JANUARY 1974

BM/E

BROADCAST MANAGEMENT ENGINEERING

Use Both Now...
...Watch Tape's Future.

Here are five good reasons to buy IVC's fully-automatic broadcast 240 Film Chain Camera and 4000A Multiplexer.

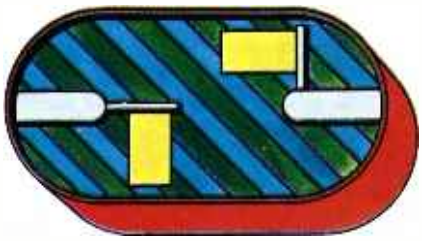
We have dozens more.

Money. We put the latest solid-state circuitry and some clever design techniques into the IVC-240 and the 4000A—not just to make them more reliable, but to give them the industry's finest price/performance ratio. Example: we use costly precision fixtures, like other manufacturers, to align the 240's dichroic mirrors. Unlike other manufacturers, however, we set the mirrors permanently in optical epoxy. The expensive fixtures stay here—but the precise optical alignment stays with the 240—permanently. Features like this hold the price of the 240/4000A combination to less than $30,000.

A free-standing camera cabinet. Ordinarily, if you accidentally bumped into a film-chain camera, you'd disturb the picture. But when the IVC-240's cabinet is accidentally bumped or nudged, picture positional stability, as viewed on a picture monitor, is virtually unaffected. The reason: the optical system and Vidicon/yoke assemblies are mounted on a separate rigid backbone that is lagged directly into the floor through the sheet metal of the cabinet. The effect is the mechanical isolation of optics and cabinet.

Money again: Having a single neutral-density filter wheel inside the camera for automatic white level is a special cost-saving bonus from the IVC-240. This unique arrangement can save you up to $4200 by eliminating the usual separate disc for each projector. The lightweight disc and high-torque motor, which are built into the camera enclosure, respond to light level changes up to 100 to 1 in 0.6 second (maximum). And typical changes are compensated for much faster.

An automatic black level circuit complements the automatic white level control. Result: hands-off operation—all day.



A better mirror system. The IVC-4000A's mirrors swing vertically, like the flag on a taxi meter. This approach makes it difficult for dust to settle on the reflective surfaces and provides a smooth on-air transition; the special tapered mirrors are positioned by self-braking motors in just one fifth of a second. Audio-follow logic is built into the system.

It makes your studio look nicer.

But we can't tell you all about the 240 and the 4000A here—there isn't room to talk about their minimal maintenance requirements, their exceptional stability, their hands-off operation, their automatic features. We suggest you write to Camera Product Manager at the address below.

We'll be glad to give you **all** the reasons why choosing IVC is a good move.

IVC

International Video Corporation

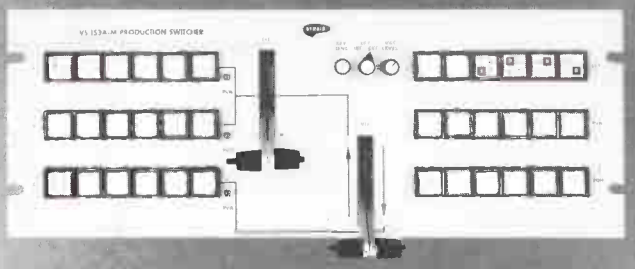
International Video Corporation
990 Almanor Avenue
Sunnyvale, California 94086
Telephone: (408) 738-3900

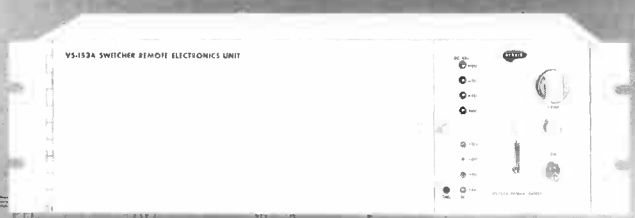
Circle 100 on Reader Service Card

NOW.

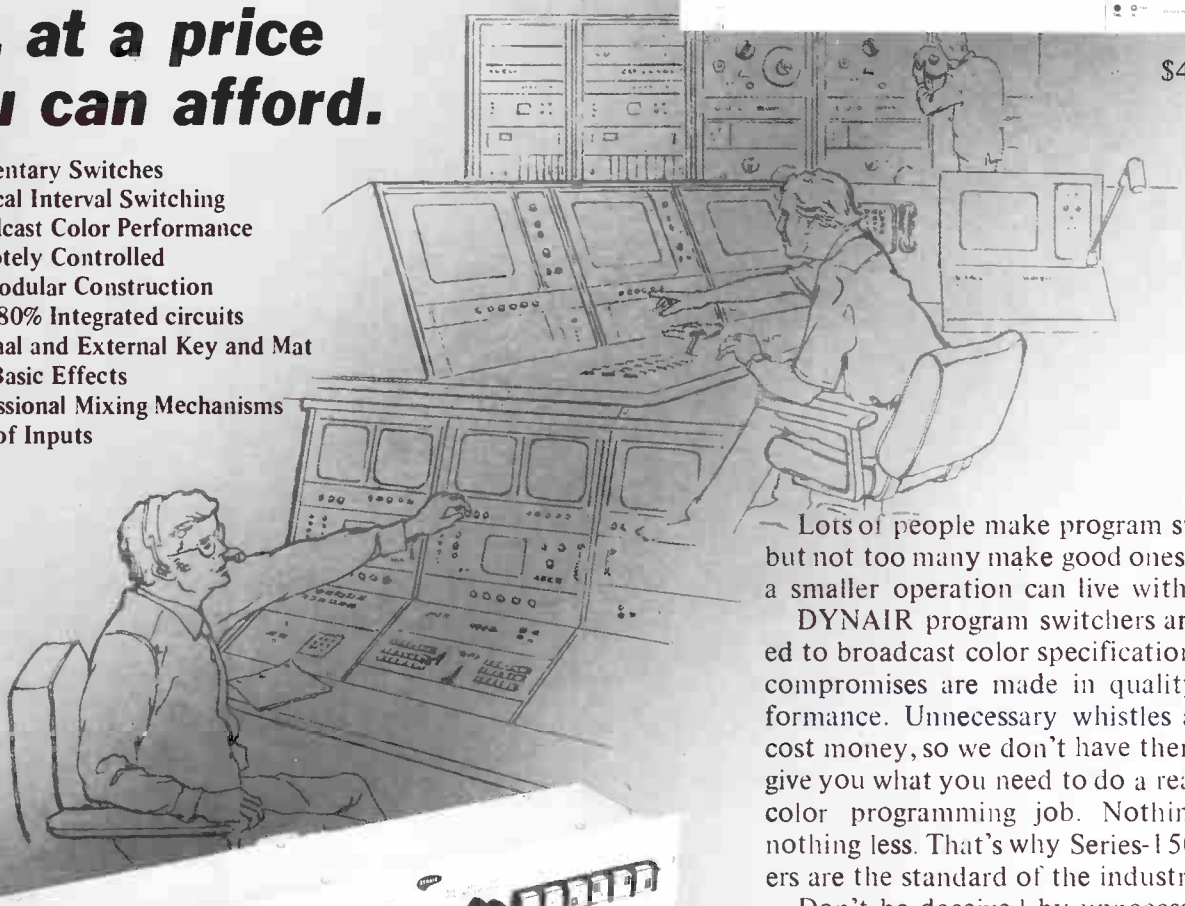
All the good things you ever wanted in a production switcher . . . at a price you can afford.

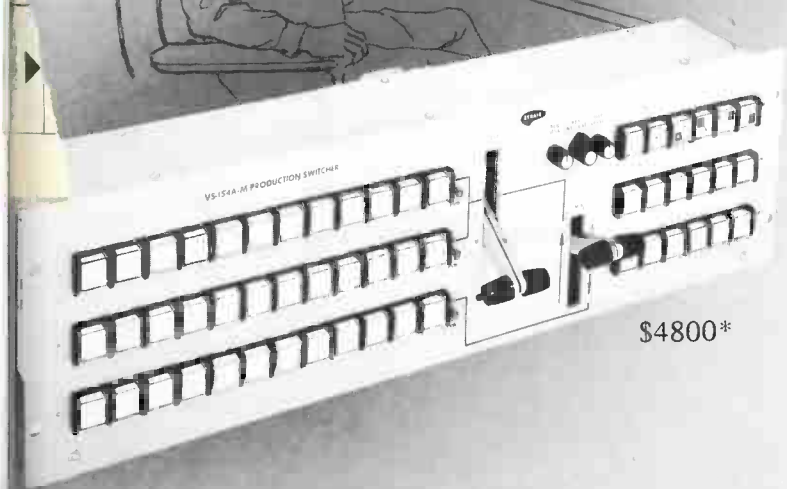
- Momentary Switches
- Vertical Interval Switching
- Broadcast Color Performance
- Remotely Controlled
- All-Modular Construction
- Over 80% Integrated circuits
- Internal and External Key and Mat
- Full Basic Effects
- Professional Mixing Mechanisms
- Lots of Inputs





$4000*





$4800*

Momentary switches are featured in DYNAIR's new VS-153A-M and VS-154A-M Program Switchers. And the VS-154A-M has 17 inputs . . . great for special applications with lots of sources. Also, you can replace your existing mechanically interlocked VS-153A control panel with the momentary version for only $1500!

*includes remote control unit

Lots of people make program switchers, but not too many make good ones at prices a smaller operation can live with. We do.

DYNAIR program switchers are designed to broadcast color specifications . . . no compromises are made in quality or performance. Unnecessary whistles and bells cost money, so we don't have them . . . we give you what you need to do a really good color programming job. Nothing more, nothing less. That's why Series-150 switchers are the standard of the industry.

Don't be deceived by unnecessary frills offered by other manufacturers. Take a look at the important things. Things like quality of construction and electrical components. Things like reliability and the reputation of the manufacturer. Ask yourself why DYNAIR consistently exhibits the Series-150 equipment at major trade shows operating into not only color picture monitors, but *waveform* monitors too. Then look at waveforms; they tell the real story. Finally, ask a friend who has one . . . he knows.

Specify the standard . . . specify DYNAIR.

DYNAIR ELECTRONICS, INC.
6360 FEDERAL BLVD. SAN DIEGO, CALIF. 92114
PHONE: 714-582-9211

DYNAIR

Circle 101 on Reader Service Card

BM/E
BROADCAST MANAGEMENT/ENGINEERING

JANUARY 1974/VOLUME 10/NUMBER 1

Both tape and film are essential to TV production. Tape's future is very bright. See article page 28.

CM/E: A supplement for those with cable interests: following page 52.

BROADBAND INFORMATION SERVICES, INC.
274 Madison Ave.
New York, N.Y. 10016
212-685-5320

Editor
James A. Lippke

Associate Editor
Robin Lanier

Contributing Editor
M.L. Hollowell

Assistant Editor
A.E. Gehlhaar

Editorial Assistant
Cheryl L. Settle

Art Director
Gus Sauter

Production Manager
Arline G. Jacobs

FCC Counsel
Pittman Lovett Ford and Hennessey

Publisher
Charles C. Lenz Jr.

BM/E, BROADCAST MANAGEMENT/ENGINEERING, is published monthly by Broadband Information Services, Inc. All notices pertaining to undeliverable mail or subscriptions should be addressed to 274 Madison Ave., New York, N.Y. 10016. BM/E is circulated without charge to those responsible for station operation and for specifying and authorizing the purchase of equipment used in broadcast facilities. These facilities include AM, FM, and TV broadcast stations; CATV systems; ETV stations; networks and studios audio and video recording studios; consultants, etc. Subscription prices to others: $15.00 one year, $25.00 two.

Controlled circulation postage paid at Easton, Penna.

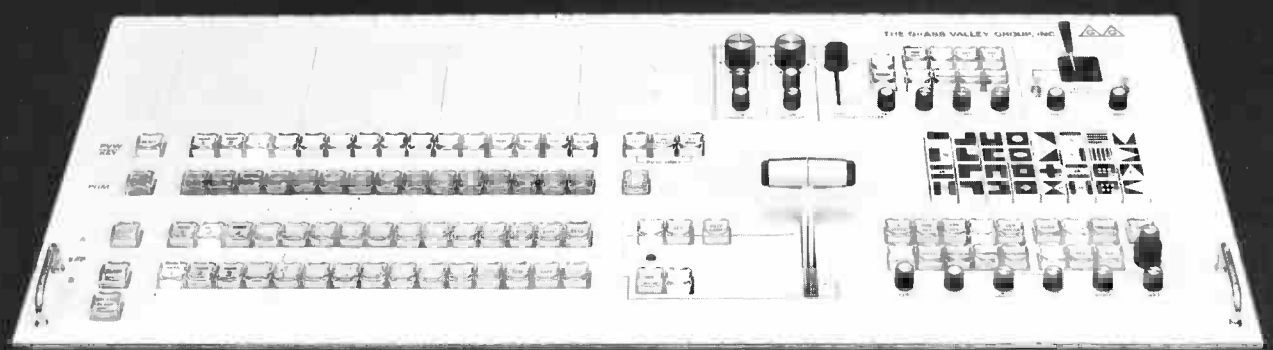
MODEL 1600-2A ----- A SWITCHER OF MODERATE SIZE AND PRICE PROVIDING STATE OF THE ART TELEVISION PRODUCTION TECHNIQUES SUCH AS *LINEAR KEYING, SOFT WIPE* AND *ELECTRONIC VIGNETTE.*

STANDARD FEATURES

- 16 VIDEO INPUTS
- 4 OUTPUT BUSES---MIX/EFFECTS A & B, PREVIEW/KEY, PROGRAM
- COLOR BLACK/COLOR BACKGROUND GENERATORS
- 32 WIPE PATTERNS
- JOYSTICK POSITIONER WITH MODULATION
- HORIZONTAL AND VERTICAL PATTERN LIMIT PRESETS
- ELECTRONIC SPOTLIGHT
- SOFT WIPE – ADJUSTABLY SOFT PATTERN EDGES
- BORDERED PATTERN EDGES – ADJUSTABLE COLOR AND WIDTH
- FOUR KEY MODES

OPTIONAL FEATURES

- CHROMA KEY SIGNAL GENERATOR
- DOWNSTREAM (PGM BUS) KEYER SYSTEM
- BORDERLINE GENERATORS FOR MIX/EFFECTS OR DOWNSTREAM KEYER
- CUTBAR SYSTEM
- RBG CHROMA KEY SWITCHER, 6 INPUT
- TECHNICAL PREVIEW BUS
- AUDIO FOLLOW VIDEO SYSTEM



THE GRASS VALLEY GROUP, INC.

SOLD EXCLUSIVELY BY GRAVCO SALES, INC.

6515 Sunset Blvd.	Station Plaza East	125 South Wilke Road	Redbird Airport	1644 Tullie Circle, N.E.
LOS ANGELES, CALIF.	GREAT NECK, N.Y.	ARLINGTON HEIGHTS, ILL.	DALLAS, TEXAS	ATLANTA, GEORGIA
(213) 462-6618	(516) 487-1311	(312) 394-1344	(214) 330-1245	(404) 634-0521

OVERSEAS - GRASS VALLEY INTERNATIONAL - BOX 1114, GRASS VALLEY, CA 95945 - USA

Circle 102 on Reader Service Card

BROADCAST INDUSTRY NEWS

NAEB Convention: Quiet Affair

Usually black communicators provide some disquieting moments at the NAEB Convention. Few blacks were to be seen in New Orleans at this year's meeting. Tony Brown, executive producer of the PBS "Black Journal," did show up and held a press conference (he was not on the program) to say he and his black colleagues would wage war on CPB and the Establishment for a greater share of available funds to do minority programming. Support for such programming has been cut to a partial funding of "Black Journal."

Women libbers in a sense replaced the blacks, but no real militancy emerged. Panelists in a discussion on "Women in Public Broadcasting" agreed with the only man on the panel, NAEB board member James McAndrew, that women generally work harder, are more dedicated, and take more risks for things they believe in, than men. Dona Lee Davenport, station manager of WTVI-TV, Charlotte, put it into a set of success rules for women in broadcasting: "Act like a lady. Look like a woman. Think like a man. Work like a dog."

On the last day of the meeting the association, without dissent, transformed itself from a trade association into a professional society (*BM/E*, November 1973, page 6). President William Harley called NAEB in its new character a "society of individuals with a common sense of social purpose."

The scarcity of funds for public broadcasting was a basic preoccupation of the attendees, alleviated by the hope in a new plan described by Joseph D. Hughes, CPB board member and chairman of the Long Range Financing Task Force. The plan, reportedly backed by Clay Whitehead of the White House Office of Telecommunications Policy, is for federal contributions that will match on a 1-for-2 basis those from other sources. Hopefully, this would raise the Federal contribution to $100 million in fiscal 1975, and to higher figures in later years.

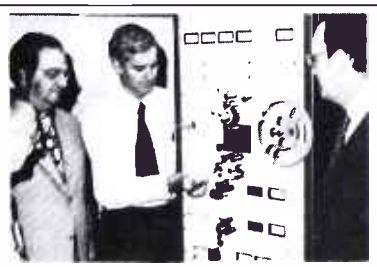
In the keynote address Dr. Roger W. Heyns, president of the American Council on Education, told the public broadcasters that the great need is for high quality in the materials they use. He said that a lack of quality was the prime reason that TV instruction had not yet reached its full promise, and he warned that quality does not come cheap, but takes the full investment of effort by highly competent people, like that of Kenneth Clark in "Civilization."

A similar admonition came from FCC Commissioner H. Rex Lee, who cited "Hollywood Television Theatres," "V.D. Blues," and "Sesame Street" as examples of the quality that public broadcasting must develop more generally. Calling the present a "time for warning," Lee also said managers must establish identities for the UHF stations, must get in the fight for a free press, and must hire more minority persons.

Evolution of the Public Broadcasting Service into a combination of programming agency and representative of the licensees was called a success by PBS Chairman Robert Schenkkan, who had figures to back this up—88% of public stations have paid their dues and all but one of the remainder have said they will soon do so.

The recently formed Association for Public Radio Stations, in an opening meeting, heard their president, Matthew Coffey, urge them to participate in proceedings affecting them now before the FCC, including radio regulation and ascertainment. He told the members they should offer constructive cooperation on ascertainment, and not blind opposition.

A report on interesting developments at the technical sessions at the convention appears on other pages in this issue.



SMPTE Gets New Equipment for Calibrating Sound Test Films.

To insure high accuracy in the 16mm and 35mm films it distributes to the industry for checking film sound systems, the Society of Motion Picture and Television Engineers has installed in its headquarters new calibrating and check-out equipment for test films. Eastman Kodak Co. aided the Society in the set-up and demonstration of the equipment which can measure all magnetic and optical sound recording on 16mm and 35mm film. It was built by Magna-Tech Electronic Co.

Rules Okaying Automatic Transmitting Systems Coming

The process of simplifying FCC rules is continuing, Harold Kassens told engineers attending the NAEB Convention in New Orleans in mid-November. The goal is to get the FCC out of the broadcasters' day-to-day operations, Kassens said.

The Broadcast Bureau is now working on a rule covering automatic transmitter systems, Kassens reported. What will be sought is authorization of a system that checks its own frequency, power, and modulation levels, and shuts itself off if measurements move out of tolerance. There will be no FCC requirement to keep logs or to have operators standing by. "There'll be nothing to inspect," said Kassen, "except to see if its working."

In the immediate future, the industry can expect a rule change that will throw out the need for using a type-approved frequency monitor—or any monitor. The broadcaster is expected to stay on frequency and the field Bureau will make spot checks from time to time (against WWV as a standard), but there will be no rule insisting on use of frequency monitors.

Another rule to be rewritten soon covers remote control. There will be a clarification on the use of extension meters and Part 74 on remote pickups will be simplified.

NAB Opposes Year-Long Daylight Saving Time

The chairman of the Radio Board of Directors of the NAB, Clint Formby, has opposed the proposal to make daylight saving time mandatory year-round. Many people in smaller communities, he pointed out in a statement, depend on local radio stations for weather, local news, emergency information, school closings, etc. "If

continued on page 8

3/6/75

Manual video correction is no longer necessary...

...so why do it?

The TEKTRONIX 1440 Automatic Video Corrector takes the work and the worry out of video signal quality control . . . with FULLY AUTOMATIC CORRECTION of overall video gain, black level, color saturation, burst phase and gain, and sync level.

The quality of your program signal will be stubbornly maintained by the TEKTRONIX 1440 Automatic Video Corrector. And, since signal distortions are automatically corrected, your engineering people will be freed from the task of continuously readjusting controls.

Attempting to keep up with continuously varying conditions with manual correction is no longer necessary . . . so why do it? The assurance of signal quality that comes from using the 1440 is something that can't be priced, but the 1440 costs just $2450.

The VIR Signal is the reference used to assure signal quality.

Your local Tektronix Field Enginee. can demonstrate how the 1440 and other VIRsatile products will work for you at incoming network feed, remote feeds, master switcher output, transmitter input and at other key points.

To receive a VIR Signal application note, use the reader service card or write:

TEKTRONIX TELEVISION PRODUCTS
Box 500-A, Beaverton, Oregon
97005.

Circle 103 on Reader Service Card;
For demonstration, Circle 114.

TEKTRONIX TELEVISION PRODUCTS

TEKTRONIX®
committed to technical excellence

daylight saving time is imposed year round, these people will be deprived of this vital service because many stations will not be able to sign on until 9 a.m. DST," he noted. The mandatory DST is under consideration in Congress.

Commerce Dept. Sees Solid Future for Broadcasting, Cable

Television and radio broadcasting will continue to grow and flourish through 1980, but cable will grow at a higher rate, according to a projection issued by the U.S. Department of Commerce recently. The report estimates the compound annual growth rate of cable revenues at between 16% and 21% for the period, with 6.5% to 8% for radio and 7.5% to 10% for television. That will make TV's annual take about $6.5 billion in 1980, radio's around $2.4 billion, and cable subscriber fees about $1.7 billion, with "substantial" additions for cable from pay-program fees and advertising.

CSAE Studies Satellite-Cable Proposals

In a meeting in Chicago in November, the Cable Satellite Access Entity, industry group studying ways of using satellites in cable networking, received bids from ten research groups on a proposed study of the availability of programming and the economic feasibility of satellites for cable. Rex A. Bradley, chairman, was authorized to appoint a selection committee to choose among the bidders. CSAE also elected Scientific-Atlanta as the first associate member, a class to include manufacturers, program producers, and others with interests corollary to those of the cable-TV industry.

DGG Celebrates 75th Year With Honors to Berliner

Deutsche Grammophon Gesellschaft, giant German disc firm which was founded 75 years ago by Emile Berliner, inventor of the flat disc record, celebrated its birthday and its founder in September with a huge reception in Hamburg. Among the honored guests was Oliver Berliner, of Audio International, Inc. in Beverly Hills, Calif., and grandson of Emile, who received a gold replica of the original "gramophone" as a tribute to his grandfather.

Kaiser Sets Up Own Sales Staff for Stations

Kaiser Broadcasting Company, now the owner of six television stations in major markets (Boston, Philadelphia, Detroit, Cleveland, Chicago and San Francisco), has set up its own national sales organization to represent the six stations to advertisers everywhere. The Kaiser move was precipitated by the decision of Metromedia, Inc., which formerly represented Kaiser, to concentrate on their own stations.

IVC Sues Ampex

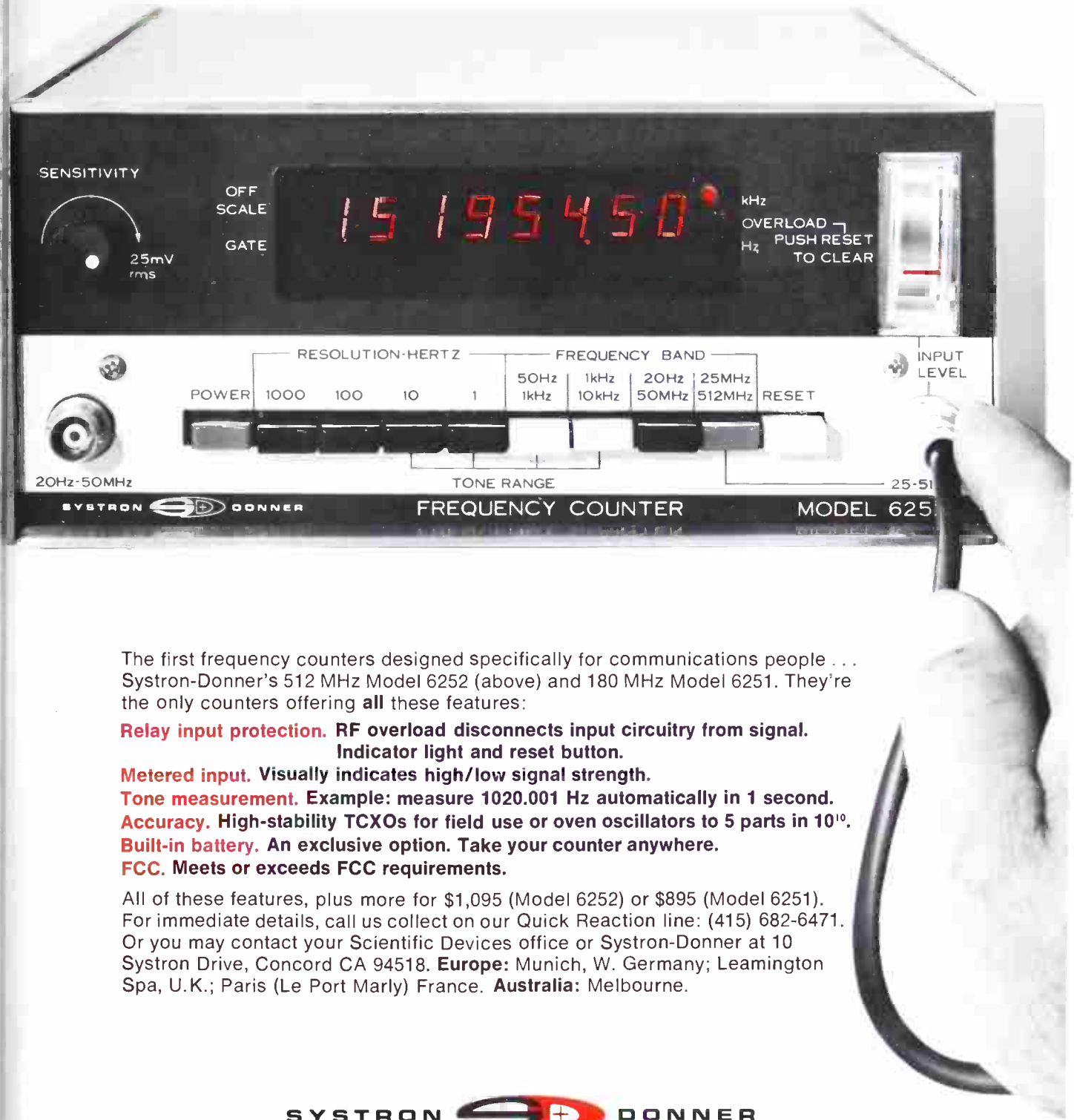
International Video Corp. early in November filed suit for a $25 million anti-trust claim against Ampex Corp., charging that company with monopolistic practices since the late 1950s, based on a patent pool with U.S. and foreign competitors. The suit is in effect a counter-claim to an earlier one by Ampex, charging patent infringement by IVC. The IVC suit says that Ampex refused licensing of certain devices, forcing IVC to make more complicated and expensive tape recorders than would have been necessary. IVC also claims that Ampex is harassing IVC customers in the U.S. and other countries.

HEW Gives $4 Million To Public TV Radio

The first grants of the fiscal year to public television and radio stations, to

continued on page 10

Will your next frequency counter have all these features?



The first frequency counters designed specifically for communications people . . . Systron-Donner's 512 MHz Model 6252 (above) and 180 MHz Model 6251. They're the only counters offering **all** these features:

Relay input protection. **RF overload disconnects input circuitry from signal. Indicator light and reset button.**

Metered input. **Visually indicates high/low signal strength.**

Tone measurement. **Example: measure 1020.001 Hz automatically in 1 second.**

Accuracy. **High-stability TCXOs for field use or oven oscillators to 5 parts in 10^{10}.**

Built-in battery. **An exclusive option. Take your counter anywhere.**

FCC. **Meets or exceeds FCC requirements.**

All of these features, plus more for $1,095 (Model 6252) or $895 (Model 6251). For immediate details, call us collect on our Quick Reaction line: (415) 682-6471. Or you may contact your Scientific Devices office or Systron-Donner at 10 Systron Drive, Concord CA 94518. **Europe:** Munich, W. Germany; Leamington Spa, U.K.; Paris (Le Port Marly) France. **Australia:** Melbourne.

SYSTRON DONNER

Albuquerque, (505) 268-6729; **Baltimore,** (301) 788-6611; **Boston,** (617) 894-5637; **Burlington, NC** (919) 228-6279; **Chicago,** (312) 297-5240; **Cleveland,** (216) 261-2000; **Denver,** (303) 573-9466; **Dayton,** (513) 298-9904; **Dallas,** (214) 231-8106; **Detroit,** (313) 363-2282; **Ft. Lauderdale,** (305) 721-4260; **Hamden CT** (203) 248-9361; **Huntsville, AL** (205) 536-1969; **Houston,** (713) 623-4250; **Indianapolis,** (317) 783-2111; **Kansas City, KS** (913) 631-3818; **Los Angeles,** (213) 641-4800; **Minneapolis,** (612) 544-1616; **New York City area** (201) 871-3916; **Norfolk,** (804) 499-8133; **Orlando,** (305) 841-8180; **Philadelphia,** (215) 825-9515; **Phoenix,** (602) 834-1682; **Rochester, NY** (716) 334-2445; **San Antonio,** (512) 694-6251; **San Diego,** (714) 249-6642; **San Francisco area** (415) 964-4230; **Seattle,** (206) 454-0900; **St. Louis,** (314) 842-2535; **Syracuse,** (315) 457-7420; **Washington, DC area** (703) 451-6500.

Circle 105 on Reader Service Card

improve facilities, total nearly $4 million, according to a report from the granting agency, the Department of Health, Education and Welfare. Continuing the program instituted by the Broadcasting Act of 1969, which has included a total of 109 grants carrying around $90 million to date, HEW chose for the latest 17 grants non-commercial stations in 12 states. Among the larger grants—in almost every case to expand coverage and upgrade services—were $475,000 to Greater New Orleans Educational TV station WYES-TV, $474,436 to WRLK of the South Carolina Educational TV Commission, and $475,000 to KNME-TV, operated by the University of New Mexico and the Albuquerque Public Schools.

Advent Corp. To Produce Projection TV

The Advent Corp. of Cambridge, Mass., heretofore known mainly as a manufacturer of high fidelity loudspeakers and audio cassette players, announced the leasing of manufacturing space for production of Videobeam Projection Color TV sets. Under technical and market study for several years, Videobeam is a two-piece system which projects TV pictures onto a screen 4¼ feet wide and 5-2/3 feet high. Selling price will be around $2500 and initial deliveries are expected in April 1974, according to the announcement.

TV Station Set Up in Antarctic by U.S. Navy

What is surely the farthest-South TV station in the world was put on the air by the U.S. Navy in late November at McMurdo station, a main base for the U.S. Navy and civilian experiments and exploration that are being carried out on the Antarctic Continent. The portable black-and-white facility will be used both for essential communications and for entertainment to the more than 1000 people in the various projects on the "coldest continent." Entertainment program support will come on film from the American Forces Radio and Television Service, which for many years has been distributing, to U.S. military installations, TV programming supplied by the broadcast industry, commercial-free.

AMST Study Shows Only Eight "Drop-Ins" Possible

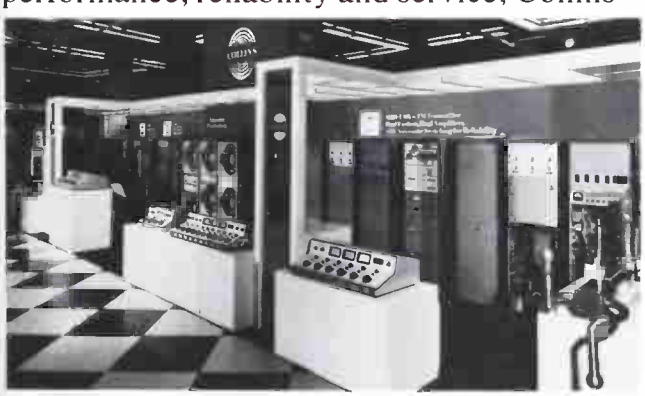
A detailed engineering study and analysis prepared for the Association of

continued on page 12

Collins broadcast equipment is priced competitively.

And that's where the competition ends.

We'll match our prices with competition anytime. But when it comes to quality, performance, reliability and service, Collins traditionally has been in a class by itself.



You can see the difference. You can hear it.

You get it in every piece of equipment we build. In our transmitters. In our consoles. In our antenna systems. In our programming equipment. In every piece of Collins equipment you use in your station.

And we back everything we make with a two-year warranty. Plus 24-hour, on-call service which means you get help when you need it.

AM. FM. Stereo. Broadcast equipment from Collins. Competitively priced to give you the best sound on the air.

Collins Broadcast Equipment

COLLINS

Circle 107 on Reader Service Card

NEWS

Maximum Service Telecasters indicates that, of the 85 VHF "drop-ins" proposed in recent Office of Telecommunications Policy reports, only eight really meet the criteria set up by OTP for the new stations. The analysis, released in late November by AMST, considers the main factors of each proposed new allocation, and finds that OTP overlooked, in more than 70 cases, terrain obstructions, interference, or other bars to operation within existing rules and regulations.

Markle Head Tells Methods To Build Public TV

A four-point program for building a large and stable audience for public television was proposed by Lloyd N. Morrisett, president of the John and Mary R. Markle Foundation, in a report issued by that body. The proposal includes a systematic study of special interests of Americans, on which TV producers can draw on designing program material; heavy promotion and advertising to reach the specific audience for each show; a new rating system to evaluate the impact of each show; and special incentives to programmers who succeed with the audience. Mr. Morrisett said that public television should not, and could not, compete with commercial TV on its own ground, but could meet its responsibilities and opportunities splendidly by serving a variety of special interests that in aggregate would cover a majority of Americans.

Business Briefs

Westinghouse will spend $10 million to expand TV picture tube production at its Elmira, N.Y. plant . . . **Home Box Office**, pay-cable subsidiary of Time-Life, has begun a full schedule of pro basketball and hockey games, of first-run movies, and of children's programs . . . **New York Record Plant**, recording complex, has obtained additional space to set up a new 24-channel quadraphonic mixing room.

Videonetics Corp. of Anaheim, Calif., has introduced a series of programs, on cassettes compatible with Sony U-matic players, on the fundamentals of early childhood . . . **Plessey Co., Ltd.**, parent of Garrard Engineering, maker of Garrard turntables, will transfer U.S. distribution in July 1974, from British Industries Corp. to the Plessey Consumer Products Division.

Laclede Communications Services, St. Louis video production firm, has bought about $500,000 of Norelco

continued on page 16

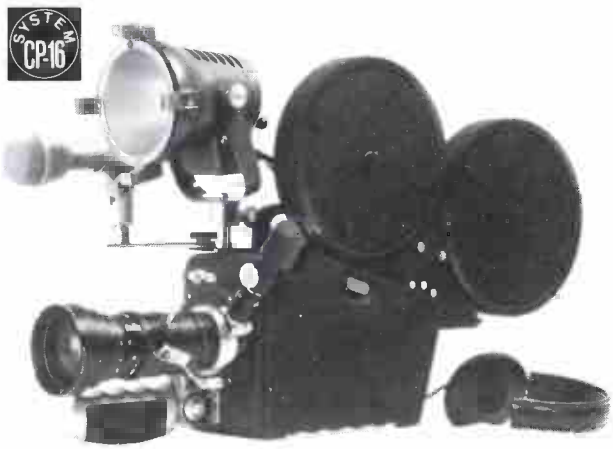
Yes. We know you know we've gone ahead and reflexed the CP-16 and CP-16/A cameras. However, a reflex camera is not necessarily what you require to best handle your TV-newsfilm/documentary filming needs. Not even a reflex camera designed by Cinema Products. Let's face it. A lot of excellent and award-winning news footage has been shot non-reflex.

We believe that our non-reflexed CP-16 and CP-16/A camera models are as valid now as they were on the day that they were first introduced—two years and some thousand cameras ago. Valid for all the reasons that have made the CP-16 and CP-16/A the most popular and outstanding value in 16mm single system/double system sound cameras. Successfully competing against everyone else's non-reflex *as well as* reflex cameras. All that's different now is that they'll be competing against *our own* reflex model as well. So you owe it to yourself to give the non-reflex CP-16 and CP-16/A camera system a thorough tryout in the field.

It may just be the very camera system that's right for you. Without upsetting your budget. After all, reflex cameras do cost considerably more. And you can go on using those expensive, long-lived zoom lenses equipped with reflex viewfinders—lenses you have so painstakingly acquired through the years.

Like we've said all along, our non-reflex CP-16 and CP-16/A cameras continue to make sense.

Equipment sense *and* dollar sense.



CP-16/A Camera (non-reflex) shown with Mike/Lite bracket, RE50 microphone, and Cinema Products' new *Sturdy-Lite* quartz 250 watt/30 volt battery-operated focusing spot light. The *Sturdy-Lite* focusing spot weighs only 12 ounces.

For further information on CP-16 and CP-16/A Cameras, please write to:

cinema products CORPORATION

Technology In The Service Of Creativity

2044 Colner Avenue, Los Angeles, California 90025
Telephone: (213) 478-0711 ■ Telex: 69-1339 ■ Cable: Cinedevco

Circle 109 on Reader Service Card

CONSOLIDATED VIDEO SYSTEMS TOTALLY WIPES OUT THE LANGUAGE BARRIER BETWEEN HELICALS AND QUADS.

INTRODUCING THE CVS 504. A SINGLE "UNIVERSAL" DIGITAL VIDEO SIGNAL CORRECTOR FOR ALL REASONS.

We know it sounds wild, but the new CVS 504 works with ¼", ½", ¾", 1" and 2" non-segmented helical VTR's. In color, it doesn't matter whether the signal from the tape recorder is direct or heterodyne.

For example, how about taking a Sony U-matic*tape and dubbing it up to a quad? Easily done with the 504's exclusive "color interlacer" switch. The result when played back on the quad will be phased interlaced color.

Or, how about taking an EIAJ ½" recorder and using it as a camera source locked to house sync. It's easy with the CVS 504 if the recorder has a capstan servo. Even if it doesn't, you can still drive a camera from the internal sync generator in the CVS 504 and do special effects between the recorder and the camera.

Come to think of it, there isn't very much you can't do with the CVS 504. Your CVS Representative is carrying a videotape with him these days that demonstrates most of the 504's features. Why not ask him for a look at the tape? Or, you might ask him for a demonstration. Or, just drop us a line. We'll send you some literature on the CVS 504.

It's some kind of time base corrector.

*TM Sony Corp.

Consolidated Video Systems

CVS

Perfectors of Video Signals
3300 Edward Avenue
Santa Clara, California 95050
In the heart of Video Valley

Circle 110 on Reader Service Card

NEWS

camera and audio equipment, including five PC-100A cameras, one PCP-90, and studio equipment . . . **Memorex Corp.** announced that definitive agreements were expected by the end of 1973 with its principal creditors, on terms allowing the company to continue as an on-going, independent business . . . **Magnavox CATV Division** reported seven cable systems as recent installers of the MX-404 distribution equipment, with system mileage totalling about 2500.

Long and tortured story of the **struggle for Channel 5 in Boston** is subject of a book, "The Hundred-Million-Dollar Lunch," by veteran radio/TV writer and producer Sterling Quinlan . . . **Collins Radio Co.** sold its crystal-filter facilities and product line to **McCoy Electronics**, subsidiary of Oak Industries . . . **CBS Private Line News Exchange** (PLNX) added to its regular line-up movie critic Pauline Kael, of the New Yorker, and Prof. William Wood, Columbia School of Journalism, who has long experience in radio and television.

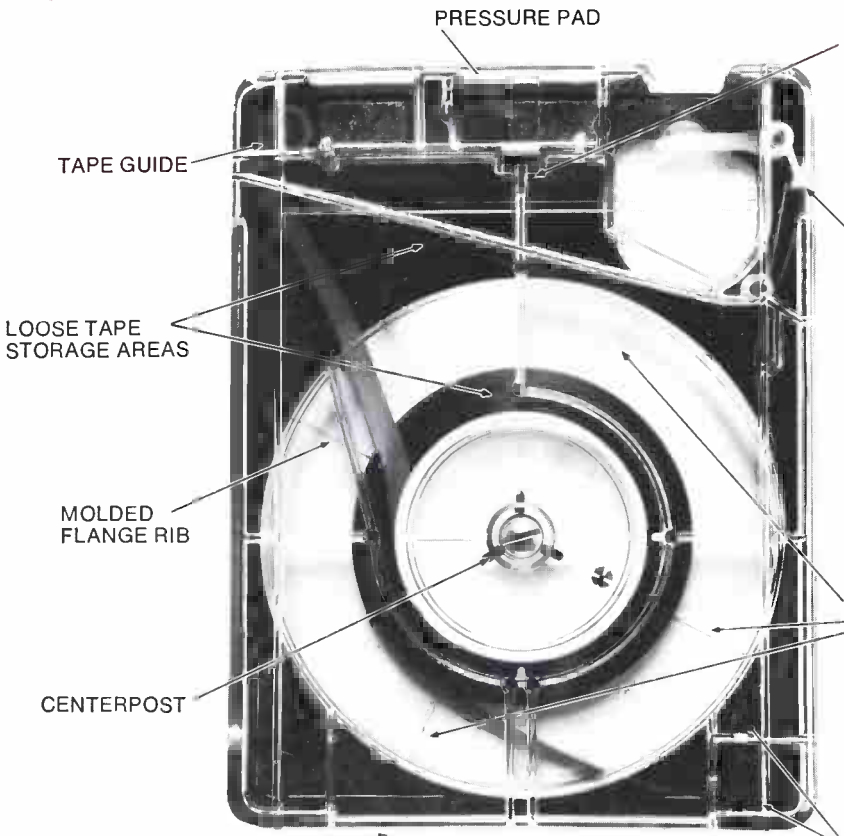
Ampex Corp.'s recent sales of AVR-1 VTRs include three to Production 70 in Atlanta; two to the Grand Ole Opry House in Nashville; three to Compact Video Systems; and four to the State University of N.Y. . . . **International Industrial Television Association** announced its 1974 videotape competition; meeting is in April 1974 and competitors should promptly reach Kal Raasch, Fireman's Fund, P.O. Box 3395, San Francisco (Tel. 415-929-2206).

The Music Director, Chestnut Hill, Mass., distributor of MOR music, announced the 1973 supplement to its list of MOR hits . . . **RCA** sold to the Republic of Zaire about $1.6 million in TV equipment and services, as part of a shift to color television . . . **Birns and Sawyer**, Hollywood makers of movie equipment, experienced a change in ownership with president Jack Birns and Vice President Marvin Stern buying all the interests of Clifford Sawyer and Normal Margolin.

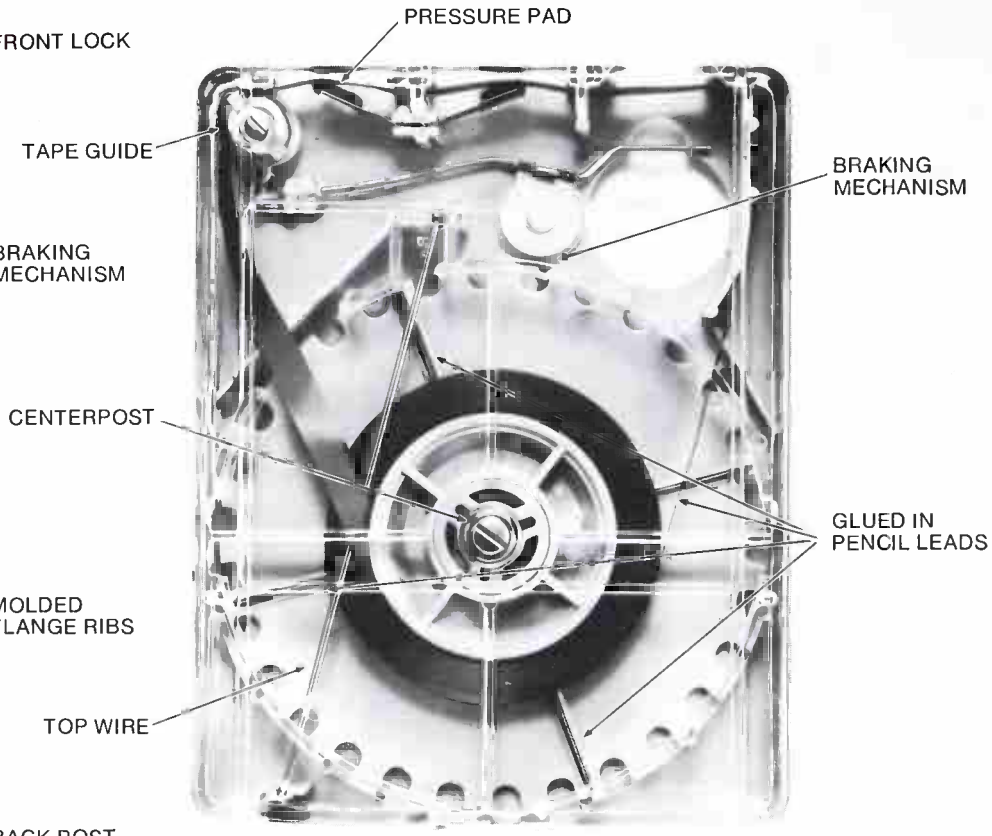
The Filtron Co., maker of special radio and TV filters, was bought in its entirety by George Barry, president . . . **Delco Electronics** has set up a mobile laboratory for checking signal levels, noise interference at particular spots, as well as receiver performance of auto radios, looking to elimination of reception difficulties and improved auto receiver design . . . **Gates Division of Harris-Intertype** is delivering transmitters for a total of about $1.1 million to all five TV stations of the Capital Cities Co.

continued on page 63

YOU BE THE JUDGE!



AUDIOPAK® A-2 BROADCAST CARTRIDGE



FIDELIPAC® BROADCAST CARTRIDGE

FOR MORE INFORMATION AND A FREE SAMPLE OF THE A-2, WRITE TO...
AUDIO DEVICES, INC., A CAPITOL INDUSTRIES CO., 100 RESEARCH DRIVE, GLENBROOK, CONN. 06906 • MANUFACTURERS OF AUDIOTAPE®, AUDIOFILM® AND AUDIODISCS®

Circle 112 on Reader Service Card

Tape is a 4-letter word:

Fuji.

Fuji is fast becoming the new way to spell tape for America's leading television producers, major group television stations and two of the three national networks.

Take our word for it.

Fuji is distributed in the U.S. by

COLTAPE

a division of Columbia Pictures Industries, Inc.

711 Fifth Avenue, New York, New York 10022
(212) PL 1-4400 (212) PL 1-7859

The Burbank Studios, 4000 Warner Blvd., Burbank, California 91505
(213) 845-8838 (213) 843-6000

Circle 113 on Reader Service Card

INTERPRETING THE FCC RULES & REGULATIONS

Equal Employment: Annual Employment Report—FCC Form 395

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

Several years ago, the Commission took definitive action to eradicate discrimination by broadcast licensees in employment practices. Pursuant to determining that such discrimination was incompatible with the broadcasters' obligation to operate in the public interest,[1] the Commission promulgated new rules requiring that equal opportunities in employment be afforded by licensees.[2] Thereafter, additional rules were adopted which required the filing of an annual employment report with the Commission, the maintenance of records, and the preparation of specific equal employment opportunity programs by applicants and licensees.[3] Similar rules now also apply to common carriers and cable television system owners and operators.[4]

The underlying basis for requiring annual submission of statistical employment data is best expressed by the Commission:

> "... It is useful to show industry employment patterns and to raise appropriate questions as to the causes of such patterns. Thus, if none of the broadcast stations in a city with a large Negro population had any Negro employees in other than menial jobs, a fair question would be raised as to the cause of this situation."[5]

The Commission views equal employment opportunity as vital to the broadcasters' responsibility to operate in the public interest. Broadcasters and cable television system operators and owners should treat the Commission's Annual Employment Report accordingly.

To assist broadcasters in preparing accurate reports, a description follows of the Annual Employment Report, FCC Form 395. Full disclosure of the employment picture will facilitate the Commission's (and the public's) efforts in determining whether or not broadcasters are contributing to the national goal of full minority group participation in every phase of the American economy.

FCC Form 395: Who, When, and Where?

The following must file two copies of FCC Form 395 *with the Commission* no later than May 31 of each year:

1. All licensees and permittees of commercial and noncommercial AM, FM, television, and international BROADCAST stations with FIVE or more fulltime employees.

2. ALL licensees and permittees of COMMON CARRIER service stations with SIXTEEN or more full-time employees.

3. All operators of CABLE TELEVISION SYSTEMS, both in that capacity and as licensees or permittees of cable television relay stations, if each such system has FIVE or more full-time employees.

It should be noted that broadcast stations and common carrier service stations with fewer than five and 16 employees, respectively, must file FCC Form 395N instead of 395.

Reporting Period

The data included on FCC Form 395 must reflect employment statistics *from any one payroll period in January, February, or March* of the subject year. The *same* payroll period should be used in each subsequent year's employment report—a clarification of past FCC procedure.

Broadcast Stations

Each AM, FM, TV, and international broadcast station, whether commercial or noncommercial, must file an Annual Employment Report. Thus, even if an AM in Atlanta, Ga., and a TV station in Memphis, Tenn., are commonly owned, *each* station must file a *separate* Form 395. An exception to this rule is made, and a *combined report* may be filed, for an AM and an FM station, both of which are *1.* under common ownership *and 2.* assigned to the same principal city or to different cities within the same standard metropolitan statistical area. For example, commonly owned AM and FM stations in Manhattan may file a combined report.

A separate report must be filed for *each* "Headquarters Office" of a multiple station owner at which the employees perform duties *solely* related to the operation of more than one broadcast station. For example, clerical employees who perform work relating to a com-

continued on page 22

FCC Rules & Regs

continued

monly owned AM and TV station must be reported on a separately filed report covering all such "Headquarters Office" employees. At the risk of confusion, an "exception to the exception" must herein be noted: a separate report need *not* be filed to cover headquarters employees already reported in a combined AM-FM report (discussed above), if *all* such employees are included in such combined report.

Finally, a "Consolidated Report" must be filed by a multiple station owner; such report must cover all stations and headquarters employees in spite of their previous inclusion in separate station and headquarters reports.

Cable Television Systems

A separate Annual Employment Report must be filed for each cable television system, with the exception that a combined report will instead be filed by two or more cable systems with five or more employees that have jointly established an equal employment opportunity program pursuant to Section 76.311 (e)(2)(i) of the Commission's Rules.

A separate report must also be filed for each "Headquarters Office" under the same conditions requiring a broadcaster to file such a report. This filing requirement for cable systems is expected where the cable television systems in question constitute *one employment unit*, and all the employees who would be covered by the "Headquarters Office" report are covered in the combined "single employment unit" report.

Finally, as with broadcasters, multiple cable system operators must file a "Consolidated Report" in spite of separate station and headquarters reports covering *all* employees.

Job Categories

This section constitutes the real substance of the Annual Employment Report; broadcasters and cable system operators are strongly advised to make a good faith effort to *accurately* categorize employees. *Precise* job definitions will inestimably aid the Commission in determining the present status of minority group industry employment and, more importantly, will contribute toward the industry's goals of bringing minority groups into full participation.

The following "job category definitions" should be used in completing FCC Form 395:

1. **Officials and Managers**—Jobs which require administrative personnel who set **broad policies**, exercise **over-all responsibility** for execution of these policies and direct individual departments or special phases of a firm's operations. Broadcast licensees should include in this category the following: Officers; station manager and assistant manager; program, sales and news directors; office managers, budget officers; promotion managers, public affairs directors, and chief engineers.

2. **Professional**—Jobs which require **college graduation** or equivalent experience. Broadcast licensees should include in this category the following: Persons engaged in the writing, preparation, and production of programming, including continuity and news writers or editors, producers and directors of programs, floor directors, announcers, singers, actors, and music librarians.

3. **Technicians**—Jobs requiring both **basic scientific knowledge** and **manual skill** obtained through about two years of post-high school education, or equivalent experience. Broadcast licensees should include in this category the following: Audio and video engineers, cameramen (live or film), film processors, light men, stage hands.

continued on page 27

Services, Services

It all starts with getting to know you.

At RCA, we believe that probably the most valuable asset a company has is its relationship with its customers.

So in addition to constantly improving our product line, we've tried over the years to develop a wealth of services geared to your special needs as a broadcaster.

And in this issue of Prime Time, we'd like to tell you about some of them.

One of the ways we've become the most experienced company in broadcasting is by anticipating broadcasters' needs.

To do that, we have to talk to you. So periodically we send out our survey teams to find out what people in the business are thinking, doing and planning.

For example, in the early stages of the development of our TCR-100 Cartridge Recorder, RCA survey teams spent weeks poring over station program logs. Their purpose: to find out what really happens at the station break. How long is the typical spot? What's the optimum number of events that a station break machine should be able to handle? Is the added expense of a "random access" machine really necessary?

Getting answers to these questions resulted in a Cart Machine designed for easy, day-to-day use in programming and production rather than a more expensive, complex showpiece. And broadcasters have responded by ordering and reordering at a gratifying rate.

A further result of the feedback we got is our whole approach to automation. We found a widespread interest not only in equipment with automatic performance features, but also in equipment that handles program segments automatically. Besides the TCR-100, this led to the new TCP-1624 Cartridge Film Projector.

"Our survey teams...find out what people in the business are thinking, doing and planning."

And to make sure that our technology keeps up with what broadcasters need in the years ahead, there's our Princeton Research Center. Here's where basic communications research leads to breakthroughs of tomorrow.

Another vital service factor is your RCA representative. When he calls on you or your chief engineer, it isn't just to sell you something. He's there to help you with your planning—to assist in the determination of how our latest equipment offerings may best be applied to your individual operation. He's also your link to our products of the future. His analysis of your everyday operations, his reports of your comments and needs play a major role in our planning activities.

And in the pages of this Prime Time, you'll find a lot of other ways we're committed to the future of the broadcast industry. Knowing your needs is just the first step in being a qualified supplier.

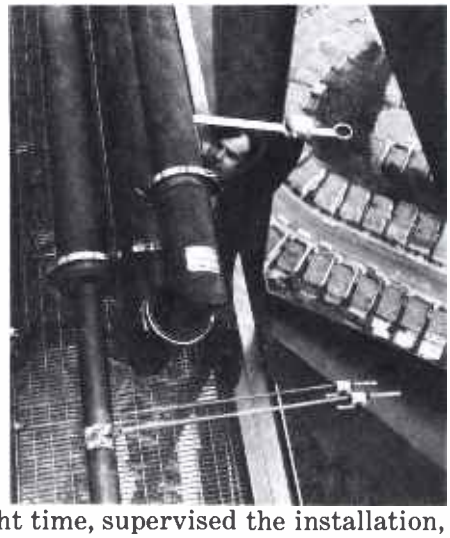
Circle 156 on Reader Service Card

Project Management

The giant on Mt. Sutro.

If you've ever wondered how big an antenna system project RCA can undertake, the new tower on San Francisco's Mt. Sutro should give you an idea.

It's 977 feet high, nearly as tall as the Eiffel Tower. It serves four FM, five VHF and three UHF stations, one of the latter not yet on the air.



Three types of TV antennas, plus standbys, were provided by RCA: VHF Superturnstiles, Traveling Waves, and UHF Polygons.

The final design was the result of an eighteen-month developmental program by RCA engineers, using computers during the early mathematical stages to plot electronic interactions among the antennas. Later, these calculations were evaluated with 1:10 scale models.

RCA managed the logistics of getting the right antenna materials to the site at the right time, supervised the installation, and checked it all out after construction.

But big projects aren't the whole story. We handle small and medium-size jobs, too. Anything from a modest mobile van to complete studio systems of cameras, VTRs and telecine units, like the complex we supplied to the Austrian broadcast agency ORF in Vienna.

What do you have in mind? Maybe we can help. Talk to your RCA representative.

Circle 155 on Reader Service Card

Parts

Getting on the ball to keep you on the air.

Speeding your orders rates top priority at our Parts and Accessories Depot in Deptford, N. J.

This is because we know that even good products may need a replacement part fast.

First of all, this means we've got to have the parts you need in stock.

So we built one of the largest commercial electronics parts distribution centers in the world. Seven football fields would fit into it with room to spare. Then we stocked over 40,000 different stock numbers.

With minor exceptions, RCA stocks replacement parts for 10 years. However, some parts that are in active use are stocked for periods extending up to 25 years or more.

But having the parts here at RCA is just the beginning. Getting them to you is important, too.

That's where our computer comes in. It's helped us reduce average delivery time considerably. Perhaps one day you'll place your order directly with our computer, further speeding delivery time.

We ship by just about every form of transportation there is.

In emergencies, our proximity to Philadelphia International Airport—a fifteen-minute drive—contributes to speedy delivery.

"We stock most replacement parts for transmitters for a minimum of 10 years."

Last Christmas Day, when the modulation transformer of WHWH-AM, Princeton, N. J. burned out, its chief engineer called Parts and Accessories. We had the part he needed, and two hours after his phone call, a new transformer was at the station ready for installation, and the engineer was breathing a sigh of relief. And remember—this happened on Christmas Day.

All of which shows what you can expect from RCA Parts and Accessories. And demonstrates our belief in doing more than supplying good products.

Circle 157 on Reader Service Card

Repairs

With CRAE, "good as new" is a lot cheaper than "new."

Maybe you don't need that new piece of equipment yet.

It could be that all your old equipment needs is a quick visit to RCA Custom Repair and Engineering (CRAE).

We can take older RCA cameras, projectors, VTRs and multiplexers, and give them a new lease on life for a fraction of what you'd pay for new equipment. We've restored hundreds of microphones to like-new condition—and we certify that the refurbished mikes meet original specs.

Depending on what the equipment needs, you can choose from systems modification and updating, complete overhauls, "electronic washing", testing, refinishing and optimizing.

For further information, or a quote on a specific project, contact Mr. D. G. Mager at RCA, Bldg. 2-2A, Front & Cooper Streets, Camden, N. J. 08102.

Circle 158 on Reader Service Card

Education and Training

Seminars on RCA equipment make sure you get out everything we put in.

When we sell you a piece of equipment, we want you to get the fullest possible use out of it.

So we've created an ongoing series of technical seminars, each centered around a major RCA product. Like the TCR-100 Cartridge Recorder, the TR-70C reel-to-reel VTR, the new TK-45 Color Camera and others.

From 350 to 400 station engineers, teleproduction and CCTV systems people attend these seminars each year.

Located in Camden, N. J., our Broadcast Training facility houses a fully equipped studio for hands-on training, plus classrooms. They're used for instructing our own personnel as well as our customers.

"From 350 to 400 station engineers, teleproduction and CCTV system people attend RCA seminars each year."

Under the direction of a new Manager of Broadcast Technical Training, John W. Wentworth, author of the pioneering text *Color Television Engineering*, several educational innovations are being implemented.

Among them are more emphasis than ever on hands-on instruction, the use of team-teaching techniques, and mini-courses on equipment operation and trouble-shooting for those

customer personnel who don't require in-depth training.

We're even looking into the possibility of going to our customers with regional seminars.

Purchasers of major broadcast products qualify for RCA seminars. Your RCA representative can arrange for your participation.

Circle 159 on Reader Service Card

Information

Service by the numbers.

Just about any problem you may have that's not covered under "Parts" or "Repairs" can be handled by calling the Tech Alert number at the left below.

You can get product information, answers to warranty questions, installation schedules and other help. The Tech Alert operator will connect you with the right specialist for your problem during business hours.

After hours and on weekends, a recorder will take your message for action the next weekday, and also give you an emergency number.

Tech.Alert Parts Repairs

Tech Alert. It's one number you can call 24 hours a day, seven days a week.

And as for Tech Alert people, you'll meet them each time you purchase a major RCA product. They're the people who arrange to have a field engineer come in and check it out for you.

Along with the Tech Alert number, we've also included the phone numbers for repairs and parts replacement, discussed elsewhere in this issue.

Circle 160 on Reader Service Card

FCC Rules & Regs

continued

4. **Sales**—Jobs engaged primarily in **direct selling,** such as advertising agents and salesmen, insurance agents and brokers, demonstrators, salesmen and sales clerks, and kindred workers.

5. **Office and Clerical**—Jobs involving all **clerical-type** work regardless of level of difficulty, where the activities are predominantly nonmanual. Examples include bookkeepers, cashiers, accounts collector, messengers and office boys, office machine operators, shipping clerks, stenographers, typists, secretaries, and kindred workers.

6. **Craftsmen (skilled)**—Jobs involving **manual work** of relatively **high skill level** requiring a thorough and comprehensive knowledge, and extensive period of training. Examples include the building trade, hourly paid basemen who are not members of management, mechanics, skilled machine operators, compositors and typesetters, motion picture projectionists and kindred workers.

7. **Operators (semi-skilled)**—Jobs requiring **intermediate skill level** that can be mastered in a few weeks. Examples include building trade apprentices, attendants, chauffeurs, deliverymen, furnacemen, painters (except construction), truck drivers, welders, and kindred workers.

8. **Laborers (unskilled)**—Jobs in manual occupations requiring **no special training.** Such jobs may be learned in a few days and require the application of little independent judgment, including garage laborers, gardeners and grounds keepers, and laborers performing lifting, digging and loading operations and other kindred workers.

9. **Service Workers**—Jobs in both **protective** and **nonprotective service areas** including attendants, nurses aides, laborers, charwomen and cleaners, cooks, elevator operators, guards, watchmen, doorkeepers, stewards, janitors, porters, waiters and waitresses and kindred workers.

Note that employees performing more than one job should be listed only once—in that job category which represents the *most important* work done by that person.

Minority Group Identification

Information necessary for minority group identification may be made by *1.* inspection of employee records; *2.* visual survey; *3.* employee use of the language (i.e., Spanish); or *4.* other indications that an employee belongs to a particular minority group. An employee may be included in a minority group classification if he (or she) "appears to belong" or is "so regarded in the community as belonging."

Conclusion

The communications industries are making meaningful progress in meeting the national commitment of eliminating social and economic discrimination and providing equal employment opportunities to all regardless of race, religion, sex, or ethnic background. These industries have come a long way, but must go even farther to meet our national goals. Careful, accurate and honest compilation of the Annual Employment Report, Form 395, will help in informing all just how far the communications industries have progressed in confronting this vital national issue. **BM/E**

[1] *Memorandum Opinion and Order and Notice of Proposed Rule Making in Docket No. 18244,* 13 FCC 2d 766, 13 RR 2d 1645 (1968).
[2] *Report and Order in Docket No. 18244,* 18 FCC 2d 240, 16 RR 2d 1561 (1969).
[3] *Report and Order in Docket No. 18244,* 23 FCC 2d 430, 19 RR 2d 1571 (1970).
[4] *Report and Order in Docket No. 19246.* 34 FCC 2d 186, 24 RR 2d 1629 (1972).
[5] *Report Order, in Docket No. 18244,* 23 FCC 2d 430, 431, 19 RR 2d 1573 (1970).

Tape and Film: The Fight Goes On

Film is still a strong contender, but tape now looks like the better bet for the long haul.

Both tape and film have been on the up escalator in the 12 months since our January 1973 report on the relative positions of the two media in broadcasting. Both have been riding on the large expansion in the use of all forms of visual programming.

But tape has moved more, and has firmed up technical progress that gives it additional margin in the competition with film for a range of jobs in broadcasting.

It has not been a knockout battle—we are not at that point yet. Some observers see it a few years ahead, as we note in the following. Some other people are saying it is not a battle at all, but a case of having two media, each better for certain jobs, often used in combination, giving the user a wide range of choices.

After talking to a broad array of people in the production, distribution, and use of recorded visual programming, however, *BM/E* is persuaded by the majority opinion: tape has inherent advantages that will enable it to invade more and more of film's territory. A quick takeover by tape is not for right now. Moreover, we cannot rule out completely the possibility of a breakthrough for film that will reverse or alter this expectation. But nothing of the kind is in sight and we can't avoid being impressed with the long-range strength of tape.

In the following, we survey the tape-film confrontation in program origination, in editing, in duplication and distribution, in news gathering, all with the intention of helping the broadcaster get the most out of the available hardware now and get ready to do the same in the close future.

Origination

The advantages of shooting for TV programming on video cameras are known in detail by the TV broadcaster. As we noted in the earlier survey, the main ones are instant replay, quiet cameras, a broader range of light sensitivity, original takes in a form easily converted to readiness for broadcast. A very large quantity of TV programming, both ads and feature material, starts today on the video camera, and the TV broadcaster need have no fear that he has to go outside his own electronic competence for the most sophisticated program origination. This was true a year ago, as we noted then; it is even more true now.

But film is not by any means all through in this area; it still has some tremendous strengths. One of them is the large body of directors and producers in independent film shops, in advertising and industrial film production, who have the lifetime experience of creating with film. Many times, when *BM/E* asked professionals what keeps film going, the answer was "habit!"

This habit means that a substantial quantity of production on film is currently underway, that there are very numerous creative groups working with film. It means that large production and post-production houses, like Reeves, Screen Gems, and Teletronics in New York, Byron in Washington, and similar outfits across the country, must be set up today to work with film in all forms, being prepared for tape-film and film-tape conversions, as well as for original production on film when it is asked for.

The persistence of film in the smaller independent creative shops is reinforced, in locations away from the large cities, by the high cost of tape equipment and the non-availability of rental tape equipment—only in the large post-production centers can proper tape equipment be readily obtained. Thus there are scores of producers across the country who will do only film, and during the past year their business, on the whole, has been expanding.

However, even this fortress of film, at least in the larger cities and among the larger creative shops, is beginning to be eroded. A brand-new trend, coming to full force during the past year, is a pro-tape influence among the large advertisers from their experience with the video cassette—which means up to now the Sony U-matic system. The U-matic has become so widespread in industrial and business communications that tape is a new vernacular in broad reaches of American industry. The cassette networks are set up, both within companies and across company lines; the communications men want the company ads on cassettes, for internal communications, whatever the form for distribution to television.

One result is that large post-production houses like Reeves, Teletronics and Screen Gems, now have massive business in U-matic duplication, whereas they had little or none a year ago. Another is that the advertiser executives, now accustomed to tape, want it used all the way through. This demand has worked back to the creative shops, and has forced many of the larger ones to set up tape production alongside their film production.

This new movement is noteworthy for broadcasters because it is one more force, partial in its effects but cumulative with a number of others, pushing tape toward the top.

There is another pro-tape force, also partial, noted for *BM/E* by Garry Davis of WFAA Productions in Dallas,

Automated and semi-automated videotape editing is becoming standard in the tape production houses (and in larger broadcast stations as well). Here Bruce Harris of WFAA Productions, Dallas, assembles a videotape program with the help of the Ampex RA-4000 random-access timecode editor.

which many TV broadcasters will recognize in their own shops. Quite a few stations have gone into commercial production as a way of spreading their investment in video equipment over a larger business. This often means bringing in creative directors, and this body of directors has become a reservoir of creators highly skilled in using the video camera. It is axiomatic that development of such a group of skilled "videographers" means increased use of the video camera in original production.

In one area, not of primary interest to most broadcasters, there is still a technical hang-up restricting the use of the video camera in production. When the final result is to be 35mm film for theatrical projection, most professionals say the program had better start on film. Although there is some difference of opinion among users, most agree that the tape-film transfer, even with such highly advanced devices as the electron beam recorder and the laser color recorder, still results too often in marginal 35mm prints.

Richard Kloss of Screen Gems blames this on the 525-line system, as not providing enough resolution for quality to survive the transfer to projection film. With, say, 800 to 1000 lines, the difficulty would disappear—video origination for the movie houses could sweep in. This might be an opportunity for some hardware maker, because the high-resolution video camera is, of course, already here in CCTV applications. It would apparently be mainly a repackaging job, with high-resolution electronics applied to video cameras of top quality.

Image Transforms, West Coast firm with a secret process for transferring tape to film, claims that their operation, in effect, raises the resolution to the equivalent of around 650 horizontal lines. Users praise the results, but in general those results do not seem to differ too greatly from what can be obtained with the electron-beam recorder.

To sum up for the broadcaster: the video camera is looking more and more like the dominant visual recording instrument of the future. With a high-resolution system made for the internal loop from camera to 35mm

How Tape and Film Fit In, Now and for the Future.

The broad extent of activity in the television and motion picture industries, directed toward assessment of the tape/film equation, or toward new systems for using one or the other, was most evident at the 114th technical meeting of the Society of Motion Picture and Television Engineers, held in New York in October. Here are some of the papers bearing on those topics:

"Electronic Cinematography," by W.G. Connolly of CBS, describing experimental production of a network feature, "Sandcastles," starting with video cameras and using videotape all the way through.

"Approach to the Design of a News/Documentary Camera," by E.M. DiGiulo of Cinema Products, stresses the systems approach in a 16mm camera design.

"Video Rushes for Hand-Held Cameras," by Jean-Pierre Beauviala of Aaton SA, in France, describes a European experiment in developing a video monitor for a 16mm camera; a part of the light is bled off from the taking lens and fed to a built-in video camera, allowing for video monitoring and, with a ½ inch VTR connected, for editing "rushes" that are immediately available.

"Television News Gathering," by Joseph A. Flaherty of CBS, (material is summarized in accompanying story).

"Portable Color Camera with ½-inch Videorecorder for Electronic Journalism," by H.R. Groll of Fernseh, (summarized in box in the accompanying article).

"Automatic Videotape Editing System," by Noboru Yura and Tsugu Yoshi Itoh, Far East Laboratory, describes a semi-automated editing system using kinescopes for "off-line" work.

"The Film-Tape Experience," by Gary Jones of WFAA Productions, describes a feature program production method that starts with 16mm film, but quickly shifts to videotape for editing, duplication, etc.

projection print, the video camera could become the movie maker as well.

Editing and Processing

It is in this part of the production process that tape has, in the past year, made its most influential advances. Automated editing of videotape, on several levels of sophistication, has been here for several years: *BM/E* surveyed the field in detail in the July 1972 issue.

But the new deal in tape editing seemed to reach a level of general acceptance and accomplishment in 1973 that gave it enormous impact. Professionals involved with both film and tape agree that editing a program on tape is now 50% and up cheaper—mainly in the cost of time—than editing the same program on film. It is a great deal easier, more flexible, more quickly responsive to the editor's commands, and this has allowed the creative, non-engineering person to become a highly effective program editor.

It further allows the post-production process to be far more efficient by separating the creative part of the editing from the physical, with the latter automated on several cost levels. Jim Hartzer of Reeves, for example, describes one newly developing editing setup in that plant. The editing is done "off line," on one-inch copies of the original tapes, with IVC helical machines. In many cases the editing "copies" are not copies—they are "originals" shot *alongside* the quad tape, on separate one-inch machines. This saves duplication time as well as wear and tear on equipment and originals. The quad version and the one-inch version have the same frame-by-frame coding. The editor can sit down with the one-inch version and two or three IVC machines, plus a SpectraVision JBT-102 Editor. Reeves has recently set up several such editing rooms. The editor can in a short time prepare a complete frame-by-frame specification sheet, together with instructions for special effects.

At Reeves, this information is fed to a Central Dynamics PEC-101 computer system, which automatically applies the instructions to the original quad tapes. This was one of the first computer systems for tape editing. Central Dynamics, as shown in the accompanying box on tape editing equipment, has later, more highly-developed units and there are a considerable number of other systems available. Very significant in this listing are the comparatively inexpensive units, which are somewhat less automated but still supply the basic flexibility and ease of the new tape editing. There are now perhaps a dozen different ways to edit videotape, at a wide range of equipment costs, but all offering some basic advantages of electronic editing.

The cream of this new technology, of course, are the

Several Really Portable News Systems Are On The Way

As the accompanying story notes, the 16mm camera is by and large still the dominant news gathering device, but the video camera is beginning to move in. So far, most electronic news gathering, like the CBS system described in the story, has been with equipment not strictly in the backpack category, even though the camera could be hand-held.

Several really portable systems, however, are here, in experimental use, or are due to appear on the market about the time this story reaches print. The main ones:

AKAI ½-inch VTR and video camera—On the market for some time; in experimental use by, among others, ABC-TV (see story).

Magnavox Chromavue 400, feeding Sony or Norelco cassette recorder—In use for news interviews at, for example, KDUB in Dubuque. Chief engineer Cyberski finds the quality adequate and the sound better than on his 16mm film systems.

Editel ENC-1—A complete system, hand-held camera and backpack electronics, promising broadcast quality due early 1974 at a price around $30,000.

Asaca ACC-5000—Another complete backpack system claiming full broadcast quality demonstrated at the last NAB, also to be deliverable in early 1974.

AKAI portable camera in use for news interview at WSNL-TV, new Long Island station.

Videotape Editing: Today's Equipment Gives the Program Creator Full and Easy Control, Plus Wide Resourcefulness.

Videotape editing has become perhaps the most flexible and resourceful mechanical aid to the creative process ever devised. It does a great deal more, and generally does it a lot quicker, than film editing; on the basis of very large time saving, the operational cost of editing a given program on tape is usually much lower than editing the same program on film. Videotape editing is available at a wide range of automatic levels, from the total automation of the CMX and Central Dynamics systems in the top bracket below, to the frame-selective dubbing of units in the lowest bracket. At every level, though, videotape editing is fully available to the non-technical, creative program director. He gets more freedom to do what he wants with visual programming than he ever had before.

Full automation systems: Over $100,000:

(Note: Cost of a system will vary considerably from one installation to another, depending on the user's VTR complement, operation needs, etc.)

Central Dynamics—PEC-102
CMX—600

Medium-level systems: $15,000 to $100,000:

Ampex—RA-4000
CMX—Edipro 300
EECO—BE Series Systems
RCA—TCE-100 Time Code Editing System

Least-expensive frame control systems: $15,000 and below:

Central Dynamics—EDS-200 (includes a micro-computer)
Datatron—Vidicue 5050
Dynasciences—Model 1000
SpectraVision—JBT-102

Central Dynamics' EDS-200 is a complete videotape editing system.

Another system is the EECO BE430 Edit Code Programmer.

The Fernseh "Electronic Journalism" System

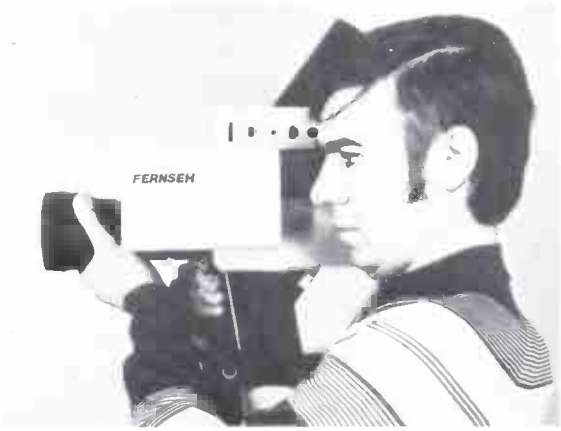
Described at the SMPTE technical meeting in October, due for demonstration at the NAB Convention in March, and promised for the American market shortly after that, is an "electronic journalism" system developed by Fernseh in Europe. The system starts with a new portable camera, the KCR, weighing about 15 pounds, which can be hand-held or mounted on a tripod. (Fernseh, incidentally, confirms the experience of CBS with its system—see accompanying story—that news cameras are actually hand-held a very small percentage of the time: over 90% of news programming is picked up with the camera on a tripod).

A backpack easily worn by the cameraman holds the camera electronics, an automatic processing amplifier, and a battery pack. AC power can also be used when it is available. The video material gets back to the studio by any of three routes: via an omnidirectional microwave link, with a second man carrying the mobile transceiver, linked to the camera by coaxial cable; via a microwave link using directional antennas with the transmitting equipment on a mobile truck; and via a system with a second man carrying a portable VTR, again linked to the camera via coaxial cable. The objective with all three systems is to get material on the air with "broadcast news" quality, comparable to the quality of on-air material that starts on 16mm news cameras.

Fernseh claims to have achieved this quality, and the demonstration of the system at the SMPTE suggested they may be right. Further careful investigation at the NAB is in order.

The third, or recording, system uses a video cassette heavily modified from the Norelco ½-inch VCR. Fernseh says their objectives, all of them realized, were: 2.5 MHz bandwidth, S/N ratio 38 dB, playing time 30 minutes, no restriction on color fidelity, full synchronism with studio sync possible. The cassettes are carried back to the studio and played there on a machine developed especially for the system.

Backpack (above) and camera (below) of Fernseh journalism system.



super-automated systems on the list, which hand the editor almost total control.

Videotape could almost win the battle on this advantage alone. As *BM/E* noted in last year's report, the ability to pull a whole world of special effects out of a small box of semiconductors is perhaps the greatest gift of electronics to visual programming. Instant color correction, several varieties of image enhancement, the ever-expanding range of wipes, dissolves, etc., are now accepted resources of the tape editor.

Magnavox Chromavue 440 is one of the portable video cameras newly on the market which are getting tryouts for some areas of television news gathering. Others are listed in box on earlier page. Such portables will ordinarily involve a backpack with the electronics for the cameraman, plus a VTR carried by a second man or in accompanying mobile unit.

Super 8mm film is on the upswing as the origination medium for spot news on television, with the film program transferred to quad tape on high-quality telecine equipment. Kodak's Supermatic 200 sound-film camera, due early in 1974 and using film in 50-foot and 200-foot cartridges, is likely to become important in this area.

Aid to the spread of Super 8mm film in TV news will come from new automatic processor, the Kodak Supermatic 8, which accepts color film in cartridges for quick loading and has a dry-to-dry time of about 8½ minutes. It is due on the market in early 1974.

In what amounts to a comment on the supremacy of this process, Reeves applies electronic processing to some programs on film without ever going onto tape. The film program is turned into electronic form on a telecine, but not recorded. Color correction, image enhancement, "opticals," and all the rest are applied to the signal, which then immediately passes to the electron beam recorder to go back onto film, with final quality considerably above that of the original.

The tremendous weight that the new tape editing has thrown onto the tape side is being widely acknowledged both inside and outside the industry. Bernard Gallagher, the Newsletter Seer of marketing and advertising, late last year announced that "tape wins battle against film in TV. . . . computerized editing overcomes film's last big advantage," and probably overstated the case when he said all TV, except reruns and movies, would be on tape by 1977. George Gould of Teletronics, like Reeves one of the half-dozen biggest production and post-production houses in this country, estimates the time for the tape take-over as "three to five years" away.

Many of the projects and experiments that are currently exploring new potentials of tape, or assessing its comparative efficiency as against film, were reflected in papers at the SMPTE Convention of last October in New York. The unusual number of such papers suggests the high interest in both tape and film advances. In the accompanying box we refer very briefly to several of these papers.

Distribution

The broadcaster is, of course, basically concerned with the form in which material will reach him from the outside. National spot ads, syndicated material, etc., which a few years back were predominantly on film, are moving strongly toward tape, continuing the process that we noted last year. Observers disagree as to the exact division between the two at the present. IDC Services, in the business of coding commercials, says it was 55% film-45% tape at the end of 1973. Everyone agrees, though, that tape is moving forward at the expense of film.

There are a number of reasons for this, including the greater longevity of tape copies we noted last year. Lately the tremendous spread in the use of video cassettes has influenced many advertisers toward tape in TV distribution, as well as in production.

The reusability of tape is becoming an important factor here. Screen Gems is one firm that now often *rents* the tape to a client when distributing features or syndicated material. The user pays only a small tape rental plus fees for the services supplied in preparing the program. The tape is returned to Screen Gems within a stated period for erasure and reuse. The high cost of the videotape itself no longer restricts program suppliers.

News Gathering

In this important section of the broadcasters' job, the film camera has had a very strong position. Last year we related the unchallenged advantages of the 16mm camera in compactness, low cost, instant usability, as preserving its predominance in the news field.

The 16mm camera still has those advantages and is still the predominant instrument of news gathering for television. But tape equipment made advances in porta-

bility during the year, and when these are added to a new emphasis on the video camera as part of a news gathering *system*, we can discern handwriting on the wall that, again, points toward a big future for electronics in news, possibly with film remaining as an auxiliary or companion method. One thing is agreed to: any inexpensive, easily-portable tape news system would sweep film out of the top position in short order.

Of course, a number of stations have for some time been using video cameras for news, and the latest in portable cameras are enlarging this market steadily. The accompanying box gives a breakdown of new portables in use or becoming available. It is important to remember, however, that in most cases film still does the greater part of the job.

But, as indicated, the most significant new development is the *system* approach. Two principal examples are the CBS experimental electronic news project, and the Fernseh system, developed in Europe, to be available in this country shortly after this article appears.

CBS, at New York headquarters and at several of the owned stations around the country, has been working during the past year with a news gathering system based on the Norelco PCP-90 camera in a mobile unit, with microwave link (by Microwave Associates) to the studio.

With this arrangement, the news gets back to the studio *as it happens*. This not only makes the most of the speed possible with video origination, but also allows for a new approach to news editing. The editor watches the news as it comes in, is primed to put it in shape for airing the second he has seen it through—or may be able to air some of it "live." CBS has found that this kind of editing adds greatly to both the vividness and the accuracy of news coverage, and is setting up a series of news "cubicles" for editors on the studio end of the microwave link.

The system opens other interesting possibilities. For example, when a newsworthy person is being interviewed by the mobile crew, the editor or the anchorman at the studio can inject questions directly over the voice communications channel to the mobile unit and get immediate answers. All this can be added to the air program to whatever extent the editor wants. As a by-product of the system, CBS finds that its mobile crews get 15-20% more work during a day because they don't need to get back home with film far enough ahead of air time to allow for processing.

The European Fernseh news system is briefly described in the accompanying box. Of course, many television stations will not be able to, nor want to, make the investment needed for a full electronic news gathering system comparable to the CBS or Fernseh systems. CBS estimates that a single mobile channel, with present equipment, costs roughly $50,000 (against a comparable 16mm film channel cost of around $17,000). But it seems likely that the video camera-microwave system will eventually be manageable at substantially lower cost.

A somewhat different "systems" approach to electronic news gathering is exemplified by experiments underway as this was written at ABC-TV headquarters in New York, under direction of Mike Foster. The objective is to develop a video system that can be considered a reasonably even swap in portability for a 16mm camera: ABC has tentatively set its sights on 35 pounds total for camera, electronics, *and* VTR, all to be easily carried by a two-man crew. At the time of writing, the AKAI ½ inch system was in experimental use: ABC was not ready to state its conclusions on that system.

News gathering crew of WSNL-TV, Long Island, using AKAI portable in the field. (Recommended accessory—umbrella-holder on top of camera.)

The pressure on television news operations for more immediacy will keep the pressure up for electronic news gathering, with every advance in video camera portability or reduction in cost of portable systems winning some takers. A good example of a situation in which the news director wants to get on the air in a few minutes is the interviewing of winners on election night—a "beat" is important to the station. Every TV station operator can name other similar situations.

However that works out, though, it also seems likely that film will stay in the picture to some degree because of the extreme lightness and compactness of the latest equipment, making it an inexpensive, reliable, emergency pickup system par excellence. Recently Super 8 has been more and more used for emergency TV news gathering. Going directly from Super 8 film to quad tape on high-quality telecine equipment is proving to be a valid route to usable news material, with the quad version good enough for copying into other wanted forms.

One station using Super 8 in this way for a variety of news assignments is WHYY-TV, community-owned station in Philadelphia. Engineering Vice President Bob Hall says the quality of the Super-8-quad-tape combination has been considerably better than that of small video cameras he has tried so far, and fully acceptable for many spot news broadcasts. With a cost only a fraction of that of 16mm operation, plus extreme lightness and convenience, it seems likely that Super 8 will hold onto a substantial role in TV news gathering, for the occasions when processing time can be accommodated and the quality is adequate.

Finally, we ought to re-emphasize the obvious: Everything going on in the tape-film confrontation means better service to the broadcaster, ways of doing new things, or better ways of doing old ones. And, if we want to be philosophical: the story means that with the infinite resourcefulness of electronics on your side, you can hardly lose over the long haul. BM/E

For your every broadcast and tape equipment problem or need ...Telex.

You'll find that Telex has both quality and range.

From economical, manually operated tape cartridge transports to heavy duty, commercial/industrial three motor tape transports with hysteresis synchronous capstan drive.

And from compact, monaural tape playback preamplifiers to single and dual channel professional magnetic tape record/playback amplifiers.

For recording and reproducing sound of incomparable quality, of course look no further than the standard of the industry Magnecord series.

In fact, look no further than Telex for any and all of your broadcast and tape handling needs, including headphones. For literature, write Telex Communications, Inc., 9600 Aldrich Avenue South, Minneapolis, Minnesota 55420.

PRODUCTS OF SOUND RESEARCH

TELEX®

COMMUNICATIONS INC

CANADA: Double Diamond Electronics Ltd., Scarborough, Ontario

INTERNATIONAL: Telex Export Dept., 9600 Aldrich Ave. S., Minneapolis, Minn. 55420 U.S.A.

7310

Circle 117 on Reader Service Card

Digital Audio and Video Coming

Host of papers on digital video were presented at the 114th SMPTE Technical Conference. At the NAEB Convention, PBS and NPR engineers described action to improve quality through digital techniques.

Use of digital signals in the transmission, storage, or processing of audio and video programs was a recurring theme at the 114th Technical Conference of the Society of Motion Picture and Television Engineers meeting in October. Papers described work being done at various labs, but there was little discussion of the overall implications of applying digital technology to practical broadcasting problems. The following month, however, in New Orleans at the NAEB Convention, Dan Wells, director of engineering, Public Broadcasting Service, and George Geesey, director of engineering, National Public Radio, said it was time to improve the quality of audio broadcasting and that digital audio was the way to go. Digital encoding of audio could be piggybacked onto video transmission for improvements in bandwidth or, if one was interested in audio alone, quadraphonic radio networking was possible.

SMPTE papers

A variety of applications using digital techniques were discussed at the SMPTE Conference. British speakers described two systems being tested in that country for transmitting alpha-numeric information along with the standard TV picture. ORACLE—Optional Reception of Announcements by Coded Line Electronics—developed by the Independent Broadcasting Authority, adds 50 pages of information (22 lines of 40 characters each). Two lines of each TV field are reserved for the data transmittal; it takes 32 seconds to transmit the 50 pages which appear in sequential form. Data stored on a computer disk can be edited independent of transmission.

CEFFAX is the name of the digital technique coming out of the British Broadcasting Corp. It differs from ORACLE in that there is faster access to individual pages, but the overall rate is slower. The British hope tests of both systems will indicate best format and market potential. Cost of viewer decoder is expected to be modest.

Patrick King of Hazeltine Research Inc., Chicago, described a system for adding digital data to existing TV lines without detectable interference with video. Hazeltine's approach is to insert a low-amplitude subcarrier which is phase modulated by a specially-clocked data stream. Subcarrier of 2.5 MHz was used because in NTSC luminance energy falls off at the frequency at which chrominance energy is just beginning to rise. By clocking it at one-half the TV time scanning frequency, data cannot be seen on the TV picture. Data rates of 20 and 25 kilobits/sec. have been tested.

A solid-state memory system using MOS dynamic shift registers to store a frame of TV video in digital form was described by Scott Purcell of CBS Labs. The system was developed to permit video signal enhancing prior to electron beam recording of video. PCM encoding of video offered a gray scale amplitude resolution of 256 levels between black and white. The system was designed for the Air Force.

Another CBS Labs engineer, John Rossi, described a PCM encoding system suited for NTSC signals and J.P. Chambers, a BBC engineer, showed how digital recording on VTRs might be practical through data reduction. (Tape consumption is excessively high for recording digital TV when the data rate is 100 megabits/sec.) Data reduction eliminates non-changing picture scenes, which occur 20% of the time.

An effort to combine audio with video for long lines transmission was described by R. Evans Wetmore, Public Broadcasting Service. Four-phase PSK methods were used to diplex up to four 15 kHz audio signals onto a video channel. Audio is sampled at 34.4 kHz. The PCM sample is quantitized to 14 bits and then companded into 12 bits resulting in a transmission bit rate of 1.79 megabits/sec. Subcarrier frequency is 5.5 MHz (which fits midway between upper video frequency of 4.2 MHz and the second harmonic of the color subcarrier at 7.2 MHz and the second harmonic of the color subcarrier at 7.2 MHz). A coherent reference in the receiver tracks out slow phase intermodulation products. Wetmore said performance (over 4000 miles) is better than existing audio transmission systems.

NAEB discussion

Wetmore's paper was delivered in full at the NAEB Convention. *BM/E* has extracted portions—see box. Efforts to get this system adopted by AT&T Long Lines was described by Don Wells of PBS. AT&T is apparently ready to take some action to improve the transmission of audio through its microwave distribution system, but might not necessarily pick the system being promoted by PBS which has the attractiveness of being the only system of four up for consideration that can handle four separate audio channels discretely.

Capability of handling four channels would be a boon to National Public Radio. NPR could use the same video channel as PBS in distributing its programming and could do discrete four-channel broadcasting. A demonstration of discrete quad at the NAEB meeting was most impressive. Not only could quadraphonic musical programs be transmitted but, for instructional purposes, up to four languages could be handled simultaneously. The system, of course, is immensely attractive as a means of handling high quality stereo radio signals. The NPR wants this capability now; PBS hopes that stereo will some day be possible on TV. As Wells points out, some serious artists now refuse to perform on TV because of the poor audio quality.

Ability to transmit more than one audio channel simultaneously has other benefits—non-programming

type messages could be sent at the same time, for example.

The proposed PCM system is compatible with AT&T's TD-2 4 GHz equipment, Wells said. PBS spokesmen said their system has received kind words from the BBC in England which has pioneered its digital transmissions.

The ability to distribute stereo programs was viewed as very desirable by Geesey of NPR. Recently for example, 30 hours of jazz and blues music was originated at an Ann Arbor festival, but it could only be trans-

DATE—Digital Audio for Television.

Extracted from a paper by R. Evans Wetmore at NAEB

In December 1972, the Network Transmission Committee (NTC)—the working liaison between the Bell System and the four major television networks—sent out a request for possible systems to permit network audio to be combined with network video for distribution nationwide over a single transmission facility as opposed to the totally separate facilities for audio and video currently used. Also, the new audio system was to have full-audible range fidelity and be of high quality. It was also deemed desirable that the proposed system be expandable to more than one audio channel.

After analyzing initial feasibility test data, the Public Broadcasting Service and Digital Communications Corp. decided to enter into a joint project to develop a multichannel digital audio system that would meet the NTC requirements.

The DATE system has two basic parts: the analog-digital-analog conversion systems, and the modem. ADA systems convert the analog audio signals into digital form and, at the receiver, back into audio. The modem (modulator-demodulator) provides the means to convey the digitally-encoded audio along with the video. A basic block diagram is shown in Fig. 1. As can be seen, the system can provide up to four discrete audio channels.

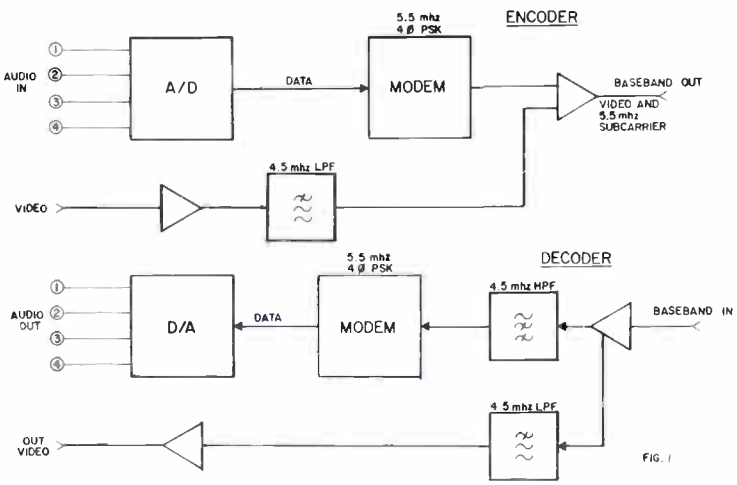


FIG. 1

The input audio channels are converted into data by the analog-to-digital converter. The data then modulates a 5.5 MHz carrier within the modem. The modem output is combined with video to generate the baseband signal which is fed into the long-haul transmission facilities. At the receive point, the subcarrier is then fed into the receiver modem where it is converted back into data. The data is used to recreate the original audio fed into the system at the transmit point.

The analog-digital-analog subsystem

DATE uses conventional pulse-code modulation. The amplitude of each sample is a binary number. These binary representations of the audio are sent over the transmission system. At the receiving point, the binary representations are used to reconstruct each sample which is then low-pass filtered to yield an analog signal.

The DATE system samples each audio input channel at a rate of 34.42×10^3 times per second (525/60 NTSC color subcarrier rate divided by 104). This value was chosen for several reasons: it obeyed the criteria of the sampling law for a 15 kHz audio channel; it was possible to bandlimit the incoming audio and the reconstituted audio with a relatively inexpensive filter; and it was possible to count the rate down from the stable color subcarrier sources available in most television plants. The 34.42 kHz sampling rate in each of four channels makes the overall bit rate 1.79 megabits and the symbol rate 895 kilobits.

Each sample is encoded into a 14 bit binary word thus providing 16,384 possible quantizing levels. This yields a signal to distortion ratio of 85.8 dB, equivalent to less than 0.01% harmonic distortion.

Allowing 14 dB of headroom reduces the signal-to-distortion (S/D) ratio to 71.8 dB (approximately 0.03% THD) for an input sine wave. A very soft passage in the program material might be approximately 50 dB below the nominal input level. At this level, the S/D ratio would be 21.8 dB (approximately 10% THD). Actually, this relatively high distortion is effectively reduced by the noise from the program source, so that for all practical purposes the program source noise is the limiting factor, not the system. The program noise tends to add and subtract from the program material in such a way as to cause the quantizing error to "average out." Subjective testing by the BBC showed that 14 bit resolution introduced no audible distortion from quantizing.

Because the THD is low, advantage can be taken of this fact to reduce the number of bits that must be transmitted to the receiver. This bit reduction technique is called digital companding. In the DATE system, a reduction from 14 to 12 bits is effected; this reduction in sample word length permits a sizeable reduction in subcarrier bandwidth.

Basically the action of the compandor is to truncate the three most significant bits during a soft passage (the MSBs carry no intelligence during a soft passage) or to truncate the three least significant bits during a loud passage. A "law" bit is then added onto the truncated word so that the decoder knows what has been done to the word it is receiving. In a loud passage where three bits have been truncated, there is an 18 dB degradation in the S/D ratio, but because the amplitude of the signal is high, the S/D ratio is still approximately 65 dB (approximately 0.17% THD).

Pre- and de-emphasis are used in the DATE audio channels for two reasons. The quantizing error inherent in PCM systems gives rise to a flat wideband audio noise whose amplitude changes with program material. Digital companding further increases this effect as loud samples have less resolution and hence higher quantizing distortion than soft ones. The aesthetic degradation caused by this so-called "program-modulated noise" may be effectively eliminated by de-emphasizing the high frequencies at the decoding point. As high frequency noise is more objectionable and is less easily masked by the program material, the reduction of the high-frequency noise greatly enhances the quality of the received signal.

The other important benefit derived from pre- and de-emphasis is the reduction of the subjective impairment caused by sample errors. Sample errors, caused by various impairments in the transmission channel, cause clicks in the audio. These clicks tend to be impulsive in nature. The receiver de-emphasis tends to blunt and reduce the rise-time of the samples, thereby reducing the subjective impairment of the erroneous samples.

The encoded audio binary stream is transmitted continu-

mitted in mono. Geesey said the ABC radio network is showing interest too since it needs to promote better quality audio for some of its late night live musical broadcasts.

Geesey pointed out that even if stereo were not transmitted, two separate programs could be sent, thus extending the flexibility of NPR.

The system described is also compatible with satellite transmission which NPR expects to be doing on the CTS satellite in 1975 and 1976. **BM/E**

ously by the system. It is therefore necessary to have a method to tell the receiver where one binary word stops and the next one starts. A technique called robbed-digit framing is employed. The least significant bit of every 13th binary word is replaced by one bit of a repeating bit sequence. It is anticipated that this algorithm may be changed to permit framing to occur in a shorter time than is currently possible. The prototype system reframes in less than two seconds: the modified updated version now under construction will reframe in approximately 100 milliseconds.

Extensive work by the BBC has shown that bit errors, which cause clicks in the audio, may be reduced in subjective impairment by the use of zero-order extrapolation. Added to each 12 bit binary word is a 13th parity bit which has been calculated from the first five bits of the sample word. If at the receiver there is a parity violation, the previous sample is held by the receiver. This technique changes the "just perceptible impairment" threshold from a bit error rate of 10^{-7} to approximately 10^{-5}, a significant improvement. Another technique called first order interpolation will be used in the future so that the error rate may be improved to 10^{-4}.

The modem

The binary data stream is transmitted by signals generated within the transmitting modulator and converted back into a binary stream by the receiving demodulator. The modem system also performs the video filtering and combining functions.

The modem uses a 5.5 MHz carrier. This frequency was chosen for several reasons. The primary reason was the large amount of second harmonic distortion observed on the terrestrial radio-relay facilities over which the tests were conducted. The distortion causes a large energy concentration to be formed at 7.2 MHz, the second harmonic of the 525/60 NTSC color subcarrier. As the audio subcarrier is almost 2 MHz wide and the second harmonic energy would act as an interfering carrier, it was decided to put the subcarrier in the "valley" between 4.5 MHz and 7.2 MHz.

Also the 5.5 MHz subcarrier frequency was the lowest frequency that could be used and not have its spectrum overlap the video spectrum.

Another important reason for the choice of 5.5 MHz was its minimal effect on the bandwidth of the radio-relay system. The nominal IF bandwidth of the intercity microwave used to provide network service is 20 MHz. With a 5.5 MHz subcarrier in the baseband, the first two sidebands of the FM channel are displaced 5.5 MHz and 11 MHz from the carrier. All appreciable energy is within a 20 MHz bandspace. Splatter into adjacent channels would be negligible.

The coding scheme used in the transmitting modulator is 4-phase PSK. Each of two bit streams, constituted from the analog encoders, balance modulates a 70 MHz carrier. One of the carriers is 90° out of phase with respect to the other so that an in-phase (I) and quadrature-phase (Q) signal are generated. The I and Q signals are then summed and heterodyned to produce the 4-phase PSK 5.5 MHz subcarrier.

The receiving demodulator uses coherent decoding. The incoming 5.5 MHz subcarrier is heterodyned to 20 MHz, AGC'd, and then splits to two points. The first point quadruples the signal to 80 MHz which is used with a VCXO to recover a coherent carrier for demodulation. The coherent 80 MHz is then divided down to 20 MHz. From this coherent 20 MHz, two feeds are derived, one feed being 90° out of phase with respect to the other. These two 20 MHz quadrature carriers are then mixed separately with the incoming 20 MHz signal to derive the I and Q data streams. These two data streams are then fed into a digital clock recovery system and then into the digital demultiplexor and framer. From this point, clock, framing, and data are sent to the analog decoders.

Differential coding is used in the data streams to permit positive identification of the I and Q channels in the receiving unit. Without this type of coding, more complex methods would be necessary to resolve phase ambiguities in the received signal. This type of differential encoding should not be confused with DCPM (Differential Pulse Code Modulation) which is often used for data compaction.

In preliminary tests of the modem, extreme phase intermodulation of the subcarrier by the line and field rate components of the video was noted. It is for this reason that the VCXO phase-locked loop in the carrier recovery system has a 15 kHz loop bandwidth. With this bandwidth and the fact that the symbol rate (895 kilo-symbols-sec^{-1}) is much faster than the sync component intermodulation, it is possible to effectively "track out" the phase intermodulation.

In any PCM system it is important that the samples be very accurately spaced in time. If the sample times do vary, a spectrum of noise is generated in the recovered signal, the distribution and magnitude of which is a function of the irregularity of the sampling times. For high-quality audio, the sampling interval jitter should not exceed 5 ns.

To achieve this figure, de-jittering circuitry is necessary in the receiving terminal. The digital clock recovery circuit in the demodulator provides timing accurate to ±33 ns. A VCXO is then used to reduce the jitter to an acceptable 5 ns.

DATE system tests

Two terrestrial facilities have been used for testing DATE, the PBS Eastern Round Robin (1200 km) and the PBS Western Round Robin (6400 km). Each of these facilities are regular network-quality video facilities leased from the Bell System. The TD-2 4 GHz microwave radio system is used to provide the inter-city service. The Western Electric type A2A(T) baseband cable system is normally used between the TOC (Television Operating Center) and the customer. As the audio and video signals originate at premises of the originating customer and terminate at the premises of the receiving customer, the baseband signal normally goes through an A2A(T) circuit, a TD-2 circuit, and then another A2A(T) circuit.

On the PBS Eastern Round Robin (ERR) the performance of DATE was excellent. With all types of test signals and program video, the error rate of the digital subcarrier was 10^{-5} or better. The audio performance was subjectively unimpaired.

On the PBS Western Round Robin (WRR) DATE required a 4 dB reduction in video transmit level and the insertion of a 6 dB down at 1.5 MHz notch filter into the video going into the transmit unit. (A 1.5 MHz peak is then used at the receive unit.) The reduction in video level and the notch filter were necessary to reduce the harmonic distortion in the 5.5 MHz region. The harmonic distortion acts like an interfering carrier to the PSK subcarrier and causes error bursts.

As the build-up of harmonic distortion is a gradual one, increasing with distance, it seems reasonable to think in terms of regenerating the subcarrier at baseband points in a long-haul facility, a technique impossible with analog systems. By the use of regeneration it should not be necessary to reduce the video transmit level or put a notch in the video spectrum.

Slope equalization across the 5.5 MHz subcarrier spectrum is necessary, therefore adjustable equalizers are provided in the receive and transmit terminals, up to 15 dB in each unit. The use of automatic equalization is also being investigated.

"Meet our new Recorder/Reproducer You'll call it fantastic. We call it the 280-B"

What's so great about it? First off, it's really up to the state-of-the-art. In electronics, control logic and architecture. Everything's changed but the transport. (Why mess with that? It's field proven.)
Here's what you get:

S/N ratios at a consistent 72 dB at mastering speeds on full track, .25 inch tapes. Improved headroom and increased record level for maximum signal utilizing high output tapes.

Band widths are just about flat at ±2dB, 30 Hz to 18 KHz. Tape handling is incredible. Our new motion sensing system (OPTAC™) gets rid of deck top sensor mechanisms. Internal logic lets you select a new mode and activate it without having to hit the STOP button. And enter and leave RECORD while the transport's in PLAY.

Maintenance is a snap, too. We got rid of all the spaghetti and replaced it with plug in IC's. And TTL logic for high reliability and low power consumption. Test and adjustments are made without bending all over the place. Individual channel modules come out easily. And all electronics are in slide out drawers.

Oh yes. Selectable synchronization with extended response. Standard on 2 and 4 channel machines.

You can get all the specs (or a machine) by writing or phoning (415) 968-8389 TLX 34552[illegible] 475 Ellis Street, Mountain View, California 94040

Scully/Metrotech
Recording Divisions of Dictaphone

Scully and OPTAC are trade marks of Dictaphone Corporation. Rye, New Yo[illegible]

Circle 118 on Reader Service Card

NEW BOOKS OF TIMELY INTEREST TO ALL IN BROADCASTING!

Professional Broadcast Writer's Handbook—

by Stanley Field, Deputy Chief, Broadcast Pictorial Branch, U. S. Army Information Div.

SAVE $2.00

PREPUBLICATION PRICE ONLY $12.95

- List Price $14.95
- 396 fact-filled pps.
- 14 Chapters
- Hardbound Volume
- Only $12.95 if you order now

Covers all forms of writing—drama, documentary, children's and religious programming, news and commercial copy—for both radio & TV.

A new text that will help anyone prepare for all fields in radio and TV—either staff positions or as a free-lancer. The author has drawn on his many years teaching experience in putting together this comprehensive volume, and he covers every form of writing in careful detail, illustrating each with excerpts from modern radio and TV scripts. Shows how to use the script formats in current use for TV and radio, and how to develop a familiarity with the terminology script writers use.

Documentary production is thoroughly examined. Beginning with the development of the concept of the idea, the author explains scripts to illustrate each stage, including the research necessary to produce an authoritative script. The book contains extensive treatment not only of news and documentary writing, but of the TV drama and series plays as well. Excerpts from numerous dramatic productions are used to explain how writers develop material needed to supply the producers' demands. Tells how to "tailor" ideas to the confines of suitable productions and how to develop new ideas. Radio drama is covered, too, as is religious programming and children's programming. And, with the recent concern shown by many authorities for the quality of programs directed to children, this becomes a vital field for writers interested in producing such material.

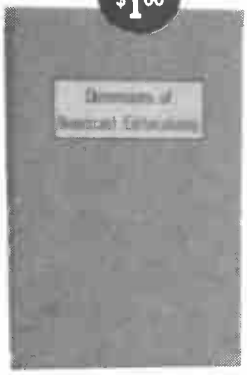
In the field of journalism, the author tells what it takes to be a news writer and how to write effective copy for both radio and TV. Again, actual script excerpts are used to illustrate desirable forms. Commercial and public service copy writing are also discussed. Separate chapters deal with each field and tell how to write "selling" material. The vast fields of government information programs and public broadcasting are examined in detail. Also includes a brief discussion of copyrights and markets and a glossary of terms. 396 pps., 14 Chapters.

CONTENTS: FORMATS—Television (documentary and drama), Timing, Radio. TECHNICAL TERMINOLOGY—THE DOCUMENTARY—Concept, Treatment, Objectivity, Research, Theme, Categories, Local Production, Special Productions, Radio Documentaries. THE TELEVISION DRAMA—Conflict, Plot Structure, Theme, Characterization, Empathy and Sympathy, Motivation, Dialog, Teaser, Flashback, Adaptations. SERIES PLAYS—Weekly, Sitcom, Adventure-Crime, Westerns, Dramatic—RADIO DRAMA—RELIGIOUS PROGRAMS—Themes, Formats, CHILDREN'S PROGRAMS—NEWS—Requirements, Clarification, Variation, Alliteration, Identification, Leads, General Considerations, Commentary, Wire Services, COMMERCIALS—Categories, Sample TV, Radio, Scripts—IN THE PUBLIC INTEREST—Public Service, TV and Radio, Impact. GOVERNMENT INFORMATION PROGRAMS—DOD, U.S. Information Agency, U.S.D.A., NASA, HEW—PUBLIC BROADCASTING—National Educational Television, Corporation for Public Broadcasting, National Public Affairs Center for Television, Instructional Broadcasting. COPYRIGHTS & MARKETS—What May Be Copyrighted, Free-Lance Markets. APPENDIX—Assignments, Glossary, Bibliography. INDEX.

Dimensions of Broadcast Editorializing— by Edd Routt, Assistant to the President, McLendon Stations; Instructor in Station Management, Southern Methodist University

This vital new book on a vital subject should fill a vacuum in any broadcaster's library.

SAVE $1.00



Dealing with a task ignored by some and feared by others, this new volume explains why broadcasters should editorialize, how to establish an editorial policy, how to develop and write forceful and effective editorials, how to present them, and how to avoid legal complications resulting from violations of the FCC "fairness" rules. The text is needed by broadcasters who recognize the importance of the role of community leadership, and for the student who believes the broadcast medium has a social duty. The reader will learn about the origins and background of the broadcast editorial—how the right to editorialize was won and how attempts to control that right have been fought. An examination of the broadcast medium reveals how the spoken word can and should be used, how people usually respond to what they hear, the importance of emotions, and how to establish credibility.

The role of the broadcaster as a communicator is discussed. In this chapter, the author delves into the controversial subject of news vs entertainment; then, he examines the influence of audience interests, the financial pressures involved in broadcasting, and the broadcaster's responsibility to editorialize. To erase the fear of legal entanglement, harbored by many who would editorialize, an entire chapter is devoted to the FCC's view and the rules governing "fairness." It examines rights covered by the First Amendment, fear of control, the much discussed "Fairness Doctrine," the personal attack rule, and amendments to Sections 312 and 315. The reader will learn how broadcasters must handle political broadcasts and how to meet reply obligations. There is also a thorough discussion on libel and slander—the types of libel, libel defenses, when to use retractions, damages assessed in some of the better known cases, plus special cases of libel. Various types of editorials are examined, and the considerations involved in writing and delivering editorials is discussed in detail. These principles are well illustrated by numerous examples of editorials and editorial campaigns actually used by several stations. Production techniques are covered, too. The last two chapters include a discussion of the editorial policies of numerous stations in large and small markets. Excerpts from the NBC Manual on Editorializing will prove interesting and informative for those who are considering editorializing. 192 pps., 9 chapters.

CONTENTS: Rhetoric in Retrospect—The Nature of The Medium—The Contrast of Print—Broadcasting: Entertainment or Communications?—Editorializing Under the FCC—Ways and Means of Editorializing—The Editorial—Editorial Practices—Small- to Medium-Market Efforts.

PREPUBLICATION PRICE ONLY $7.95

- List Price $8.95
- 192 thought-provoking pages
- Hardbound Volume
- Indispensable for all stations
- Only $7.95 if you order now

Radio Production Techniques— by Jay Hoffer, Vice-President Program Operations, KRAK Radio.

In all respects, perhaps the most comprehensive and practical text ever published on the subject.

SAVE $3.00

For the broadcaster who wants to develop that professional sound, here is a truly modern text. It is written in an easy-to-read style and covers every phase of radio production from announcements to the overall station "sound"—in fact, every creative aspect of today's radio. And for those who must produce results for an advertiser, it tells how to inject the dynamism that sells.

Part one of the three-part text begins with an analysis of programming content. Those who aspire to be air personalities will learn how to develop production expertise and how to use the elements of pacing and timing in every production they undertake. Since music is a vital ingredient in much of today's radio, emphasis is placed on the production aspects of record screening and the use of jingles in the overall format structure. Today's broadcaster needs a firm grasp of news—how to write it, deliver it, how to use taped inserts and remote pickups—and these aspects are thoroughly covered, too. To round out the reader's knowledge of other programming elements, Part One also covers on-air promotion, public service, contests, public affairs, remote broadcasts, and specialized programming such as talk shows, farm broadcasts, etc.

Part two is devoted to the sales message. It covers idea development, research writing, the function of the advertising agency, and the station salesman's role in the development of a commercial. Additional information explains how to select the right personnel for each assignment, the various type commercials in current vogue, how to use production aids to create more effective commercials, and how to evaluate the effectiveness of a commercial. The engineering aspects of production are dealt with in Part Three. The author tells how to select and install the proper equipment, maintain the quality of the station sound, equip the station newsroom, handle remote broadcasts, and how to plan and integrate an automation system. 204 pps., 17 chapters, 86 illustrations.

CONTENTS: Part One—PROGRAMMING CONTENT—The Air Personality—Music—News—On-Air Promotion—Public Service Messages—Contests—Public Affairs—Remote Broadcasts—Specialized Programming. Part Two—THE SALES MESSAGE—Planning the Sales Message—Executing Commercial Production—Evaluating Results. Part Three—THE ENGINEERING WATCH DOG—Selection of Proper Equipment—Quality Control—Equipping the Newsroom—Remote Installations—Automation.

PREPUBLICATION PRICE ONLY $9.95

- List Price $12.95
- 204 fact-filled pps.
- Hardbound Volume
- Covers Programming Sales & Engineering
- Only $9.95 if you order now

Order any or all of these books today at our risk for 10-Day FREE examination. SEND NO MONEY! Simply fill in and mail the handy NO-RISK coupon to receive your own copies of these helpful volumes.

PUBLISHER'S GUARANTEE

Put the information in these books to work for you for 10 days. If they don't prove to be worth several times their cost, return them and we'll cancel invoice.

NO RISK COUPON—MAIL TODAY

TAB BOOKS, Blue Ridge Summit, Pa. 17214

Please send me_____copies of Professional Broadcast Writers Handbook at the Special Prepublication price of only $12.95. (10% additional discount on 3 or more copies).

Please send me_____copies of Dimensions of Broadcast Editorializing at the Special Prepublication price of only $7.95. (10% additional discount on 3 or more copies.)

Please send me_____copies of Radio Production Techniques at the Special Prepublication price of $9.95. (10% additional discount on 3 or more copies.)

☐ I enclose $_____. (Postage & handling prepaid.)

☐ Please invoice me on 10-day FREE trial.

Name_____ Phone_____

Company_____

Address_____

City_____ State_____ Zip_____

SAVE POSTAGE by remitting with order. Foreign add 10%. Pa. add 6%. B-14

Circle 119 on Reader Service Card

today EVERY frame in the TOP SHOWS..

...is indexed for ELECTRONIC editing

Today you need faster production, lower production costs and more sophisticated editing. There's only one answer... electronic indexing of all taped frames so that —

- ...scenes can be located automatically and rapidly.
- ...previewing and program planning can be both exacting and economical.
- ...edit points in final assembly can match editing decisions accurately to a single frame.

Because most shows develop their own editing standards, methods and techniques, equipment versatility is also important. The exceptional modularity of EECO Electronic Editing equipment provides for unequalled response to such individuality.

use EECO's new electronic "building-blocks"

Index tapes electronically with SMPTE Edit Code — put visual indexing on dubs and kine workprints — synchronize any two mag tapes (sprocketed or unsprocketed audio and quad or helical video) — edit electronically with single frame accuracy, dissolves, AB rolls and special effects.

EECO

ELECTRONIC ENGINEERING COMPANY OF CALIFORNIA

1441 East Chestnut Avenue • Santa Ana, California 92701 • Phone (714) 835-6000 • TWX 910-595-1550 • Telex 67-8420

Circle 153 on Reader Service Card

Phasing System Network Sensitivities

By R.S. Bush

What an adjustment in one leg or branch of a "T" network does to other parameters is often not fully understood. Here's some insight on how to confidently control antenna parameters.

RF feeder systems, or phasing systems as they are sometimes called, are designed and connected to control only two parameters: the phase and amplitude of currents flowing in the individual towers or antennas. However, considerable knowledge of the design of networks and how they are adjusted is necessary so that these two antenna parameters can be adequately controlled. Conversely, inadequate knowledge of the networks often leads to wasted effort expended in the adjustment of the networks rather than the control of the antenna parameters.

Figure 1 shows the basic arrangement of the several networks in a general directional antenna feeder system. Antenna Coupling networks, Phase Shift networks, and Input Matching networks are usually of the so-called "T" configuration, while the Power Dividing network may take several different forms.

If any of these networks are constructed, for instance, with a variable control in each leg of the network and adjusted without knowledge of the constraints of each leg or the sensitivity of each branch of the individual network, the adjustment process easily degenerates into a problem of network adjustment rather than the control of one of the antenna system parameters.

It is the purpose of this paper to show how proper knowledge of network element sensitivity can be of considerable help in system adjustment rather than network adjustment.

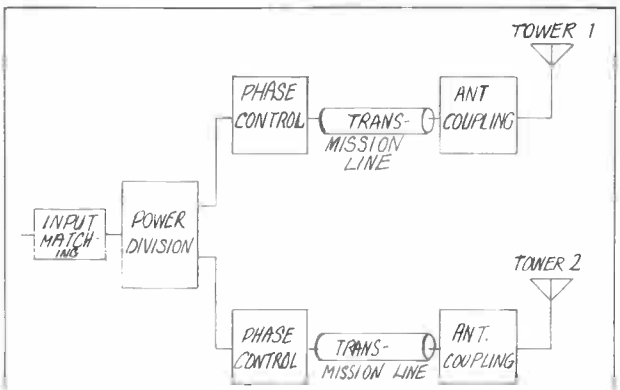


Fig. 1. Basic elements in directional antenna feeder systems.

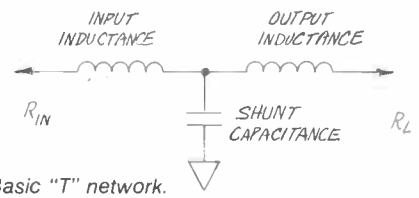


Fig. 2. Basic "T" network.

The "T" network—more complicated than it looks

The "T" network, very familiar to most engineers engaged in antenna systems, has been demonstrated by many otherwise very competent engineers to be highly complicated in its adjustment when its basic principles are not thoroughly understood. As will be shown, the adjustment of one branch may require a compensating adjustment of a second branch for the parameter of interest. At the same time, this adjustment can cause results exactly opposite to those desired in the second antenna parameter—unless the engineer is aware of the sensitivity of the arm being adjusted and its relationship to the system parameter of interest.

The writer considers the "T" network complicated because, even after many years of designing and adjusting them, there always appears to be something more to be learned.

A simple sensitivity analysis run on a computer using a standard well-known computer program helps one to grasp the significance of design and changes. The analysis points up at least one example of a customary and traditional practice (ganging series legs) that has been inefficient.

The analysis is based on a common Phase Shift network which is designed to operate between two equal resistances and whose sole purpose in the system is to provide a phase adjustment in each individual tower feed. It is a lagging network such as is shown in Fig. 2. The results of the analysis, however, may be applied to a "T" network used for another purpose, if qualified for that purpose.

In this analysis each leg is changed, one at a time, by 1%. The change in phase shift through the network and the ratio of the input resistance exhibited by the network to the load resistance is then noted. For example, if the input leg is changed 1% and the phase shift through the network changes 1%, then the effect of the input leg on the phase shift of the network is considered 100%. If the input leg changes 1% and the phase shift changes ½%, then the effect of the input leg is 50%, and so on: A negative sign simply indicates that the change in the phase or resistance ratio is opposite to the change made in the network branch.

Results are shown in Table 1 of networks designed for a nominal phase shift of 30, 60, 75, 90, 105, 120, and 150 degrees.

Mr. Bush is an engineer at Harris-Intertype Corp., Gates Division.

The Input Branch. First, it should be noted that the input leg adjustment has very little effect on the input/output resistance ratio, but produces substantial changes in the network phase shift. In a practical network these results would not be strictly true since the loss resistances of the input leg would enter the picture, but since these losses are indeterminate and generally small, the results give a very clear picture of the sensitivity of the input branch.

It should also be noted that the effect of the input leg on the phase shift of the network increases as the design center phase shift increases. In other words, the higher the nominal phase shift design of the network, the more sensitive the phase shift of the network to the adjustment of the input leg.

The Shunt Branch. The shunt leg, as might be expected, has a very substantial effect on both phase and resistance ratio except possibly at very low phase angles. This is a good illustration why in any given "T" network regardless of end purpose, the shunt leg should always be adjusted or established first and, once established, determines the adjustment center of the network.

The results relating to variations in this branch of the network cannot be emphasized too strongly—certainly the shunt leg is the one branch of the "T" most often misadjusted. As can be seen from the accompanying tables, an adjustment of this leg produces very substantial effects on both parameters of the antenna system, such that one parameter must receive a corresponding compensation if the shunt leg has been changed to produce a single desired parameter change in the system. Furthermore, as will be shown later, this branch of the network has definite limitations which, if exceeded, prevents any possibility of a desired input/output impedance relation.

The Output Branch. The output leg is interesting in that, for all phase shifts other than 90 degrees, this leg controls input impedance as well as phase shift. Incidentally, the zero results shown at 90 degrees does not indicate that the output leg has no effect in the network, but merely that its effect is extremely small throughout the range of this analysis—10% for each component.

The important consideration here is simply that the output leg of the "T" cannot be adjusted simultaneously with the input leg to vary the phase shift through the network without also causing a change in the input impedance of the network which, in turn, in a phasing system, causes a change in power division. In other words, the output branch, like the shunt branch, will change both the phase shift of the network and the input/output resistance ratio, although to a lesser degree, except when the adjustment center of the network has been made at 90 degrees.

The Load Resistance. The effect of the load resistance on the performance of the network is extremely important in that it shows a measure of the stability of the system adjustment versus the network phase shift design.

As can be seen from the tables, the load resistance into which the network operates has an increasing effect on the phase shift of the network as the design center phase is reduced. For example, in a network design of a nominal phase shift of 30 degrees, the 1% change in the load resistance produces an 82.9% of 1% change in the phase shift of the network. This is accomplished while it also produces a 25% of 1% change in the input/output resistance ratio.

This simply means that in a system employing "T" networks *designed with low phase shift angles,* any slight changes in antenna resistance values, transmission line characteristics, or other network load resistance changes because of weather, temperature changes, etc., will cause both the phase and amplitude system parameters to vary.

Conversely, a phasing system employing networks designed and adjusted for very nearly 90 degrees will maintain its phase relations more closely and will only vary in amplitude with changes in the load resistance of the networks. Such a system would, of course, be much more stable.

What we can conclude from sensitivity analysis

There are many conclusions that may be drawn from this analysis—too many to be included in the scope of this paper. It is hoped the preceding discussion will assist the reader in the design and adjustment of "T" networks in the future.

We would like to emphasize that phase shift networks as used in feeder systems *should not have the two series legs ganged to control phase* as we have so long thought in the past. Changing the input leg or branch controls the phase shift, but changing the output leg means that the resistance ratio will also be changed, which in turn causes a change in power division. In other words, if we want a phase shift network to control phase and not be a factor in the power division of the system, we must vary only the input control.

The customary design of the phase shift network is shown in the upper network in Fig. 3, while the suggested design is shown at right.

Phase shift networks of the latter type have been in use by some antenna engineers for some time and, apparently, they are already acquainted with much of the information presented here. The majority of system designs in use today, however, still employ networks using ganged series inductors either because of custom or because the design engineers are not familiar with the design considerations.

A second and very important point to be made as a result of this analysis is the proper procedure for setting up any "T" network regardless of the purpose for which it is to be used. First, adjust the shunt leg for the desired impedance transfer and/or the desired phase shift. As demonstrated, this must be done to establish the design center conditions for the network since the shunt leg has such a pronounced effect on both phase shift and impedance relations.

Once the shunt branch is fixed, the input and output series arms are adjusted for the correct or desired impedance relations, adjusting, in general, the input arm for reactance control and the output arm for resistance.

Network formulae

The "T" network is seldom discussed in the literature in terms particularly applicable to the engineer—particularly one who must wade out to the tower in the middle of the night and adjust the antenna coupling network with one hand while he swats mosquitoes with the other. For this reason, a few network design formulae are given here simplified for this purpose in Table 2.

The minimum possible shunt reactance—or maximum capacity—that may be used in a "T" network, and still obtain a match between the input and output resistance,

Table 1.
"T" Network Sensitivity Analysis
For One Percent Changes In Component Values

Network Design Φ	Input Inductance		Shunt Capacitance		Output Inductance		Load Resistance	
	$\frac{RL}{RIN}$ %	Φ %	$\frac{RL}{RIN}$ %	Φ %	$\frac{RL}{RIN}$ %	Φ %	$\frac{RL}{RIN}$ %	Φ %
− 30°	−0.05	51.17	13.4	6.86	− 11.61	38.34	24.96	−82.9
− 60°	−0.17	55.12	50.19	27.69	− 24.95	13.76	75.46	−41.67
− 75°	−0.3	58.91	74.49	43.75	− 19.16	3.96	94.14	−19.29
− 90°	−0.5	63.66	100.49	64.30	− 0.00	0.00	101.0	− 0.00
−105°	−0.72	70.96	126.12	90.36	32.48	4.72	94.24	13.69
−120°	−1.28	82.61	149.03	125.73	75.38	20.75	75.60	20.81
−150°	−5.65	142.48	167.08	270.50	160.93	108.41	25.27	16.67

Table 2.
Simplified "T" Network Design Formulae

MIN. SHUNT REACTANCE $= \sqrt{R_{IN}R_L}$

OR

MAX. SHUNT CAPACITANCE $(in\ \mu f) = \frac{0.159}{f_{(MHZ)} \times \sqrt{R_{IN}R_L}}$

FOR ANY PHASE SHIFT

X SHUNT $= \frac{\sqrt{R_{IN}R_L}}{SIN\ \phi}$

OR

C SHUNT $(in\ \mu f) = \frac{0.159 \times SIN\ \phi}{f_{(MHZ)} \times \sqrt{R_{IN}R_L}}$

INPUT INDUCTANCE $(in\ \mu h) = \frac{X\ SHUNT + R_{IN} \times COT\ \phi}{6.28 \times f_{(MHZ)}}$

OUTPUT INDUCTANCE $(in\ \mu h) = \frac{X\ SHUNT + R_L \times COT\ \phi}{6.28 \times f_{(MHZ)}}$

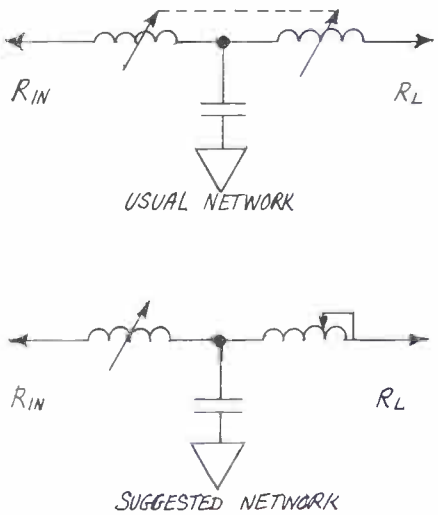


Fig. 3. Phase shift network design.

is equal to the square root of the product of the input and output resistance. This value must include any reduction in the capacitive reactance resulting from lead inductance. This simply means that the shunt reactance of a "T" network can never be less than the geometric mean of the two impedances between which it is to be connected.

This can also be computed in terms of capacity expressed in microfarads as shown. Knowledge of this reactance or capacity is usually very helpful in adjusting the network because it places an important constraint on the adjustment of the shunt leg.

This fact about the "T" network is the principal reason why a variable control in the shunt branch—which can be adjusted without knowledge of the actual reactance being produced—can lead to very difficult network adjustments.

The figure 0.159 used in the capacity formula is one that should be indelibly inscribed in the minds of every engineer working in medium frequencies. It is the reactance of a .001 mfd. capacitor at 1 MHz. From this value, the reactance of any capacitor at any frequency can be easily obtained simply by dividing 159 by the frequency in megahertz and comparing the relation of the capacitor of interest to a .001 mfd. capacitor. This is the basis for the capacity formulae used here.

The minimum shunt reactance or the geometric mean between the input and output resistances provides a 90 degree phase shift network if the input and output arms are also made this value but opposite in sign. The balance of the formulae in this table give the reactances or element values for the "T" network at other phase shift angles. The numerators for the input and output inductance formulae give the inductive reactances for these arms.

The plus and minus signs between the two terms of the numerators have been used to call attention to the fact that there are always two solutions for the series arms for any given shunt reactance. The minus sign gives the value for a phase shift less than 90 degrees, while the plus sign provides a value for angles greater than 90 degrees. The plus sign results from the fact that the cotangent of any angle between 90 and 180 degrees is negative.

System impedance components

The relationship of the real and the imaginary part of any impedance occurring within the network or the feeder system is often confusing.

The only power passed on from one part of the

system to another is that power which is dissipated in the real part of the impedance at that point. However, many times systems and networks have been designed or adjusted to deliberately increase the reactive to resistance ratio at various points. This is especially true in power divider circuits. It has the effect of increasing the reactive currents in this portion of the circuit which, in turn, give an apparent greater adjustment control per turn of the crank. The final result, however, is to provide a system which is, or can be, very unstable. It is difficult to maintain stability because the system parameters are more subject to noncontrollable variations, such as temperature, weather, etc.

This is another way of saying that the system "Q" is increased at this point. A higher "Q" also means a narrower bandwidth and if the "Q" is made sufficiently high the entire system can be made unusable for AM broadcasting—a condition which has happened in at least three systems of record.

The above information provides a very useful method of checking a phasing system for stability and sensitivity to non-controllable variations due to weather, etc. The lower the reactance to resistance ratio measured at any point in the system, the more stable the system. This is especially true for a measurement of the impedance presented by the power divider at its input following the input matching network.

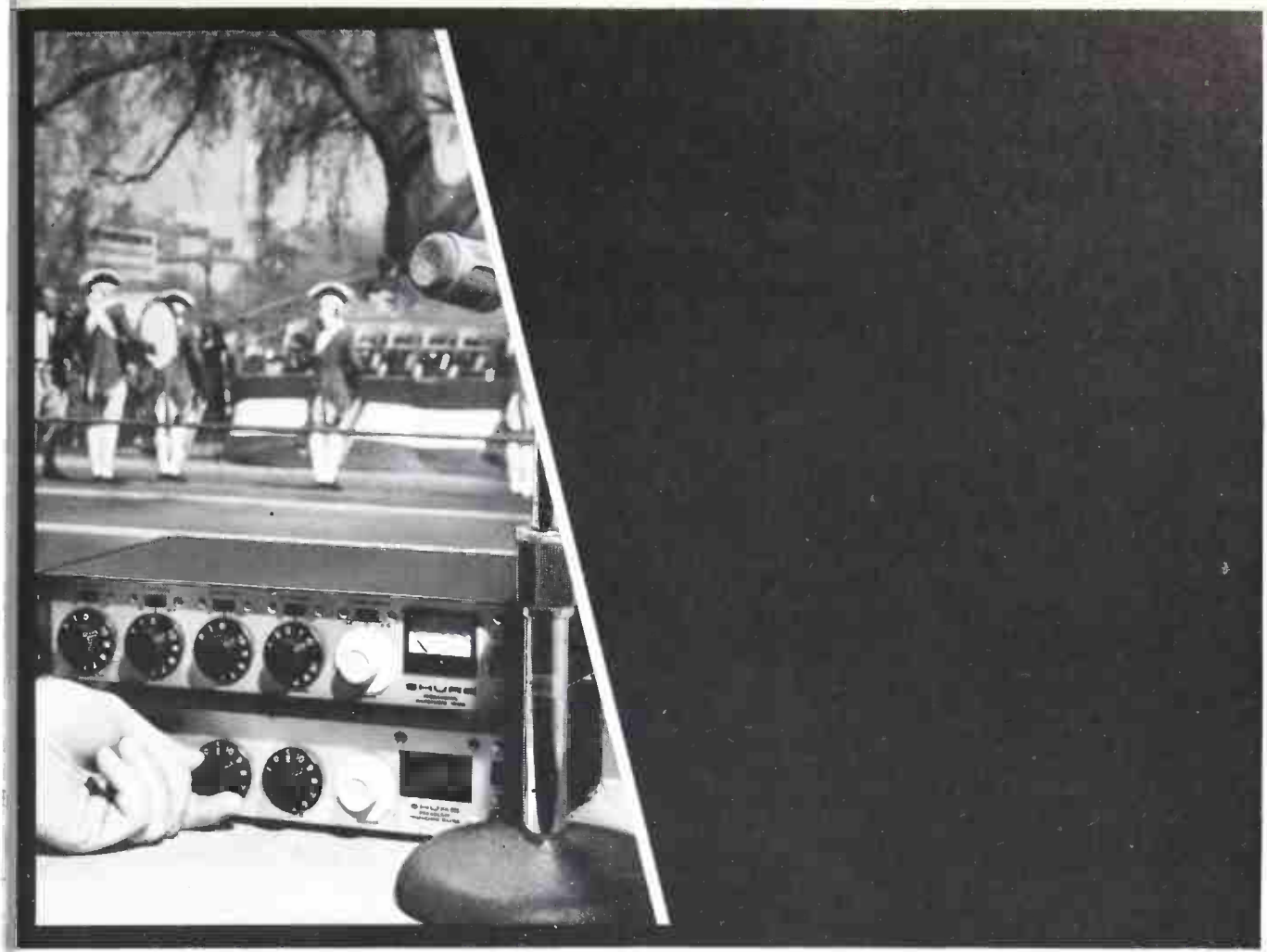
Component selection

Component selection for a phasing or feeder system is important since components affect system sensitivity. Many otherwise excellent designs have been seriously impaired by poor component selection resulting from an inadequate knowledge of the components themselves.

Inductances, for example, are influenced heavily by their surroundings and it is next to impossible to accurately predict their actual inductance or even their voltage and current capabilities until after they have been installed. Yet an empirical or experienced idea of what may be expected is vital to the successful system design.

An excellent illustration of this point is in the choice of large tubing coils where perhaps a small ribbon coil is normally more than adequate. Large tubes are often picked on the theory that if a small coil is adequate for carrying the expected circuit current, a larger coil will provide a larger safety factor. Quite often the exact reverse may be true. The larger the physical size of a coil, the greater are its stray capacities to its surroundings. The larger these stray capacities, the higher will be the stray currents within the coil. If carried to the extreme, the stray currents may exceed the circuit currents for which the inductor is used. When this occurs, circuit control is lost because the inductor is now being adjusted for stray currents rather than its circuit purposes.

A good rule of thumb is to select the smallest coil that will adequately provide for the circuit requirements with a modest safety factor. Then, if in practice, additional current is found in the coil, determine the cause and correct it. **BM/E**



A production console* for $325.80!

Eureka! A complete remote and studio production console for a fraction of what you'd expect to pay for a console with comparable features and performance! Simply purchase a new *Shure M675 Broadcast Master* and the extremely popular Shure M67 Professional Microphone Mixer. By combining these two units*, you get inputs to handle microphones, turntables, phone lines and tape machines — *with cuing provision on line and magnetic phono inputs.* Result? A versatile low-noise, low-distortion broadcast production console for in-studio, remote, and standby assignments; a complete CATV console; a studio production console. All for $325.80! For complete technical data, write:

Shure Brothers Inc.
222 Hartrey Ave., Evanston, Illinois 60204
In Canada: A. C. Simmonds & Sons Ltd.

SHURE®

*Each model is also available separately: M67 — $169.20 net; M675 — $156.60 net.

Circle 120 on Reader Service Card

AUTOCUE®. The only memory lighting control system with every value always on display.

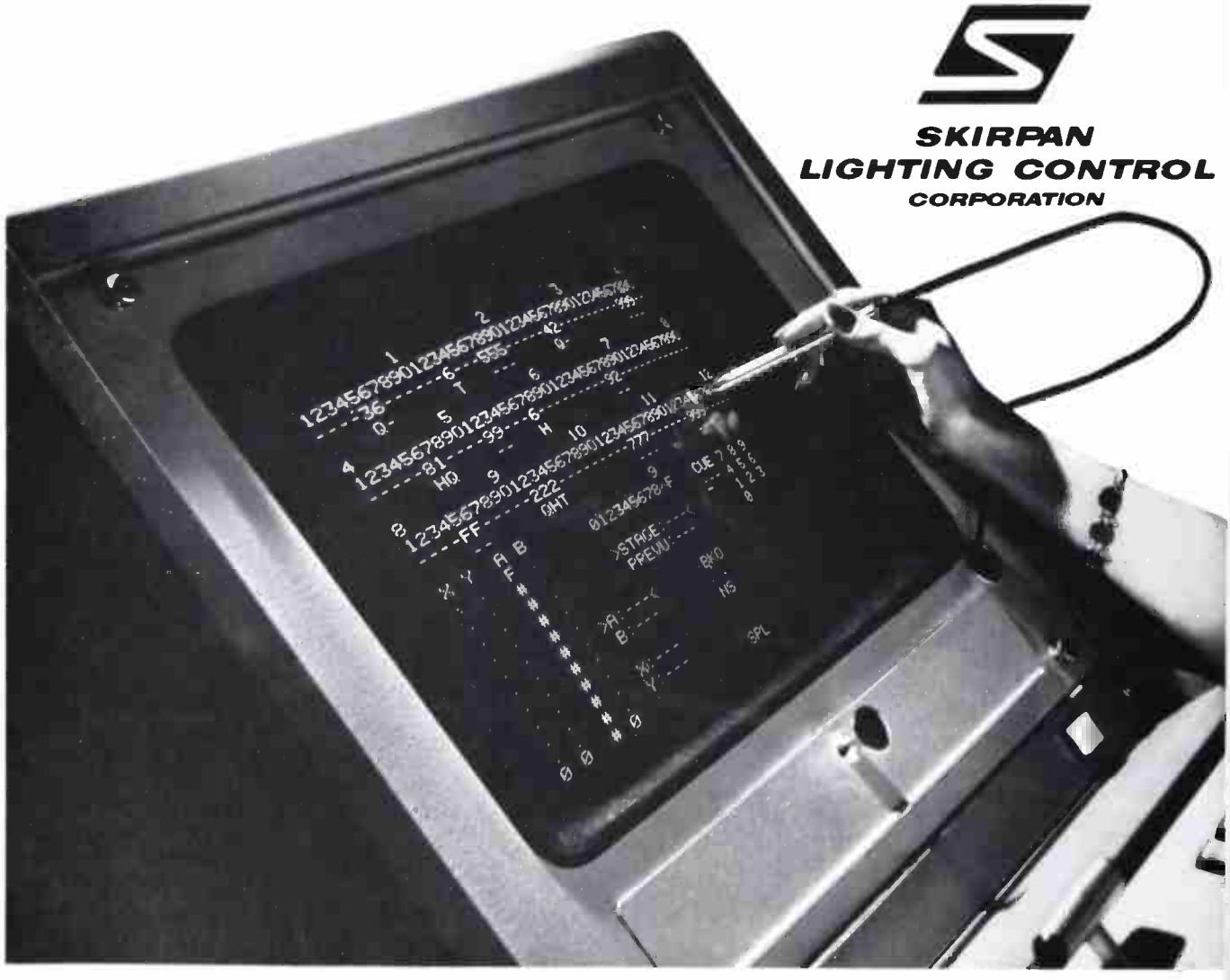
If you're a talented lighting director who has experienced the limitations of other lighting systems, AUTOCUE is a creative necessity. Now complex, rapid cues that other systems can't achieve are easily attained. For example, you'll have no trouble keeping pace with the wild witch scene in Sleeping Beauty or with the frantic stage action in the rumble scene of West Side Story.

AUTOCUE uses a standard television monitor, so remote displays can be placed at any desired location. The result is absolute control. You see the complete system status at all times, including the exact intensity value of every dimmer. Even during a fade.

Furthermore, unlike other systems, AUTOCUE can be designed for any number of dimmers and any desired cue capacity. Before the show, you can set or change dimmer values and recall cues instantly with the light pen. Cues are then loaded onto a crossfader and recalled at the rate required by stage action. Cues can be skipped, duplicated, modified, previewed, canceled or called in any sequence. And the computer can store thousands of cues on a magnetic cassette for future use.

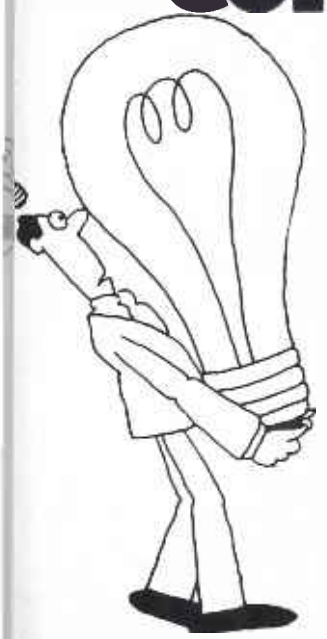
What's more, a teleprinter transcribes all cues avoiding the rehearsal time-loss associated with handwritten cue sheets. And, AUTOCUE is modular for easy maintenance.

But that's not the whole story. For more information, write or call SKIRPAN LIGHTING CONTROL CORPORATION, 41-43 24th Street, Long Island City, N.Y. 11101. (212) 937-1444.



Circle 121 on Reader Service Card

ENTER THE GREAT IDEA CONTEST



Station Engineers!

Win a Caribbean cruise! Send us your solutions to day-to-day or long-range engineering problems. We will publish them and invite your colleagues throughout the industry to vote for the best. Four winners will each get a free Windjammer Cruise for two in the Caribbean! Top entries in nine categories will each be awarded a Certificate of Merit.

Station Managers!

Encourage your engineering personnel to enter our contest! It is a chance for them to get professional recognition for work well done. It's a chance to show off your station as an innovative leader. All meritorious material sent in will be published.

Why we are doing it

The collective ingenuity of station engineering personnel is a massive technical resource of the industry which is to a harmful degree unused. The tremendous reservoir of techniques accumulated in solving day-to-day problems, in making needed changes or improvements in facilities, and in designing new facilities, gets poor distribution through the industry because there are few channels for disseminating it.

After years of being unhappy about this lack of circulation for front-line engineering experience, *BM/E* decided that one way to improve matters would be a contest which would stimulate engineers to send us their ideas for publication. In addition to the recognition, we'd give a significant prize for the idea that readers vote the best. *But our primary objective is not to winnow out a few "best" ideas.* We think publication of a substantial volume of good ideas is the important thing, both for the advancement of the industry and for the satisfaction of justified pride on the part of their creators.

Subjects can touch on just about every facet of station technical operation and design. The following list is *suggestive only,* to show the breadth of the acceptable field:

☐ A particularly efficient way of using telco lines for remotes;
☐ Preventive maintenance of tape recorders, etc.;
☐ Simplifying directional antenna measurements;
☐ Modifying existing equipment for higher quality, greater flexibility;
☐ Simplifying the monitoring operation;
☐ Giving news announcers the best technical backup;
☐ An ideal studio layout for . . .;
☐ Getting top performance from . . .;
☐ Automatic switching without a full-blown automation system;
☐ Assuring top quality throughout a stereo audio chain;
☐ Efficient control unit for remote news pickup crew;
☐ Solving the ground loop problem in audio equipment;
☐ Protective measures for antennas and transmission lines;
☐ Equipment and procedures for maximizing station security;
☐ Simplifying proof-of-performance measurements;

☐ Practical methods for improving studio lighting;
☐ Chasing an elusive noise source;
☐ Smart ways of meeting FCC requirements.

We repeat: This list is simply to start your thinking; it is *not* a specification. The actual range of possibilities could run into many scores of items.

How it works

Readers are invited to send us descriptions of their favorite engineering creations, technical solutions, or clever how-I-solved-it ideas right now. We will publish all accepted items, beginning with the January 1974 issue. Each month readers will rate the published items on a merit scale of 0 to 10. Highest ranking items will be republished in the issue of December 1974 for a final overall vote. Winners will be informed in February and announced in the March 1975 issue of *BM/E*.

Prizes and awards

There will be one winner in each of four categories: AM (5kW and below); AM (above 5kW); FM; and TV. The prize for each of the winners will be a six-day Windjammer Cruise in the Caribbean for two. (See rules for locations and dates.)

In addition, nine Certificate of Merit awards will be presented: **Audio** (four awards)—TV, FM, AM (Class I or II), AM (Class III or IV); **RF** (four awards)—same classes as audio; and **Video** (one award)—TV. Author of each entry accepted for publication will receive a $10 honorarium.

Words to the wise: Enter early

Your brainstorm may be a winner, but only if you tell us promptly. We are sure that many good ideas have occurred to more than one engineer. Unfortunately, we will not be able to publish duplicative material.

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. Material must be legible but need not be directly reproducible—although camera-reproducible material is preferred. Length can vary, but should not exceed 1000 words. *BM/E* reserves the right to edit material. Entry should include: Name, title, station affiliation, and the class of station—TV, FM, AM (Class I or II), or AM (Class III or IV). Indicate if idea is completely original with you.

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

4. Voting. Every reader of *BM/E* is entitled to rank the ideas published. This can be done on the ballot in the magazine or by letters or cards sent to the *BM/E* office. A reader can judge one or all ideas published. Readers must assign a point score to each idea on a scale of 0 to 10: e.g., if you think an idea is excellent, score it 10; if you think it is without merit, score it 0; if you like it but want to discriminate, pick the appropriate number between 1 and 9.

5. Winners. Relative ranking of each month's entries will be published after 60 days. Top-rated entries for various categories will be republished in December 1974 for a second and final round of scoring. Final winners will be picked in February 1975 and notified by mail. Winners will be published in the March 1975 issue of *BM/E*.

6. Prizes and Awards. Four top prizes will be awarded—each a six-day cruise for two on a Windjammer in the Caribbean.* Cruise awards will be one each in categories of TV, FM, AM (Class I and II), AM (Class III and IV). In addition, highest ranking entries will receive a *BM/E* Certificate of Merit award, one each for the following nine categories: TV, RF; TV, Video; TV, Audio; FM, RF; FM, Audio; Class I and II Radio, RF; Class I and II Radio, Audio; Class III and IV Radio, RF; Class III and IV Radio, Audio.

*Between months of May to November, choice of cruises: Bahamas, Virgin Islands, West Indies. Deck Cabin accommodations. Travel to and from port cities of Miami, San Juan, or Virgin Islands not included. Authors of top-ranked items will receive Windjammer Cruise information in November 1974.

Entry Form for BM/E Great Idea Contest—1974

Mail to: *Editors, BM/E*
274 Madison Avenue
New York, New York 10016

Name _____ *Title* _____

Station Call Letters _____

Address _____

City _____

State _____ *Zip* _____

Licensee _____

Class of Station: *TV* ____ *AM (Class I or II)* _____
FM ____ *AM (Class III or IV)* _____

Title of Entry _____

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

_____

Solution: *(use separate sheet)*

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

Here Are The First Three Entrees in the Great Idea Contest!

1. Bus-borne FM receivers that will tune bus riders in Spokane, Washington, to KESE-FM wherever they go.
2. A way of getting rid of waste transmitter heat that ought to make the energy conservators happy.
3. A really inexpensive automatic processor for color film.

1. FM in Buses for KESE-FM

Spokane, Wa., will be host, starting in May 1974, to a World's Fair. The city government saw this as an excellent time to update its bus system with new quiet, air conditioned units. The new buses are coming in and they markedly raise the comfort index for all riders in the city.

The management of KESE-FM, local "easy listening" station, led by General Manager Willard D. Martin, approached the city with an idea: why not FM receivers in the new buses tuned permanently to KESE's signal?

The city agreed to the idea, and KESE agreed to supply the receivers and the installation. The timing was good for KESE, too, with a recent move of the transmitter to a mountaintop overlooking the city. Without the greatly improved coverage that resulted, Mr. Martin believes, the KESE signal would not have been adequate throughout all the bus routes in the city: field tests have shown that the new signal, from 41 kW of erp, is indeed strong enough wherever the buses go.

The first idea, of using a single-channel receiver on KESE's 106 MHz, turned out to be more expensive than use of a standard FM auto radio of high quality. Finally chosen was the Motorola FM152M. Since KESE's signal is horizontally polarized, the antenna is a window-tape dipole placed horizontally across the top of the windshield. Lead-in comes through the dashboard up to the receiver in a jockey box. There are six loudspeakers, distributed through the bus for a low-level, "no blasting" projection. The actual volume level will be set jointly by KESE and the city Transit Authority, to ensure audibility without annoyance.

Average ride in the city is estimated at 22 minutes; daily load on the buses is about 17,000 people. So KESE's demographics gets a unique addition: about 6000 daily hours of bus-rider listening.

2. Waste Heat Is No Longer Waste at WUTR-TV, Utica, N.Y.

The hardware set-up at WUTR-TV, channel 20, in Utica, until early last fall included this: The GE TT55 transmitter, rated at 813 kW, like other transmitters in its class, produces about 300 kW of waste heat. Water cooling carried this heat into an adjoining space, where a heat exchanger delivered it to the air; then it was blown out through the roof.

Hoyle S. Broome Jr., vice president of operations, and Jerry Devine, chief engineer, had been struck with the wastefulness of the operation and were deeply concerned about the oil shortage obviously on the way. The building includes a complete ducting system for the air conditioning: why not feed that hot air through the ducts to help heat the building?

It turned out to be relatively simple to connect the heat exchanger output to the duct system in the building. Central thermostats control the blowers—already in place for the oil heating system. The cost, Jerry Devine estimates, was around $1000; he was able to use some control equipment the station had on hand, which helped keep the investment so low. Even at worst, though, Mr. Devine believes that any station with a sizeable amount of waste heat, and with a heat distribution system already in place, will be well ahead of the game by connecting the two.

Of course, with the fuel crunch on, using waste heat becomes a patriotic deed, as well as potential life-saver when and if fuel gets really short.

The system went into operation just five weeks before President Nixon called for immediate measures to reduce industrial consumption of energy. It has allowed WUTR-TV to operate with almost zero heating oil consumption, Mr. Broome reports; the

How do you judge them?

Rate these ideas for us now on the Great Idea Merit Scale. Rate all three items on a scale of from 0 to 10. If you think the idea is excellent, score it 10; without merit, 0. You can rate all items the same using whatever number you think appropriate, or you can discriminate and rate each one differently. We encourage you to rate all ideas, but you need not if you feel unqualified to rate some. Use the form at the end of this section and mail it to the editors, or write your ranking number on the Reader Service Card in the space "Tell us what you like . . ."

regular heater is now used only as a backup on the coldest days. WUTR-TV's engineering management has developed a highly pertinent idea.

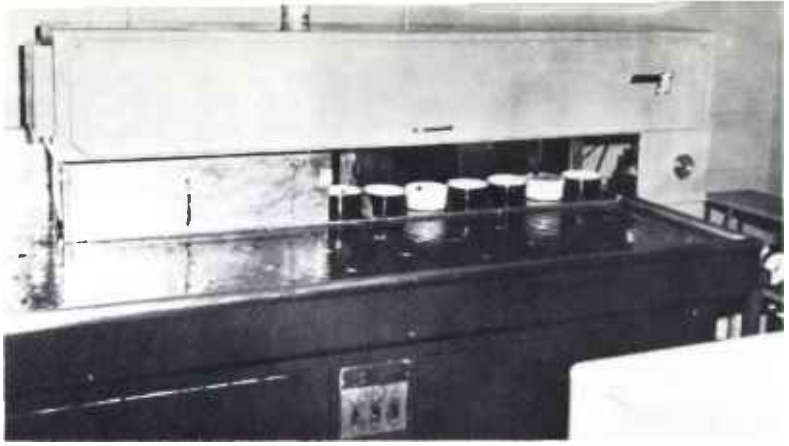
3. An Inexpensive Automatic Processor for Ektachrome (Adjustable to Other Film!)—One Hour Dry-to-Dry.

When Harry Holbert, art director for WTRF-TV, Wheeling, W.Va., was in bed getting well from surgery, he became mentally involved with a problem that had nagged him for some time: how to process Ektachrome film more efficiently than by the hand process used at his station, but without investment in a large automatic processor.

The result of his mental activity, plus three years of model building, experimentation, trial, and active use at WTRF-TV, is now covered by U.S. Patent No. 3,724,353: a simple automatic film processor that will take care of the moderate quantities of Ektachrome film for slides produced daily at the station.

The processor works by moving the film from one bath to another along a horizontal line traverse. The solutions are in open-top containers in a line along a horizontal platform. At each solution, an eccentric gear lowers the film, held in a Nikor development reel, into the container. It stays there the required time, is raised, and moved horizontally to the next solution.

The timing is all accomplished with a motor-driven cam, revolving at 1 rph, that successively trips a series of microswitches. Timing can be adjusted by realignment or replacement of a section of the cam. The solutions are agitated by a slow vibration around the horizontal axis of the platform, plus a 60-cycle shake produced by an electromagnet.



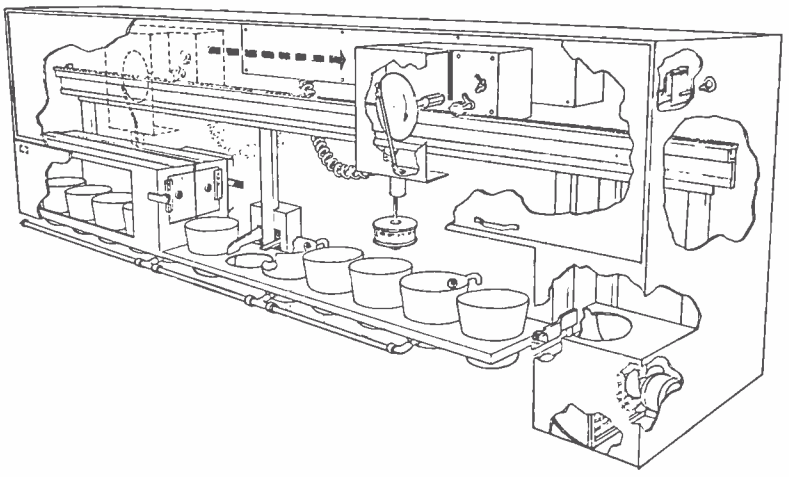


Photo (above) shows automatic color film processor developed by Harry Holbert, WTRF-TV, on top of bench in station lab. Solutions for open-light part of process are in containers visible along lower right of processor. Drawing (below) shows main features of mechanism, with film in developing reel being carried across horizontal transverse, to be dipped successively into solutions.

The whole device is scaled to the needs of a medium-market TV station: the containers need only hold one pint of solution apiece to process a roll of 35mm film, or a quart for two 36-exposure rolls. The early stages of the process, which must be done in the dark, are in a light-tight compartment, from which the carriage merges automatically, to continue through the half dozen or so remaining stages.

The original machine built by Holbert is in constant use at WTRF-TV. He says the only part needing occasional "babying" is the timer, which uses a $2.98 display motor plus brass gearing to get the once-per-hour turn.

Holbert thinks a complete, manufactured version of his processor ought to sell for around $2000. He is in negotiation with interested firms, and hopes to make an announcement on that subject soon.

BM/E

Rank each idea on a 0 to 10 scale on the form below, or write your ranking on the Reader Service Card in the back of the magazine in the space "Tell us what you like . . ."

Great Idea Contest
BM/E
274 Madison Avenue
New York, N.Y. 10016

Here's my ranking on a 0 to 10 scale of the January Great Ideas.

1. Bus-borne FM receivers	[ ]
2. Waste heat no longer waste	[ ]
3. Inexpensive automatic film processor	[ ]

Name _____ *Title* _____

Station or Company _____

Enter Your Own Great Idea Now. You May Win a Windjammer Cruise. See Contest Rules.

Transferring film to tape used to be complicated...

AKAI makes it simple.

AKAI's unique new VLC-8 Tele Cine Adaptor takes the hassle out of color film and slide transfer.

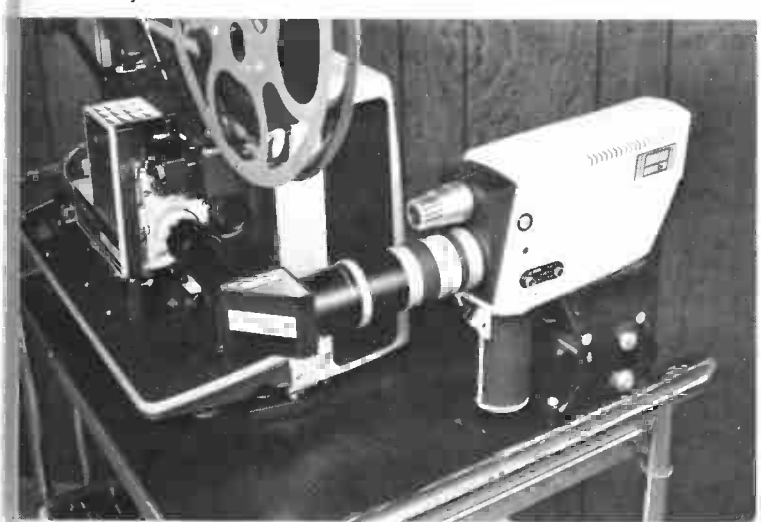
Simply connect the VLC-8 to your AKAI video camera, face it up to your projector, and you have an instant film chain–quickly . . . easily . . . inexpensively. From any size film. To all sizes of video tape.

And, when used with AKAI's VC-150 Portable Color Camera, the reproduction is superb. Because the VC-150 is equipped with an automatic iris. So the camera automatically adjusts instantly to light level variations.

What's more, the VLC-8 enables you to transfer film through the camera *directly* to a monitor. So you can see how it will look on the air. Before it's aired. Without tying up busy equipment.

Your nearest AKAI distributor or dealer will be happy to show you how AKAI can economize and simplify your film transfer needs.

Why not call him now?



AKAI VIDEO MASTER DISTRIBUTORS

*Powell Electronics, Inc.
3906 Jackson Highway
Sheffield, Alabama 35660
(205) 383-3330

*AKAI AMERICA, LTD.
2139 E. Del Amo Blvd.
Compton, California 90220
(213) 537-3880

*Professional Video Products
4455 South Broadway
Suite No. 3
Englewood, Colorado 80110
(303) 761-7185

Video Engineering Co., Inc.
Riggs Road at First Place, N.E.
Washington, D.C. 20011
(202) 882-6131

*J & J Television Electronics, Inc.
5855 Johnson Street
Hollywood, Florida 33021
(305) 989-7111

*Visual Systems Company
3870 North Peachtree Road
Atlanta, Georgia 30341
(404) 457-1388

Schwendiman Wholesale, Inc.
910 Lincoln Road
Idaho Falls, Idaho 83401
(208) 522-2492

*Vid-A-Comm Systems, Inc.
515 - 13th
Des Moines, Iowa 50309
(515) 282-7669

*Lake Systems Corporation
55 Chapel Street
Newton, Massachusetts 02160
(617) 244-6881

R. P. Hermes Company, Inc.
9600 Whittier
Detroit, Michigan 48224
(313) 886-4566, 886-4567

Wahl & Wahl, Inc.
2641 29th Avenue South
Minneapolis, Minnesota 55406
(612) 729-7301

Alexander Electronics, Inc
1820 Wyandotte Street
Kansas City, Missouri 64108
(816) 474-6656

*Sales Dynamic Supply, Inc.
2342 Centerline Industrial Dr.
St. Louis, Missouri 63141
(314) 567-4646

*Vid-A-Comm Systems, Inc.
2079 4th Avenue
Lincoln, Nebraska 68524
(402) 799-2471

*Audio-Video Corporation
55 Delaware Avenue
Elsmere, New York 12054
(518) 439-7611

*Seneca Audio Visual Corporation
112 Killewald St.
Tonawanda, New York 14150
(716) 693-8446

Electronic Products Corp.
16006 Waterloo Road
Cleveland, Ohio 44110
(216) 692-3050

*Lerro Electrical Corporation
3125 North Broad Street
Philadelphia, Pennsylvania 19132
(215) BA-3-8200

Northeastern Futuro, Inc.
Suite 4300, Ambassador East
Pittsburgh, Pennsylvania 15221
(412) 243-1300

*R. L. Bryan Company
P.O. Drawer 368
Columbia, South Carolina 29202
(308) 779-3560

*Arnold Barnes Associates
740 South Sherman Street
Richardson, Texas 75080
(214) 235-4543

Midwest Telecommunications
1514 Springmeadow Blvd
Norfolk, Virginia 23518
(804) 855-1056

Ballie Video World
170 Denny Way
Seattle, Washington 98109
(206) 682-3770

Midwest Telecommunications
300 First Avenue
Nitro, West Virginia 25143
(304) 722-2921

*Concord Communication Systems
11901 W. Dearborn Avenue
Milwaukee, Wisconsin 53226
(414) 778-0210

*Complete Service Facilities Available

From AKAI™ The Innovators

AKAI America, Ltd./2139 E. Del Amo Blvd., Compton, California 90220

Circle 122 on Reader Service Card

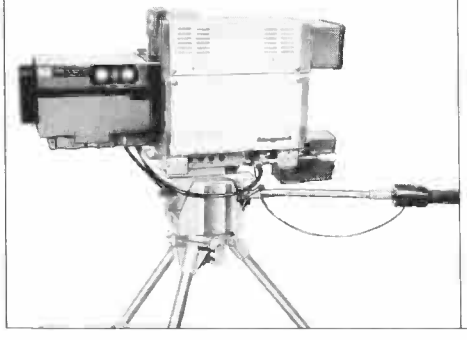
Canon offers the perfect zoom lens for the camera of your choice

P10 x 20B1

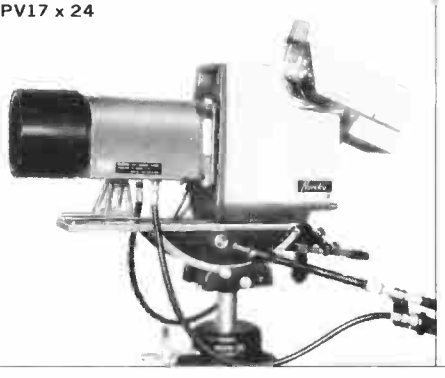
P17 x 30B1

P17 x 30B2

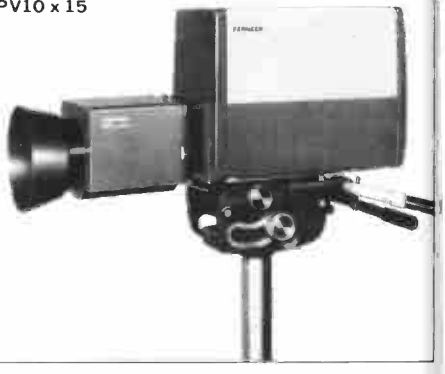
PV10 x 16B



PV17 x 24



PV10 x 15



More and more people are discovering how significantly superior Canon Zoom Lenses are for TV broadcasting purposes. Their outstanding color characteristics, even in dim light, is one of the many reasons why Canon was chosen for telecasting the Munich Olympics.

Canon's wide range of excellent zoom lenses encompass three types of operation control—all-servorized, via flexible cables and by effortless push-pull rod control. And it can be attached to fit and operate with any make of TV camera.

Shown on this page are only a few examples of the quality lenses Canon has available to more than meet your particular demands. Specify Canon to stay ahead.

The following are Canon TV Zoom Lenses for the Plumbicon® color cameras currently available on the market:

Size of image tube	Lens	Image format covered
1⅓" Plumbicon® color camera	P10 x 20B4 P17 x 30B1 P17 x 30B2	17.1 x 12.8mm (21.4mmφ)
1" Plumbicon® color camera	PV10 x 16B1 PV10 x 15B2 PV17 x 24B1 PV 6 x 18B1	12.8 x 9.6mm (16mmφ)

® Reg. TM N.V. Philips of Netherlands.

The Canon TV Lenses Naming System

P10 x 20B

- Glass Compensation for Beam Spliter
- Minimum Focal Length
- Zoom Ratio
- Application

Applications	Image Format	Pick-up Tubes
P	21.4mmφ	1⅓" Plumbicon
PV	16mmφ	1" Plumbicon

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

Canon

● CANON INC.: 9-9, Ginza 5-chome, Chuo-ku, Tokyo 104, Japan ● CANON U.S.A., INC.: 10 Nevada Drive, Lake Success, Long Island, New York 11040, U.S.A. (Phone) 516-488-6700 ● CANON U.S.A., INC.: 457 Fullerton Ave., Elmhurst, Illinois 60126, U.S.A. (Phone) 312-833-3070 ● CANON OPTICS & BUSINESS MACHINES CO., INC.: 3113 Wilshire Blvd., Los Angeles, California 90005, U.S.A. ● CANON AMSTERDAM N.V.: Gebouw 70, Schiphol Oost, Holland ● CANON LATIN AMERICA, INC.: Apartado 7022, Panama 5, Panama

Circle 123 on Reader Service Card

BROADCAST EQUIPMENT

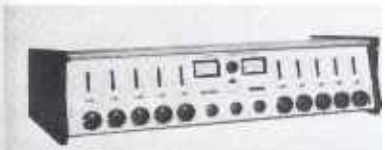
Lens adapter mates all Nikon and Nikor lenses to Eclair 16mm cameras. TESNI adapter makes a secure connection in less than a second, can be used with heavy gloves. ECLAIR CORP. **300**

Wireless microphone system has crystal control, rechargeable batteries. Comrex 450 MHz system is for sound

cameras in news gathering, has power output of 100 mW and receiver sensitivity of 1 microvolt, output of −150 dBm at 150 ohms. COMREX CORP. **301**

Audio monitoring unit for 16mm sound camera fits within camera body, has jack output for headphones. Unit draws negligible power from camera battery, can be used on Models LW-16 and MC-581-DC cameras, is compatible with all Auricon-type amplifier systems. $250 installed. FREZZOLINI ELECTRONICS INC. **314**

Broadcast audio consoles have 6, 8, and 10 channels, in mono, dual mono, or stereo. All have step type silver con-



tact faders, noise, hum, and cross talk 68 dB below 18 dBm output, built-in cue/talkback system, many other features. $1595 to $3695. AMPRO CORP. **315**

Series of low-light-level to sunlight TV cameras cover dynamic range of 10^8 with maximum sensitivity of 10^{-5} foot candles. XR Series are self-contained in sealed environment, can be installed out of doors, can use a wide range of fixed and zoom lenses. JAVELIN ELECTRONICS, DIV. OF APOLLO LASERS. **316**

TV camera tube is 23-in. in diameter, will make possible very small, light cameras. "Saticon" tube uses a new semiconductor material, has a photodiode with an amorphous semiconductor layer and conductive tin oxide layer. HITACHI LTD. **312**

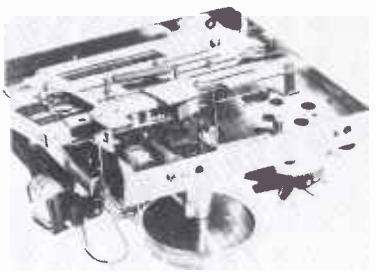
Bulk eraser for magnetic tape handles audio and video tape up to 2-in. widths, on reels up to 17-in. diameter. Professional audio/video/computer eraser Model HD-25 is rated 20 amps at 115 volts, supplies erasure up to 90 dB below saturation. $150. MICROTRAN COMPANY. **313**

Video message generator supplies one row of 16 alpha-numeric characters with adjustable height. Model MG-1

allows positioning message anywhere on frame, locks to any sync or video. DATAVISION. **305**

Color production center consists of Magnavox CV400 camera, Panasonic NV-3120 ½-in. recorder, and Unimedia 9-in. monitor. Units are mounted on wheeled cart with large cabinets below for storage. $4199. COLUMBIA VIDEO SYSTEMS. **306**

Audio cassette tape transport has three motors and 2-track, 2-channel record/play head. Model CAS-4 has positive



slot loading making incorrect cassette position impossible, electronic control with solenoids, connections for remote control. CONRAC CORP. **307**

Digital multimeter measures capacitance as well as volts, amperes, ohms. Model 20 has 3½ digits, 2000 count, resolution of 1 pf and accuracy 0.2% of reading. $269. DATA TECHNOLOGY CORP. **308**

Tungsten-halogen lamps for film chains are rated 300, 500, and 1000 watts, are designed as direct replacements for incandescent units, the first, EEX for CXK; the second, DZG for DAS; and the third, BTC for DGS. Color temperatures are 3200 K for the first two and 3325 K for the third. Reflectors are built in. GTE SYLVANIA. **311**

Electronic master clocks have accuracy on the order of one-fourth second per year. Solid-state units are available in various forms. STANDARD ELECTRIC TIME. **320**

Equipment racks have standard 19-in. front, 24-in. depth. "Action" racks are available in seven heights, and with

New 512 MHz frequency counter is for monitoring and measuring carriers in mobile communications. Model 6252 has input level meter, overload relay to protect input, frequency multiplier with phase locked local oscillator. Input sensitivity is 25 mV rms to 50 MHz and 50 mV rms above that. Measurement is displayed on a 5-digit readout. The unit can be powered by AC or by external DC or rechargeable battery. There is a multiplier for TONE measurements with resolution of .001 Hz/sec. $1095. SYSTRON-DONNER. **310**

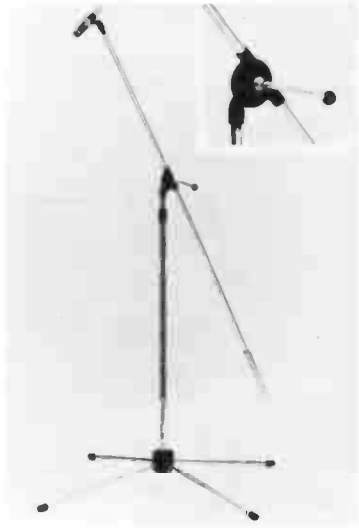
PRODUCTS

any combination of 16 vinyl colors. $160 to $225. OPTIMA DIV. OF SCIENTIFIC-ATLANTA. **321**

Universal degreaser and magnetic tape head cleaner cleans oil, dirt, oxide build-up, leaving no sticky film or powder. "Geosolv" is safe on all metals, rubber, plastics, and magnetic tape. 18-ounce can, $3.50 plus postage. GEOS CORP. **322**

Frequency counter for 20 Hz to 18 GHz measures automatically to 100 Hz resolution under remote control. Model 351C uses electronically tuned YIG comb generator, has an 11 digit display with constant decimal placement. Unit is TTL compatible, has four options for output and control. EIP INC. **323**

Microphone stands have single lever control for boom length, angle, and



rotation. KMAL stands also have a drum boom to hold an additional microphone. KEITH MONKS, LTD. (AUDIO TECHNIQUES, Stamford, Conn.) **302**

Hand-held IC tester combines a logic probe, logic clip, and logic comparator in one. Model 200 IC "Testclip" automatically powers itself from the board under test, has a 16-position switch for use as a logic probe, shows difference in truth table or state behavior from reference IC plugged into case. A pulse-stretching circuit allows LED to act as logic monitor, detecting stuck or toggling pins. Reference IC is plugged in for comparator use. $395. JOHN FLUKE TRENDAR. **324**

Test films in Super 8mm and 16mm include black-and-white "chess board" for operational checking of projector optical resolution and geometry. "Porta-Pattern" series also has color flesh-tone films for set-up of color

PRODUCTS

telecine systems, and test slides with all industry standard patterns, for telecine checkout. Films, $35 to $80; slides, $120 to $205. TELECOMMUNICATIONS INDUSTRIES. 325

FM re-broadcast receiver is for stations in networks, taking signal from another FM station. Unit has afc, built-in program amplifier, 40-20,000 Hz response, distortion under 2%. $125. TRI-TRONICS. 326

Optical multiplexer for telecines provides selection of any of three inputs for one output. Model M-3 positions first-surface, optically-flat mirrors in the optical path in less than 50 ms, has a neutral-density filter wheel driven by servo amplifier; light transmittance range is continuous from 1% to nearly 100%. COHU INC. 327

Output interface for ½-in.-tape helical scan video recorder boosts output to

+8dBm at 600 ohms. Model AO-12 has balanced output for patchcord connection to other studio facilities. $125. ULTRA AUDIO PRODUCTS. 328

Packaging system for electronics units consists of metal enclosures in a number of sizes. "Modpak" system includes all hardware, choice of external connectors, internal capacities ranging from two to 40 cubic inches. MODPAK. 329

New 15 MHz oscilloscopes have calibrated 8x10 cm display, DC coupling, triggered sweep. Models 1220A (dual channel) and 1221A (single channel) have deflection factors of 2 mV/cm to 10 V/cm, internal graticule, all solid-state electronics except the CRT, 3% accuracy on vertical calibration. 1220A, $625; 1221A, $500. HEWLETT-PACKARD. 330

Transmitter remote control system can operate over voice-grade telephone lines or by microwave. Model RC-2600E supplies 26 control positions and 24 analog meter channels. Coded pulse width modulation, used in control circuits, is neither amplitude nor frequency sensitive. $1990. RUST CORP. 331

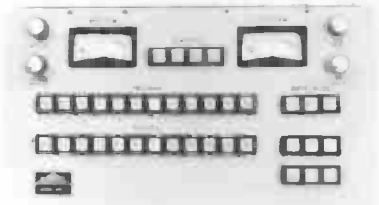
Dual electronic timer in a monolithic IC can be used for time delays, time

continued on page 56

PRODUCTS

sequences, pulse generation, pulse width modulation. Model NE/SE556 can produce fully controllable time delays between one microsecond and one hour, run free as oscillator up to 300 KHz, or perform a number of other functions, $1.25 (in quantity). SIGNETICS. **332**

Master control switching system has two busses, audio-follow-video. Model



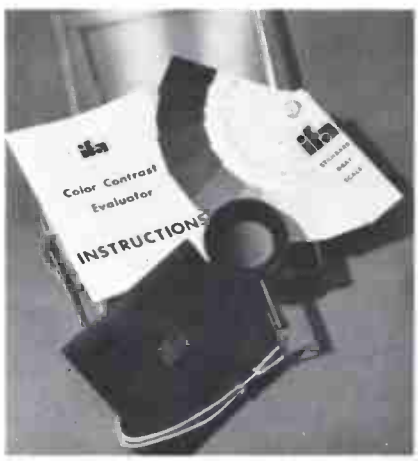
570.11 has four auxiliary inputs, ten-watt monitor amplifiers, output of −24 dBm into 600 ohms. AMERICAN DATA CORP. **303**

Backfill tilt blade is available as an option for R30, R40, and R65 diggers. Blade can tilt up to 20 degrees in either direction; tilt, raising, and lowering are controlled hydraulically. DITCH WITCH, DIV. OF CHARLES MACHINE WORKS. **317**

Pan and tilt drive for video cameras has silent studio performance. Model V366APT has hardened steel gears and is slip-clutch protected, with external, adjustable stops. VICON INDUSTRIES INC. **310**

New "L" series of rebuilt quad video heads have a warranty of 500 hours. They are available in all Mark III and Mark X configurations. $950. VIDEOMAX CORP. **318**

Color contrast evaluator allows examination of scene to determine separation of scenic elements. Color Contrast



Kit compares colors with IFA grey scale which is included. $19.50. IMERO FIORENTINO ASSOC. **319**

PRODUCTS

Digital multimeter has 3½-digit display, automatic polarity selection. Model 360 has 29 DC, AC, and resistance ranges, including low-power ohms, and analog output jack for interface with recorders and other instruments. Overrange indication is automatic. Unit runs on batteries or AC. SIMPSON ELECTRIC CO. 354

Dipole antenna for CATV radiation measurements under FCC Part 76 Subpart K, has telescoping elements, adjustable to exact frequencies with tape measure calibrated in frequency. Model KT5-105A covers 20 to 300 MHz, can be used with rf meter of 50 or 75 ohms input, is supplied with calibration curves. $360. SINGER INSTRUMENTATION. 355

Test set for audio tape recorders reads input and output levels, frequency response, harmonic distortion, S/N ratio,

and flutter. Model 6500 has "quick look" meter with color bands, as well as numerical calibration. It runs on AC or on six standard "D" cells. $1595. 3M CO. 309

Illumination level meter has spectral sensitivity close to that of human eye. Model 408 also can be used as light meter or to make luminance measurements (with slip-on luminance tubes). Four ranges cover up to 500 footcandles. $125. SIMPSON ELECTRIC CO. 329

Improved 1-GHz transistors have gold metallization, reduced package parasitics. Series 2N5596 are available in ratings from 1 to 20 watts, with gain at 1 GHz of 5 and 6 dB. TRW, INC. 334

Portable quartz lighting kits are available in four sizes. "Traveliter" kits are intended for CCTV, film production, etc. $192.60 to $581.75. PACKAGED LIGHTING SERVICES, INC. 335

Condenser stereo headphones use electret units, eliminating need for polar-

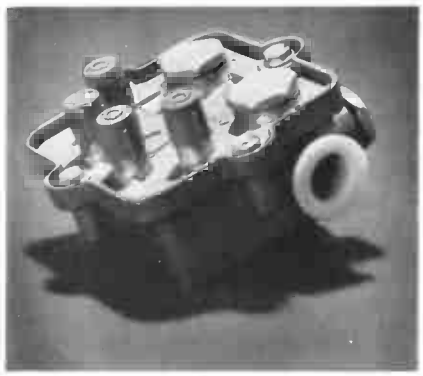
continued on page 58

PRODUCTS

izing voltage. Model TEL-111 headset is rated for power to 65 watts, weighs 17 ounces, claims total harmonic distortion of 0.2% at 115 dB SPL. TELEPHONICS. **336**

Audio intercom system with modular units can be installed with stations desired, expanded or altered as needed. Crossbar intercom system has switchers, amplifiers, logic cards and power supplies on plug-ins, can provide IFB switching or priority control. HOLLAND ELECTRONICS. **333**

Wideband directional tap covers 5 to 300 MHz. Model 2500 is available in



2-port or 4-port designs, has a seizing device that locks in connector pins or a cable center conductor. ANACONDA. **304**

Oscilloscope has 10 MHz bandwidth, 10 mV/cm vertical sensitivity. Model 455 has sweep frequency from 1 Hz to 200 KHz, and special horizontal-sync sweep for TV work, plus R-Y/B-Y inputs. $295. SIMPSON ELECTRIC CO. **337**

Magnetic tape editing pen erases small areas on sound or videotape. Model HD-35M will remove single syllables or other material. Active tip area, ¼-in. diameter. 115 Volts, 10 watts. $32. MICROTRAN COMPANY. **338**

AM/FM modulation meter measures FM deviation up to 500 KHz at carriers to 1200 MHz, and AM depth to 95% at carriers to 400 MHz. Model TF2300B is improved version of TF2300A with lower noise, higher sensitivity, and more convenient tuning. MARCONI ELECTRONICS. **339**

New thru-shaft meter movement has very high torque. "Super-Torque" movement is 25° type that tracks to ± 2% and has hysteresis less than 0.75%, can take push-on pointers. Available in sensitivities from 10 to 60 mA. BEEDE ELECTRICAL INSTRUMENT CO., INC. **343**

PRODUCTS

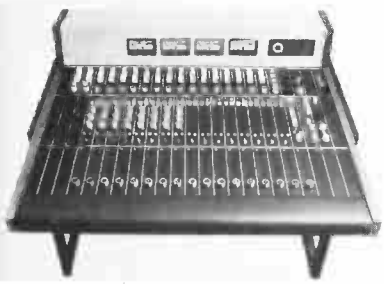
Standby power for cable systems supplies 30 or 60 volts, operating from a 48-volt battery pack. Model EMNB107 is all solid-state, (no relays) includes DC/AC inverter, transfer switch and sensing logic which cuts power in so rapidly that no signal is lost to viewer. JERROLD/GULTON. 344

CCTV surveillance camera has 600 n-line horizontal resolution, automatic adjustment to light level over a range of 10,000:1. Model CTS-11 has electronics on plug-in fiberglass boards, 15,750 Hz horizontal sweep rate, 525 line/frame, 30-frame sound. $625. MOXON INC./CTS DIV. 345

Digital multimeter has 4½-digit readout, 24 ranges. Model 41 has TTL-compatible BCD output, 100 microvolt resolution on AC, 10 microvolt on DC, 100 mohm on resistance and 10 nA on current. $595. DATA TECHNOLOGY CORP. 346

Two-way diplex filter for cable TV has 26 dB return loss, isolation of 40 dB minimum. "Three-in-One" diplexer has chroma delay of 2 nanoseconds at channel 2 and 5 - 36 MHz bandwidth in the sub-channels. COMMUNITY INFORMATION SYSTEMS, INC. 347

Audio control console is modular, expandable, handles up to 16-track recording and on-air applications. Model 110 is expandable to 18 mixing posi-



tions—36 inputs—in 36-in. width. It has metering, two echo send/receive channels, talkback, separate control room and studio monitoring, test oscillator. AUDITRONICS. 340

Transistor tester checks any transistor or FET, requires only connection of three leads and pushing of test buttons. Model TF26 produces chirp tone as well as meter indication when transistor is good. $140. SENCORE, INC. 341

Digital multimeter has five AC and DC voltage ranges, five of current and six for resistance. Model 8000A has 3½-digit readout, is available with option for extended high current readings, to 10 amperes continuous or 20 amperes intermittent. Line operation, $299; line and battery, $349. JOHN FLUKE MFG. CO. 342

NEW LIT

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

"Public Access Report" is a description of Public Access Celebration, a three-day event in New York involving individuals, community groups, and the two cable companies, Sterling and TelePrompTer. Sold at $3.00 each, P.O. Box 393, New York 10024.

Selection of **image Orthicon tubes,** and of other **TV camera tubes** in general, are subjects of two guides, CAM-800C and CAM-703B respectively. **RCA.** **250**

Pocket Media Guide is a miniature booklet with names, addresses and telephone numbers of radio and television stations, magazines, newspapers, syndicates and wire services. Media Distribution Services. **251**

Detailed instructions for **tape recorder care** are supplied by new 32-page "Recorder Care Manual," which includes sections on basic operation, on heads, on general maintenance. Nortronics Co., Inc. **252**

Communications service monitor, FM-10C, for measurement of all important two-way-radio parameters, is covered in detail in Data Bulletin FMD-106A. Singer Instrumentation. **253**

Miniature travelling wave tubes for phased arrays are subject of brochure which supplies applications data and technical specifications. RCA. **254**

Impulse noise and measuring set, Model 480A, is covered in new technical data sheet. Bowmar Instrument Division. **255**

Film laboratory service and price book includes all services for 35mm, 16mm, and, as a new addition, 8mm/Super 8mm film, together with technical data such as exposure indexes for regular and forced development. Bebell, Inc. **256**

Full-line 40-page catalog covers **panel meters, meter relays, multitesters and test accessories.** Simpson Electric Co. **257**

Photo facilities for mobile and location work for television and motion pictures are detailed in new catalog. Birns and Sawyer, Inc. **258**

TV broadcast sync generator, Model 2750, covered in new technical brochure, includes black burst and dot bar generator. Cohu, Inc. **259**

continued on page 62

NEW LIT

Metric conversion kit includes a 9-inch pocket conversion calculator; an English-metric steel tape measure; a roll of fifty 0-100 centimeter stick-on rules, and other aids to the "Big Switch," among them a detailed 54-page paperback with all tables, etc. $5.00 postpaid from Edmond Scientific Co., 380 Edscorp Bldg., Barrington, N.J.

CCTV Buyers' Guide has more than 500 pages of listings of video equipment and components, including cameras, monitors, VTRs, and accessories. Cramer Video. **260**

New fact sheet shows **universal directional coupler,** Model MX-3700, aerial/pedestal mounting tap, which has ten values of two- or four-output versions. Magnavox. **261**

Back panel wires which are flame, chemical and radiation resistant, and stable to 266 degrees F, are described in new data sheet. Brand-Rex Co. **262**

Complete **CATV equipment price schedule** covers electronic units for single and dual cable, bi-directional amplifiers and extenders, mid- and super-band converters, and accessories. AEL Communications Corp. **264**

Function generators for 5 MHz, 10 MHz and 20 MHz have built-in sawtooth generator, are described in new brochure. AILTech. **265**

Series of 150 amp silicon rectifiers with reverse voltage ratings to 1200 volts are covered in new data sheet No. PD-2.017. International Rectifier Corp. **266**

Ultrasonic glass delay lines are the subject of technical brochure, which gives general background, characteristics, applications. Corning Glass Works. **267**

"The Logic Analyzer" is a 28-page booklet telling how to **troubleshoot digital equipment** using a new technique of capturing any section of a digital bit stream, with the help of Model 5000A Logic Analyzer. Hewlett-Packard. **268**

NCTA Marketing Workshop Transcript Available

A transcript of the CATV marketing workshops at the NCTA Convention of 1973 in Anaheim, Calif., has been issued by the NCTA. The marketing sessions, which were widely praised for their depth and comprehensiveness, are completely covered in the transcript. Copies are $2.95 to members, $4.95 to non-members, from NCTA at 918 16th St. N.W., Washington, D.C.

 continued from page 16

Financial Briefs

Multronics: nine months to July 31, 1973, revenue $174,254; income 5,169; up from a loss of $64,028 in 1972 period ... **RCA:** third quarter 1973 earnings up 14% to $42 million on record sales of $1.05 billion ... **Anixter Brothers:** year ended July 31, 1973, record sales of $112,731,687; earnings of $1,070,433.

Pioneer-Standard Electronics: six months ended September 30, 1973, record sales of $13,037,783, up 29%; and earnings of $524,627, up 31% ... **Cox Broadcasting Corp:** nine months ended September 30, 1973, revenue was $65,277,605, up 16%; earnings were $7,091,219, up 9% ... **GBC Closed Circuit TV Corp:** year ended May 31, 1973, sales were $6,588,392 and earnings $209,694, both record highs.

Oak Industries: for nine months ended September 30, 1972, record sales of $85,708,114, up 19%, and record income of $3,434,575, up 82% ... **Warner Communications:** for nine months ended September 30, 1973, operating revenue was $401,321,000 ... **Scientific-Atlanta Inc:** for the three months ended September 30, 1973, sales were $6,080,000 and net earnings $213,000, up 49% and 53% respectively.

TeleMation Inc: nine months ended September 30, 1973, net revenues were $12,967,300, and net income $30,549 ... **TelePro Industries:** nine months ended September 30, 1973, record sales and earnings of $8,394,398 and $751,740, respectively ... **Cohu Inc:** nine months ended September 30, 1973, sales were $11,102,053, up from $8,240,406, and net income was $660,214, up from $396,721.

People

Ted Blum became director of CATV engineering for Tocom, Inc. ... New program director for Warner Cable of Columbus is **James B. Feeney** ... **Mary Lou Scott** was named assistant manager of Empire State Cable TV Co., Binghamton, N.Y.

Tore B. Nordahl was appointed vice president, marketing, for Ameco, Inc. ... **Maurie Webster,** formerly vice president at CBS Radio, joined Compu/Net, Inc. as executive vice president ... **Frank X. Daly** is midwest manager, **Roy N. Wade** is Detroit manager, and **James C. Warner** is eastern manager, all in the new national sales organization of Kaiser Broadcasting Company.

John Leusink, who has had a comprehensive career in international business administration as well as in engineering, was named president of Eclair Corp. ... **Walter E. (Gene) Smith** became president of Communications Exporting Corp. of Washington, D.C., firm engaged in design and installation of radio and television systems in the Caribbean area. **Larry Fry** is the new western sales representative of Anaconda Electronics ... **Richard H. Meeder** was named local sales manager for WQXI-TV, Atlanta, Ga.

David A. Aptaker was named regional sales manager for Marco Video Systems of Philadelphia ... **George Konkol** of GTE Sylvania was elected to a second term as chairman of the board of the Electronic Industries Association ... **Robert W. Sarnoff,** chairman of RCA, got an Honorary Fellowship from the British Royal Television Society.

Gail E. Oldfather became president of Televents, Inc., operator of a number of cable systems in California; he had been executive vice president ... **Rod Church** was named manager of Clinton TV Cable Co., which has a system under construction in Clinton, Iowa ... **Peter Lussier** became production chief for both video and film at MPCS Communications Industries, New York video production firm.

CROSS-TALK

Dear Editor:

In reference to the article, "Do We Practice What We Preach? Part II" in the November issue of *BM/E*, I would like to take this opportunity to point out a limitation in the TV control audio system described. Perhaps my suggestion will help Mr. Berliner avoid an embarrassing moment of air time or production time in the future.

In Fig. 2, I immediately thought of the poor audioman or audiowoman who must reach across the turntable in order to thread the tape transport. Even if the tape transport is to only be threaded before beginning of production, in an emergency, it would still be quite awkward to reach across the table whether or not it was being used at that moment. Needless to say, if the turntable were in motion, the results could be quite disastrous.

It would be a much better idea to stretch the budget $150, and put the tape transport in another cabinet on the left side of the audio console. It would also help if a high intensity lamp were installed over the turntable so as to better facilitate viewing the separate cuts on the records. And the raised edge on the turntable cabinet will probably result in some bruised elbows!

Now a comment on the professional Revox tape deck from the viewpoint of an engineer who has done tape production on all kinds of tape decks. It is impossible to edit on a Revox. The heads (especially the playback) should be visible for tight edits. If the studio designer had in mind editing on another machine, then the Revox would suffice. However, why not save the money and just put in a Crown to begin with. This is an excellent machine for tape handling and it has fine specs.

The UREI limiter should be a must in all recording of audio, not just rock groups. I have yet to find an untrained voice who will give you a real audio level when testing and setting-up. The test and the actual voice are two different things. A limiter/compressor is a must to keep levels within tolerance. This avoids running the final product through such a device after your studio should be done with the whole project. I speak from experience!

I must give Mr. Berliner credit for going as deeply into the audio problem as he has. I have seen more CCTV, educational and business TV systems which have been designed only for the TV end and not the audio. When the owners of such systems see the results of their set-ups, they wonder why they can't *hear* very well! Audio is much simpler than video, but is seldom less important in the final analysis.

I'm looking forward to future articles by Mr. Berliner on studio design. The low-budget aspect hits home with many of us working for companies who can't afford, or are skeptical to invest, a great deal of money.

Bravo to *BM/E & CM/E*. I look forward to every issue and save them all!

Pam Eberhardt
Audio engineer
Prairie View, IL

Ed. note: Mr. Berliner elected to go with two cabinets rather than three for portability reasons.

PERFECT YOUR CCTV SYSTEM WITH COSMICAR® LENSES

A rich variety of COSMICAR CCTV lenses will ensure you to satisfy any of your technical purpose.

Be sure to get the finest image recording results with quality Cosmicar lenses.

Also available are scores of other lenses, ranging from 4.8mm to 1,000mm telephoto, zoom and those motordriven among them, for immediate delivery after being tailored to your specifications.

COSMICAR

COSMICAR OPTICAL CO., LTD.

424, Higashi-Oizumi, Nerima-ku, Tokyo, Japan Cable Address: "MOVIEKINO TOKYO"

Representative & Service Office: Asahi Optical (America) Inc. 15 East 26th Street, New York, N.Y. 10010, U.S.A.

Circle 145 on Reader Service Card

Take it to the moon or mountaintop. It's the new Fluke go anywhere telecommunications counter.

Model 1980A with rechargeable battery pack and carrying case.

- 5 Hz to 515 MHz
- 6 digit LED display
- Units annunciation
- Optional snap-on battery pack for up to 5 hours off-line operation
- 50 millivolt sensitivity over entire range
- Superb Fluke quality and reliability
- TCXO for instant-on full time accuracy
- World-wide network of factory service centers

FLUKE

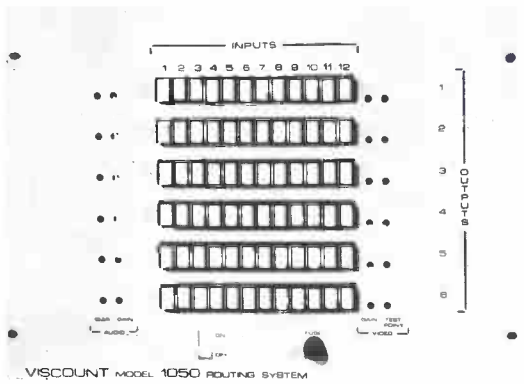
For data out today, dial our toll-free hotline, 800-426-0361

John Fluke Mfg. Co., Inc., P.O. Box 7428, Seattle, WA 98133

Circle 146 on Reader Service Card

PRICES SLASHED

DELIVERY 4 TO 6 WEEKS



MODEL 1050 ROUTING SYSTEM
THE MOST RELIABLE, LOW-COST SWITCHING MODULE YET

FACTORY ASSEMBLED	PRICE EXAMPLES		
INPUT OUTPUT	VIDEO	AUDIO	AUDIO/VIDEO
12 X 3	$ 1200	$ 860	$ 1490
12 X 6	1710	1370	2150
12 X 9	2380	1980	3000
12 X 12	2920	2520	3720

VISCOUNT INDUSTRIES LTD.

105 EAST 69th AVE., VANCOUVER 15, B.C.

TELEPHONE: (604) 327-9446

Circle 147 on Reader Service Card

BM/E CLASSIFIED MARKETPLACE

CLASSIFIED ADVERTISING RATES (Effective January 1, 1974)

DISPLAY CLASSIFIED ADVERTISING: $32.50 per inch 1x; $30.00 per inch 6x; $27.50 per inch 12x. ALL OTHER CLASSIFIED ADVERTISING 35¢ per word; minimum $3.50. BLIND BOX NUMBER: $1.00 extra charge. Replies sent to address below will be forwarded to you. PAYABLE IN ADVANCE; send check with order. CLOSING DATE: 5th of 2nd month preceding issue date.

BM/E, Monterey and Pinola Avenues, Blue Ridge Summit, Pa. 17214 Phone 717/794/2191

HELP WANTED

MANUFACTURERS REPS WANTED
Established manufacturer of video products seeks professional reps in most metro areas of U.S., Europe, and Japan. Liberal commission rate basis. Full technical support on quality equipment for TV Broadcasting, ETV, ITV, & CATV. Reply should include present companies and lines represented. Reply to Box 174-2, c/o BME, Blue Ridge Summit, PA. 17214.

Dynamic educational communications center of constituent college of State University of New York seeks television technician to operate and maintain production and distribution equipment including: quadruplex and helical recorders, 10 studio cameras, 24-channel campus CATV, and several TV sub-systems; and to provide technical support of other media when necessary. Position requires FCC First Phone or equivalent in formal training, strong background in quality/broadcast video, some CATV, digital logic experience helpful. Three years operational experience or equivalent is expected. Moderate salary; excellent benefits; recreational opportunities in growing residential community. Contact Director of Educational Communications, State University College, New Paltz, N.Y. 12561. EQUAL OPPORTUNITY/AFFIRMATIVE ACTION EMPLOYER.

Television Station Supervisor—Position requires contemporary skill in installation, operation, and maintenance of broadcast equipment, particularly TV cameras. First Class FCC license, 3 years technical training, and 3 years responsible experience required. Additional responsible experience can substitute for technical training. Apply Office of Staff Personnel, Room 134, French Admin. Bldg., Washington State University, Pullman, WA. 99163. Phone (509) 335-4521. An Equal Opportunity Employer.

Superb Opportunity for chief engineer in midwest and mid-south. 2-station chain needs first capable of handling directional AM, maintenance, repairs, and annual proofs. Good fringe benefits. Salary Open. Box 174-3, c/o BME, Blue Ridge Summit, PA. 17214.

Maintenance engineer needed. FCC First Phone Required. Excellent working conditions. Experienced in maintaining VTRs. Color Cameras. Switchers, and all associated equipment. Send resume to: Chief Engineer, WRET-TV, Box 12665, Charlotte, N.C. 28205.

CATV TECHNICIAN. Located Upstate New York. 35 miles of system. Attractive area. Minimum 2 years experience, CATV. Send resume, including employment history and salary required. Box 174-1, c/o BME, Blue Ridge Summit, PA. 17214.

Experienced Chief Engineer needed for midwest 5kW Directional AM and Automated FM. Excellent equipment and working conditions. Salary $900/month plus. Send references and resume. E.O.E.. Box 1273-1, c/o BME, Blue Ridge Summit, PA. 17214.

MISCELLANEOUS

3 KW FM Southeast Nebraska. New C.P. Owner will build and lease with option to buy. Qualified Owner/Manager required. Artcom, 1711 So. 22nd St. Lincoln, Neb. 68502.

EQUIPMENT FOR SALE

BROADCAST AND RECORDING EQUIPMENT: Scully, V.I.F. International, Metrotech, Langevin, Electrodyne, Q.R.K., Micro-Trak, MRL, Nortronics, McMartin, U.R.E.I., E.V., A.K.G., Stevenson, Gately, D.B.X., Advent, Altec, Fairchild, Audio Designs, 3M, Magnecord, Telex, Inovonics, Nagra, Uher, Tape-Athon, Package Deals, Installations, Service, Request Flyer. Weigand Audio, Middleburg, PA. 17842. (717) 837-1444.

CARTRIDGE TAPE EQUIPMENT—Rebuilt. New paint, heads, flywheel, pressure roller, belts etc. Spotlessly clean and thoroughly tested. 30 day money-back guarantee. 90 day warranty. Also contact us for discounts on new equipment and accessories.
AUTODYNE, Box 1004,
Rockville, Maryland 20850
(301/762-7626).

EQUIPMENT FOR SALE (Cont'd)

FIELD STRENGTH METER. 540 KHz to 5MHz, Ten microvolts to 10 volts per meter. New solid state design, long battery life. Stable accurate calibration. Free literature. Solar Electronics, 901 No. Highland Ave., Hollywood, Cal. 90038.

MOTORS FOR SPOTMASTERS
NEW Papst hysteresis synchronous motor HSZ 20.50-4-470D as used in series 400 and 500 machines. Price $39.00 each prepaid while they last. 90 day warranty. Terms check with order only, no COD's. Not recommended for Tapecaster series 600 or 700.
TAPECASTER TCM, INC., Box 662
Rockville, Maryland 20851

Solid-state audio modules-console kits, power amplifier kits, power supplies. Octal plug-ins—mic, eq. line, disc, tape play, tape record, amplifiers. Audio & tape bias oscillators. Over 50 audio products. Send for free catalog and applications. Opamp Labs. Inc., 172 So. Alta Vista Blvd., Los Angeles, Calif. 90036. (213) 934-3566.

RCA Studio Equipment. Stereo consolette BC-19B; professional audio tape recorder RT-21B; dual speed turntable BQ-51, all equipment new condition—package deal only. $3500, or best offer. Specifications on request. Western Video Co. Box 1775, Billings, Montana. 59103. (406) 248-8660.

I.C. COMBINING AMP CARDS from $40.00. Fully tested and guaranteed for 10 years. Distribution amps, line amps, mic preamps, transformer cards, Card files and power supplies. Electronic crossovers and equalizers. Direct from Manufacturer. NO DISTRIBUTOR MARK-UP! IXTLAN ENGINEERING. Box 323, Lombard, Ill. 60148. (312) 833-6362.

FOR SALE- 2- Bell and Howell Model 614, 16mm TV film projectors, Mag./Opt. sound, suitable for color operation. Asking $2500. KORN-TV, Mitchell, S.D. 57301.

Two RCA TK-42 Color Camera chains complete with auxiliary electronics and controls. $10,000 each. Claude Scott, Chief Engineer, KTBS-TV, Shreveport, LA. 71104. Phone (318) 868-3644.

Utility "340" Tower, 225 feet, All lighting, W guys, etc. Excellent condition. Dwaine Munyon, KOAK, Red Oak, Iowa. 51566.

RCA MI-40790-AZ Headwheel panel. $600. Norman Gillaspie, Box 2124, Monterey, CA. 93940. (408) 375-7424.

The complete and reliable source for new and used broadcast equipment. Request our free listings. Broadcast Equipment and Supply Co., Box 3141, Bristol, Tennessee 37620.

MICA AND VACUUM transmitting capacitors. Large stock; immediate delivery. Price lists on request. SURCOM ASSOCIATES, 1147 Venice Blvd., Los Angeles, Cal. 90015 (213) 382-6985.

4—650 ft. towers $6500.00 each. Many more. Ground wire 85cper xx. lb. Bill Angle, Box 55, Greenville, N.C. 27834. Tel. 919-752-3040.

One stop for all your professional audio requirements. Bottom line oriented. F.T.C. Brewer. Box 8057, Pensacola, Fla. 32505.

WE BUY TUBES, TRANSISTORS & CAPACITORS. Send your lists of sale items. Specialty Supply Ltd., P.O. Box 22391, Denver, Colo. 80222.

CAPSTAN IDLERS for AMPEX 300, 350, 440. Series. self aligning with replaceable ball bearings, $22.50 net. VIF INTERNATIONAL, Box 1555, Mtn. View, Ca. 94040.

PARTS—for SPOTMASTER cartridge units. IN STOCK, Immediate delivery, new and used equipment, too! LOW PRICES. COMMUNICATION MEDIAS, Box 54, Allentown, PA. 18105. (215) 437-0607 or 437-9447.

Surplus Audio Patch Panels All Standard Configurations. Gulf Telephone & Electronics, Inc. 6235 Beverly Hill, Houston, Texas 77027.

EQUIPMENT WANTED

Wanted—type approved microwave system to pass color. Respond to Box 4371, Inglewood, CA. 90309.

RCA TR-60 or AMPEX used videotape recorders. Call (904) 354-2806. Engineering, WJCT-TV, Jacksonville, FL.

PROGRAM SERVICES

"Free" Catalog . . . Everything for the deejay! Comedy, books, aircheks, wild tracks, old radio shows, and more! Write: Command, Box 26348-A, San Francisco 94126.

Deejays! New Comedy! 11,000 classified one-line gags, $10. Catalog FREE! Edmund Orrin, 2786-M West Roberts, Fresno, CA. 93705.

JINGLES, STATION I.D.s, ANNOUNCE SPOTS. Major market quality at bottom dollar. Castle Productions, P.O. Box 628, Lake Geneva, Wis. 53147.

INSTRUCTIONS

FCC FIRST CLASS RADIOTELEPHONE LICENSE IN SIX WEEKS. Classes in Dallas, Atlanta, Denver, Ft. Worth, Hartford, Houston, Memphis, Nashville, New Orleans, Oklahoma City, and San Antonio. For information contact Elkins Institute, 2727 Inwood Rd., Dallas, Tex. 75235 214/357-4001.

ATTENTION VETERANS! First class license in five weeks with complete theory and R.C.A.equipped laboratory training. Approved for veterans Tuition $333.00. Housing cost $16.00 per week. American Institute of Radio, 2622 Old Lebanon Road, Nashville, Tenn. 37214. 615-889-0469.

First phone through tape recorded lessons at home plus one week personal instruction in Washington, D.C., Atlanta, Boston, Detroit, New Orleans, Minneapolis, Seattle, Denver, Portland, Los Angeles. Proven results. Our 17th year teaching FCC license courses. Bob Johnson Broadcast License Training, 1060D Duncan, Manhattan Beach, Calif. 90266. 213-379-4461.

PROFESSIONAL CARDS

COHEN & DIPPELL
CONSULTING ENGINEERS
Formerly GEO. C. DAVIS
527 Munsey Bldg.
(202) 783-0111
Washington, D. C. 20004
Member AFCCE

JANSKY & BAILEY
TeleCommunications Consulting
Department
CATV & CCTV
Phone 703/354-3400-ext. 722 or 2400
Shirley Hiway at Edsall Road
Alexandria, Virginia 22314
Atlantic Research Corporation

PROFESSIONAL CARDS (cont)

CHU ASSOCIATES, INC.
Telecommunications Division
AM—FM—TV—CATV
Applications—Facilities Planning
Field Surveys and Proofs
Appraisals
800 Fesler St., El Cajon, Ca. 92020
(714) 442-9459
TWX 910 331 1178

VIR JAMES
CONSULTING RADIO ENGINEERS
Applications and Field Engineering
Computerized Frequency Surveys
345 Colorado Blvd.—80206
(303) 333-5562
DENVER, COLORADO
Member AFCCE

BROADCAST STUDIO DESIGN
Control Systems, Facilities Planning, Plant Layout & Manufacturing
DYMA ENGINEERING, INC.
Route 1, Box 51, Taos, New Mexico 87571
Phone: 505/758-2686

RALPH E. EVANS ASSOCIATES
Consulting Radio Engineers
AM - FM - TV - CATV - ITFS
3500 North Sherman Blvd.
MILWAUKEE, WISCONSIN 53216
Phone: 414-442-4210

McCLANATHAN & ASSOCIATES
Consulting Engineers
APPLICATIONS & FIELD ENGINEERING
TURNKEY INSTALLATIONS — RADIO & TV
Domestic and Foreign
P. O. Box 750
PORTLAND, OREGON 97207
Phone: 503/246-8080

BM/E
Classified Advertising Dept.
Blue Ridge Summit, Pa. 17214
717—794-2191

Please run the ad attached in BM/E s CLASSIFIED MARKETPLACE:

☐ 12 issues ☐ 6 issues
☐ 3 issues ☐ 1 issue

in a space of ..... inches .....
words under the classification of:

.....

From:

Name .....

Station or Co. .....

Address .....

City .....

State ..... **Zip** .....

USE BM/E's CLASSIFIED MARKETPLACE TO REACH OVER 28,000 BROADCASTERS!

ADVERTISERS' INDEX

SALES OFFICES

Broadband Information Services, Inc.
274 Madison Avenue
New York, New York 10016.

EASTERN STATES
274 Madison Avenue
New York, New York 10016
212-685-5320
Charles C. Horner

MIDWESTERN STATES
New York Office

WESTERN STATES
1111 Hearst Building
San Francisco, California 94130
415-362-8547
William J. Healey

16400 Ventura Blvd.
Encino, California 91316
213-981-0611
Art Mandell

JAPAN
Nippon Keisoku Inc.
P.O. Box 410
Central Tokyo, Japan
Tokyo (03) 667-7681
Yoshi Yamamoto

BM/E READER SERVICE CARD / January 1974 Issue

Use this FREE postpaid card for more information on the products described.

NAME ..... TITLE .....

STATION OR COMPANY .....

ADDRESS .....

CITY ..... STATE..... ZIP .....

100-249: ADS / 250-299: LIT / 300-450: EDITORIAL

TELL US WHAT YOU LIKE OR DISLIKE ABOUT THIS ISSUE:

.....

.....

WHAT ARTICLES WOULD YOU LIKE TO SEE?

.....

.....

USE UNTIL APRIL 30, 1974

00 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135
36 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171
72 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207
08 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243
44 245 246 247 248 249
250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279
80 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299
300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315
16 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351
52 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387
88 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423
24 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450

BM/E READER SERVICE CARD / January 1974 Issue

Use this FREE postpaid card for more information on the products described.

NAME ..... TITLE .....

STATION OR COMPANY .....

ADDRESS .....

CITY ..... STATE..... ZIP .....

100-249: ADS / 250-299: LIT / 300-450: EDITORIAL

TELL US WHAT YOU LIKE OR DISLIKE ABOUT THIS ISSUE:

.....

.....

WHAT ARTICLES WOULD YOU LIKE TO SEE?

.....

.....

USE UNTIL APRIL 30, 1974

00 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135
36 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171
72 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207
08 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243
44 245 246 247 248 249
250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279
80 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299
300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315
16 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351
52 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387
88 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423
24 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450

COMPLIMENTARY SUBSCRIPTION QUALIFICATION CARD

1. I would like to receive BM/E ☐ Yes ☐ No
   I would like my copies to include CM/E ☐ Yes ☐ No

2. My company is: (Please check ALL items which pertain to your firm.)

☐ AM Station(s)
☐ FM Station(s)
☐ TV Station(s)
☐ Instructional TV or CCTV
☐ Campus Limited Radio
☐ CATV Facilities
☐ Telephone Company
☐ Program Sources
☐ Recording Studios
☐ Government
☐ Consultant
☐ Lawyer
☐ Distributor/Manufacturer dealer
☐ Other (please specify) .....

3. Are you responsible for more than one station or facility?
☐ Yes ☐ No

4. My primary area of responsibility is: (Please check one)

☐ Corporate Management
☐ Engineering & Engineering Management
☐ Operations Management
☐ Station, Production or Program Management
☐ Other (please describe)

5. Your signature .....

Title ..... Date .....

Name ..... Title .....

Station or Co. .....

Street .....

City ..... State ..... Zip .....

If this is an address change, affix label

Is this your business address? ☐ Yes ☐ No

If not, please give us your business address below so that we can avoid sending duplicate copies.

Name .....

Station or Co. .....

Street .....

City ..... State ..... Zip .....

BUSINESS REPLY MAIL

NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

FIRST CLASS
Permit No. 665
Duluth, Minnesota

POSTAGE WILL BE PAID BY

BME
BROADCAST MANAGEMENT ENGINEERING
CME
CABLE MANAGEMENT ENGINEERING

Broadband Information Services, Inc.

P.O. BOX 6058

Duluth, Minnesota 55806

BUSINESS REPLY MAIL

NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

FIRST CLASS
Permit No. 665
Duluth, Minnesota

POSTAGE WILL BE PAID BY

BME
BROADCAST MANAGEMENT ENGINEERING
CME
CABLE MANAGEMENT ENGINEERING

Broadband Information Services, Inc.

P.O. BOX 6058

Duluth, Minnesota 55806

BUSINESS REPLY MAIL

NO POSTAGE STAMP NECESSARY IF MAILED IN THE UNITED STATES

FIRST CLASS
Permit No. 665
Duluth, Minnesota

POSTAGE WILL BE PAID BY

BME
BROADCAST MANAGEMENT ENGINEERING
CME
CABLE MANAGEMENT ENGINEERING

Broadband Information Services, Inc.

P.O. BOX 6056

Duluth, Minnesota 55806

Why our time base correctors should be the apple of your eye

roven Flexibility in Standalone ime Base Correctors

Regardless of your VTR—power line-cked, capstan servo'd/V-locked, or -locked—our Delta Series Time Base rrectors and Hue Shift Correctors fer standalone processing of all color gnals—either NTSC direct, "NTSC-pe" or heterodyne "color under." And monochrome—either RS-170 or RS-30 industrial sync.

Offering the best economy and flexi-lity, the Delta 44-328 HETROCOLOR™ BC works with all types of monochrome nd color VTRs. Particularly in cassette TRs without our TBC, the color tape will e a long way from FCC acceptance. Aside om independently varying sync and sub-rrier frequencies, editing capabilities e marginal. The HETROCOLOR TBC is e only unit on the market that allows ansfer of heterodyne record VTR signals a broadcast VTR. Second generation layback of this tape through the TBC rrects the color signal for broadcast ith clean electronic splices.

For the best cost/performance pack-ge in the business, select the stand-lone Delta 44-200 NTSC Direct Color BC coupled with the Delta 7 VELCOR ue Shift Corrector for the finest in roadcast color processing.

And if you're staying with monochrome mewhere in your system, our Delta 4-028 TBC combines broadcast specs ith our lowest price.

For more flexibility, we've added the elta 23/3.58MHz subcarrier generator s an accessory to the Delta 44-328 TBC r combined outputs that are the equiva-nt of a broadcast stable NTSC color nc generator.

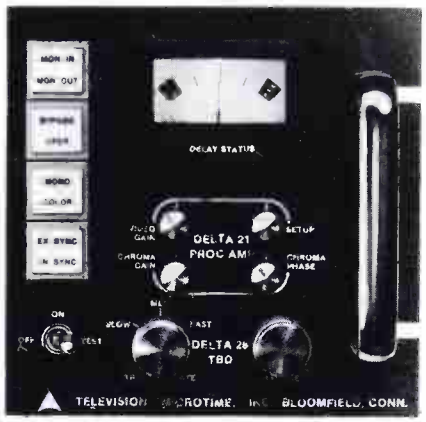
Exclusive Features of Our Growing TBC Family

Optimized Design. Of the several ways to eliminate time base error generated by all VTRs, we primarily use binary related delay lines which are switched in or out of the signal path at line rate. This technique offers the highest output performance looking at all the critical specifications of signal to noise ratio, bandwidth, differential phase and differential gain. There is no tampering with the visual portion of the picture. There is no contouring and quantizing noise as in digital techniques, or differential phase/gain variation as in EVDL techniques.

Velocity Error Corrector. In NTSC direct playbacks from 1" helical and all quad VTRs, color streaking (velocity error) is another problem that must be solved when either interchanging tapes or dubbing through several generations. Adding our Delta 7 VELCOR™ Hue Shift Corrector in front of any broadcast quality TBC, you get faithful color reproduction as well as imperceptible time base jitter throughout the entire picture.

Universal Color Corrector. In "NTSC-type" and "color under" playbacks from ½", ¾" and 1" VTRs, all you need is our exclusive HETROCOLOR TBC, despite the wide variety of color recording and recovery techniques.

Full Proc Amp. All Delta Series TBCs have a built-in Delta 21 proc amp with front panel controls for video gain, set-up, chroma gain, and chroma phase. The plug-in Delta 28 with front panel controls for gen-lock tracking rate and H-phase timing is included in all Television Microtime models working with less sophisticated VTRs.



TMI's exclusive built-in Delta 21 proc amp and Delta 28 TBD.

Front Panel Switches. All our TBCs have illuminated front panel switches to provide easy selection of operating modes. These include separate monitor and program video outputs on separate in/out and operate/bypass switches. A failsafe program bypass exists to handle power loss.

Experience is Our Guide

We introduced the first of our Delta family at the Chicago NAB Show in April 1972 and delivered our first production unit to the University of North Carolina two months later. In March 1973 at the Washington NAB Show we introduced two additional TBC models, the Delta 7 Hue Shift Corrector and several accessories. We are now delivering this family of products that work with the whole spectrum of VTRs from ½" helical to 2" quad.

But our experience goes back even further. In addition to developing custom TBC products for the networks, we've been supplying delay lines to Ampex Corporation who builds them into the full line corrector in their AVR-1 Teleproduction Recorder.

Look at Who Has What in Time Base Correctors

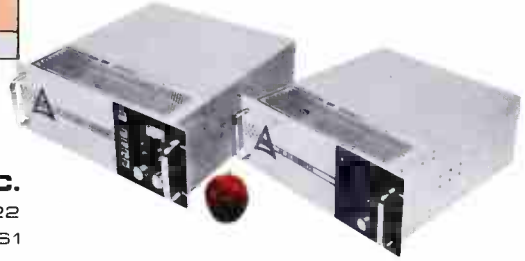
Review the chart then call us for a demonstration. We're sure you'll be as pleased as our many customers are—in every segment of the television industry—broadcast, CATV, education, medicine, industry, research, government, and OEM. Contact us. Television Microtime.

	Ampex	RCA	IVC	TMI	CVS
MONO All Mono VTRs				44-028	
COLOR ½" line/V-lock				44-328	*502
¾" line lock				44-328	*502
1" line lock				44-328 7-001	*502
1" V-lock TBC				44-328 or 44-200 (with 14)	500
HSC				7-001	
1" H-lock TBC	790		4102	44-328 or 44-200	500
HSC	VELCOMP (Optional built-in)			7-001	
2" Quad TBC	AMTEC COLORTEC PROC AMP	ATC CATC PROC AMP		44-200 or 44-328	500, If VTR has AMTEC or ATC
HSC	VELCOMP	CAVEC		7-001	

*Announced last June (ask CVS about availability — and specs)

How do you like them apples?

AVAILABLE FROM LEADING TELEVISION DISTRIBUTORS THROUGHOUT THE UNITED STATES AND CANADA.

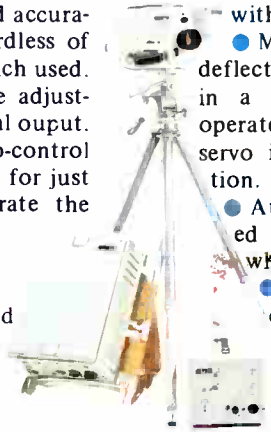


See our newest HETROCOLOR TBC and accessories at NAVA.

TELEVISION MICROTIME, INC.
1280 Blue Hills Ave., Bloomfield, Conn. 06022
(203) 242-0761

Circle 151 on Reader Service Card

The lightest, most flexible compact color TV camera system for broadcast use yet. A three-tube mini-system, the ASACA ACC-5000 camera and back pack together weigh only 11 kilos (24 lbs). It's a portable designed with emphasis not only on mobility, but also on dependability and accuracy of color output regardless of the conditions under which used. Automatic white balance adjustment. Optimal color signal ouput. The self-adjust and auto-control systems make it possible for just about anybody to operate the ASACA ACC-5000.



Features . . .

- Diminutive camera head is easy to hold and highly flexible. The unit is particularly suitable for relaying outdoor news events, interviews and sports programs.
- Self-adjust system facilitates quick set-up. Color adjustment and operation being extremely simple, practically anyone can handle the unit with ease.
- Motor driven 6X zoom lens and deflection optical system integrated in a single body. The electrically operated zoom drive is capable of servo iris control to expedite operation.
- Automatic white balance adjusted merely by pressing the auto-white button.
- Perfect NTSC (PAL)* signal output permits direct connection to a VTR.
- Gen-lock capability via external sync allows parallel camera operation and centralized control.
- Camera cable can be extended up to 300 meters from the control box.
- Camera can be powered by either a regulated power supply in the control box or by a battery.

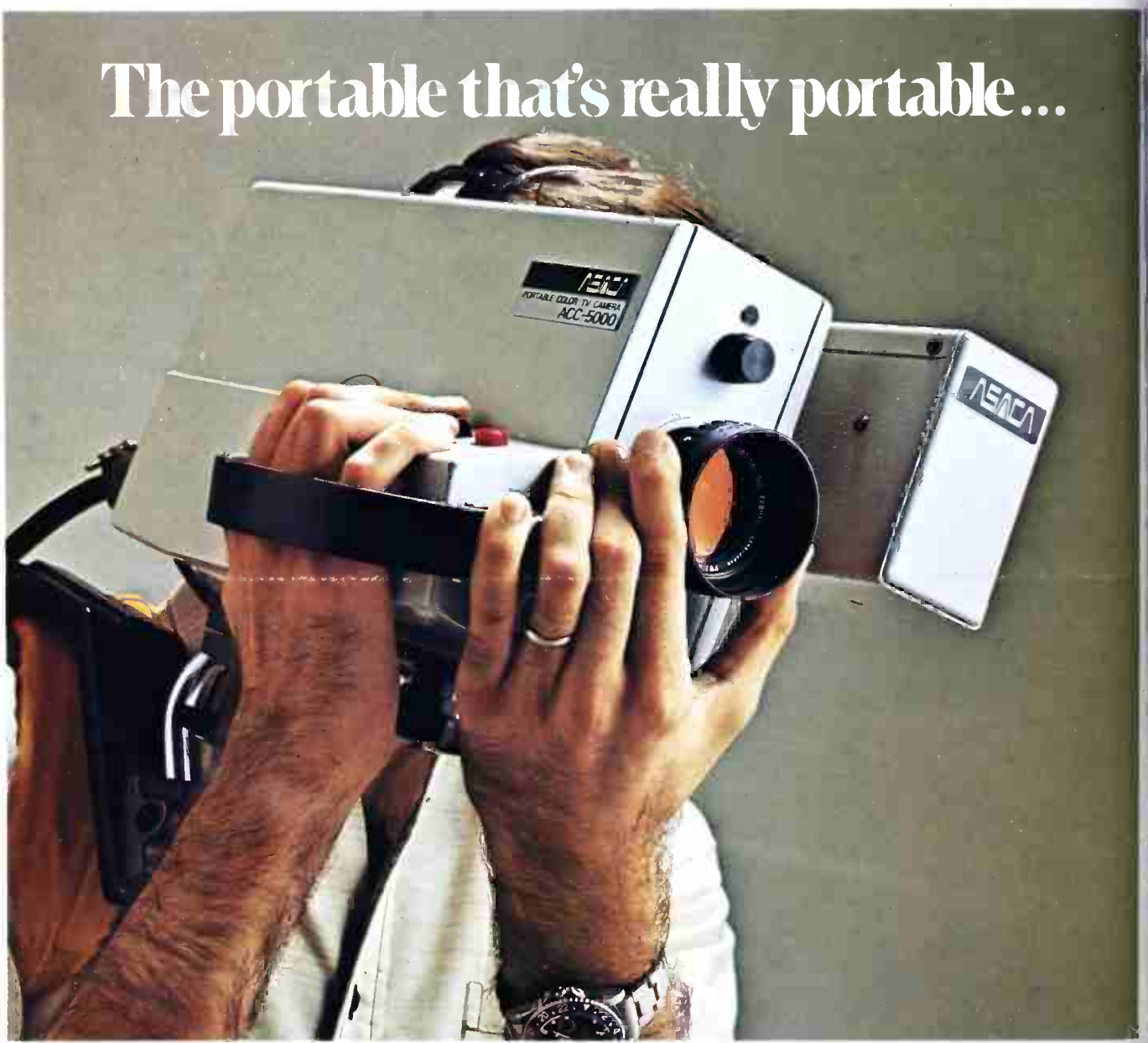
WE CREATE CHANGE

ASACA®

ASACA CORPORATION, TOKYO, JAPAN
3-2-28, Asahigaoka, Hino-City, Tokyo, Japan
Phone; 0425-83-1211, Cable; ASACA HINOTOKYO
ASACA CORPORATION OF AMERICA
1289, Rand Road, Des Plaines, Illinois, 60016, U.S.A.
Phone; 312-298-4380

PORTABLE COLOR TELEVISION CAMERA SYSTEM ACC-5000

The portable that's really portable...



ACC-5000 has been awarded the 26th MPTES (Motion Picture and Television Engineering Society of Japan, Inc.) Prize, and ADACHI Prize of The National Association of Commercial Broadcast in Japan.

Circle 152 on Reader Service Card