Broadcasting Network to produce an hour-long special on nutrition.

ComQuest Corp. has announced it will conduct a major multi-client study called *Closed Circuit Video Systems: U.S. Market Analysis (1976-1981)*, an area that U.S. industry is currently spending \$300 million annually

J.R. Poppele, president and one of the founders of the **Veteran Wireless Operators Association**, presented President Gerald Ford with a telegram and sounder at a special ceremony in the White House Rose Garden following the organization's 50th anniversary dinner in Washington, D.C. . . . **The National Broadcasting Company**, on the occasion of its 50th Anniversary, will receive the 1976 Gold Medal of the International Radio and Television Society—IRTS' highest honor awarded annually for "achievement in or contribution to broadcasting," at the IRTS' 36th Anniversary Banquet, March 18, at the Americana Hotel, New York City.

Audio-visual producer **Close Productions** of Fort Myers Beach, Fla. offers its clients individually-tailored color slides at a new low bottomed price of only \$12.95 per slide

Jerrold Electronics has produced its 100,000th Super Descrambler at its Nogales, Mexico plant **Ampex Corp.** has announced delivery of its 500th AVR-2 modular videotape recorder/reproducer to Australian station Ten-10 in Sydney

Approximately 12,000 radio and TV programs entered in the annual Peabody Awards competition during the past 50 years have been acquired by the **University of Georgia** libraries **Bebell, N.Y. film laboratory** located at 416 W. 45th St., has announced daily development service for the new Ektachrome 7240 video negative film.

Being First

is a Western tradition.



The FIRST 2.5 kW AM broadcast station in modern times is KZUL, Parker, Arizona. Our congratulations, Rick Murphy!

The Sparta 703B 2.5 kW AM Transmitter is FIRST . . . but NOT NEW. For a decade it has proven dependable around the world — from the frozen, miles-high Peruvian Andes to Oceanic island locations. THAT'S dependability!

The 703B's solid state intermediate amplifier design is the choice of dozens of 2.5 kW AM applicants. Think NOW of your own contingency order for the Sparta Model 703B.

Think FIRST of Sparta's complete, dependable transmitter line.



Satisfaction GUARANTEED!



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Business Briefs

Ampex Corp. has been awarded a \$1 million contract to deliver color videotape recording equipment to the National Iranian Radio and TV organization.

on The Broadcast Products Division of **Harris Corp.** has received a 345,000 order from the General Electric Broadcasting Co. for a BT-D-36L, 6 kW IF modulated TV transmitter and a \$53,000 order from the Jefferson-Pilot Corp. of Charlotte, N.C. for a System-90 program automation system **International Video Corp. (IVC)** has received an order in excess of \$260,000 for studio and portable broadcast color TV cameras and associated equipment from London Weekend TV.

Twenty radio stations joined the **CBS Radio Network** in 1975, bringing the number of affiliates to 256. On January 19, **WFDE**, Flint, Mich. became an affiliate **Eastman Kodak Co.** has opened new offices as part of expansion of its Whittier marketing and distribution center, headquarters for the company's Pacific Southern region

Audio-Video Concepts has moved to new facilities at 6909 Old Alexander Ferry Road, Clinton, Md. 20735; 301-868-7600 **R F Systems** has announced the completion of its new test range facility at Cohasset, Mass. for R.F. antennas up to 50-ft. in diameter **Sudden Music** has formed a new company, **All Of A Sudden Music**, Riverdale, N.Y., to handle the firm's ASCAP licensed compositions .

Walther M.A. Anderson & Associates have named two new field sales organizations: **Fieldtec Inc.** based at 4500 Campus Drive, Newport Beach, Calif. 92660 714-540-4000 to cover southern California and Arizona and **Foster Associates**, 1078- Wentworth St., Suite B, Mountain View, Calif. 94043 415-965-4010 to cover northern California and Nevada **Hervic Corp.** recently announced the availability of new price listings covering some of its Beaulieu Camera Systems. Lists can be obtained from **Hervic Corp.**, 14225 Ventura Blvd., Sherman Oaks, Calif. 91423 **International Tapetronics Corp.** has announced a two-year warranty on their entire line of professional cartridge and open reel audio tape machines **Scientific-Atlanta, Inc.** announced that it has completed arrangements for a 15-year loan for \$6 million from the Equitable Life Assurance Society.

People

Lawrence M. Clamage has been appointed Program Manager of **WKBD-TV**, the Kaiser Broadcasting Station in Detroit **Jim Dyer** has been appointed Program Manager for **KOOL AM**, Phoenix, Az. . . . The appointment of **Cheryl Daly** to the position of Manager of Press Services for the CBS Radio Division has been an-

nounced **Dr. Tom Brislin** has joined the staff of Guam CATV System as Cablecasting Manager.

Philip W. Semisch has been named Vice President of **Jerrold Electronics Corp.'s** Manufacturing Operations **Richard M. Sykes** has been elected Vice President—Finance and Treasurer of **Teleprompter Corp.** by its board of directors **Video Concepts, Inc.** has announced that **Joe Benaim** has joined its staff as Senior Vice President, Research & Development **Robert J. Lewis** has been elected President and Chief Operating Officer of **Jones Intercable** by its board of directors **Sylvia Caso, Patrick Caruso and James W. Elmore** have been named Vice Presidents of **Cablevision, Inc.**

Richard Putman has been appointed Instrumentation Optics Manager of **Angenieux Corp. of America** **Thomas W. Smith** has been appointed—Manager, Telecommunications Instrument Product Line of **Scientific-Atlanta, Inc.** **David C. Herbert** joins the Video Systems Division of **Peirce-Phelps** as Systems Engineer in the company's Washington D.C. office.

Donald F. Smith has been named National Sales Manager for **CEI (Commercial Electronics Inc.)** **Spindler & Sauppe** has announced the appointment of **Vern Schultz** as National Sales Manager **McMartin Industries** has appointed **Charles F. Rockhill** as Western Sales Manager **Henry M. Edwards** has been named Western Manager for **Phelps Dodge Communications Corporation.**

Gerry Heitel has joined **Recortec** in the newly created position of Vice President of Marketing **Fred P. Wilske** has joined the staff of **Video Concepts, Inc.** as Director of Marketing **Jerry M. Astor** has been named Director of Marketing for the Video Products Division of **Akai America Ltd.** **Phillip L. Gantt** has been appointed Sales Manager of the Video Systems Division of **Peirce-Phelps, Inc.** **Brand-Rex Company** has announced that **Kenneth L. Porter** has been appointed Marketing Coordinator for the industrial market, **Richard H. Bamford** has been promoted to Manager of Sales and Marketing for **Industrial Products**, and **George C. Graeber** has been promoted to Manager of Sales and Marketing for **Electronic Products** **Peter Comandini** has been named Director of Technical Sales for **Image Transform CCA Electronics** has announced that **A.W. Bill Trueman** has been appointed Director of Marketing and that **Sam Colodny** has been promoted to Director of Engineering.

William L. Starling has joined
continued on page 22

FUJINON BCTV LENSES*



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4. Low Cost Field Zoom Available with 1.5x and 2.5x add-on extenders.	14x37.5 f:2.2	14x29.5 f:1.8
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6. ENG Lenses (Pictured below) Extreme light gathering power with ideal ranges of zoom and focusing.	1" K7x11 f:2.0	3/4" A10x10 f:1.8 A7x9 f:1.4 A6x12.5 f:2.0
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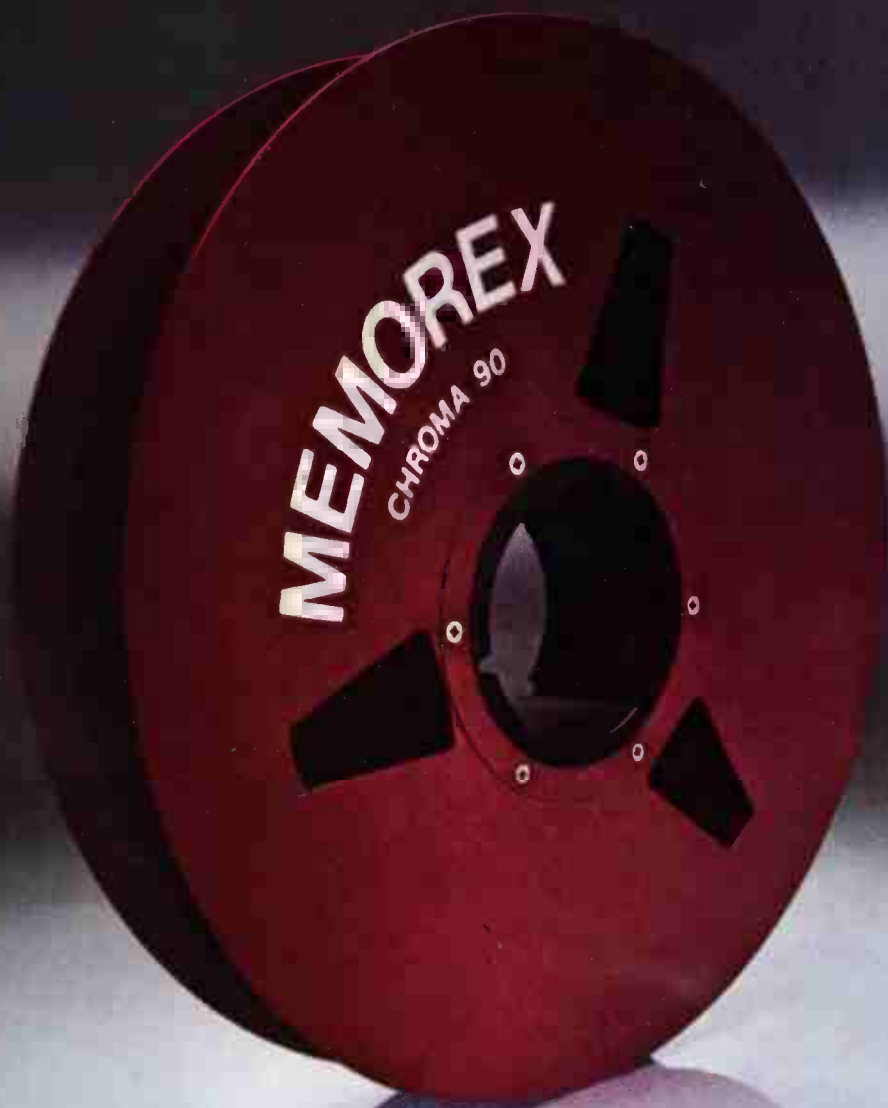
NEWS

Capitol Magnetic Products' professional products division as Field Sales Manager, operating out of the Los Angeles office, for Southern California and Arizona . . . Telemet announced the appointment of **L. Parson** as Sales Manager, Southeastern Region, and **Robert Daines** as Sales Manager, Western Region . . . **Lee Whitehurst**, formerly Chief Engineer, has been promoted to Technical Director of WSM, Inc., Nashville, Tenn., and will have the overall engineering responsibility for the WSM Stations including WSM-AM, FM and TV, the Grand Ole Opry and Opryland Productions . . . **Cal Arnold** has been promoted from Sales Manager to Station Manager of KKYK Radio Little Rock, . . . **Joseph Capobianco** has been promoted to Program Manager of radio station WAAF-FM, Worcester, Mass. . . **Jayne Boyd** has been appointed Program Manager of WKBS-TV Philadelphia, a Kaiser Broadcasting Co. station . . . **George Causey** has been named Chief Engineer for Donrey Media Group's KGNS-TV Laredo, Texas.

Al Roberts has been appointed National Sales Manager of Uher of America . . . **Gary Gross** has been appointed National Marketing Manager of Cinema Products Corp. . . . **Curtis I. Kring** has joined the Communications Equipment Div. of Microwave Associates as Director of National Marketing . . . **Michael J. Clark** has been appointed Director of Sales for Trans World International . . . The Magnetic Audio/Video Products Div. of 3M has named **Jack Bondus** as Marketing Manager and **John A. Miller** as Sales Supervisor for its commercial and educational markets.

Jerry Bassett has been named Director of Marketing, Spectra Automation Div., Spectra Data, Norridge, Calif. . . . **Jack K. Dana** has been appointed Director of Marketing of the Vega Div. of Cetec Corp. . . . **Edward King** has been appointed Marketing Manager of Hicksville, N.Y. Div. of Ampex Electronic Corp. . . . Camera Magazine has promoted **Herbert Browning** to National Sales Manager, **Jeff Wohl** to Sales Manager and **Shim Ben-Dor** to Service Department Manager . . . **Larry Sloop** has been promoted to Sales Manager, major accounts for Davis Manufacturing Div. of J I Case, Wichita, Kan. . . **Daniel A. Roberts** has been promoted to the position of Manager, Industrial Relations and Government Sales . . . continued on page 10

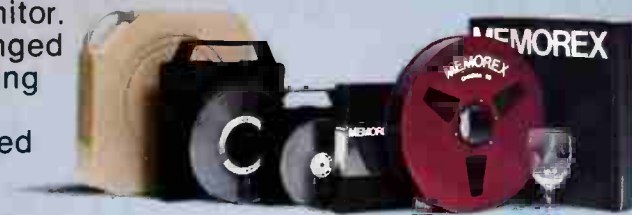
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NEWS

Broadcast Products Div. of Harris Corp. . . . **Jesse Lancaster** has been elected a Vice President of Cook Engineering Co., Alexandria, Va., division of Dynatech Laboratories Inc. . . . **Dominick Azzaro** has been named a Vice President of Vide Techniques, New York City . . . **Herbert M. Perkins** has been elected a Vice President of Datatron . . . **Ben Pellegrino** has been appointed a Vice President of Tele-Vue Systems Inc. . . . **Dennis B. McAlpine** has been named Vice President-Corporate Development for Warner Cable Corp. the CATV subsidiary of Warner Communications . . . Manhattan Cable TV has announced that **E. Thayer Bigelo**, formerly Vice President for Operations, has become Executive Vice President; **Frank Chiaino**, formerly Director of Operations, succeeds Bigelow as Vice President for Operations; and **Joseph J. Kelly** has become Vice President for Marketing . . . **George Alexandrovich** has been appointed Vice President of Field Engineering and Professional Products Manager of Stanton Magnetics . . . **Bernie Holtman**, Chief Engineer of WAVE, Louisville, Ky., has been promoted to Director of Engineering for Orion Broadcasting . . . **Albert E. Audick** has been named Washington area Liaison Manager for International Video Corp. . . . **Juan C. Gregorio** has joined the Engineering Dept. of McMartin Industries and will be engaged in the development and design of new AM and FM broadcast transmitters . . . **James A. Monroe** has been appointed to the newly created position of Director of Governmental and Institutional relations for American Cable Television . . . **Chuck Iannazzo** has become Supervisor of the camera department for Berkey Manhattan Filmstrip and Slide Laboratories . . . **Bud J. Shepard** of Vancouver, Vice-Chairman of the Board of Premier Cablevision Ltd. and co-founder of Vancouver Cablevision, died on January 9, 1976 in Houston, Texas at the age of 46 . . . Veteran broadcaster **Carl Fox**, Vice President and Program Director of KYTV, the NBC affiliate in Springfield, Mo., died January 6, 1976 of a heart attack at the age of 64 in his home in Springfield. . . . **Charles Shephard**, Vice President-Engineering for Rust Craft Broadcasting Co. radio and TV stations, retired on September 1, 1975 after nearly 35 years with the company . . . **Andrew D. Ring**, former Assistant Chief Engineer of the FCC from its formation in 1934 to 1941, died December 29, 1975 of cancer.



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INTERPRETING THE **FCC** RULES & REGULATIONS

New Community Ascertainment Guidelines For Broadcast Renewals

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

New guidelines for ascertainment of community needs, problems and interests for presently licensed broadcasters have been adopted by the Commission.¹ The revised guidelines apply only to *commercial* broadcast renewal applicants.

In short, the new ascertainment guidelines provide for *continuous* ascertainment of community needs, problems and interests. This supplants the previous requirement that an ascertainment survey be made within six months of the renewal application filing date. The *1971 Primer*² still governs new broadcast license applications.

Detailed hereinbelow are the Commission's new broadcast renewal ascertainment guidelines.

I. Demographic Showing

Renewal applicants need no longer prepare a complete demographic study of its city of license. Instead, a licensee must maintain, in its *public file*, a listing of the following demographic characteristics of its city of license:

1. Total population figures.
2. Numbers and proportions of;
 - a males and females;
 - b minorities;
 - c youth; and
 - d the elderly.

The Commission did not specify how often this data must be updated, but it seems reasonable to assume that updates should be made as soon as readily available statistical updates are published. Broadcasters should note that the Commission requires retention of statistics relating *only* to the city of license and not to other portions of the licensee's service area.

II. Community Leader Interviews

One of the most difficult aspects of community needs ascertainment has been the selection of a representative "cross-section" of community leaders. The Com-

mission introduced some certainty into this process by composing a Community Leader checklist. The checklist includes the following institutions/elements of your community

1. Agricultural
2. Business
3. Charities
4. Civic, neighborhood and fraternal organizations
5. Consumer services
6. Culture
7. Education
8. Environment
9. Government (local, county, state and federal)
10. Labor
11. Military
12. Minority and ethnic groups
13. Organizations of and for the elderly
14. Organizations of and for women
15. Organizations of and for the youth (including children and students)
16. Professions
17. Public safety, health and welfare
18. Recreation
19. Religion
20. Other

Since the Commission has determined that these structural and institutional elements are common to most communities, any licensee seeking renewal can protect himself as follows. First, if he has interviewed leaders from each of these community segments, he will be deemed to have met Commission standards for "gross quantitative sufficiency" of the Community Leader Survey. Second, if he meets the "gross quantitative sufficiency" standard, he will be immune from challenge to same *IF* the number of Community Leader consultations equal or exceed the following:

Population of City of License	Number of Consultations
10,001 to 25,000	60
25,001 to 50,000	100
50,001 to 200,000	140
200,001 to 500,000	180
Over 500,000	220

¹First Report and Order in Docket No. 19715, FCC 75-1361; adopted: December 15, 1975; released: January 7, 1976.

²Primer on Ascertainment of Community Problems for Broadcast Applicants, 21 RR 2d 1507 (1971).

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Note Carefully: Even if a licensee conducts the minimum suggested Community Leader consultations, his community ascertainment may still be open to challenge in terms of "qualitative sufficiency" (i.e., whether the relative coverage given to the several significant elements found in the Community Leader checklist achieves "representativeness"). For example, a licensee in a city of 26,000 may conduct 100 Community Leader surveys and still be open to challenge concerning "representativeness" on the grounds that no Leaders representing minority and ethnic groups or religious institutions were interviewed.³

In a significant change from prior policy, the Commission now permits up to 50% of Community Leader interviews to be conducted by non-management-level employees (so long as they are under proper supervision). (The old guidelines required that 100% of the Community Leader surveys be conducted by principal or management-level employees.) The other 50% of the interviews must be conducted by management-level employees, officials and principals of the licensee. Further, those Community Leaders representing the interests (1) racial and ethnic minorities and (2) women should among the 50% interviewed by principals, officials or management-level employees.

While reiterating that face-to-face interviews with Community Leaders "should remain the staple," the Commission acknowledged that some minor use of telephone consultations with Leaders will be acceptable, especially in outlying portions of a renewal licensee's secondary service area. *In spite of this directive, to be safe, broadcasters are urged to conduct face-to-face interviews with virtually 100% of the Leaders that they select.* In the event of renewal challenge, the minimum additional effort required to do so will obviate time-consuming and potentially costly hearing issues.

Community Leader surveys should be conducted throughout the three year license terms. Summaries of interviews must be placed in the licensee's public file within a "reasonable time" (not more than 30 to 60 days) after each interview. Any interview that is not reflected in a licensee's renewal application must be placed in the public file *on or before* the date that the renewal application is filed. Each Leader's public file documentation shall include:

- 1 Name, address, organization, and title of Leader interviewed;
- 2 Date, time and place of interview;
- 3 Name of principal, management-level, or other licensee employee conducting the interview;
- 4 Problems and needs discussed during interview (if interviewee requests that statements be held in confidence, statement to that effect);

5 For interviews conducted by non-principals or non-managers, date of review of interview record by licensee principal or management-level employee.

The licensee need *not* file copies of the Leader interview records with the Commission each year. Instead, each licensee should file one "Community Leader Checklist" for the three prior years with its renewal application. This Checklist should list the 19 institutions (elements noted above), the number of Leaders

continued on page 2

³If one of the 19 institutions/elements does not exist in a licensee's community, the licensee must so explain in its renewal application.



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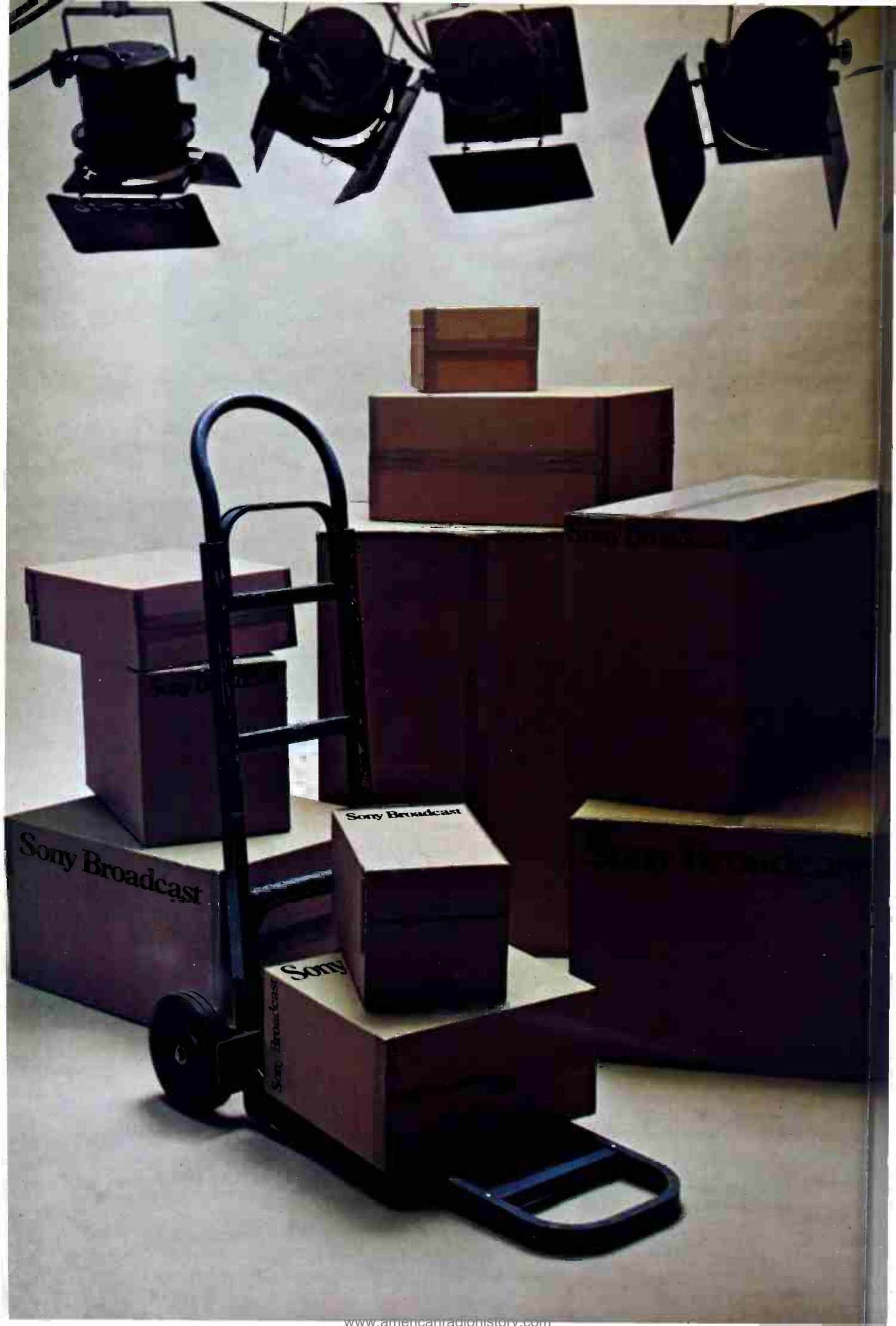
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FCC RULES & REGS

of each interviewed, and a brief explanation if no Leaders from any one category were interviewed.

III. General Public Survey

The Commission retained its General Public survey requirements. Renewal applicants have a choice of conducting continuing surveys (e.g., one during each of three license years) or one survey prior to filing of the license renewal application (as was previously required). Licensees must place (1) a "brief narrative statement covering the techniques and results" of the General Public survey in the station's public file within a "reasonable time" (generally not longer than forty-five days) of survey completion. A General Public survey that is relied upon in a renewal application must be placed in the public file *on or before* the date that the said renewal application is filed.

IV. Annual Problems-Programs List

AM and FM broadcast licensees will hereafter be required to prepare (1) an annual list of not more than ten significant problems and needs existing in their service areas during the preceding 12 months, and (2) a related list of illustrative programming presented during that period to treat those problems and interests. (Television licensees have been required to prepare such a list for some time.) Each list must be placed in the station's public file on the anniversary date of the filing of the renewal application. (Of course, in the license renewal

year, the list must be placed in the public file on the date that the renewal application is due to be filed with the Commission.) The license renewal application shall contain the "Annual Problems-Programs List" for each of the three preceding years.

V. Exemption For Small Market Stations

All broadcast stations located in small communities (i.e., with populations under 10,000 and not within a "Standard Metropolitan Statistical Area") are exempt from Commission inquiry into the manner in which they become aware of community problems and needs. This means that such smaller community stations (1) need not conduct Community Leader interviews, (2) need not conduct General Public surveys, (3) need not maintain a checklist of demographic aspects of its community, (4) need not draft (or include in their public file) a Community Leader checklist and (5) need not file a checklist with their license renewal application. *Small community licensees must still remain conversant with community problems.* Further, these small market licensees must prepare an "Annual Problems-Programs List" which must be submitted with license renewal applications.

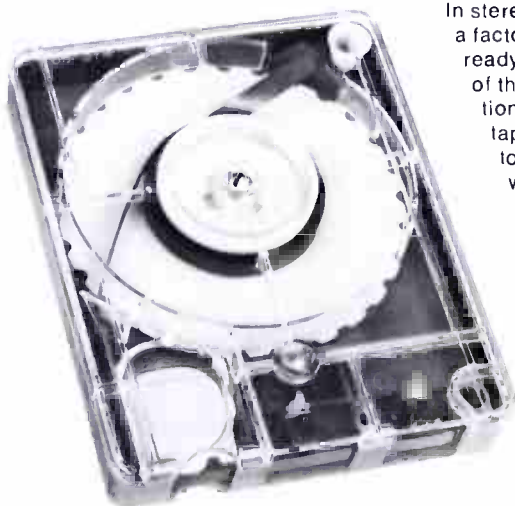
VI. Effective Date

The revised community ascertainment guidelines become effective as follows:

1. For licensees whose authorizations expire on or after December 1, 1976 (e.g., whose renewal applications are due to be filed on or after August 1, 1976), the new guidelines become effective on or after February 6, 1977.

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2. For renewal applicants whose licenses expire prior December 1, 1976 (e.g., whose renewal applications due to be filed on or before July 1, 1976): *Upon commencement of the new license period.* Thus, such licensees will be expected to follow existing guidelines in the 1971 *Primer* with regard to their 1976 license renewal application.

VII. Primer For Renewal Applicants

The Commission adopted a *Primer* for its new community ascertainment renewal guidelines. *The Primer for Renewal Applicants* is similar in scope to the 1971 *Primer* which was originally designed for new broadcast facility applicants. Current licensees should refer to the new *Primer* when planning and implementing their community ascertainment studies. Note that the *Primer* requires licensees to *certify* in their renewal applications that the required demographic checklist, Community Leader checklists and Annual Problems-Programs checklists were timely placed in the station's public file.

VIII. Conclusion

The Commission's 1971 *Primer* has resulted in ending confusion and a plethora of issues designated in conjunction with renewal hearings. The Commission hopes to obviate some of these problems by announcing the new guidelines detailed hereinabove. While community ascertainment will be simplified somewhat, several areas of difficulty still remain. The *Renewal Primer* should clarify some of these problems and broadcast stations should carefully review same before beginning community ascertainment preparations.

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ENG And Digital Video Double Bill At Winter TV Meet

Topics are prelude to what will be discussed at Chicago NAB Convention.



ENG experiments were related by broadcasters. Raymond Smith, WKYC-TV, Cleveland, led off the program.



Photo of WKYC-TV mobile unit.



Joseph A. Flaherty of CBS-TV network (left) and Renville McMann Jr., president Thomson-CSF Labs, look over their joint development effort, the Microcam.

Organizers of the Tenth Annual Winter Television Conference, Detroit, went all out in an effort to establish this annual event as *the* technical meeting of the year. By picking the two hottest subjects in TV, ENG and Digital Video, they were successful. Over 700 flooded into the Southfield complex which would have seriously overflowed the area were it not for the fact that many local citizens had departed the area for milder and sunnier climates.

But with a generous wine and cheese party hosted by WJBT-TV one night and a double-barreled seminar Friday night, there was no need to venture into the winter chill.

Highlights of the conference were premier presentations of two outstanding developments: the new Thomson-CSF Microcam and the joint Ampex/CBS effort, the Electronic Still Storage system.

There were other very significant first time announcements—Nippon Electric Co. Ltd. described the development of a new camera that certainly need not take a back seat to the Microcam. The NEC MNC-61 is a single piece camera weighing 13-lbs., and which consumes only 25 watts. Its compact size is achieved by virtue of using a hybrid microcircuit.

While not revealing precisely what they would show, Ikegami used the

occasion to announce yet another ENG camera—one that would be unveiled at the NAB Show. Ikegami was followed by Sony which declared it would have a brand new large broadcast line of products at NAB including portable cassette units, an editor cassette console, and an editing system. Also something of a first was the showing of a working model of the TK-76 ENG camera by RCA. Here, however, only a prototype was shown.

Another first was the announcement by Cinema Products that it was coming out with a stabilizer for film cameras—a device that could also be used on ENG cameras. A film demonstrating the virtues of this camera stabilizer showed some incredible pictures made as the cameraman was jiggling on rugged terrain or running up and down stairs and shooting at the same time.

A new communications system for studio-to-field intercommunication was described by Motorola. And although the device was displayed at earlier events, the new editing system by Convergence Corp. got official recognition by virtue of having a paper on the editor included as part of the program.

The remaining half of the Winter TV Conference was devoted to digital video. A great many papers were tutorial or research oriented, but a few described actual equipment. The highlight product in this category was the new Electronic Still Storage system developed by Ampex for CBS Television Network as a result of a joint Ampex/CBS development effort. Drawing a great deal of interest was

Leonard Golding, Digital Communications, discusses methods of making quality assessments of digital signals.





Photo of the new NEC camera as projected on a screen at Winter TV meet.

description of the new Quantel Digital time store synchronizer. A paper on this device was read by J. Brian lately, Micro-Consultants, Inc., Palo Alto. Micro-Consultants is the sales man in the U.S.

There were other papers on other equipment but most of the products described were already known to broadcasters.

For the first time, the Winter TV conference included an exhibit area.

It were the products already mentioned—the RCA TK-76, the convergence Corp. editor, and the Quantel digital synchronizer. Among other relatively recent products on display were the BCC-2 Portable color broadcast camera from Ampex, a time-video assist aid for film making from Cinema Products, a video disc recorder from Eigen and some new ENG antennas from Nurad. There may have not been another product present. CMX Systems showed a shipping crate marked NAB Chicago and Secret. In it could have been the new CMX ENG editing system the CMX-340. We understand this editor will be a pulse-count type selling in the under \$20,000 range compared to the more expensive CMX-40 SMPTE time code editor.

See NAB Preview article for more on ENG cameras

Since the ENG cameras described at Detroit will be exhibited and highlighted at the forthcoming NAB Convention we are describing them more fully in the article on the NAB that follows. Please refer to that section.

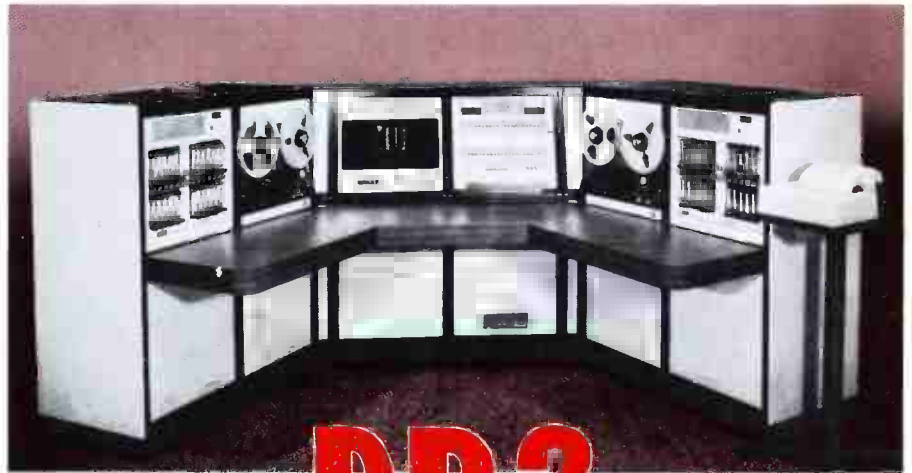
The Electronic Still Storage system (ESS)

Engineers attending the Detroit Winter TV meeting were subjected to a title 'future shock' despite an intense effort to avoid such an occurrence. We refer, of course, to the introduction of the new Electronic Still Storage system as a replacement for the telecine chain. This is a device that can randomly search a library of still pic-

tures, arrange stills into the order to be played, play them at the rate of one second per still, and do it without touching the medium. It's a shocking device in concept but more than that it shocks you into realizing digital video is here!

During the tutorial seminar the preceding evening and during the morning session prior to the paper on ESS a laudable effort was made to introduce the subject of digital video without threat. From the presentations of Frank Davidoff of CBS and Leonard Golding of Digital Communications on the first

evening and that of Charles Ginsberg the following day (Ginsberg is chairman of the SMPTE Digital Television Study Group) one got the impression that digital video was certainly coming, but its introduction would be at best slow. We learned that the least likely device to go digital would be the video tape recorder because the bandwidth requirements for digital video are greater than that for analog. We heard that in digital TV the minimum active bit rate is 45.8 M bits/sec. You roughly translate bit rates into
continued on page 38



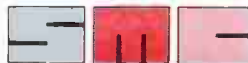
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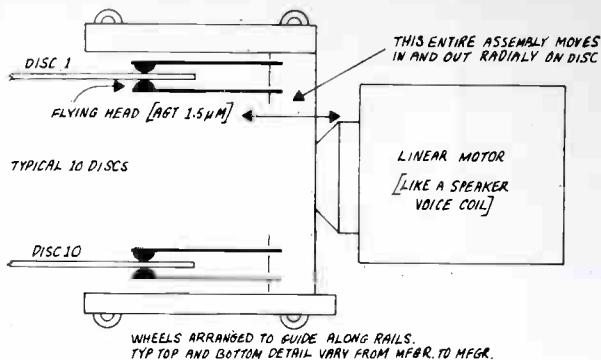
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ENG AND DIGITAL VIDEO

bandwidth by multiplying by two. To handle such bandwidths and/or bit rates VTRs would have to have a tremendous writing speed. So you relax—no need to master this subject just yet, because it ain't practical. Then Mr. Connolly of CBS steps up to the microphone and delivers his paper. He describes a digital video recorder that is a reality now! As it turns out, by using a disk drive rather than videotape, high writing speeds are practical



Simplified drawing of disc pack containing discs. Heads are always aligned and 16 surfaces constitute one video frame.

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and it is all possible. But we're getting ahead of the story. Let's go back to why even consider replacing the telecine with a digital system.

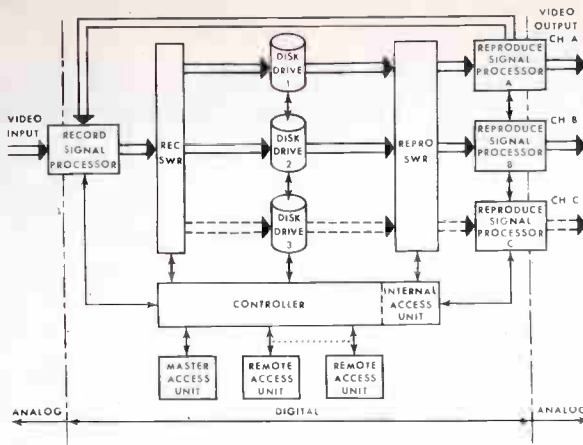
Connolly points to three trends at which downplay film: 1) the increased use of the automatic TCR-100 and ACR-25s for playing commercial spots, 2) the fact that feature films are now integrated into videotape for broadcast, 3) the switch of TV news from film to videotape.

This means that the broadcasting of stills is the last major function of the telecine chain. Even in this realm character generators have made slides unnecessary in the first place. One then calculates the cost of using telecine for simply showing slides. It turns out to be expensive.

If one doesn't make a slide and achieves graphics directly by putting a card in front of a camera, one is less guilty of making wasteful use of equipment. Mindful of these considerations and trends, CBS thought it was time to examine using digital video storage devices for storing video images in digitalized form. Studies at CBS stations using slides showed that 900 stills are about the number that are active in a 100 day time frame. Altogether, 3000 slides are probably the most that would be in inventory and usable. This kind of load can be handled by an ESS.

Basically, an ESS system performs four functions: record, retrieve, assembly of a sequence for broadcast and play. Such a system should be able to access any still in storage in less than one second and it should be able to access stills on a continuous basis. Also one should be able to play and repeatedly with no deterioration in playback quality. A further requirement is that an ESS should be able to play back two different stills simultaneously. This will permit preview—or the possibility of superimposing two slides. So that others in the station can view stills, remote access is necessary and there should be two independent video channels so that on-air programming is not interrupted. All of these objectives

Simplified block diagram of the ESS (from Connolly paper).



A frame is stored each revolution. A frame is then a "cylinder"; the perimeter of the cylinder is one of the 800 tracks and the height (or depth) is the sixteen surfaces all directly below the head associated with the top surface. This one-to-one correspondence of "cylinders" to stills means the play-back of a frame is accomplished without head carriage movement. (It also makes it simple to rearrange stills into sequences for airing. Up to 128 of the 800 "cylinders" of each disk pack can be assigned as working tracks for continued on page 40

been met in the Ampex/CBS design.

It was assumed in the ESS design phase that a sampling frequency of three times color subcarrier would be adequate and that each sample would have eight quantizing bits (256 levels). Connolly said "The eight-bit value assigned to a sample is fortuitous for the reconciliation of PCM video standards to computer standards, since it coincides with the eight-bit "byte", the unit used by the computer industry to measure mass memory size. Large memories are measured in "kilobytes" and "megabytes"."

The disc drives that are standard in the computer industry work ideally in an ESS system. The Ampex DM 331 system, rotating at 3600 rpm offers 800 tracks per surface and provides a capacity of 200 megabytes per disk pack. Information is transferred serially, one bit at a time at 6.45 megabits per second. There is one read/write head for each surface; the head does not come in contact with the magnetic surface. The air-film distance is approximately 45 micro-inches. This air gap means the head can move radially across the 800 tracks of the disk rapidly and without wear. Traverse time across the disk is 55 milliseconds.

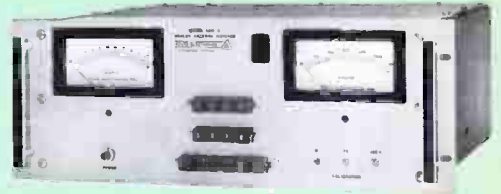
The physical parameters of the Ampex DM331 Disk System permits the stretching of the linear packing density. Thus, the 6.45 megabit per second linear packing rate must be increased to 10.7 megabits per second, which is the familiar rate of three times color subcarrier. This 60% stretching of packing density has been successfully accomplished in the feasibility model. The resulting error rate is well below the one part in 10^7 deemed acceptable for digital television.

A key to understanding the ESS system is to realize that a still is not recorded on a single disk. Rather the system is formulated so that a single video field is divided up into eight disk surfaces. The head associated with each surface is wired to the output of one of the eight quantizing levels. It takes sixteen heads (and disk surfaces) to record two fields or one full frame.

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A Simple System For Quick And Precise Cartridge Phase Alignment

By Grady Moates

By using the three cue oscillators as simultaneous test tone sources, this easily built system allows very fast and accurate azimuth alignment of stereo carts, for elimination of phase error. At station KIKK the system has not only cleaned up sound on matrixed, stereo, and mono FM and on simulcast AM (allowing for higher levels), but also provides rapid quality checks of new carts, checks for playback levels when recording, and distinguishes mono and stereo carts.

In November, 1972, BM/E published an article called, *Solve the Cart Phase Problem with Instant Alignment*. This article began: "By now, nearly everyone in the technical end of broadcasting has at least heard about interchannel phase error in stereo tape cartridges . . ."

Well, now it's 1976 and that sentence, with a minor editorial correction can start this article, too. By now everyone in all phases of broadcasting is aware of the stereo cart phase problem. And in a way, that's nice!! No, not the problem, I mean the awareness. It signals the start of a new era in radio. 1976 is going to be a great year for the broadcast engineer, primarily because of this new *awareness at management levels* of subjects such as phase linearity, synchronous AM, ringing, and their attendant symptoms of poor separation, IM distortion, ragged sounding highs, and inconsistent modulation levels. Management has learned, the hard way in some cases, that if these problems and others like them are not dealt with, they will cost money in the form of lower ratings and consequential lost revenue when the competition cleans up their act and we don't.

Phase problems particularly are getting a higher priority at budget planning time, and that's been a long time coming. Too long, with the advent of matrix-quad FM, because encoded-quad *will not decode properly*, and in some cases *will not modulate at a consistent level*, if the original phase relationship between the channels is not maintained. Even if a phase error is introduced before the synthesis, it will cause more problems in matrix-quad than will the same degree of phase error in a simple stereo program situation, according to Jerry Budelman and Daniel Gravereaux at the CBS Technology Center.

Looking at some simple vector diagrams of the encoding process will verify this. No matter which matrix system you use, it works by altering the phase relationship of the rear channel information with respect to the front information, and then mixing them together.

Since in the synthesis process the front and rear in-

formation is basically the same except for a 90° phase differential, if the front channels are carrying monaural audio a 90° phase error in the cartridge tape system will cause the front channels to partially cancel with the rear channels when mixed to mono, due to the 90° phase shift introduced by the quad synthesis circuitry. This effect is minimized by a 3 dB lower rear channel information level introduced by the quad synthesizer, but the cancellation will still occur to some degree. Because of the additional problems introduced by matrix-quad encoding, many FM broadcasters have not only switched to the new "phase-standardized cartridges," but are doing further exploration in this area to see if further refinements of the system can be made.

This article presents an easy, inexpensive solution to these problems. It's a refinement of the approach used in the 1972 article mentioned earlier. Soon after the article was published, ITC made available a factory modification to the RP-0004 which allowed mechanical front panel adjustment of the record head azimuth to optimize response and phase in exactly the manner outlined in the article.

Later, ITC offered a newer design incorporating a small DC motor driven azimuth adjust screw, with a three-position spring-return toggle on the front panel. This new design included automatic switching of the kHz cue oscillator so that response could be peaked by monitoring the "CUE-PLAY" position of the meters.

This, however, leaves room for a 20° to 25° error due to slight differences in tapes and record head gap scatter. In order to adjust stereo phase tracking accurately, an external oscillator with variable frequency or a sweep oscillator is usually necessary, in addition to an oscilloscope-type display connected to the output of the playback amplifiers.

It occurred to me, however, that with the three very stable cue oscillators already available internally in the record amp, spread out in the audio spectrum as they are, the whole process could be greatly simplified and made less expensive, eliminating the need for external oscillator or sweep generator.

Mr. Moates is Chief Engineer, KIKK, Pasadena, Texas.

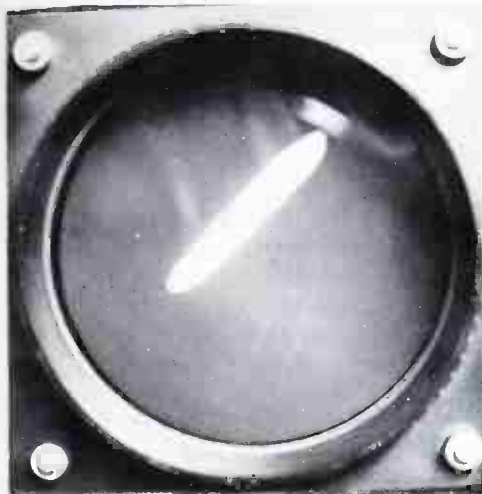


Fig. 1 Familiar 45° line usually signifies an in-phase condition; but in this trace, made with two oscillators, the 150 Hz is in phase in the two channels, the 8 KHz is 360° out of phase.

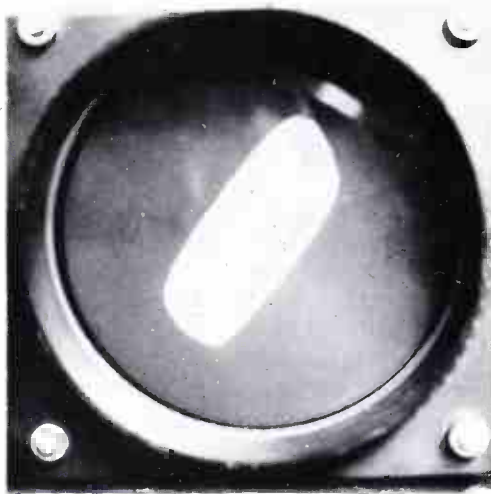


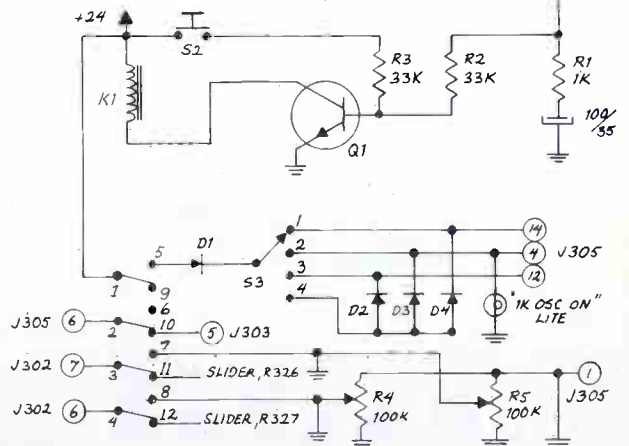
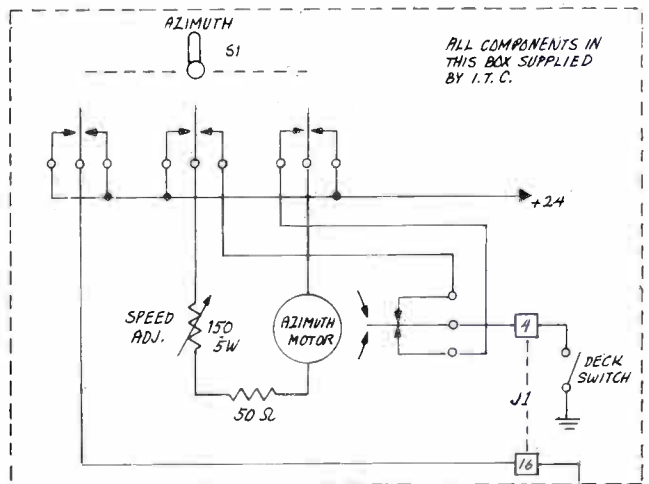
Fig. 2 To show the out-of-phase condition not revealed in the preceding trace, the third cue oscillator (1 KHz) is turned on; with three tones, only perfect alignment will produce straight 45° trace.



Fig. 3 Another typical out-of-phase trace is shown here, with at least two of the three oscillator signals far off coincidence in the two channels.

Fig. 4 Above (right) elements of the ITC system for azimuth adjustment; and below, schematic of author's switching system for applying the three cue oscillator signals singly or simultaneously to the cart. The test system can be readily adapted to any cart machine that provides manual or motorized azimuth adjustment.

K_1 = P&B KHP17P11 24 VDC
 All diodes + ECG 116
 S_2 = manual oscillator ON
 S_z = oscillator selector (150 Hz, 1 kHz, 8 kHz all)
 When azimuth adjust switch is actuated, Q_1 will hold K_1 "ON" for approximately 8 seconds.



PHASE CART ALIGNMENT

Any machine with a means of adjusting the record head azimuth either mechanically or electrically may be used, and with the addition of about \$15.00 worth of parts (cost new) and a cheap scope, repeatable phase tracking within five degrees throughout the spectrum will be easily attainable.

The basic circuit works as follows. A relay is used to perform these switching functions simultaneously:

- 1 turn on all three cue oscillators;
- 2 disable the bias oscillator feed to the cue record gap;
- 3 feed the oscillator outputs to the left and right inputs of the record amps, disconnecting the regular inputs, without disturbing any level or equalization adjustments;
- 4 provide a delayed-off feature to allow the display to stabilize for several seconds after the final adjustment of record azimuth has been made. This allows time also for a check of response tracking and phase-flutter;
- 5 at the conclusion of these tests and adjustments, all circuitry automatically returns to normal

You may wonder why all three oscillators must be used at once for the initial phasing of the cart. Referring to Fig. 1, you will note a standard 45° line indicating an in-phase condition. This trace was taken using only the 150 Hz and 8 kHz oscillators.

It looks nearly like a perfectly phased cart, but in reality is drastically out of phase. The 8 kHz component of the signal is 360° out of phase between the channels, while the 150 Hz component is only about 2° out. A casual look could fool an inexperienced operator. Addition of the third tone, however, removes all doubt, as in Fig. 2. Fig. 3 shows another typical out-of-phase condition. Because of the mathematical relationships of the three frequencies, *there is only one point at which all three frequencies will yield a flat line, and that is in perfect phase.* Schematic of system, and connection to ITC, is in Fig. 4.

Q¹ turns on K¹, and C¹ and R¹ with R² provide approximately 8 seconds of delay before turn off. S¹ is the azimuth adjust switch supplied by ITC, S² is a manual on

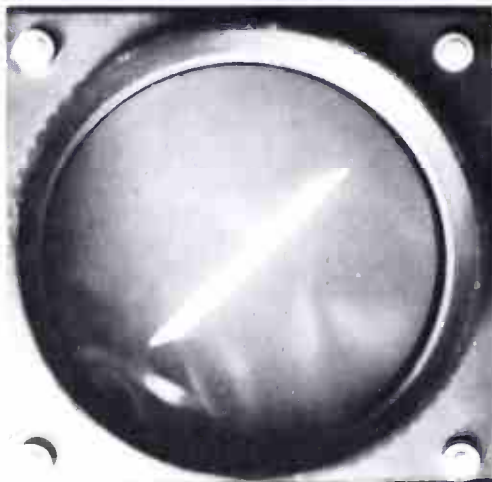


Fig. 5 Trace shown is composite of 150 Hz, 1 KHz and 8 KHz; switching oscillators on and off will reveal that the component at less than 45° is from an 8 KHz tone that is much lower in one channel.

switch for obtaining a display without changing the record azimuth. S³ selects each oscillator independently and then simultaneously. K¹ contact set 1-5-9 present +24 vdc to S³ to key the oscillator bank, set 2-6-1 disables the bias feed to the cue record gap, set 3-7-1 disconnects the normal audio and feeds the oscillator audio to the left channel, and set 4-8-12 does the same for the right channel. R⁴ and R⁵ set tone levels, and are fed from the common point on the oscillator card, available through a 33K resistor at pin one of J305 in the ITC.

Operating procedure is quick and easy:

- 1 erase cart to be optimized and insert in recorder;
- 2 press record button, then play button;
- 3 actuate azimuth switch or manual switch to obtain display;
- 4 adjust for thinnest possible line on scope screen;
- 5 watch display for a few seconds after last trimming of azimuth to check for stabilization;
- 6 remove cart, erase, reinsert in machine, and proceed as normally.

Fig. 5 shows a cart that is phased optimally, but with a poor response tracking problem. To verify, simply switch each oscillator on alone for about a second each and watch the slope of the trace. If it varies from the normal 45° slope, there is a response imbalance in that part of the spectrum. This can be due to any of the following:

- 1 improper equalization in record or playback circuits
- 2 worn tape;
- 3 poor gap-to-tape contact due to dirty or dished heads or abraded tape on one track, or tape skew;
- 4 poor tape tension, worn pads or worn tape guides in cartridge.

If the display at 8 kHz is at 45° but will not remain fairly stable, straight line, you have a phase-flutter condition, caused by any of the above, or also:

- 1 unstable tape tension, due to worn lubricant or abraded tape edge or surface;
- 2 tape turntable binding.

Finally, this same system is really handy for sorting brand new carts fresh from the carton. You can readily find the 4 or 5 percent of your new carts that are unstable as received, so that they can be returned without even causing a problem on the air.

This system has been in use for over two months at KIKK, and the operators love it. They have a way not only to optimize for phase, but also to check for proper playback levels, while recording; check the mono component of agency tapes to determine if any phase correction is necessary; determine if a source is mono or stereo so that in the case of a mono signal it can be dubbed from only one channel as source, thereby further minimizing phase error. On the air, the system has cleaned up our sound considerably, not only in quadrasonic, stereo and mono FM, but in mono AM when simulcasting which is a large percentage of the time. AM loudness is up, and AM highs are cleaner than ever before!!

In 1972, this idea was a "make-do" idea to ease smaller station's phase problems without the great expense of switching to all new carts at once. But in 1976 using the "phase-standardized cartridges" this approach yields phase stability and tracking throughout the spectrum approaching that of your studio to transmitter link.

Here's to more perfect audio in 1976.

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The Absolute Field In Directional Antennas

By T. Frank Ritter

In an earlier article, BM/E April, 1975, Mr. Ritter discussed how the magnitude and phase of the current in each tower affected the electromagnetic radiation pattern created by "n" towers. In this article, the author discusses conical patterns and the effects of different height towers.

(Ed. Note: In the earlier article, the terms of equation 2 were reversed. Equation should have been $[(A \times \cos B + j(A \times \sin B))] = ALB$. The examples using the equation were correct.)

Complicating the treatment of AM directional antenna pattern calculations are factors such as antenna height and non-horizontal radiation. This article discusses these factors and their quantitative relationships to the theoretical pattern. Hopefully, the explanation will allow the novice to understand some rather complex directional antenna theory.

One reason for employing a directional antenna system is the ability to provide pattern "nulls" which protect the service area of an existing distant station on the same frequency, while delivering a strong signal in other directions. The horizontal pattern plot of a directional antenna system is a step toward predicting and controlling this process, but nighttime ionospheric reflection of various vertically-directed waves may also cause significant interference to a distant station.

Less ominous, but also important, is the fact that nighttime AM reception often involves both the direct and ionospherically-reflected radio waves. These waves

will have a phase difference based on their respective path lengths, and may add or cancel, depending upon their resulting combination. As the ionosphere changes the path length of the reflected wave may change, dynamically distorting the received signal. Thus, the existence of a relatively large high-angle lobe, in addition to wasting power that might better be used in the horizontal ground-wave signal, may considerably reduce nighttime distance reception.

The calculation of the relative horizontal pattern for an array of equal-height towers is relatively straightforward with the application of equation 8.

$$E = \sum_{k=1}^{k=n} E_k / \sqrt{r_k + S_k \cos(\phi - \phi_k)} \quad (8)$$

Equation 8, however, does not allow the calculation of conical patterns; i.e., fields radiated at various elevations to the horizon. Thus we are unable to even approximate long-distance interference.

Developing the vertical angle component

Imagine, for a moment, that we can immediately move ourselves to any position around and over a directional antenna array. Riding a distant orbit over a directional system, we may notice that the distance difference between ourselves and each of the towers will change as we glide toward the vertical. If we stop directly over the array, we will find no difference in the distance between ourselves and any tower in the array. Since this distance difference (and resulting relative phase shifts between fields arriving from each tower) is the primary explanation for directional characteristics, it is apparent that the horizontal pattern shape cannot apply at various vertical angles.

When we analyze the situation, as in Fig. 6, we find that whatever spacing differences exist between the towers (as we observed the situation at the horizon), they decrease by the cosine of the vertical angle assumed by the observer (with respect to the horizon). We can now proceed to modify equation 8 with our new information. Vertical distributions of energy radiated from a vertical

Mr. Ritter is Vice President, DANTCO, Austin, Texas

Another Approach To Understanding Directional Antennas

Jack Layton, chief engineer, WTEL, put his pen to work and TAB Books published in December, *Directional Broadcast Antennas: A guide to Adjustment, Measuring and Testing*. The book lives up to this title and is filled with practical information.

Recognized that a subject as complex as directional antennas involves some mathematics for effective explanation/understanding, Layton strove to present the necessary theory with an elegant simplicity, using only simple high school math. Ritter's math in the accompanying article has been kept at the level of trig but the subject is developed from a mathematical perspective. The subject is developed quite differently by the two authors. Layton adds simple diagrams extensively to get across working principles.

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47

tower, will be included as symbols $E_k \theta$ in equation 9.

$$E = \sum_{k=1}^{k=n} E_k f_k(\theta) \angle \Psi_k + S_k \cos \theta \cos(\phi - \phi_k) \quad (9)$$

- where: E = complex resultant wave
- $E_k f_k(\theta)$ = relative or absolute field from tower k at vertical angle θ
- Ψ_k = phase of current in tower k
- S_k = physical distance at tower k from reference point, degrees
- θ = vertical angle from horizon, degrees
- ϕ = azimuth bearing
- ϕ_k = physical bearing of tower k from reference point

This is the basic equation we will use for calculating the three-dimensional pattern for any array.

Vertical radiation distribution

The energy radiated by a single tower is distributed in the vertical plane as well as the horizontal. For short antennas, this distribution takes the form of a regular hemi-toroid (like a donut sliced in half edgewise, although the hole is only a single point). For taller antennas, the shape begins to flatten and widen, until a new, high-angle lobe comes into existence for towers over $\frac{1}{2}$

wave in height. Thus, ground-level field strength varies even for the same radiated power, from antennas of different height. Of course most listeners exist at ground level, so in one sense, the efficiency of an antenna system can partly be related to the portion of the input power which it radiates to the horizon. FCC rules require minimum horizontal field values for all directional arrays.

Energy radiated from a vertical tower is distributed non-uniformly in the vertical plane because a standing wave exists on the tower which affects the current at each point on the tower. Radiation occurs from each point along the length of the antenna in proportion to the current flowing at that point. Each of these infinitesimal "current elements" radiates a toroidal pattern, each with an electrical phase difference (due to its height on the tower), and physical distance difference when seen from any elevation other than horizontal. The summation of the toroidal patterns from each point on the tower, with the effect of the ground plane at the base, serves to map the radiated energy field distribution pattern for a tower.

A small tower can radiate just as much power as a large one, but this radiated field is distributed differently. Horizontally, the patterns from both towers will have a circular shape, although different in size. The vertical

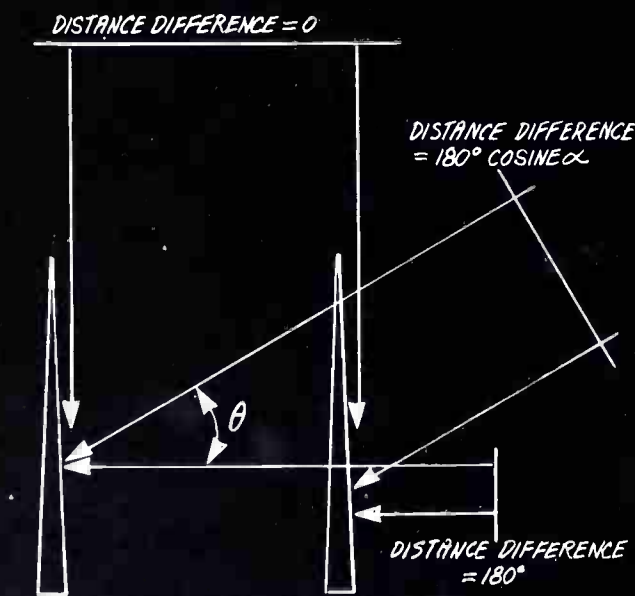


Fig. 6 Variation of distance differences between towers seen from various vertical angles (cosine alpha should read cosine theta).

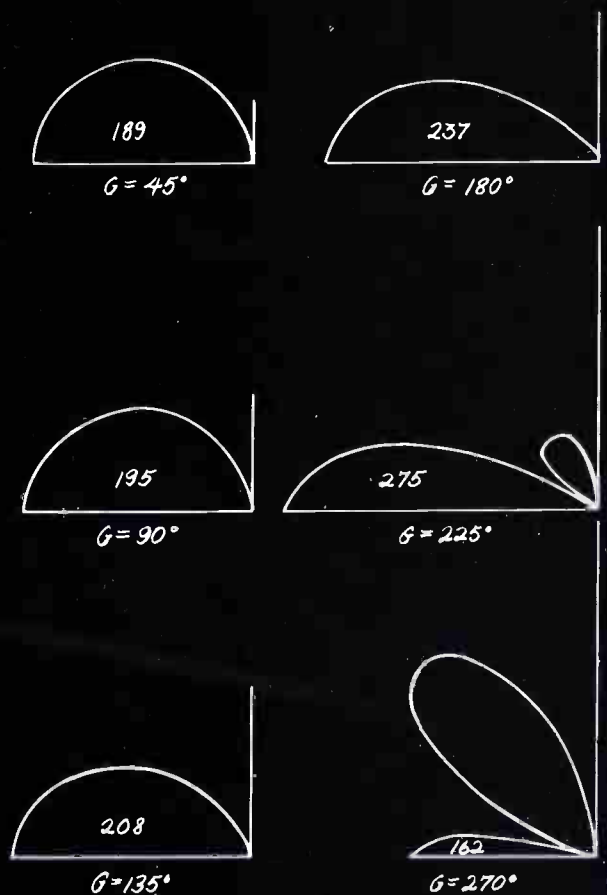


Fig. 7 Vertical energy distribution from various height vertical antennas. Number inside pattern is 1kW non-directional horizontal field.

ABSOLUTE FIELD

patterns will be different in shape and size. This relative shape compared to the horizontal field is found from equation 10.

$$f(\theta) = \frac{\cos(G \sin \theta) - \cos G}{(\cos \theta) \times (1 - \cos G)} \quad (10)$$

where: $f(\theta)$ = field radiated at vertical angle θ , compared to horizontal field

G = length of antenna, degrees
 θ = angle from horizon, degrees

Despite the fact that different height antennas have different vertical pattern shapes, if two different-height towers radiate the same amount of power, intuitively one senses there must be some relation between their overall patterns. Observing Fig. 7, one might be tempted to jump to the conclusion that the areas under the vertical distribution curves might be equal. The relationship is not that simple.

The true relationship between the vertical-distribution shapes is that towers of different heights radiating the same power will have different three-dimensional patterns with the same surface area. If the surface area for this complex solid is calculated, it can be compared to the surface area of a known non-directional reference, and a constant found that will scale the relative vertical distribution values to absolute values in millivolts per meter (mv/m) at 1 mile. The values derived in this manner will be correct only in a non-directional system (since they were derived by comparison to a non-directional reference), but the proportional field relation between one tower and another at any particular angle will remain the same. Equation 11 presents the reference field from a uniform hemispherical radiator which has the desirable characteristic of an easily-calculated reference surface.

$$E_s = 152.151 \times \sqrt{PR}$$

where: E_s = field from hemispherical radiator, mv/m @ 1 mi.

PR = radiated power, kilowatts

Two important methods will now be presented for calculation of absolute fields from a vertical antenna. The first is relatively uncomplicated and direct, which is why we present it first. Unfortunately, the method has serious inherent inaccuracy for towers over a certain height. The second method is tedious and roundabout, requiring (for now) the computation of a full three-dimensional pattern simply to scale even the horizontal fields. It will, nevertheless, handle all arrays.

Calculation of absolute field values from base current

The oldest and simplest method for calculating absolute fields from various height antennas at any vertical angle is equation 12.

$$E_k f_k(\theta) = \frac{37.2765 J_k}{\sin G} \left[\frac{\cos(G \sin \theta) - \cos G}{\cos \theta} \right] \quad (12)$$

where: E_k = field magnitude from tower k , mv/m @ 1 mi.

J_k = base current in tower k , amperes

G = antenna height, degrees

θ = angle of elevation, from horizon

Equation 12 is predicated upon the ideal standing-wave model of tower current: i.e., tower loop current equals base current divided by the sine of the tower height in degrees. Unfortunately, this approximate relationship breaks down rather badly on towers over 120 degrees, yielding some amazing results at 180 degrees. The magnitude result of equation 12 is inserted into equation 9 as the $E_k f_k(\theta)$ terms. Equation 12 must be re-calculated for each combination of different tower height and vertical angle.

Since most directional pattern computations are made at the horizon, equation 13, the simplified special-case of equation 12, may be used instead.

$$E_k = \frac{37.2765 J_k}{\sin G} [1 - \cos G] \quad (13)$$

We should note that an electromagnetic field exists around any conductor when an RF current flows in it. In a negative operating-base-resistance tower, induced power from the fields of other antennas flows from the antenna back into the power division system. Realizing this fact unnecessarily complicates matters, since the direction of power flow has no effect on the existence of the "radiated" field. The field "from" a negative-resistance tower may be considered a "negative field," if you can imagine that, but it is a real field nonetheless. Equations 12 and 13 are accurate independent of tower base resistance or lack thereof.

Since a directional antenna system radiates more power in some directions than others, some of those directions being above the horizon, it is desirable to be able to calculate the "average" effective field at various vertical angles. We could expect the "average" effective field to be greater than the pattern minima, and less than the maxima; being graphically a circular pattern of the same area (thus, power) as the directional pattern.

Fields from a directional antenna system are proportional to current flow, not power. To find the "average" field, we must employ a technique which will insure that the total power from both the directional pattern and the equivalent "average" pattern are actually equal. The method used is to square the computed field magnitudes at a number of equal bearing intervals, find the average of those squared values, then take the square-root of that value, as in equation 14.

$$RMS = \sqrt{\frac{1}{n} \times \sum_{k=1}^{k=n} E^2(\theta_k)} \quad (14)$$

where: RMS = Root-Mean-Square field

n = total number of bearings used

$E(\theta_k)$ = actual or relative field at k th bearing

This is usually done for each 10-degree interval, a total of 36 bearings for each vertical angle RMS.

Alternately, the RMS value may be found by graphical techniques. The calculated field values are plotted to scale (perhaps 1" radius = 100 mv/m @ 1 mi) on polar graph paper, and the radius of a circle found which would enclose equal area. If the polar plot is traced onto a sheet of small-grid graph paper (say .1" square), the area of the directional pattern can be found by counting the squares inside the figure. Remembering that there are 100 one-tenth-inch squares to one square inch, the radius of a circle with equivalent area can be found from equation 15.

continued on page 50

Examples of calculations

Problem: Given the array of Table 1, below, find relative pattern, then use rms values to scale the relative pattern into absolute field values.

Table 1. Array constants for example problems

Tower Position		Theoretical Fields		Tower Heights
#	S_k ϕ_k	E_k	Ψ_k	G
#1	0° 0°	1	0°	90°
#2	180° 0°	1	0°	90°

Power = 10 kw

Example 1: Applying equation 9 to example array, shows resultant horizontal field at bearing zero degrees. (Since $G_1 = G_2$, $f_1(\theta) = f_2(\theta)$ for all θ . Since $\theta = 0^\circ$, $f_k(0) = 1$ for all k .

$$\begin{aligned}
 E &= E_1 f_1(\theta) / \Psi_1 + S_1 \cos \theta \cos(\phi - \phi_1) \\
 &+ E_2 f_2(\theta) / \Psi_2 + S_2 \cos \theta \cos(\phi - \phi_2) \\
 &= 1 \cdot 1 / 0^\circ + 0^\circ \cdot \cos 0^\circ \cdot \cos(0^\circ - 0^\circ) \\
 &+ 1 \cdot 1 / 0^\circ + 180^\circ \cdot \cos 0^\circ \cdot \cos(0^\circ - 0^\circ) \\
 &= 1 < 0 + 1 < 180 \\
 &= (1 + jo) + (-1 + jo) \\
 &= (0 + jo) \\
 &= 0 \text{ magnitude}
 \end{aligned}$$

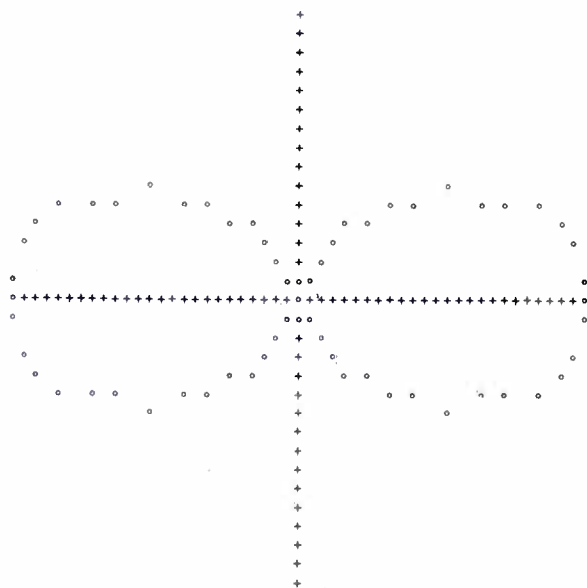
OUTPUT	BEARING		
2.9005E-5	0	2.9005E-5	180
0.011983	5	0.011983	185
0.047751	10	0.047751	190
0.10702	15	0.10702	195
0.1892	20	0.1892	200
0.2933	25	0.2933	205
0.41781	30	0.41781	210
0.56055	35	0.56055	215
0.71857	40	0.71857	220
0.88804	45	0.88804	225
1.0642	50	1.0642	230
1.2417	55	1.2417	235
1.4142	60	1.4142	240
1.5752	65	1.5752	245
1.7182	70	1.7182	250
1.837	75	1.837	255
1.926	80	1.926	260
1.9813	85	1.9813	265
		0.011983	175
		0.047751	170
		0.10702	165
		0.1892	160
		0.2933	155
		0.41781	150
		0.56055	145
		0.71857	140
		0.88804	135
		1.0642	130
		1.2417	125
		1.4142	120
		1.5752	115
		1.7182	110
		1.837	105
		1.926	100
		1.9813	95
		2.9005E-5	90

HORIZ. RMS DIV: 1.1796

Example 2:

Computer-calculated relative pattern for example array. Equation 9 is applied 72 times to obtain field values at 5° intervals. The relative horizontal rms value is obtained using eq. 14. Pattern is then plotted (roughly).

RELATIVE HORIZONTAL RADIATION PATTERN:



Example 3:

Computer-calculated results shows relative rms values at nine conical angles, and the rms constant derived by using eq. 16. (In practice, these values are more easily obtained by other methods.)

VERT. ANGLE	RELATIVE RMS
0	1.1796
10	1.1651
20	1.1247
30	1.0636
40	0.98192
50	0.87049
60	0.71686
70	0.51466
80	0.26976

RELATIVE OVERALL RMS: 1.095
NECESSARY HEMISPHERICAL FIELD: 481.13
RMS CONSTANT: 478.75

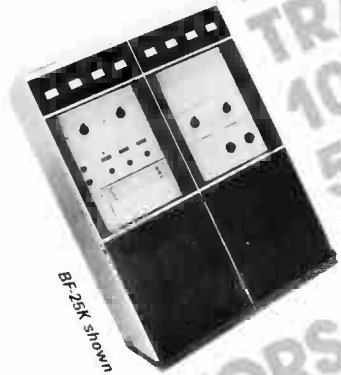
Continued on page 52

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$$r = \sqrt{\frac{A}{\pi}} \quad (15)$$

r = radius of circle with area A

Converting the resulting scaled distance value back into field value, the RMS value for any pattern at any particular vertical angle may now be found. Accurately counting 600 or more tiny squares is no joke: if you have not already been introduced to this method, you may wish to try it—once. Such graphical methods were of great import prior to the advent of inexpensive electronic calculators.

Calculation of absolute field values from radiated power

Since equation 12 breaks down when used on towers over 120 degrees in height, it is desired to have a method for handling arrays containing high towers. One method makes use of a concept of radiated power which we have previously seen related to a single tower. Knowing the radiated power of the array, we can find the true surface area of the complex three-dimensional pattern for that array, derived from equation 11. Calculating the relative three-dimensional pattern (from theoretical horizontal field ratios), the relative surface area of the solid pattern can be found. Comparing the two surface areas, a constant can be found which will scale the relative field results to absolute values. The same constant will also scale relative tower fields to absolute values.

The relative field pattern is developed by inserting the

results of equation 10 into the $f_k(\theta)$ term of equation 9. The horizontal field ratios are known, and these value are inserted in equation 9 as E_k . The entire pattern is the computed at 36 azimuth bearings (usually 0 through 35 degrees) for each of 9 vertical angles (0 through 8 degrees; from equation 10 we see there is no 90-degree field). The relative RMS values for the patterns at each vertical angle may now be found using equations 14, and the necessary field constant directly calculated from the approximation of equation 16.

$$k = \frac{364.197 \sqrt{PR}}{\sqrt{\frac{E_o^2}{Z} + \sum_{n=1}^{n=8} E_{10n}^2 \cos 10n}} \quad (16)$$

where: k = field constant, in mv/m

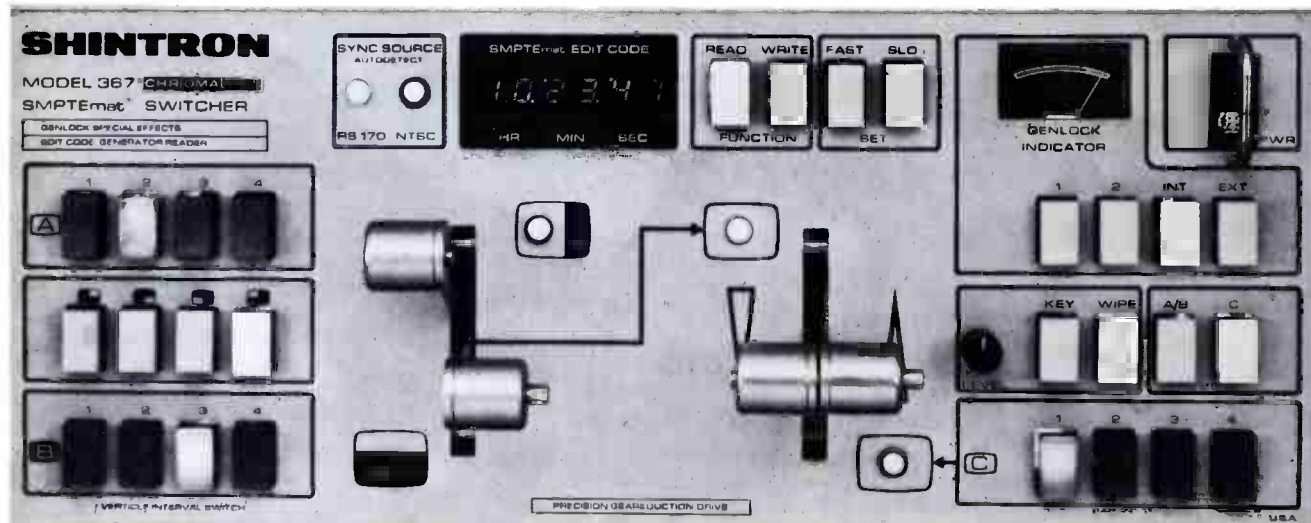
PR = radiated power, kilowatts

E_o = relative pattern RMS at horizon

E_{10n} = relative pattern RMS at $\theta = 10n$ degrees

In conclusion, I have described some of the effects of different tower heights on radiated RF fields. Equation for finding the relative fields at different vertical angle from single towers or any desired array have been presented. The relationship between radiated power and the resultant field pattern, regardless of pattern shape have been covered. This led to techniques for finding actual field values based on calculable or observable array values. This is a fairly complete treatment of patterns although some advanced relationships, shortcuts and other techniques are possible. **BM/I**

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cassettes. But the overall results are just as important. Dolby FM is cleaner, with sparkling high frequencies free of limiting. And, of course, noise is reduced, which often increases the area of good reception.

As of August 1975, over 100 US stations have purchased the Dolby Model 324 or

334 FM Broadcast Unit. The unit accurately compresses the signal in accordance with the Dolby B-Type characteristics and changes the effective transmission time-constant to 25 microseconds. This allows the station to reduce or eliminate any high frequency limiting required previously.

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Rabany NY	WHSB 106.5	Collegeville MN	KSJR 90.1	Fairmont NC	WFMO 100.9	Los Angeles CA	KIQQ 100.3	New York NY	WRFM 105.1	Skokie IL	WCLR 101.9
Allentown PA	WFMZ 100.7	Columbus GA	WEIZ 100.1	Flint MI	WGMZ 107.9	Los Angeles CA	KPFK 90.7	Normal IL	WGLT 91.7	St. George SC	WPWR 95.9
Alta Vista VA	WKDE 105.5	Columbus OH	WCOL 92.3	Fort Wayne IN	WMEF 97.3	Lancaster PA	WDAC 94.5	Opportunity WA	KZUN 96.1	St. Louis MO	KCFM 93.7
Arlington TX	KAMC 94.9	Columbus OH	WOSU 98.7	Fort Worth TX	KWXI 97.1	Lexington VA	WLUR 91.5	Paterson NJ	WPAT 93.1	Stevens Point WI	WSPT 97.9
Baltimore MD	WAMR 106.5	Dayton OH	WTUE 104.7	Fresno CA	KPHD 95.5	Louisville KY	WCNS 99.7	Philadelphia PA	WMMR 93.3	Sylvania OH	WXEZ 105.5
Birmingham MI	WHNE 94.7	Dallas TX	KCHU 90.9	Gainesville GA	WDUN 106.7	Louisville KY	WLRS 102.3	Portland ME	WDCS 97.9	Topeka KS	KTPK 106.9
Boston MA	WROR 98.5	Dallas TX	KTLC 100.3	Grand Rapids MI	WZZM 95.7	Madison WI	WYXK 92.1	Richmond VA	WEZS 103.7	Tuscaloosa AL	WUOA 95.7
Boston MA	WBFB 105.7	Dallas TX	KVIL 103.7	Hanover NH	WDCR 99.3	Maine FL	WAIA 97.3	Rochester NY	WCMF 96.5	Utica NY	WOUR 96.9
Buffalo NY	WDCX 99.5	Dallas TX	KZEW 97.9	Hartford CT	WTIC 96.5	Manassas VA	WEZR 106.7	Rochester NY	WEZO 101.3	Washington DC	WAMU 88.5
Buffalo NY	WBEN 102.5	Denver CO	KBPI 105.9	Henrietta NY	WITR 89.7	Memphis TN	WKNO 91.1	Rochester NY	WQOB 102.9	Washington DC	WASH 97.1
Carbondale IL	WSIU 91.9	Denver CO	KLZ 106.7	Houston TX	KILT 100.3	Miami FL	WAIA 97.3	Salt Lake City UT	KDAB 101.1	Washington DC	WGMS 107.3
Charlotte NC	WEZC 104.7	Detroit MI	WABX 99.5	Houston TX	KRLY 93.7	Minneapolis MN	KSJN 91.1	Salt Lake City UT	KSL 100.3	Washington DC	WHUR 96.3
Charlotte NC	WRQQ 95.1	Detroit MI	WOMC 104.3	Indianapolis IN	WNAP 93.1	Morgantown WV	WAJR 101.9	Salt Lake City UT	KEXL 104.5	Washington DC	WMAL 107.3
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Cincinnati OH	WEBN 102.7	Detroit MI	WQRS 105.1	Los Angeles CA	KBIG 104.3	New York NY	WNEW 102.7	San Francisco CA	KABL 98.1	Youngstown OH	
								Seattle WA	KIRO 100.7		

JANUARY 1976: 30 more stations

As listeners to these stations can hear for themselves, a Dolby FM signal is compatible. In fact, most people find it a better signal even when received on their normal equipment without Dolby decoding.

However, some listeners like to take advantage of every opportunity for improvement. If they use Dolby circuitry during reception, they can bring the signal even closer to the quality of the original source material used at the station.

Naturally, the noise is reduced. But that's not all. Dolby compression is standardized, recoverable compression. By using Dolby encoding instead of the conventional high frequency limiting normally required during transmission, the station gives the listener at home the opportunity of recovering the full frequency range and dynamics of the signal. Furthermore, depending on the amount of limiting previously used, many stations find that Dolby encoding permits them to increase their level - which is good for both the listeners and the station.

If these prospects excite you, we think you will soon be wanting to check out the new Dolby Model 334 FM Broadcast Unit. \$1,350 and 1 1/2 inches of rack space are all you need to get moving with Dolby FM - an improvement we think both you and your listeners will appreciate.

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Technical literature and reprints of papers describing these developments are available from our offices or distributors

*Some of the 50 Dolby licensees are already producing their new receiver models, and others have new designs in the pipeline.

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Circular Polarization Could Greatly Improve Television Reception: It's In the Cards For 1976

The case for circular polarization in TV, as presented to the industry during the past year, is very strong. The FCC is expected to open a rule-making on the subject, hopefully early in 1976, with the decision by summer, at best.

Markedly improved reception on rabbit ears, loops, whips, and other antennas with non-horizontal elements; more solid coverage with all antennas in the primary coverage area; great reduction in ghosting, if a circularly polarized receiving antenna is used, are the main advantages of circular polarization in TV(CP), as put forward at major industry meetings in 1975.

The discussions have centered on fully-developed CP

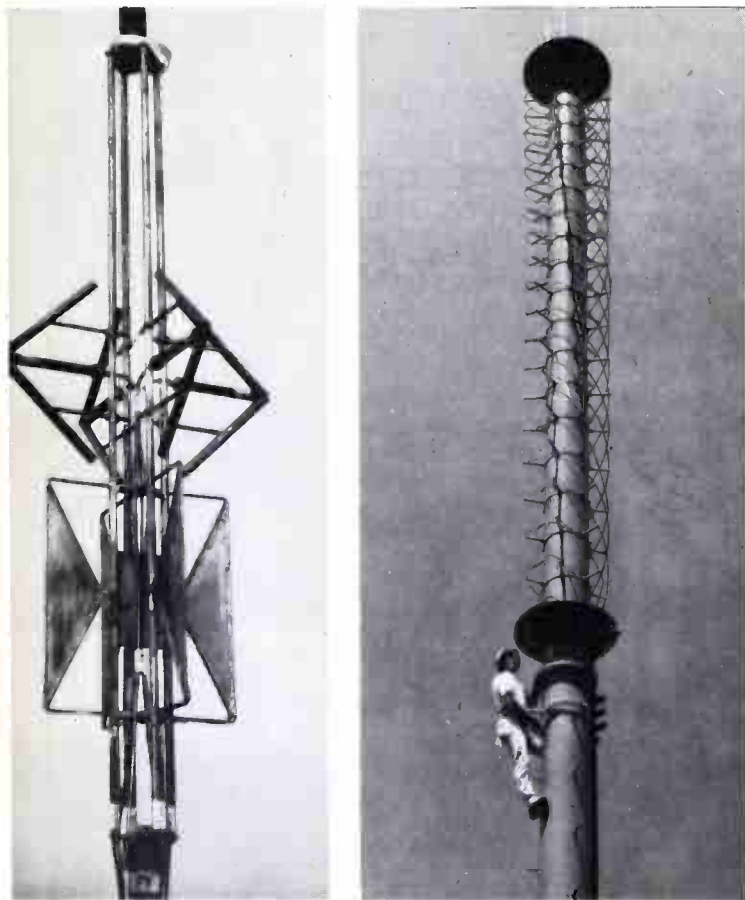
antenna designs announced by three firms, Harris, Jampro and RCA. In addition, the industry heard preliminary reports on two extensive series of on-the-air tests by broadcast stations under FCC experimental authorization, one at VHF using an RCA antenna, and one at UHF using a Jampro antenna. These tests have in general confirmed the expectation that CP would strongly benefit television broadcasting.

How does the industry stand on moving into CP? The FCC, of course, has to change the rules to make CP legal for television. The two series of on-air tests were designed in large part to stimulate the FCC to open a rule-making looking toward such a change; reports on the tests, or at least major parts of them, were due to reach the FCC at the end of 1975 or very early in 1976. Informally, the Commission has indicated a positive view of CP and does promise a rule-making on the subject.

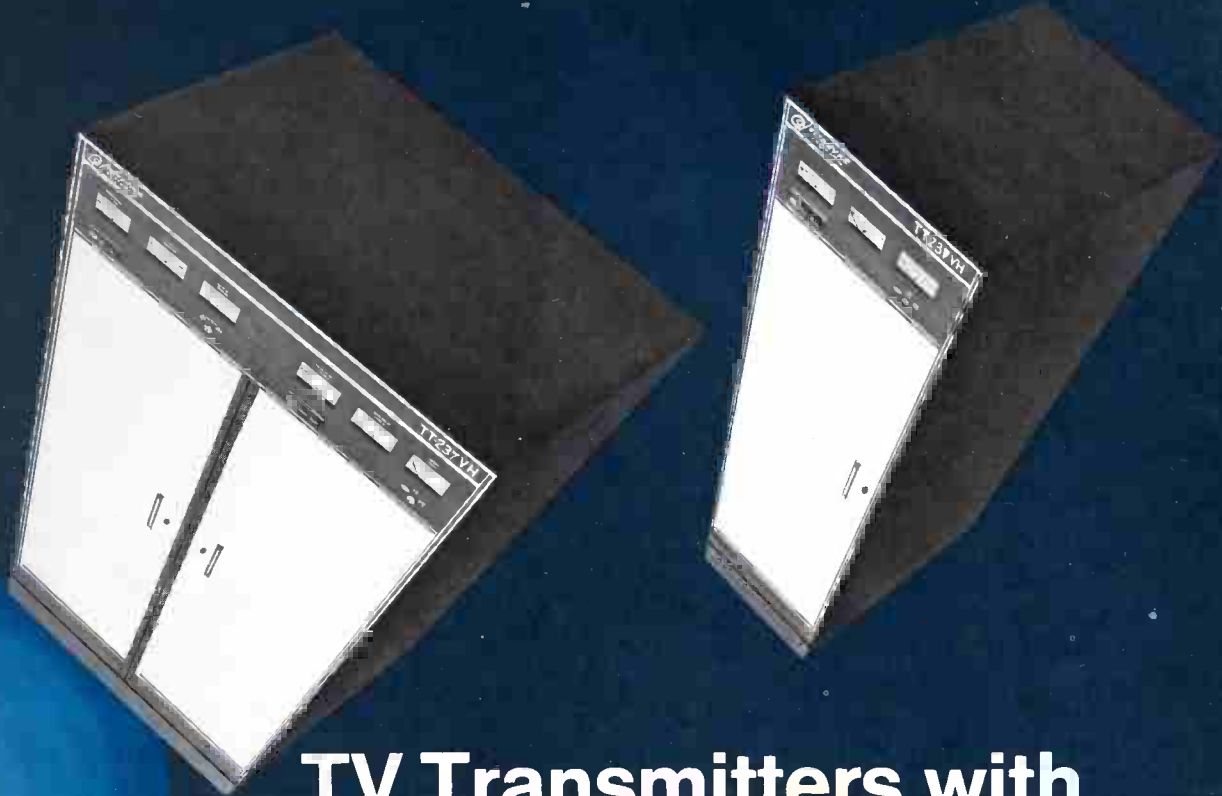
In the meantime, broadcasters will want to study the basics of CP in television and the results of the tests, so they can express themselves effectively to the FCC when the rule-making is opened (the most hopeful prediction is on that are late winter or spring). In the accompanying article, Dr. Matti Siukola of RCA sets forth the basics of CP for television, describes the RCA design, and summarizes the tests made with it at WLS-TV in Chicago over a period of nearly a year. Mr. Neil Smith of Smith and Powstenko, who were engineering consultants for the WLS tests, has detailed the test results elsewhere, including findings that CP does, indeed, improve performance in the major coverage area, does not substantially change that area, and does not increase the station's potential for interference.

Results of the tests with the Jampro antenna, carried out at Station KLOC, Modesto, CA., on Channel 191, were similarly positive. Mr. Peter Onnigian, president of Jampro, told BM/E that they hoped to finish the KLOC tests around January 1st, with the final report going to the FCC a little later. He supplied some interesting highlights from the results: with a method for quantifying ghost reduction, Jampro found that circular-to-circular transmission easily produced ghost reductions of 10 to 20 times; receiving antennas (of whatever kind) often need not be pointed directly at a CP transmitting antenna for good reception, simplifying matters when TV stations are in different directions from the receiver; quantification of the results with rabbit ears and loops showed that improvement by factors of three to five times could be commonly expected.

All the developers of CP antennas have pointed out
continued on page 56



Circularly-polarized antennas of two of main developers are shown above: RCA at left, Jampro at right. The RCA model, one of several forms built by that firm, uses crossed elements which are fed with signals phased to produce a rotating field. Jampro has a spiral radiator wrapped around a vertical cylinder. Both antennas have been used in extensive on-air tests by broadcast stations.



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that the design requirements are extremely stringent as compared with a CP antenna system for FM, in use for many years. This is one important reason that CP for television has been much longer in arriving. It is all the more interesting that the designs of the three main developers are all radically different.

As the photos show, the RCA antenna uses a combination of horizontal, vertical, and angled elements. Jampro uses a spiral radiator wrapped around a cylinder. Engineering logic of these designs was described in papers at the NAB, and at the IEEE Broadcast Symposium (see BM/E's reports).

The Harris antenna, also the result of several years' development work, was refined by the maker in comprehensive testing facilities built for the purpose. It uses a cavity in back of a "butterfly" design of crossed dipoles. The "cavity" has been formed by an open cage of wire to reduce wind loadings (photo). The dipoles are fed in quadrature and excite the entire cavity with a rotating RF field. The cavity helps control the characteristics of the radiated field in a number of ways.

One of the important aspects of CP that the television broadcaster must consider is its effect on ERP, and the relation of transmitter power to antenna gain and coverage. As Dr. Siukola points out in his paper, since the horizontal and vertical components are in effect separate, the full ERP can be carried by each component, doubling the power in the field without changing the official "contour," as far as horizontal and vertical receiving antennas are concerned. But this requires a doubling of transmitter power.

There is a negative side: if CP is installed without increasing transmitter power (or antenna gain), there may be some loss of fringe coverage for horizontal antennas. The major coverage area will not be affected in this way.



Harris CP antenna has crossed dipoles backed by a cylindrical cavity formed of open wire to reduce wind loading. Rotating field from dipoles excites cavity, which in projection of CP signal at high efficiency.

Circular Polarization: A Ready Way To Improve Local Coverage, Reduce Ghosting In Television

by Dr. Matti Siukola

Before we get to the potential benefits of circular polarization (CP), let's compare it with the horizontally polarized transmission used presently in TV broadcasting.

In horizontally polarized (HP) transmission, the electric field vibrates in a horizontal plane as shown in the drawing of Fig. 1. The instantaneous field passes through a zero value every half wavelength. A dipole antenna, oriented horizontally in this field, captures energy from the field. When this same dipole is oriented vertically in the field, however, no voltage is induced and thus no signal received. The intensity of the received signal depends upon the orientation of the receiving dipole and is proportional to the length of the dipole as projected to the horizontal plane.

With CP the situation changes considerably. The field produced, for example, by two orthogonal dipoles with currents 90° out-of-phase rotates without passing through a zero value. The rotation is either clockwise or counterclockwise depending on the lead/lag phase relationship

of the exciting currents. Fig. 2 illustrates this behavior.

A clockwise-rotating field, looking toward the propagation direction, is termed a "right-hand" polarized field (RH); a counterclockwise rotating field is a "left-hand" (LH) polarized field. In a circularly polarized field, a receiving dipole captures a constant level of signal regardless of its orientation: horizontal, vertical or at any angle in between as long as the dipole is perpendicular to the propagation path.

CP is compatible with standard antennas and increases coverage among "portables"

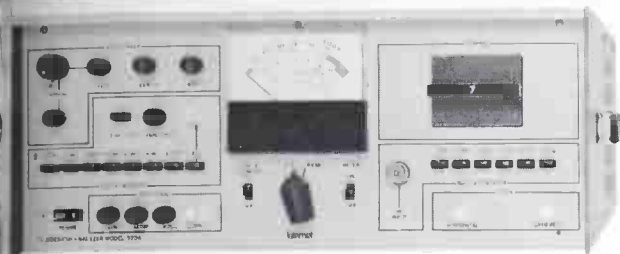
As a result, circularly polarized transmission is expected to be compatible with the receiving antennas in common use today: the "whip" (a vertically polarized antenna); the "rooftop" antenna (horizontally polarized); and the "rabbit ears" antenna (which might use both vertical and horizontal components of a circular field). Fig. 3 illustrates this point graphically. In addition, for obvious reasons circular polarization should make whip and rabbit-ear antenna orientation less critical than with horizontal polarization. This should improve coverage with horizontal polarization. This should improve coverage with horizontal polarization.

continued on page 26

Dr. Siukola is with Advanced Antenna Development, RCA Corp.

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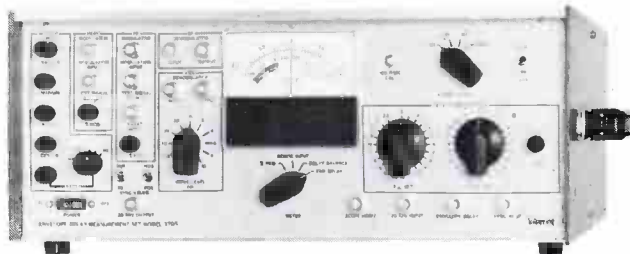
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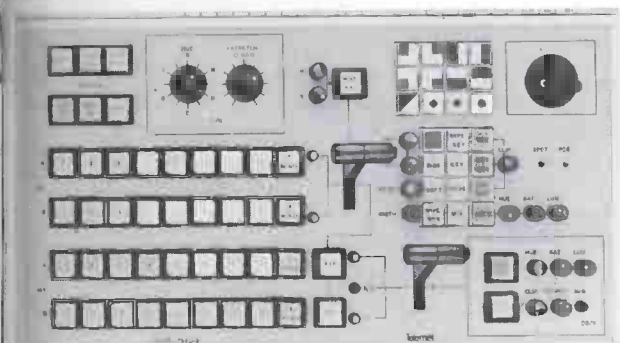
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erage among the portable antenna audience.

CP allows transmitter power to be increased

The horizontal and vertical components of a circularly polarized signal are orthogonal and, therefore, independent of one another. Since no appreciable twisting or depolarization of the fields is expected, each signal will propagate the same distance as the present horizontally polarized signal. Consequently, it appears feasible to radiate each signal—vertical and horizontal—at total authorized ERP without increasing co-channel or adjacent-channel interference. Putting the total ERP into each polarization could be achieved by increasing transmitter power or by increasing antenna aperture, or by a

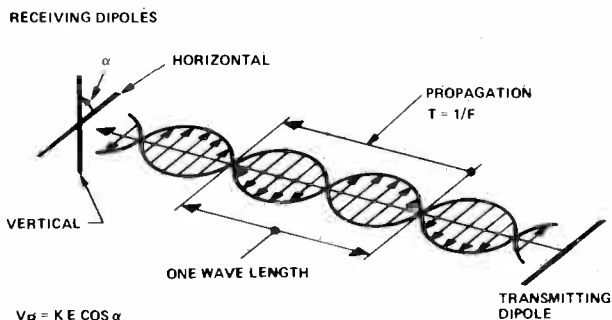


Fig. 1 Horizontal transmission, illustrated in this drawing, has all the energy moving in horizontal plane, going through zero each half-cycle.

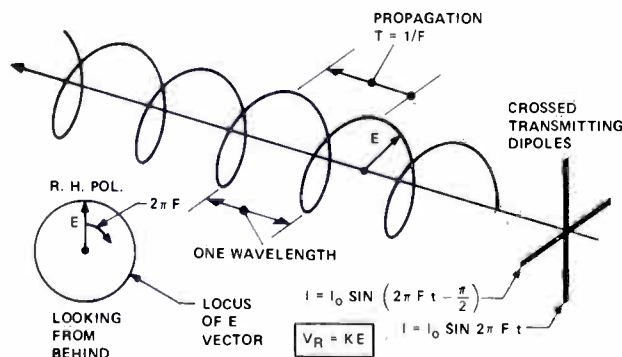


Fig. 2 Circular transmission, produced by crossed dipoles fed 90° out of phase, rotates around the axis of propagation without going to zero. Clockwise rotation, viewed in the direction of propagation, is called "right hand."

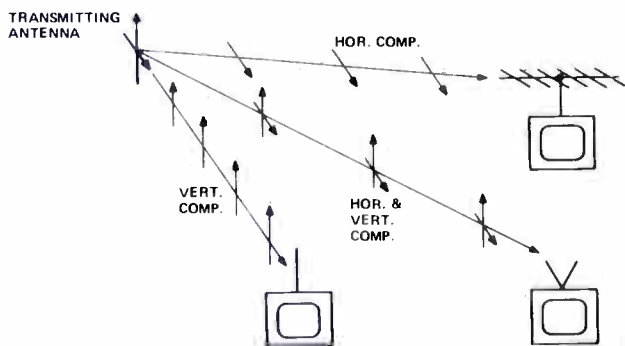


Fig 3 CP transmission is compatible with all receiving antennas, as shown in the drawing above. Vertical whips respond to the vertical component; rabbit ears get energy from both the horizontal and vertical components; horizontal antennas from horizontal component.

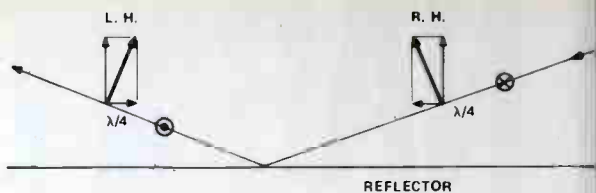


Fig. 4 Reflection reverses the direction of CP rotation, by reversing the phase of the horizontal component, as illustrated in drawing above.

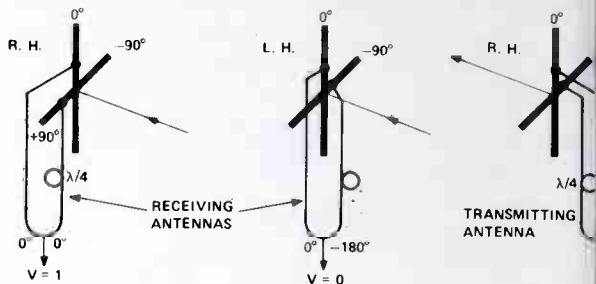


Fig. 5 A right-hand antenna for CP responds only to a right-hand signal; it is virtually "blind" to a left-hand signal and vice versa. The drawing illustrates the additive relationship in the first case, the opposing relation in the second case.

combination of increased power and increased aperture.

If total ERP in each component is obtained by increasing the antenna aperture, the close-in coverage will be reduced due to the narrower vertical beam-width associated with larger apertures. For an existing station it is more desirable to maintain the close-in coverage by retaining the existing antenna aperture and increasing transmitter power. It seems reasonable to expect that the power doubling, by itself, would provide better close-in service. This is especially true if circularly polarized receiving antennas are used.

CP reduces multipath ghosting

When a circularly polarized field is reflected from a perfect reflector, the vertical component remains unchanged while the horizontal component reverses polarity as shown in the drawings of Fig. 4. The reflected signal has an opposite sense of rotation as compared to that of the incident (or direct) signal: an RH polarized incident wave creates an LH polarized reflection and vice versa. This sense of rotation reversal gives circular polarization a capability for picture-ghost reduction in situations where multipath propagation is a problem because it complements a characteristic of CP receiving antennas.

Polarization discrimination by receiving antennas

A right-hand CP antenna responds only to right-hand circularly polarized fields; it is essentially blind to left-hand polarized signals. This is illustrated in the drawing of Fig. 5. An RH polarized field develops additive currents at the RH polarized receiving antenna output because of the 90° phase relationship between the vertical and horizontal dipoles. In an LH polarized receiving antenna, however, opposing currents are developed because of the reversed polarity provided by the horizontal element of the antenna. Thus, an ideal RH polarized antenna is essentially blind to an LH polarized signal.

continued on page

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unresponsive to the reflections of a right-hand rotating field. The drawing of Fig. 6 illustrates how the antenna "blocks" the reflection. This is the polarization discrimination characteristic of circularly polarized receiving antennas.

This same mechanism might also reduce other multipath-caused picture distortions such as changes in picture sharpness or color saturation due to less-than-perfect video response of the path.

Under ideal reflection conditions, perfect ghost rejection would result if both transmitting and receiving antennas were perfect circularly polarized devices. Unfortunately, true circular polarization is an ideal; polarization is always more or less elliptical rather than truly circular. As a result, RH polarized antennas radiate a small amount of LH polarized signal while RH polarized receiving antennas respond, in a small degree, to LH polarized signals.

The "quality" of circular polarization

We can describe the quality of circular polarization in two ways: "polarization ratio" and "axial ratio". *Polarization ratio* is the mathematical ratio of maximum vertical component to maximum horizontal component of the signal. *Axial ratio*, on the other hand, is the ratio

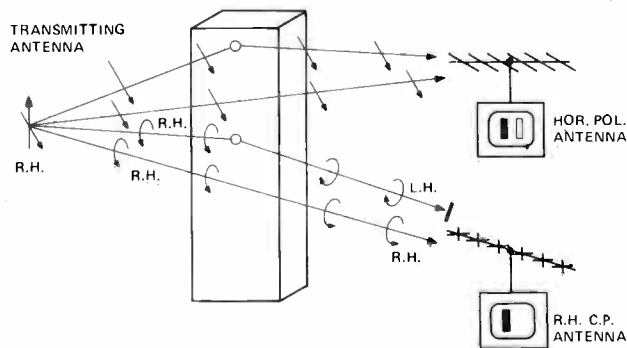


Fig. 6 CP transmission provides reduction in ghosting since reflected signals change direction of rotation. A CP receiving antenna can thus discriminate against the reflections, as illustrated in drawing above.

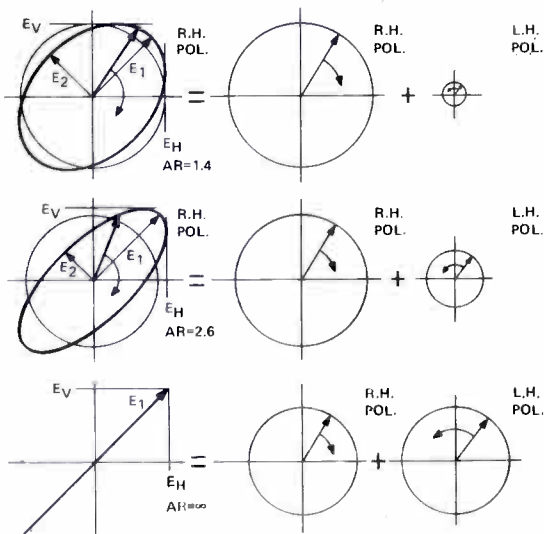


Fig. 7 Drawings illustrate effect of axial ratio and polarization ratio on discrimination against reflections. Text of article describes how discrimination is mainly dependent on axial ratio, which is thus important parameter of CP quality.

of the major axis of the polarization ellipse to its minor axis.

The polarization ratio adequately describes performance of antennas used in FM radio because the receiving antenna is usually either vertically or horizontally polarized and not circularly polarized. FM radio essentially provides a dual service: one for auto radios and portable sets with whip antennas and another for home receiver with rooftop antenna.

For antennas used in television broadcasting, however, we expect that the axial ratio will become a more important parameter of antenna quality because as the axial ratio approaches unity, the potential reduction in multipath ghosting increases.

To illustrate, let us assume that we have an elliptically polarized antenna radiating mainly in the RH mode with a small amount in the LH mode as shown in the top drawing of Fig. 7.

The RH rotating signal is picked up by an RH polarized receiving antenna while the LH part of the signal is rejected. However, the LH energy in the incident wave becomes RH when reflected and, as a result, is acceptable to the RH receiving antenna. Since the reflected wave is mostly LH polarized and includes little RH polarized energy, the reflected signal is of little consequence as far as the received picture is concerned. On the other hand, if the transmitting antenna's axial ratio is infinite (the worst possible case; bottom drawing of Fig. 7), the RH polarized energy in the reflected signal matches the LH component. In this situation, the "circularly" polarized transmission mode would provide no ghost reduction, even though the polarization ratio may be unity. Thus we see the value of Axial Ratio as a parameter of CP antenna quality.

Possibility of reduced interference

Another potential benefit of circular polarization is a possible reduction in co- and adjacent-channel interference. Advances in receiving antenna design will be the governing factors in this area.

Generating a circularly polarized signal

Antenna design principles for receiving systems are identical to those for transmitting systems. It is often easier, for purposes of discussion, to consider the whole system as a transmitting antenna; we do that in the following.

To generate a circularly polarized signal we need a rotating field which might, for example, be the sum of two fields of proper magnitude and relative phase, oriented at right angles to one another.

In the discussion above, we used orthogonal dipoles with a 90° phase shift between the two radiating currents which are of equal magnitude. Such an antenna produces a circularly polarized field and is simple in construction. Crossed-dipole design is often the basis for panel-type transmitting antenna designs.

A circularly polarized antenna can also be obtained by displacing the dipoles a quarter wavelength apart along the axis of radiation. With the essential phase shift provided by the displacement, the exciting currents to the dipoles can be in-phase, eliminating the need for an electrical phase-shift device.

If we form a multiturn helix with an approximately one wavelength periphery and a quarter-wavelength pitch, we have an end-fire-helix circularly polarized antenna.

continued on page 62

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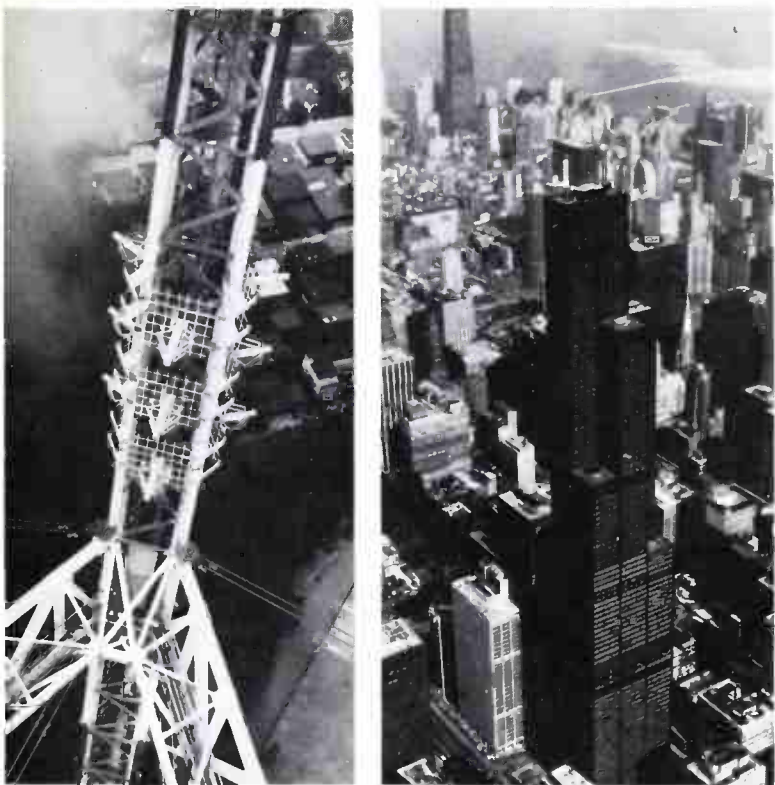
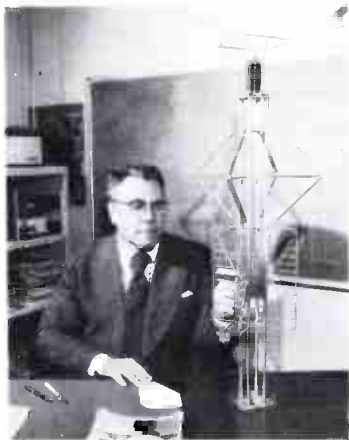


Fig. 8, left. FM version of the CP antenna, long used, is shown in photo on leg of Mt. Sutro Tower in San Francisco, where it serves for high-power transmission. Fig. 9, right. CP antenna got on-air tests at Chicago station WLS-TV, mounted atop the world's-tallest Sears Building as shown here.

Author Siukola shows model of basic crossed-element CP antenna, used in early lab tests to check out design.



radiator. This type of antenna is popular for radar-tracking and telemetry applications. The design is also useful as a basis for broadcast antennas. RCA has developed a circularly polarized helical antenna for VHF-highband with the shallow helix mounted in a dishpan-like reflector. The axial ratio of this antenna is better than 3dB and a quite-acceptable ± 2.5 dB horizontal pattern circularity can be achieved. The design is feasible for omnidirectional antennas with total combined power gains up to approximately 16.

The WLS transmitting antennas

Chicago's WLS is presently conducting a large-scale

experiment on the circularly polarized mode of transmission for TV broadcasting. The American Broadcasting Company requested that RCA provide suitable antennas for the experiment. At that time, during 1971 it was determined that two separate arrays were most suitable for the purpose: one, a circularly polarized three-layer system and, the other, a two-layer, horizontally polarized system. The circularly polarized array was based on a design used for high power FM broadcast, scaled down for the higher operating frequencies of Channel 7. An FM version of the antenna design operates on one leg of the Mt. Sutro Tower in San Francisco¹. The photo shows the array on the tower leg. The horizontally polarized WLS array uses the RCA "Butterfly" design.

Since the antenna-test information was to be supplied to the FCC for possible use in rulemaking, the WLS antenna was completely assembled and tested at RCA-Gibbsboro (NJ) antenna engineering facility and test range.

The antenna, in its ultimate environs, is mounted on the side of a steel cylinder atop the Sears Building in Chicago. (Fig. 9). This cylinder affects antenna performance because of its proximity to the radiators. As a result, the cylinder had to be simulated on the test range using a screen of steel mesh in the shape of a cylinder. Since the antenna design also includes a radome, that was in place during the tests at Gibbsboro. After testing, the antenna was shipped to Chicago and installed atop the building late in 1973.

The system design includes separate feed systems for the circularly and horizontally polarized antennas so that either one might be operated independently of the other. The first on-air tests took place during January, 1974, in the early hours of the morning. These tests confirmed the fact that the new mode of transmission resulted in an appreciable increase in coverage area, to satisfy the requirement that there be no increase in co- and adjacent channel interference.

The tests that followed showed that the circular polarization caused no degradation in the received picture. Once these requirements were satisfied the FCC granted permission, in May of 1974, for operation of the circularly polarized system during normal programming hours instead of only during off-air hours. Tests continue today and no negative effects have been discovered as of this writing.² As a result of the test success, ABC petitioned the FCC (in February, 1975) for rulemaking recommending adoption of circular polarization as an optional transmission mode for television broadcast.

Items in the trade press indicate that other experiments in circular polarization are underway.^{3,4,7}

What are the characteristics required of an antenna to assure proper operation? In a horizontally polarized system, the important antenna characteristics are its input impedance across the operating channel, its power gain and its vertical and horizontal patterns. Adding vertical polarization requires knowledge of the gain and pattern characteristics for both polarizations. When the system is circularly polarized, it requires an evaluation of axial ratio in addition to those listed above.

Making measurements on antenna models

All these parameters are easily measured during antenna development using scale models on a three-

CIRCULAR POLARIZATION

turntable" with a fiber glass boom that supports the model above ground. The model antenna is operated as a receiving unit for a signal source that mounts on the ground below the model antenna. The signal source radiates upwards toward the antenna under test to avoid errors due to reflections. Rotating one or both antennas provides all the measurements needed. This technique was described by Dr. Ben-Dov in 1972⁵.

Full-scale antenna measurement

Testing full-size antennas, unfortunately, isn't quite so easy. We discussed earlier how an RH polarized signal tends to change into an LH polarized signal at the point of reflection. In test terms, this means that if we measure the axial ratio of even a perfect circularly polarized antenna in the presence of a reflected wave, we encounter considerable error. As the ratio of reflected wave to direct wave increases, the axial ratio of the antenna—as seen by the test antenna—increases. For example, a ten percent (-20dB) reflection results in a measured axial ratio of 2dB on a perfect antenna. Obviously, such a technique is unsatisfactory for full-size antennas.

Another test error factor arises from propagation differentials. With large antennas, long distances between the test antenna and the signal source are essential. Although depolarization is quite small under such conditions, we can't be sure that vertical and horizontal polarized signals propagate alike. To offset this, we compare test data with that of a reference antenna. Even then, small errors due to depolarization tend to reduce accuracy.

We've found that, in practice, using a very good test range—one with a minimum of depolarization—we can make separate measurements of the vertical and horizontal components. A calibration between these two measurements can be made for gain purposes. Other means, however, appear necessary for the measurement of axial ratio.

A technique used is to mount a portion of the large antenna high above ground or, alternatively, energize only a portion of the large antenna and locate the signal source below it, on the ground. By rotating the signal source, we can establish the axial ratio of that portion of the antenna. Fortunately, the axial ratios are essentially identical from one layer to another of the antenna.

Obviously, circularly polarized antennas require more factory tests than do their horizontally polarized counterparts. In addition, the circularly polarized antenna requires considerable care in testing even when the test range is a good one.

Conclusions

Circular polarization offers enough potential advantages to encourage implementation in television broadcasting.

The principles for practical hardware have been developed to a point where antennas can be built to meet the needs of broadcaster's requirements.

We now have the experience and the measurement methods to test circularly polarized hardware. **BM/E**

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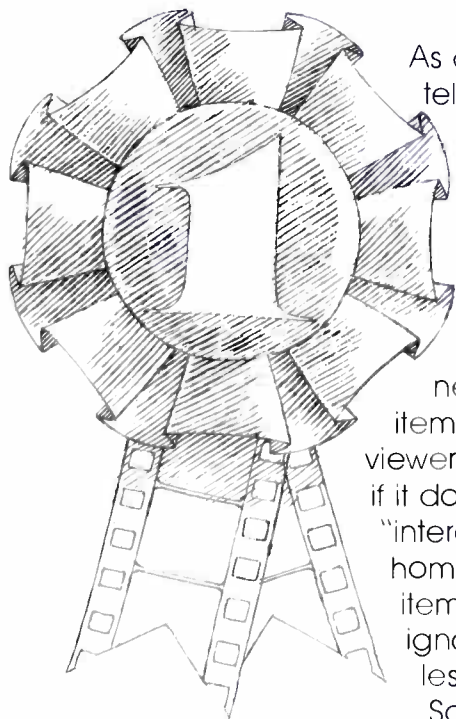
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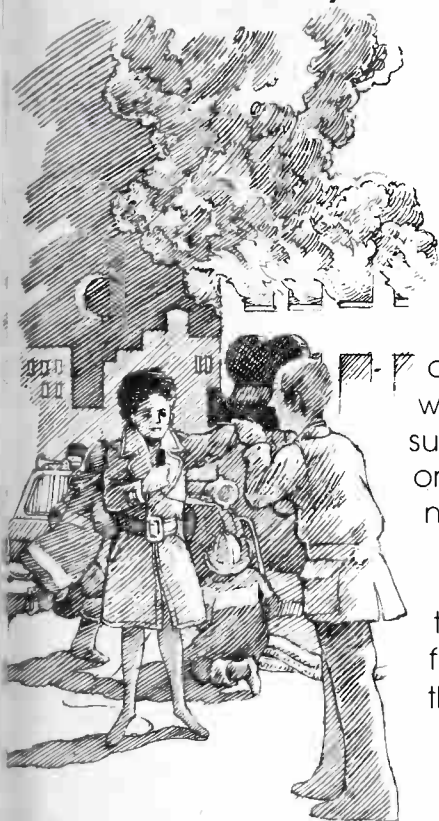
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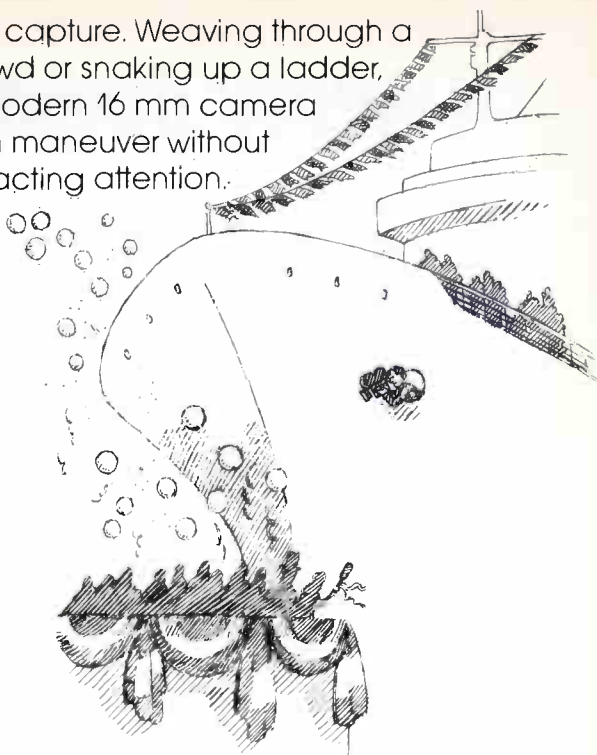
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EKTACHROME EF Film 7242 (Tungsten), new EASTMAN EKTACHROME Video News Film 7240 (Tungsten) (now being introduced) will allow you to shoot in light as low as FIVE FOOTCANDLES with extended processing. Both films will yield excellent color. And 7240 will provide a better, tighter grain pattern. With either film, whether it's bright and blazing or dark and gloomy, you'll have a better chance to grab the important footage that sometimes makes or breaks your broadcast.

Film. For every angle.

Talking heads provide useful news, but TV is the visual medium. Movement. Action. The unexpected. That's what film can help

you capture. Weaving through a crowd or snaking up a ladder, a modern 16 mm camera can maneuver without attracting attention.



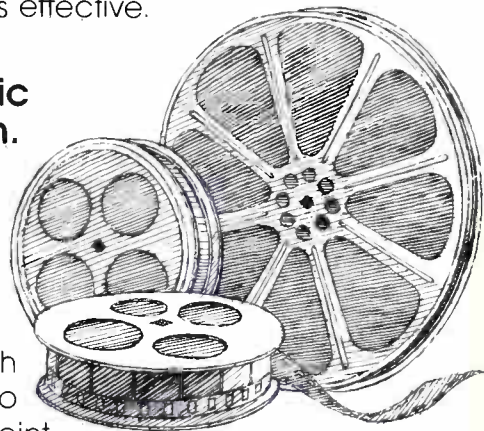
Film. The processing time is also good news.

For last-minute news just before air time, or bulletins as they happen, videotape makes a valuable addition to film. But even film is far from slow. The average 16 mm film can be processed quickly, and simply edited—all in less than 30 minutes.

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But no less effective.

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**GOING to the NAB convention?
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SEE a station break on film.**

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Twenty Questions On Digital Video Answered

By Harold E. Ennes

1. What is the purpose of this Q&A?

To serve as an orientation to the present status of digital video for managers, engineers and technicians.

2. Why should digital video instead of analog video be considered at all?

You can do some things digitally that can't be done in the analog form. Time base correction is an example. As observed in Fig. 1, the digital system doesn't care whether the input is quad or helical head, laser scanner, non-synchronous remote or network signals, etc. The output signal is of time-base corrected analog form, raster and color-synchronous with the local sync generator and, in special cases when desired, changed in format, size, or other characteristics. Processing in digital form is virtually limitless.

The digital system is strictly "hands off" automatic operation with no operating adjustments, resulting in lower operating costs. Every year will witness more and more applications in broadcasting.

3. Have subjective tests ever been made to determine picture quality of a digitallized color video signal?

Yes. Highly satisfactory results were obtained.¹

4. Will video be transmitted digitally to home receivers?

Depends upon your conception of "transmission." The main video signal will *not* be transmitted to home receivers in the foreseeable future. However, digital information in the vertical interval (repeated at field or frame rate) may be used for special services.² The more immediate application is strictly in-plant; tape, laser (or other) recorders, time-base correctors, image enhancers, automatic synchronizers and timers, standards conversion, video compressors, special effects, all-electronic slide (storage) projectors, etc.

5. Is digital video and digital control the same thing?

No. Digital control of analog video switchers, analog tape editing, color cameras etc. is already well established in the field. Digital video is the actual handling of video signals in digital form, not analog form.

6. What is the "digital form" of video?

The varying analog video signal (usually 1 volt peak-to-peak) is converted to a system of binary numbers representing 0 to 1 volt.

7. What is the basic principle of converting an analog

signal to a system of binary numbers?

By "sampling" the signal, usually at a symmetric rate, and converting each instantaneous sampled level to a corresponding binary number. This process is termed "pulse code modulation" (PCM).

8. What does "sampling" the video signal mean?

A method known as "quantizing" is used as shown in Fig. 2. Note that the amplitude of the quantized signal changes in equal steps. (Termed "pulse-amplitude modulated" or PAM). This is accomplished by a "sample and hold" circuit. (See Q16). Each step is termed a "quantum" and the maximum quantizing error is $\pm \frac{1}{2}$ quantum. The midpoint (hopefully) of each step is then converted to a binary group as indicated. The signal is now PCM. This requires a 4-bit binary number for the 16 levels shown in Fig. 2. Note that although the count is 15, 16 levels occur counting zero.

If the quantized signal (PAM) were applied to a monitor, steps (contours) of 16 shades from black to white would appear rather than the continuous transition of the

Table 1—Effect of Sampling Levels

Bits	No. Of Levels	Comments	Unweighted p-p Signal To rms Noise Ratio (db)
1	2	Can get intelligible information through, but far from broadcast quality.	13
2	4	Significant improvement over (1) but very bad contouring. Far from broadcast quality.	19
3	8	Significant improvement over (2). Still very bad contouring. Not broadcast quality.	25
4	16	Some improvement over (3). Some contouring. Not quite equivalent to present broadcast quality.	31
5	32	Small improvement over (4). Slight contouring. About equivalent to poor S/N ratio camera or VTR.	37
6	64	Small improvement over (5). No contouring. About equivalent to average low-band VTR.	43
7	128	Slight improvement over (6). Equivalent to best present cameras and VTR's.	49
8	256	Equivalent to anticipated future cameras, VTR's and other signal sources.	55

References

- ¹A.A. Goldberg, "PCM Encoded NTSC Color Television Subjective Tests," Journal of the SMPTE, Aug. 1973.
²For example, see Manfred Maegle, "Digital Transmission of Two Television Sound Channels in Horizontal Blanking," Journal of the SMPTE, Feb 1975.

Author Ennes is the author of many books on broadcasting and a consulting electronics writer, Beech Grove, Ind.

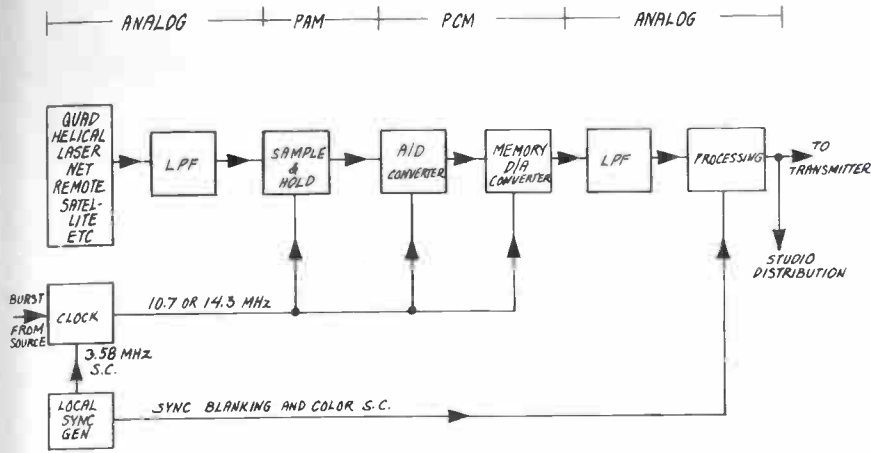


Fig. 1 Simplified flow diagram of how digital video fits into a broadcasting plant.

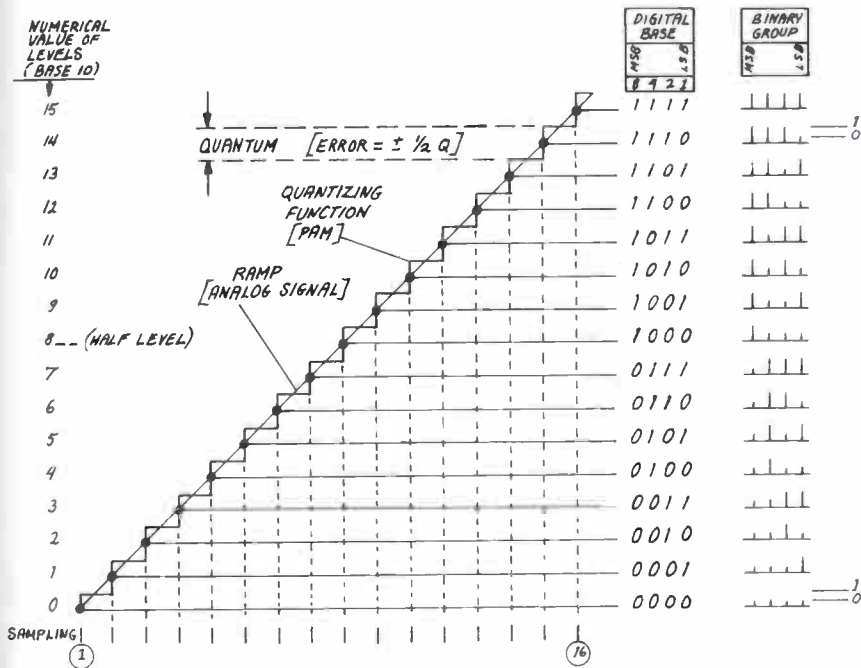


Fig. 2 Analog-to-PAM-to-PCM for a four bit signal of 16 levels. Broadcast TV calls for eight bits resulting in 256 levels.

original ramp signal. Note however, that if the quantizing signal was filtered out before monitor application, the appearance would very closely approximate the original ramp signal.

Note also that the most significant bit (MSB) of the binary group first occurs at half-level. This understanding is useful in certain binary operations (see Q17).

On the far right of Fig. 2, small pulses representing binary "zero" are shown. In practice, typical values are:

- binary 0 = 0.2v
- binary 1 = 4.0v

Thus you have a voltage ratio of $4/0.2 = 20 = 26 \text{ dB}$, and "1's" are readily recognized from "0's."

What is the maximum quantizing error for the signal in Fig. 2?

Since there are 16 levels:

- quantum $(Q) = 1/16$
- $1/2 Q = 1/32$ or 1 part in 32
- $= 0.03125 = 3.125\% \text{ max quantizing error.}$

Thus if the ramp signal represented 0-1 IEEE units (0.714 volts) then:

$$0.714 \times 0.03125 = 0.022$$

thus: $0.714 - 0.022 = 0.692 \text{ min}$
 $0.714 + 0.022 = 0.736 \text{ max}$

Another way of saying this is that the quantized signal (for 16 levels) is almost 97% accurate, or that 97% of the original information is contained in the quantized signal. (Worst case). The inverse of quantization accuracy is quantization noise. Q error and Q noise are generally taken as one and the same.

10. How many sampled levels are actually used in present digital video systems?

256 levels is well standardized in present digital video systems. Table 1³ shows average effect of picture monitor presentation correlated to binary bits and resulting number of sampled levels. Note that to obtain 1/256 as the LSB, an 8-bit binary word is required. Also note that each bit reduction reduces the S/N ratio by 6 dB.

11. What is the maximum quantizing error for a 256-level (8 bit) system?

continued on page 70

³Based on actual demonstration by Mark Sanders (Ampex) "TVC-800 Digital Time Base Corrector," SMPTE Annual Winter Conference, Jan 25, 1975.

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X16

TWENTY QUESTIONS

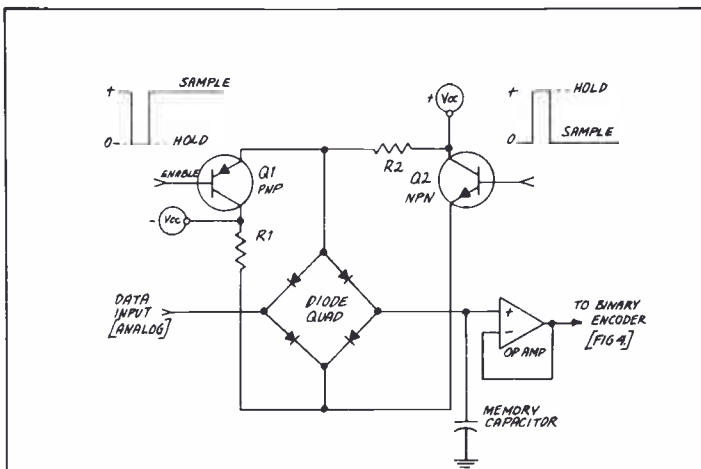


Fig. 3 Example of sample and hold gate.

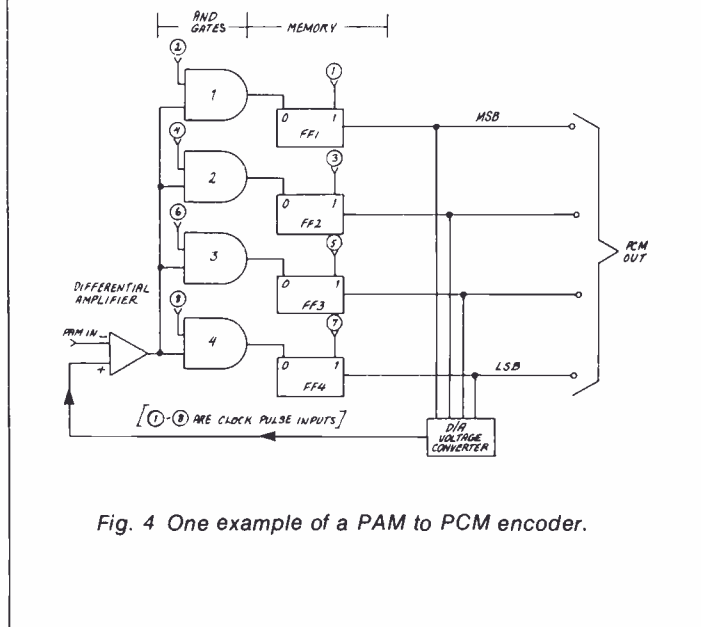


Fig. 4 One example of a PAM to PCM encoder.

Since:

$$Q = 1/256$$

$$\frac{1}{2}Q = 1/512 \text{ or } 1 \text{ part in } 512$$

$$= 0.00195 = 0.195\% \text{ or } 0.2\% \text{ approx (worst case).}$$

$$= 99.8\% \text{ quantizing accuracy (worst case).}$$

This effect on a 0.714 volt signal is:

$$0.714 \times 0.002 = 0.0014$$

$$0.714 - 0.0014 = 0.7126 \text{ min}$$

$$0.714 + 0.0014 = 0.7154 \text{ max}$$

and this error could not be read on the IEEE scale.

Note: When the 256 levels are concerned with the entire composite video (see Q12) only about 180 samples are reserved for video. This very slightly reduces the accuracy.

12. Is the entire composite signal (including sync) sampled, or just the active-line video?

Depends. For in-plant use, only the active lines need be sampled, with blanking, sync and burst injected later (Fig. 1). For digital transmission outside the plant, the entire composite signal must be sampled. Some in-plant systems also sample the entire composite signal in-

cluding sync and burst.

13. How is the minimum sampling rate (frequency) established for digital video?

Sampling theory is based upon the "Nyquist Criterion."^{4,5} Briefly, this states that the sampling (encoding) frequency must be at least twice the highest information frequency concerned. Look at it this way; sampling similar to a double-sideband, suppressed carrier modulator. Thus if the sampling frequency (f_s) was less than twice the highest video frequency (f_v), the lower sideband ($f_s - f_v$) would overlap the video causing decoding (separation) problems. If f_s is higher than $2f_v$, this problem does not exist. In practice, to avoid phase distortion and filtering problems, $1.2(2f_v)$ is considered the minimum practical sampling frequency for digital video. Thus: $1.2 \times 2 = 2.4 f_v$. Since highest f_v is 4.2 MHz: $2.4 \times 4.2 = 10.08$ MHz absolute minimum. Sub-Nyquist methods beyond the scope of this paper do exist in other services.

14. What is the actual sampling frequency used in present digital video systems?

It has been shown⁶ that it is desirable (probably necessary) that f_s be an odd multiple of one-half the line rate. A convenient choice is three-times the color subcarrier frequency, or $(3.58)(3) = 10.74$ MHz. This is the most common f_s in present digital video systems. However, there is a strong movement underway for standardization on 4-times the color subcarrier (14.3 MHz).^{7,8} This is an even multiple of the color subcarrier frequency (f_{sc}), and f_{sc} is an odd multiple of $\frac{1}{2}H$.

15. What is the required signaling speed in a digital video system?

The 8-bit character for each of the 256 levels must be propagated at 3 or 4-times the color subcarrier frequency.

Thus:

$$\text{for } 10.7 \text{ MHz: } 8 \times 10.7 = 85.6 \text{ megabits/sec.}$$

$$\text{for } 14.3 \text{ MHz: } 8 \times 14.3 = 114.4 \text{ megabits/sec.}$$

When parity bits (error detection) are employed, the 85.6 megabits/sec becomes 100, and the 114.4 becomes 143. Bit-rate reduction schemes are being experimented with at the present time.

16. Fig. 2 shows that each represented level is "held" momentarily so that the pulse-amplitude modulated signal can be converted to a system of binary numbers (pulse-code modulation). Is this a special type of sample-and-hold circuit?

It differs from the conventional type only in the method of "keying." As observed in Fig. 3, the circuit acts as a data gate from the sampling (clock) pulse. With Q1 and Q2 both cut off, all diodes are conducting from the current through R1 and R2. Thus the data input charges the memory capacitor during this time. (Gate is open allowing passage of the analog data input). The interval is the sampling time.

When the clock pulses arrive (opposite polarity in-

continued on page 66

⁴H. Nyquist, "Certain Factors Affecting Telegraph Speed," Bell System Technical Journal, March, 1924.

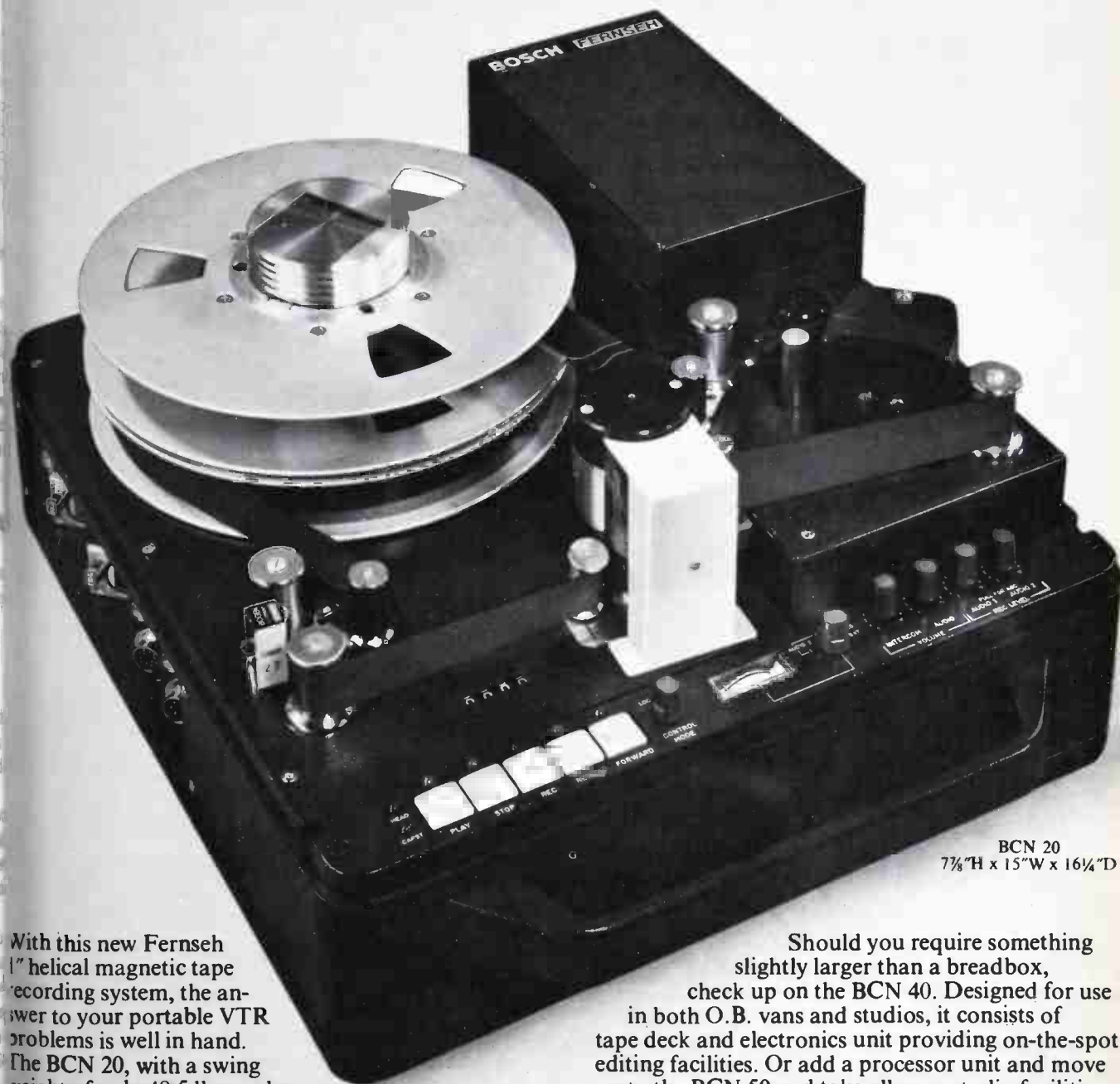
⁵H. Nyquist, "Certain Topics in Telegraph Transmission Theory," AIEE, April 1928.

⁶L.S. Golding and R.K. Garlow, "Frequency Interleaved Sampling of Color Television Signal," IEEE Trans. on Communications Technology, Dec 1971.

⁷John P. Rossi, "Color Decoding a PCM NTSC Television Signal," Journal of the SMPTE, June 1974.

⁸Paper by John Lowry (Digital Video Labs), "Digital Video Processing of 4-Times Color Subcarrier," SMPTE Annual Winter Television Conference, Jan 25, 1975.

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TWENTY QUESTIONS

example), the diodes become reverse-biased, closing the gate so that the charge on the capacitor is "held" at the level sampled. The operational amplifier acts as a buffer between the memory capacitor and the encoder input.

17. How is PAM converted to PCM?

Pulse-amplitude modulated signals (PAM) are converted to pulse-code modulated (PCM) signals by several different means. One type (successive approximation) is shown by Fig. 4. This illustrates memory for a 4-bit (16 level) binary.

At the start of each sampling interval each flip-flop (FF) is set to its zero state by a clock pulse. (Same as sampling pulse). Note that the clocked inputs are to both the AND gates and flip-flops. Clock pulses occur simultaneously, speeding up the conversion; *i.e.* 2 and 3, 4 and 5, 6 and 7 are simultaneous, with 8 and 1 the "start" pulse.

As observed from Fig. 2, the MSB of any binary word first occurs at half-level. The MSB responsible for half-scale voltage sets the action of FF1. (Fig. 4). Its weight is converted back to an analog signal via the D/A (digital-to-analog) converter. If this input to AND gate 1 (via the difference amplifier) equals or exceeds $\frac{1}{2}$, the bit is allowed to remain. If it is less, the MSB is turned off by the clock pulse at 2.

The process is repeated for the next MSB ($\frac{1}{4}$ voltage

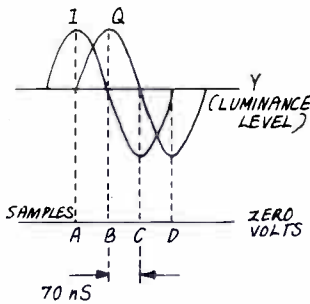


Fig. 5 Shows I, Q and Y components sampled at 14.3 MHz rate.

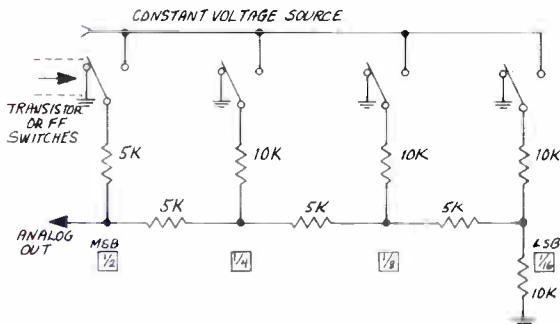


Fig. 6 Constant voltage source with ladder attenuator shows digital-to-analog conversions.

level) until the LSB (1/16 level) has been subtracted or added. Thus a 4-bit binary character has been created from the instantaneous voltage level sampled.

Note that the above requires 4 "looks" for a 4-bit system. Obviously an 8-bit binary requires 8 memories. This means that an 8-bit group is created for each of the 256 levels. Thus 8 "looks" for an 8-bit system is required.

There are other (higher speed) methods of conversion. For example, a separate voltage comparator for each of the 256 levels can be used. This requires 255 comparators. Another method is a 16 level "one-look" type of A/D yielding a 4-bit number which represents the most significant digits. When re-sampled, a 4-bit number is obtained representing the least significant digits.

18. How is color information extracted from a digital video signal?

Usually by digital comb filtering and a matrix network. See reference (7) for rigorous treatment.

Very briefly, I and Q color signals are superimposed on the dc level of the Y (luminance) component. (Fig. 5). This drawing is for a 14.3 MHz sampling rate. Therefore, the sampling period is $1/14.3 \text{ MHz} = 70 \text{ nanoseconds}$.

I and Q can be digitally extracted as follows:

$$\begin{aligned} I &= A - C \\ Q &= B - D \end{aligned}$$

Then Y can be extracted as:

$$Y = \frac{1}{2}(A + C) \text{ or } Y = \frac{1}{2}(B + D)$$

19. How is digital video converted back to analog information?

A common method of D/A conversion is illustrated by Fig. 6. In this drawing, transistor (or FF) switches are represented as toggles. Note that the MSB is attenuated the least ($\frac{1}{2}$) while the LSB is attenuated to $\frac{1}{16}$ the original voltage used as reference.

Switching the resistor network as shown between two given constant voltage source and ground provides the possible levels of output. (Since each input can be 0 or 1 the total combination is $2^4 = 16$). In practice, 8 digits are used, giving 256 possible levels counting zero. A constant current source with different configuration may be used with lower value resistors.

As observed in Fig. 1, a low-pass filter (LPF) is used at the input and output of the digital system. The input LPF removes all analog frequencies and spurious components above the 4.2 MHz intended passband. Similarly, the output LPF removes the sampling and digital transient components above the intended video passband.

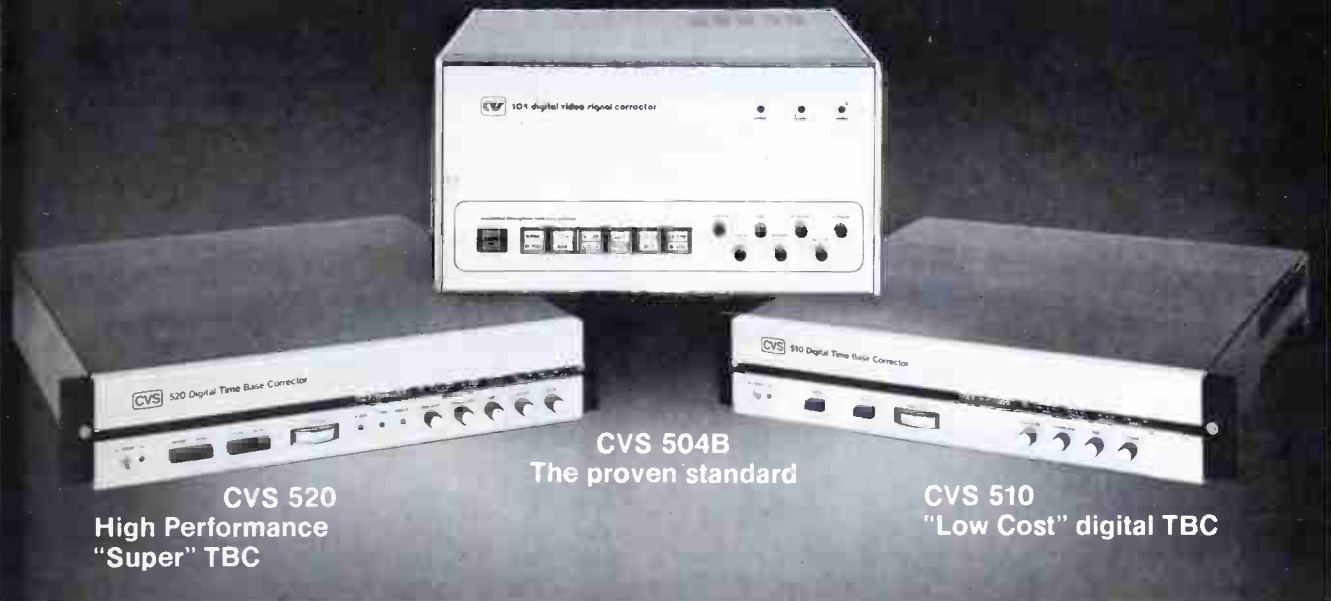
20. What sequence of training should be followed to upgrade the technical staff in digital video?

Binary math. Logic. Digital technology that includes PCM. Ask help from your librarian. Investigate manufacturers seminars. The following references are vital but even those listed under "Additional References" for students require a background at least equivalent to the contents of this Q&A.

Additional References

- The following are especially slanted to the student. All appear in the Journal of the SMPTE, July 1975.
- David A. Howell, "A Primer on Digital Television," (Mostly non-technical).
- E. S. Busby Jr., "Principles of Digital Television Simplified."
- Frank Davidoff, "Digital Video Recording for Television Broadcasting"
- John P. Rossi, "Digital Television Image Enhancement." (More advanced).

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ITFS To Battle Nurses' "Future Shock" With On-The-Job Education

(Editor's Note: The following article is adapted from a detailed report prepared by David Green, acting station manager of the Educational Television Center, and Michael O'Sullivan, director of the ICE/TV Network.)

"All aspects of nursing and medical care are changing so rapidly we just cannot keep up. Our nurses are constantly threatened with 'future shock.' Isn't there some way we can get together for an effective joint attack on this problem?"

About a year ago a number of organizations in the San Francisco Bay area responsible for the training of nurses got together; they agreed unanimously on the fact stated above and on the question that follows it. They reported a constant bombardment of demands for new educational programs to instruct hospital personnel in the latest medical techniques, to orient new employees, and to refresh older ones in medical basics.

Adding urgency to their questions was a new California law, to go into effect in 1978, which will require nurses, along with a long list of other licensed professionals, to complete prescribed educational courses for a mandated, periodic re-licensing. A third incentive for enlarged educational programming was the desire to enlarge opportunities for nurses and others to complete courses for advanced degrees.

The decision of the group was to seek a Federal grant to help them start a centralized, regional educational program that would deliver course material to all the participating organizations. Their presentation to the Department of Health, Education and Welfare brought them, in January, 1975, a three-year grant to help set up an educational network for the Bay area, which would hopefully, in a short time, be self-supporting.

The joint effort, calling itself In-Service and Continuing Education by Television (ICE/TV), after a thorough study decided that an ITFS system would be the best and least costly way to deliver the program to the participant hospitals and nurse training centers. This was especially true in their case because they had access to an ITFS system already in being, on which they could rent the "air time" needed for their programs. This system is a facility of the Educational Television Center (ETC) of the Archdiocese of San Francisco.

It has a central transmitter feeding three regional transmitters which easily reach all the hospitals and medical training centers in the area. The four channels assigned an ITFS system would allow ETC to continue serving the more than 50 schools which were its prime "clients," while renting to ICE/TV the program time required for the medical program.

And ETC, responding to the ICE/TV inquiry, was happy to cooperate in such an important program, and to get additional funds for amortizing their \$500,000 in-

vestment.

The program is scheduled to go into operation in January, 1976. Within a short time, according to plans, it will be extended to reach about 50 hospitals and other medical centers in the San Francisco area.

The production and coordinating of the program will be undertaken by the Health Services Educational Council (HSEC), of San Jose, an area health education center. HSEC will draw on the programming resources of all the participating organizations, will seek other sources of needed programming, and will stimulate the production of new programs when none on the required subject exists.

The "students," for their part, will watch the programs at times assigned while they are on duty; when a scheduled course comes through outside of a student's regular duty hours, the nurse will be required to report for "school," and will get extra pay for doing so. Distribution of the programs within each facility will be simple in most cases because nearly all the participating centers have internal MATV systems, each of which requires only a single ITFS converter to cut into the system.

Obviously, ICE/TV could have chosen any of several other methods for delivering the course material throughout the area. Videotape cassettes bicycled from point to point are, of course, the chosen vehicle for hundreds of commercial and public service organizations with somewhat similar training problems, and ICE/TV studied that possibility. Other possible systems considered were open-circuit TV broadcast (renting air time from a public TV station in the area); point-to-point straight line microwave; and coaxial cable.

Because the system will eventually reach more than 50 centers, all easily reachable by local television, a television system quickly emerged as cheaper than videotape cassettes. The story would probably be different (as the tremendous success of the videotape cassette shows) if most of the delivery points were out of range of a single television transmitting facility.

Public TV was attractive for low receiving cost, but was eliminated by the relatively high cost of air time and the limited availability of the single air channels. Straight-line microwave would have required heavy investment, and would be inflexible to change, and to delivery over a number of different directions and distances. Coaxial cable, with plenty of channel "space" and low cost after installation, would require the large capital investment of all since no system covered the area—far beyond any foreseeable resources of the group.

With an ITFS system already in being and available, it was far and away the best solution. The system could be "on line" 24 hours a day, at comparatively low cost. The Bay Area ICE/TV program thus appears as an appealing model for other public-service organizations with similar needs.

BM



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This is the CP-TV antenna which underwent A-B method of testing at KLOC-TV in Modesto, California during the past year. Full details of the antenna used in the test as well as test results will be presented by JAMPRO at the Ambassador Hotel, Chicago, on Tuesday, March 23rd.

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Circle 153 on Reader Service Card

"MINIPACK" CCU FREES TKP-45 PORTABLE CAMERA FROM AC POWER.

Part of the one camera camera system.

The TKP-45 studio/portable camera offers a choice of accessories that create a true system in one camera.

High on the list in importance is the "Minipack" CCU. It's a self-contained, 35-pound unit that provides complete independence from outside power sources, yet offers all the features of a full-sized studio camera control unit.

No performance compromise.

Features such as horizontal and vertical contour enhancement with coring and combing are built into the "Minipack." This is a top quality enhancer using 2-line delay. White Balance, Black Balance and Iris Control are automatic in this uncompromising performer. A source sync generator operable in crystal or genloc modes is another integral feature.

Scene Contrast Compression.

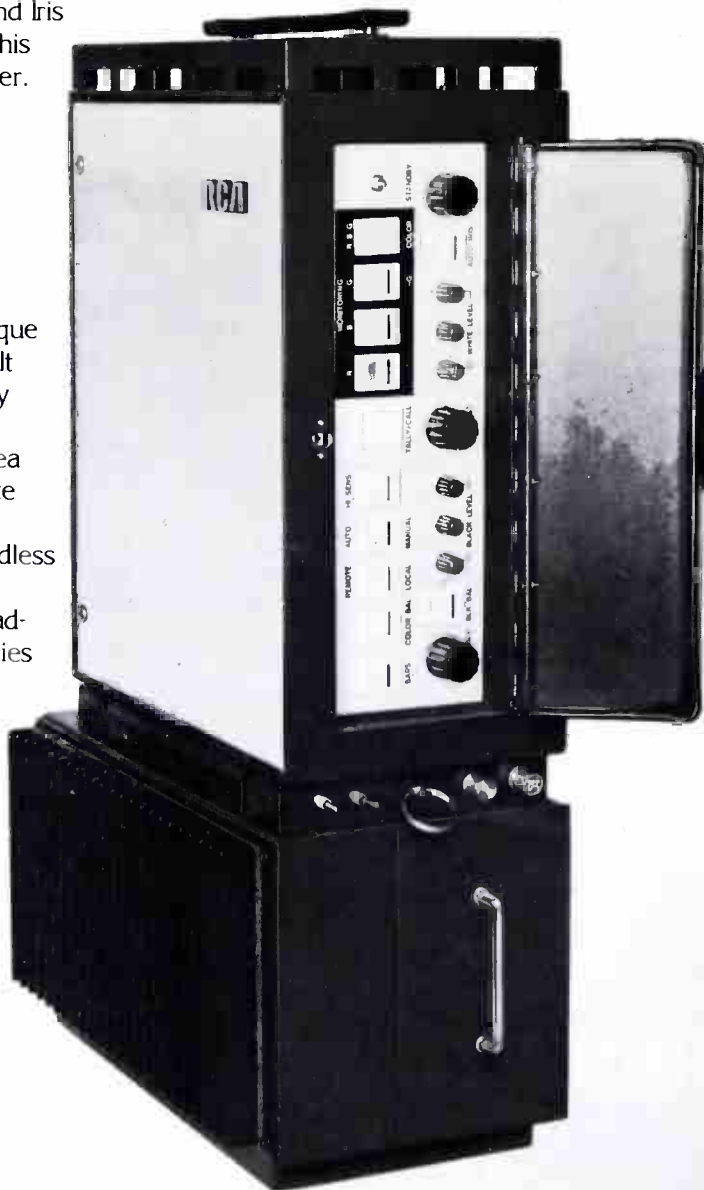
This is a valuable and unique RCA "Minipack" feature. It brings out details normally hidden in shadow areas. Colors in the stretched area do not desaturate; accurate color rendition and color balance are assured regardless of the amount of stretch.

Rechargeable nickel cadmium or silver zinc batteries are self-contained in the "Minipack." They are



replaceable in seconds. Where AC current is available, a plug-in adapter can be substituted for the battery pack.

Ask for complete details on the TKP-45, the one camera camera system, and its unique "Minipack" CCU.



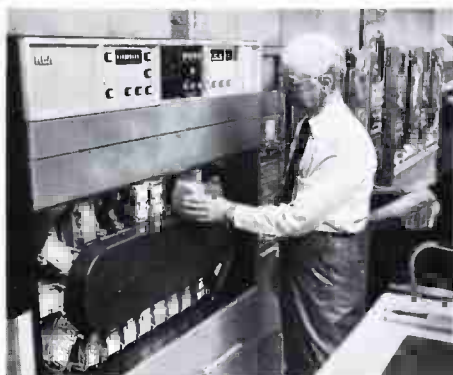
RCA

ES ALL "CART," REALIZES PRODUCTION BENEFITS.

Investment pays off. Channel 3, Springfield, is a progressive station that earned the advantages of a investment program. Investing for new equipment in depreciation, the station is able to add the production needs for a growing local programs, news, dubbing.

KY-3's film facilities now include two new islands with TK-28 color cameras; TP-55 Multiplexers; TP-66 and TP-7 Projectors. The TK-28 cameras include ASCET (Automatic System for Correcting Errors in Telecine).

To round out the equipment picture, a TCP-1624 Cartridge Film System is installed on one of the film islands.



atic station breaks,

At KYTV, the TCP-1624 film cart averages some 70 plays a day, while the TCR-100 airs up to 130 clips in a 24-hour period. The complete story of KYTV is told in the December, 1975, issue of RCA Broadcast News. Ask your RCA Representative for a copy.

Busy carts.

At KYTV, the TCP-1624 film cart averages some 70 plays a day, while the TCR-100 airs up to 130 clips in a 24-hour period.

The complete story of KYTV is told in the December, 1975, issue of RCA Broadcast News. Ask your RCA Representative for a copy.



1 frames and empty slots.

In addition to freeing other equipment, the TCP-1624 is a production aid in many instances, its stop-on-frame feature makes single frame inserts an easy task. Instant stop-start makes the TCP-1624 ideal for program editing; for handling film-to-tape transfers of short film segments which are loaded on cartridges. Other film cart machine benefits that KYTV calls "Empty Slot Sequencing." The cart is sequenced for automatic operation, with an open sequence between sequences. The cart responds to a command to start the sequence; the empty slot gives the operator an additional sequence

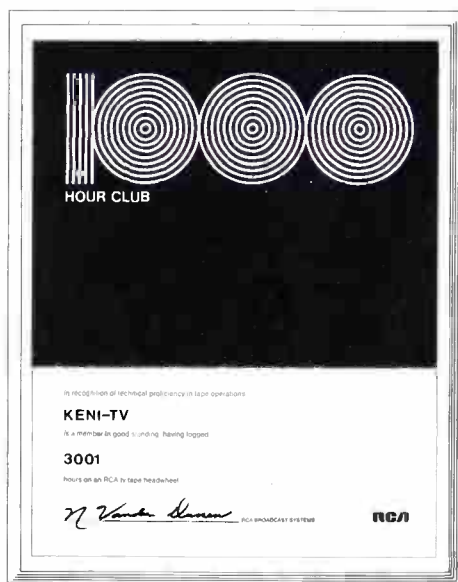
1000 HOUR CLUB MEMBERSHIP REACHES 353.

Update on a successful program.

Broadcasters and teleproducers who return videotape headwheels to RCA for remanufacture receive a handsome 1000 Hour Club membership plaque if the headwheel has performed for more than 1000 hours. Club membership has now been given to 353 stations worldwide.

Alfecon II used in remanufacture.

This superior RCA-developed poletip material is used in a comprehensive conditioning program. Each headwheel receives all the new panel



testing and precision assembly that go into a new headwheel.

RCA, Ampex units included.

The RCA headwheel remanufacturing program is available for all RCA highband headwheels. RCA also remanufactures Ampex Mark X highband panels in Models VR-1100 (highband), VR-1200 and VR-2000 VTR's.

RCA

PRIME TIME

ANTENNAS AND TRANSMITTERS

HOW RCA ANTENNAS AND TRANSMITTERS BRIGHTEN THE PICTURE FOR TWO VERY DIFFERENT TV STATIONS

KGUN-TV, Tucson, Arizona, and WEDH-TV, Hartford, Connecticut are about as different as two TV stations can get. The first is a highband commercial station; the second, a UHF public TV outlet.

One thing they had in common was the need to improve their transmission facilities in a way that would assure stability, low maintenance and improved picture quality.

RCA helped both stations attain their objectives. Here's how:



RCA TT-25FH TRANSMITTER "AN ALL AROUND PERFORMANCE WINNER," SAYS GLEN HILLS, KGUN-TV.

"Our 25 kW RCA transmitter has been operating for well over a year now, from the top of 8500-foot high Mount Bigelow," reports Glen Hills, Chief Engineer, KGUN-TV. "The

"...improved our picture quality substantially."

transmitter has been reliable, very stable, and has improved our picture quality substantially.

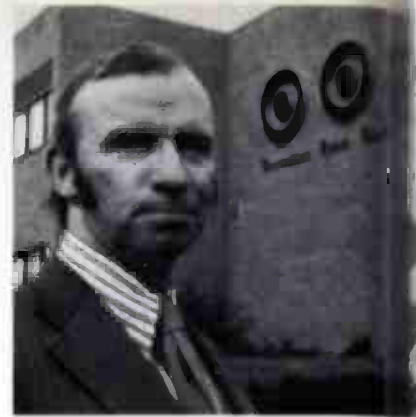
"With only two broadband stages, the TT-25FH is easy to tune, but that's rarely necessary. Ours goes three or four months without more than a touch-up. The automatic controls minimize the need for constant tweaking.

"Sometimes in the summer, lightning storms turn Mt. Bigelow blue, but we've had no lightning problems. It doesn't affect the transmitters' solid state circuits. Our picture even looks good when we're

"...just sits up there and runs!"

transmitting with our emergency diesel generator—and the transmitter seems immune from generator effects.

"The TT-25FH just sits up there and runs. It's a winner!"



"TOP-RATED TRANSMISSION ON A BUDGET," SAYS JACK KEAN, VP/ENGINEERING, WEDH-TV.

"Public television needs a quality picture as well as worthwhile programming to get and hold audience," says Mr. Kean.

"Our RCA Antenna/Transmitter system was installed in 1973. It has given us excellent coverage and signal strength—to the point where WEHD is currently the top-rated Public Television UHF station, and #5, among all Public TV outlets.

"Our new TFCU-20J omnidirectional antenna resulted in a phenomenal

"...phenomenal improvement in signal clarity."

improvement in signal clarity, in all areas and giving us excellent reception to all of Hartford, minimizing the need for roof-top antennas."

The new transmitter for WEHD was an RCA TTU-60BX with an economical standby power option. It is a single-ended 60kW transmitter with a klystron switching arrangement that permits one of the visual klystrons to function as an aural amplifier in the event of an aural klystron failure.

"The TTU-60BX transmitter is remote-controlled from the studio and its redundancy features are

"...support as outstanding as the equipment."

excellent. The spare exciter with automatic switchover gives us full protection—and we no longer have to man the transmitter site.

"RCA support has been as outstanding as the equipment."

RCA

The Impact Of The New Techniques On The Television Viewer And Broadcaster

G.T. Waters, Dir. of Engineering, RTG, Dublin

Based on presentation made at Ninth International TV Symposium, Montreux, Switzerland, May 23-29, 1975.

Aldous Huxley, writing in 1932 in his novel "Brave New World," conceptualised his view of the audio visual entertainment of the future. His fantasy envisaged the public enjoying the media through four of the five senses: for instance, he described the motion picture as "An All-Super Singing, Synthetic-Talking, Coloured, Stereoscopic Feely, with Synchronised Scent-Organ Accompaniment," calling on the senses of sight, hearing, smell and touch; taste alone is omitted, but perhaps the North American phenomenon of the "TV dinners" satisfies that sense.

In the forty years or so since Huxley wrote his novel, developments have come unbelievably close to his predictions. In the cinema we have had films with multiple sound and colour stereoscopic images and we have even had the additions of odours to lend realism to the situation. Modern television systems, whilst perhaps not providing all of the ingredients of Huxley's "Feelies," go a long way to meet the realisation of his dream. We have in the past thirty years or so expanded and enlarged the medium.

However perfect may be the modern television system, technologists will seek to improve it—adding additional dimensions as new techniques are developed. To predict the television system of the future, one must consider the state of the art to-day. With more than 300 million television receivers, valued in excess of \$1 billion, in use throughout the world, it is fair to assume that compatibility, as in the past, will dictate that additional information will have to be accommodated without distorting the present television waveform. Indeed there seems to be no reason why this information cannot be accommodated within the waveform as it now stands. Television engineers are opportunists, exploiting the physiological characteristics of the persistence of vision and memory. Indeed we might be described as masters of deception. Fifty times each second we deceive the viewing public by exploiting human attributes, giving the illusion of continuous motion and full colour fidelity.

The next step in our progress towards ultimate perfection will undoubtedly be to add the third dimension to the television image. Stereoscopic television will evolve from developments currently being pursued, either from holographic techniques or from multi-image projection applications.

The additional information will be conveyed to the viewer as an addition to the standard waveform. We have learned how to add more and more information within the confinements of the allotted channel widths, by additions of modulated sub-carriers, carefully chosen to avoid mutual interference with the primary information, and by coded digital information superimposed on the redundant part of the television

waveform. Even with the addition of colour information and alpha numeric data—such as Teletext—there is 20% of the inter-line and frame space still available to carry additional material.

The great illusion could not be complete without the addition of enlarged sound reproduction. Stereophonic and tetraphonic sound are a reality to-day. They can be easily added to the television waveform.

But what of the home of tomorrow: how are all these developments to be accommodated in the average dwelling house? Television screens displaying life-size images will require large areas of wall space: sound images extending well beyond the confines of the room will demand special listening arrangements. All this will undoubtedly mean that the home of tomorrow will have as a normal facility a special viewing room with one wall accommodating the large screen and sound reproducers strategically placed. Who knows, it may even be possible by some electro-chemical and electro-mechanical devices to add odours and feeling to complete the Huxlian picture.

With the miniaturisation of electronic components, television receivers will become more portable. With portability will follow the personal television facility—just as the transistor radio has become a personal facility to-day. An illustration of what a breakthrough in technology can do may be drawn from the phenomenal development of the pocket calculator. In the world of the media the same proliferation of miniature television receivers will make demands for more and more programme channels, to satisfy the diverse needs of a knowledge and entertainment hungry public.

Broadcasters will have to provide the means of distribution. Before the end of the present century, capacity for at least ten simultaneous broadcast programmes will be available utilizing the available six program capacity of the terrestrial transmissions in the VHF and UHF bands, and the proposed four channel capacity of the direct broadcast satellite. The extension of cable systems will, in the cities at least, offer choice to satisfy every need. Fibreoptic "cables," with their low loss, high bandwidth and immunity to electro-magnetic interference characteristics will open up still further possibilities.

Although there is a tendency towards 'science fiction' in some of the things I have been saying, there is no need to remind you of the dramatic and rapid technological evolution of television in recent years. Apparently impossible problems have been solved by the application of developments in the broadcast and sister technologies. Progress may be faster than we expect, so with "tongue in cheek" I will predict that by the beginning of the twenty-first century Huxley's futuristic fantasy will to a large extent be a reality.

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WV-2200: Battery-run featherweight— for color anywhere! The ultimate in economical portability. About \$4,500, including 6:1 zoom lens. Two vidicons. 1½" viewfinder. Ideal for scouting store locations, plant sites — or next week's sports opponent.

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* Lens additional.

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Circle 154 on Reader Service Card

Easily-Built Pulser Locates Transmission-Line Faults

by Thomas M. Wimberly

Time-domain reflectometers, pulsers, and similar devices are widely used in the aerospace field, in the telephone system, in CATV and MATV to identify and locate faults in many varieties of cable.

Here is a simple dc pulser (Figure 1) that does a good job of fault location on broadcast transmission line. It provides a pulse that has .02 microsecond half-amplitude duration. Used with a suitable oscilloscope, it can locate cable faults to an accuracy of 10 feet.

As best can be determined from the literature, the term "dc pulser" means only that the pulse *does not modulate* an RF carrier¹. The output of this device is similar to the 2T pulse used in the VITS system.

To use the pulser, connect it to the scope and transmission line as shown in Figure 2. The trigger connection is usually not needed. The switch at the output is set to match the impedance of the line under test. Alligator clips will work fine in connecting the pulser to the line. The dc pulser output is shown in Fig. 3.

A shorted line will send back a reflected pulse that is opposite in polarity to the reference pulse (Fig. 4). An open line sends back a reflection that is the same polarity as the reference pulse (Fig. 5).

Mr. Wimberly is transmitter supervisor, WAND-TV, Decatur, Ill.

To determine the location of a fault you have to know the velocity of propagation of the line you are testing. A 6 1/8 inch line has a velocity of 975.13 feet per microsecond. But remember that the scope display will cover the distance both to and from the fault, so the distance indicated on the scope must be divided by two.

For example, Fig. 6 illustrates the dc pulser used on an antenna that had been hit by lightning. The pulse itself would not tell you much unless compared to the reflection from a good antenna. It turns in the direction of short, but so would the reflection from all low impedance antennas, including that from your dummy load.

First let's determine the fault location. The sweep is 1 microsec/CM and the display is 4.3 CM long (leading edge h.a.d. to leading edge). When we divide by 2, we have 2.15 CM. $2.15 \times .5$ gives us 1.075 microseconds. Using 6 1/8 inch line gives us $975.13 \times 1.075 = 1048$ feet for the total distance. The tower is 981 feet tall to the base of the antenna complex. The transmission line covers 40 feet from the point of pulse insertion to the tower base; $981 + 40 = 1021$ ft to the complex base.

So we know that the transmission line is good to the base of the antenna complex. We can't tell much more right away because this antenna is a four-section folded bay ZEE panel unit. The trouble could be in any unit.

continued on page 8

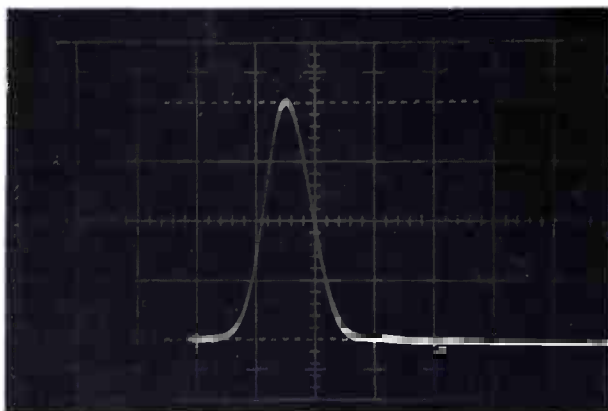


Fig. 3. Shape of the output pulse, with setting for 10 volts/cm gain.

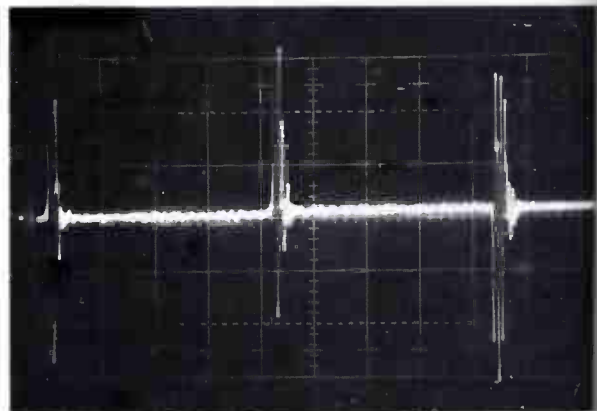


Fig. 4 Transmitted pulse and reflection from a shorted line. The polarity reversal can be seen.

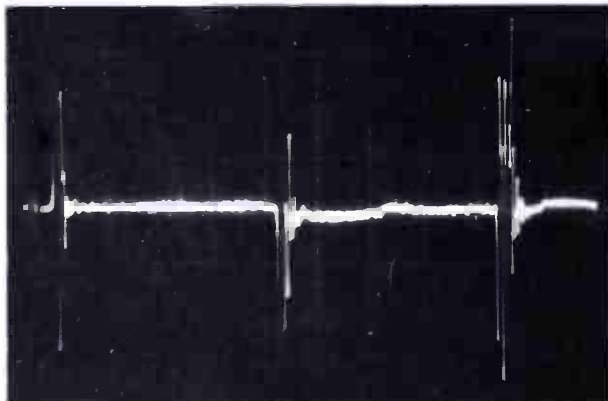


Fig. 5. The reflection from an open line has same polarity as the transmitted pulse. Vertical setting was 1 volt/cm.

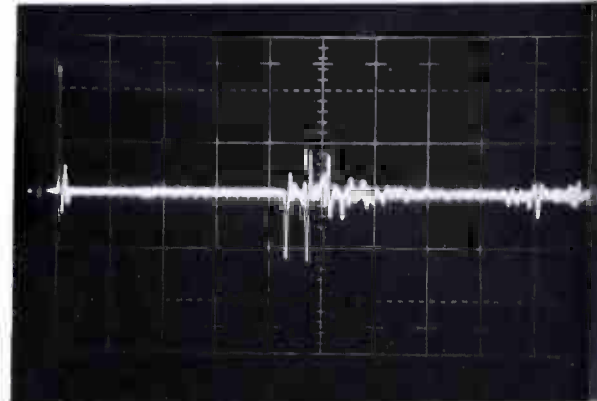


Fig. 6 Reflection from an antenna hit by lightning is used to determine distance to fault. See text for computation.

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Circle 156 on Reader Service Card

BULLETIN: The **Do It Again at Boot**

**DON'T MISS THESE 7 GREAT NEW PRODUCTS
FROM 3M . . . SEE THEM DEMONSTRATED.**



1. NEW AT NAB! D-8000 Video Art Memory System.

Now you'll be able to present artwork in seconds on a random select basis. The D-8000 converts any high-contrast original art into digital format for storage on low cost diskettes. It changes fixed-

5. NEW AT NAB! D-3000/ D-4000 Animation.

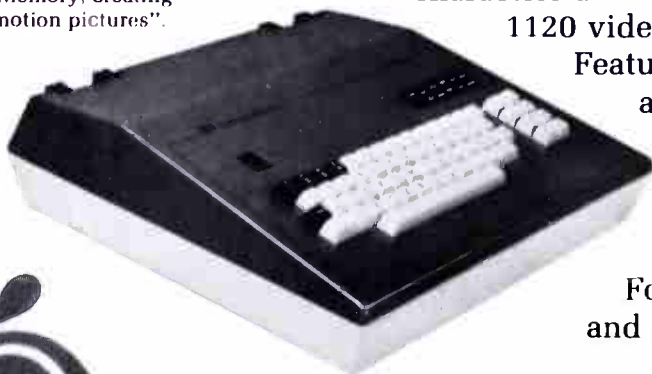


We've added new dimension to the D-3000 Character Generator and companion D-4000 Disc Memory. Now, you have a greater selection of video-type fonts . . . including Upper and Lower Case. Also, selected math symbols, and accented foreign language characters. PLUS, you can animate your display for action. New Animation Mode allows you to play out full frames at a rate of 6 or 12 per second from the D-4000 Memory, creating "video motion pictures".

image video inputs from a standard monochrome TV camera into black-and-white or colored video art. Current Re-entry Mode allows use of up to 6 different color Stores and displays one "full frame" presentation. Use the D-8000 now for high-impact '76 Election Coverage . . . and throughout the year for colorful station logos, repetitive titles, product art, and special graphics.

3. NEW AT NAB! D-2000 Character Generator.

Our new D-2000 Titler provides high-resolution characters at the lowest price ever. Up to 1120 video element resolution per character. Features internal video mixing and audio interface. Internal four-page memory. Page format has 24 characters per row, 10 rows per page. Both 28sl and 20sl Upper Case Fonts. Lower Case Fonts optional. Automatic Centering and Character Edging optional.



Good News" People

29, NAB '76!

NEW AT NAB! 1114 Production Switcher.

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6. NEW AT NAB! Video Outliner.



Now there's a Video Outliner from 3M. Add sharp, clear outlines to camera or video generated titles and artwork. Built-in video keyer. Features: Full edging; 4-position drop shadow selection; black and white outlining capability; more.

7. NEW AT NAB! Keyer/Colorizer.

New. Companion to our Video Outliner, or can be used as a stand-alone unit. Full Remote Control Panel provided. Features: 5 insert modes; Cut or selectable rate Dissolve control; accepts 3 "push-button selectable" video inputs; unique circuit minimizes "edge crawl" effect.

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NEW AT NAB! RGB Image Enhancer.

Introducing a new, professional quality RGB Image Enhancer from 3M, featuring green-derived enhancement, 3.58 combing, and adjustable noise reduction circuitry. Also features . . . Horizontal/Vertical Enhancement Balance . . . Level Dependent Aperture Equalizer . . . Coring controls . . . three sets of independent inputs to drive encoder, effects generator, and monitor . . . much, much more.

Mincom Division **3M** COMPANY

Circle 157 on Reader Service Card

Fig. 1. Schematic of pulser shows simplicity of construction. Output pulse has .02 microsecond half-amplitude duration.

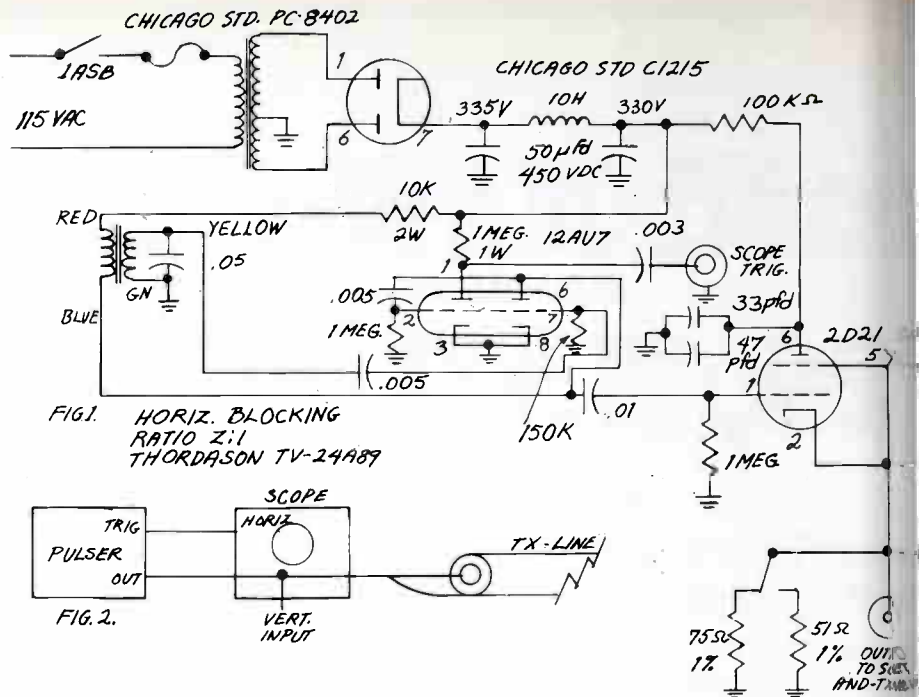


Fig. 2. Pulser is connected to oscilloscope and to line under test as shown here. The trigger connection is often not needed.

happened to be in the second bay up. A 16 foot section of 3 1/8 inch line and a tuned T were burnt.

Fig. 10 shows the "no reflection" from a good transmission line, with the vertical gain turned up to show the roughness of the bullet contacts and/or inner conductor dents. It is a good idea to take a photo on a hot summer night and one also on a cold winter night. This is desirable because a 6 1/8 inch copper line 1000 feet long will expand and contract one foot from hot summer to cold winter, if you are in a temperate or colder climate².

In summary, I suggest that if you don't have a pulser you should build one; you will find it highly useful. When your monthly antenna resistance check is due, use the pulser too. Keep a photo on file for later comparison. Use it to check out your off-air demod antenna and match long coax lengths. Many other uses will occur to every broadcast engineer.

¹Broadcast Antenna Systems Handbook, Tab Books T44, pg. 162-1
²T.M. Gluyas, Influence of RF Output Systems on TV picture Quality Conference April 1972

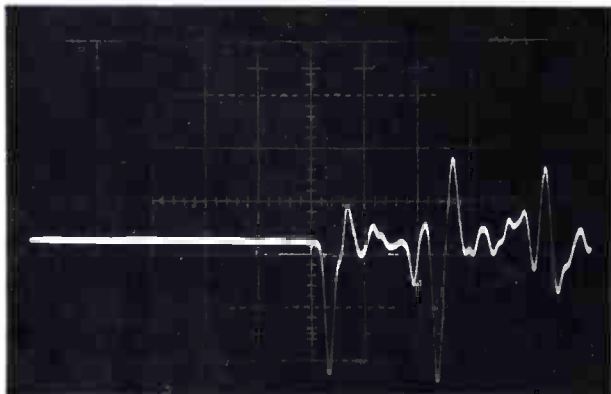


Fig. 7. Expanded view of reflection in Fig. 6; antenna was a four-section, four-bay Zee panel unit.

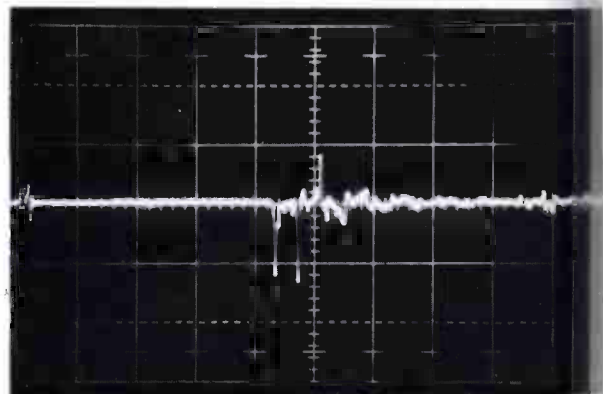


Fig. 8 Reflection from a good antenna; see text for interpretation.

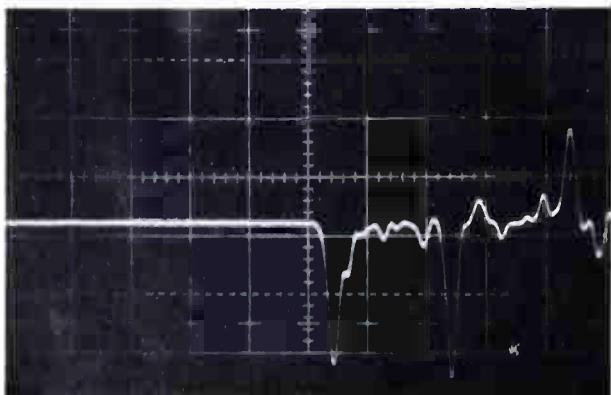


Fig. 9. Another reflection from a good antenna (no fault on transmission line).

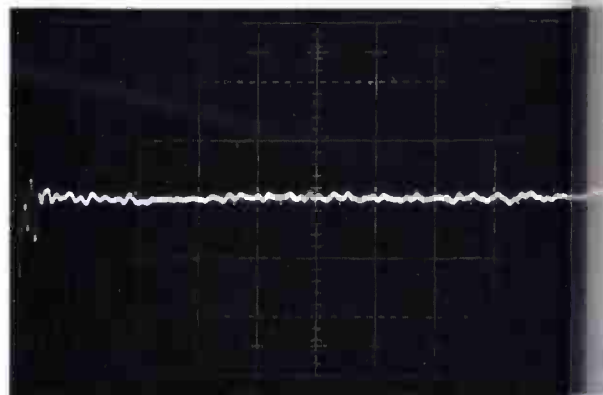


Fig. 10. The "no reflection" from a good transmission line with gain turned up (0.5 volt/cm).

When the FCC approves
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to better serve the people
of the United States,
EIMAC tubes will do the job.



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Circle 159 on Reader Service Card

Supply Power: Notes On Keeping It Alive, Keeping It Steady

At most stations, serious power supply problems don't hit often, but when they do they can be disasters. Below are brief accounts of how some stations coped with power problems.

With a distant mountain-top transmitter, WBRE-FM's supply voltage went up and down so much it was hard to keep the transmitter legal.

In 1967, the management of WBRE-FM, Wilkes-Barre, Pa., replaced an old transmitter on Wyoming Mountain with a new RCA BTF 5E1 transmitter, increasing transmission range from 20 miles to 50 miles. There was only one problem. In its isolated location, the transmitter was at the end of a power line. As a result, line voltage fluctuations were a constant aggravation.

"A mere 5% change in line voltage feeding the transmitter," says Jack Demsky, WBRE's transmitter chief engineer, "could change our power output as much as 10 or 15 percent, beyond the FCC limits of +5, -10 percent. This is because our primary 208-volt AC line has to be built up and converted to 5000 volts DC to power the transmitter. So, for example, a two-volt change on the primary, or incoming line, is multiplied and could mean a 50-volt change on the secondary.

"Since our transmitter is at the end of the line, voltage bounces up and down between 190 and 210 volts. It all depends on draw."

During peak hours from about 7 a.m. to 9 a.m. when plants down the line start up, voltage drops at the trans-

mitter site. When operations cease for the lunch hour at the close of the day, power surges. An hour later when area residents start preparing the evening meal and switching on TV and lights, the power drops again. Later on there's another increase as Wilkes-Barre relaxes for the night.

Faster, less predictable fluctuations are also a problem. "There's an automatic switching operation at the foot of the mountain," Demsky points out. "Whenever voltage drops too low, capacitor banks trip in to increase voltage and that causes a very brief but severe surge. A 24-hour engineer watch was needed to keep transmitter power within limits.

But in 1969 the station installed a Mosley Remote Control System. Engineers no longer stood vigil on the mountain top, monitoring and adjusting power on the spot. A Mosley automatic logging device recorded transmitter power output every 10 minutes, and triggered a bell and blinking light if power dropped below 95% or went above 105%.

The system worked perfectly. It worked so perfectly in fact, that bells rang and lights blinked almost constantly. "We discovered that line voltage variations at the transmitter site were happening often enough to trigger off the new alarm system with regularity," Demsky says. "Putting it mildly, power adjustment took up a lot of the engineer's time."

But even more serious was the fact that a 10 minute interval could pass before a power line drop or rise big enough to put WBRE outside FCC regulations was brought to the engineer's attention.

As the final solution to his problem, Demsky decided to try a Solatron, a solid-state controlled static-magnetic voltage regulator developed by Sola Electric Division of Sola Basic Industries. It has no moving parts, accommodates line fluctuations ranging from +10% to -20% and responds within .16 seconds to maintain output that varies less than $\pm\frac{1}{4}\%$ from nominal.

"Since we installed the regulator in March, 1973, the transmission level has been constant within 2 or 3 percent," Demsky says. "We're all done with the bells and flashing lights, and now our engineers make the long drive to the top of Wyoming Mountain only for routine inspections and calibrations."

continued on page 91



To steady the supply voltage for a mountain-top transmitter at the end of the power line, WBRE-FM installed this self-contained Solatron regulator; it keeps the output power within FCC limits.

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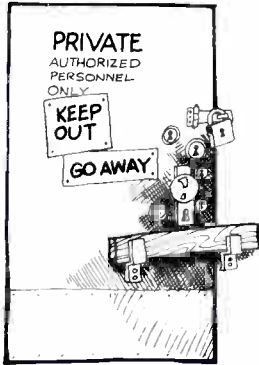
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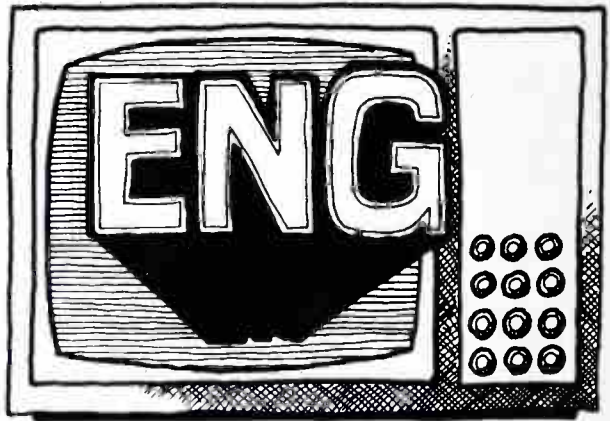
P8130 Coaxial Leddicon
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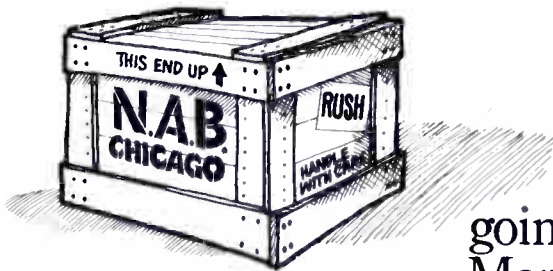


We tried to keep the door slammed on a second new x-pandable system under development. But the word is out.

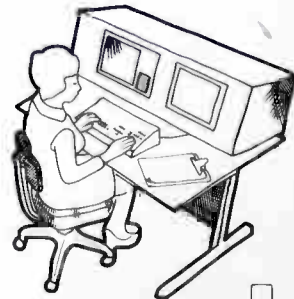
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Windstorm takes out power for all commercial TV in Lexington; educational TV station's emergency power saves day for WKYT's vital news programs.

When a weather emergency strikes, people turn to television and radio broadcasts for essential information on what's happening, what dangers there are, whether to stay home or go out. On January 13th of this year, when a furious windstorm hit Lexington, Kentucky, this information line was broken because primary power was "blown away" for all three commercial TV stations and several radio stations in the city.

But the news management of WKYT-TV, remembering an earlier weather disaster, the tornado of April, 1974, when the emergency power supply at educational station KET-TV kept it going, immediately proposed to KET a joint effort to get the vital news on the air. Management of KET, the Lexington outlet of the Kentucky

Educational Television Network, made their studio and transmitter available to the WKYT news team. Detailed emergency news started going out soon thereafter, with power still out through most of the city.

Actually KET, in a different part of the city, did not lose commercial power in the latest storm, but the emergency generators were fueled up and running in order to take over immediately if a break came. WKYT's management hailed the event as a splendid example of cooperation between commercial and educational TV, for the good of the community. A spokesman there also suggested that the management might be taking a longer look than ever before at the costs and potentials of emergency power.

Ohio University telecommunications goes from 30 kW to 60 kW of emergency power; how the design problems were solved.

Ohio University at Athens has a 33-county audience in Ohio, West Virginia and Pennsylvania for its WOUB-TV and WOUC-TV, and large reach, too, for AM and FM radio operations, all adding up to more than half a million potential viewer-listeners. The University management has come to take most seriously its responsibility for staying on the air, as a public-service, state-supported operation with a number of educational, community-aid, and personal-interest programs. Recent surveys have indicated stable audience interest in the kind of educational and cultural material broadcast by the University system.

This sense of responsibility led to the installation of 30 kW of emergency power for the broadcast operation some years ago; and the emergency power proved itself on several occasions by keeping the broadcasts on the air in the face of interruptions to commercial power. Then, about two years ago, it became clear that, because of the great expansion of facilities, the Telecommunications Center would overburden the emergency power system should it be called on again.

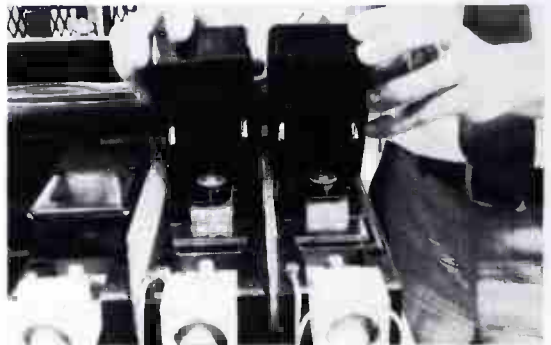
So the University decided to build for the long future by doubling emergency power capacity to 60 kW.

The first choice that had to be made was between buying a new 60 kW system, or trying to incorporate the standing 30 kW into the new system. It turned out to be completely practical, as it does in many similar cases, to add 30 kW of new power in parallel with the old. This included the adding of a number of new automation features to the old system, among them completely automatic start up and load transfer, with a 10-second delay to avoid response to momentary commercial power interruptions. A battery bank takes over the load during the 10-second switch over delay interval. Many other advanced operational features can be optionally added to older systems.

Finding additional floor space, maintenance space, and ventilation capacity, which is often difficult and expensive in broadcast stations that have not planned for enlargement of emergency power, was done with rela-

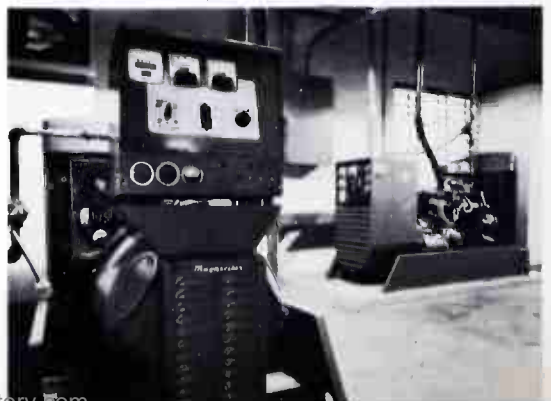
tive ease at the University through assignment of a totally new space for the additional 30 kW of power. The new equipment was supplied by Onan Corporation, and their engineering department was responsible for integration of new and old into the whole system.

Now, with one generator supplying all building needs in the Telecommunications Center and the other supplying the broadcasting equipment, Ohio University at Athens is feeling pretty secure about the continuity of its service to its three-state audience. **BM/E**

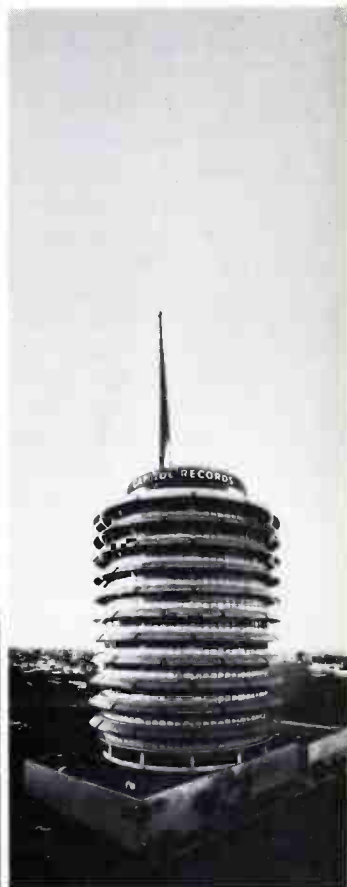


Switch-over to emergency power is effected by these switches, enclosed in heat-resistant contact chambers that control and isolate arcs with tongue-and-groove covers, also keep dirt off contact surfaces.

Old 30 kW generator (left) and new 30 kW (right) at Ohio University occupy adjoining roomy spaces, are integrated by new automatic control systems that provide easy operation of both old and new.



Capitol Records Tests, Calibrates, Evaluates, Approves, Repairs, Quality Controls, and Reviews with the Stanton 681 Cartridge Series



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Part III

Studio Lighting & The Energy Crisis

Problem: Panel Of Experts Discuss Causes & Solutions

This is the final installment of a three-part series that began in March and April 1975 issues of BM/E which deals with energy conservation in TV studios. Panelists are Joe and Moe Tawil, president and chief engineer, and Tom Pincu, product manager, all of Berkey Colortran, and Jim Davis, market planning manager for GTE Sylvania.

BM/E: Let's review for a moment the three things we can do to conserve energy and dollars. One, drop to lower light levels. Two, set better maintenance standards. And three, upgrade equipment. The next question is, what are the improvements in equipment that can allow a television station to operate more efficiently and use less power?

TOM: Better lenses, and reflectors and sockets that stay in better alignment.

JOE: I think our most impressive new unit is the 10-inch Ring Focus fresnel. It just out-performs everything else in both the spot and flood position. I'm talking of beam spread and evenness of field which are the most important characteristics. We're putting out substantially more light than popular brand-name 2,000 watters found

in many TV studios.

MOE: There are two things to look for in evaluating the performance of a fresnel. First, you want higher intensity levels in spot, and flood positions over a wider area. Secondly, a fresnel is used because you want a certain element of control.

MOE: Even the mechanical design of a light can have an impact on energy uses. For example, rear lamping is very convenient. You don't have to move the barn door to change the lamp if it should burn out. This saves time. And you're moving the lens instead of the filament. Also, you're not shocking it and that improves lamp life. All our tests show it cools better than any other fresnel.

BM/E: Running cooler you're not generating as much studio heat?

MOE: No. The heat's still there. But the unit has better thermal flow. The thing that's exciting about this fresnel is that we literally searched the world for a superior lens. One that gives you better barn door control, an 11 to 1 ratio and a higher light output.

BM/E: When was this lamp introduced?

JOE: About two years ago.

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M/E: What kind of response was there in the industry?
DM: In this case, very good. As a matter of fact, we were surprised. It costs more, but it's been well received at many stations.
M/E: Isn't it true that normally many failures occur during focusing?
DM: Right. Because if you move the lamp, you get mechanical shock to the filament. But in the Ring Focus you move the lens. Another development is our bi-post socket. And it's the only UL approved bi-post socket for the power we know of. It permits four surface contacts, as opposed to the standard two or three. And, the receptacle floats.
M/E: So you have more surface contact then. How does that effect power usage?
JOE: Probably very slightly. But it does effect lamp life. If you don't have good contact, you have a voltage drop. It's not that you use more power, but you get less efficiency, less light.
DM: This comes back to maintenance and what we discussed earlier. If you're getting a voltage drop because your plugs are pitted and because your wire is the wrong size, that can cause 10% to 15% less light output. So you end up by using more fixtures and higher wattage to get the level you need.
JOE: A 1% voltage drop across the socket would be quite conceivable. This changes your light output by 5%. So you have a 120 volt lamp that's only putting 119 volts through, that's a 5% light loss.
DM: With the coming of color, many studios originally went to 2,000 watt fresnels. The smaller units weren't usable. Now it's conceivable to use something

like a 6-inch sweep focus light with a 750 or 1,000 watt lamp. It's a very compact luminaire and a very efficient one. Again, if you're upgrading your equipment, it's conceivable to use something like this to reduce your use of power.

JOE: I want to come back for a moment to the power consumption in the cyclorama, which is phenomenal. As we said, the light level established on a cyclorama becomes a reference point for the light level on the foreground. First of all, you want the light level on the cyc as low as possible while still getting technically and aesthetically what you need. But that's not easy to do. The simplest cyc configuration with color requires something like 1000 watts per running foot minimum. One reason is that filters are commonly used for coloring the light on a cyc.

TOM: That's a good point. Take our medium blue Gelatran, which is very commonly used. It only has a 7.3 percent transmittance in the visible regions. If you were to take dark green, the transmittance is 9.5 percent. Once you start to add color, you drop out much of the light. So far we haven't come up with more efficient ways of getting color on a cyc. It's certainly an area to work on. We are dropping a tremendous amount of the energy here.

JOE: But these are things we have done. If the cyclorama starts to get over 12 feet high you're lighting it from top to bottom . . . you're using 2,000 watts per running foot. Visualize 100 feet of cyc; you're talking about 200,000kw, and very often the engineers in the station don't realize this until they actually light the cyc.

continued on page 00

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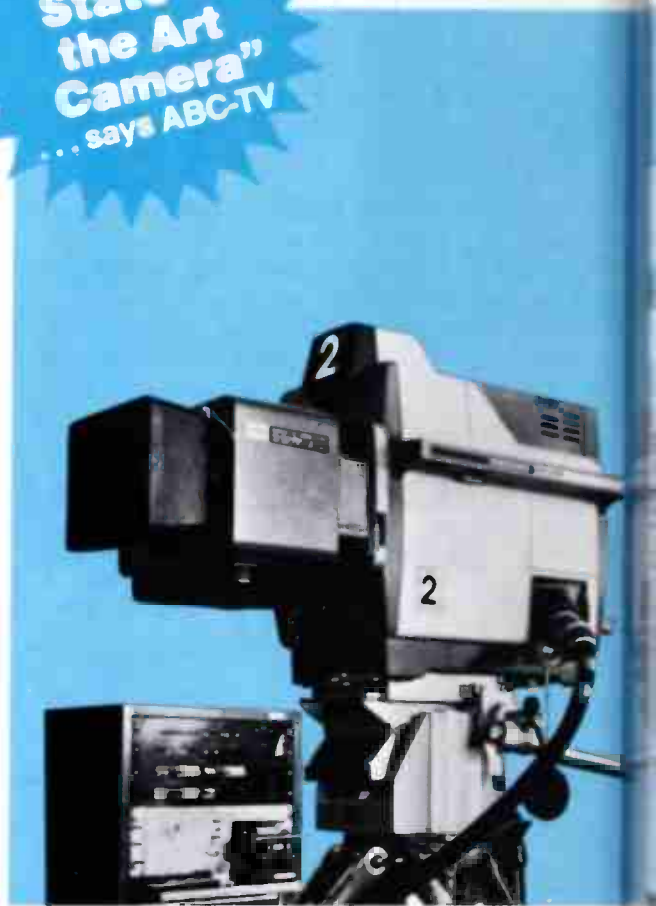
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STUDIO LIGHTING

One of the big power consumers in the studios is the cyclorama, and as a more efficient approach to lighting it is very desirable.

TOM: We designed a unit called the "Far Cyc"—which we can use to light a cyclorama as high as 25 to 30 feet.

MOE: It's engineered with a new concept. Originally the cyc pipes were designed so the lights were 18 to 36 inches from the cyc. The result was a less efficient unit than one mounted with the lights perhaps eight to ten feet away, where the distribution of light was more effective. The light gathering design of the new reflectors and the evenness of light spread are the keys to making the new fixture more efficient. We use more of the light. We get more light on the cyc and less of it bouncing off the floor or spilling out on the top.

BM/E: Was this originally designed for theater lighting?

JOE: No. Far Cyc was originally designed for television by our sister company in England. As we said, Europeans have been more concerned from an engineering point of view, about conservation of power. They were looking for ways to drop the power requirement on the cyclorama quite a few years ago. They designed a unit called "Dominos," which was very successful. We took their basic concept and improved the optical and mechanical design somewhat.

TOM: We can do some things with the Far Cyc that we could not have done with the existing equipment. We



Design of a new bi-post socket used in the Ring Focus Fresnel can enhance energy efficiency by as much as 60%.

feel the result is more satisfying and you can do it with half the power requirement. It's a system that uses fewer lamps, consumes less electrical power, ties up fewer dimmers, uses less color material and smaller circuit capacities. All these residual benefits may well justify throwing out the old lighting equipment. The money you save on lamp replacements alone will pay for the new lights.

JOE: One of the things built into the design is a cue color holder which allows uniform distribution of energy across the color filter so you'll actually get longer utilization out of it.

BM/E: How do broadcasters know whether the equipment they have now is giving them sufficient return on their investment? How do they evaluate what they have now as compared to what is available?

TOM: I think there are knowledgeable people within their own organizations in most cases.

MOE: Most of the television people I know are professional engineers. And if management would do nothing more than ask their own engineering department to come up with a quantitative study on what's going on in their lighting, they probably would get 80% of the answers they're looking for. The network requirements are very different from the small independent or educational TV station.

JOE: I think the point we can stress here is that management has competent engineers on their staff. They should have confidence in them. In addition, they can seek out advice and discuss specific problems with the fixtures and lamp manufacturers.

TOM: You know, we have to be careful not to overstate the question. If power becomes a more critical problem, TV stations might not get all they need. So they'd better attack and solve the problem before it gets worse.

MOE: In general, when anybody is installing a new studio, or modifying an old one, voltage drop is a tremendously important thing to consider. We should be concerned about the voltage drop through the dimming system. Try to get the maximum amount of copper because if you skimp on the size of the wire, you're going to have a greater voltage drop. And you pay for that operating costs, year after year.

JOE: In addition to lamp conservation, a good dimming system can contribute a lot of other things to a studio. First of all, the ability to aesthetically control your lighting and get the kind of proportions you're looking for is

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important. Secondly, if you have a solid state dimming system, you use less energy. So you're also cutting power consumption. Thirdly, you can increase lamp life significantly when you minimize the voltage on lamps. Fourthly, the fact that you work through a dimmer very often reduces current in-rush that so often shocks and fails a lamp. So, if you're picking a new system, choose a good quality dimmer that has minimum voltage drop consistent with proper filtering.

TOM: The contributions dimming can make to conservation of energy, improvement of lamp life and aesthetic considerations are very often underestimated or misunderstood by the smaller stations. There are economical packages of smaller dimming equipment, such as Colortran's dimmer pack, which can fit in the tightest budget. They'll probably pay for themselves over a number of years in just the saving of lamp life.

BM/E: What else haven't we covered?

JOE: When a show is rehearsing, don't have the lights on full.

TOM: You don't need gorgeous pictures at this point. You're selecting angles. Rehearsing. When you get ready to run the show, then get up to your required levels.

MOE: When dimming the lights, unfortunately the energy saved is not in direct proportion to light loss. What might be more effective is to use half the lights. At a rehearsal, use only the fill lights which will generally give you a wash of light you can see with. A work light, if you will. Then you'll be able to rehearse using a minimum of equipment, generating a minimum amount of heat.

JOE: Well, again, that's planning. Somebody has to think about what he's doing and decide how he's going to conserve the energy. It's a matter of education at policy, and a matter of planning and consciously deciding you're going to save energy.

TOM: I've walked into studios where the lights were on all the time. Nobody in the studio and all the lights on. Turn off lights when you're not using them. A place here is where the dimmer comes in. We can save energy by reducing the burn time of lights. And, the energy doesn't have to consume taking the heat off to cool the facility is also saved.

JOE: I would say that anyone planning a new facility that does not consider this factor is looking for trouble. Maybe he can afford the power he consumes. But can the community afford the peak load requirement that he throws into the power system? By dropping his energy requirements, he can make himself more palatable to his own community. Otherwise, some day that community might say, "We're not going to build a new power plant for you." Then, he's out of business. So he has to look toward these economies in power consumption. It may not be just a matter of saving money. It may be a matter of staying on the air!

TOM: I'm not an energy expert, but certainly in the near future, until atomic energy comes on-line and starts contributing significantly to power requirements, we're going to be in a tight bind.

JOE: I think we're going to be in a tight bind for a while. We're going to see solar energy, atomic energy and thermal energy evolve. But there is *always* going to be a problem. And we'd better start realizing it now! **BM**

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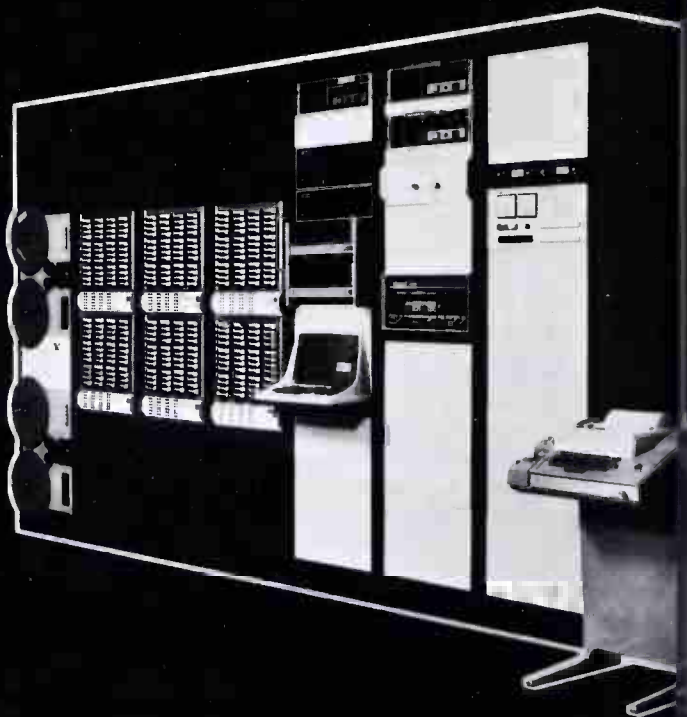
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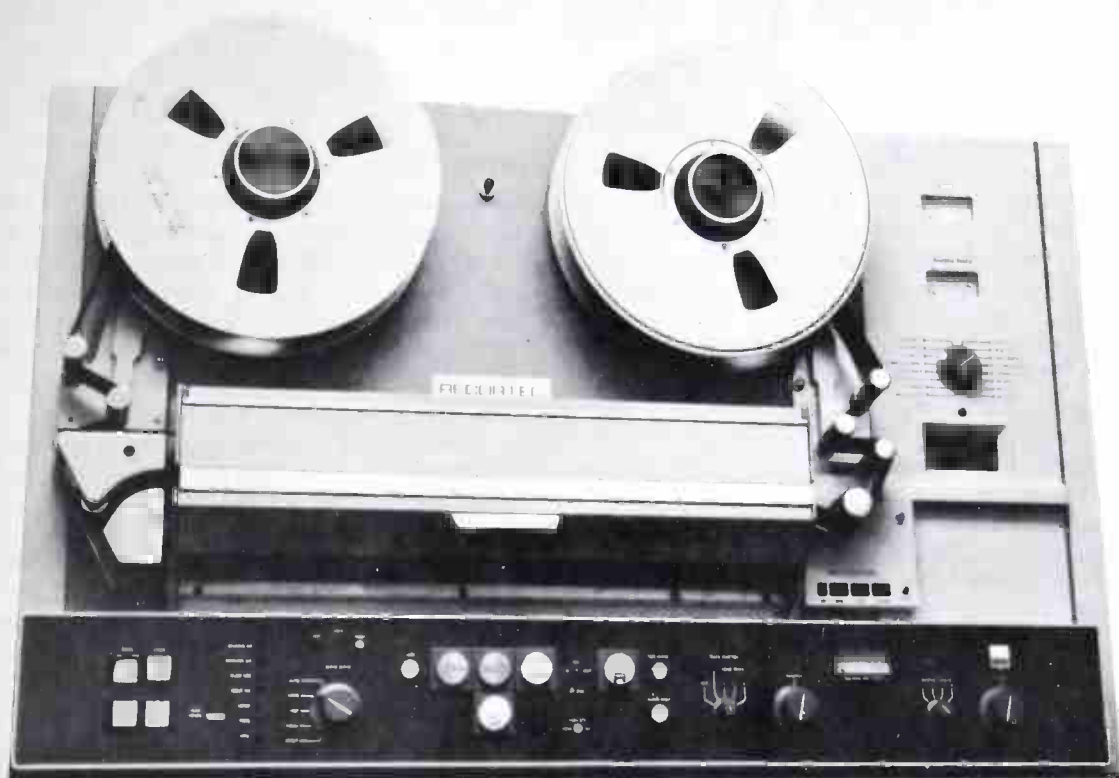
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Chicago NAB 1976 Showcase Of The Industry

If we judge by size alone, the NAB Convention '76, March 21-23, will be a huge success. There are more exhibitors than ever before, more square footage devoted to exhibit space and attendance is expected to break new records.

The best that the industry has to offer will be on display in exhibit booths. Best, in 1976, is measured not only in terms of highest performance but in terms of performance per dollar. Competition sees to that and there is plenty of competition this year—more than ever before.

1976 sees keener competition in transmitters than in previous years (not necessarily in numbers of manufacturers but fuller, more complete lines from those in business). There is sharper competition in radio automation in terms of product capability and broad competition in audio consoles with a fantastic variety of standard consoles available in 1976. There is more competition in the character generator/graphic display area with new sources appearing on the scene and old-time suppliers adding new wrinkles to their products. There's a wide open race developing for ENG dollars—in cameras, microwave, editors, etc. As digital video continues to make headway, we see new concepts emerge in frame storage/synchronizing devices, time base correctors, video special effects, video processors, electronic still store devices, etc. In the VTR area, non-quad systems proliferate.

Immediately below in selected categories BM/E describes some of the brand new equipment that will be at McCormick Place, Chicago. A list of exhibitors complete up to press time including a description of both new and familiar equipment that they will display begins on page 124.

Transmitters: full lines from many

The transmitter section will continue strongly trends of recent years toward more makers, with fuller lines: all the familiar mainstays of the industry are back, most with more transmitters than ever, and there are some newer ones, including one reappearance after a decade. The reappearance is that of Townsend Associates, whose line was taken over by Ampex some years ago; that arrangement has been terminated and Townsend will operate on its own, beginning at the current show with an exciter for UHF, new Klystron techniques for UHF, later introducing a full line of transmitters.

Collins, Continental, Harris, RCA, will have their extensive lines of AM, FM and TV transmitters. Harris' all-solid-state MW-1, the 1 kW AM that made a splash last year, is now well established (the big rival of last year, the Westinghouse 5 kW design, intended for licensing by other manufacturers, will not appear this year). McMartin will establish itself as a full-line trans-

mitter source with a number of new FM and AM models from 10 watts to 55 kW. CCA is back with a refurbished image, with an advanced FM antenna, a new 2.5 kW solid state FM, a new AM. Sintronics has their line; Collins new last year, has a new 25 kW FM; Acrodyne has new CCIR transmitters; AEL has two new models; Wilkinson has a new all-solid-state 250 watt FM; EMCEE has a new 5 watt backpack TV transmitter.

Among the transmitter accessories are some new brightened-up ideas: Bird has a series of harmonic filter and filter/couplers for FM, with 0.5 dB insertion loss and over 60 dB harmonic reduction; Electro Impulse has high-power dummy loads, for example 30 kW in compact package; Cablewave has a new dehydrator for coax. Both Moseley and Marti continue to expand remote-control choices, Moseley with a new digital system.

Antennas are plentiful too, with continued emphasis on circularly polarized TV antennas (anticipating FCC action) by Harris, Jampro, RCA, Micro Communications. Full lines of antennas will be there from Harris, RCA, Phelps Dodge, Jampro. Flash Technology is back with a strobe beacon system usable on "hot" AM towers. Transmitter tubes will be shown by Eimac (high power tetrodes), Thomson-CSF (klystrons) and Collins will appear as a source for all leading brands of transmitter tubes.

Audio consoles reflect new trends

The audio consoles are not going to lose their griping the "most competitive" title: just about everybody who showed consoles last year will be back, many with several new models. An innovation will be complete remote control of console functions, coming from Ramtek. Automated Processes will also show some DC control along with advances in several models. A newcomer to the U.S.) is the Audix line, to be shown by Rank. What we have called Robins/Fairchild or Fairchild/Robins is now firmly fixed as the Robins Broadcast and Sound Equipment Division, and will continue the Fairchild tradition of modular consoles. Philips will become an important console source. Among others who will play the full their established roles as console suppliers almost always with improvements reflecting the intense competition, are Audio Designs, Auditronics, Broadcast Electronics, McCurdy, Rupert Neve, Revox, Russel Ward-Beck, Dipol, QRK, Cetec, Sparta, LPB, McMartin, Microtrak, RCA and Wilkinson.

Audio processors and accessories; microphone, etc.

Prominent here will be the new Orban Optimod, a processor of radical design; a new Volumax from Thomson-CSF may furnish strong competition. Other compressor/limiter equipment will come from

Thomson-CSF (Audimax); Pacific Recorders and Engineering (Multilimiter); Automated Processes, and Broadcast Electronics, a newcomer here with a new "deluxe" unit. Such equipment will be seen in the exhibits of Cetec, Collins, Harris, LPB, McMartin, Marti, RCA and Shure.

Reverb units will be shown by MicMix, with a new series, and by AKG, in the Philips booth. Microphones are coming from AKG (Philips), Electro-Voice, Shure (with two new headband models), Beyer (Revox). Wireless microphones are from Comrex, Vega (both showing new "diversity" systems, with two spaced receivers and automatic choice of the best signal), and Swintek, English brand sold here by Alan Gordon. Turntables are from Russco, Microtrak, CCA, Harris, RCA, Pioneer, Sony, Panasonic and QRK.

Phono pickups will be shown by Shure and Stanton. McCurdy, as in earlier shows, will have a complete operating studio with turntables, console, all support gear.

Audio carts—new types

The new NAB specifications have spawned a new generation of cart machines. They will be there from all the established cart makers: Ampro, Broadcast Electronics, Garron, (Rapid-Q), Harris, ITC, McCurdy, QRK, RCA, SMC, Sparta and Telex. UMC, a newcomer here, has a whole line built on the Beau motors, the "Beau-

cart" series. There will be new cart splice finders: one from Ampro uses a special AGC circuit to prevent falsing on program level changes; Broadcast Electronics and ITC have improved cart splice finders. As for the carts themselves, Fidelipac will show the "Master Cart", aimed at extremely close phase control, and Capitol Magnetics will have the Audiopack, with similar design motivation. (See the article in this issue on a simple system for precise phase adjustment).

Audio tape machines

They will be there in plenty at the extremely high quality of recent years, but no radically new audio machine ideas were in the offing as this was written. Scully/Metrotech has a new model, the 285B. ITC will introduce an economy series, the 750. Otari has improved a number of models since the last show. Others showing well established machines will be Ampex, RCA, Willi Studer, Revox, Telex, Autotec, Nagra, 3M, QRK, Sony, Pioneer and Sparta. There is some rumor that Ampex will have a new machine.

Radio automation

As last year, radio automation systems continue to move in two directions: toward more elaborate, more flexible control and larger event capacity, often using microprocessor or computer control; and also toward

continued on page 108



Mini console/turntable unit by Microtrak.



Large console from Audio Designs.

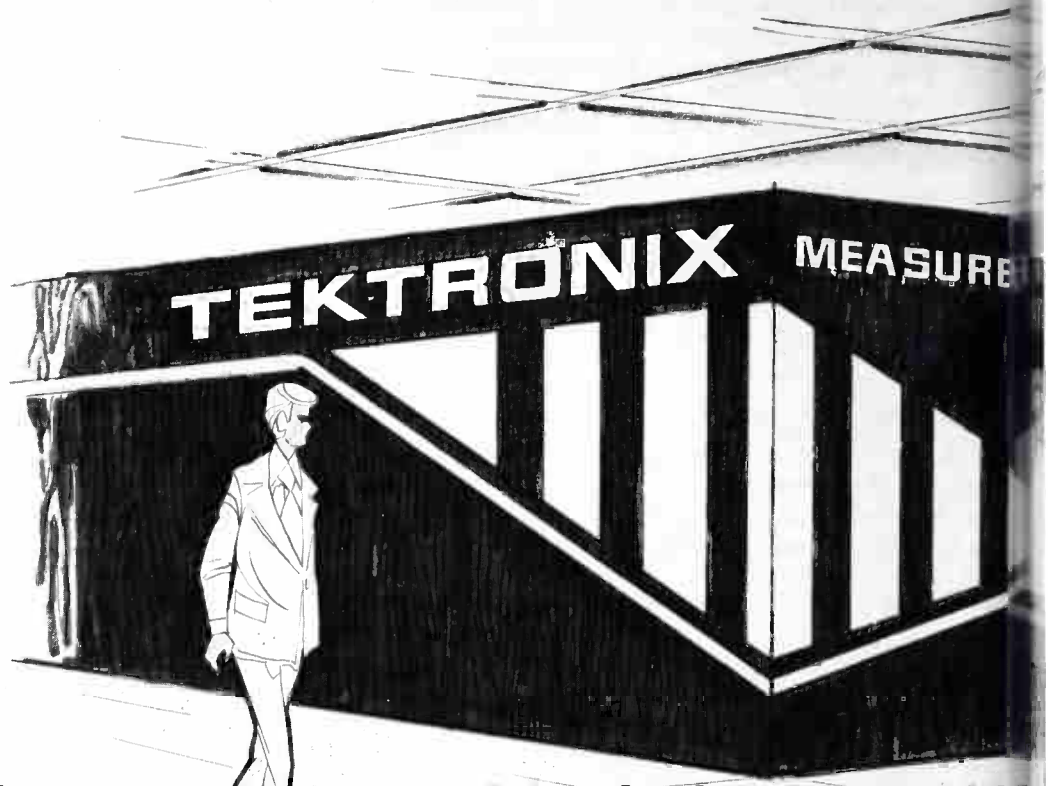


Compact audio console from Automated Processes.



New console to be introduced by Philips.

You'll find something the Tektronix Measure



New, effective measurement techniques and instruments for TV...for AM...for FM...for Audio

You'll find something new and interesting at NAB-76—scheduled presentations of Operational Measurements for AM, for FM and for Television in the Tektronix Measurement Theatre—you will also see new products for AM, FM, and Television operations throughout the Tektronix Exhibit.

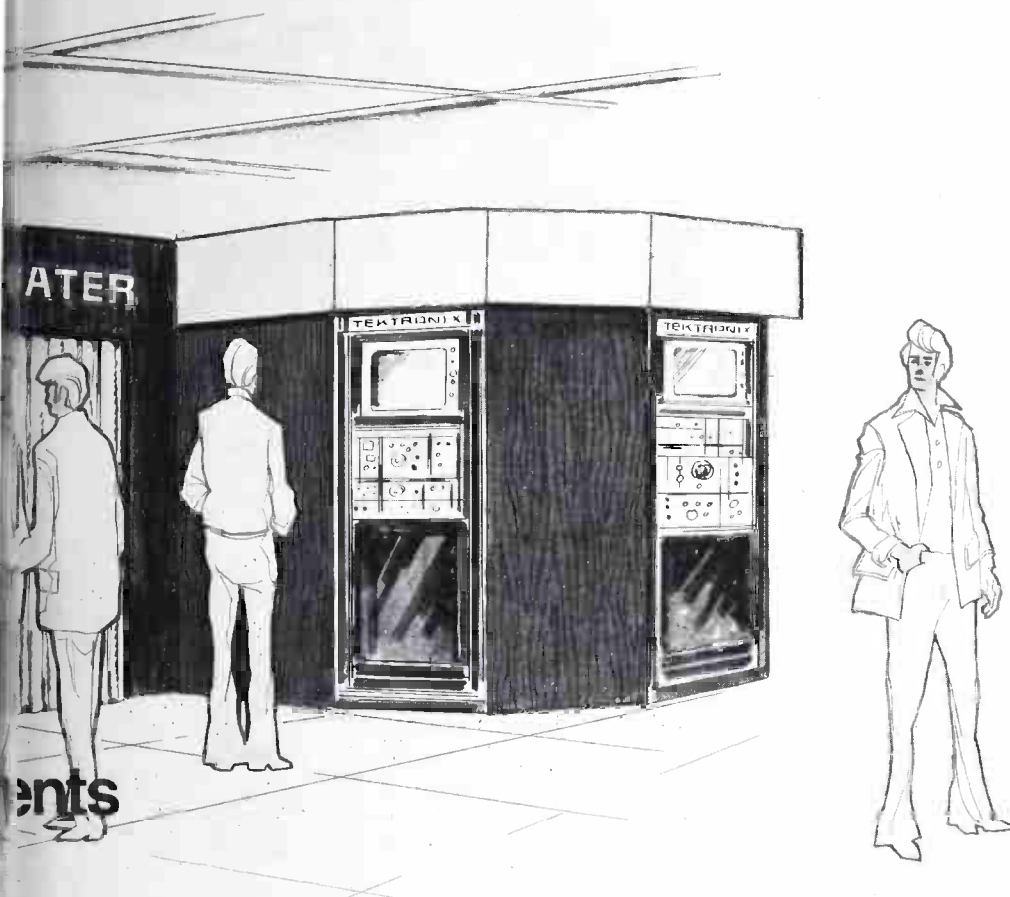
The Measurement Theatre presentations will be "how to" sessions. One will concentrate on AM Station Operations. Another on FM Station Operations. The third will cover measurements in Television Station Operations. The basic elements of each presentation will be Proof-of-performance procedures, monitoring requirements and day-to-day maintenance requirements. Audio systems tests and measurements will be a major part of the AM and FM sessions. If your work gets you into Audio, Video or RF, get yourself into the Tektronix Measurements Theatre.

See two **new generator series** in our exhibit. One, the 1410 Series, offers you unique flexibility that allows you to design the system that does your job best. Select from two color standards, three sync generators and four test signal generators and you can have just the capability you need. Need a master sync generator? Do you want a source of color bars, linearity test signals and a convergence pattern with (or without) sync outputs? Then again, you might want a genlock master sync generator plus one or more test signals. These are just a few of the combinations you can select from the 1410 Series.

The **second series of new generators are particularly easy to use.** The 1470 CCTV Sync and Test Signal Generator and the 1474 CCTV Sync Generator provide high-quality sync and test signals and will genlock to most hi-fi scan VTRs. You will find the push-button signal selectors on the 1470 provide all the commonly used test signals needed in a basic operation. Color bars, staircase, multiburst, etc. 1470 provides color fields for push-button adjustments as well as a useful convergence pattern.

Visit the Tektronix Measure

new and interesting in Exhibit Theatre at NAB-76



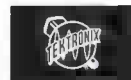
Looking for a **measurement-quality demodulator**? Look at the new Tektronix Demodulator. It uses a surface acoustic wave filter to achieve almost textbook quality Nyquist slope characteristics. With this demod and our new sideband adapter, you can determine exactly how well your TV transmitter is doing.

With the new **1405 Sideband Adapter** and a Tektronix 7L12 or 7L13 Spectrum Analyzer, you can produce a response curves of television transmitters with frequencies up to 1 GHz. The 1405 generates a composite video signal, the "picture" portion of which is a constant-amplitude sinusoidal signal which sweeps 15-0-15 MHz. Use the 1405 to verify the performance of RF, IF and video circuits of your transmitter.

Evaluating other RF and Audio Systems? See the full complement of new RF sweepers and tracking generators in our exhibit. These units, the SW 503 and TR 501 and 502, provide coverage from audio through UHF frequencies. With Tektronix Spectrum Analyzers the AM, FM and TV engineer can fully evaluate his system's performance in the frequency domain.

Considering a studio monitor? The new 670A is being shown. With variable aperture, this 17-inch color monitor is available now and attractively priced. Of course, we will be showing products to time, test, measure, correct and display the television signal too. Stop by and see us at NAB-76. We will be there to welcome you.

If you're staying at the Conrad Hilton, Palmer House or Hyatt Regency, start your day with the Tektronix **Television Measurement Wakeup Seminar**. 7-8:30 a.m., Channel 3 at the Hilton and Palmer House, Channel 12 at the Hyatt Regency.



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Exhibit Theatre at NAB-76

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simplified systems aimed at making the DJ's job much easier and surer with a moderate amount of equipment—and investment. In the first class is the new Schafer 903E, 8,000 events, using time-base control; the Control Design Mark III, and the SMC DP-2 with microprocessor control. Several others in this class will come over from 1975: the Harris System 90, RCA systems, Schafer/NTI 700 computer series. IGM will bring this year an intermediate system, the new Marc VII (manual assist remote control) which uses a microprocessor. Collins will show complete systems based on Control Design components.

Radio Programming will be stressed

Syndicated programmers will be strong this year on the exhibit floor itself, rather than in hotel suites as in earlier years, with at least five nationally-operative outfits demonstrating their wares, in most cases with listening booths. Broadcast Programming International will have several formats; Camex will have both an automated system and programming to go on it; Drake-Chenault will demonstrate their wide range of programs, as will Radio Programs, Inc. Michelson has something a little different: re-runs of famous radio dramas, now growing in popularity, including such long-runners as "The Shadow", "The Lone Ranger", many others.

ENG cornucopia of products

At least six brand new ENG cameras will be on display. Companies indicating that they would have new ENG cameras were Asaca, Ikegami, Hitachi-Shibaden, NEC, Sony and Thomson-CSF. Counting the recently shown Ampex BCC-2, the count is seven. As we go to press, we don't know if the Toshiba CK-38 will be ex-

continued on page 110



Philips LDK-11 is now ready for delivery.



New SK-80 backpackless ENG camera.



New York camerawoman is delighted with light weight of Thomson-CSF Microcam.

1975 Best Station Award Winners

In our December issue, BM/E described the layouts of nine stations that reflected creative but dollar-conscious thinking. We asked our readers to vote for two radio stations and one TV station that they felt should receive a Best Station Award Plaque. The winners for 1975 are:

Radio Station WIDR

Making A Student-Run AM-FM Production and Control Center Do Triple Duty—submitted by John McNeill, Program Director, WIDR, Western Michigan University, Kalamazoo, Mich.

Radio Station CHWO

Putting Two AM Stations 60 KHz Apart On The Same Directional Antenna Array (Saving A Half-Million In Real Estate Alone)—submitted by Alexander Velleman, Director of Engineering, CHWO, Oakville, Ontario.

TV Station WPRI

Triangular Structure Fits Site; Satisfies WPRI's Operation Needs—submitted by William Kessler and Associates, Inc., architects, on behalf of WPRI-TV, Providence, R.I.

Many congratulations to this year's winners and a reminder to stations currently re-modeling or re-building to keep our 1976 contest in mind!

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hibited or not—or whether it will appear under somebody else's nameplate.

We have no details on the new Asaca, Ikegami, or Sony cameras, but considerable information is available on the Thomson-CSF Microcam and the new contender from Nippon Electric. Both of these units were described at the SMPTE Winter TV meeting in January. Since then, Hitachi-Shibaden has released preliminary information on a new SK-80 unit.

All of these new cameras are broadcast quality and *extremely low in weight and low in power drain*. Hitachi and NEC have put all electronics in the camera head and do not require a backpack. Thomson-CSF has divided the electronics between a small camera head (8-lbs.) and a belt or over-the-shoulder pack (3-lbs.).

To give you some idea of where camera design is headed note these figures:

Hitachi-Shibaden	13.7lbs.	32 watts
NEC	13 lbs.	26 watts
Thomson-CSF	11 lbs.	22 watts

The lower power requirement means longer running periods without changing batteries. A chart display at the Winter SMPTE meeting by Thomson-CSF reveals the significance of reduced weight and power drain.

We have already described some of the Thomson-CSF camera features in BM/E January, 1976, page 50. These included an image enhancer, three-channel masking amplifier, full I & Q encoding with phase compensated I filter and a constant white balance circuit.

At Detroit, some additional specs were released: noise

NAB 1976



Marconi's Mark VIII P camera for field work.

is 52 dB at 4.2 MHz unweighted; resolution is 500 lines at center and limited only by the Plumbicon; sensitivity is down to five foot candles at f1.4. Unit has good stability.

continued on page 112

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NAB 1976

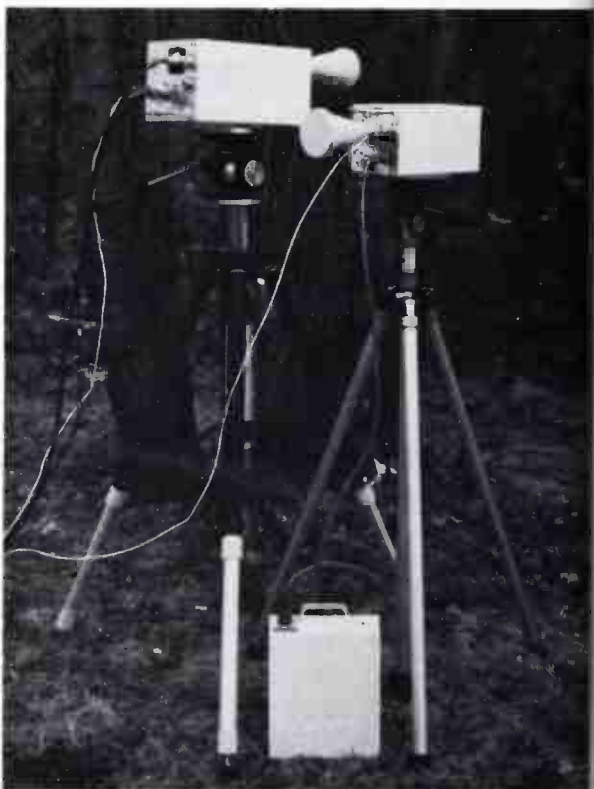
ity and works over the range of -20°C to $+60^{\circ}\text{C}$. Price is \$30,000.

In a paper at Detroit, NEC said design objectives for its new camera (in addition to light weight) were increased reliability and stability and that these could be achieved only if power consumption was a minimum, thereby reducing heating. Working with NHK Broadcast, NEC began developing a micro-powered process amplifier in 1974 which was tested in 1975. The results were so successful that NEC decided it could build the final camera design includes the following LSIs: video processor, encoder, pre-amplifier, synchronizing system and deflection system.

NEC says the LSI circuits reduce power ($1/4$ to $1/19$) and size ($1/4$ to $1/20$ th) and upgrade reliability. The process amplifier, for example, includes 126 elements. The company says it can use $3/8$ -in. Plumbicons, Saticon, or Chalnicons. Sensitivity is listed as 2000 lux at x (minimum illumination with $+6\text{dB}$ gain is 200 lux). S/N is better than 50 dB (p-to-p/rms). Working temperature range is listed as -10°C and over 45°C .

The Thomson-CSF camera uses prism optics; NEC uses a relay optical system which it says is now competitive with prisms because of improvements in coating techniques. Although NEC says prisms still are somewhat superior in sensitivity, lens exchangeability is poorer and, further, the center-of-gravity of relay optics can be put over the shoulder for easier camera handling.

BM/E is in no position to evaluate these different claims. What it does all add up to is a few busy days for engineers as they test out all those new cameras. (T)



Microwave Associates MA-13 CP portable microwave.



Nurad's new circularly polarized transmit antenna, the Goldenrod.

NEC camera, incidentally, will be shown in the TeleMation booth).

The new SK-80 self-contained Hitachi Shibaden is an all new camera designed for ENG use. It has three 2/3-in. tubes. The camera on exhibit will incorporate the Saticon H8397 tube which Hitachi feels is ideal for ENG work. Features are full I & Q encoding; H & V image enhancer; bias light; color bar gen; auto white balance; master pedestal; auto iris; 6 dB gain switch; 500 lines resolution at center; S/N 50 dB. There's a low battery indicator and ivideo level indicator in the viewfinder. Standard lens is a Fujinon 10:1 f1.9, auto iris. Camera accepts C mount and Arriflex lenses. Price is listed as less than \$20,000 and camera is available for delivery in June of 1976.

Hitachi will also show its remarkable single tube camera, the FP3030, using the exclusive tri-electrode tube. This camera does not match the quality of three-tube models but it has good colorimetry and stability and is of great interest to stations as a starter for getting into ENG.

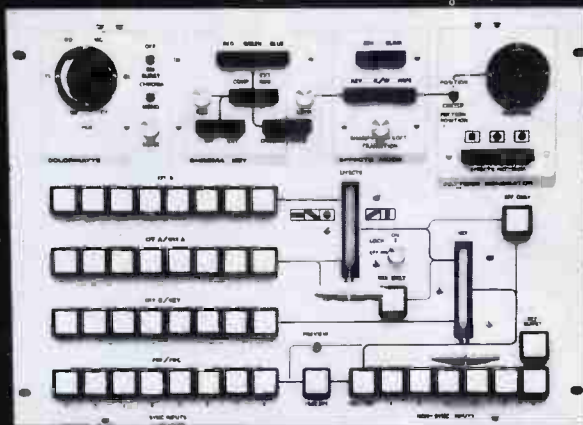
You will, of course, see heavy emphasis on ENG cameras at other exhibits. These include Akai, Bosch Fernseh, JVC, Philips and RCA. Philips has recently begun delivery of the LDK-11 and it's sure to be promoting this fact. Bosch-Fernseh will be promoting the KCN, already in use at many stations and RCA will be showing first production models of the TK-76. Panasonic is an exhibitor this year and it has a small two-tube camera along with a 1/2-in. VTR. Whether or not it will be promoted as an ENG system is not known.

ENG is a theme that will be played at many other exhibits. Camera pedestals for ENG will be promoted by ITE, Listec and Quick-Set. Microwave will be promoted by Farinon, Microwave Associates, Micro Communi-

continued on page 114

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NAB 1976

Highlights Of The Convention Sessions

The engineering and management conferences will have enough analyses, debates, guidance clinic technical presentations, mind-bogglers to keep the registrant busy five times over. A few of the many Big Top sessions will be: TV programming, with tips and discussions from a panel of industry leaders; a debate about pay cable, between cable operators and broadcasters; "The Business of TV", how to get local advertising national sales; "Audio Odyssey", a trip into broadcasting's future; how to make a radio station go, with results on the bottom line. There will be 25 radio and television workshops, on important subjects from programming to promotion to financial control, ENG operations, automation, etc., etc. The technical paper sessions cover a score of engineering subjects, and include the traditional question session with an FCC panel of top staffers. There will be the first report from the National AM Stereo Committee, given by the chairman, Harold Kassens. There will also be reports from the Engineering Advisory Committee and the Committee on Intersociety Coordination. A study of the program should lead any registrant to a list of many sessions he really wants to hear.

Important Speakers At The Convention

As this magazine went to press the list of important speakers included Richard E. Wiley, FCC Chairman, who will speak to the joint radio-television luncheon on Tuesday, March 23; radio commentator Paul Harvey, who will be heard at the radio luncheon on March 22; Senator Vance Hartke (D-Ind.), scheduled for Monday afternoon's television session; Representative Torbert MacDonaold, (D-Mass.), chairman of the House Communications Subcommittee, for the Tuesday morning radio session; and Representative Lionel Van Deerlin (D-Calif.), slated for the Tuesday morning television session.

The NAB Engineering Achievement Award will go to Frank Gregg Kear, consulting engineer and veteran innovator in the industry. The NAB Distinguished Service Award will go to Julian Goodman, president of NBC. The Federal Communications Commission, sitting all together en banc, will talk about important broadcast topics and answer questions from the floor.

communications, Nurad, RCA and Terracom. A new computerized Teledata Systems (Booth 939), will be on hand showing a control system for maneuvering microwave antennas.

Nurad will be stressing a brand new circularly polarized transmit antenna called the Goldenrod. It is equivalent in performance to a 2-ft. parabolic antenna but has less wind loading and is easier to handle. It will be used as the transmit complement to the Nurad Quadrupole GHz receive antenna now used by over 50 stations.

Farinon will stress an ENG version of its FV(2)P portable system. It is a dial-tuned unit with 6 or 20 watt power out. Terracom will have a new TCM-5 model on hand. Microwave Associates will feature the MA-1 microwave "window" system. Communications for ENG will be the subject of an exhibit by Comcon.

continued on page 16

FOR TODAY'S GREATEST VALUE IN A STUDIO TAPE DECK, YOU'VE GOT TO COME TO A (PARDON THE EXPRESSION) HI-FI COMPANY.



See the new RT-2022 in Booth 837 at the NAB Show.

Additional broadcast and recording-industry suppliers, with their low-volume high-profit operations, are in no position to make a tape deck like the Pioneer RT-2022 anywhere near its price.

Even though the RT-2022 competes with their best in versatility and performance.

It's a 3-motor, 3-head, 2-track deck, with speeds of 15 and 7½ ips. Its design is completely modular, with transport, controls and electronics on three separate chassis. The head assembly is interchangeable, so that 4-track heads can be snapped in for either 2-track operation or quad. For quad, a second electronic section can be mounted.

Perhaps the most outstanding feature of the

RT-2022 is simultaneous sync monitoring for live overdubbing. Another is the built-in calibration oscillator (1000 and 10,000 Hz). It's front-panel controlled, just like the continuously variable bias and the multiple EQ. Head alignment is accessible right through the head cover. Some hi-fi machine!

If you're a professional whose budget is limited, so is your choice.

 **PIONEER**[®]

Anyone can
hear the difference.

U.S. Pioneer Electronics Corp., 75 Oxford Drive, Moonachie, NJ 07074. (201) 440-8100. West: 13300 S. Estrella, Los Angeles, CA 90248. (213) 323-3101. Midwest: 1500 Greenleaf, Elk Grove Village, IL 60007. (312) 593-2960.

Circle 180 on Reader Service Card



New lens from Canon.

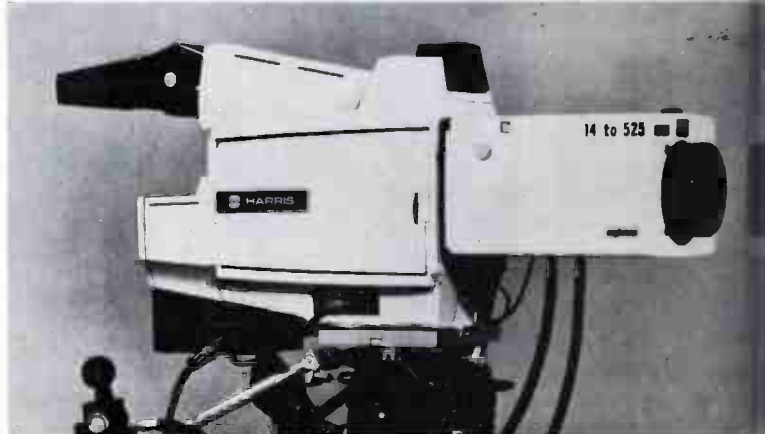


Family of cameras from CEI, including the CEI-287.

The new TC-80 camera from Harris.



New lens from Schneider.



If you are thinking of running two ENG cameras or a camera and a VTR, or if you want to do some keys or wipes during editing, Shintron will show you a switcher for the job. It's a three bus color switcher and includes an edit code reader/generator.

Editors for ENG/production

Much of this year's editing equipment will stress ENG. As we mentioned, Sony will unveil at the show a new line of broadcast equipment which will include a pulse counting editing system. CMX Systems will unveil a new time code system for ENG, the 34X priced under \$20,000. System is expandable until it has full production capability.

Also in the mystery class is a new announcement from Datatron. It's called Tempo '76 and is described as a new generation of editing equipment built around a concept of time sync. Datatron says it is tomorrow's technology available today. It's at booth 409.

Beta Technology says it will have a new editor for video cassettes at the show, the model 650. Possibly Recortec will show something in editing too.

Editing is a feature of the new JVC videocassette unit, the CR-8300. It has an optional remote control panel which means it, too, should be mentioned in this section. Cooke Engineering will have a new SMPTE generator/reader.

Somewhat surprising is the fact that the dynamic up-start TRI will not be exhibiting. TRI apparently cancelled out because it could not get its hands on the new Sony broadcast cassette unit. Without the new version, it

did not have a significant new product to introduce so sitting out this NAB.

Studio cameras will fight for attention

Although ENG cameras are the hot item this year there will be plenty of emphasis on studio units. Don't be surprised to see Ampex put on a huge camera show. It will stress a full range of all-new-cameras—the studio BCC-1, the battery-powered portable BCC-2 and the low cost field unit the BCC-3. Highest quality yet flexibility will be Ampex's theme.

A brand new studio camera will be shown by Harris—the TC-80. It's a top-of-the-line type and offers a carrying cable as one of its options. Commercial Electronics will show a new studio camera, the CEI-287. Most camera manufacturers will display systems already introduced to the market.

Lenses: still more

There's a never ending stream of new lenses—lenses for studio cameras with extended capabilities and lenses for new ENG cameras.

Angenieux will have a new 42xf2 lens and a lightweight (2-lb.) 15xf2.5 system for close focus. Canon will introduce a new series of one-inch Plumbicons—which it calls the "ultimate". Fujinon will stress lenses for ENG cameras. Schneider (Telec booth) will have two new ENG lenses plus a new 3 lens with a focal length of 34 to 1020 mm. Rank will exhibit lenses, but we have no details on types. A full

continued on page 117

Old-New Reel Time Recorder

Telex/Magnecord series 1400 broadcast quality recorder/reproducer. An old name that spells reliability. A new design for today's state of the art.

The Old. Telex/Magnecord products are still made in the USA so parts and service are always available. The series 1400 is still built on a solid die cast aluminum main frame for reliable operation around the clock. It's still available in full, half and

quarter track configurations, has fail safe differential brakes and accepts 8 1/4 inch reels. It also still comes with three motors—but then, that's touching on the new.

- The New. A brushless d.c. servo drive with a crystal oscillator control reference so accurate it virtually eliminates program timing errors. New, three speeds: 3 3/4 - 7 1/2 - 15 ips. New catenary head block for straight tape loading, the convenience of one hand cueing and the bi-level illumination of push button controls. New DTL logic controls eliminate EMI and provide fast, spill

proof tape handling gentle enough for half mil tape. And new electronics, clean to 60 dB S/N at all speeds.

- If you're looking for a real time, reel recorder with old name reliability but designed for today's demands, you'll find it in the Telex/Magnecord series 1400. For complete information please write:



PRODUCTS OF SOUND RESEARCH

TELEX
COMMUNICATIONS, INC.

9600 ALDRICH AVE. SO. • MINNEAPOLIS, MINN. 55420 U.S.A.
Europe: 22, rue de la Legion-d'Honneur, 93200 St. Denis, France
Canada: Telak Electronics, Ltd., Scarborough, Ontario
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lens adaptor will be shown by Comquip.

VTRs still broadening out

Although quad has demonstrated its staying power in the broadcast industry through the introduction of the compact AVR-2 from Ampex and the TR-600 from RCA, there will be a further assault on quad supremacy

ENG lens from Fujinon.



New contemporary look in operator keyboards, the Vidifont Mark IV from Thomson-CSF.

from helicals.

As mentioned, Sony is expected to capture a lot of attention with the introduction of its new broadcast quality U-matic cassette unit. JVC will show a line high competitive with the Sony 2850/3800 combination. Bosch Fernseh will introduce to the U.S. market the BCN segmented helical-scan series (portable-through studio units) now catching favor in Europe.

IVC will continue to highlight the IVC 9000 but says it will have an expanded line of 2-in. and 1-in. VTRs on hand.

The NAB marks the 20th anniversary of videotape recording and one can expect to see a little nostalgia exhibited by both VTR and videotape manufacturers.

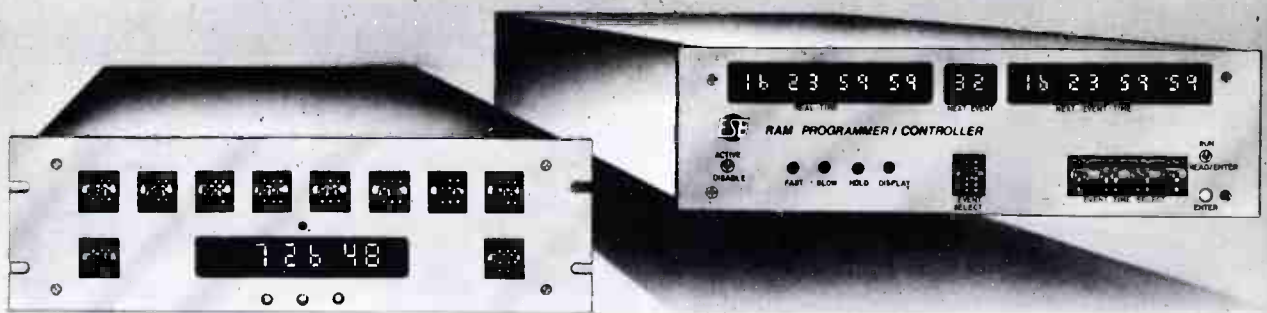
This year there will be two video disc systems demonstrated. Data Disc returns with a competitor to the Ampex slow-motion system and Eigen Video will exhibit a low cost slow-motion/freeze frame system using the floppy disc.

Videographics—new dimensions

The character generator field that we have watched expand over the last several years is becoming a large entity we call "videographics". There is continued movement toward extremely flexible and easy manipulation of graphics on the screen, often with computer control, balanced with a trend to lower-cost, simplified units. Chyron will introduce a "dynamic montage unit" for montage and animation of graphics; Thomson-CSF's new Vidifont IV has interface for camera art; RCA's computerized system will have improved operability

continued on page 1

PERFECT TIMING



Programmer/Comparators and Controllers

Whether your station is based in New York, Honolulu or anywhere in between, perfect timing of programs, station breaks and commercials is essential. To meet your exacting timing requirements ESE now offers two precision timing systems. For flexibility and economy with up to ten events, ESE has designed the 750 Series of Programmer/Comparators. Rugged thumbwheel programmers coupled with an ESE clock or timer to provide a single pole contact closure (1 Amp contact rating) for the length of time program matches display. Low on cost, the reliable Programmer/Comparators start at \$305. Write, Wire or Call Today: 505½ Centinela Avenue



When you want to program more than ten events, consider the ES 780 Series of Programmer/Controllers: A Solid State Random Access Memory united with an ESE clock or timer to provide 32 user-programmed outputs. Ten minutes is all you need to program all 32 events. Manual override and ten second re-programming provide maximum flexibility. All this in 5¼ inches of rack space! Internal crystal time-base and battery pack are standard features. Four digit, 32 event units are \$1,200 and Eight digit, 32 event units are \$1,500. Custom options and special orders are available. Inglewood, California 90302 • (213) 674-3021

WHAT IS DUCA- RICHARDSON

Producer of the most advanced video switching systems on the market.

At Duca-Richardson we consider it our greatest challenge to design and build the finest and most advanced switching systems equipment on the market.

What you see below* is the result of our breakthrough technology and common sense effort.

It's the heart of the most advanced switching system you can own.

Here's why:

It is the ultimate in simplicity of operation, achieved by grouping ALL of the operating controls on ONE unified FUNCTION MODULE subpanel, where any of seven switcher functions can be initiated with a SINGLE pushbutton. The result is a cluster of controls within easy reach and a display of switcher status easily visible at a glance.

You can preselect any of 99 wipe patterns, 9 key modes, and automatic transition rates from 0.1 second to 9.9 seconds by depressing pushbuttons on an innovative KEYBOARD, similar to those on hand calculators. The numbers corresponding to selected modes appear in a display Register. By depressing the Transfer Button, the numbers shift from the Register to one of the Mode Displays and simultaneously enables the appropriate mode control in the FUNCTION MODULE.

With a special dual function transition, you can display a CHROMA KEY in the foreground, AND

independently controlled MIXES OR WIPES, in the background. INLINE KEYERS added to the buses give you a titling capability BEHIND the chroma key so that title keys can be wiped or mixed as transitions are made from bus to bus. Bilevel techniques eliminate the halos and edge noise and allows you to chroma key on very thin shadows.

You can do INSERT KEYING from any source (PVW Bus, B Bus, or External) and these can be bordered in the DOWNSTREAM KEYER. You can adjust borderline luminance from black to white, and outlines can be COLORED in the outline mode.

SOFT COLORED BORDERS are also possible. You can independently adjust width, softness and color of pattern borders, to give you colored borders which can vary from wide to narrow and soft to sharp in any combination.

With features like these it's easy to understand why Duca-Richardson is the most advanced company of its kind in the industry today. They produce the kind of extraordinary switching systems, custom and standard, that professionals search for... and at prices that make sense.

For specifications, quotations and delivery dates, call Duca-Richardson Corp. today at (303) 697-9202 or write: P.O. Box 2469, Evergreen, Colo. 80439.

THE NEW IDEAS COME FROM

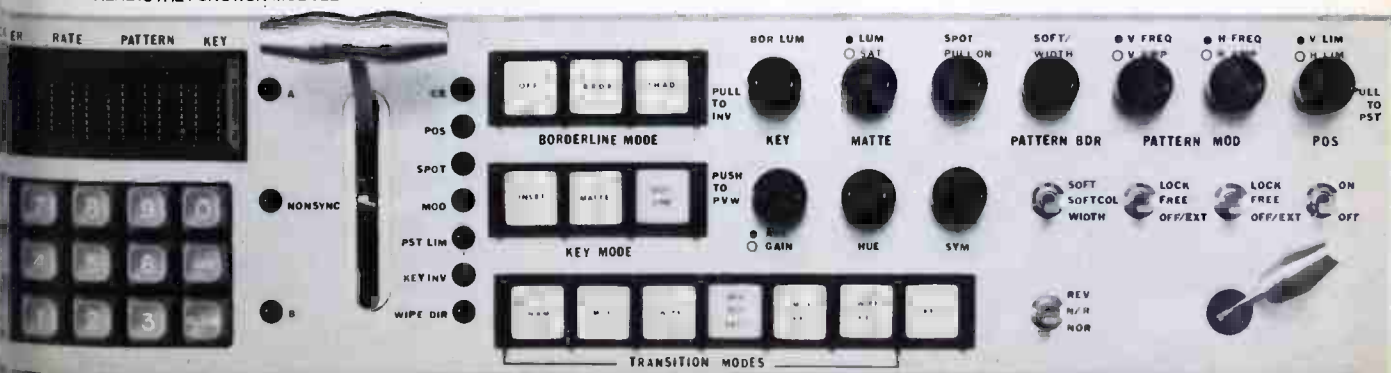


DUCA • RICHARDSON CORPORATION
P.O. BOX 2469, EVERGREEN, COLORADO 80439



*SHOWN HERE IS THE FUNCTION MODULE

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3M is expanding the Datavision line, taken over last year, with new models of various functions; Laird and Telemation have new medium-priced models. Among the low-cost units is one from 3M, others from Kansas State, Knox (a newcomer). Broadcast Electronics (Scriptel) and Telescript will show systems apparently not using electronic character generation; details at the show.

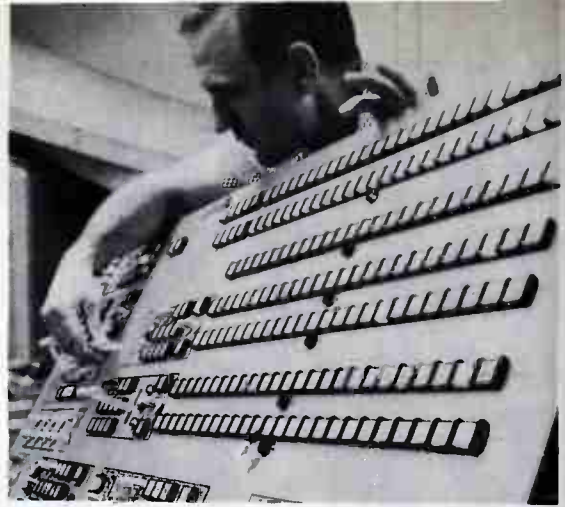
Low cost character generator from KSN.



Production gets new aids

In addition to new things in videographics, you can expect to see something new in video switchers. Richmond Hill will return again to NAB, this time with a fully automated television switching system. Vital will show new switchers with star special effects patterns.

Grass Valley isn't tipping its hand before show time, but Central Dynamics says it will have a radically new video production system. Tied in with the new switcher



New production switcher from Computer Image.

is a new sequential effects generator that does something entirely new in special effects.

Production is the theme of many other exhibits: American Data (a new 558 series), Industrial Science (new 1200 series), Computer Image (new large 72437 switcher), Dynair (Chromatech line), Comtech (low cost switcher), Telemet (the 7960A) and Shintron (E switcher).

Business automation and technical automation will be linked more closely this year than ever. Data Communications (BIAS) will show actual demonstrations, how a system interfaces with three popular production switchers CDL, Grass Valley and Vital. Cox Data will also show an interface to switching systems.

continued on page 124

Production Power

Creating sound that stands out on the dial isn't easy. It takes creative people and powerful tools. One of the most powerful is the Orban/Parasound Parametric Equalizer. Unlike conventional equalizers, the Orban/Parasound Parametric gives you complete, continuously variable control over tuning, bandwidth, and amount of boost or cut. For the first time, you have the power to tune your sound exactly the way you want it. No more compromises.

The four equalization sections each tune over a 20:1 frequency range, and are cascaded to avoid interaction. All potential overload points are monitored by a "peak-stretching" overload indicator, and overloads are instantly correctable with the front-panel gain control. The overload/noise ratio is an outstanding 106 dB, and the harmonic distortion is typically 0.006% (1kHz at +18 dBm). This recording studio quality assures clean, transparent sound

whether you use the Orban/Parasound Parametric in production or live on the air.

Best of all, this versatility comes for less than \$370/channel in the dual-channel version, with Orban/Parasound's proven quality and reliability. This month, put the creative freedom and production power of the Orban/Parasound Parametric Equalizer in your station. You'll be well on your way to creating the audience-grabbing, sponsor-pleasing airtone you've always wanted.

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orban/parasound

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(415) 673-4544
or your local Orban/
Parasound distributor.



Write for free brochure called, "How to Choose Equalizers for Professional Recording Applications."

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Smart switcher



CDL has just raised the standard
for video production switchers. Again.

The CD-480 is the first totally new full scale
production switcher from CDL in 7 years.

It offers every wanted feature, from superb
chroma keying to Rotating Wipes with Colored
Borders and Soft Edges.

We applied unique technology to create an
operator's "dream". A *single* CD-480 Effects
amplifier can perform production sequences
that are not possible even on a conventional
multiple M/E switcher.

The CD-480 is not just a new switcher, but a
completely modular production system.

Call us!

CD-480
gives you the
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advantage!



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New video processor

If you've been thinking about buying a frame synchronizer to avoid those gen locking problems encountered with remotes, you'll have plenty to investigate at NAB. NEC is expected to show some new options and CVS, which created a big stir last year with its video compression option will be there promoting its units heavily. But unless NEC or CVS comes in with some surprises, a lot of their thunder is going to be stolen by another company, Quantel Ltd. of Caterham, Surrey, England, doing business in the U.S. through Micro Consultants, Inc., Palo Alto.

Quantel's DFS 3000 Digital Framestore Synchronizer does everything the predecessor units have done and it does it in a smaller, lower power drain unit. It also sports some features not heretofore available—it's both a frame store synchronizer and a time base corrector. Its "look ahead" velocity compensator comes into play when the remote VTR is a direct-record helical. When it's a color under remote, such as the Sony U-matic, a standard velocity compensator functions.

As with all synchronizers the inputs to the equipment may be a non-synchronous network feed or VTR sources. The output from the DFS 3000 locks to local station vertically, horizontally and in color, providing facilities for production mixing, fading and special effects without the need for any gen-lock operation.

Special effects are incorporated enabling the picture

size to be reduced by four to one and positioned anywhere on the monitor screen. A "freeze" facility provides one frame storage and continuous display for stop motion effects.

All of these capabilities are packaged into an equipment which occupies only 8.75-in. of panel space and dissipates less than 250 watts. A great deal of attention has been paid to reliability. The store uses 16 cards (total capacity 3M bits or two fields stored at an 8 bit level). Standard MOS technology is used but it is organized to optimize the performance with an NTSC format. All cards are identical and therefore interchangeable in event of failure.

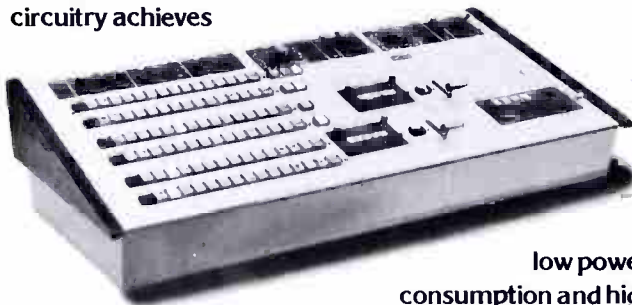
Test equipment

Measurement will be very big on the floor, with a number of new and improved systems reflecting a steady upgrading of standards, the desire for faster, easier, more accurate testing. The Tektronix "measurement theatre" will show how it is actually done. TV, FM, AM, for proof of performance, monitoring day to day maintenance, both audio and radio functions fully covered. Audio Designs will have an audio spectrum analyser that puts 28 vertical bars, representing amplitude every 1/3-octave, on a CRT. Sound Technology will have their combined oscillator/measurement unit that determines audio distortion to 0.002%. Rotund and Schwarz will have automatic measurement systems for TV. Belar has a new RF signal analysis system; Decca a new high-precision antenna monitor. Marconi will show their line of instruments. Potomac has a new line of

continued on page 4

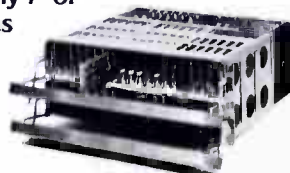
Switch to the Ross family. It's a new generation.

Maximum production at minimum cost. It's ideal. To achieve it we came up with a new generation. Ross Video Production Switchers. Cost effective design gets the best and the most for less. State of the art CMOS circuitry achieves



low power consumption and high

reliability—human engineering combines sophistication with ease of production and logical operating procedures. Space efficiency opens up a dramatic new range of applications. Look into the RVS16-6. 16 inputs, 6 buses, dual effects generators and more, much more. Complete production capability with an electronics and power supply package that occupies only 7" of rack space. The RVS16-4 features 16 inputs, 4 buses and effects generator—and for maximum production flexibility at minimum cost, there's our



new 10 input 4 bus RVS10-4. It's available in two formats: conventional remote control panel, or super compact, integrated electronics/control package at a super low price.

Ross Switchers are in use in major broadcast installations. Check our specs in the largest studio or the most mobile mobile, Ross Video Production Switchers are right at home.

Illustrated is our top of the line RVS16-6. Ask for technical literature on our full family of switchers.



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RCA power tubes of the future have a remarkable past: actual lifespans up to 30,000 hours.

Tube Operating Hours Reported by 20 TV Stations*		
Up to 5 kW	24,142 hrs.	21,329 hrs.
Types 8890 & 8806	12,263 hrs.	19,200 hrs.
Aural service	16,200 hrs.	14,000 hrs.
Up to 12.5 kW	10,096 hrs.	10,525 hrs.
Type 8891	9,402 hrs.	
Visual service		
Up to 17.5 kW	16,600 hrs.	18,300 hrs.
Type 8807	29,800 hrs.	21,200 hrs.
Visual service	30,100 hrs.	20,400 hrs.
Up to 27.5 kW	9,778 hrs.	9,776 hrs.
Type 8916	7,875 hrs.	13,183 hrs.
Visual service	10,799 hrs.	

* Serial numbers and tube type data available on request

RCA power tubes are at work now in new-generation color transmitters. Proving their value with an excellent combination of high gain, high linearity, plus long operating life.

Documented long life. In the table, you can see actual operat-

ing hours reported by 20 TV stations. That reliability comes from RCA's sturdy, coaxial CERMALOX® construction and thoriated-tungsten mesh filament, which minimize inductances and feed-thru capacitances. So you can use simple, economical broadband circuitry.

In fact, RCA can supply you with the right circuit and cavity to go with the tube you select.

For high performance and proven long life in a wide range of power tubes, there's one thing to do. Contact your RCA Representative. Or, RCA Power Tube Marketing, Lancaster, PA 17604. Telephone 717/397-7661.



RCA

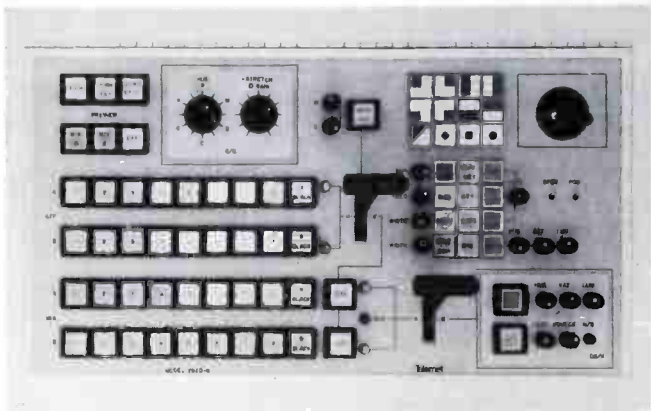
Circle 187 on Reader Service Card

strength meter; Time and Frequency Technology a new modulation monitor; Tentel new tape tension gauges.

Interesting miscellany

A few miscellaneous, interesting exhibits will be: Ke Marketing's "Instapoll", system for transmitting recorded poll questions automatically to dialed phone and recording the responses; Lightning Elimination Associates' method for prevention of lightning strikes to protected structures; Scientific-Atlanta's complete satellite earth station; Sansui's complete QS quadraphonic (matrixed) audio line. AM stereo will also be shown by Belar (and maybe RCA) and it too will be of special interest.

Cinema Products will be showing a CP-16R reflex camera with a Cinevid-16 video-assist camera. The video camera feeds three monitors. Camera Mart is a new exhibitor this year. If you see something you like and don't want to buy it, rent it from Camera Mart. **BM**



New Telemet Model 7960 production switcher.

Complete Listing of 1976 NAB Exhibitors

Acrodyne Industries (Booth 109)

Will introduce a new series of CCIR transmitters with power ratings to 2.5 kW; on display the 500-watt PAL-B unit from this series. Also introducing: a new 100% solid state 10-watt TV translator. Also covered: complete line of TV transmitters and translators.

Akai America (Booth 545)

Will show the complete line of color cameras and VTR's for ENG, including the new VT-150-EP VTR designed to interface with the TRI-EAS video tape editor. Also introducing: the Model TBC-150 time base corrector, usable with most helical scan VTR's; the Model SEG-161 vertical interval switcher/special effects generator, designed for use with the Akai CCS-150M color camera or any other color camera with external control, along with the new color sync generator, Model CSG-162.

Alford Manufacturing (Booth 503)

Will show antennas for FM, TV, microwave; RF transmission line equipment and accessories.

Amco Engineering Co. (Booth 827)

Will show stylized communications consoles, instrument cases, cabinets; will demonstrate expansion from smaller to larger enclosures.

- Late Exhibitors

 - Broadcast Programming Int'l, Booth 803
 - Camera Mart, Booth 935
 - Cine-60, Booth 913
 - O'Connor Engineering, Booth 916
 - QEI, Booth 943
 - Tepco Corp., Booth 934

American Data Corporation (Booth 403)

Showing for the first time the Model 558 and 553 video production switchers; 558 is primarily for large studios and introduces a "four-channel video mixer"; 553 is primarily for small studio applications, including ENG and remotes. Also showing the full line of other video switchers.

American Electronic Laboratories (Booth 601)

Will introduce two new transmitters: the FM-5KE and the AM-5KE. Also showing the FM-25KE and AM-10KD transmitters, antenna towers, buffers, reject loads, combiners, other RF gear.

Ampex Corporation (Booth 513)

Will emphasize the introduction of their new line of studio cameras, including the BCC-1, BCC-2, and BCC-3. Also showing their comprehensive line of video and audio equipment. And, as in past shows, likely to unveil some completely unannounced items, in tune with the policy of giving little advance notice.

Ampro Corporation (Booth 812)

Will show a line of redesigned audio cartridge player/recorders conforming to present and proposed NAB standards. Also introducing: second generation electronic splice



Ampro cart built to new NAB standards.

finder for cart machines, using AGC to eliminate response to program material or erase/bias tone; new modular studio furniture; a new turntable pre-amplifier with built-in remote motor start; new LED peak-reading VU meters as optional on audio consoles, as addition to standard VU meters. Also showing: line of broadcast audio consoles.

Andrew Corporation (Booth 504)

Earth station antennas; TV and microwave antennas; transmission lines and line accessories.

Angenieux Corp. (Booth 304)

Will introduce the new 42X16E11, f/1.6 lens for small and large studio production, and the new 15X12.5, f/2.8 lightweight (2-lb.) lens with 24-in. close focusing, extended zoom, and wide angle. Other lenses to be shown: 10X14E11, f/1.6 and the 18X20.5E11, and the 15X18E61 for 1 1/4-in. format and the 15X9.5 for 3/5-in. format.

Anixter-Mark (Booth 130)

Microwave antennas and accessories

Asaca Corporation of America (Booth 614)

Will introduce a new camera for electronic news gathering. Will feature a complete ENG system, with camera and VTR. Also shown: the ACC-300 portable color camera.

Atwood Richards Telescreen, Inc. (Booth 915-917)

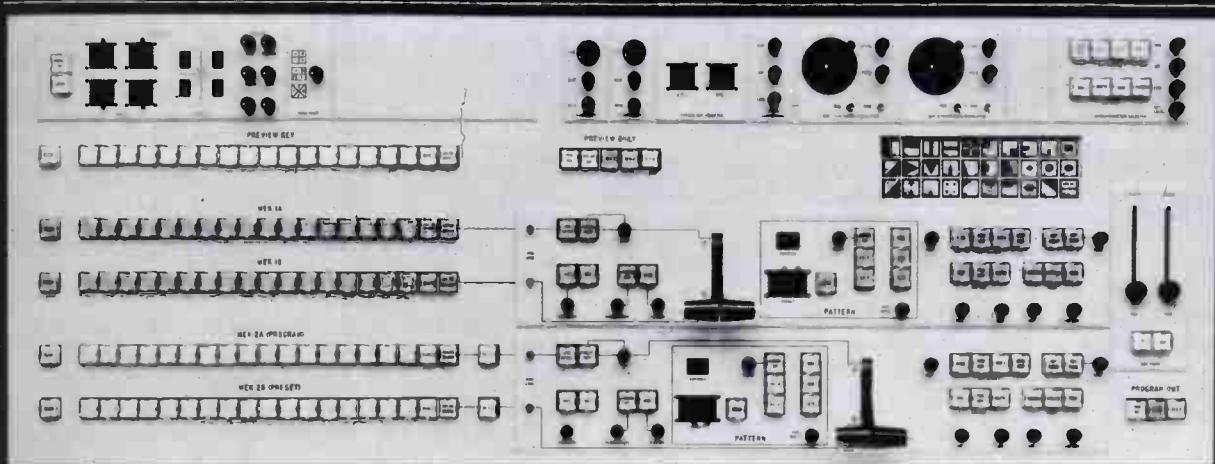
Will show Muntz big-screen television, first time at NAB. Also showing video cameras.

Audio Designs and Manufacturing (Booth 511)

Will emphasize their custom audio equipment

continued on page 12

WE OFFER MORE (*)



WITH THE AMERICAN DATA 558

(*) WHICH FEATURES THE ONLY FOUR CHANNEL MIX EFFECTS SYSTEM AVAILABLE — ALLOWING ALL OF THESE PRODUCTION FUNCTIONS TO BE DONE ON A SINGLE MIX EFFECTS AMPLIFIER.

- A-B Mix or Dissolve
- A-B Wipe
- A-B Wipe with Border
- A-B Wipe through 100% Border
- Mix or Dissolve to a Preset Wipe
- Wipe to a Preset Wipe
- Bordered Wipe to a Preset Wipe
- Mix or Dissolve to a Key
- Wipe to a Key or Wipe Key
- Mix to a Bordered Key
- A-B Mix Behind a Chroma Key
- A-B Wipe Behind a Chroma Key
- A-B Wipe with Borders Behind a Chroma Key
- Mix-Wipe or Bordered Wipe to a Preset Wipe Behind a Chroma Key
- Mix or Dissolve to a Luminance Key Over a Chroma Key
- Wipe to a Luminance Key over a Chroma Key
- Mix, Wipe or Dissolve to an Electronic Spotlight Behind a Chroma Key
- Mix or Wipe to a Quad Split, with or without Borders, Behind a Chroma Key
- Luminance Key over a Quad Split behind a Chroma Key
- And More —

SEE FOR YOURSELF
NAB BOOTH 403

AND JUST THINK — THE 558 HAS TWO!



AMERICAN DATA DIVISION

AIRPAX ELECTRONICS, INC.

401 WYNN DRIVE • P. O. BOX 5228 • HUNTSVILLE, ALABAMA 35805 USA • TELEPHONE 205 837-5180 • TWX 810 726-2125

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404 633 2100

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ROCKVILLE, MD 20853
301 460 1454

3250 WILSHIRE BL. STE900
LOS ANGELES, CA 90010
213 387 7156

2308 MULBERRY
PASADENA, TX 77502
713 941 7272

233 W. HILL AVE
GLENN ELLYN, IL 60137
312 469 6200

Cambridge Division
Cambridge, Md.
Circuit Breakers & Switches

Controls Division
Ft. Lauderdale, Fla.
Tachometry & Control Instrumentation

Circle 188 on Reader Service Card

Our Bicentennial special: Trade up to a CP-16/A and save up to \$2100!

Whatever you're shooting—newsfilm, documentaries, spot commercials—you'll find that our non-reflex CP-16 and CP-16/A camera models continue to make excellent equipment (and dollar) sense. Especially for those who operate "one-man-band" style.

Its proven performance in the field has established the CP-16 as the most reliable and dependable camera system, the *standard of the industry*.

Isn't it time you moved up to CP-16?

A Bicentennial special from Cinema Products and your local CP-16 dealer.

To introduce you to the CP-16 camera system, a system fully supported by an extensive, well trained dealer/service network, we are pleased to offer you, for a limited time only, a unique opportunity to acquire a CP-16 or CP-16/A at fantastic savings!

We can guarantee this special offer only until July 4, 1976. Beyond that date, discounts would depend on camera manufacturing costs holding steady and the availability of Angenieux lenses at present prices.

Retire your antiquated 16mm cameras and outmoded lenses.

Here's all you do.

Trade in any 16mm camera you presently own—whatever its condition, no matter how old—for a brand new CP-16/A with Crystasound amplifier and save \$1245 off list. Or \$1000 off on a standard CP-16.

Better yet, trade in any 16mm camera together with lens and magnetic head for a new CP-16/A with Crystasound amplifier and magnetic head and Angenieux zoom lens, and save \$2100.

Study our discount chart, and pick the package deal that suits you best. (Remember, these savings are *in addition* to the discount you normally get when you buy a CP-16 camera/lens package.)

WHEN YOU PURCHASE:	TRADE IN any 16mm camera... Get a DISCOUNT of:	TRADE IN any 16mm camera and lens... Get a DISCOUNT of:	TRADE IN any 16mm camera, lens and magnetic head... Get a DISCOUNT of:
CP-16 (Code # 1C216) Standard Camera Model,	\$1000		
CP-16 (Code # 1C216) as described above ... and choice of: Angenieux 9.5-57mm AV30 Lens Or Angenieux 12-120mm AV30 Lens	\$1350	\$1575	
CP-16/A (Code # 1C272) with Crystasound Amplifier	\$1245		
CP-16/A (Code # 1C272) as described above ... and choice of: Angenieux 9.5-57mm AV30 Lens Or Angenieux 12-120mm AV30 Lens	\$1575	\$1800	
CP-16/A (Code # 1C275) with Crystasound Amplifier and Magnetic Head	\$1245		
CP-16/A (Code # 1C275) as described above ... and choice of: Angenieux 9.5-57mm AV30 Lens Or Angenieux 12-120mm AV30 Lens	\$1575	\$1800	\$2100

Plus two-year warranty and free "loaner."

As part of this special offer, we take pride in extending our factory warranty to a full two years on all mechanical and electronic components. *Provided* you purchase your camera from your authorized local CP-16 dealer.

And, should your CP-16 or CP-16/A require any repairs covered by this special two-year warranty, your local dealer will provide you with a free CP-16 "loaner." This is just one example of the outstanding after-sales service and back-up you can expect from your authorized local CP-16 dealer.

Offer good till July 4, 1976

Small TV stations and independent filmmakers have to be particularly tough minded these days about cost effectiveness.

Even if your TV station is already in ENG, or contemplating the plunge—adding a CP-16 newsfilm camera makes good sense for a *balanced* news gathering operation.

With savings and benefits like these, you couldn't do better than trade up to a brand new CP-16/A with Angenieux zoom lens. And save up to \$2100.

But hurry, this offer is good only until July 4, 1976. See your authorized local CP-16 dealer now!*

*See adjacent page for listing of authorized CP-16 dealers participating in this special offer.



CINEMA
E technology in the
Service of Creativity
products
CORPORATION

2037 Garville Avenue, Los Angeles, California 90025
Telephone: (213) 478-0711 ■ Telex: 69-1339 ■ Cable: Cinevideo

Circle 189 on Reader Service Card

consoles for broadcast and broadcast production. Also showing: DA16/420 audio distribution system, 6 x , with six amplifiers, each with six rotating transformer outputs, individual in controls; and the ADM 660 audio spectrum analyzer, which divides the spectrum 40 Hz to 20 KHz into 28 third-octave bands, each displayable on TV monitor as a vertical bar with light representing amplitude.

Audiotronics (Booth 804)

Will exhibit **GRANDSON, audio console Model 110A**, expandable, modular multichannel control, up to 18 mixing positions (up to 26 in optional extension), with EQ at each input, fold-back, cue monitor, comprehensive list of other professional operation facilities. Also showing: accessories, including the Model PEQ-82 program equalizer.

Automated Processes (Booth 711)

Will exhibit **new broadcast audio console for FM stereo-quadraphonic operation**; also a new compact console for studio, remote, and on-air use; new series 7000 audio amplifiers for distribution, monitoring; also DC controlled pre-amps, line amps with remote AGC capability. Also showing: the Maglink tape editing synchronizer; mike amps, line amps, phono-tape-film pre-amps; equalizers, compressor/limiters, noise gates, signal generators, MC remote-controlled audio processing.

Hall Brothers Research Corporation (Booth 308)

Will emphasize the **Model TCB19 and CR19/25 TV color monitors**; also showing complete line of solid-state color monitors, 19-in. and 25-in.

Belar Electronics Laboratory (Booth 509)

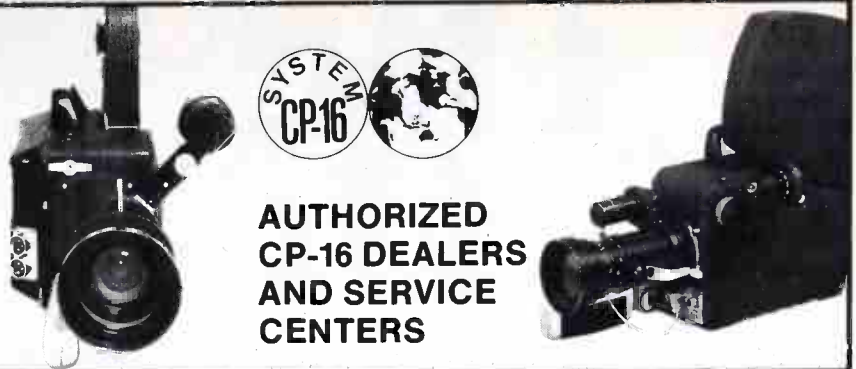
Will introduce **new equipment for accurate analysis of on-air signal**; also two new AM modulation monitors. Also showing the comprehensive line of modulation and frequency monitors for AM, FM and TV, with companion amplifiers, antennas, remote meter panels, silence alarms, etc. Also: developments in AM stereo.

Berkey-Colortran (Booth 107)

Showing for the first time the **multi-purpose Mark III lighting and grid system**, built in UK factory; also emphasizing a new memory-assisted lighting control system. Also on exhibit: complete line of other studio lighting and dimming equipment.

Beston Electronics (Booth 616)

continued on page 128



AUTHORIZED CP-16 DEALERS AND SERVICE CENTERS

NORTH AMERICAN LISTING/EFFECTIVE: JANUARY 1, 1976

(D/S) Dealer & Service (D) Dealer (S) Service

- | | | |
|---|---|--|
| <p>ALABAMA
 Bush & Millimaki Photo Equipment Service
 902 Bob Wallace Ave. Huntsville, Ala. 35801 (D/S)</p> <p>CALIFORNIA
 Alan Gordon Enterprises, Inc.
 1430 N. Cahuenga Blvd. Hollywood, Ca. 90028 (D/S)</p> <p>Birns & Sawyer, Inc.
 1026 No. Highland Ave. Hollywood, Ca. 90038 (D/S)</p> <p>F&B/Ceco Of California, Inc.
 7051 Santa Monica Blvd. Hollywood, Ca. 90038 (D/S)</p> <p>Sawyer Camera Co.
 6820 Santa Monica Blvd. Hollywood, Ca. 90038 (D/S)</p> <p>Camera World
 1071 Sixth Ave. San Diego, Ca. 92101 (S)</p> <p>Adolph Gasser, Inc.
 181 Second St. San Francisco, Ca. 94105 (D/S)</p> <p>Film Equipment Rental Co.
 363 Brannan St. San Francisco, Ca. 94107 (D/S)</p> <p>COLORADO
 Stan Phillips & Assoc. Camera Service
 1113 S. Pearl St. Denver, Co. 80210 (S)</p> <p>DISTRICT OF COLUMBIA
 Brenner Cine-Sound
 5215 Wisconsin Ave., N.W. Washington, D.C. 20015 (D/S)</p> <p>FLORIDA
 Image Devices, Inc.
 1825 N.E. 149 St. Miami, Fla. 33181 (D/S)</p> <p>GEORGIA
 Atlanta Film Equipment Rentals
 1848 Briarwood Road, N.E. Atlanta, Ga. 30329 (D/S)</p> <p>HAWAII
 Pacific Instrumentation
 5388 Papai Street Honolulu, Hawaii 96821 (D/S)</p> <p>IDAHO
 Stockdale Corporation
 1448 W. Bannock Boise, Idaho 83701 (D/S)</p> | <p>ILLINOIS
 Victor Duncan, Inc.
 676 N. St. Clair St. Chicago, Ill. 60611 (D/S)</p> <p>LOUISIANA
 La Del, Inc.
 808 N. Rampart St. New Orleans, La. 70116 (D/S)</p> <p>Pan American Films
 822 N. Rampart St. New Orleans, La. 70116 (D/S)</p> <p>MASSACHUSETTS
 Crimson Camera Technical Sales, Inc.
 60 Landsdowne Cambridge, Mass. 02139 (D/S)</p> <p>Sanford Camera & Projector Repairs
 1054 Massachusetts Ave. Arlington, Mass. 02174 (S)</p> <p>MICHIGAN
 Victor Duncan, Inc.
 11043 Gratiot Ave. Detroit, Mich. 48213 (D/S)</p> <p>MINNESOTA
 Galaxy Film Service
 3000 France Ave. Minneapolis, Minn. 55416 (D/S)</p> <p>MISSOURI
 Calvin Cinequip, Inc.
 215 W. Pershing Road Kansas City, Mo. 64108 (D/S)</p> <p>NEW JERSEY
 Cinecraft International, Inc.
 11 Caesar Place Moonachie, N.J. 07074 (D/S)</p> <p>NEW YORK
 Camera Mart, Inc.
 456 W. 55th St. New York, N.Y. 10019 (D/S)</p> <p>F&B/Ceco, Inc.
 315 West 43rd St. New York, N.Y. 10036 (D/S)</p> <p>Film Equipment Rental Co.
 419 West 54th St. New York, N.Y. 10019 (D/S)</p> <p>Mobius Cine Ltd.
 7 East 47th St. New York, N.Y. 10017 (D/S)</p> <p>NORTH CAROLINA
 Standard Theatre Supply Co.
 125 Higgins St. Greensboro, N.C. 27420 (D/S)</p> | <p>OREGON
 Things Unlimited
 3140 N.E. Bryce Portland, Oregon 97212 (S)</p> <p>PENNSYLVANIA
 Calvin Cinequip, Inc.
 217 Vine St. Philadelphia, Penn. 19106 (D/S)</p> <p>Oscar H. Hirt, Inc.
 41 N. Eleventh St. Philadelphia, Penn. 19107 (D/S)</p> <p>TENNESSEE
 Bill Billings Photo
 129 South Front Ave. Rockwood, Tenn. 37854 (D/S)</p> <p>Motion Picture Laboratories, Inc.
 781 S. Main St. Memphis, Tenn. 38102 (D/S)</p> <p>TEXAS
 Victor Duncan, Inc.
 2659 Fondren Dr. Dallas, Texas 75206 (D/S)</p> <p>UTAH
 Stockdale Corporation
 2211 West 2300 South Salt Lake City, Utah 84119 (D/S)</p> <p>WASHINGTON
 Glazer's Camera Supply
 1923 Third Ave. Seattle, Washington 98101 (D)</p> <p>Phototronics
 223 West Lake North Seattle, Washington 98109 (S)</p> <p>CANADA
 Cine Audio Ltd.
 10251 - 106 St. Edmonton, Alberta T5J 1H5 (S)</p> <p>Alex L. Clark Limited
 30 Dorchester Ave. Toronto, Ontario M8Z 4W6 (D/S)</p> <p>Branches:
 7104 Hunterwood Rd., N.W. Calgary, Alberta T2K 4J6 (D/S)</p> <p>1070 Rue Bleury Montreal, Quebec H2Z 1N3 (D/S)</p> <p>Stevie's Camera Service
 189 East 28th Ave. Vancouver, B.C. V5V 2M3 (S)</p> <p>Western Camera Service Ltd.
 1855 West Fourth Ave. Vancouver, B.C. V6J 1M4 (S)</p> <p>MEXICO
 Deksa S.A.
 Av. Nuevo Leon No. 159 Mexico 11, D.F. (D/S)</p> |
|---|---|--|



Technology In The Service Of Creativity

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the little mother



dbx new 160 compressor/limiter

She's got a compression ratio you can set anywhere from 1:1 to infinity. And she's got a very low distortion figure even at high compression ratios. You can set her threshold from -38 to $+12$ dBm, and her two red LEDs let you know whether she's above or below threshold. Her meter range is from -40 to $+20$ dB, and you can set her meter zero at any line level between -10 and $+10$ dBm. Her illuminated meter is switchable to read input, output, or gain change.

She uses true RMS level detection, which you know is more reliable and accurate than other methods. Her dynamic range is enormous and her noise contribution practically negligible. Her output is automatically ground loop compensated and she is protected against turn-on and turn-off transients. She is beautifully packaged and small enough that you can take her with you wherever you go. Or you can bolt her into the rack where she'll give you a lifetime of faithful service.

You're going to love this little mother, especially when you learn her price. She costs only \$300.00, which is a lot less than you pay for those other mothers. She's available now at your dbx professional equipment dealer's. For complete spec information including the little mother's measurements, circle reader service card or contact:

dbx dbx, Incorporated
296 Newton Street
Waltham, Mass. 02154
617/899-8090

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NAB 1976

Automatic density light controls; oscilloscope vector displays.

Beta Technology (Booth 629)

New items will be the **Model 6 editor** for videotape cassettes; the **6 editor**; the **Model 701 sync generator** and crossover unit; the **impulse clock** audio distortion meters.

Bird Electronic Corp (Booth 705)

Will introduce a new series of **high power harmonic filters and filter couplers** for $3\frac{1}{8}$ -in. transmission line with 0.05 dB insertion loss through F band, at least 60 dB attenuation harmonics to 1000 MHz, sensors for forward as well as reflected power for continuous monitoring. Also showing the line of **directional wattmeters** to 2 kW in a walk-through arch of $3\frac{1}{8}$ -in. transmission line; air cooled and water cooled dummy loads, etc.

Bosch-Fernseh (Booth 610)

Will feature the new **BCN 1-in. VT**. Also showing their complete line of studio and portable cameras.

Boston Insulated Wire and Cable (Booth 204)

TV camera cable equipment, connectors, accessories.

Broadcast Electronics (Booth 50)

Will show the **full line of single-deck cartridge recorder/players, series 2000, 3000, and 4000;** and will introduce the new **500 series of 3-deck and 5-deck cart machines.** Will also introduce the following new console: **four-mixer stereo, table or rack 5-mixer economy model; 10-mixer economy slide-fader model; 10-mixer deluxe modular slide fader model.** Also: a new **splice/fault detector for cartridges,** with user-adjustable quality levels; the new **Scriptel character generator,** with variable-size characters; a new studio system with aids for DJ operation; and a new **CLE-F deluxe compressor/limiter/expand** for mono and stereo. Also showing the line of **Modtec mono TV monitors** and a line of **rotary-fader consoles.**

Broadcast Programming International (Booth 803)

Will have private listening booths for sampling all **programming service.** Will introduce a new **Rock series;** will show the complete line of program services.

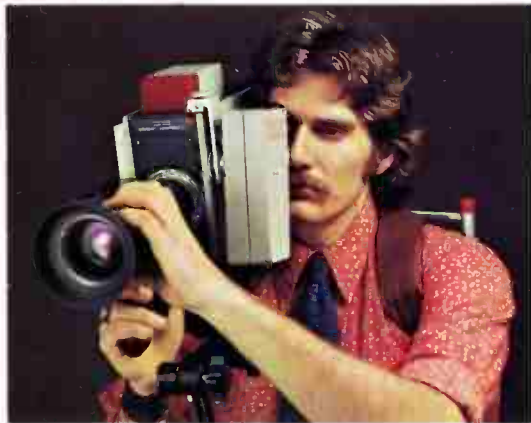
Cablewave Systems (Booth 710)

Will introduce a new low-cost **cab dehydrator, model SPD-10.** Will show the complete line of **coaxial and elliptical** continued on page 13

Two Of Our Cameras Are Covering The News.



Hitachi FP3030



Hitachi SK-70

The Third One Is News.

You're invited to the unveiling of our new Hitachi SK-80 portable ENG color camera at the NAB Show. The SK-80 is a totally self-contained camera whose exceptional design and features are sure to be appreciated by broadcasters.

While you're at our booth, also check out our existing SK-70 and FP3030 portable color cameras. The SK-70 is a modular system which can be converted easily from studio to field use, with superior performance in either mode. And the FP3030 is a light weight and low cost completely self-contained camera which is ideal for mobile video capability in ENG, as well as a variety of educational and industrial applications.



Hitachi SK-80

Come get the scoop on ENG cameras at the Hitachi booth.



HITACHI SHIBADEN
Corporation of America

Exec. Offices: 58-25 Brooklyn-Queens Expressway, Woodside, New York 11377
Offices in Chicago, Los Angeles, Dallas, Atlanta, Toronto

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www.americanradiohistory.com

STRAIGHT TALK FROM YOUR DITCH WITCH MAN



"Let's talk about the reasons we offer FREE TRENCHER DEMONSTRATIONS."

"We talk a lot about the many different jobs Ditch Witch can do. But we haven't forgotten many people need to dig trench and that's all. We know if trenching is all you need to do, you don't want to pay for features you won't be using.

If trenching is your business, Ditch Witch is for you! We built the world's first service line trencher and have been building the finest quality trenchers ever since. We have compact handlebar models, larger four-wheel drive trenchers and machines that can handle cross-country pipelines.

And wherever your work takes you, you'll find a Ditch Witch dealer nearby with a full inventory of parts, and the professionals to keep your Ditch Witch on the job.

We'd like to tell you more about our trenchers. Better yet, we'd like to show you what Ditch Witch can do. We'll bring one straight to your job for a free demonstration — no obligation.

"At Ditch Witch, we tell it to you straight!"

Call (800) 654-6481 Toll Free
for the name of the dealer nearest you.



18-HP Model J20 — 4 wheel drive, with three speed forward plus reverse transmission

Ditch Witch . . . equipment from 7 - to 195-HP.

CHARLES MACHINE WORKS, INC.
P.O. Box 66
Perry, Oklahoma 73077



Circle 193 on Reader Service Card

NAB 1976

cal wave guides, including copper corrugated coaxial, and associated products; also pressurization equipment.

Camex Corporation (Booth 714)

Will exhibit their new "Pro-Log automatic programming and logging system; and syndicated programs made for it by the ProGramme Shopp Camex subsidiary, including such formats as Rock Unlimited, Big Country, Concept MOR Contemporary Beautiful Music, and Classical.

Canon USA (Booth 501A)

Will introduce a new series of "ultimate" lenses, including the PV18X12B2, for 25mm format Plumbicon color cameras, and the PV18X16B2, for 30mm format Plumbicon color cameras. Will also show comprehensive line of other lenses for 25mm and 30mm Plumbicon color cameras; and a teleconverter for the PV10X12B.

Capitol Magnetic Products, Inc. (Booth 807)

Will show full line of professional tape and film products: Audiofilm 16mm and 35mm perforated magnetic film; Audiotape Q-15, low noise recording tape and Q-19, high output tape; Audiopak A-2 broadcast cartridge.

CCA Electronics (Booth 602)

Exhibiting a new FM antenna, circularly polarized, 700 KHz bandwidth at both low and high power, VSWR under 1.1, single-bay high power to 50 kW, single bay low power to 10 kW. Also introducing a new 2.5 kW solid state FM transmitter; and new solid state 2.5 kW AM broadcast transmitter and a new Bogner UHF TV antenna, circularly polarized, convertible.

Ceco Communications Inc. (Booth 555)

Will show broadcast electron tubes from all major manufacturers.

Central Dynamics Corporation (Booth 518)

A radically new video production system with new production switcher; a new sequential effect generator; the new VS-14 video switcher; the new AFM-10 audio mixer/switcher; also showing the VS1 switcher.

Cetec Corporation (Booth 615)

The following subsidiaries will exhibit in the Cetec area:

Cetec Audio—Showing a new series of quad audio consoles; the new 20A series of mixer consoles; the com
continued on page 13

MICROWAVE ASSOCIATES

COMMUNICATIONS EQUIPMENT DIVISION

NEW ENGLAND (INCL. N.Y.,
L.I. & N.J.) REGION
Dan McCarthy
Burlington, MA.
Phone: (617) 272-3100/3000
TWX: (710) 332-1716

NORTHWEST & ALASKA
Carl Guastaferro
Sunnyvale, CA.
Phone: (408) 733-0222
TWX: (910) 339-9248

MID-WESTERN REGION
Mert Knold
Kansas City, MO.
Phone: (816) 763-5395

NORTH CENTRAL (INCL. W.VA.,
MD., DEL., & D.C.) REGION
Clyde McCauley
Wayland, MA.
Phone: (617) 358-5054

SOUTHWEST REGION & HAWAII
John Morrissey
Sunnyvale, CA.
Phone: (408) 733-0222
TWX: (910) 339-9248

SOUTH CENTRAL REGION
Les Fisher
Dallas, TX.
Phone: (214) 239-2893

SOUTHEAST REGION
Phil Cass
Atlanta, GA.
Phone: (404) 455-3815

WEST COAST SERVICE CENTER
Jerry Elmer
Phone: (408) 733-0222
(Limited Emergency Service)

MID-WEST SERVICE CENTER
Dick Shannon
Phone: (816) 763-5395

FACTORY SERVICE CENTER
Frank Miani or Don Sicard
Phone: (617) 272-3100 or 272-3000
After Hours: (617) 272-1547

Coast to coast sales and service

The whole pie! – That's what we offer our customers when it comes to service. Whether it's sales, technical service, or just the right product for your needs, Microwave Associates puts it all together from coast to coast.

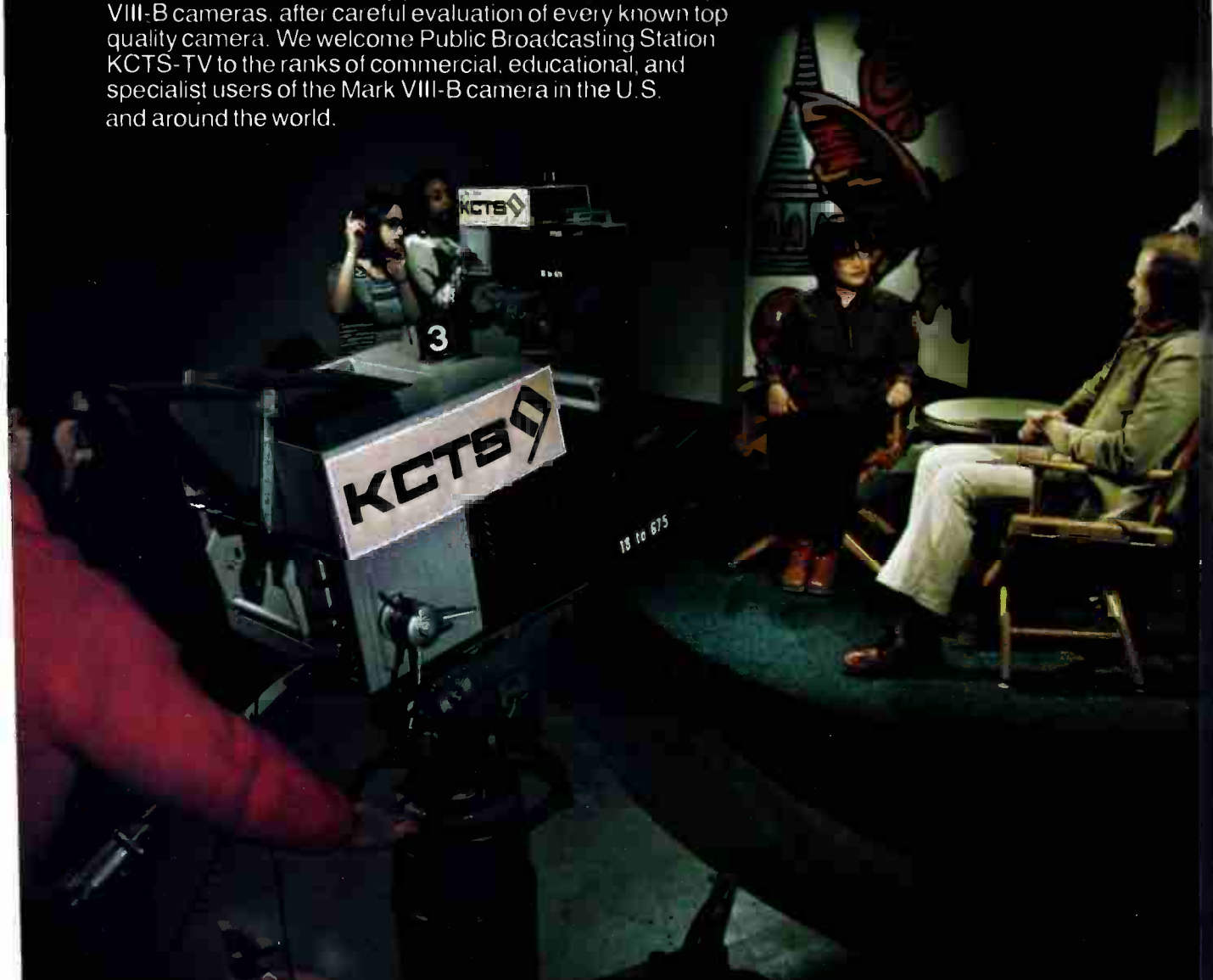
We also offer the full range of services for turnkey operation. If it has anything to do with microwave equipment, from miniature battery operated transmitters . . . to STL and mercuity point to point systems, we not only make it, we perform site surveys, install it, and train your people to use it as well. And we've got service centers nationwide, so we're never very far away.

At Microwave, we're working to help you bring the nation closer together.



In Seattle it's Mark VIII Automatically.

KCTS-TV, Seattle, recently purchased six Marconi Mark VIII-B cameras, after careful evaluation of every known top quality camera. We welcome Public Broadcasting Station KCTS-TV to the ranks of commercial, educational, and specialist users of the Mark VIII-B camera in the U.S. and around the world.



Mark VIII-B. A well-proven, reliable production tool

- World's first fully automatic color camera
- Super-sensitive. Saving studio energy by operating at f/4.0 in 75 f.c. Or operating on remotes when others quit.
- Small and lightweight, using 1/2-inch cable.
- Always making "Big-Picture" pictures AUTOMATICALLY.

Marconi Electronics, Inc.

National Sales: 4785 Lake Forrest Drive, N.E.
Atlanta, Georgia 30342
(404) 252-7842

Executive Office: N.Y. Area Sales:
100 Stonehurst Court, Northvale, New Jersey 07647
(201) 767-7250

See us at NAB Booth 301

Circle 195 on Reader Service Card

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te line of broadcast consoles for
ge and small studios; hi speed tape
d cartridge duplicators.

Jampro—Will show a new circu-
ly polarized antenna for UHF-TV;
line of FM antennas; antenna acces-
ories.

Schafer Electronics—Introducing
new 903, three-day 8,000 event
omation system with time base con-
rol; the new Mark II automatic logging
ystem with English readout; also
showing the Audiofile multicart player,
the 902 and 903 automation systems in
console and rack mounting.

Sparta Electronics—The line of
AM and FM transmitters, including the
new "C" series of solid-state AM
transmitters; also the new Centurion II
of tape cart machines; and the line
of broadcast consoles.

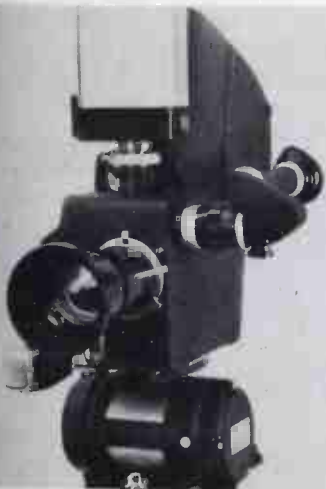
Vega—The complete line of wire-
less microphones, including the new
HF systems; also new diversity
microphone systems.

Myron Telesystems (Booth 501B)

Will introduce the new **Dynamic Mon-
tage Unit, (DMU)**, which provides
montage and animation of video
graphics, under immediate control of
designer without use of digital pro-
gramming. Will also show the line of
video titlers and graphics systems.

**Cinema Products Corporation
(Booth 406)**

Shown for first time at NAB will be the
P-16R reflex camera with **Cinevid-16**
video assist camera system, which
includes video control consoles, with



P-16R with video assist.

three monitors, wipe and dissolve, etc.
Also shown: Crystalink wireless
system; J-5 zoom lens control; Sturdi-
lite focusing spot; CPT-24 fluid head
ripod; PLC-4 16mm 400-ft. magazine;
location lighting kits; camera acces-
ories.

continued on page 134

BL-40 MODULIMITER

The Automatic AM Broadcast Limiter With Tweak-ability

Unlike other broadcast limiters that are factory-set automatic, our Model BL-40 MODULIMITER offers front panel adjustments and separate meters for output level, peak limiting and RMS limiting. No matter what your format, hard rock to classical, MODULIMITER is readily adjustable to maximize transmitter efficiency and extend coverage. Our patented electro-optical attenuator provides unobtrusive, smooth, true RMS limiting. An ultra-fast F.E.T. peak limiting section prevents unwanted overmodulation with no peak clipping. Our "Phase Optimizer" maintains most favorable signal polarity permitting up to 125% positive modulation without negative undershoot. The BL-40 MODULIMITER offers all state-of-the-art automatic features plus complete adjustability not available in others. UREI quality, of course.



11922 Valerio Street, No. Hollywood, California 91605 (213) 764-1500

Exclusive export agent: Gotham Export Corporation, New York

Circle 196 on Reader Service Card

NAB 1976

CMX Systems, An Orrox Company (Booth 606)

Will introduce a new videotape time code editing system, Model 340X, expandable from ENG up to full post-production editing capability, usable off-line or on-line. Works with helical or quad VTR's or both, has numerous optional automation features. Also: the new low-cost 34X, a "cuts-only" system, with keyboard, interactive display and intelligent processor, ex-

pandable to 340 system.

Cohu, Inc./Electronics Division (Booth 302)

Will introduce the new CAT (Cohu Automatic Telecine), a complete ready-to-use film island with NTSC color output for 35mm slides, 16mm motion picture film, adaptation for Super 8mm film. Has color encoder, image enhancer, auto balance, instant paint. Also: operational display of Model 1550 telecine island; complete line of broadcast processing equipment.



Cohu automatic telecine (CAT).

Collins Radio Group, Rockwell International (Booth 603)

Will feature the complete line of AM and FM transmitters and RF gear, including a working studio, and several program automation systems.

Colorado Video (Booth 105)

Showing system for sending compressed video over FM radio subcarrier; also the psychedelic video color synthesizer.

Commercial Electronics, Inc. (Booth 519)

Will introduce the new CEI-287 studio video camera, and a new medium camera. Also showing the CEI-288 studio camera, the CEI-290 portable production camera, and supporting equipment.

Communications Technology (Booth 232)

Will introduce new low-priced production switcher model ComTech 3100, with 19 special effects, color background generator, 11 inputs, 11 buses; also introducing the AX line of audio switchers with plug-in expansion and card-frame construction—each frame holds two 24-in. X 10 out matrices; and small routing switchers with one, two or three outputs, same features as larger series. Also showing: CEI 15X and 20X video/audio routing switchers.

Computer Image Corporation (Booth 627)

Will introduce the new large Model 7243-B video production switcher with new Master control, and two new computer controlled editing switchers. Will also have on display software production products generated for the Caed electronic animation system.

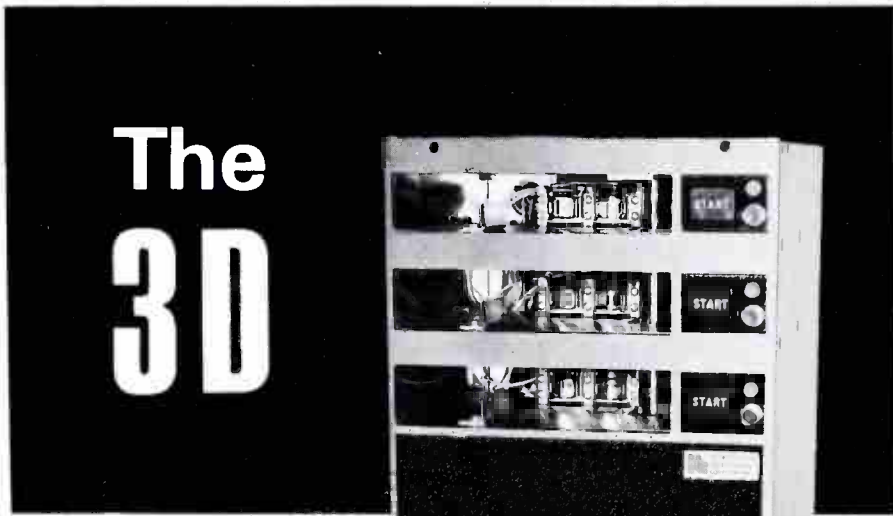
Computer Magnetics Corporation (Booth 543)

Refurbished VTR heads.

Comquip, Inc. (Booth 226)

Will feature a fixed lens adaptor for color TV cameras, allowing use of motion picture and SLR lenses with no loss of light, distortion or vignetting for wide angle, macro shots and special effects.

continued on page 100



The 3D Three reliable ITC decks in a space-saving common housing.

- **Compact** — three decks convenient to the operator in the space of two single deck machines.
- **Individual** — decks operate independently with separate audio output and remote control.
- **Versatile** — multi-tone machines may be readily adapted so each deck automatically starts the next.
- **Economical** — three premium line reproducers for little more than the price of two single deck units.
- **Rugged** — decks are 1/2 inch thick hardened aluminum to insure stability.
- **Quiet** — guaranteed by ITC's air-damped solenoids.
- **Serviceable** — simple, reliable mechanics easily accessible through a hinged front panel and slide-out decks.
- **Record** — add a WRA Recording Amplifier and convert the bottom deck to a Master Recorder/Reproducer.

Put the 3D to work in your station. Pick up the phone and call ITC collect (309-828-1381). Ask about our 30 Day Guarantee of Satisfaction.



INTERNATIONAL TAPETRONICS CORPORATION

Marketed exclusively in Canada by McCurdy Radio Industries, Toronto, Ontario, Canada

Circle 197 on Reader Service Card



Bye, bye brute.

So long, spot. Ta-ta tener. Farewell, fay brute. Miss you, maxi.

We've got something better: something you've got to see—and try—to believe. Lee Compact Source Iodide discharge lamps. A two-luminaire system that's better than a warehouse-full of conventional film and TV lighting equipment... especially for location work. Because:

They've got instant restrike—so you get all the benefits of iodide discharge without any drawbacks.

They're smaller—17 x 13½ x 12½" for the single;

17 x 25 x 12" for the twin. Fit just about anywhere, for easy shipment and setup.

They're lighter—20 lbs. for the single; 35 for the twin. Easier on your back... and your shipping budget.

They're brighter—at 100' and full spot, one 2kW twin delivers 200 foot candles. At 20' and full spot, it actually delivers 800 fc!

They're far more efficient—single requires 1000 watts (compares with 5,000 watts and up); twin, 2000 (compares with 10,000 and up).

In other words, CSI lamps draw only 1/5 the power for comparable output.



They're longer-lasting—PAR64 C.S.I. bulbs last 3-4 times longer than brutes!

They're versatile—output is perfect for video; can be filtered up for daylight; down for tungsten in film.

Now that you know what Lee CSI lights can do, why not find out more about what they can do for you. Write or call us for more information on purchase or rental.

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Comrex Corporation (Booth 831)

Will introduce the new **studio-diversity wireless microphone system**, with two spaced receivers and automatic selection for better signal; also introducing a floor-man intercom system; a 450 MHz handheld 1 W wireless microphone; and a radio ENG system. Also showing: full line of receivers for ENG cueing/command/control; other 450 MHz RA/TA wireless microphone systems; cue systems.

Conrac Division, Conrac Corporation (Booth 102)

Will introduce four new products: **Model 6000, 19-in. broadcast color monitor**, taking 15¾-in. of rack space, full front access, fully active convergence circuitry, modular construction; the **Model 5300, 19-in. color monitor** with budget price; the **Model 5700, 13-in. high resolution color monitor** for 10½-in. tape bridge mounting; and the **DZB, 14-in. updated version of DZA mono monitor**, for 10½-in. tape bridge mounting. The "Colormatch Theatre" will show a



CSI FM transmitter.

videotape on the new monitor series.

Consolidated Video Systems (Booth 547)

Will introduce a new **low-cost digital time base corrector**. Will show whole line of digital time base correctors and the digital video synchronizer with electronic video compression.

Continental Electronics (Booth 607)

Will show the **50 kW, Model 315 AM transmitter**; also the 5/10 kW Models 315 and 316 transmitters.

Control Design Corporation (Booth 706)

Will show the **Mark III 8000-event random access automation system** incorporating the Rota Cart 24 random access cart player, providing real-time digital clock operation with up to 168 real-time events per hour, designated by hour, minute and second. Introducing touch-tone telephone system allowing operation of automation from a remote location via touchtone telephone. Also showing: the keyboard entry Mini Pro sequential automation controller.

Cooke Engineering (Booth 805)

Will introduce a new **SMPTM generator/reader system**; also showing a digital clock, digital tape timer for quad machines; video, audio, and pulsed distribution amplifiers; coaxial patching equipment; line of SMPTM generators and readers, SMPM character generator/readout.

Corning Glass Works (Booth 116)

Will show four models of **image enhancers**, including the new 7000, designed specifically for industrial-educational application; the RGB; and a new model with adaptation specifically for ENG applications. Booth will include

continued on page 1



609
H1008
BOOTH
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**YOU'LL FLIP
OVER OUR NEW PRECISION
AM, FM and TV MONITORS!**



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When Accuracy Counts... Count on Belar

We've lightened your load.

Here and here.

Our new portable video cassette recorder/player makes eyewitnessing news easier than ever before.

JVC has done two things to improve your ENG capability: we've made our gear lighter and we've lowered the initial cost. Our brand-new CR-4400U Color Portable Capstan-Servo 3/4" U-VCR weighs only 24.5 pounds, complete with rechargeable battery and standard 20-minute videocassette tape. And it sits as lightly on your back as a notebook as it does on your shoulder. With the CR-4400U at your side, you're set to record top-quality color video, with a S/N ratio of better than 40 dB. There's a full-function keyboard, including pause/still and audio freeze. Other JVC features include audio freeze and multi-purpose meter to monitor audio, battery, video and servo status. Our exclusive auto assemble function enables you to get smooth, glitch-free edits between takes, and can be operated by camera trigger or remote switch. With warm-up time to full speed at less than 10 seconds, you're always ready to shoot. And you can shoot 50% longer, since the CR-4400U requires 50% less power than most other decks.

JVC's unique patented dubbing switch is provided to facilitate quality tape transfers. For playback through regular TV sets, an optional RF converter can be plugged right into the deck. The CR-4400U operates on AC as well with its companion

New JVC CR-4400U Color Portable Recorder, shown with new CR-8300U Full-Editing Cassette Recorder, GC-4800U Color Camera, CC-4800U Camera Control Unit and Dual-Machine Remote Controller.



AA-P44U Power Adaptor, which also functions as a battery charger.

But the best way for you to find out how this light-weight, low cost portable video-cassette system can add to your newsgathering ability is to get yourself a hands-on demonstration. Call your JVC dealer, or send us the coupon below.

**JVC Industries, Inc.
58-75 Queens Midtown Expwy.
Maspeth, N.Y. 11378**

Please send information on:

- CR-4400U Portable Color 3/4" Video Cassette Recorder/Player
- GC-4800U Portable Color Camera
- CR-8300U Full Editing 3/4" Video Cassette Recorder/Player
- I'd like a demonstration

Name _____ Title _____

Organization/Company _____

Address _____

City _____ State _____ Zip _____

Telephone _____

JVC
JVC INDUSTRIES, INC.

NAB 1976

miniature "studio," about 18-in. x 18-in., with articles of Steuben Glass rotating in field of video camera; image enhancers will be on line to show effect on monitored picture. Also showing: the complete line of 1H and 2H delay modules for cameras, TBC's, etc.

Cox Data Services (Booth 604)

Showing the complete in-house mini-computer automation system for radio and TV. Will introduce a new

radio system, and show planned system for interface with automated switching.

CSI Electronics (Booth 705)

Will introduce a new 25 kW FM transmitter. Also showing 1 kW, 3 kW, 12 kW FM; 25 kW FM/3 kW AM; 10 kW AM, 1 kW AM (in operation); 6 and 8 channel consoles.

Data Communications Corporation (Booth 104)

Will introduce and demonstrate the BIAS "total automation" concept, including the interface to automatic

switching systems, with actual demonstration of connection to Vital, Gr. Valley and CDL switchers.

Data Disc (Booth 112)

Will demonstrate the BDR-500 slow motion video recorder for slow motion instant replay, with switchable fixed rates forward and back, stop action, digital frame counter, present reset address control, etc.

Datatek Corporation (Booth 313)

Emphasizing the D-400 series video/audio routing switchers, with buses completely independent in control, using a computer-compatible logic system; all adjustments on front of circuit boards, adjustable during normal operation; cable equalizers, clamping vertical interval switching and high audio output are standard. Also showing: color phase equalizers; waveform correctors; video sweep generators; differential phase and gain envelope measuring sets; video, audio and pulse distribution amplifiers.

Datatron, Inc. (Booth 409)

Will unveil a new videotape editing system, "Tempo 76", which uses "time sync", aimed to bridge gap between the economy of control-tape editing and the precision and speed of SMPTE time code systems.

Delta Electronics (Booth 613)

Will introduce the new Model AAM analog antenna monitor, and the new Model TCA RF ammeter system. Also showing: DAM-1, digital antenna monitor; DAML/R-TCNS remote control system; FSM-1 field strength meter; toroidal current transformer impedance bridges, common point impedance bridges, receiver/generator

Dielectric Communications (Booth 808)

RF watt meters, strobe beacons, coaxial cable, waveguide accessories.

Digital Video Laboratories (Booth 305)

Time base correctors; video processing units.

Dipol Electronics (Booth 835)

Custom built audio consoles for broadcasting and recording.

Drake-Chenault Enterprises (Booth 806)

Syndicated programming for automated radio stations in a wide variety of formats—country, MOR, rock, classical, etc.

Dynair Electronics, Inc. (Booth 70)

Will introduce the new SE-362 Chromatech, an in-line line chroma keyer with soft combining

continued on page 11

NAB
BOOTH
507

Spotmaster[®]

CART MACHINES

THE RUGGED ONES

SERIES 3000

- Auto release deck — massive, quiet operating air damped solenoid.
- Low power consumption — less than 45 watts.
- PHASE-LOK III head bracket — minimizes stereo phasing problems.
- Full range of mono and stereo models for A, B and C size carts.



SERIES 4000

- All the same solid features as the SERIES 3000 with added standard features — microphone inputs, dummy head in record position (on playback models) and many others.
- New styling for the discriminating broadcaster.
- Additional optional features include internal fault/splice detector.



SERIES 5000

- Modular design with fold down front panel and slide out direct drive decks.
- Auto release decks — massive, quiet operating air damped solenoids.
- PHASE-LOK III head brackets — minimize stereo phasing problems.
- Separate electronics for each deck on 2 PC cards.



OVER 40 CART MACHINE MODELS. ALSO AUDIO CONSOLES, AUDIO PROCESSORS, AND STUDIO ACCESSORIES.

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TerraCom gives you anything you want in 1-15 GHz portable microwave radio



FIXED TUNED TCM-5 SERIES

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TCM-5 SERIES: video or message baseband and subcarrier for use in compact, lightweight, wideband message or TV with audio channel. All frequency bands, for STL, CARS, SHL, LDS, ENG

TUNABLE

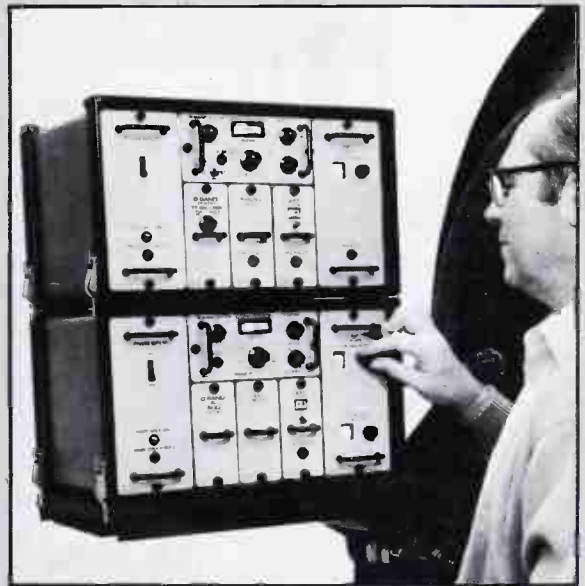
Direct reading, tunable carrier frequency in each band: 1.7-15 GHz. 1200 FDM channel message, video and audio. All plug-in modules, including RF Units for band conversion

MOBILE OPERATION

Rugged, lightweight transmitters & receivers operate airborne, in land vehicles, or portable tripod mounted in weatherproof housing. Operation is AC or DC

RF REMOTE

Plug-in modules, simplex or duplex, remotod at antenna (tower or tripod)



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FIXED RACK INSTALLATION

Convertible between mobile and fixed use. Hot standby, diversity switch. Multiplexed transmitters and/or receivers. Service channel summing and splitting.

When you operate TerraCom microwave radios, you know you have reliable and high performance equipment working for you. More than that, you have the best factory support in the business. TerraCom makes a special effort to know, and keep on knowing, everyone who has TerraCom microwave radios and to provide them with fast, responsive service, same day dispatch of free-loaner replacements worldwide, and leasing additional portable links.

TerraCom microwave gives you all frequency bands - all types of transmission - with the best in performance and maintainability and with friendly, personal customer service. We're a high quality company with high quality microwave radio systems. You should look into it - you will like the quality.



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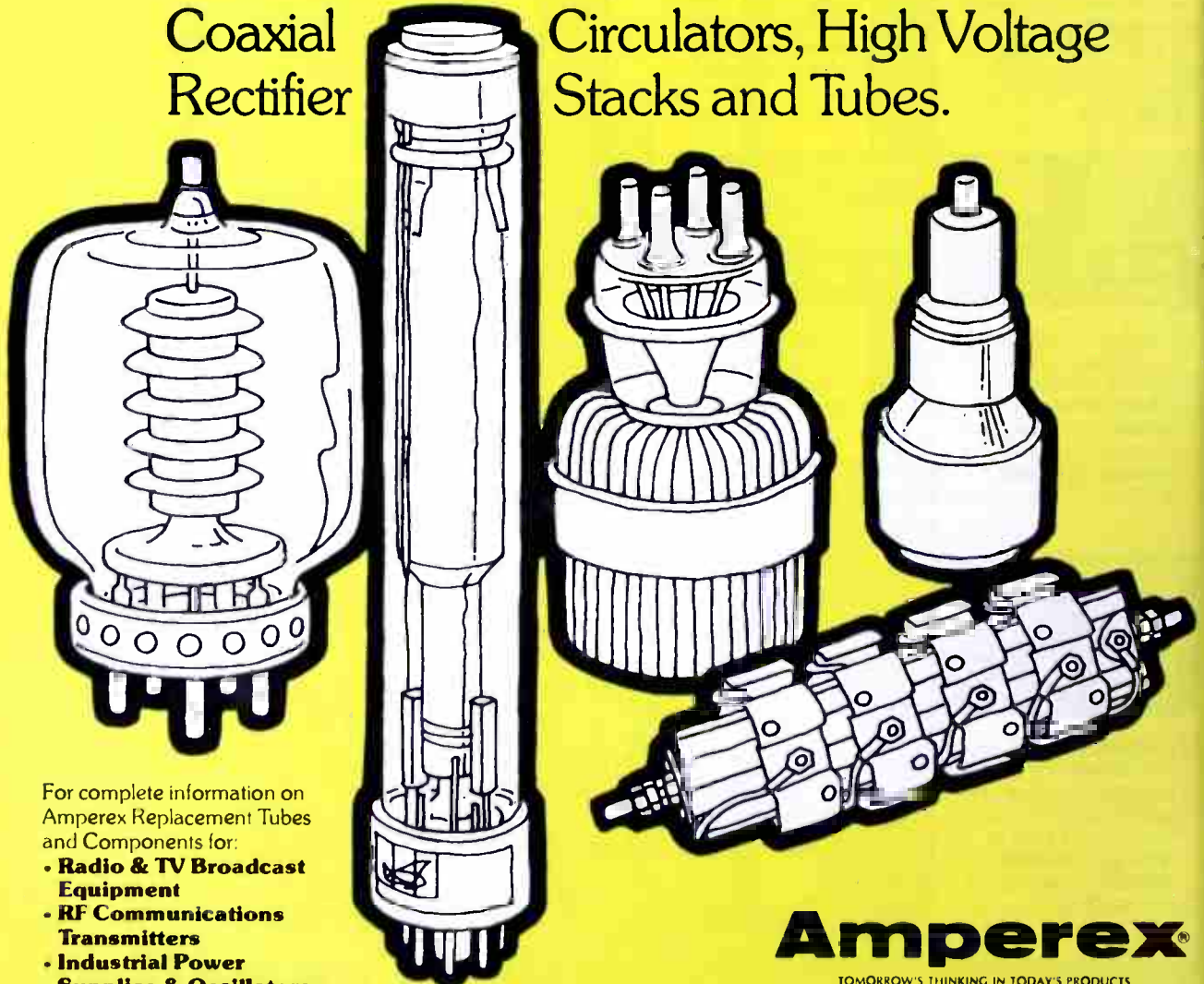
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Mention the name Amperex and what comes to mind?

Plumbicon* TV Camera Tubes, of course.

**That's fine, but we'd like
to remind you that Amperex
is your one stop source
for all these broadcast components, too!**

RF Power Triodes and Tetrodes
for AM and FM Transmitters, VHF Power
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NTSC color video sources into a composite. Also: introducing a



chroma keyer from Dynair.

line of video, pulse, pulse delay subcarrier distribution units. Show the line of video switchers, audio mixers, modulators, demodulators, signal control systems.

Dynasciences (Booth 400)

Will introduce the new Model 7200 downstream chroma keyer; also the Zia Stop lens with compensation for picture shake and bounce. Other products include image enhancers, video processors, video switchers, video distribution amplifiers, sync generators, test equipment.

Eastman Kodak Co. (Booth 521)

Exhibit will highlight role of film in television news production. Shown will be Eastman Ektachrome 7240 color news film (tungsten), introduced in September. Also shown: Kodak automatic film videoplayer, VP-X.

Elien Video (Booth 906)

Will feature: equipment for slow-motion instant replay of video material; demonstrations by professional operator; use of "freeze frame" and other editing techniques will also be demonstrated.



Eiac's super-power tetrode.

Eiac, Division of Varian (Booth 310)

Will feature the super-power tetrodes, Model X-2159 (water cooled, 50 kW and the X-2170. Also show the line of other broadcast power tubes, including the Model 8963, 25 kW ceramic focussed triode for television service.

Electrohome (Booth 311)

Showing the comprehensive line of color and monochrome video monitors.

Electro Impulse (Booth 121)

Will emphasize the Model CPTC 30 kW dummy load; an integral unit with water cooling, switching built in; also showing the complete line of other broadcast dummy loads, power meters, attenuators and accessories.

Electronics Diversified (Booth 816)

Studio light controls; patch panels.

Electronics, Missiles and Communications (Booth 314)

Will introduce the TSA-100, 100-watt MDS/ITFS amplifiers, and the TTV-5 portable backpack 5-watt TV transmitter. Also showing line of other TV transmitters and translators in powers from 1 W to 1 kW; the Bogner UHF and VHF television antennas.

Electro-Voice (Booth 802)

Comprehensive line of microphones and microphone accessories for broad-

continued on page 142

THE LOGICAL CHOICE

FOR AUDIO THAT WORKS!

- MULTILIMETER
- DIGITIMER
- MULTISYNC
- MODULIMITER
- CUSTOM CONSOLES
- COMPLETE AUDIO SYSTEMS

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PACIFIC RECORDERS AND ENGINEERING CORPORATION
 11100 ROSELLE ST., SAN DIEGO, CALIFORNIA 92121
 TELEPHONE (714) 453-3255 TELEEX 695008

Circle 205 on Reader Service Card

STOP PLAYING DIRTY TAPES ON AIR

If you use video tape, you should be using the N.O.V.A. BLOCK.

REDUCES: Operation costs. Oxide Build-up. Head Clogging. Drop-outs
INCREASES: Tape Life. Head Life. Quality

For the first time video tape cleaning is done on your own video tape recorder regardless of the tape format you are using. The N.O.V.A. BLOCK cleans 1" 2" 3/4" U-matic, 1/2" and 1/4" formats.

Until now, tape cleaning has been expensive, time consuming, and in some formats virtually impossible. The N.O.V.A. BLOCK is not expensive and requires little time and effort for you to install. Yet the results are dramatic. Consistent usage of the N.O.V.A. BLOCK insures cleaner tapes time and again.

The N.O.V.A. BLOCK cleans tape on your VTR, taking advantage of proper tensions for your particular format. This eliminates the need for costly winding units and for dedicating time and space to a cleaning operation.

The N.O.V.A. BLOCK is a synthetic monocrystalline ceramic sapphire. The sapphire crystal is formed to have 4 chip-resistant cleaning edges, is very hard and consequently has a long life.

A N.O.V.A. BLOCK is installed on most recorders in such a manner as to make its use optional. In the 2" version the cleaning is done in a shuttle mode either "forward" or "rewind" by rethreading the tape outside of the original tape path and through the N.O.V.A. BLOCK. This means that while cleaning the tape there is no wear on the audio stack, control track head, female guide, or the erase head. Therefore, costs of maintenance and operation are reduced.



2" N.O.V.A. BLOCK \$340



1/2" N.O.V.A. BLOCK \$100

REPLACEMENT BLADES

2" sapphires.....\$150 1" sapphires.....\$100
All other sapphires.....\$68



NOVA Corporation
Box 2171 • Canoga Park • California • 91306

VTR MAKE _____
VTR MODEL _____
QUANTITY _____
Check Money Order C.O.D. Request
NAME _____
ADDRESS _____
STATE _____ ZIP _____
N.O.V.A. BLOCKS are patent pending

Circle 206 on Reader Service Card

NAB 1976

cast and studio.

Emcor, Division of G.P. Business Equipment (Booth 718)

Firm under new management; will show line of **electronic cabinetry**, computer support furniture.

ESE Enterprises (Booth 122)

Will show **programmer/comparators**, digital clocks, digital timers, network joiner units, EBS two-tone generators and decoders.

Farinon Electric (Booth 110)

Will show a new **ENG-optimized version of the FV(2)P portable microwave system**, for video and subcarrier transmission at 2 GHz, frequency-agile, dial tuned optional 6 W or 20 W output.

Fidelipac (Booth 405)

Will demonstrate the new **Master Cart**, showing stereo phase performance, repeatability among 400 samples. Introducing the right-angle zenith gauge, for cartridge head zenith and gap height adjustments. Also introducing carts specifically for long-life use in delay-head applications. Showing: Models 300, 350, 600 and 1200 broadcast carts; studio on-air light; cart storage racks; alignment gauges; test tapes, other cart accessories.

Flash Technology Corporation (Booth 322)

Will show for the first time the new **FTB-205 Electroflash beacon system, designed for skeletal tower use**, with optional remote monitor/control system for "hot" AM towers; all power and optical components in one enclosure; high-gain optical system has sharp cutoff of lower beam and ground shadowing louvers.

Fujinon Optical, Inc. (Booth 541)

Will introduce a line of **lenses for the newest portable TV cameras**, broadcast and CCTV types. Also showing complete line of lenses for studio and portable TV cameras.

Fuji Photo Film USA Inc. (Booth 411)

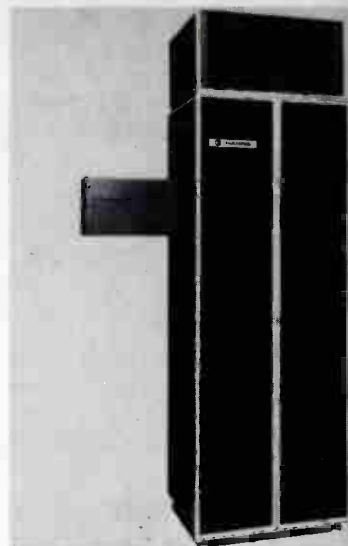
Will introduce the new Fuji **Beridox 3/4-in. U-Matic cassettes**. Will also show the Model H-701 broadcast videotape.

Garron Electronics (Booth 611)

Will show the **Rapid-Q line of cartridge tape recorder/players**, and the STE-100 stereo phase enhancer.

Allan Gordon Enterprises (Booth 925)

Will show the comprehensive line of



Harris TF-100 film camera.

Swintek wireless microphone systems.

Grass Valley Group (Booth 517)

Will exhibit their **comprehensive line of video switchers**, special effects generators, automation equipment, chroma keyers, processing amplifiers, sync generators, colorizers, equalizers, etc.

GTE Sylvania (Booth 306)

Studio and TV lights, lighting accessories.

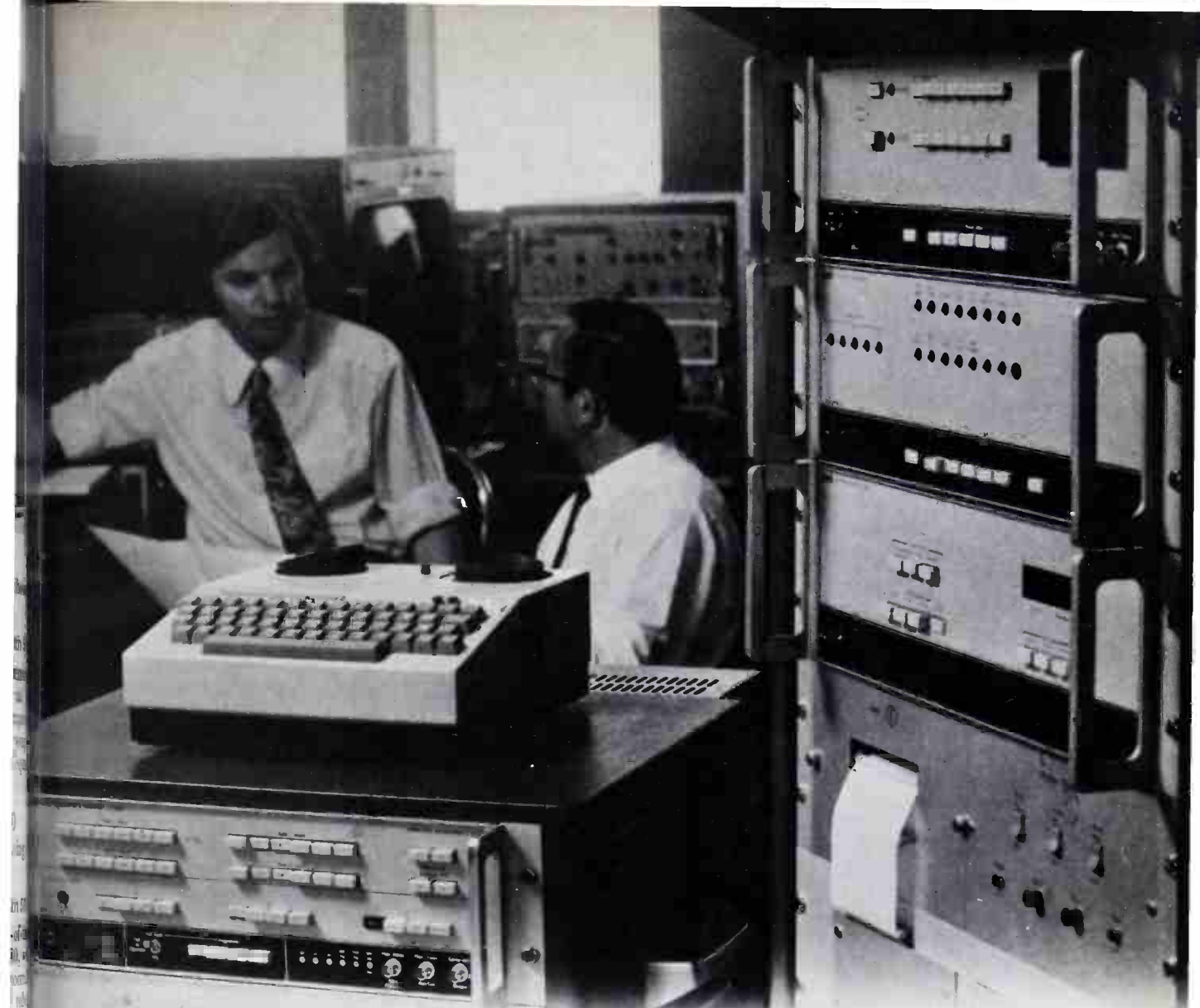
Harris Corporation (Booth 501)

Will introduce a **new top-of-the-line color camera, Model TC-80**, with optional Triax, using three normal oxide or anti-comet tail tubes, as wanted, plus full range of automation. Also introducing: the new circular polarized TV antenna, with a working model on display. Other new products: the TF-100 broadcast film camera; the new TE-301 color television camera with head, lens and viewfinder weighing a total of 40-lbs.; also the 25 Y BT-25L1 low-band TV transmitter with IF modulation, low-level sideband filtering, compensation for envelope delay. In addition, the new Mono-Stereo-5 audio control consoles. Products for repeat showing include: the TC-50 color camera; the MW-1 solid-state 1 kW AM broadcast transmitter and other AM transmitters; line of FM transmitters; the System automation system; AM, FM and monitoring equipment; line of audio consoles, tape cartridges, and tables.

Hitachi Shibaden Corporation (Booth 200)

Will introduce **two new battery-operated ENG cameras**. Also showing SK-70 multipurpose studio and ENG color camera, the FP-1214 sports camera with 14:1 f/1.8 zoom lens.

continued on page 44



mi automatic TV monitoring sets free the engineers

Time was when highly trained transmission engineers had to waste their brains (and their time) watching a battery of waveforms and pictures — instead of concentrating on work more worthy of them.

Now the TV monitoring scene has been transformed. For TF2914 Insertion Signal Analyser, TF2915 Data Selector together form THE FIRST COMMERCIALY AVAILABLE AUTOMATIC TRANSMISSION MONITORING SYSTEM.

In conjunction with a test line signal generator and inserter (such as **mi** TF2913), it will automatically cycle through the measurement of all the important parameters of the test line

signal from five separate inputs. Comparison with pre-selected limits is continuous, and an 'out of limits' fault can initiate executive action by automatic switching to standby, with remote alarm indication and simultaneous data transmission of fault location. Up to 24 parameters can also be measured manually by means of push-button selection and a self-contained digital voltmeter. Versions are available for all standards including the N.T.C.#7. Systems are now operating in ten countries. Applications include broadcast monitoring, common carriers and satellite operations. Call **mi** and discuss your application.

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DIVISION OF MARCONI ELECTRONICS INC.

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Circle 207 on Reader Service Card

FP-1212 studio color camera.

IGM, A Division of NTI (Booth 605)

Introducing the new **Marc VII (Manual Assist Remote Control)** providing electronic access and automatic sequencing of program elements in live studio and control-room operations. Operator can preset switching for up to 18 events on entry keyboard, has TV display of current and scheduled events at all times, can make changes at any time during operation; system handles up to seven separate

audio sources, each with up to 99 sub-sources. Will also show other items in complete automation line: 700 computer/automation series, RAM (random access controller), Instacart and Go-cart automatic cart players, support equipment.

Ikegami Electronics (Booth 522)

Showing the line of **color cameras for ENG applications**; will introduce a new camera.

Industrial Sciences (Booth 539)

Will introduce the all new **1200 series of video production switchers**, with 32 standard special effects patterns,



ITC Model 750 tape recorder.

tandem keying, manual or automatic transitions, adjustable soft white, special pattern modulators, border line pattern revolve; also the new Model 1100 audio-follow-video routing switcher.

Innovative Television Equipment (Booth 111)

Will introduce the **Model ITE-1 hydro head**, specifically for ENG video cameras, providing pan/tilt with hydro damping in both modes, locked friction controls. Also showing: entire line of television support equipment—heads, mounts, etc.

International Tapetronics Corporation (Booth 307)

Introducing the new **750 series economy-priced open-reel tape recorder/players**; also the new automatic cartridge tape splice locator eraser. Also showing: premium and economy lines of cartridge player/recorders; Series 850 open reel player/recorders.

International Video Corporation (Booth 514)

Will feature the **IVC-9000 VTR** and **IVC-7000 series** of color video cameras, studio and portable. Also showing an expanded line of 2-in. dia. 1-in. VTR's, and line of color camera; the new all-purpose digital time-base corrector.

Jampro Corporation (Booth 615)
See under Cetec Corporation.

Jefferson Data Systems (Booth 222)

Showing the **System 80 business computer service for broadcasters**, based on large computers at JDS headquarters, plus mini computer at broadcaster location, to do all traffic, accounting, billing, etc., from original sales contract to profit and loss statements. Also describing mini computer to be introduced this year to do work on location, and services for broadcaster who has a computer, adapted JDS software to the installation.

continued on page 144

Whatever your budget... BCS has your system.

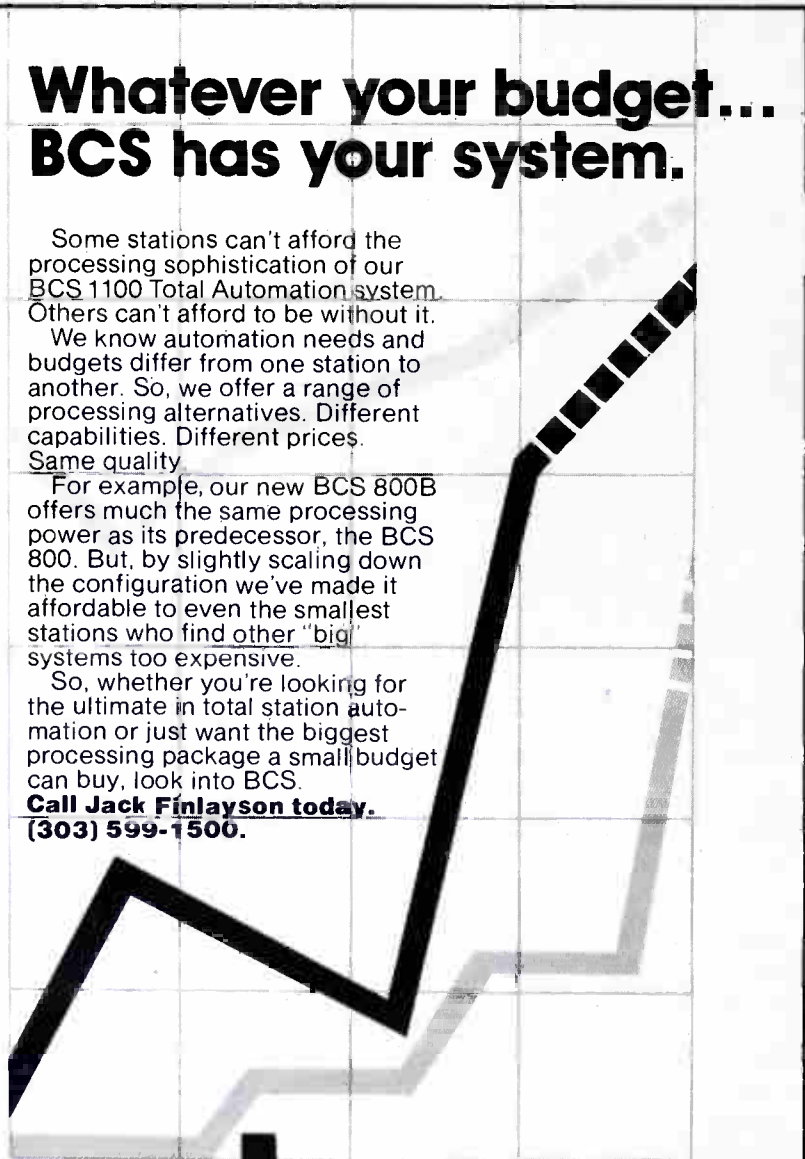
Some stations can't afford the processing sophistication of our BCS 1100 Total Automation system. Others can't afford to be without it.

We know automation needs and budgets differ from one station to another. So, we offer a range of processing alternatives. Different capabilities. Different prices. Same quality.

For example, our new BCS 800B offers much the same processing power as its predecessor, the BCS 800. But, by slightly scaling down the configuration we've made it affordable to even the smallest stations who find other "big" systems too expensive.

So, whether you're looking for the ultimate in total station automation or just want the biggest processing package a small budget can buy, look into BCS.

**Call Jack Finlayson today.
(303) 599-1500.**



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Excellent Reasons for Choosing ADM[®]



Console custom-designed and built by
Audio Designs for WKY-TV, Oklahoma City.

When you buy an ADM Console, you buy a company. You buy our skilled engineers and design personnel, our professional know-how and more than ten years of experience in building consoles that are *unexcelled* for quality and reliability.

Audio Designs[®] has consistently been a leader in innovative concepts and "state-of-the-art" techniques. Our principals have worked on the studio side of consoles—they know what professionals want and need to do their demanding jobs faster and easier. And customers know that ADM Consoles are engineered for consistent high performance. That is the reason why our customer list reads like a "Who's Who" of the industry.

Our consoles are manufactured with the finest components for long life and trouble-free operation. Hopefully you will never need service, but if you do, we will provide assistance promptly and without question. Our five-year warranty is the most liberal in the industry. Before you buy any console—standard or custom—let us give you some more reasons why an ADM Console is your best buy. Call or write us soon.



AUDIO DESIGNS AND MANUFACTURING, INC.
16005 Sturgeon, Roseville, Michigan 48066
Phone: (313) 778-8400, Cable: AUDEX TLX-23-1114

AMPEX DISTRIBUTED OUTSIDE U.S.A.
BY AMPEX INTERNATIONAL OPERATIONS, INC.

See us at the show—Booth 511

Circle 209 on Reader Service Card

PERFECT TIMING

Low Cost ESE Right On Timers



- ES-300:** Four digit incandescent display, one hundred minute timer (99:59) with six controls: Count Up, Count Down, Min-Set, Sec-Set, Stop, Reset. **\$168.00**
- ES-301:** Identical to ES-300 except with planar, gas discharge display. **\$185.00**
- ES-302:** Equivalent to ES-301 plus fast-set lever wheel programing. **\$238.00**
- ES-400:** Three digit ten minute timer (9:59) with Start, Stop, Reset. **\$ 98.00**
- ES-510:** Four digit sixty minute timer (59:59) with Start, Stop, Reset. **\$125.00**
- ES-500:** Six digit, twelve hour combination clock/timer with five controls: Start, Stop, Reset, Fast Advance, Slow Advance. **\$150.00**

STANDARD OPTIONS AVAILABLE: Kit; Slave; BCD Output; Remote Connector; 6' Remote Cable and Pushbutton Set; 220V A.C., 50Hz; 9" or 19" Front Panel 3 1/2" high; 3 Wire Cord and Molded Plug. Tenths of seconds are available on all timers except the ES-500. Relay Contact Closure at Zero and/or Stop at Zero available on ES-300, 301, and 302. Crystal Timebase available for ES-500. Custom options and special orders available.



WRITE, WIRE OR CALL TODAY

505 1/2 Centinela Avenue • Inglewood, California 90302 • (213) 674-3021

Circle 210 on Reader Service Card

How About That!

A Back Pack TV Camera Battery With 250% More Power Output

(At No Increase In Weight)

Specify

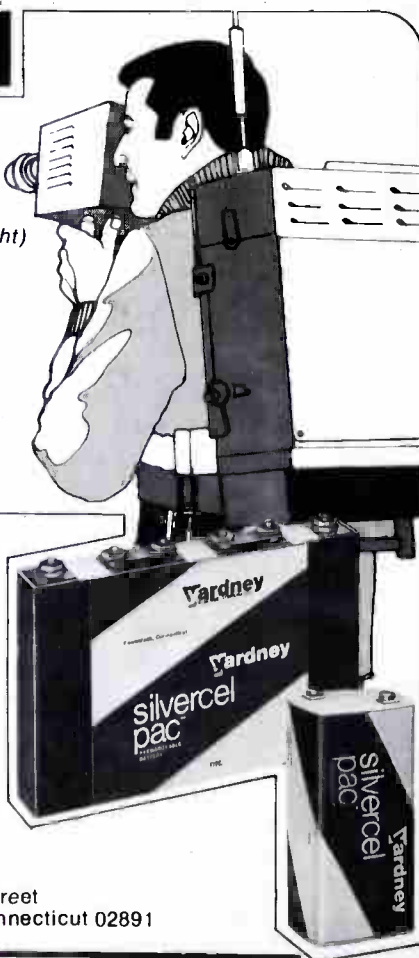
silvercel

By Yardney

Or, If Your Present Battery Is As Powerful As You Want It . . . How Would You Like To Have It At 1/3rd Its Present Weight?

Silvercel rechargeable batteries pack the most useable power into the smallest and the lightest modular package. Used by all major manufacturers of TV Back Pack Cameras as original equipment, they offer the added advantage of a QUICK CHARGE without battery damage by the use of a quick pulse charge.

Silvercel (silver/zinc) rechargeable batteries — the recognized standard of excellence in power output for back pack TV cameras. Our technical assistance and catalog are yours for the asking.



Yardney
ELECTRIC CORPORATION

82 Mechanic Street
Pawcatuck, Connecticut 02891

Circle 211 on Reader Service Card

NAB 1976



JVC portable recorder
CR-4400

JVC Industries, Inc. (Booth 41)

Will introduce to NAB a comprehensive line of video camera recording products, among them **8300U, top-of-the-line 3/4-in. U-1 cassette recorder; CR60 U-Matic cassette recorder for educational market; CR4400U, portable U-Matic, totally self-contained including batteries, weight (with batteries) 25.5-lbs.; GS-4600U portable monochrome cameras, with C-Mount zoom lens, built-in telephone LED indicator for recording and battery condition; new recording series specifically for U-Matic applications, including CD-1636 portable audio cassette recorder, MI-E60 mixer parabolic reflector, booms, mikes, and series.**

Kaman Sciences Corporation (Booth 809)

Will demonstrate the BCS 1100 business automation system, handling financial and accounting for both radio and TV. Also: will introduce and demonstrate a new BCS 1100 system that **handles AM/FM/TV simultaneously, and provides interface to automated switching.** Will demonstrate actual interfaces to Vital Industries, Grass Valley and CDL switcher.

Kansas State Network (Booth 02)

Will emphasize the **Message Master character generator, Model CC11**, a low-cost production model with speeds of roll and crawl, flash, line, automatic centering, 8 pages storage (expandable to 40 pages) showing: line of character generator **TC-100B, CG-600, CG-100, CC**

Key Marketing Corporation (Booth 911)

Will demonstrate their **automated phone polling system**, for radio and TV stations, "Instapoll", which delivers recorded polling questions to dialed phones, records responses.

continued on page 14

DFS-3000 Digital Framestore Synchronizer

would take a wall full of equipment to handle the job that DFS-3000 does in just 8.75 inches of rack space. In fact, every synchronous treatment needed for the full spectrum of NTSC compatible broadcast activities is literally at your fingertips in this light, rugged, fully portable system that goes anywhere.

Just check this list of available features:

- ▶ Two complete fields of store for full broadcast versatility.
- ▶ Infinite window TBC corrects time base errors on any VTR including ENG.
- ▶ Look Ahead Velocity Compensator cleans up color vectors on direct color VTR's for truer color presentation across entire picture.
- ▶ Video Compressor enables producer to insert second live image in any quadrant of screen.
- ▶ Joystick Control allows compressed picture to be positioned *anywhere* on screen.
- ▶ Broadcast Quality SPG permits synchronizer to be used as station reference.
- ▶ Memory Analyzer ensures system integrity.

- Frame or Field Freeze for special effects.
- Remote Control Panel for production flexibility.
- Synchronous clean-up of non-synchronous switches eliminates picture tearing and rolling.

All these features, and broadcast quality too, are packaged complete with power supply and analog circuitry in this fully modular system that weighs less than 60 lbs. Even more significant, power consumption is a mere 250 VA, keeping heat problems to a minimum.

For information on our demonstration program, call or write George Grasso, MCI, P.O. Box 10057, Palo Alto, CA. 94303. Phone: (415) 321-0832.

Quantel Limited
REPRESENTED BY MCI PALO ALTO, CA.

See us at NAB: Booth 926

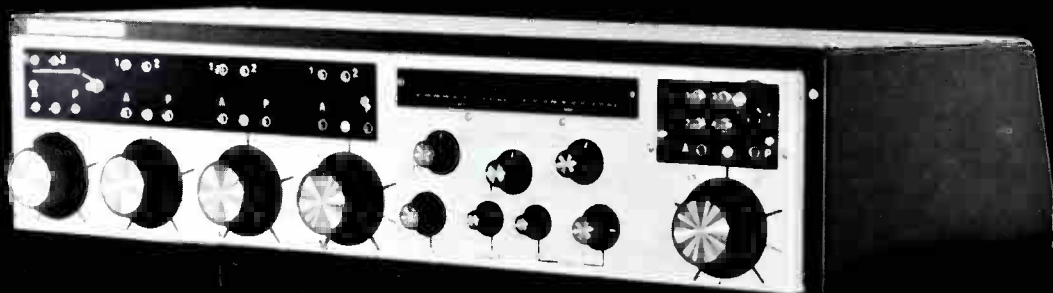
We pack more in here...



so you do less out there

Circle 212 on Reader Service Card

Tomorrows audio consoles here today!



THE BIGGEST ADVANCE OF AUDIO CONTROL IN THE LAST 15 YEARS . . .

NAB Booth
#919

Noiseless input select switches. Noiseless audition / off / program select switches. Noiseless audio mixers. Noiseless cue switching. Do these things make any sound at all? You bet! Probably the cleanest sweetest low distortion sound you've heard from any audio console regardless of price. Not only that but these babies are loaded with features that: (1) you will only find in consoles selling for 5 to 10 times more; (2) you'll only find in these consoles . . . period.

From our exclusive illuminated Touch Pad audio select switching, thru our, "better

than a VU meter", solid state light emitting meters, to the highly reliable & noiseless method of audio control. That's not all. Prices that are almost unbelievably low (compared to what you're used to) and performance that takes second place to **none**.

Want more? OK, how about RAMKO's exclusive SIMUL-Q or our full range gain select on each input, or the cue and monitor mute select patch boards on each channel (except the last one). The plug in amplifier cards or the RF suppression.

Call collect or write today. You'll find both an exciting and profitable adventure.

MODELS & PRICES

SC-5M Single Channel, mono . . . \$
DC-5M Dual Channel, mono . . . \$
DC-5MS Dual Channel, stereo . . . \$
DC-8M Dual Channel, mono . . . \$
DC-8MS Dual Channel, stereo . . . \$

RAMKO RESEARCH

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SACRAMENTO, CA 95823
Telephone (916) 392-2100

Circle 185 on Reader Service Card

...ws polling of 500 to 1000 phones
day.

**gel Brothers Stage Lighting
oth 508)**

...nting control systems for studios
remote locations, comprehensive
of studio and TV lights and light
ssories.

ox, Ltd. (with Optek Booth 902)

...ll show the **K128 TV titling**
em, low-cost character generator,
n upper and lower case, mixable
n, foreign letters and math symbols,
and crawl optional. Also: the
32 memory, which adds 32 full
es of storage to K128; and in-
ucing the **KFL16**, which generates
ngle line of characters for insert in
ting video, stores up to 16 mes-
es for instant push-button recall.

anco Electronics (Booth 707)

...ll introduce a new series of **modular**
eo test signal generators for the
eo 300 system, which will also be
display. Also showing: digital gen-
k sync generators; color stabilizing
plifier; video presence detector;
eo, pulse, and subcarrier distri-
ion amplifiers; monochrome video
nera.

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k sync generators; color stabilizing
plifier; video presence detector;
eo, pulse, and subcarrier distri-
ion amplifiers; monochrome video
nera.

**Lightning Elimination Associates
both 115)**

...owing their **system of prevention of**
lightning strikes on protected broad-
cast antennas, towers, power lines, etc.

LB, Inc. (Booth 813)

...ll show a new **stereo audio console**,
odel S-20, with **30 stereo inputs, 10**
ster channels, dual stereo program
annels. Also showing: four, five and
eight-channel mono consoles and five
eight-channel stereo consoles; a
omplete working DJ mini studio; also
ntables, tonearms, preamps, car-
tidge machines, audio distribution
plifiers, compressor/limiters.

AV International (Booth 136)

... film chain projectors.

arconi Electronics, Inc.

(Booth 301)

...ll emphasize the **Mark VIII-B**

continued on page 150

Have a great day...

... with System 90. Formatting versatility and programming simplicity are only two of the reasons why Harris' micro-computer program automation will make your broadcast day easier and more profitable!

No other competitively priced system offers so much. Which is why System 90 is now the choice of stations all across the country. Let us show you how to have a really great day . . . everyday. Write Harris Corporation, Broadcast Products Division, 123 Hampshire Street, Quincy, Ill. 62301.



HARRIS
COMMUNICATIONS AND
INFORMATION HANDLING

Circle 213 on Reader Service Card



NEW 2 GHz CIRCULARLY POLARIZED "GOLDENROD" ANTENNA

- Ideal for Remote TV Broadcast Operations
- Equivalent Performance to Two Foot Parabola with Minimal Wind Loading
- Folds Down Flat on Roof of Mobile Van
- Circularly Polarized to Eliminate Multipath Signals
- 19 dBi Gain
- 18° Beamwidth, Nominal

FOR FURTHER DETAILS CONTACT:

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Baltimore, Md. 21211

• 301-462-1700

Circle 214 on Reader Service Card



\$160 PER HOUR BRILLIANT PERFORMANCE

VTC 1000 Mastering Video Tape is a significant breakthrough in broadcast video tape. For the first time, discriminating broadcasters can depend upon a video tape to equal the performance of the newest state of the art equipment. The technical characteristics of low dropouts, hi signal to noise, and low chroma noise are only an indication of its quality; the proof is in the picture. **With State of the Art VTC 1000 pictures come out the way they go in.**

Find out more about VTC 1000 and the full line of video tape, videocassettes, and tape accessories available from The Video Tape Company.

THE VIDEO TAPE COMPANY
4212 Lankershim Blvd
North Hollywood, California 91602
Mr. Keith Austin, President

Mail this coupon today for free price and information brochure.

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Title _____

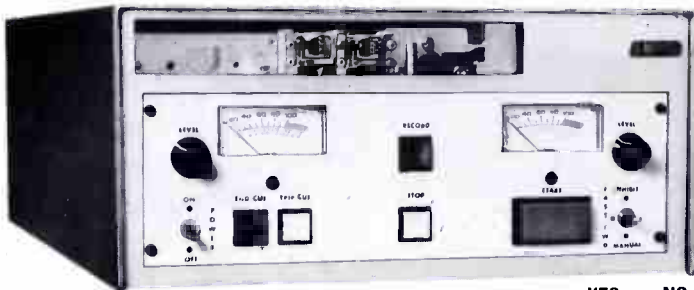
Company and/or Channel _____

City _____ State _____ Zip _____

Circle 215 on Reader Service Card

CHECK... CONSIDER...

Do your cart machines, or the ones you're talking about buying, have these standard features:



- | | | | | |
|---|--------------------------|-----|--------------------------|----|
| Direct drive hysteresis synchronous motor | <input type="checkbox"/> | YES | <input type="checkbox"/> | NO |
| Self-aligning pinch roller with air-damped solenoid | <input type="checkbox"/> | | <input type="checkbox"/> | |
| Automatic record/playback meter switching | <input type="checkbox"/> | | <input type="checkbox"/> | |
| 100 kHz transformerless bias oscillator | <input type="checkbox"/> | | <input type="checkbox"/> | |
| No adjustment digital cue synthesizer and detector | <input type="checkbox"/> | | <input type="checkbox"/> | |
| Superior RF field immunity | <input type="checkbox"/> | | <input type="checkbox"/> | |
| + 8dBm output, + 22dBm clipping; 58dB s/n ref. 3% THD | <input type="checkbox"/> | | <input type="checkbox"/> | |

All 34 standard AMPRO models do! PLUS MUCH MORE. Available in 1/2 or 1/3 rack and desk configurations. Options include automatic fast forward with manual override and electronic splice finder. Priced from \$695.00 to \$1,945.00.

AMPRO also produces a comprehensive line of 6, 8, 10 and 12 channel mono, dual mono, stereo and dual stereo/simulcast broadcast audio consoles. For complete details, call collect today or write:

Rep Inquiries Invited. See us at the Show.



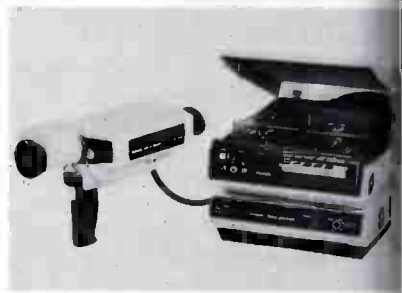
AMPRO CORPORATION
850 PENNSYLVANIA BLVD., FEASTERVILLE, PA 19047 • (215) 322-5100
Professional Equipment for Broadcasting Professionals
See us at Booth #812. NAB

Circle 216 on Reader Service Card

NAB 1976

automatic studio and portable video cameras, with new HOP (hi light overload protection), in an operating studio demonstration. Introduced to the U.S. will be "DICE", digital intercontinental conversion equipment for digital automatic standards conversion among NTSC/PAL/SECAM. Also shown: B3404 telecine system test instruments; camera tubes.

Marti Electronics Inc. (Booth 70) Will introduce "fifth generation remote pickup systems, and also new digital transmitter remote control system for radio and wire line operation. Also showing: aural studio transmitter links and accessories; compressor/limiter units; program/line monitor amplifiers.



Panasonic portable recorder

Matsushita Electric Corporation of America (Panasonic) (Booth 52) Will show the portable color system Model WV-2200/NV-3085, consisting of 2-vidicon color camera weighing 7-lbs., camera control unit, and portable VTR. Camera has 6:1 zoom lens, automatic light control, horizontal luminance resolution 400 lines at center, minimum light 50 foot-candles at f/2, RGB optical system, monochrome viewfinder/playback monitor. VTR is 1/2-in. EIAJ, using half-inch, 5-in. reels, automatic video and audio level controls. System is powered by batteries in CCU and VTR. Will also show the Model NV-3160, VTR using 1/2-in. tape with electronic editing signal locked to incoming vertical sync by capstan servo; also the new Model AK-900 color video camera, with the 1-in. Plumbicon tubes, built-in NTSC encoder and sync generator, horizontal resolution 500 lines at center, 15 foot-candles sensitivity.

McCurdy Radio Industries (Booth 704)

Will show for the first time the model 8500 modular stereo on-air console, the SA 141 reel-tape input switcher and cue unit; and the DA 504 audio distribution assembly. Also showing the S 7700 20 input mixer, with 4 submaster

continued on page 11

INNOVATIVE ELECTRONICS

for Recording and Broadcasting

MODEL 201 Average and Peak Responding Limiter



Dual-function limiter for studio recording, mastering, and broadcast production. The fast-acting Peak Limiter restricts program peaks to the ceiling value preset by a calibrated knob. The Average Level Limiter provides independent control over the average program level with choice of AVG "VU" response characteristics. A unique "ripple canceling" circuit reduces distortion to less than typical values. \$180.

MODEL 210 Frequency-Selective Broadband Peak Limiter



For independent control of high frequency program energy and broadband peaks in broadcasting and recording. Variable control of peak ceiling, attack, release, and high-frequency limiting threshold. H.F. limiting characteristic determined by plug-in "insert", which can be tailored to match system overload curve. \$490.

MODEL 220 Audio Level Optimizer



Maximizes average program level and restricts instantaneous program peaks for broadcasting. Independent Peak limiting and Average Compression functions are fully related to minimize "breathing" or "pumping" effects. Optional Frequency-Selective Limiting for FM. \$680.

MODEL 375 Tape Recording Electronics



Modern recording capability for older professional recorders or for new installations. 3-speed equalization with separate EQ for optional SYNC amp. "Linearized" record amplifier and phase-corrected reproduce circuitry for lowest distortion. Fully self-contained, and all functions fully remotable. Pin-compatible with most Ampex machines, easily adapted to many others. \$690.

TENTROL Tape Tension Control



Automatic, accurate control of tape tension with reels up to 14 inches. Eliminates pitch change from beginning to end of reel, improves high-frequency performance, and extends head life. Model 405 for Ampex machines: \$300. Model 420 for Scully recorders: \$330.



Write or call for complete information and prices.

INOVONICS
INCORPORATED

1630 Dell Avenue, Campbell, California 95008 (408) 374-8300

Circle 217 on Reader Service Card

Dymek AM5 Tuner: Worth Talking About



Here's what your colleagues say about our new AM5 tuner monitor:

“ In regard to ... the operation of the AM5 tuner we purchased this past year, the program, production and news staff have been ecstatic. With the AM5 we can show “off air” response up through 15,000 Hz and there is almost no discernable difference when switching monitors from “off console” to “off air.” ... I am well pleased ... ”

Carl A. Lewis
Chief Engineer
KLMS Radio, Lincoln, Nebraska

“ I am pleased to report that the (AM5) units perform superbly ... When the DA5 antenna was connected and ... adjusted properly, all interference was reduced and the background noise was almost as low as an FM station. ”

Arthur F. Marko
AM Engineering Supervisor
WOR Radio, New York

“ We are exceedingly pleased with our AM3 and AM5 tuner. The output quality and separation, etc. are excellent ... We have used your tuners extensively for monitoring and recording, and have found them to be superior to anything else that we used in the past. ”

Harry H. Curtis
Manager Technical Operations
American Broadcasting Company

The AM5 is an excellent inexpensive AM monitoring tuner. That's why 30% of Dymek sales are to radio stations. Special features such as less than 1% distortion, the best ceramic filters, solid state construction, and the 150 - 160 ohm option have made the AM5 the choice of sixty top North American radio stations.

Isn't this reason enough for you to use Dymek equipment?

Try out the AM5, and its companion antenna the DA5, free by calling Larry Engard, our national sales manager, toll free.

800/854-7769 Nationwide
800/472-1783 California

We stand alone in our field.



McKay Dymek Company
675 North Park Avenue
Pomona, California 91766

Circle 218 on Reader Service Card

NAB 1976

two master channels, audio console for TV production; the CS 9100, ten-station intercom system; the SS 7600 radio production console.

McMartin Industries Inc. (Booth 609)

Will show a large expansion in the line of AM and FM broadcast transmitters, which includes FM models at 10 watts, 1.5 kW, 3.5 kW, 12.5 kW, 27.5 kW and 55 kW; AM models are 1 kW and 2.5 kW. Both FM and AM transmitters from the line will be demonstrated. Also shown: full line of AM and FM monitoring equipment; remote pickup broadcast systems; 8- and 5-mixer audio consoles; complete McMartin two-tone interstation signal equipment for EBS, with associated AM and FM receivers.

MCI—Quantel (Booth 926)

Will introduce the DFS-3000 digital framestore synchronizer.

Memorex Corporation (Booth 537)

Will introduce a new helical-scan tape for their IVC 9000 VTR. Also showing: Chroma 90 broadcast chromium dioxide videotape and 3/4-in. video cassettes.

Merlin Engineering (Booth 14)

Will have on display custom-built quadplex VTR's; also hi-band color conversion kits, and accessories for quad tape machines.

Charles Michelson, Inc. (Booth 923)

Showing the “Famous Drama” series of programs now available to radio stations, among them “The Shadow”, “The Lone Ranger”, “Fibber McGee and Molly”, and others.

Micmix Audio Products, Inc. (Booth 829)

Introducing the new “C” series of reverb units at economy prices; also an improved version of the Studio B model. Also showing: the “Master-Room” series of reverberation chambers with models designed specifically for broadcasters.

Micro-Communications (Booth 118)

Complete line of FM and TV antennas, including circularly polarized TV models; microwave antennas for fixed paths; microwave antennas for ENG, with switching selection of from 360° coverage, quadrant and polarization selection; antenna accessories.

Microtime (Booth 709)

Will introduce the Model 2020 video signal processor, which provides time base correction plus additional func-

tions especially for ENG application including automatic tracking for pressing video from portable VTR. Also introducing the “Image EX” image enhancement system, for improving subjective quality, SNR processed video; and the new Digi II, automatic control system for VTR's, with microprocessor provided pushbutton random assignment of V sequences. All assignments shown LED readout, can be amended at time; all switching at the vertical interval; optional are automatic commercial insertion, and automatic recording delay broadcast.

Micro-Trak Corporation (Booth 815)

Will introduce the new “D Compact” series of portable audio playback consoles, consisting of two turntable control system, microphone, in a transportable unit with folding legs, instant set-up on location. Also showing the line of other playback consoles including broadcast, recording, studio and disco models; turntable preamplifiers; turntables; studio furniture tape cartridge racks, other accessories.

Microwave Associates (Booth 36)

Will emphasize the MA-13CP microwave “window” system for ENG. Also showing: the MA-12G, 10.7-13.25 GHz remodulating microwave relay; MA-2BP-W, remodulating 1.5 GHz portable microwave system; MA-6GW, remodulating 6 GHz microwave system; MA-2G microwave radio system; PAC-4 demodulator.

Minneapolis Magnetics (Booth 80)

Heads for magnetic tape recorder replacement heads for all leading recorder brands.

3M Company, Magnetic Audio/Video Products Division (Booth 527)

Exhibit will have a general Bicentennial theme, plus a 20-years-of-magnetic-recording theme. Shown will be the full line of quadplex and helical video tapes, video cassettes and video cartridges, plus a number of accessories.

3M Company, Mincom Division (Booth 529)

Will introduce seven new products: Model 1114 production switch with four buses, 11 inputs, special effects generator; D-2000 character generator, low cost titler with 4-page memory, choice of fonts, high resolution (1120 video elements); R image enhancer, with green-derived enhancement, 3.58 combing, adjustable noise reduction; D-8000 video

continued on page 1

There's News Out There...



And Farinon's Portable, Frequency-Agile Microwave Gets It On The Air!

The new FV Portable Microwave system is available for all bands from 1.99 to 13.25 GHz. You dial-tune to your operating frequency on the spot. There's no need for bench-work before you set up a remote pick-up. No filter selection. You don't even need a screwdriver.

You can plug in video monitors, or clampers, or up to three sub-carrier channels.

You can run 500 feet of cable between the RF head and the FMT or FMR remote unit without roll-off or equalization.

And you get 1-watt output level from 6.875 to 13.25 GHz, 5-watt output (optional 20-watt) from 1.99 to 2.11 GHz, $\pm 0.002\%$ frequency stability; 60-dB signal-hum ratio from dc to 10 kHz, and 70-dB signal-noise ratio from 10 kHz to 5 MHz.

Farinon Electric, 1691 Bayport Ave., San Carlos, CA 94070, U.S.A. Tel. (415) 592-4120. Telex 34-8491.
... in Canada: Farinon Electric of Canada, Ltd., 657 Orly Ave., Dorval, P.Q. H9P 1G1, Canada.
Tel. (514) 636-0974. Telex 05-82-1893.

Farinon

NAB Booth 110

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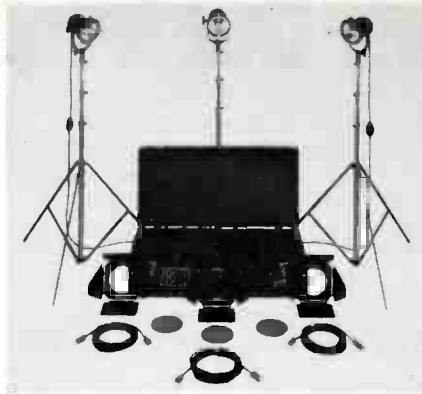
art memory system, converts high contrast art into digital form for storage on low-cost diskettes, with random access for immediate broadcast; video outliner, for edging shadows and outline effects; D-3000/D-4000 animation generator, with full-frame sequences from memory at 6 to 12 frames per second for animation effects; keyer/colorizer, for colorizing titles and borders.

Mohawk Wire and Cable Corporation (Booth 212)

TV color-camera cables and connectors for most American and European cameras.

Mole-Richardson Company (Booth 114)

Will introduce **new HMI Mole Solar Arcs at 1200 watts, 2500 watts, and 4000 watts**; also a new 2500 watt HMI Mole Solar Arc Molelipso. Also new: the 1800 watt Teenie-Weenie Mole Kit, consisting of three heads for 30 volt or 120 volt globes, 250—650 watts, plus stands, barndoors, scrims, carrying case, cable, etc. Showing in addition: Focusing spot: focusing quartz, 600 to 2000 watts; comprehensive line of Baby Solarspots,



Mole-Richardson lighting kit.

Molequartz Molelipso, Baby Softlights, Scoops, Kits, adapters, accessories.

Moseley Associates (Booth 505)

Will introduce revised version of **Model PCL-505 series of aural studio-transmitter links**, with new all-solid-state on-frequency RF power amplifier, maximum 7 watts output, higher efficiency than earlier designs. Also showing: SCG-9 stereo generator; Series 8 subcarrier system; and the complete line of remote control, remote pickup, digital remote systems, digital control systems with computer option.

Nagra Magnetic Recorders (Booth 708)

Miniature, intermediate and small portable tape recorders for broadcast and recording studios.

National Cine Equipment (Booth 117)

Will show for the first time the **Model TV350 support head** with unique film cam; also showing complete line tripods, dollies, heads, other support equipment for TV cameras.

Rupert Neve Inc. (Booth 715)

Will show the **Model 5302 "Mabourn" audio console**, with 16 input channels, separate mike and line inputs and comprehensive equalization, 2 line level direct inputs, main group outputs, complete console monitor, solo, foldback, echo, etc., for studio or mobile applications. Also **Model 8301 "Kelso"**, 10 input channels, 2 main output groups, transportable console, with complete equalization, cue, listen, solo, etc.

Nortronics Co. (Booth 801)

Heads for all magnetic tape applications; replacement heads for leading brands; test tapes; head and bulk degaussers; tape machine cleaning equipment and other accessories; tape editing equipment.

Nurad, Inc. (Booth 320)

New products: **7GHz omni, quarter polarized antenna system for remote TV pickup**; 7 GHz circularly polarized 2-ft. diameter directional antenna; 7 GHz "Goldenrod" circularly polarized antenna for mobile ENG vans and other low-windload requirements; 2 GHz omni circularly polarized antenna; 7 GHz multipolarized 2-ft. diameter directional antenna. Also showing: complete line of other microwave antennas for remote TV pickups.

Optek (Booth 902)

Will introduce the new **automatic universal bulk degausser**, Model 79, handling tape 1/4-in. thru 2-in. on NAB hubs, and all cart and cassette format audio and video, including color chrome and chromium dioxide tape, degaussing to level below -95 dB. Also introducing the **Model 1400 video transmitter demodulator** for use with Tektronix 1440 automatic color corrector. Also showing: **Model 1010B video noise meter**; new two-wire intercom closed circuit headset system, up to 10 stations connected to either of 2 channels, aural and visual page (flashing lights).

Orban/Broadcast (Booth 909)

Will feature the new **Optimod-F audio processing system for stereo**, which includes the stereo generator, compressor, limiter, etc.

continued on page

MODEL 7200 chroma keyer



- Produces chroma-keyed output from two encoded video inputs
- Comb Filter
- Zero chroma delay
- Sync adding capability for non-composite inputs
- Remote control panel includes vertical-interval key on/off switch

DYNASCIENCES | video products

A SUBSIDIARY OF **Whittaker**

Township Line Road, Blue Bell, PA. 19422
Tel.: (215) 643-0250 / Telex: 84-6358

Circle 220 on Reader Service Card

Our best ad is our price list.

note 3000
 priced 21900

Ext. Sync
 Under Scan
 330
 330
 330
 1/11/77

I can't find this anywhere. Give them a call. Fox



JSC SETCHELL CARLSON		User Price List	
A Subsidiary of Audiotechnics Corporation		EFFECTIVE NOVEMBER 1975	
MODEL NUMBER	DESCRIPTION	USER SET	PRICE
50010C	FIVE-INCH MONITOR and picture tube without cabinet		50.00
50010D	TRIPLE-FIVE MONITOR; three 5-inch monitors in a row with rack/desktop metal cabinet		700.00
50017	SIX-INCH MONITOR with metal cabinet and adjustable underscan		230.00
50017T	TRIPLE-SIX MONITOR three 6-inch monitors in a row with rack/desktop metal cabinet and adjustable underscan		660.00
50017C	TEN-INCH MONITOR with metal cabinet		225.00
50017D	TEN-INCH MONITOR chassis and picture tube without cabinet (left panel blank)		215.00
50017E	TEN-INCH MONITOR with rack/desktop metal cabinet (right panel blank)		250.00
50018	DUAL-TEN MONITOR; two ten-inch monitors in a row with rack/desktop metal cabinet		400.00
50019	TWELVE-INCH MONITOR with metal cabinet		275.00
50020	SEVENTEEN-INCH MONITOR with metal cabinet		330.00
50021	NINETEEN-INCH MONITOR with metal cabinet		300.00
50022	NINETEEN-INCH MONITOR rackmount version		300.00
50023	TWENTY-THREE-INCH MONITOR with metal cabinet		400.00
50024	TWENTY-FIVE-INCH IC-100 COLOR MONITOR		21.00
50025	TWENTY-FIVE-INCH IC-100 COLOR RECEIVER		825.00
50026	TWENTY-FIVE-INCH IC-100 COLOR MONITOR/RECEIVER with VTA video/audio drive outputs		825.00
50027	TWENTY-FIVE-INCH IC-100 COLOR MONITOR/RECEIVER with VTA video/audio drive outputs		800.00
50028	RF DEMODULATOR with rack/desktop metal cabinet		975.00
50029	MOTION DETECTOR with metal cabinet		75.00
50030	MOTION DETECTOR with metal cabinet		75.00
50031	MOTION DETECTOR with metal cabinet		345.00
50032	MOTION DETECTOR with metal cabinet		320.00

JSC ELECTRONICS, INC.
 A SUBSIDIARY OF AUDIOTECHNICS CORPORATION
 BRIGHTON, MN 55112 (612) 633-3131

We invite you to compare Setchell Carlson with any other monitor, receiver, demodulator or motion detector. When you do, we think you'll agree... Our Best Ad is our Price List! Feel more secure with Setchell Carlson—Made in America. Write us for further information and specifications.

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530 5th AVE. NW. NEW BRIGHTON, MN. 55112 (612) 633-3131

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providing very high average modulation at low distortion; will also show the Parasound line of processing equipment for broadcasting and recording.

Otari Corporation (Booth 209)

Will introduce improved versions of the following: **ARS-1000 radio automation tape reproducer**, designed for heavy-duty use in automation systems, 7½ and 3¾ ips, two-channel stereo (half-track) heads, front-adjustable azimuth, ready light to indicate proper threading; **MX5050 player/recorder**, with new optional variable speed DC capstan servo, built-in test and cue oscillator, other complete operational features as before, available in two-channel and four-channel versions; new eight-channel version of **MX5050**, with ½-in. tape and variable-speed DC capstan servo as standard; also the **MX-7308**, eight-channel recorder using 1-in. tape, optional DC capstan servo, standard reel tension servo, motion sensing, remote capability.

Pacific Recorders and Engineering Corporation (Booth 717)

Will show the **Multilimiter, multi-purpose limiter for broadcast applications**; Multisync, variable speed control for synchronous motors; Dig-

itimer, digital stop watch; tape velocity indicator for MCI recorders; digital clock. Also: showing MCI recorders for broadcasters.

Paperwork Systems (Booth 108)

Will show new **BAT computerized data systems** for billing, accounting, traffic and payroll, radio and TV, models 1300, 1400 and 1450; also showing the 1500 system.

Pentagon Industries (Booth 621)

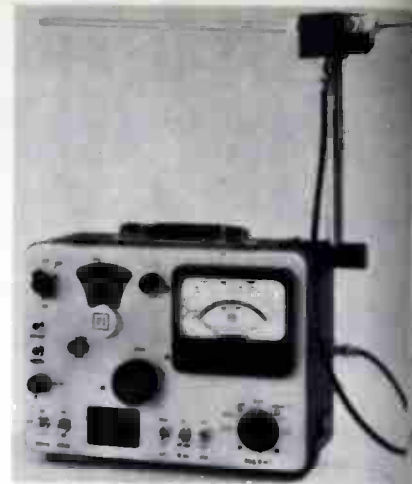
Will show for the first time the new **4-channel high speed tape copier, model C4**; also emphasizing the Tri-Master editing/duplicating system.

Phelps Dodge Communications Co. (Booth 625)

Will show **FM antennas**, rigid coaxial transmission line, transmission line accessories.

Philips Audio/Video Systems Corporation (Booth 516)

Will have a "hands-on" presentation of video cameras, including the new **LDK-11 portable color camera, with three ⅝-in. Plumbicon tubes, weight 15-lbs.**, and 19-lb. backpack with batteries, producing processed, encoded signal. Also: the **LDK-25** multi-conductor studio and field camera; the **LDK-5 Triaxial** studio and field camera; the **LDH-20S** moderately-



Potomac field strength meter.

priced color camera; **LDH-20T**, same in Triaxial version. Will also show broadcast transmitters; integrated color telecine; Magnavox hand-held color cameras and monitor/receivers; audio mixing consoles; **AKG** microphone test and measuring equipment.

Potomac Instruments Inc. (Booth 523)

Will introduce the new **FIM-71 VF field strength meter**, completely portable, for extended field use. Also showing: **AM, FM and TV field strength meters**; antenna monitors; **RF synthesizer/detector**.

Power-Optics Inc. (Booth 103)

Will show videotapes of results using new **servo optical device, "Scer-Sync"**, which allows panning and timing camera in Chroma Key scenes with stability of background. Also showing line of digital remote control systems for video cameras; **Grafikon** optical color comparator for color monitoring matching.

Q-TV Telesync (Booth 208)

Showing line of **video prompt systems**, including Model **VPS-10**, with console transport; Model **VP-300**, conveyor transport.

QRK Electronic Products (Booth 702)

Will show a new **four-channel broadcast console**; the new **Alpha pre-amplifier**. Also showing the line of other audio consoles, turntables, tone arms, preamps.

Quick-Set, Inc. (Booth 312)

Will show complete line of **television camera support equipment**, including new fluid heads for cameras from 5 to 150-lbs. Also showing the **Houston Fearless** line of support equipment for studio and ENG cameras.

For Tape Heads Head for TABER

At Taber you get precision work, quality results and low price... unmatched by any other audio head manufacturer.

We will recondition your three head assembly... F/T \$45.00... 2 TRK \$60.00. Three new 2 TRK heads installed and aligned in your AG-440B for \$264.00... Scully 280 at \$270.00.

Ampex VTR audio is priced at only \$385.00 for four new heads installed, or \$110.00 for four reconditioned heads. (Add \$38.50 if monitor post needs lapping.) RCA VTR audio heads are available for only \$475.00.

Loaner assemblies are available.

For heads, head for Taber... the best source available.

Send for free brochure.

TABER Manufacturing & Engineering Company
2081 Edison Ave. • San Leandro, Ca. 94577 • (415) 635-3831

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continued on page 15

We Package Imagination

Yours . . . and ours!

We build switchers for the video production industry because we learned to build them for ourselves.

Our first switcher was our imagination. All the Video Controllers we produce now are designed with *your* imagination.

That's the secret of our success: we build what you need!

Every production manager knows pretty well his desires . . . and chief engineers know what set of "specs" will accomplish those requirements.

We are producers and engineers, too! We know how to translate your needs into a switcher that not only takes care of today's requirements, but is modular in design and pre-wired for tomorrow's capabilities.

No switcher in the industry is more versatile, with broadcast quality performance . . . at a lower cost.

You are the people that have determined the state of the art of video production . . . we are the people that are designing to . . . and beyond that state.

We also package computer and video production software with that same philosophy . . . Your imagination, and ours can build a better product cheaper, because it's designed for tomorrow, not yesterday. Try us with a set of switcher requirements . . . production, editing or master control, we think you will be excited with our answer.

Us at NAB! Booth 627

For further information call or write:
Vice President, Marketing,
Video Controller Division

COMPUTER IMAGE CORPORATION

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Virginia 92807

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Cherry Hill, New Jersey 08003
(609) 424-4660

Communications Devices, Inc.
1700 17th Avenue, Suite 203
California 95050

Landy Associates, Inc.
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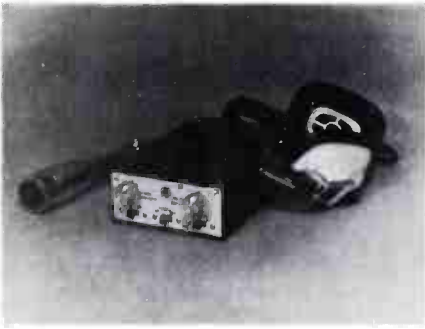
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3203 Lanier Drive
Atlanta, Georgia 30319
(404) 237-6097

Electronics
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Michigan 48024

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2809 Raintree Drive
Carrollton, Texas 75006
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7243 PRODUCTION SWITCHER
custom designed for KHTV
Houston, Texas



Ramko dual mike mixer

Radio Programs (Booth 927)

Will show three syndicated program formats for radio broadcasters: "Blue Denim", easy listening; "Blue Velvet", old standards; and "Star-trek", interview and music program in Country and Pop.

Ramko Research (Booth 919)

Will show for the first time a new series of audio consoles, including five-channel and eight-channel models, with DC control of all audio switching and mixing functions, touch-pad switching, meters combining instantaneous and VU ballistics, RF suppression, plug-in modular electronics. Will also introduce the DML-2 series of

portable, dual mike mixers, with individual limiting/compression on each channel for "set and forget" volume control, rated 20 Hz—20 KHz ± 1 dB, distortion 0.1% maximum, available in mono and stereo versions. Also introducing: solid state VU meters; 200 watts/channel. Also showing: pre-amps, mike and line amps; audio distribution amps; turntables; tape cartridge and cassette loaders.

Rank Audio Visual (with Strand Century) (Booth 124)

Will show for the first time in the U.S.: The Audix Model B101 audio console, with 10 mike/line inputs, two-group working modular construction, and comprehensive metering and talkback facilities; the Audix B200, compact audio console for smaller studios with two mike and eight line inputs, modular construction, the Rank Model 1724A wow and flutter meter, compatible with BS, DIN, and CCIR standards.

Rank Precision Industries (Booth 201)

Main attraction will be Model Mk III flying spot color telecine, (Rank Cintel), with vertical aperture corrector, automatic color corrector, NTSC encoder, remote control system. Also: static displays of lenses, including Va-

rotal 30, VRM, 16:1 RM and XX.

RCA/Commercial Communication Systems (Booth 500)

Will show production models of TK-portable video color camera (introduced in 1975 in engineering model); camera crews will use to make tapes throughout convention, to be edited and displayed in booths. Also introducing a new TV van for location work, with fiberglass body, carry two TKP-45 portable cameras, TR-600 VTR, and audio and switching equipment, with roof hatch, for camera positions. Display will highlight RCA's complete TV newsgathering systems, including cameras, portable microwave gear, portable VTR and editing equipment and accessories. Will also introduce a new studio color camera, TK-46, with new low-noise preamps, other refinements. Will show the complete line of videotape products, including the TCR-100 automatic cartridge player, and the TR-600 VTR with a new-generation editing system and new super-high-band recording format allowing high-quality high speed operation. Also shown: TK-telecine with built-in automatic controls; Video IV character generator with expanded capacity; the TCP-16 film cartridge system; 25 kW VHF transmitters; new klystron pulse modulation for UHF transmitters; new radio automation system with microprocessor control.

Recortec, Inc. (Booth 101)

Will introduce the Video Spot Assembler (VSA), microprocessor-based system for programming video spots from two VTR's, providing random access to up to 100 spots, access to stills and film chains; plays up to 10-second spots back to back, with changes allowable up to last break time; programming is by start and stop time, addressable with frame accuracy; up to 100 breaks programmable, with eight events per break.

Revex Corporation (Booth 549)

Will show their line of tape recorder for broadcasting, including the A7, A700, etc.; also the line of Beyerdynamic microphones; FM tuners, preamps, remote controls for tape recorders; consoles and mixers (Lamb); disc cleaners; studio lights.

Richmond Hill Laboratories (Booth 100)

Will demonstrate a fully automatic TV switching system, with the new VP-3000 series of video production switchers, a new video test signal generator and a new Unipulse pulse distribution system.

continued on page 1

QUICK-SET IS FEARLESS

...Houston-Fearless, that is.

Introducing, from Quick-Set, the professional champs in television and microwave support equipment. We've acquired the Houston Fearless product line of studio pedestals, heads, tripods and dollies. These popular heavy duty units accommodate a complete range of studio/remote requirements.

Stability, smooth action and quality are the key ingredients in every Quick-Set product. This is why we can offer a lifetime guarantee against defects in materials and workmanship. We back this with worldwide distribution and service to give you the professional support you deserve.

Send for our complete catalog.



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INCORPORATED
Instrument positioning equipment
3850 Woodhead Drive, Northbrook, Illinois 60062
312/498-0700 Telex: 72-4382

TANDBERG

10XD bridges the gap between consumer and professional tape recorders.

It's the world's first and only 10½" reel tape recorder that operates at 15 ips and combines Tandberg's unique Cross-Field recording technique with the world-famous Dolby* B system. Result: A *guaranteed minimum* signal-to-noise ratio of 72 dB, measured on a 4-track machine using IEC A-weighting. Simply put, the 10XD completely eliminates audible tape hiss!

Here are some of the many sophisticated features that make the 10XD the best tape recorder Tandberg has ever

... offered:
Speeds: 15, 7½, 3¾ ips. Electronically selected
Two motors; Hall-effect capstan motor
Two heads; plus separate bias head
Electronic servo speed control
Electronic logic mode controls, including photo optics
Electronic balanced microphone inputs
Auto stop, sound-on-sound, editing, and B tests

- Peak reading meters
- Direct transfer from playback to record (flying start)
- Ferrite playback head with symmetrical balanced output for hum canceling purposes and differential playback amplifier.

Remote control and rack mount optional. Pitch control by special order. For a complete demonstration of this remarkable new advance in stereo tape recording, see your Tandberg dealer.



*Dolby is a trademark of Dolby Laboratories, Inc.

Tandberg of America, Inc., Labriola Court, Armonk, N.Y. 10504
A: Allen Pringle Ltd., Ontario, Canada

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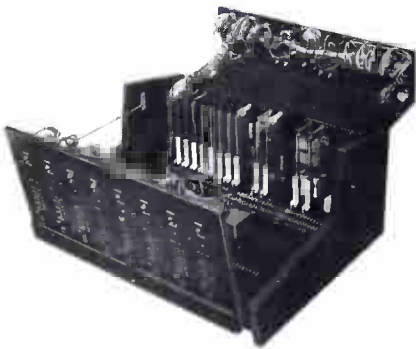
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Robins Broadcast and Sound Equipment Division (Booth 553)

Will introduce the **new portable stereo mixing console, Model FPC**, with 16 inputs, 8 balanced outputs; adjustable limiting, stereo panning, monitoring, pre-hear and equalization on every input.

Rohde and Schwartz Sales Co. (Booth 533)

Will emphasize a **new automatic TV transmitter and video signal measurement system**; a new VHF/UHF receiver/demodulator; a new automatic performance measurement system for sound broadcasting with data trans-



Robins portable stereo mixer

mission, remote control and program identification; also showing a new solid state 10 W UHF translator.

Rosco Laboratories (Booth 929)

Will introduce a **new portable light**, for ENG or film newswork, 200 watts HMI, with portable battery power, flickerless ballast control, for use with any film speed; also introducing an expanded line, Roscolux, with 76 color filters for lights, etc.; also showing the full Cinegel line of filter and reflector accessories for TV and motion picture cameras, and the line of HMI lights and light accessories.

Russco Electronics (Booth 551)

Showing their **broadcast turntables**; compact audio consoles; preamps; line amps; monitor speakers.

Sansui Electric (Booth 525)

Will have in operation a **complete QS quadrasonic audio line**, from four-channel tape and record input through encoder, exciter, etc. Will also show high-power audio amplifiers, the TU-9900 FM monitor tuner; the SR525 and SR717 direct drive turntables; the QS decoder line; CA 3000 studio preamp; SC3003 broadcast cassette deck.

Scientific-Atlanta, Inc. (Booth 132)

The feature attraction will be a **video satellite earth terminal**. Will also



Scully Model 285 B recorder

show line of enclosures for electronic equipment.

Scully/Metrotech (Booth 817)

Will introduce the **new Model 285 recorder/player**, available in full or half-track mono, or two-track or quarter-track stereo, with 600-ohm and 3-watt monitor outputs. Also showing new versions of 280B and 284 recorder/players; and broadcast loggers with time code generator/readers.

Sescom (Booth 119)

Audio amplifiers; audio equalizers

Shafer Electronics (Booth 615)

See under Cetec Corporation.

Shintron Corporation (Booth 907)

Will introduce the **new Model 36 basic four video switcher**, and the Model 315 sync generator for NTS. Also on display: Model 370 switcher with special effects generator, 6 inputs, built-in colorizer and keyer; the Model 367 switcher with sync generator, etc. code capability.

Shure Brothers, Inc. (Booth 324)

Will introduce **two new head-worn microphones**: Model SM-10, low-impedance, unidirectional microphone for talk applications, with close-talk operation, adjustable boom; and the SM-12, same with integral earphone assembly added.

Sintronic Corporation (Booth 713)

Will show their line of AM and FM **broadcast transmitters**; exciters; line surge protectors.

Skirpan Lighting Control (Booth 218)

Will have on demonstration a **computerized lighting control system** showing features of recently-installed \$500 M system for ABC New York TV studios; also showing components computerized systems, dimmer lights, etc., and covering software d

continued on page 1

Finest Cassette Duplicators at any price



combination system includes open reel and cassette master

Ease of operation; you don't have to be a professional to use it. High frequency response; obtain broadcast quality at 8 or 12 times speed. Complete expandability; add reel or cassette slave units as needed. This equipment is designed for continuous heavy duty use.

Write or call for an illustrated brochure covering Pentagon's full line of duplicator systems and premium cassettes.



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**Super C-1
Cassette Copier**
Ideal for duplicating from 1 to 100 cassettes in a hurry at an extremely low price.

- One button operation
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- 16 times speed, 30 l.p.s.
- Track selection

Enter Now Great Idea Contest 1976 Win a calculator!

Entry Form for BM/E Great Idea Contest—1976

Mail to: **Editors, BM/E**
274 Madison Avenue
New York, New York 10016.

Name _____ Title _____

Station Call Letters _____

Address _____

City _____

State _____ Zip _____

Telephone No. _____

Licensee _____

Class of Station at which idea is used (check one)
 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)

I assert that, to the best of my knowledge, * the idea submitted is original with this station; and I hereby give BM/E permission to publish the material.

Signed _____ Date _____

* If you feel credit for prior work or antecedents should be given to someone outside of the station, indicate to whom and when.

Tell us how you solved an annoying or time-wasting problem at your station. Gain professional recognition and become eligible for a prize at the same time. Three grand prizes will be awarded—a slide rule engineering calculator for the best idea from an AM station, FM station, and TV station. Ten secondary prizes consisting of pocket business calculators will be awarded in the categories of audio, video, control and RF. See rules for details.

Contest begins in March, 1976. Use entry form below and enter now.

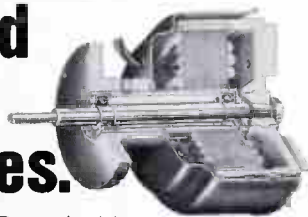
Rules for BM/E's Great Idea Contest

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.

Beau. The only quality replacement motor for cartridge and reel-to-reel tape machines.



Ever wonder why the unique Beau, inside-hysteresis synchronous tape drive motor is specified just about every major piece of cartridge tape equipment? Why so many Ampex and Scully machines are equipped with Beau replacement motors? The answer is simple: Quality. Beau offers unbeatable operating specs, outstanding reliability, long life, quiet operation, compact size, and conditional factory support. No import can beat Beau, the original broadcast tape drive motor.

To order Ampex and Scully replacements, specify tape speed and model number from the table below:

Type and Models	Beau Prices
Ampex — Model 440	\$180.00
Ampex — Models 350, 351, 354	\$195.00
Scully — Models 270, 275, 280, 282	\$180.00

For fast delivery of cartridge drive motors for ITC, ATC, Spotmaster, Ampro, and Sparta machines, call (313) 288-7731. Or write for our free Beau motor bulletin.

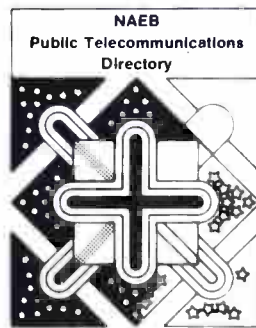
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NAEB 1976 Public Telecommunications Directory

YOU NEED THIS DIRECTORY!

The NAEB Directory of Public Telecommunications is the most comprehensive, reliable collection of data available on public broadcasting and instructional communications.



1976 Directory—published in March—includes complete information on:

- *every non-commercial television and radio station;
- *ITFS systems;
- *State Telecommunications Authorities;
- *related agencies and organizations;
- *NAEB members, including professional addresses and phone numbers; and
- *much more

Price: free to NAEB members/non-members \$9.00 includes 1st class postage (also available in bulk orders of 1-10 \$7.50/over 10-\$6.00).

Mail orders to: NAEB, Publications Office, 1346 Connecticut Avenue, N.W., Washington, D.C. 20036.

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veloped for large and small studio installations.

Joseph M. Soll, Inc. (Booth 120)

Will describe complete services for broadcasting, including **design, construction, and installation of broadcast facilities**, of RF switching and control systems, and of antenna towers.

Sonex International (Booth 224)

Chroma keyers; luminance keyers.

Sony Corporation of America (Booth 303)

Will show new technical advances and improvements in broadcast recording products, portable and mastering VTR's; also a **color camera for portable production requirements**, a time base corrector, video monitoring and editing equipment, audio equipment.

Sound Technology (Booth 123)

Introducing the **Model 1710A distortion measurement system** for determining total harmonic distortion in audio systems; combines oscillator and distortion analyser, balanced input and output, oscillator output calibrated -90dBm to +25dBm in 0.1 dB steps, automatic nulling distortion readable to

SMC DP-2
automation
system.



0.002% in five seconds.

Sparta Electronics (Booth 615)

See under Cetec Corporation.

Stanton Magnetics (Booth 811)

Will show complete line of **phono pickup cartridges** for broadcast and quality control applications, including the new 681EEE calibration standard, and the 600 and 500 series for broadcast use.

Storeel Corporation (Booth 700)

Will introduce a **new mobile-track system of storage enclosures with ready installation and noiseless operation**. Also emphasizing: other high-density mobile storage systems for the television, radio and audio/visual industries.

Strand Century, Inc. (Booth 401)

Will show the **MMS, Modular Memory System for automatic light-**

ing control. Also: the comprehensive line of lighting equipment, including HMI laniro quartzcolor halide fresnel 575 to 4000 watts; studio lighting systems for all sizes of studios; line-portable lighting kits; quartzcolor laniro cyclorama lights; laniro softlights; complete line of stands and accessories.

Willi Studer America Inc. (Booth 833)

Will show the new **Model A-4 quarter-inch recorder/player**, available in full-track mono and half-track head configurations, stereo and mono with three-speed crystal-controlled servo capstan; servo tape tension control on both reels; tape timer in minutes and seconds.

Studio Tape Exchange (Booth 811)

Will show video tape cleaning and evaluation service; also new and reconditioned videotape at discount prices. Will introduce a **S.T.E. brand videocassettes**.

Systems Marketing Corporation (Booth 709-A)

Will introduce the new **DP-2, microprocessor-controlled automatic system**; and the new "Ras-Pro" random access selector for music formats. Also showing the **DP-2 automation system**; the **Caro-Stat multiple cart player**.

Taber Manufacturing and Engineering (Booth 623)

Replacement audio heads for VTR and audio tape machines; test tape head and bulk degaussers.

Tektronix (Booth 515)

Will operate a "**measurement theater**", with sessions demonstrating actual operational measurement of AM, FM and TV stations; audio system measurements will be stressed in AM and FM sessions. Will cover production of performance, monitoring, and day-to-day maintenance. Will introduce the new **1410 series of NTSC sync pulsed and test generators**, with modular construction allowing choice of a number of generator types with plug-ins; also introducing the **1470 CC** color sync and test signal generator, providing gen-lock sync plus a selection of full-field test signals; it can

continued on page 44

NEED EQUIPMENT?

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FOR NEW OR USED BROADCAST EQUIPMENT

MOST MAJOR BRANDS • FAST SERVICE

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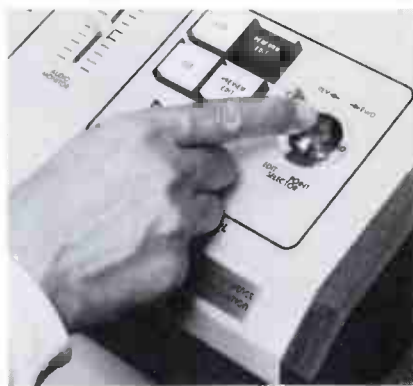
RELAX! ALL YOU NEED IS 20 MINUTES' EXPERIENCE BEFORE YOU'RE JOY-STICKING OUT ENG STORIES FOR THE EVENING NEWS



networks and major group owners are buying the ECS-1 by the dozens to break the ENG editing log jam

The Convergence joy-sticks provide continuously variable tape motion control from still frame up to three times normal play speed . . . both forward and reverse. The ECS-1 provides fingertip control of any speed you want, the farther you push, the faster you go in either direction. At last . . . videocassette editing with *noviola* style simplicity. News film editors converting to video tape have discovered that ECS-1 makes the ENG transition natural and hassle-free.

Tight audio cues are a snap. What's more, you can preview, and adjust precise audio or video cuts . . . as many times as you like . . . with both VTRs, automatically re-cueing back to a five-second preroll point. If this is starting to sound interesting, wait until you learn about our new SM-2 low cost joy-stick search and check module for a single VTR, and our new PC-3 triple function digital program computer for automatic bi-directional tape search, tape timing, and programmable inset timing with keyboard entry.



Simply stated: The ECS-1 makes it easier and faster for any operator than any system ever made. Select, preview, and perform precise, frame accurate ENG edit decisions on cassette VTRs. That's a promise! Let us prove it. Call or write for a demonstration. Better yet, see us at NAB.

CONVERGENCE CORPORATION

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Telephone: 714/549-3146

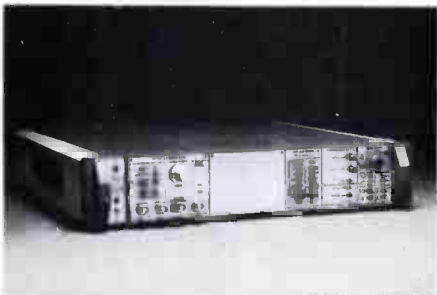
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NAB 1976

master sync generator, or be fully or partially timed from external sources; test signals, including color bars, multiburst, convergence, etc. Will also introduce model 1474, with same sync generator functions as Model 1470 but without test signals.

Telecine, Inc. (Booth 216)

Will show the **Schneider line of lenses**, introducing the new 30x lens with focal length of 34—1020mm, f/2.1 to f/5.3, weight 35-lbs.; a new low-cost wide-angle 15x lens, focal length 12.5—190mm, f/1.6 with close working distance of 15-in.; and two new ENG lenses, a 10x (10-100mm) and a 6x (12.5—75mm). Also showing a new 20x lens, 17—340mm, f/2; and other lenses in comprehensive line.



Tektronix 1410 test generator.

Telecommunications Industries Inc. (Booth 205)

Will introduce a **spherical transparency illuminator**, with inner surface of sphere coated with Kodak 6080 achromatic calibration standard paint for flat illumination, producing light even within 1% across whole area of an 8X10-in. transparency; light source is a quartz iodine lamp run on regulated DC supply.

Teledata Systems (Booth 939)

Will show for first time an antenna **control system for directional control of ENG microwave antennas**, available to stations and antenna manufacturers; also showing digital remote control for transmitters.

Teledyne Camera Systems (Booth 210)

Main attraction will be the new **CTR-3 Tri-Optical color telefilm recorder**, for transferring programs from videotape to 16mm film; uses DB-74 compressed-air-drive camera, high-resolution three-tube display system, special test and adjustment facilities, choice of frame rates, 33-minute recording time at 24 fps.

Telemation, Inc. (Booth 316)

Will introduce the new **TCG-3000 character generator**; and will em-



Telecom Industries spherical illuminator.

phasize in addition the TVS/TAS-100 video/audio distribution switcher. Also showing: TCF-3000 color film camera; FS-10B and FS12 frame synchronizer; TVP-1000 video processing amplifier; TCG-1432A character generator; and the complete lines of sync generator, color encoders, video and audio switchers, test generators, audio, video and pulse distribution amplifiers, and monitor amplifiers.

Telemet, Division of Geotel (Booth 300)

Will emphasize the **Model 790 studio production video switcher** available with 9, 15, or 21 inputs, and numerous options for special effects. Also showing: video and pulse distribution amplifiers, video test generators; precision demodulators, TV band analyzers and other video test gear; routing switchers; RGB chroma keyers, NTSC chroma keyer decoder; signal conditioning equipment; and distribution amplifiers.

Telescript, Inc. (Booth 207)

Shown for the first time will be the **Monitor Prompting System** from Telegraphics, low-cost system for prompting, graphics, etc.

Television Equipment Association (Booth 203)

Will introduce the new "Tron Watch" headset for on-air commentary from a helicopter or plane; also the new Matthey automatic video equalizer. Also showing: Arvo vox headsets for disc jockeys; sportscasters; intercom headset; Matthey video and pulse delays, video filters; Magnatek tape cleaner and eraser; Link camera tube conditioner; I.R.T. color monitor comparator.

Telex Communications Inc. (Booth 512)

Will introduce the new TMM
continued on page

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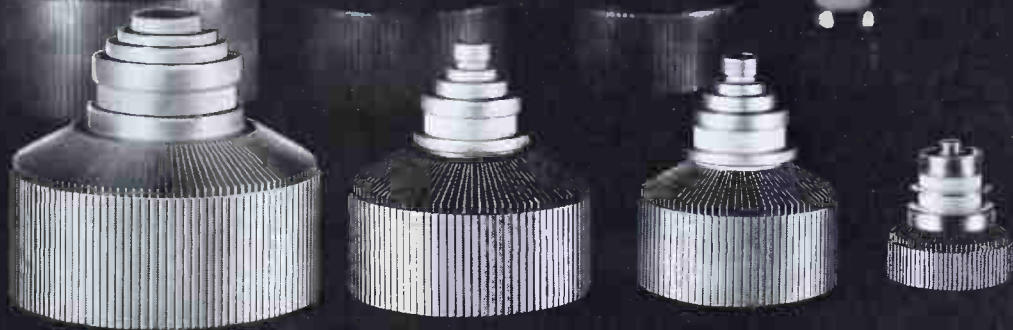
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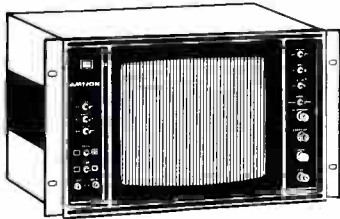
Sweden - THOMSON-CSF Elektronrör AB / Box 27080 / S 10251 STOCKHOLM 27 / Tel. : (08) 22 58 15

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AMTRON

RACK MOUNT COLOR MONITORS

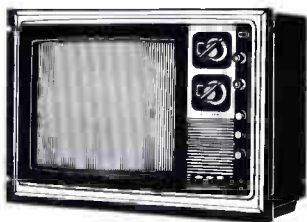


Model AM12 \$975

Professional in every respect, the Amtron AM-12 features the ultra-dependable, single-gun Trinitron® color system for superb colorimetry and freedom from moire and convergence problems. Professional, too, are the extras—separate R-G-B gun switches, switchable under-scan, internal/external sync, tally light—at no extra cost. A-B selection of video input, pulse-cross display, and rack mount slides are optional. Fits in 10½ inches of standard 19-inch rack space.

Two for the money... One for the show!

Value-loaded, the Amtron TR-12R offers the same single-gun Trinitron® color system in two different rack mount packages—monitor only and monitor-receiver. The TR-12R occupies only 12¼ inches of standard rack space and pulse-cross display, under-scan, internal/external sync plus individual gun switches for easy set-up and color balance are available as options, as are audio/video demod outputs on the receiver version.



Model TR12R \$615

AMTRON

The honest-value compact color monitors

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TM SONY

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NAB 1976

commercial music tape player, for background music using syndicated tape cartridge programs. Emphasizing the 1400 series of open-reel player/recorders, with DC capstan servo drive, all solid-state switching. Also showing: the TMS-100 background music carousel holding 12 tape cartridges, played automatically in sequence; sportscasters and cameramen's headsets; accessories.



Telex music player.

Tentel (Booth 228)

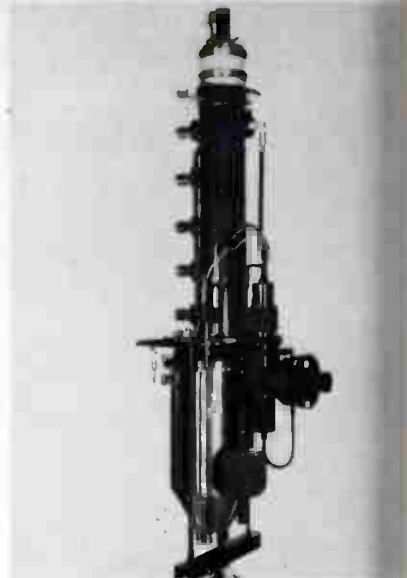
Will introduce a new tape tension gauge for the Sony Series 2850 VTR's. Also emphasizing the Diagnostic Tape Tension Gauge, Tentelometer Model T2, for tape widths from ⅛-in. to 2-in. Also showing: tension gauges for IVC, Ampex, Sony, and other standard VTR's.

Terracom, Division of Conic Corporation (Booth 931)

Will show for first time the TCM-5 series of microwave radio systems, for fixed vehicular or rack mounting; also showing the portable, tunable TCM-6 series; also mounting accessories for portable microwave applications, including lightweight antennas.

Thomson-CSF Electron Tubes (Booth 814)

Will show comprehensive line of high-power integral-cavity Kly-



Thomson-CSF klystron.

trons for UHF TV applications, with output ratings from 10 kW to 44 kW.

Thomson-CSF Laboratories (Booth 520)

Shown for the first time: new FM improved Volumax Model 4101 (mono) and 4111 (stereo); also introduced will be the Vidifont Mark IV with fit compose camera interface, new operator keyboard. Another featured product will be the "Microcam", a hand-held TV color camera weighing 8-lbs., with electronics pack weighing 3-lbs. Other products on display: a line of telecine systems; Triax studio and portable video color cameras; color correction system, image enhancement, chroma insert/keyer; audio processing units for AM and FM, including wide dimax, Volumax, dynamic presence equalizer; the dual audio distribution amplifier.

Time and Frequency Technology (Booth 619)

Will show for first time the new Model 753 precision broadband AM modulation monitor, with linear phase filter and built-in meter attenuator.

continued on page 68

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We've taken the latest advances in electret technology one step further. By combining them with advanced acoustic technology to make professional condenser microphones more portable, more practical and less costly. A lot less.

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One common powering module (K2U) serves three different compact heads: omnidirectional (ME20), cardioid (ME40) and shotgun (ME80). Thus, for most studio and location situations, it's no longer necessary to carry three different microphones. Or pay for three different complete units. Each head contains its own microphone capsule and "front-end" electronics, all exactly matched to its own precisely-controlled acoustical environment. Resulting in the first electrets with response and directionality to rival our famous RF condenser models in all but the most critical applications.

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If all this sounds good to you, call or write us. We have a lot more good things for you to hear.

Powering module and heads available separately.

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\$79.00 list.

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\$78.00 list.

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*Unbalanced version also available

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meter and peak flashers automatically calibrated to $\pm 40\%$ carrier level; also the Model 754 tunable preselector, which extends capability of Model 753. Also showing: the full line of frequency and modulation monitors for TV, FM, FM SCA, and AM; digital sync clock system; receivers for WWV calibration.

Townsend Associates (Booth 901)

Theme of exhibit will be improving performance and increasing power of klystron transmitters for UHF; new product on display will be a **solid-state IF-modulated UHF exciter**.

UMC Electronics (Booth 712)

Will introduce a new line of **broadcast audio tape cartridge recorder/**



UMC tape cart.

players, using Beucart motors; Type 10 is for A-type cartridges; Type 20 for A, B, and C-type cartridges. All models are available in mono and stereo versions.

Unarco-Rohn Div. Unarco Industries (Booth 905)

Antenna towers built and erected; microwave reflectors.

United Research Laboratory Corporation (Booth 823)

Will emphasize their **Auto-Tec line of open-reel recorder/players, with new modular electronics**, introduced at the show; also showing solid-state replacement electronics for older tube-equipped recorders; exact duplicate replacement parts for most professional recorders; the "ML-6", low-wear pinch rollers for most professional machines; replacement motors and heads; ultra-low distortion oscillator and audio distribution system.

U.S. Pioneer Electronics Corporation (Booth 837)

Will emphasize the **RT-2022 stereo tape deck**, which has comprehensive set of professional operational features, reel sizes to 10½-in. speeds 15 and 7½ ips; also the RT-2044, same machine with two add-on electronic modules for 4-channel record/playback.

Utility Tower (Booth 531)

Antennas and towers for AM, F, TV and microwave.

Video Aids of Colorado (Booth 14) Will show their sync and cross pu generators; picture monitors; bu phase meter; intercom system.

Videomax, An Orrox Company (Booth 606)

Will exhibit **video head refurbishing/rebuilding capability** for Amp Mark III, Mark X, and for the first time Mark XV; also RCA high-band and low-band heads.

Video Tape Company (Booth 40)

Will introduce a new **videotape cassette**; will also show the VTC-10 quadruplex videotape.

Vital Industries (Booth 106)

Will emphasize total automation of television. Showing for the first time **new video switchers with star speed effects patterns**. Also showing: complete line of video processing units; routing and production switchers; video, pulse and audio distribution systems; chroma keyers; other video products.

Ward-Beck Systems (Booth 407)

Will demonstrate **large custom-built audio consoles**, including one from series for large network installation; also one of 50 **transportable consoles** made for TV-audio at Innsbruck Olympics, also to be used in Montreal Olympics. Also showing the 7000 series intercom systems; audio amplifiers; and console accessories.

The Winsted Corporation (Booth 230)

Will show for the first time molded plastic dividers for **videocassette storage racks and video consoles**. Also showing: line of fixed and mobile storage units for videotape reels and cassettes, video and audio cartridge audio tape reels, 16mm film canisters.

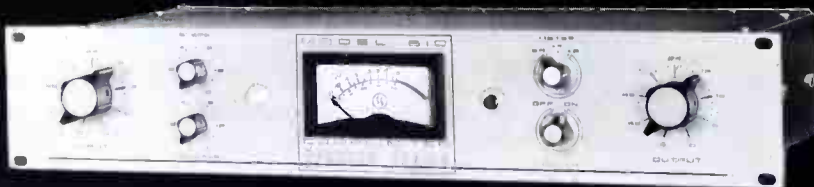
Wilkinson Electronics (Booth 6)

Will introduce a new **all-solid-state 250 watt FM transmitter**; also emphasizing the 2500 watt and 25 kW transmitters; studio and audio equipment; silicon rectifiers; line surge protectors.

World Video (Booth 214)

Will highlight the new **CDR series TV color monitors**, which take 8¾ of vertical rack space, can replace 9 monochrome monitors directly; with A-B inputs, underscan, internal external sync, blue-gun control, key back-porch clamp. Also showing 6210A series of 12-in. color monitors with plug-in electronics; line of other color monitors, including models for CCTV.

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MODEL 610

Used in recording studios; disc mastering studios; sound reinforcement systems; TV, AM, FM broadcast stations to maintain a *sustained average signal* at a level *significantly higher* than that possible in conventional limiters, and with performance that is seldom attained by most *linear amplifiers*. Rack mounted, solid state, functional styling, the Model 610 is in stock for immediate shipment.

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ANY OF THESE YOU?



broadcast station that wants smooth, multi-speed slide dissolves while committing only one film chain to slides?

lab that needs a simple, economical way to convert training productions from slides to video cassette, color corrected, with dissolves and special effects, and all from just one film chain in a single pass?

A small market station that would like to produce high quality, low budget slide commercials?

A college that needs to videotape its slide based, multi-media instructional programs?

A broadcast station that wants 3-second random access availability of up to 32 slides?

A production company that would like to completely pre-program slide com-

mercials and training programs, including special effects and multi-speed dissolves, before video taping?

If even one of these descriptions matches your needs, then you need to see the incredible, new Selectroslide Producer 32 film chain slide projector. There's never been anything like it before.

Direct descendant of the respected Spectrum 32, with its interchangeable slide drums and time proven mechanism, the new Producer 32 is the first slide projector to incorporate a micro-processor. It controls the servo maga-

zines for high speed random access operation; provides eight different dissolve rates, ranging from cut to 300 frames (10 seconds); controls special effects such as flash, fade-out and fade-in, alternate, and superimposition, at all dissolve rates; creates left and right crawls; and makes possible memory programming of dissolves and special effects. The Producer 32 may be operated in real time, from its electronic memory, or from pulses encoded onto an audio track.

And there's more. Much more. Producer 32—probably more than you ever dared hope for in a professional film chain slide projector!

During the NAB Convention, see a demonstration of the Producer 32 at the Cohu Exhibit Booth #302. The Producer 32 will also be in use at the NAB booths of Harris Gates Division, I.V.C., and Telemation.



Spindler & Sauppé

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North Hollywood, Ca. 91605
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TLX SPINSAUPPÉ LSA 651306

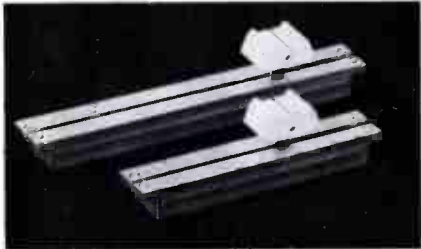
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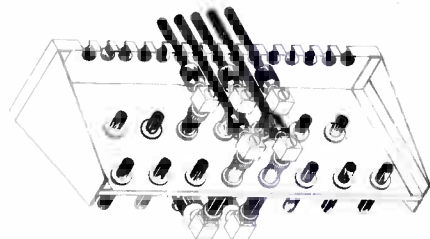
Monitor power amplifier Model F62500, is rated at 25 watts, and operates from a standard 600-ohm audio line. The amplifier drives an 8-ohm or 16-ohm monitor loudspeaker. Power output at 8 ohms is 25 watts continuous; power output at 16 ohms is 15 watts. Harmonic distortion at full power is 0.4% and frequency response is ± 1 dB from 20 to 20,000 Hz. ROBINS/FAIRCHILD **300**

Faders panel controls are half-width and can mount two units in same space as one. The MM-4 and MM-6 conductive plastic faders can be mounted



on $\frac{3}{4}$ -in. centers. For mono use only, the attenuators are available in linear, modified audio, or logarithmic tapers. Specified attenuation is 90 dB (minimum) while tracking (dual) is rated at 1 dB maximum (0 to 40 dB). WATERS MANUFACTURING CO. **301**

Video connector block provides up to 15 quick connect-disconnects on each side for BNC "Wedgelock" coaxial connectors. Model VB-15 mounts on $\frac{3}{16}$ -in. rails, 9-1in. apart, and slides along rails to connect position, where it



can be locked in. It fits the following groups: Belden #8281 and #8279; Alpha RG-62 A/U; WE-724; and is adapted to other groups on request. CONCO ELECTRONICS CORP. **302**

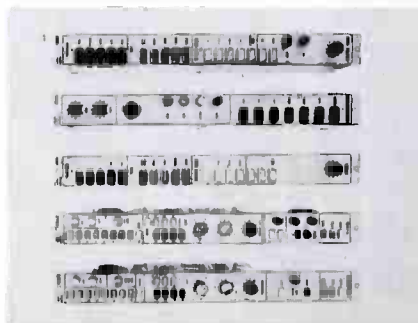
Programmer sequentially places any one of six audio tape machines on the air. The machines can be inter-mixed in any desired combination by dialing in the format on 24 thumb wheel switches. The thumb wheel switches



can be used in 4 groups of six events each to facilitate a four-stops-per-hour format. Switches allow the fourth and fifth events in each group to be skipped if more songs are not needed before a commercial break. Price is \$1,675. MICROPROBE ELECTRONICS. **303**

Five-channel mixer/preamplifier, LX-500C, accepts four microphone and one program-level source with switch selection for either low-impedance balanced or high-impedance unbalanced sources. Two of the mic channels may be switched for RIAA-equalized, magnetic phono inputs. A 1,000 Hz tone generator for presetting levels is standard. Output is via 600-ohm balanced line with additional outputs at 5 kilohm unbalanced. McMARTIN INDUSTRIES **304**

Recording console modules, Series 8422, provide switching and control facilities for multi-track recording, quad-stereo-mono mixdown, and monitoring. Features include: selectable mic/high-level inputs with programmable LED peak level indicators; an internal power network for condenser mics; switchable 70 Hz hi-pass filters; quad panning and quad/4 track/stereo mode selection; direct track feed and two independent echo channels with pre-post fader selection, delay,



echo and monitor send and return functions. Faders, equalizers and/or compressors are omitted from the input modules. MODULAR AUDIO PRODUCTS INC. **305**

Super-8 camera is available only in limited edition and comes equipped with the Angenieux 6-80 mm, f1.2 X zoom lens. Only 100 Beaulieu Moc 4008ZM2 cameras will be offered in the U.S. Features include: existing light filming capability, increased filming speeds of 2 to 80 f.p.s., macrocinematography from within 2 feet of the front element of the lens. \$1,699. HERVIC CORP. **306**

CATV sweeper, Model 1402A, covers the 1-to-400 MHz frequency range and includes a 36-position programmable switch. The switch presents the center frequency of the instrument to IF (MHz), broadcast channels 2 to 13, and lettered channels A to W. Flatness ± 0.1 dB over any of the 35 channels and better than ± 0.25 dB over the entire range. Spurious signals are suppressed greater than 30 dB down from the fundamental output. \$1,395. WAVETEX INDIANA, INC. **307**

FM subchannel receiver, Model TR-E6, is designed for in-home reception of special programs for use by the visually-handicapped or for large audience educational purposes. The receiver has only two front panel controls: power switch/volume and fine tuning. A telescoping whip antenna is built in, but an external FM antenna may be attached. External recording equipment may be connected through the rear jack. \$75 (1-99). McMARTIN **308**

Video switcher, VS-2, automatically sequences between two video cameras with an adjustable rate from $\frac{1}{2}$ second to 60 seconds and is intended for two small two-camera CCTV systems. Front panel controls include: interval timer, homing switch, and power on/off. U.S. ASSOC. **309**

Dual cue controller update kit for audio tape transports, the BE-46, when used with the Model BE-450 synchronizer, offers the user a chase feature. The feature allows the selection of either one of two tape transports to chase the other in a follow-the-leader mode during fast forward and rewind operations, and is in addition to the original capability of cueing two transports (master and slave) automatically.

continued on page 142

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about everything you can think of in between. (Enough to fill a book, in fact.)

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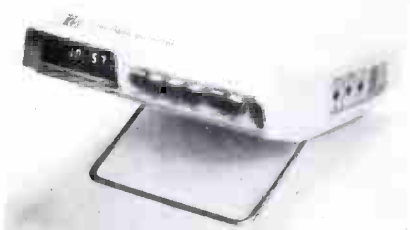
PRODUCTS

to any selected point either individually or simultaneously. A code verification routine also has been added. Price of the kit is \$985. EECO 310

Coaxial switch, the Model RF-2, is designed for video, IF, and RF switching applications. The unit insertion loss is less than 0.5 dB with a minimum return loss of 23 dB. COMSONICS 311

Video satellite earth terminal, Series 8000, furnishes network-quality video and audio signals to broadcasters and other users. A 10 meter antenna may be directed from any location in the continental U.S. to a satellite between 70° and 135°W. The terminal receives audio and video signals, then amplifies and down-converts the signal for distribution through existing broadcast equipment. SCIENTIFIC-ATLANTA, INC. 312

Autorangeing digital multimeter, Model 3476, is a 3½-digit, five-function instrument. Voltages are measured from ±100 μV to ±1,000 V dc and from 300 μV to 700 V ac, resistance is



measured from 1 ohm to 11 megohms and current can be measured from 100 μA to 1.1 amp dc, and 300 μA to 1.1 amps ac. Autozero and autorangeing are built in. A range hold feature allows the instrument to be locked to any desired range. The LED readout gives all voltage readings in volts, all resistance readings in kilohms and all current readings in amperes. Model 3476A (\$225) is ac line powered; model 3476B (\$275) is line powered and portable via rechargeable nickel cadmium batteries. HEWLETT-PACKARD 313

VHF sweep generator, Model 1050A, covers a frequency range of 1 to 400 MHz and has a calibrated output of from +10 dBm to -60 dBm. Marker accuracy is 0.005%. A built-in RF detector is included. \$495. WAVETEK INDIANA, INC. 314

Waveform monitor, XWM-2000, features include internal or external synchronization, two separate video inputs with loop-through and termination, Y-pass filter, and selectable 1 volt p-p or 4 volt p-p sensitivity. Display modes include 2H lines, 2V fields, H blank-

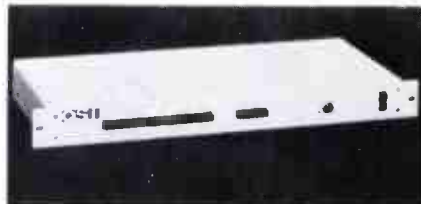
ing, V blanking, internal calibration and sync generator test. \$750. SHARP ELECTRONICS 315

Video delay module assembly offers a nominal delay of 63.5 μsec. Signal bandwidth is 10 Hz to 6 MHz, 3 dB. Input level is 1 volt p-p from 50-ohm or 75-ohm source while input impedance



is above 2,000 ohms and output impedance is 50 ohms. Dynamic range is 47 dB; differential phase is 0.5° and differential gain is 1%. WALTHER M.A. ANDERSEN & ASSOCIATES 316

Time date generator, Model 600, features 12-digit display of month, day, year, hour, minute, and second. Characters are 7 or 14 TV lines high, switch selectable. A built-in memory automatically predetermines the number of days in the month with manual override which compensates for Leap Year. A two-speed control permits fast or slow forward for easy setting of time and date. A front panel control matt shades characters from



black to white. The generator works with any 525-line source such as random interlace, 2:1, RS330, RS170 or color. QSI SYSTEMS, INC. 317

FM-AM signal generator, Model 950A, is continuously tunable over the range of 1.5 MHz to 80 MHz. The generator offers direct 5-digit frequency readout. Calibrated FM deviation is from 0 to 10 and 30 kHz, and is read directly from a front panel meter. Generator frequency accuracy is 0.005%. RF output is 3 volts and automatically leveled to within ±0.5 dB. \$2,275. LOGIMETRICS 318

Bench-mount attenuator may be used for measurement-by-comparison and for reduction of high-level signals to sweep generators, oscilloscopes and

spectrum analyzers. The Model features 0-80 dB attenuation in 1 steps, a 75-ohm impedance and 500-MHz frequency range. Insertion loss is less than 0.3 dB at 30 MHz, less than 0.8 dB at 500 MHz. VSW less than 1.2:1 at 500 MHz. Standard connectors are supplied; BNC, T and N connectors are available. ROLD/TEXSCAN

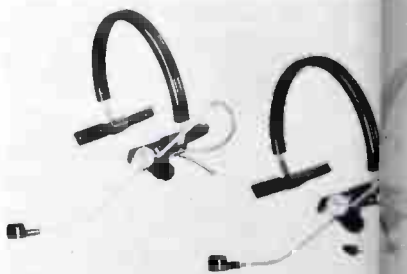
Basic audio amplifiers are available in 25-watt and 75-watt versions, the MS-252 and MS752, respectively, offer the ability to expand amplifier capability to accept up to two plug-in modules. Plug-ins include low-level mic and RIAA-equalized phono preamplifiers, to an electronic buzzer or siren. Electronic mute control of microphone channel is included in basic amplifier models. Frequency response characteristics are ±1 dB, 40 to 15,000 Hz; distortion is less than 1% at the rms output levels. McMARTIN INDUSTRIES, INC.

Inline transformer and accessories series is comprised of 18 units, configured to terminate in a three female input and male output professional audio connector. Models



through IL-5 are for mic matching and have a primary impedance range of 50 ohms. Their secondary impedance range is from 600 ohms to 60 kilohms. Models IL-6 through IL-10 are for matching and show a primary impedance range from 600 ohms to 5 kilohms and secondary range from 60 ohms to 60 kilohms. SESCOM 319

Broadcast microphones, Models SM10 and SM12, are worn on the user's head. The SM10 consists of



headband and microphone only; SM12 has a headband, microphone and earphone. Also available is an accessory cough button, Model A10

continued on page 7

SATICON catches the action live... ...with a small 2/3 inch color tube.

The Hitachi SATICON, a newly-developed camera tube, is characterized by heterojunction target between tin-oxide and selenium doped with arsenic and tellurium in its photo-conductive layer.

Model H8397 is the first in the SATICON series, a small 2/3 inch high-performance tube that is particularly suited for hand-held color television cameras. Size and weight are significantly reduced with no impairment in picture quality or color. In the studio or out on the field. The Hitachi SATICON makes for easy versatile on-site TV broadcasting.

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The Hitachi SATICON H8397 will be on display at Booth 200, 1976 NAB Convention.



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111 East Wacker Drive, Chicago, Illinois 60601, U.S.A.
Telephone: (312) 644-6565 Telex: 230-25-3261

PRODUCTS

List price of the SM10 is \$72; \$96 (SM12); \$24 (A10CH). SHURE BROTHERS 322

Power-and-sync generator called Porta-Dapter Model 100 allows for independent operation of portable b&w cameras without its recorder. Connectors at the rear provide horizontal and vertical outputs for synchronizing other cameras, switching system or special effects generator. Also provided are separate channels for video output and mic output. A sync polarity switch facilitates compatibility with

cameras built by Sony, Panasonic, RCA, Sanyo and others. Sync is 2:1 interlace, line lock. Both EIA and CCIR standards are available. \$195. QSI SYSTEMS, INC. 323

Time code reader/display reads standard SMPTE time code from any source and displays it as a digital readout. The standard SMPTE code is displayed in hours, minutes, seconds, and frames. Real-time operating speed ranges from 1/5X to 50X. The unit is plug-compatible with any editing system. \$1,990. CMX SYSTEMS. 324

Fluid head tripod, Model 2030, is built by Miller-Universal of Australia.

The tripod carries cameras weighing to 30 lbs., is lockable at 90° tilt and leakproof and dustproof. Fully operative in temperatures ranging from -20°C to +75°C. The tripod features self-operating and adjusting free and concentric tilt lock/tension device which is either hydrostatic or mechanically self-equalizing. The fluid head with wooden tripod legs (6C330) costs \$825. The head only (6C333) is priced at \$625. CINEMA PRODUCTS CORP. 3

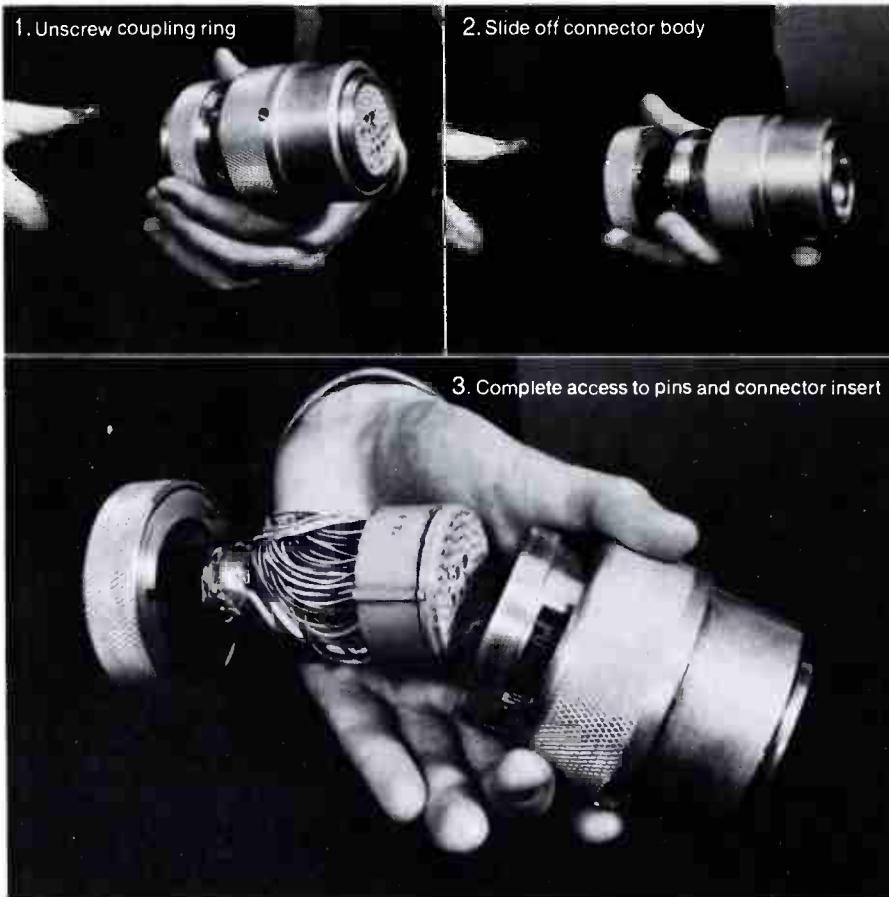
Level generator, the Model AT-60 is a portable instrument with a frequency range of 200 Hz to 4.5 MHz. It has an output power range of 0 dBm (mw) to -70 dBm (-70 nw). Its sinusoidal output has harmonically related distortion products suppressed more than 40 dB and non-harmonically related spurious outputs suppressed more than 80 dB. Output power (ohm unbalanced) varies less than 0 dB from its value at 10kHz over a range of 200 Hz to 4.5 MHz. \$2,700. WANDEL & GOLTERMANN INSTRUMENTS, INC. 3

Video cassette, the KCS-30, is now offered in the U-Matic format. Play time is 30 minutes. The cassette is designed for use in the Sony VO-3800 and VP-3000 recorder/players or equivalent. DUPONT CO. 3

Black-and-white 9-inch video monitor, Model VM-909, for close-circuit surveillance and similar applications. Horizontal resolution is better than 500 lines at center. Optical adapters are available for remounting two monitors in a standard 19" cabinet. \$185 each. HITACHI/BADEN CORP. 2

RF modulator, Model RFM-100, adapts video output from any video source (camera, VTR, etc.) and transforms it into an RF signal tunable to TV channels 2-6. Present FCC rules and regulations governing RF devices used in conjunction with MATV, CATV and RF distribution systems exempt. CREST ELECTRONICS 9

Function generator/counter, Model 304B, provides readout storage of precise measurement while a new reading is made in either mode of operation. In the function generator mode output frequency is from 10 Hz to 1 MHz. The 1 sec. gate switch provides 0.1 Hz resolution without changing the output frequency range. In the counter mode frequency range is from 5 Hz to 10 MHz with six selectable gate times from 100 μsec. to 10 sec. for resolution to 0.1 Hz. The time base is crystal controlled. Input sensitivity to 50 mV is achieved with a vernier attenuator. Input impedance is 1 megohm. \$595. MONSANTO



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NEW LIT

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

A technical paper, **Design Considerations for Modern CATV Head-end Signal Processing Equipment**, is available on request. The paper describes the signal processing requirements of a modern CATV headend. Jerrold Electronics Corp. **250**

A 34-page booklet entitled **Accessory Guide**, form number CCV-113, describes accessories for **closed-circuit video equipment**. The catalog includes items such as pan and tilt units, scanners, video switchers, housings and enclosures, mounting accessories, controls, video signal equipment, consoles and lenses. RCA Closed-Circuit Video Equipment **251**

A technical data catalog sheet offers information on a line of **broadcast audio cartridges**. The six-page folder gives details of cart performance in a variety of applications. Fidelipac **262**

LETTERS/ FEEDBACK

One of the departments that frequently gets cut from the pages of BM/E is our "Feedback" or letters-to-the-editors column. We value this information and would like to share your comments with others. But when it comes to a choice of running new material or commenting on the old, we usually opt for the former.

There were several unusual events in 1975, however, that we'd like to tell you about. Two articles that drew top praise were *How To Backtime With Your Pocket Calculator* by Mary F. Zoller, September, 1975 BM/E and *The Only True Route To High-Grade AM Audio* by J. Fred Riley and Harrison J. Klein, October and November, 1975 BM/E. Below are what some of our readers said about them.

Zoller's Calculator

Dear Editor:

Thanks to you and a hearty thanks to Mary Zoller, for her article on using a typical calculator to add timings. We only wish we had read this article years

ago. Her technique almost made adding times fun.

Upon posting a copy of Ms. Zoller's article on our production department bulletin board, graffiti immediately appeared. The first asked "What all frames?" Since CPTV has a computer editor, this is an interesting question.

The answer is to use the number rather than 940, to convert number frames that are 30 or greater. If you forgets about the hours figure, and enters into the 8-digit calculator minutes, seconds and frames, the system works perfectly.

We just thought we'd pass this on. Thanks again.
Jay L. Gondelman
Producer, Connecticut Public Television

Dear Editor:

I read BM/E this week with more than usual interest. Mary Zoller's article *How To Backtime With Your Pocket Calculator* is just sensational—a great aid to everyone in ours and many other industries.

I would like very much to have permission to duplicate the article for mailing to all member public television stations in the Central Educational Television work.

Thank you for your assistance.
continued on page 7

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The ENG wave can only roll bigger and faster, but that is not all the new mini-equipment will do. It will generate a wave of instant, "anywhere" inexpensive documentaries, commercials, video for business and personal communications. Mini-equipment offers a new production technology: studios-without-walls, editing without engineers, professional results at amateur costs. This Electronic Field Production will be another video revolution.

This Manual is the first publication that describes the new mini-equipment in full detail, and provides a complete user's guide to both of the new technologies—ENG and Field Production.

This book is skillfully edited for the technical and non-technical reader alike; broadcasters and non-broadcasters. It's a great compilation of facts for the experienced hand, it's a primer for managers, directors, engineers and technicians looking at all electronic news and field production for the first time.

Ten big chapters: 1. the ENG/EFP revolution and where it's going 2. ENG systems in use 3. significance of all electronic systems 4. mini-portable cameras 5. portable videotape recorders 6. tape editors 7. time base correctors 8. microwave links 9. program audio and intercom 10. future developments.

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LETTERS/FEEDBACK

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Thomas E. Rogeberg
Program Manager, Central Educational Network

A Letter To J. Fred Riley

Dear Fred:

We talked by telephone yesterday regarding a problem of low readings on positive peaks on a Gates 5693 Modulation Monitor. Thanks again for your helpful suggestions.

I wish I had realized that you were co-author of the article in October BM/E when we were talking, as I think it is the most interesting article that I have ever read in a broadcasting journal.

I was in the radio equipment product management group at RCA for five years (1964-1969) and became very appreciative of the problem of proper transmitter loads during that time. You and I and a few other people appreciate the load at sideband frequencies, but unfortunately I found that many consultants never even check the impedance at the carrier frequency at the transmitter terminal, much less the sideband frequencies.

As I recall, the EIA specification on AM transmitters was that the load not vary from the design or rated figure more than 10% in resistance and reactance in ohms should not exceed 10% of the design load resistance. I think the manufacturers should do more to bring this to the attention of the owners of their equipment, and to those professionals who are involved in installation and testing of equipment for others.

Again, congratulations on a very fine article.

William A. Culpepper
Broadcast Service, Matthews, North Carolina

On Riley & Klein . . .

Dear Editor:

Your two part series on the *True Route To High-Grade AM Audio* was excellent.

Harold Hallikainen
President, Hallikainen & Friends, San Luis Obispo, Calif.

. . . Also Small & Orban

Dear Editor:

Your October BM/E justifies great acclaim. The *Combining High Signal Quality With High Modulation Levels In FM* by Eric Small and Robert Orban clearly represents a breakthrough, and *The Only True Route To High-Grade AM Audio* by J. Fred Riley and Harri-

son J. Klein article is on target.

I do think the caption on Fig. 6, p. 30 makes things seem much better than they are. A 40% modulated AM shown with the claim: "In the test illustrate response is good down to dc."

Surely not by the square wave response illustrated. With textbook method calculation it has a full 50%. The same transmitter set up for 100% modulation on a mid-band square wave could be expected to overmodulate to 25% when swept back to 20 Hz. That isn't good.

Unfortunately the "response down to dc" which should and could be achieved with current technology is still not being produced by today's transmitter manufacturers to the detriment of the profession.

G. Endres
C.E., WRVR-FM, NY, NY

A Letter From Eric Small

Dear Editor:

Many thanks for publishing my paper. I was particularly pleased with the layout and the way the graphics were handled. Please convey my compliments to the artist.

There was, however, a minor error I would like to bring to your attention. The caption on Fig. 5 should read: *First exciter after clipping and filtering demonstrates mainly fundamental energy with a small amount of phase shifted third harmonic. The 2.1% fundamental increase plus the small amount of third harmonic add up to the 132% modulation shown.*

Again, many thanks for the fine work.
Eric Small

Liked ENG Issue

Dear Editor:

Your coverage of ENG in the January issue was outstanding!

Comprehensive, current, well thought out, apparently accurate, and most certainly fair to all.

Congratulations.
Donald E. Prather
Saratoga, Calif.

Needs Help

Dear Editor:

Please advise. I have at least six Scotch metal 10½-in. reels that defy all attempts to de-warp them. They are usable reels but right now they sound against the stainless steel panel on my Revox A 77. Would any of your readers have comments? Thanks.

R. Dennis Alexander
Owner, Radex Productions, 110 S. Carlisle St., Greencastle, Pa. 17228

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CHARACTER GENERATOR. Outdated, but still useful. D1500 by Datavision. Originally \$4500, now \$1250. Service Policy available. (301) 840-1930 or write KNOX, Box 278, Washington Grove, Md. 20880.

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