

BROADCAST ENGINEERING

Vol. 1, 1978/\$2.00

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BROADCAST ENGINEERING

The journal of the broadcast-communications industry



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About the cover

This month's cover depicts a lighting situation that's not so unique to television. For other production improvement ideas, be sure to read our lighting feature on page 37. (Cover photos by Ron Whittaker.)

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EDITORIAL

- Ronald N. Merrell, *Editorial Director*
- Michael Schelbach, *Managing Editor*
- Ron Whittaker, *Production Spotlight*
- Howard T. Head, *FCC Rules*
- Joe Roizen, *Video*
- Peter Burk, *Radio Workshop*
- Dennis Ciapura, *Audio*
- Robert A. Jones, *Facilities*
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- Dudley Rose, *Graphic Designer*

CIRCULATION

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ADMINISTRATION

- George H. Seferovich, *President*
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ADVERTISING SALES

- Jan Winters, *Production*
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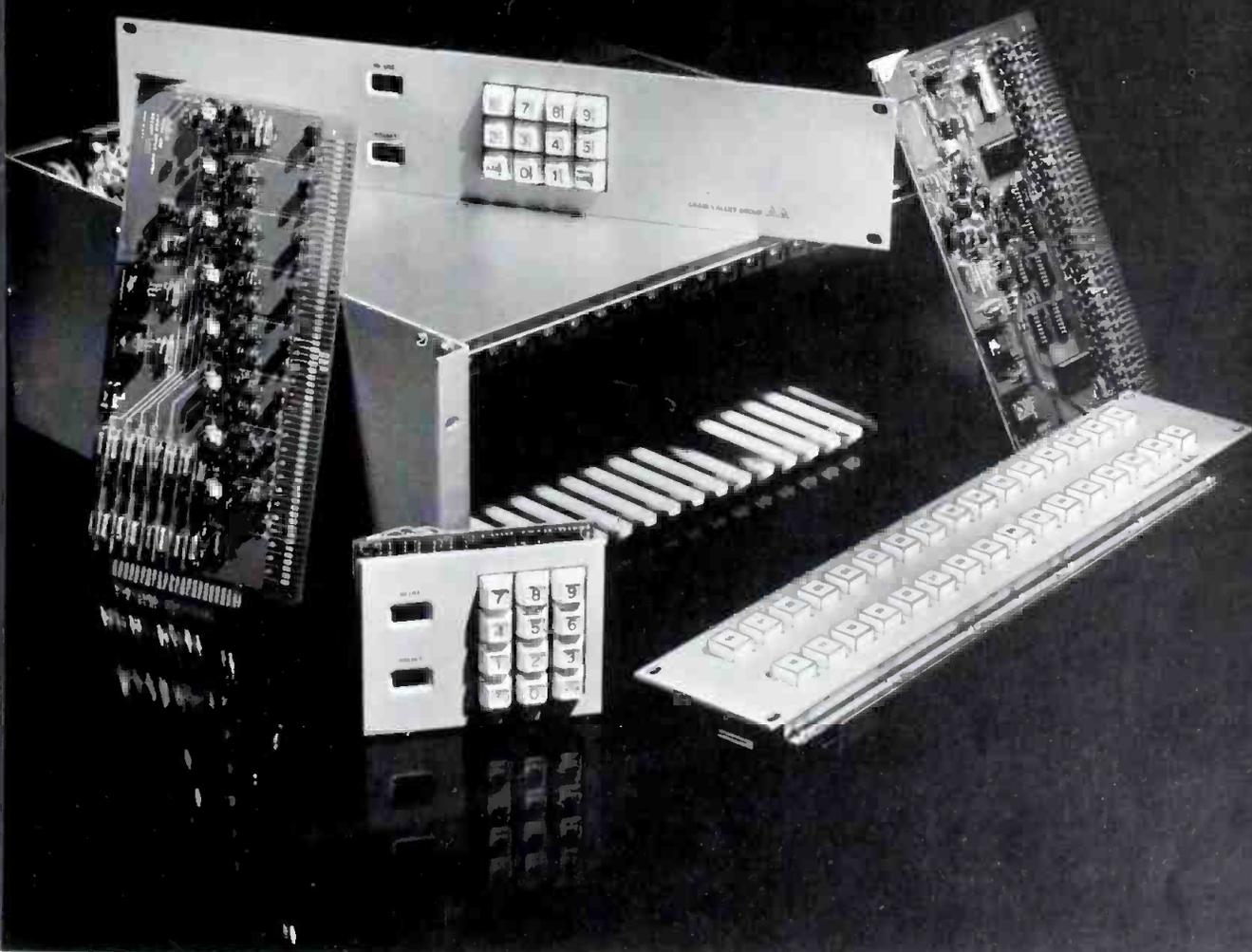
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DIRECT CURRENT FROM D.C.



April, 1978/By Howard T. Head and Harold L. Kassens

FCC application processing

When the FCC announced a freeze on the filing of AM and FM applications for new stations or major changes commencing July 1, 1976, they were inundated with 256 AM and 277 FM applications in the month of June 1976 alone. On July 1, they found themselves with a total of 1,287 pending applications. As of January 30, 1978, there were 483 AM and 601 FM, for a total of 1,084 either being worked on or awaiting action. Since the freeze, the overworked processing staff has averaged four engineers on AM and two on FM. As for FM, the situation is quite encouraging because those applications filed late in 1977 are now being processed by the engineers.

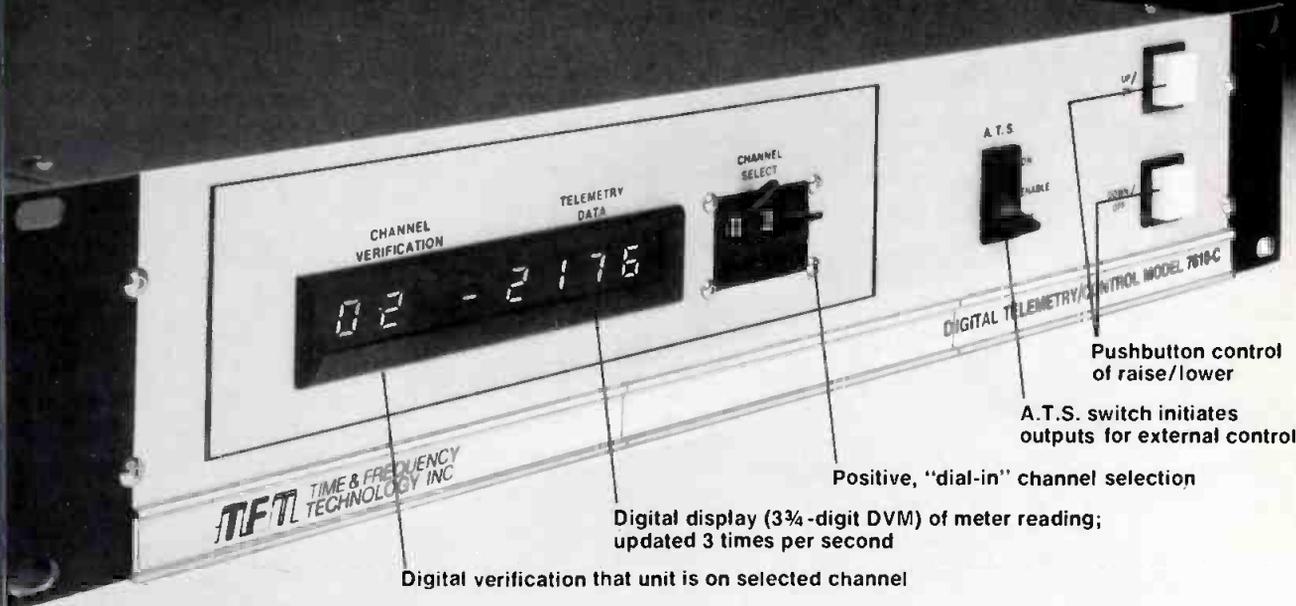
For AM, the situation is a bit more difficult. With a stack of 483 applications staring them in the face, the situation could be conservatively characterized as hopeless. However, a task force of five additional engineers has been added to processing for 60 days in an effort to get beyond those filed through June 30, 1976. Once past that point, the six-month freeze will take the staff up to those filed after January 1, 1977. There have only been 115 AM applications filed since then and 82 of these involve daytime operation only. We wish the staff all our best, but we'll retain the prediction we made in July, 1976: The last application will be disposed of shortly after 9:30 a.m. Monday, February 26, 1979!

Ford stereo installations

In comments submitted to the FCC in the AM Stereo Docket (No. 21313) the Ford Motor Company has revealed the ratio of monaural to stereo factory radio installations for recent model years (stereo is defined as AM/FM stereo radio, stereo cassette, or quadraphonic cassette). The percentage climbed from 30% in 1973 to 60% in 1977. The company indicates a definite growth pattern in public demand for stereo automobile radios and signifies its interest in offering AM stereo.

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Digital remote control, priced like analog

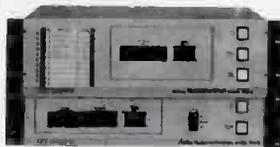


Now you can have ten channels of raise/lower and telemetry in a digital remote control system — the TFT 7610 — that costs only a little more than the most basic analog systems.

With the 7610, you don't have to twiddle calibration knobs or interpolate from meter scales. Instead, you get a positive, unambiguous data display. In addition, you get BCD (digital) outputs that make the 7610 compatible with computer and ATS systems. Most importantly, with TFT digital designs, you get increased data accuracy and fewer errors because of special closed loop data verification.

Along with a low price and digital convenience, the 7610 also gives you convenience features you'd expect to find only in much more expensive systems, if you find them at all.

Calibration, for example, can be done on site by one man. And unique, quick-disconnect barrier strip boards allow you to remove the equipment from the rack without interrupting any of the wiring to the transmitter or sampling points.



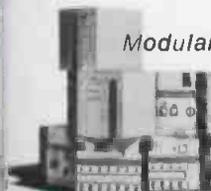
Model 7610 control point (bottom) and remote point modules.

You also have your choice of interconnect setups: telephone lines, STL and SCA or TSL. Data is transmitted via pulse code modulation (PCM) and data modems are built-in.

Modular versatility is another advantage, and a TFT exclusive. For example, when and if you want, you can add up to 60 more channels of telemetry and raise/lower, in 20-channel increments. Or, mate the Model 7610 with our Model 7615 Status Monitoring and Direct Control unit. That will give you direct on/off control and status monitoring — up to 30 channels of each. You can add modules at any time in the field.

So, whether you're upgrading an existing system or starting from scratch, specify TFT for remote control. It could be the start of something big.

For details and a demonstration, contact your TFT representative or call the factory. In Canada: Caldwell A/V Equipment Co., Ltd., Toronto (416) 438-6230.



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DIRECT CURRENT FROM D. C.

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Marconi anniversary

In January 1903, President Theodore Roosevelt and King Edward of England exchanged greetings in messages sent by Guglielmo Marconi with his 36 kW rotary gap station on Cape Cod. In celebration of the 75th Anniversary, the FCC authorized the Town of Barnstable Amateur Radio Club to operate a special event station with the call letters KMLCC (Marconi used the call "CC"). The station was authorized to transmit telegraph signals with a 240 Hz tone to simulate the sound of the old rotary spark.

FCC bans linears

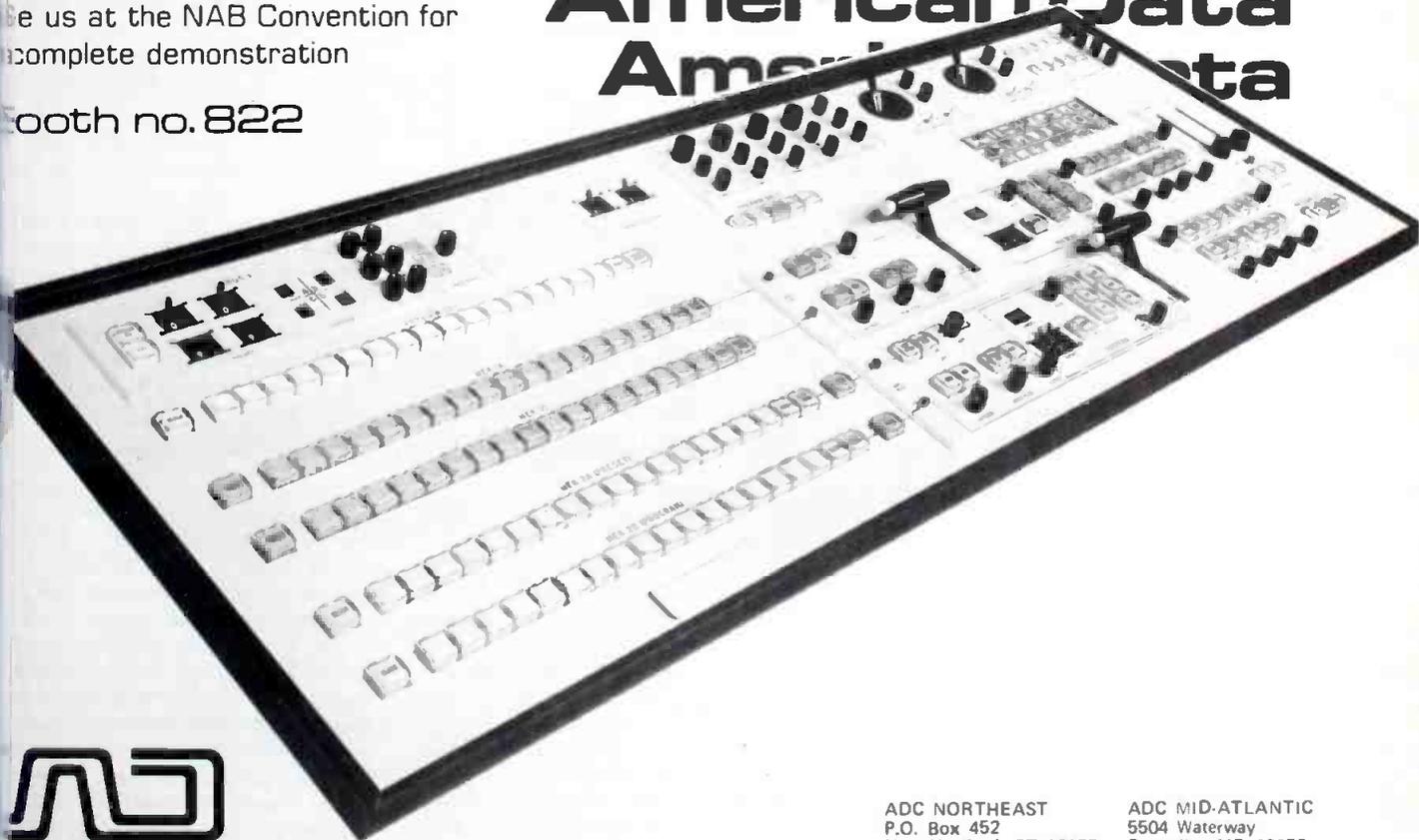
The commission has voted to prohibit the marketing of RF linear amplifiers capable of operation on any frequency from 24 to 35 MHz, particularly in the amateur and CB services. The FCC used this as its way of trying to reduce CB interference to television receivers. They claim that the majority of interference is the result of CBers using modified 1 kW amateur linears. Industry sources suggest that linears for the amateur bands will continue to be manufactured, but will have an internal device to prevent operation from 24 to 35 MHz.

Short circuits

A market research study under FCC contract reveals that there is a CB user in 18% of U.S. households and this may grow an additional 40%...The FCC has decided against adopting rules relating to the carriage of radio stations on cable systems...The rule requiring aural modulation monitors which are calibrated for 125% positive peaks has been stayed indefinitely...The FCC reports that the number of amateur licensees grew by 13% in 1977. A total of 328,648 were licensed by the end of 1977...In a recent order, the commission once again stated that each day a violation continues is a separate violation and not just one continuing violation. Thus, they can tack on additional fines when corrective action is not taken...The commission cautioned ship licensees against purchasing and installing marine transceiver crystals. The rules prohibit the licensee from making any modification of the transmitter...The commission has prohibited radio transmissions by ship radio stations "when the vessels are on land." The commission noted that this restriction would not apply to vessels "run aground or in repair drydock."

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industry NEWS

Wasilewski defends broadcast industry

Responding to recent criticisms and federal proposals relating to the broadcast industry, Vincent Wasilewski, NAB president, told the Federal Communications Bar Association that "broadcasters are not pleading poverty, but neither will we sit back and suffer broadsides about how good we've got it."

Noting that some criticize industry profits, Wasilewski cited FCC statistics for 1976 which showed that 1,677 commercial radio stations operated at a loss; independent FM radio registered more stations with

operation losses than gains; and one-third of UHF television stations and nearly 10% of VHF stations reported losses.

In his wide-ranging address, the NAB president also spoke on implications for broadcasters of pending or recently considered proposals, and the size and scope of the industry.

He specifically mentioned proposals which would restrict or prohibit commercials for saccharin products, over-the-counter drugs, snack foods, and toys. Another

proposal would require broadcasters to pay additional fees recording artists and record companies. The defeat of the performers' royalty is one of NAB's priorities, Wasilewski said.

Commenting on the size of industry, Wasilewski pointed out that two-thirds of all radio stations have less than 10 employees. "though the broadcasting industry massive in terms of outreach, numbers of employees it hardly qualifies as 'big business,'" said.

Canadian government re-introduces communications legislation

The Canadian government has re-introduced communications legislation aimed at streamlining federal regulation of communications to make it more responsive to technological change and to provincial concerns.

The legislation, to be known as the Telecommunications Act, is virtually identical to Bill C-43, which was introduced in March 1977. Although a number of changes have been made, the amendments do

not alter the nature and intent of the original legislation.

The new legislation will clarify and consolidate existing federal legislation. It will replace four existing statutes and parts of two others by a single body of national telecommunications law.

The act will establish a clear demarcation between the functions and responsibilities of the government and the Canadian Radio-television and Telecommunications Com-

mission (CRTC). It also contains provisions by which policy and delegation agreements with provincial governments can be implemented.

Under the Telecommunications Act, the CRTC will continue to regulate and supervise the activities of all broadcasting undertakings in Canada, as well as those telecommunications common carriers which are subject to federal regulation.

Kentucky to establish fiber optic video system

The Commonwealth of Kentucky has awarded a turnkey contract to Times Fiber Communications Inc. for a commercial fiber optic video system.

The system will be part of the statewide communications network called the Kentucky Emergency Warning System (KEWS). This network will be used by state and local officials, state police, and the state's educational TV network for disaster notification and emergency communications.

The basic system is of the analog type, with the inherent capability for future expansion in both analog

and digital modes. The contract calls for the installation of 20 miles of Times Fiber Communications' optical fibers.

The Times Fiber installation, which will serve two key sites within the Kentucky network, will be a total communications system providing two-way multi-channel baseband video links via optical fibers, as well as voice communications using conventional audio cable.

According to J. Paul Warnecke, KEWS coordinator for Kentucky, "The statewide communications system which Kentucky is now developing will be the most complete facility

of its kind in the nation. As we assessed our communications needs and examined the options available to us, it became evident that use of fiber optics within our system would be the most technologically sound and most cost-effective way to proceed. In addition, an optical fiber system of the kind designed by Times Fiber Communications has advantages of easy interface with other portions of the statewide network, a superior broadcast quality video signal, and a unique capability for future expansion as new technology becomes available."

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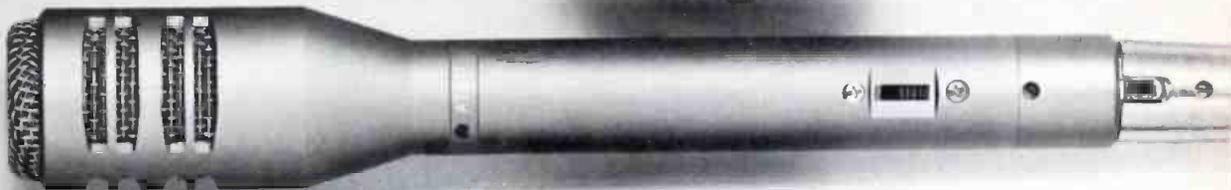
Audio-Technica introduces five new microphones... and a pleasant surprise.



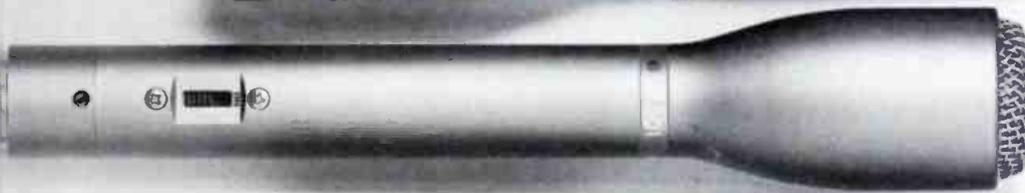
AT813
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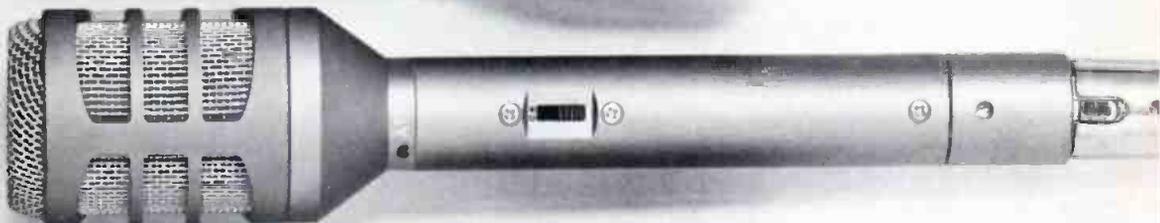
AT811
Electret
Condenser
Cardioid



AT801
Electret
Condenser
Omnidirectional



AT812
Moving Coil
Dynamic
Cardioid



AT802
Moving Coil
Dynamic
Omnidirectional



Take a close look at these new Audio-Technica microphones. Three electret condensers and two dynamics. Two clip-on miniature electrets (not shown). All are superbly finished. Carethought out in every detail. With the "heft" and feel. Professional A3M aircraft output connectors, of course. Then listen in your studio. Full-range, peak-free, clean and crisp. With

no distortion even when used close-up to high-level performers. And the balanced, phased Lo-Z (600 Ohm) output matches pro and semi-pro mixers alike.

Now for the surprise. The price. Both omnis are nationally advertised at just \$60, for either dynamic or electret condenser element. The two basic cardioids are just \$80, while the AT813

electret condenser with integral wind-screen is pegged at \$95. All complete with full one-year warranty.

Once you've seen and tried these new Audio-Technica microphones we think you'll welcome them. Not just because they cost so little...but because they do so much. Available now from your Audio-Technica Professional Products dealer.



audio-technica *Great sound. right from the start!*



The fire, earthquake, election and touchdown company now brings you love scenes in Studio Two.

The new HK-312 studio camera from Ikegami, the ENG experts.

Wherever there's been news, from natural disasters to national elections to sport events, Ikegami ENG cameras have been there with the news teams.

Ikegami makes news of its own: the introduction of our new state-of-the-art HK-312 studio and camera.

We've built ENG cameras so good in the rough-tumble of news-gathering that more Ikegami ENG cameras are in use than all others combined.

Imagine how good an Ikegami camera can be in the stable environment of a studio.

Very good indeed.

Ikegami's new HK-312 color-TV camera is like no other. It has built-in minicomputer that trims the daily camera checkout from a one-hour

deal to an automatic through that's faster than a 20-second

commercial. With its auxiliary computer, you'll be able to cycle the Ikegami HK-312 (and up to 10 other Ikegami HK-312 cameras linked to it) through every adjustment parameter in under 30 minutes: white balance, black balance, flare correction, gamma correction, video gain, beam alignment, and eight registration functions.

All this before you start shooting. The HK-312 gives you three 30-mm Plumbicon tubes for highest picture quality. You frame your shot on a high-intensity, high-resolution, seven-inch variable viewfinder. Signal-to-noise ratio is better than 54 dB.

We've combined the zoom lens and camera tube in a single rigid assembly for highest accuracy of optical axis. Class-A deflection amplifiers assure maximum linearity and best picture quality. Black balance correction is automatic. Picture quality and brightness are maintained in spite of flare.

A complete two-line image enhancer provides horizontal and vertical detail correction. A special comb filter keeps background noise to a minimum.

All this and a lot more.

If your budget or production requirements are smaller, use our tried-and-tested TK-355 studio camera. Five were used for network feed at the 1976 Democratic National Convention where camera failure would blow a lot more than a few fuses.

Camera-control unit for the HK-312

The TK-355 uses three 25-mm Plumbicon tubes which are bias-lighted for reduced lag at low lighting levels. This reduces studio lighting and air conditioning power consumption. And the camera is more compact and lighter, a little easier to maneuver. The unique half-rack CCU facilitates multi-camera studio installations.

Both broadcast cameras use TV-81 minicable for ease of handling.

If you need a small, fixed-position camera for announcer booth and news-casting, check out the Ikegami HK-309. It can be operated remotely or simply turned on and left in fixed position.

For movies, the Ikegami TK-950 is a large-image film-chain broadcast camera system for 16-mm or 35-mm film or slides with highest quality color reproduction. Much of its operation is automatic, requiring a minimum of engineering support. Its unique optical system is dust-shielded and unusually compact.

Ikegami has been famous for its ENG cameras for a long time. Now take a look at what we can do with studio cameras. For specs or a demonstration, get in touch with us. We have nationwide distribution.

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news

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continued from page 8

Radio Programming Conference scheduled

Radio program directors will receive the most up-to-date information on radio programming at the upcoming NAB Radio Programming Conference, scheduled for August 20-23 at the Hyatt Regency Hotel, Chicago.

Program directors will have an opportunity to discuss various program formats with experts, as well as talk with editors of radio trade publications during a two-way press conference.

In addition, producers will be displaying all that is available in music, syndicated, and pre-recorded programming.

The conference will be open to program directors, operation managers, program syndicators, and general managers. Registration fee is \$125 for NAB members and

associate members, and \$200 nonmembers. Forms will be mailed May 1.

NAB joint meeting with Canadian broadcasters

The first joint meeting of the National Association of Broadcasters' and the Canadian Association of Broadcasters' boards of directors is scheduled for Thursday, June 29, in Toronto, Canada.

The meeting will cover the regulatory communications policies of the two countries, technological developments, cable television, pay television, copyright, the 1979 World Administrative Radio Conference (WARC), and social issues affecting both.

The agenda for the joint meeting was announced by Donald Thurston, NAB joint board chairman, following a meeting of executives from both associations held in Montreal on February 20.

continued on page

Log Entries

April

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

12—EIA/DPD, eastern region meeting, New York.

19-21—Kentucky Broadcasters Association, annual convention, Louisville.

24-26—Electronics Component Conference & Design Engineers Electronic Components Conference. Anaheim, California.

May

1-3—Advisory Group on Electron Devices & the Electron Devices Society of the IEEE, 1978 Microwave Power Tube Conference. Naval Postgraduate School, Monterey, California.

5-6—SESAC, 6th annual gospel radio seminar. Airport Hilton, Nashville.

8-10—International Institute of Noise Control Engineering, 7th International conference. Jack Tar hotel, San Francisco.

15-19—IEEE Antennas and Propagation Society, 1978 international symposium. University of Maryland, College Park, Maryland.

16—New Hampshire Association of Broadcasters, sales seminar, New England Center, Durham.

19-20—Public Radio in Mid-America, spring meeting. Hilton Plaza Inn, Kansas City, Missouri.

20-22—Second Annual International Light and Sound Show. Sheraton Atlanta hotel, Atlanta.

30-June 1—Euro Comm 78, communications conference. Copenhagen.

June

5-7—National Bureau of Standards and National Institutes of Health, 3rd international symposium on ultrasonic imaging and tissue characterization. Galthersburg, Maryland.

5-8—IEEE, industrial and commercial power systems conference. Stouffer's Cincinnati Towers, Cincinnati.

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Will "NTSC" COLOR and sync of low cost VTR's.

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No matter how a slide or scene comes in, you can compress and/or change its aspect ratio as you wish, down to one picture element, and position it anywhere on the screen.



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GENERATE your own effects with Vital's pre-programmed micro-processor.

Record 4 pictures on one recorder and play back any one full screen with no perceptible degradation.

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Or up to 4 Channels in One



You will not be locked out with one video channel "Squeezoom." Add other channels as you wish. Too many exciting features and applications to describe. Call us toll free 1-800-874-4608.



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■ **ANSWER** is automatic.

Ideal for continuous surveillance at remote transmitter and earth station sites. **ANSWER** requires no operator attention, thus reducing training requirements, and freeing engineering personnel for more pressing tasks!

■ Minimizes need for out-of-service system evaluation.

Performance of your system over its entire dynamic range may be easily determined in-service. **ANSWER** not only measures signal average picture level, but may be programmed to instantaneously run a complete measurement routine when a specified APL condition occurs.

■ Fast identification and warning of system faults.

ANSWER provides *two* sets of programmable limits for each measured parameter. Limits set #1 can trigger data logging; limits set #2 can initiate data logging, activate alarms, and cause executive action such as switching to a backup line.

■ High accuracy – low maintenance.

Up to 15 dB noise reduction through digital signal averaging gives improved measurement accuracy. In addition, **ANSWER**'s all digital circuitry minimizes drift and extends the time between periodic recalibrations.

■ System compatibility.

Three RS232C interface ports are standard. An IEEE 488,1975 (GPIB) interface is available as an option.

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- Legal Signals ?
- Long-Term Performance Trends ?
- Permanent Records ?

The ANSWER...

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WRGH-TV

IN SERVICE MEASUREMENTS

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INS GAIN	-2.2	IRE
LINE TIME DIST	2.9	IRE
SHORT TIME DIST	5.0	IRE
CHROM-LUM GAIN	-6.4	%
CHROM-LUM DELAY	50.0	NS
AMP/FREQ	0.5	MHZ
	1.0	MHZ
	2.0	MHZ
	3.0	MHZ
	3.58	MHZ
	4.2	MHZ
LUM NON-LIN	-4.0	IRE
CHROM NON-LIN GAIN	-1.0	IRE
	-4.4	IRE
CHROM NON-LIN PHASE	4.7	DEG
DIFF GAIN	0.1	%
DIFF PHASE	4.6	DEG
CHROM-LUM XTALK	2.0	IRE
RANDOM NOISE	54.0	DB
REL BURST GAIN	-0.2	%
REL BURST PHASE	-0.7	DEG
SYNC GAIN	39.1	IRE
BURST GAIN	30.0	IRE
APL	41.0	%

H SYNC	4.91	US
FRONT PORCH	1.79	US
SYNC-BURST END	7.79	US
SYNC-VIDEO START	9.61	US
H BLANKING	11.40	US
COLOR BURST	9.0	CYCLES
BREEZEWAY	0.56	US
EQ PULSE	2.46	US
SERRATION	4.73	US
U BLANKING	21/20.5	LINES

You can get individual measurements or complete sets of amplitude and timing measurements on-command or continuously from ANSWER. Hard copy, such as shown here, minimizes manual logging and provides a uniform, permanent record.

Sample output is one of many possible formats.

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For Demonstration Only Circle (39) On Reply Card

There are few things in life designed like a Scully

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If there is a standard recorder in the broadcast world, the 280B is it. You'll find it wherever professional performance and reliability are a must.

Scully's 280B series offers extraordinary versatility with all the other proven Scully professional features.

The 280B... another classic performance by Scully.

For complete details, write or call Scully Recording Instruments, Division of Dictaphone Corp., 475 Ellis Street, Mountain View, California 94043, (415) 968-8389 TLX 34-5524.



Scully
Recording Instruments
For classic performance.

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news

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continued from page 12

In announcing the Toronto meeting, Thurston said, "Communications media are the vital link between our neighboring countries. We feel it is time to develop formal liaison and to share information in order to better understand others' systems. This is especially important in light of WARC '77 which will determine the allocation of the broadcasting frequency spectrum throughout the world."

The June 29 meeting will coincide with NAB's June board meeting also scheduled for Toronto.

FCC acts on prime time access rule

The method by which the top 50 television markets are determined each year for applying the prime time access rule has been revised by the FCC.

The commission said the change would provide stations in markets around the 50 mark with the opportunity for more planning and greater stability in their operation by increasing the period of advance notice that the prime time access rule would or would not apply for approximately six months to almost two years. The change also expands the period during which a given market is subject or not subject to the rule's provisions from one to three years.

The prime time access rule (Section 73.658 [k]) limits network-owned and -affiliated stations in the 50 largest television markets to no more than three hours of network and off-network (rerun) programming each evening during prime time (7-11 p.m. EST).

Under the new rule changes, the following will apply:

- Effective in the fall 1980, the three-year rather than one-year period will be specified during which a market will be either in or outside of the rule;
- A list will be issued in the spring based on the average of Arbitron audience/rating survey (swipe) data of that February and the previous February, of the top 50 markets to which the rule will apply starting in September the second year following (e.g., a list will be issued in spring 1978, reflecting the average of February 1977 and 1978 audience data, to be effective from September 1980 to September 1981).



Scotch 479 Master Broadcast

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Scotch® has been state of the art broadcast videotape for more than twenty years. It's an industry-wide fact that nobody knows tape like 3M.

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3M
COMPANY

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NAB Booth No. 3807

A Panasonic 3/4" direct-drive editing system this good is no surprise.

It doesn't make much sense to build a 3/4" editing system around two expensive editing recorders when one editing recorder and one less expensive player/recorder are all you really need. That's why you need the economy and direct-drive performance of Panasonic's Series 9000™ 3/4" editing system. The NV-9500 editing recorder, the economical NV-9200 player/recorder and the amazing editing controller that goes between them, the NV-A950. Together they give you the kind of performance you expect from Panasonic, along with considerable savings over comparable editing systems.

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

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

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

NV-9200

NV-A950

Under \$10,000 is.

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

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

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

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

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

Panasonic Series 9000 1/4" editing system. If its performance doesn't surprise you, its price will. For more information, write: Panasonic Company, Video Systems Division, One Panasonic Way, Secaucus, N.J. 07094. In Canada, contact Panasonic Video Systems Department, 40 Ronson Drive, Rexdale, Ontario M9W 1B5.

Panasonic

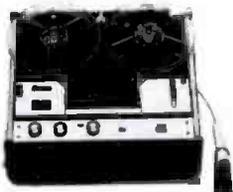
just slightly ahead of our time.



NV-9500

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BUDGET REELS



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Portable-Plus ...
7-Inch Production
Sony TC377 — \$395



Portable-Plus ...
10-Inch Production
Sony-TC 765 — \$929

Portable-Hi-Speed
10-Inch 7.5 + 15 IPS
Sony-TC 766-2 — \$989



Rack Mount 2-Track
10-Inch Complete
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news briefs

A. F. Associates receives ABC contract

A second contract from ABC for a Mobile Color Van System, referred to as Phase 8, has been awarded to A. F. Associates Inc. In addition to the usual complement of equipment, the two vans will include hand-held cameras, Slo Mo's, character generators, video frame store systems, and an audio/video switcher for program assembly and editing at remote sites. The need for additional remote broadcast equipment hastened the release of the Phase 8 contract.

Dytek Industries acquires VAMCO

Dytek Industries Inc. has acquired VAMCO Engineering of Tulsa, Oklahoma. VAMCO designs and manufactures digital videotape timers, digital clocks, and routing switchers for the broadcast industry. Gene Randall, vice president and general manager of VAMCO, said that the design and engineering capabilities of VAMCO coupled with the marketing and sales network of Dytek will add to the growth potential of both companies.

Broadcasting award announced

The Ohio State Awards Committee has presented George Jellinek, music director of WQXR in New York City, with the 1978 classical music programming award for "The Vocal Scene," a weekly radio series syndicated by Parkway Productions Inc. of Washington, DC. Singled out for the award was Jellinek's broadcast entitled "Napoleon, a Musical Saga." A one-hour program devoted to music from opera and the recital stage, it is written and narrated by Jellinek and held in high regard by listeners nationwide.

Bright future for filmmaking industry

The future for the filmmaking industry will be better than ever, due not only to technological advances, but also to increased demands for made-for-TV features and special programming. Those were the comments of Kenneth Mason, assistant vice president and general manager of Eastman Kodak's Motion Picture and Audiovisual division, who spoke recently at the Rochester (New York) Institute of Technology. Mason cited increased levels of movie production (especially on-

location) and growing box office receipts as portentous of a healthy future for the filmmaking industry. He also said that integration of technologies and their innovation will enhance visual communication in the future.

OT publishes transmission loss analysis

The Office of Telecommunications (OT) has published a theoretical analysis that will permit fiber optic designers to calculate the transmission loss in an optical waveguide due to minute bends in the waveguide. The analysis, entitled "Microbend Losses in Multimode Optical Fibers," was prepared by Allen Howard of the University of Arizona. For a copy, send \$5.25 to National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161, attn: OT Report 77-136, PB 275-387/AS.

Time and Frequency opens service center

Reshal Associates Inc. and Time and Frequency Inc. of California have established a new warranty service center in Arlington Heights, Illinois. The first of its kind for Time outside of its factory, the center will provide customers with full factory warranty and non-warranty repair and calibration service.

Videotaped microprocessor courses available

Genesys Systems Inc. is offering four seminars and three courses on microprocessors. Each of the four seminars conducted by Dr. Rodney Zaks of SYBEX includes a complete state-of-the-art survey, and provides a user-oriented "how-to" guide. These seminars and the three more comprehensive courses conducted at Colorado State University are available on videotapes, with associated workbooks and texts available for individual study. In addition, two more basic microprocessor courses are available: An Introduction to Microprocessors, and Programming Microprocessors. For more information, write: Charles Martin, Genesys Systems Inc., 1121 East Meadow Drive, Palo Alto, CA 94303; (415) 494-3701.

Applications lists for AM construction permits

Lists of pending applications for AM construction permits will be available from the FCC through an AM data base by state, frequency, and file number. The lists include city, state, frequency,

number, day/night coordinates, day/night theoretical RMS, and submit applications for modification of PPs. The lists of pending applications are unofficial and are superseded in authority by the primary sources. Copies may be purchased from the Downtown Copy Center, 1000 K Street, N.W., Washington, DC 20006; (202) 452-1422.

SMPTE tutorial seminar

The Chicago section of the SMPTE will hold its third annual all-day tutorial seminar April 22 at the Granada-O'Hare Inn in Rosemont, Illinois (near O'Hare Field). Subjects to be covered include 1-inch helical tape recorders, microphones, cables, and lighting. A slide presentation by Eastman Kodak will be part of the program. William Hedden, SMPTE president, will speak briefly concerning on-going activities of the society. Advance registration, by mail, is \$9 for the entire day, including a prime rib of beef luncheon. Registration at the door will be \$11.

Media law seminar

The second one-day seminar covering legal problems encountered in radio and television newsrooms is scheduled for May 5 at the Pittsburgh Hilton. The seminar, sponsored by NAB, the Radio and Television News Directors Association, the Reporters Committee for Freedom of the Press, and the Society of Professional Journalists, is designed to supply practical guidance for broadcast newspeople, station management, and attorneys in the broadcast news area. Registration is \$40 for members of any of the four sponsoring groups and \$60 for nonmembers. Checks should be mailed to the "Pittsburgh Media Law Seminar" and mailed to NAB, 1735 DeSales St., N.W., Washington, DC 20036.

Newvicon Retrofit

Service Centers expanded

Calvert Electronics Inc. plans to establish a nationwide dealer network of Newvicon Retrofit Service Centers, in an effort to provide specialized technical support to commercial and educational video producers and television broadcasters. Service centers will be able to modify television cameras for use with the popular low-light sensitive Newvicon tubes, in addition to carrying a stock of Newvicon TV camera tubes. For more information, write: Calvert Electronics Inc., 220 East 23rd Street, New York, NY 10010.

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I comparison shop. I found it is more economical to do business ... Orders are expedited, corrections are immediate, questions researched.
... Bob Rose — KLIN, Lincoln-NE

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What caused us to work with you is personalized service and speed of delivery.
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Your service is second to none. Difficulties with equipment are made right immediately. You are the best in the business.
... Terry Duffie — WKMX, Enterprise, Alabama

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You have the largest conceivable selection of broadcast equipment and supplies in the business. You also have the most prompt service.
... Harley Drew — WBBQ, Augusta-GA

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I like personal service. I have never had anyone show such an interest in my business and success. You won my loyalty.
... Larry Fuss — WMYQ, Newton-MO

Dependable

We appreciate your immediate attention and dependability. It's simpler to do business with one good source.
... Eddie Fritts — KCRI, Helena-AR

Experience

We get quick, immediate service. Price is important but so is a source that can help with station management solutions.
... Virginia Wetter — WASA, Havre de Grace-MD

Integrity

You do what you say. If a problem develops — you always get back to me.
... Bob McKune — KTRR, Rolla-MO

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David Green

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broadcast consultants corporation

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people in the news

Radio/Television

Don McGouirk recently assumed the position of general manager at WCNI-TV in Columbus, Mississippi. McGouirk has been active in the broadcast industry since 1968, when he started as a local sales representative in Macon, Georgia. Since 1974, he has served as administrative coordinator of WMAZ Radio and Television in Macon.

Steven Terhaar, formerly chief engineer with KVO Radio in Moorhead, Minnesota, has taken a position as technical director with Midwest Radio in Fargo, North Dakota.

Kim Aubry, 21, was recently named chief engineer of WYSO-FM in Yellow Springs, Ohio. Aubry will be responsible for maintaining the 24-hour operation, production assistance, and staff technical training.

Thomas N. Spaight was elected assistant vice president of Communicators Inc., which owns and operates KRNA Radio in Iowa City, Iowa. Spaight joined the staff of KRNA as chief engineer in November 1977 and continues in that position.

Patrick C. Alvarez, formerly of Metromedia at ABC-TV in Hollywood, joined KQED-TV-FM and KQEC-TV, San Francisco, as manager of broadcast engineering. **Robert K. Diehl**, engineering supervisor for the KQED stations, has been appointed manager of production engineering.

KSL News, Salt Lake City, Utah, announces several changes in the television news photo department. **Warren "Skip" Ericksen** becomes chief cameraman; **Dan Schear** is the EJ video-editor supervisor; **Bob Lish** is new cameraman from KCCI-TV, Des Moines, name news and EJ cameraman; **Allan Green** and **Dave Jackson** named news cameramen; and, **Jim Sanders** and **Gary Henoch**, named EJ technicians.

Thomas Smith, general manager of WYAH-TV, Portsmouth, Virginia, announces the appointment of **William Malendoski** as TV operations manager. Malendoski comes to WYAH from WFBC-TV, Greenville, South Carolina, where he was employed since 1954.

Manufacturers/Distributors

George A. Grasso has been elected to the board of directors of Micro Consultants Inc. Grasso joined the company in 1976 as marketing vice president.

As Southeast regional sales manager for Convergent Corporation, **Frank Boyd Logan** will have distributed sales responsibilities for the firm's entire Southeast sales territory. Previously, Logan was a sales representative and video specialist for Ceavco Audio Visual Inc. in Denver, Colorado.

Russ Ide, recently appointed national marketing manager for Ampex's audio-visual systems division

continued on page



\$1895

one good sync gen leads to another...



\$750

When it comes to good performance, people identify with VACc's model 5000 sync generator... operating in Alaska in its rough climate synchronizing cameras to monitor ecology around the pipeline; or genlocking to a computer; or in a studio genlocking to a helical color VTR in still-frame.

But let's face it, a lot of people like you don't need all that power. That's why we developed a new ENG/EFP color sync generator that's powered with rechargeable batteries so you can synchronize 2 or more cameras in the field without a long yellow power cord. It has all the outputs you need with full NTSC/RS170 specifications. You get more performance for less money than you thought possible because at VACc you can't get too much of a good thing.

Manufacturer's of:

Editor-Programmers	Cross Pulse Generators
Party Lines	Burst Phase Meters
Gen-Lock Color Sync Gen's	H-Phase Meters
VIRS Inserter	Black Burst Generators



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WJZ-TV, Baltimore, Maryland

If you're really hard-nosed about audio quality, you'll see our perfectionism in our equipment. We're really demanding about our engineering, manufacturing and quality control standards. Correction. Make that read "downright finicky."

We're insistent about maintaining complete in-house design and manufacturing operations and about our painstaking quality control methods. These factors help maintain our position as the innovator, the one others look to for leadership. They give you the finest, the most reliable and advanced audio equipment.

You'll probably want to read every word of our excellent 5-year warranty, the most comprehensive in the industry. And while you're at it ask for our customer list. We're proud of it and we think you'd be proud to have your name on it some day. For our complete catalog contact Audio Designs and Manufacturing, Inc., 16005 Roseville, Roseville, Michigan 48066. Phone (313) 778-8400. TLX-23-1114.

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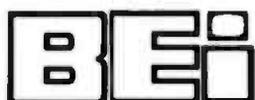


The Audio Company

Put "yesterdays" film island in touch with "tomorrows" needs by using the BEI-709 A.L.C.

The BEI-709 Automatic Light Control eliminates the electronic and mechanical problems associated with light level control on "yesterdays" film islands.

The BEI-709, make it work for you "today", quickly & simply.



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EASY AND ECONOMICAL WAY TO CREATE SPECIAL EFFECTS ON YOUR CYC OR SCRIM. FOR EXTRA DEPTH, PUT STAR PATTERNS IN TWO OR MORE SPOTS OF DIFFERENT FOCAL LENGTHS. TO LIGHT A HAZY SKY, SOFTEN THE FOCUS. FOR A SUPERNATURAL LOOK, TRY KEYSTONING. CHOOSE FROM SIX DIFFERENT STAR PATTERNS THAT RANGE FROM REALISTIC TO PURE DECO. NINE CLOUD PATTERNS PLUS CRESCENT MOON AVAILABLE. \$7.50 EACH. SUPERFAST DELIVERY.

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people in the news

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continued from page 22

will develop and implement marketing activities for full line of audio and videotape recorders, disc recorders, broadcast cameras, and computerized editing and video storage systems.



ELLISON



BRINSON



CORNETT

Max Ellison was named vice president for Convergence Corporation's Eastern Hemisphere Operations. In this new position, Ellison will have full responsibility for all the firm's activities in Europe, Africa, Australia, and both the Middle East and Far East. Prior to joining Convergence, Ellison was managing director for Marmac Ltd. in Ireland.

Image Devices Inc. announced the appointment of **Stephen C. Brinson** to the staff of the recently established Atlanta office where he will be in charge of camera and related equipment rentals and sales. Brinson had previously been with WXIA-TV Atlanta.

Richard F. White has been appointed to the newly created position of vice president-electronic operations for Belden Corp. White joined Belden in 1935. **Roger W. Cornett** succeeds White as vice president and general manager of the electronic division, based in Richmond, Indiana.



ROTHFELD



SMITH



TSUNODA

The appointment of **David Rothfeld** to the position of general sales manager at Electro-Voice Inc. was announced by **Lawrence LeKashman**, vice president of marketing. Rothfeld came to Electro-Voice from Unicord, a Gulf & Western company, where he was vice president and director of sales.

Also at Electro-Voice, **Bill Smith**, formerly regional sales manager for Epicure Products, was appointed national consumer products sales manager. And, **George Silsby** joined the firm as product sales manager for professional markets.

Koichi Tsunoda, a veteran of 17 years with Sony, has been named president of Sony Video Products.

continued on page



The Audio Earth Terminal from Farinon gets any network audio signal off the ground and up where it belongs—in the sky.

Farinon re-introduces wireless radio.

Use a piece of a satellite. The AET can give you and your subscribers uniform high quality. Satellite transmission gives you up to 15KHz bandwidth—good enough for mono or stereo high-fidelity audio. The best readily available Telco service is 5KHz. The satellite responder is the only repeater. No noise buildup from long lines, repeaters, local loops, and frequent amplification is eliminated. For the same reason, the quality is usually high at *all* earth stations.

Uniform low costs, too. Distance means nothing once you beam your message to a satellite. The location of earth terminals does not affect cost—unlike Telco distribution,

which penalizes the more remote subscribers with higher leased-line costs. Farinon's Audio Earth Terminal—antenna, low-noise amplifier, and audio receiver—costs less than \$7,000, turn-key installed, and will pay for itself in eliminated leased-line costs. Furthermore, once you lease satellite space, transmission costs are fixed; the addition of any number of earth terminals does not affect them.



We offer you a total system approach, no matter what kind of wire service you operate—data, news, telegraph or news pictures. We'll help you define your requirements. Then we'll provide, assemble, and test every part of the system.

And, of course, we'll service the system. Like all Farinon products, the Audio Earth Terminal is backed by Farinon's famous customer support philosophy. You can depend on us.

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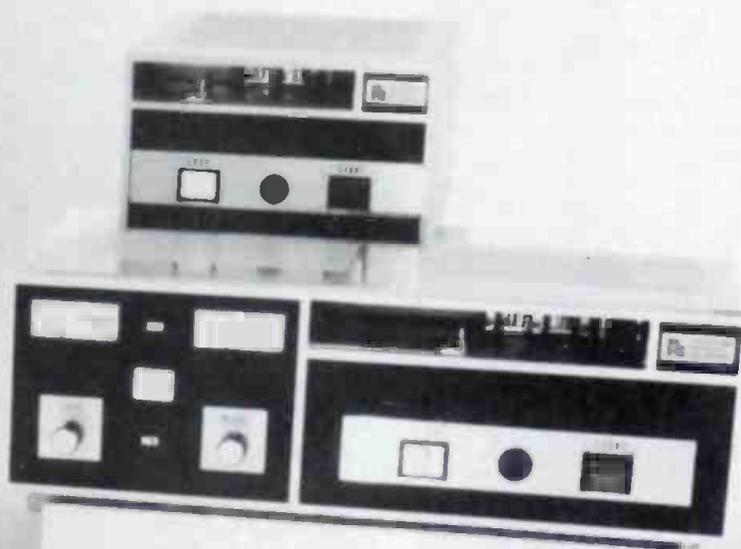
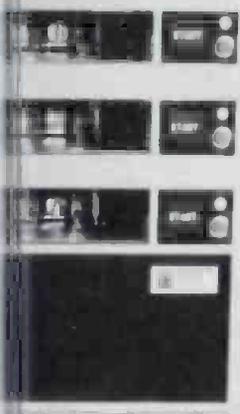
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**The faces are familiar...
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updates have kept this
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- New program recording and reproducing amplifiers provide less distortion, more headroom.
- +18 dBm audio output (optional).
- Improved 450 RPM capstan motor with less heat, less wow and flutter, higher reliability.
- New, long life Nortronics Duracore® heads. Ten times longer head life.
- Improved head mounting blocks provide better stability.
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- Improved solid-state recorder logic control for better reliability.
- Improved tone detectors for fail-safe high-speed operation.
- Improved equalization technique. Recording Amplifier smooths high end response.
- RP Delay machine for program delay and cartridge production (optional).
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- Two year warranty on parts and factory labor.

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people in the news

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continued from page 24

Company, recently announced as one of three independent marketing companies under Sony Corporation of America. Tsunoda joined the international division of the parent company in Tokyo in 1961. At the beginning of this year, he was promoted to vice president of Sony America.

The appointment of **Richard W. Burden** as LPB Inc.'s engineering representative for the West Coast was announced recently. Burden, of Burden Associates, is a 25-year veteran of the broadcasting industry and is a fellow of the AES and an SBE certified broadcast engineer.

David Burnes, formerly with Electronic Labs of Louisville, Kentucky, has joined the staff of Allied Broadcast Equipment as a sales engineer.

Sidney B. McCollum joins Recortec as national sales manager for video products. McCollum previously was sales manager for CMX/Orrox.

David Bain Associates has been appointed New York City sales representative for CCA Electronics Corporation. The firm will handle all CCA AM, FM and TV transmitters; FM antennas; and broadcast equipment.

A new sales representative/distributor firm has been formed by **Martin Jackson**, formerly vice president and Northwest regional manager for Broadcast Communications Devices, Inc. The purpose of the new firm will be to serve the broadcaster and other professional users of audio/video electronic equipment. It is located in Scotts Valley, California; (408) 438-4273.

James A. Gimbel has been appointed marketing director for RCA Broadcast Systems in yet another move at RCA. Gimbel joined RCA in 1957 and for the past year has been sales manager for the broadcast equipment activity in Europe, Africa and the Middle East.

Dick Reilly of United Media, Inc., has become the exclusive manufacturer's representative for Address Corporation with corporate offices in Campbell, California.

Richmond Hill Laboratories, Inc. has announced the appointment of **Fernando Marques da Costa** as the new United States sales manager. In addition to his functions as sales manager in the continental U.S., da Costa also will be responsible for all of Latin America and the Caribbean markets.

In recent action at American Satellite, President **Emanuel Fthenakis** appointed **John Mehrhoff** assistant vice president for national accounts, and **Lawrence Basso**, assistant vice president for Southwest sales. Both men rejoined American Satellite after holding marketing positions with other domestic satellite carriers.

GE television projection helps get your point across

GE large screen television projectors are at work, today, presenting video information to audiences in Education, Business and the Arts.

At Universities, lectures, science demonstrations and off-campus programs are being presented in bright, color video, on screens up to 20 feet wide. At live seminars, overflow attendance is being accommodated in nearby facilities with large screen television projection.

At medical schools, surgical techniques and medical procedures are projected in images larger than life, with clarity and impact which facilitates subject retention and learning.

In addition to use at stockholder's meetings, seminars and training programs, business management also employs GE large screen television projection to present computer bank data. Coupled to computer facilities through interface equipment, it projects alpha numeric data, graphic displays and computer generated images in real time.

The GE Solid-state PJ5000 is reliable and designed to deliver projected pictures with high contrast, brightness and resolution, with simple remote control operation. Here's why:

- GE's exclusive single gun, simple optical path system generates the complete range of colors simultaneously.

No fussy alignment of three separate images.

- Single optical path provides the same color picture to everyone in the audience, regardless of his angle of view.
- Variable picture size from two to 20' wide for both large and small groups.
- Simple image changeover for front or rear screen projection, with sweep reversal switches.
- For easy set-up, internal sync and RGB Color Bar generators are provided.
- Convenient remote control unit allows picture set-up adjustments and operating control, at the projector or up to 200 feet away with the addition of an accessory control cable.
- Only power required is standard 120V/20 amp appliance outlet.
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- High efficiency power conditioning circuits permit operation over a range of line voltages without affecting picture.
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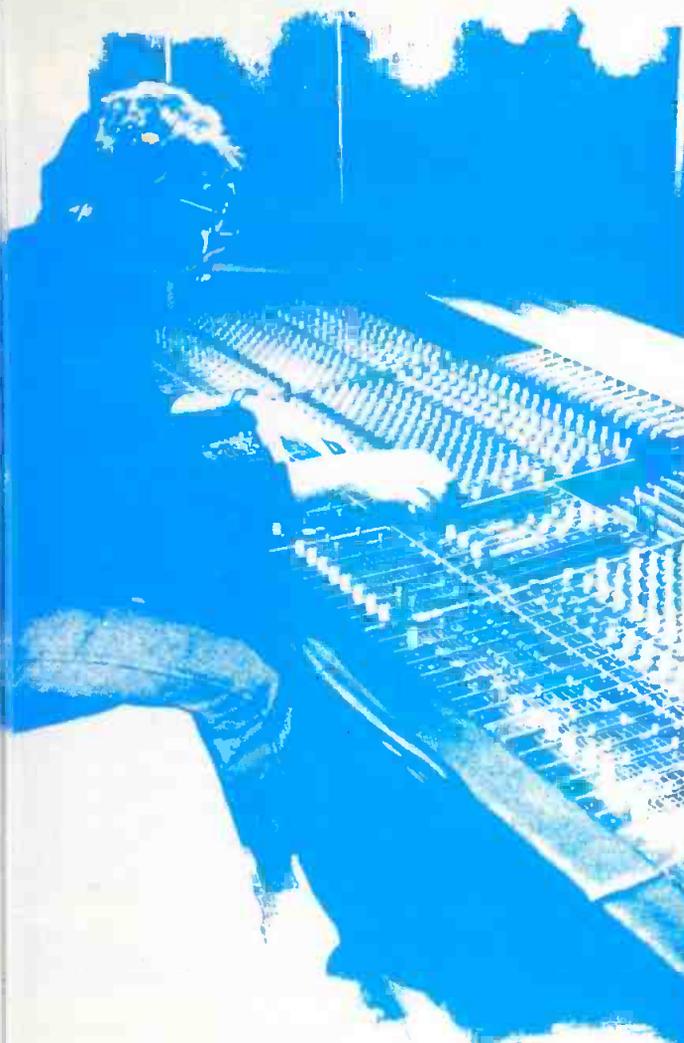
For more information call (315) 456-2562 or 456-2533 today, or write to: Video Display Equipment Operation, General Electric Company, Electronics Park—6-206, Syracuse, New York 13201



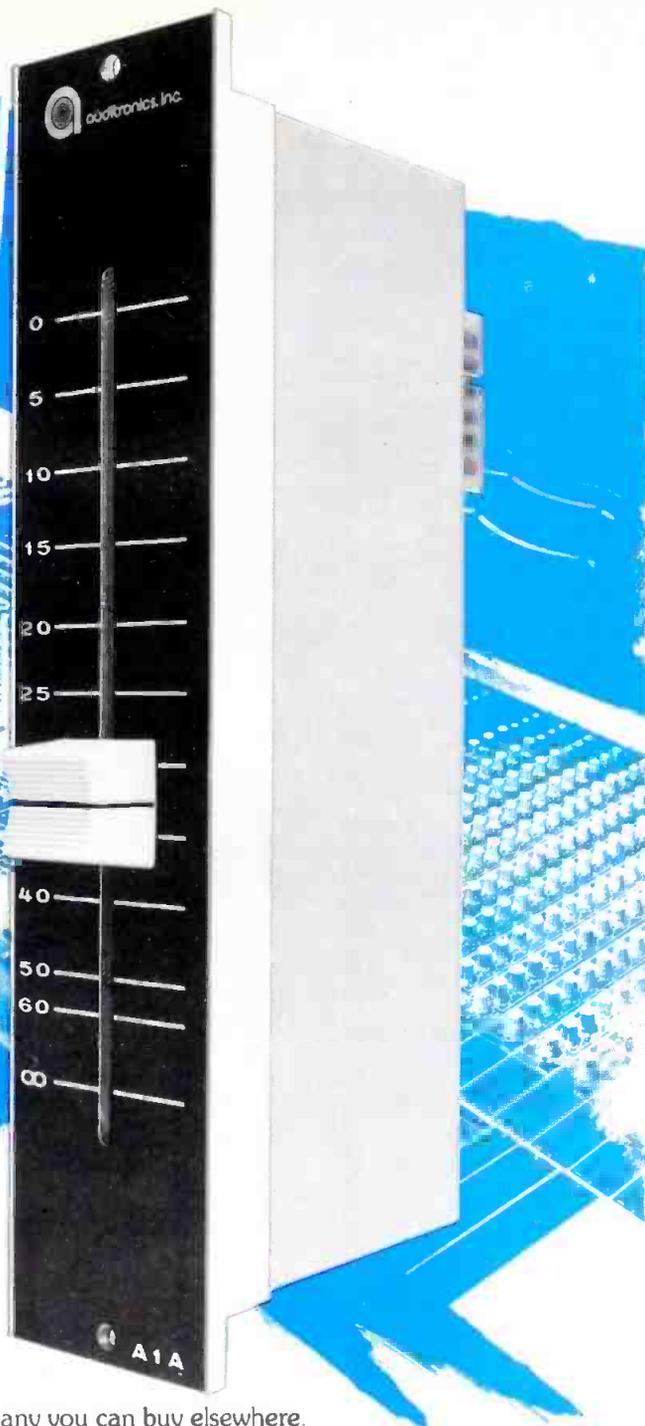
GE large screen color TV projector PJ5000

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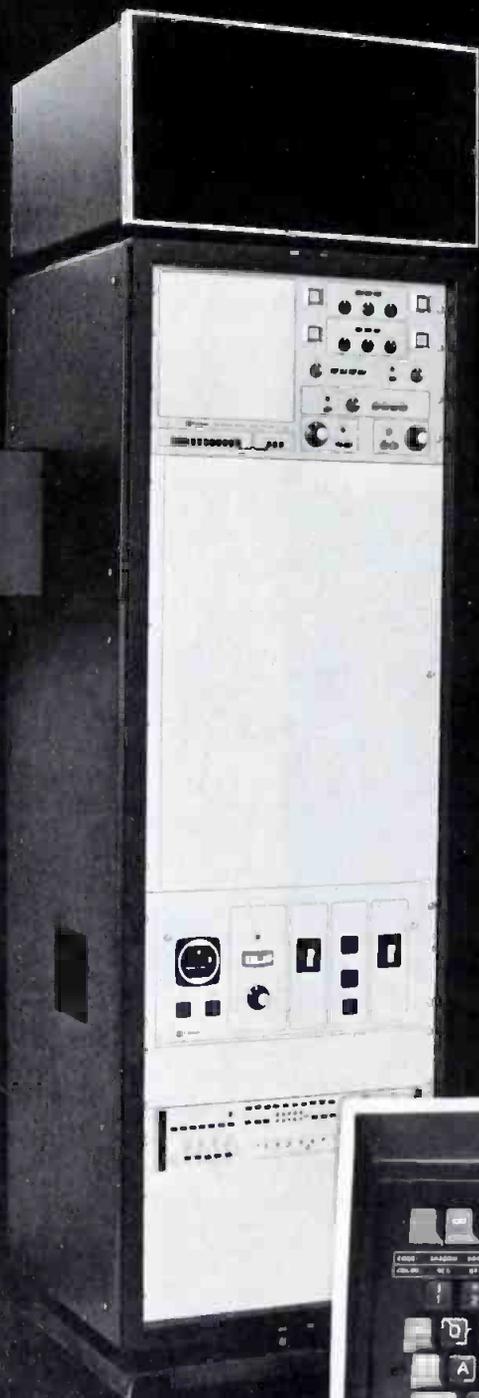
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New from TeleMation



Introducing a state-of-the-art digital noise filter that costs less.

From input to output, the 8-bit TDF-1 represents an entirely new approach to digital noise reduction. At the input, we've included a full, broadcast-quality processing amplifier that completely regenerates incoming sync pulses. The TDF-1's charge-coupled device (CCD) memory offers the same high performance as RAM systems at a significantly lower cost. We've also increased the video sampling rate from three-times-subcarrier to four-times-subcarrier for greater bandwidth and resolution. And maintenance of the TDF-1 is made simple by a built-in diagnostic system.

A graphics system with off-line archival storage.

Everyone who uses an electronic graphics system has their own artistic requirements. With the new Compositor I™ memory system, each of your clients (or departments) can use the fonts they like and logos they need to create up to 999 graphics on a low-cost, removable cartridge disk. At the end of their taping session, they simply take out the cartridge and put it on the shelf. The next user (such as your news department) can then load another cartridge containing different fonts, logos, and pages and be on line in seconds. And, with the new dual disk system, you can copy directly from one cartridge to another.

What else is new with Compositor I? Fonts! More than 40 fonts are now available, including weather symbols, graph characters, and foreign fonts. And Compositor I's are now in use in PAL countries.

A microprocessor-controlled distribution switcher.

The new TVS/TAS-1000 Distribution Switcher microprocessor option can be programmed to perform salvo switches of multiple crosspoints simultaneously. Eight (or more) different salvos can be loaded into the system's memory and previewed by the operator before the live switch is executed, virtually eliminating the possibility of error. Other new control options include X-Y panels, where the source is selected with one button and the destination with another, and category-number selectors, where the input is selected by a name key (such as "VTR," "Camera," "Studio," etc.) and a number key.

A telecine camera that replaces GE units quickly and easily.

A new optics kit allows the TCF-3000 Broadcast Color Film Camera to replace GE 240 and 240-format cameras without so much as moving a projector or changing a lens. The TCF-3000 also gives you true hands-off color balance and color correction, automatically correcting poor-quality film without disturbing balance or gamma tracking of good film. This long term operational stability is made possible by unique, temperature-compensated sampling and control techniques. The TCF-3000 has several other advantages over competitive units, such as lower noise, more detail in black, and superior color separation. And a fully-removable six-vector color corrector is available as an option.

For more information about these TeleMation products, circle one of the numbers below or contact:
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Academy announces its scientific/technical awards

Our news feature spotlight this month falls on four behind-the-scenes stars of the entertainment world. Our focus was prompted by the selections of the scientific and technical honors awarded by the Academy of Motion Picture Arts and Sciences.

The 50th annual Academy Awards for scientific and technical achievements have been announced, and this year's winners include Cinema Products, Eastman Kodak, EECO (Electronic Engineering Company of California), and Nagra Magnetic Recorders.

A Class I Award (Academy Statuette) will be awarded to Garrett Brown and the Cinema Products Corporation engineering staff, under the supervision of John Jurgens, for

the invention and development of Steadicam. This marks the first Class I Oscar to be awarded since 1968.

The award recognizing Steadicam's contributions is not presented for the part it played in any one film. As the picture here shows, Steadicam was in the ring with "Rocky." It also was behind the scenes with "The Marathon Man" and "Bound for Glory."

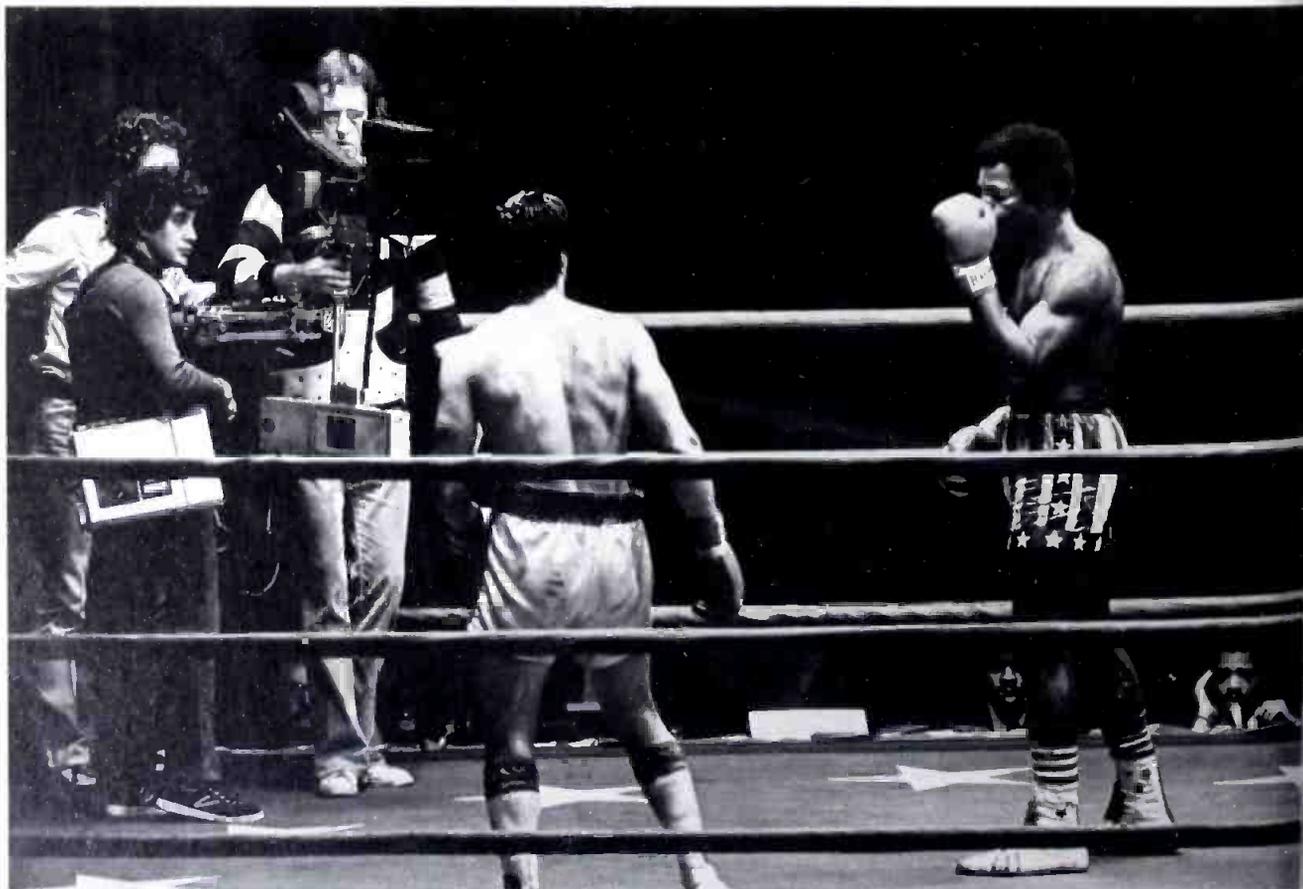
The Steadicam made its debut in television on the production side of the 28th annual Emmy Awards ceremony. A TK-76 was modified (CP/TK-76) for use with Steadicam, and the system was used live. John C. Moffitt, director for the 28th annual Awards, was given an award at the 29th annual Emmy

event for outstanding achievement in coverage of special individual events.

Class II Awards are Academy plaques, and one will go this year to Eastman Kodak Company for the development and introduction of a new duplicating film (type 5243) for motion pictures.

Nagra's Class II Award is for the engineering of the improvement incorporated in the Nagra 4.21 sound recorder for motion picture production.

EECO will receive an Academy Class III (citation) Award for developing a method for interlocking non-sprocketed film and tape media used in motion picture production.



Cameraman Garret Brown joins Rocky in the ring with a prototype Steadicam for filming boxing sequences. James Crat was director of photography.



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

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

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

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

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

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

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

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

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

- **Self-illuminated control buttons,**

allowing easy identification of the operation mode.

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

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

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

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

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

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

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

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

ually for convenient connection to an external system.

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

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

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

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

- **Tracking control meter** for maximum

tracking adjustment.

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

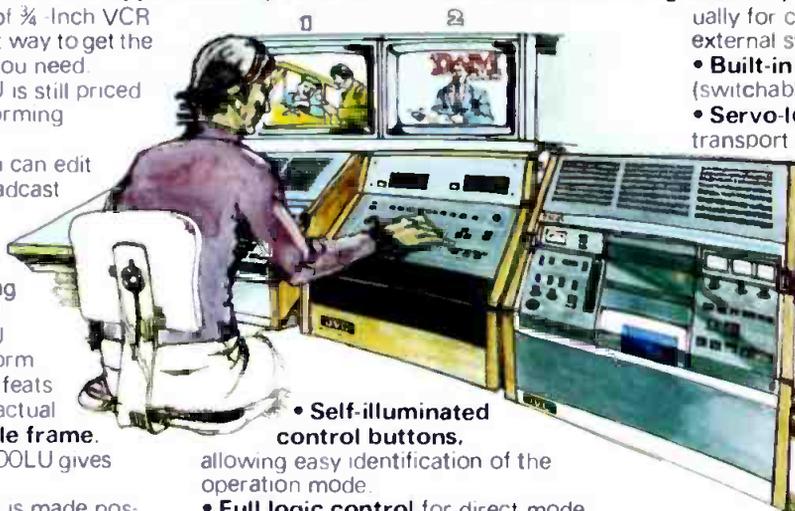
All that with one editing unit. But when you combine two editing units with our new RM-85U automatic editing control unit, you'll enjoy all the benefits of a total-performance system.

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

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

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

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



time indicated for each insert edit by LED display.

preview mode available, for "arsals" of actual edits.

in point search mechanism. After edit, a Return button rewinds the tape automatically to the edit-in point, so operator can check edit conditions.

to-shift search mechanism to step through the tape speed automatically, and for quick and accurate location of the edit point.

up safety guard circuit. Because of the unit in the still-frame mode can potentially cause damage to tape or video head, a tape safety guard circuit places the unit into the stop mode automatically.

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

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

Our CY-8800U offers a lot more picture quality and stability that compares favorably with units costing as much.

As to JVC's technology, the CY-8800U

is



With the Basic configuration, it's a perfect ENG/EFP camera that's completely self-contained. No ACU required. Easy to operate, just plug into our CR-4400U

portable recorder, with optional cables available up to 66 feet.

With the Studio configuration it's a working studio camera. Just add the CR-8800U remote Synchronizing unit and a large screen, top mounted viewfinder. And as for big-ticket features, we've got what the others would let you add

for:



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

• **Selective editing modes**—assemble editing, insert editing for audio channel-1, audio channel-2 or video.

• **Versatile editing capability** offering techniques like "edit-in/out," pre-roll, and automatic pre-roll.

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

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

And JVC's field-tested CR-4400U

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

• **A built-in 1.5 Inch adjustable electronic viewfinder** for the convenience of the operator.

• **A built-in battery warning system.**

• **A built-in tally light.**

• **A built-in VSI—video system indicator** for precision F-stop control.

• **A built-in color bar generator.**

• **A built-in +6dB, +12dB sensitivity switch** for low light level applications.

• **A built-in auto white balance.**

• **A built-in fast warm-up capability.**

• **A built-in electrical color temperature adjustment** for different applications (variable from 3000°K to 10,000°K).

• **A built-in filter system** (neutral density) for variable light levels.

• **A built-in level switch** (+50%, 0, -50%) provides 1/2 F-stop adjustment, letting you fine tune for added contrast.

• **A built-in time lapse meter** to show total hours of camera use.

• **A built-in intercom system** for studio applications.

• **An RGB output**, and NTSC encoding (Y, I, Q).

• **A built-in Gamma control** to fine tune gamma level.

• **An AC Adaptor**—standard.

• **Lightweight—17.4 lbs.—portability.**

• **Optional 12-to-1 zoom lens** with automatic iris and power zoom.

• **Built-in horizontal and vertical contour correction circuits.**

• **Signal-to-noise ratio of 49dB,** F. 4/3000 lux.

• **Resolution of 500 lines at center.**

• **Return video** in the viewfinder.

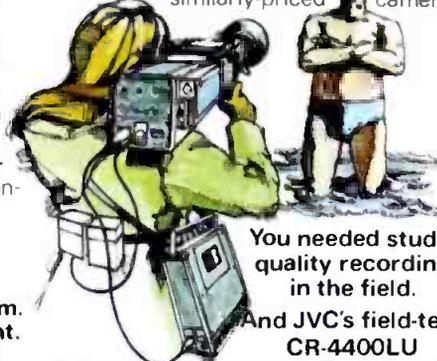
• **A built-in -G circuit** for registration.

• **Minimum illumination F 1.9/300 lux** (+6dB switch on).

• **A comfortable hand grip** to stop and start the recorder. With a switch to operate iris control and a switch for return video.

• **A built-in CCU.**

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



You needed studio quality recording in the field.

And JVC's field-tested CR-4400U

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

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

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

Because it's the lightweight machine with heavyweight features:

• **Weighs in under 27 lbs.** So you can take it anywhere, and assemble edit on the spot. You enjoy total flexibility. Complete freedom. Fast results.

• **AEF (Automatic Editing Function)** gives you clean assemble edits.

• **Built-in, full color recording and playback circuitry.** No need to buy an adaptor.

• **Low-power consumption** that lets you operate on a miserly 13.5 watts, for longer battery life. A multi-purpose meter checks battery, audio, video and servo levels for precise control of all functions.

• **Flexibility to record with the CY-8800U** or other high quality color cameras.

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



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Figure 1 Lighting is often used upon to communicate an important part of the total video message. The lighting in this scene could have very radically changed the mood and message of the video. (All lighting effects and photographs by author.)



LIGHTING

is your best shot at better production

by Ron Whittaker

A well-known motion picture producer has been quoted as saying that 80% of effective cinematography rests in the creative use of lighting.

The television producer or director typically has a restricted opportunity to use creative lighting effects. Instead of carefully staging and lighting each scene for one angle (one film camera) he often must light a scene so that it will hold up for three or more camera angles simultaneously. The quickest, easiest and safest way to do this is

to "light flat." So, with the move away from film to videotape in the production of dramas and situation comedies, we are seeing more and more flat lighting.

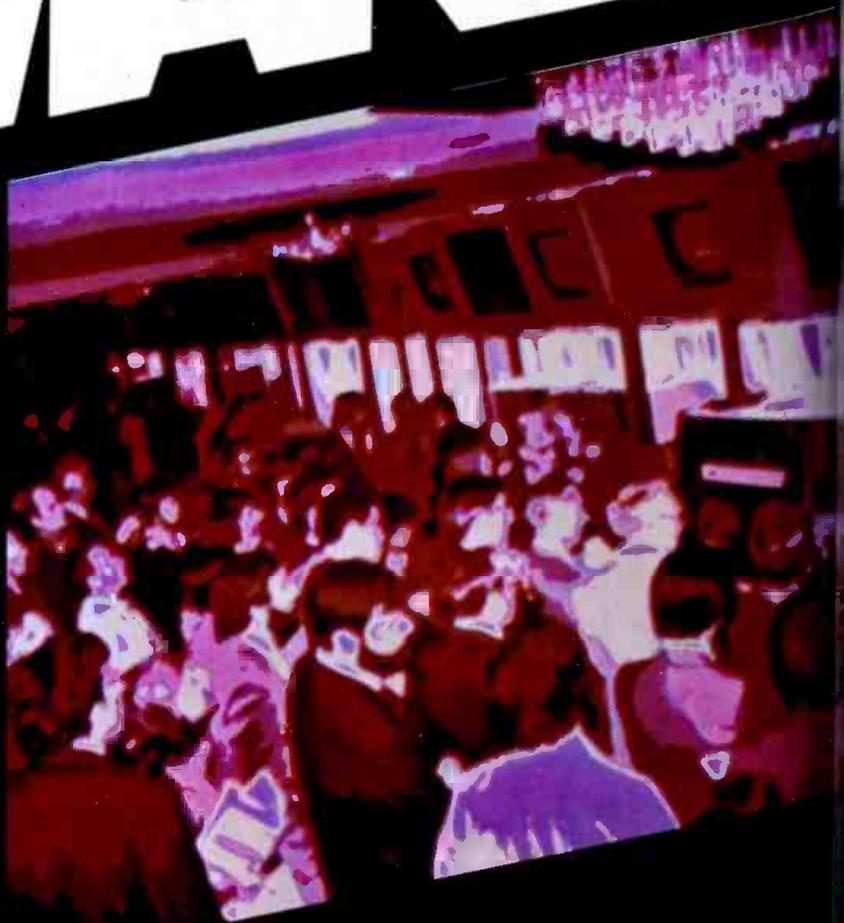
Film/tape lighting differences

A public which has grown up with film as the basic TV recording medium still seems to be partial to the "film look." Part of this film look is in the slightly softer film image.

Another part of the film/videotape difference centers on the techniques

continued on page 40

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Ampex makes the equipment for exciting broadcast productions, and it'll all be on display at this year's NAB convention in Las Vegas. Excitement in Cameras: Star of this year's camera show is the BCC-10 color studio camera, with on-demand ACT and more dynamics than ever to enhance the visual "reach" of your most imaginative productions. Excitement in Helical: Ampex is showing a Type C machine, the VPR-2, and a compact on portable, the VPR-20. There's a new window digital time base corrector, the AVR-2, to round out the helical excitement Ampex is creating. Excitement in Quad: Super High Band Pilot is the industry's hottest quad development, and it's available in the "intelligent" AVR-3 and the "low-on-the-job" AVR-2. These sophisticated

and versatile VTRs extend the worldwide leadership of Ampex in quad recording. Excitement in Editing: Now there are three electronic editing systems from Ampex to provide any desired degree of flexibility, making tape as creative as the mind that controls it.

Excitement in Digital Technology: If you're ready to go digital, Ampex has the first commercially available digital video production system, the ESS-2. You have to see it to believe what it brings to video.

Excitement all over the Booth: Ampex audio recorders, synchronizers and magnetic tape products will be at NAB too. It's going to be an outstanding NAB year, because... Ampex makes it exciting.

AMPEX

Ampex Corporation
Booth: C603



Figure 2 A color temperature meter will quickly reveal problems between sources of illumination within a production. Once cameras are balanced on an incandescent light source, a shift of 100 degrees Kelvin in a key or fill light can be noticed.

TYPICAL COLOR TEMPERATURES

candle flame	1,900°K
household light bulb (100 watt)	2,850
quartz or incandescent studio lamp	3,200
warm white fluorescent tube	4,500*
cool white fluorescent tube	3,500*
average daylight	5,000
noonday summer sun	5,500
daylight fluorescent tube	6,500*
high intensity arc light	6,600
hazy or overcast sky	7,500
clear blue northerly skylight	25,000

*These sources are typically "broken spectrum" and do not have pure color temperatures. (See text.)

Lighting

continued from page 37

associated with the creative use of depth of field: selective focus, follow focus and rack focus. Consequently, at least one major TV production company is doing a series with greatly reduced studio light levels on the set. This means cameras have to shoot virtually wide open at f:2.0 or f:2.8. This maximizes the selective focus effect in cameras by minimizing depth of field. Although focus becomes quite critical, especially when lenses are zoomed in, obvious separation between scene elements is achieved along the camera axis. And possibly more importantly, this technique suggests "film" to viewers, since selective focus, follow focus and rack focus are familiar film techniques.

But, the most important technical film/videotape difference centers on lighting—that 80% factor in cinematographic creative control.

Actually, we don't have to worry about the art of effective and creative lighting being lost for all time in the transition from film to video. The importance of lighting in conveying information has been known since the Greeks started painting 2,000 years ago. And, all you have to do is study the paintings of the masters throughout the ages to see just how important lighting is to the presentation of subject matter.

We may find that creative lighting techniques temporarily get sidetracked in the film-to-video transition, however. Producers who understand the importance of good lighting will be able to smooth out

the transition for viewers, and, even more importantly, to maintain a significant dimension of expression in "visual language."

A skilled lighting technician (artist) can radically alter the mood and meaning of a scene through the use of lighting. Even the apparent personalities of actors and actresses can be shaped and altered. Figures 1, 3 and 4 suggest some of these possibilities.

Light and its dimensions

To use light effectively, its characteristics and variables must be thoroughly understood and applied. Chief among these variables is the direction or angle of the major lights—generally the key and fill lights. Probably more has been written (and argued) about light angles than about any other variable. Therefore, we'll temporarily skip a discussion of light angles, and refer you to our March **Broadcast Engineering** lighting article, and go on to other important variables: quality, quantity and color.

The dimension of quality

Light quality or coherence is probably the most neglected and underrated of the variables.

Quality has to do with the hardness or softness of the light sources—generally the key light. According to one lighting specialist, it is a major mood-determining factor.

Specular light, which emanates from a small, point source, is composed of direct, parallel rays

and has a hard, crisp quality. Common studio sources are ellipsoidal spotlights and beam-spot projectors. These lights will produce a very hard, contrasty effect. Surface detail and irregularities in subject matter stand out. Shadows are very hard and black. This would look good in showing off the grain of leather, but very bad for illuminating a female face.

Diffused light has quite the opposite effect. It will impart softness to subject matter, while de-emphasizing surface detail. Many of the paintings of the masters make use of soft, reflected light instead of the comparatively hard light of the direct sun.

In the studio, scoops with mat surface reflectors and scrims will break up and diffuse the light from tungsten halogen lamps. "Softlight" lighting instruments are the best choice, when they can be used. Unfortunately, they are rather large and they don't "throw" light over great distances (only large areas).

You even can go all the way to totally diffused, non-directional light by using a "light tent" if you need to show shining metal or glassware while holding down both spectral highlights and brightness range. This approach was illustrated by the author in "Beyond Formula Lighting" in the April, 1977, **Broadcast Engineering**.

Light intensity

Overall light intensity is generally determined by the sensitivity of

continued on page 40

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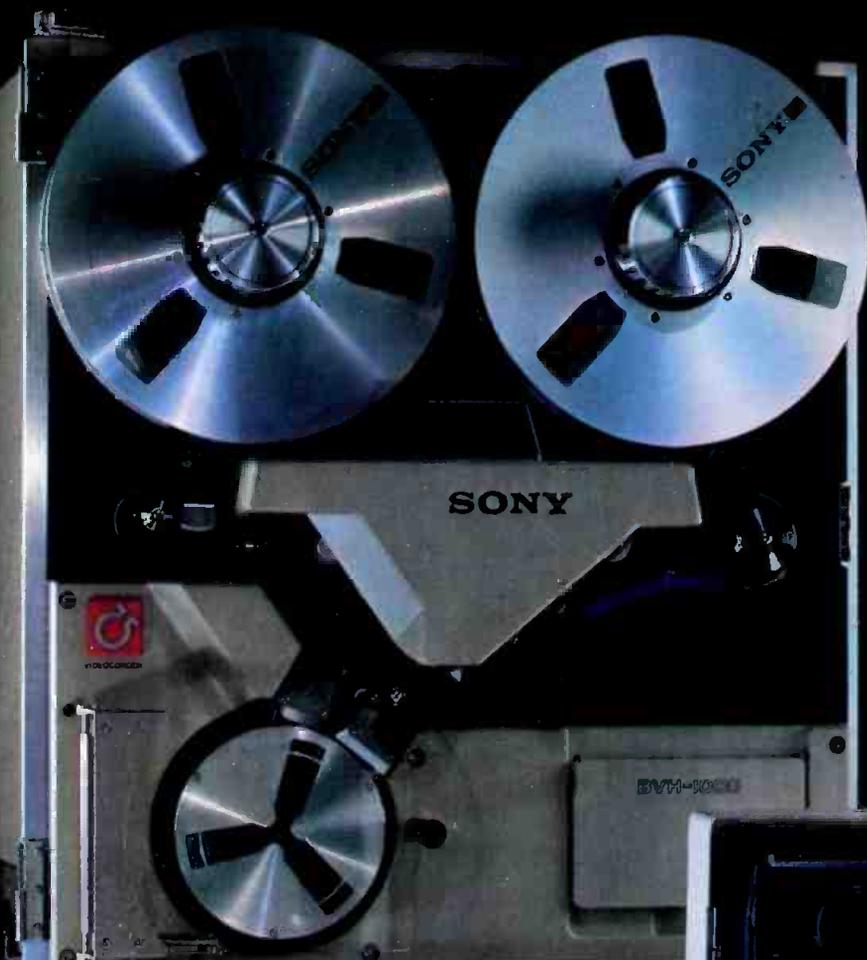
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We're kind of proud of that. From the start, Sony Broadcast was a leader in the 1" revolution. We pioneered many of the technical innovations incorporated into the 1" helical-scan VTR. And it's good to be part of a movement so beneficial to the broadcast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

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

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

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

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

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

sequences. And more.

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

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

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

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

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The BVH Series, from Sony Broadcast.

All things considered, it's quite an accomplishment.

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bi-post lamp. Motion
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Figure 3



Figure 4

The photograph on the left was made with essentially flat light. A standard formula lighting setup was used for the picture on the right. Note the difference in the depth and roundness of the face.

Lighting

continued from page 40

cameras and depth-of-field needs. To hold down general energy costs, it is best to keep the intensity levels as low as you can without sacrificing quality.

The amount of light that hits your subject from a light depends upon the lamp wattage, the efficiency of the lamp, the transmission efficiency of the lighting instruments (reflector, lens and focus), the type of scrim or gel material used (if any), and the distance of the lamp from the subject matter.

In black and white television, dimmers were commonly used to control light intensity; in fact, this was the easiest and quickest way. Dimmers, however, affect color temperature, and because of this their use has to be reserved for areas where color shifts in light will not be apparent. You can often get away with dimming backlights and background lights. However, with key and fill lights the eye will begin to notice a 100-degree Kelvin shift (at least in this general color temperature range). A 100-degree shift will result from a 10-volt drop in line voltage. Remember that even the use of long extension cords will drop line voltage, not to mention the effect of heavy electrical loads.

Since illumination falls off according to the inverse square law, light intensity can be quickly varied by changing lamp-to-subject distance. For those who like to see

formulas, here is how that looks:

$$\text{intensity} = \frac{1}{\text{subject-light source distance}^2}$$

So, if the lamp-to-subject distance is doubled, the illumination on the subject will drop 75%.

Although lamp-to-subject distance manipulation is a good way of controlling intensity, there are two others which are far more practical for quick adjustments.

First of all, the beam of many spotlights (the Fresnel in particular) can be flooded out and pinned down. The former reduces the intensity over the coverage area and the latter increases the intensity. The dimensions of the light area can then be shaped to a large extent by barn doors.

The last area of intensity control involves the use of scrims over lighting instruments. Stainless steel or spun glass scrims cut down light intensity without affecting color temperature. (They do diffuse the light and make it softer, however.) You can even put two or three of them together, if you have to.

Intensity control is important in balancing key, fill, back light and background lights. Normally the fill light is half the intensity of the key light; the back light is somewhere around one and one-half times the key, depending on subject matter and the background lights are about

continued on page

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Lighting

continued from page 44

two-thirds the intensity of the key light.

Color temperature

Unlike the human eye, television (or film) cameras cannot automatically balance themselves for changes in color temperature—as in going from daylight to incandescent light, for example.

Most studio cameras are set up to accept the 3,200-degree Kelvin studio lights and must rely on a straw-colored optical filter behind the lens to cope with comparatively blue (5,500-degree) sunlight.

These two basic color temperatures—3,200 and 5,500 degrees—are more or less "standards." Where you run into trouble is with fluorescent lights and mixtures of light.

Since fluorescent light isn't produced by heat, it has "broken spectrum" characteristics, quite different from sunlight or incandescent light. Instead of a smooth mix of colors, there are abrupt dips and bumps in the spectrum profile.



Figure 5 A footcandle or meter is an important aid in balancing the intensities of studio lights. Since dimmers affect color temperature, lighting directors now adjust not just intensity in three ways: altering lamp-to-subject distance; adding scrims; or, in the case of spotlights, pinning down the beams.

Green faces and significant color shifts often result. Many TV cameras have fluorescent light filters included in their filter wheels behind the zoom lens. The Tiffin Optical Company makes two types of filters for coping with fluorescent light.

Beyond this it is helpful to know the approximate color temperature equivalent of different fluorescent tubes. "Daylight" fluorescent tubes

have an approximate color temperature of 6,500 degrees; "cool white" 4,500 degrees, and "warm white" about 3,500 degrees.

If you must do regular productions in a fluorescent-lit location and are getting unwanted color shifts, it would be wise to check out different fluorescent tubes. Of course, the best solution, if you can change the lighting completely, is

continued on page 46

Split Second Time Machine

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Lighting

continued from page 46

use incandescent light, possibly bounced off the ceiling.

Mixed light sources

When you have two radically different light sources present—one incandescent and one daylight, for example—life can become even more complex. A common situation would be if you need to videotape a scene inside (with standard incandescent light) and include sunlight coming in a window.

You can actually solve two problems here by using one or more large sheets of straw-colored acetate correcting gel over the outside of the window(s). This will bring down the color temperature of the sunlight, and, at the same time, drop the intensity of the outside light to somewhere near the acceptable contrast range of the television system.

Occasionally you will want to make mixed color sources work for you. Moonlight is typically simulated by blue light. So, if you had a night scene of a peeping-Tom looking in a window, you could use blue light from behind and yellow light to simulate the incandescent light coming through the window. This light mix would suggest the inside-outside situation.

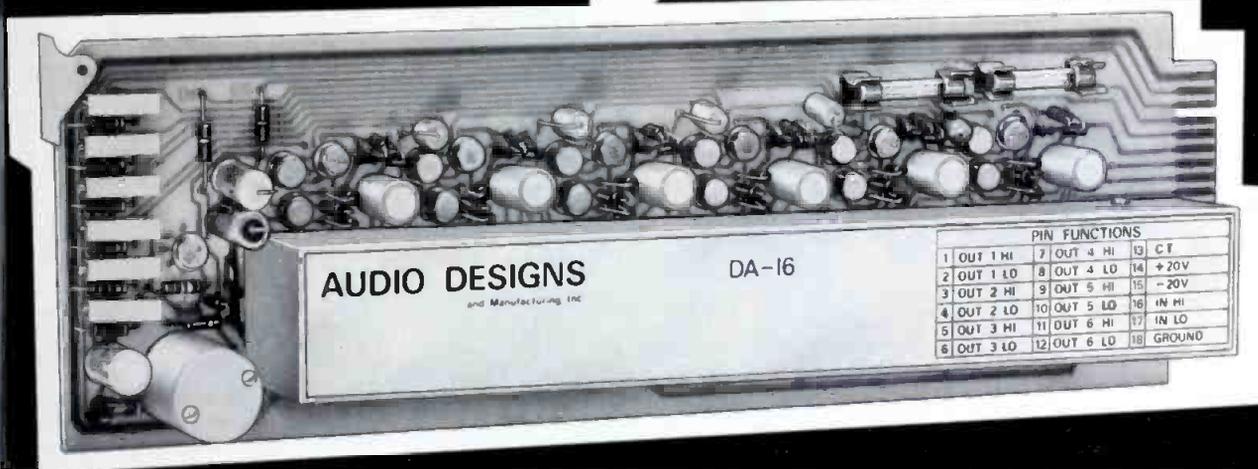
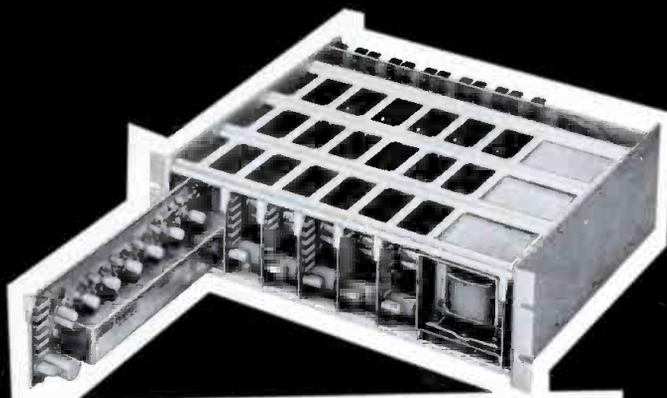
As a closing word on color temperature, we might also mention the extreme color differences which the sun goes through during the course of a day.

In early morning, sunlight must travel through more of the earth's atmosphere because of its angle. The result is that much more blue light is absorbed than red (shorter wavelengths are more readily absorbed) and the color temperature is quite low (red).

During midday the temperature of the direct sunlight will rise to about 5,500 degrees, depending upon where you live in the world. However, if it happens to be a hazy or overcast day, the Kelvin temperature will go up to between 6,500 and 8,500 degrees. And the color temperature of blue skylight (no direct sun) can reach 27,000 degrees, which can impart a very cold, blue look to skin tones.

As the setting sun drops toward the horizon at the end of the day, the resulting color again shifts toward the red. And, this sounds like a very good place to stop for now. In the March article we tackled some more points in the "language of light."

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1"-VTR-Report '78

The BCN-Format is the basis of the SMPTE-1"-Type B-Standard. Today more than 350 BCN systems are in operation throughout the world.



BCN scanner (life size), equally suitable for reels and cassettes

Bosch Fernseh decided in favour of the BCN short track segmented field technique from the alternative 1" solutions (segmented field with an 80 mm track and non-segmented field with a 450 mm track) for the following important reasons:

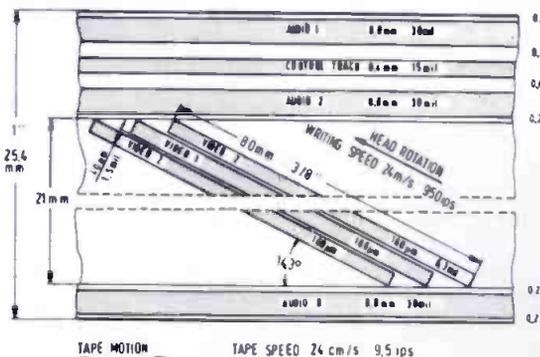
- Additional tracking correction system is not necessary.
- Omega wrap angle of 190° enables multigeneration copies with minimal chroma noise.
- Overlapping 2-head technique enables uninterrupted recording of the video signal encompassing also the entire vertical blanking period.
- No additional head required to record vertical blanking period.
- Superior luminance signal to noise ratio because time base correctors and their inherent analogue to digital, and digital to analogue conversions are not necessary.
- Video track tilt angle of 14,3° ensures insensitivity to longitudinal dropouts.
- The track and scanner arrangement is suitable for reel and cassette applications.

The BCN-Format has three audio tracks

Apart from the video and control tracks there are three audio tracks of equal quality. It is therefore possible to record stereo sound or multilingual commentary. Track 3 can be used to record a time code, using either the built in time code generator or an external one.

The BCN Editing Systems solve every problem

- Integrated insert/assemble operation
- Automatic electronic editing using the EES 9 with BCN 40/50 machines
- An automatic editing system for 7000 for up to 5 BCN units
- A freely programmable, computer controlled editing system such as the ESC 40 K - offering an enormous range of applications.
- Editing point definition using most modern digital techniques. Unlimited "still" picture reproduction without any danger of damaging the valuable master tape. Jogging and slow motion are possible as well as special production effects such as "Cross Split".



Identical tape transport for all TV Standards

segmented field technique makes possible the reduction of the number of segments per field from 6 (525/50) to 5 (525/60). The conversion of any BCN machine to any standard NTSC, PAL, PAL-M or SECAM is therefore purely an electronic and not a mechanical matter. The tape transport and scanner remain completely unchanged.

A guaranteed future for the BCN format with respect to digital recordings

The development of the BCN format was carried out taking in mind the requirements of a future generation of digital recording techniques. As soon as tape, head and component technology provide a cost effective solution for digital recording, BCN machines will find additional applications without any changes to the existing deck.

Cassettes or reels for portable, mobile, or stationary operation

The BCN format concept covers all operational applications:

The BCN 5 cassette version is intended for the production of rapid, studio quality, 20 minute programme contributions and of course, for all ENG activities. The portable, battery operated BCN 20 having 60 minute reel time is ideally suitable for all mobile applications whereas the conventional BCN 40/50 machines combine mobile outside broadcast operation with stationary applications.

BCN 40/50 for studio OB applications

The BCN system is based on a modular building brick concept. Modules with related functions are arranged in portable units.

The standard version of this universal equipment is the BCN 40/50, the typical VTR for studio stationary use.

The same version, however, is also, highly suited to mobile OB van applications.

For monitoring purpose a "monitoring bridge" consisting of a black and white or colour centre monitor, waveform monitor and vector scope can be added to the deck, electronics processor units.



BCN 50 as studio machine with "monitoring bridge" and integrated automatic editing EES9

Outside Broadcast productions with studio quality under all conditions: BCN 20

This portable or mains operated BCN version with 60 minute reel time is intended for high quality outside broadcast productions from a car, helicopter, ship, or motorcycle.

The additional electronic unit BCWQ 9 together with a standard processor unit enable high quality BCN 20 production suitable for transmission.



BCN has made this new compact OB van concept possible

The first studio quality cassette: BCN 5

The BCN-cassette fulfills the demand for ENG in studio quality. Recording and reproduction are ensured under all conditions between -10°C and $+45^{\circ}\text{C}$.

The 20 minute cassette enables rapid cassette change because it can be removed in any winding state and a reel subsequently removed and replayed directly on any BCN 20/40/50 without the need for adaptors.

A multi cassette automatic using the same 20 minute cassettes is in preparation and intended for automatic studio applications.



Reporter of the future with BCN-cassette

Experience gained from practical use

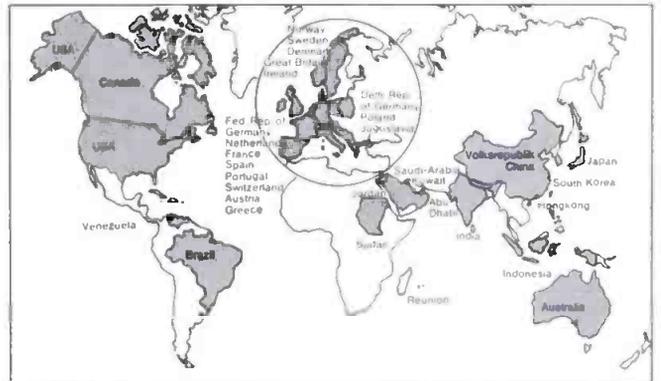


On the move recordings are now possible under the most extreme conditions

More than 70 TV authorities and production houses have decided in favour of the BCN system because of its outstanding economy and complete equipment range, covering both reels and cassettes. Stationary and portable BCN machines are now in operation all over the world.

The BCN format is the basis of the SMPTE-1"-Type B Standard

All BCN machines delivered so far are in accordance with this standard and need no alterations. In addition, the BCN format is being processed at the IEC and published as DIN Draft 45 483. The EBU regards the BCN-standard as already defined by the SMPTE; the BCN is in use in 16 EBU countries.



More than 350 BCN-systems in operation in 33 countries

BCN. A format that has proved itself

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For More Details Circle (20) on Reply Card

What do you do when the logic isn't logical?

By William A. Farnbach Engineering Section Manager, Hewlett-Packard, on sabbatical at Brigham Young University teaching Electrical Engineering.

If you are working with mini-computers, microcomputers, or your own processor-based design, you are working with a "data-domain" machine. A data-domain machine is not a data cruncher; it is a machine that interprets electrical signals as

data which consists of addresses, instructions, and some type of input or output. Your machine reads the electrical signals as bits, combines these bits into bytes and words, and then acts on these words to accomplish the desired task.

Consider the two flow charts Figures 1 and 2. No amount of time, pulse width, or other time domain measurements would allow anyone to determine which flow chart a particular processor is executing; yet, the ability to trace *continued on page*

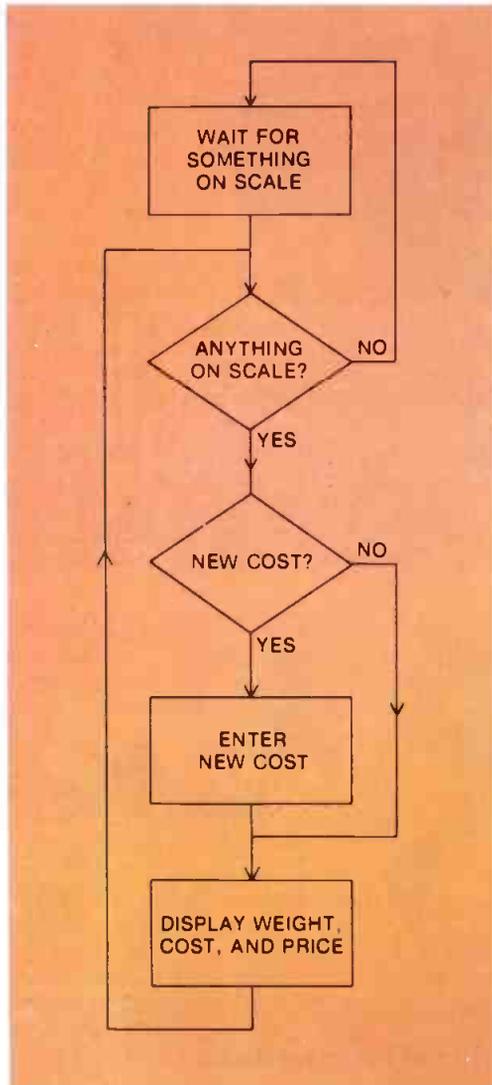


Figure 1

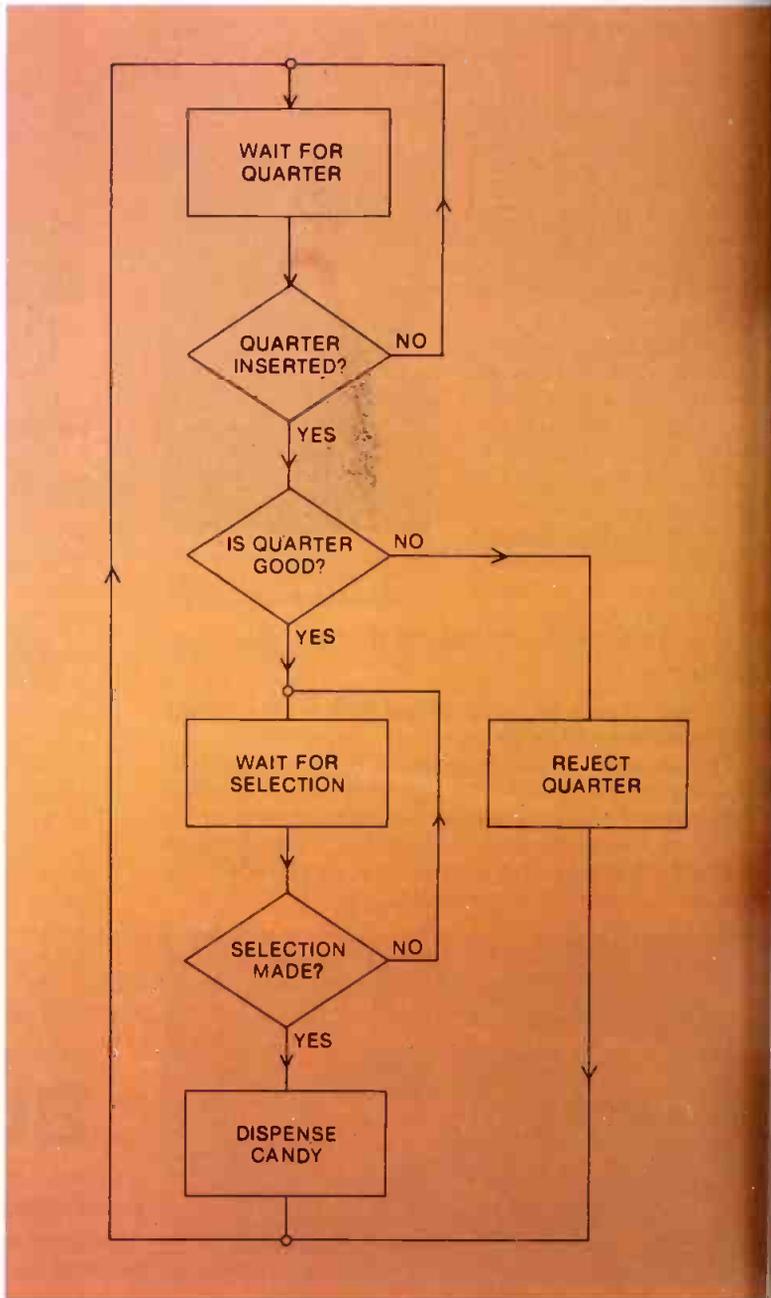
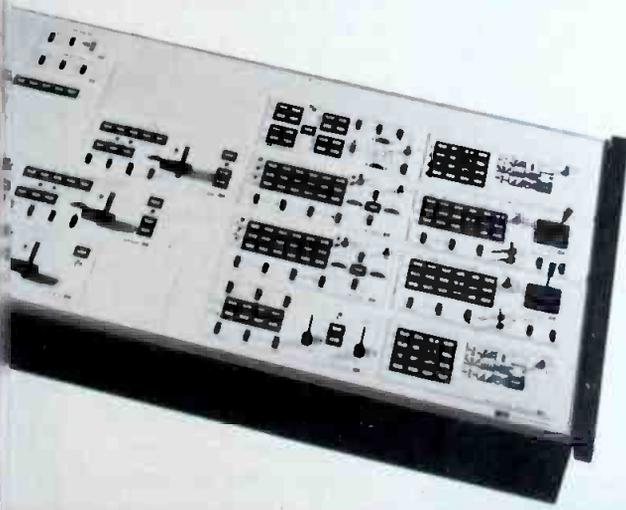


Figure 2



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internal signal flow as data would differentiate between the two flow charts immediately.

Now, no one will get very excited about the ability to differentiate between a candy machine controller and a meat scale controller by monitoring program execution; but, the very heart of designing useful systems with processors is the problem of making sure that the processor reliably executes your

program, not some diabolical variation of its own.

Consider the candy machine controller flow charts in Figures 2 and 3. The problem of making the candy machine controller execute the flow chart of Figure 2 instead of Figure 3 is very real—in initial design or in debugging. Again, the ability to monitor the signals inside a processor-based system as data is essential to learning why your

machine prefers the flow chart Figure 3 to that in Figure 2.

It would be a great help to be able to see exactly where your machine goes on its errant romp through the "weeds"—or, better yet, to see where it departs from the straight and narrow. A logic state analyzer can find either of these deviations with ease in its own environment at its normal operating speeds without simulation, substitution, or slow down.

The logic state analyzer used in this example is the Hewlett-Packard model 1602A which is 16 bits wide, has a memory 64 words deep, and clock speeds to 10 MHz. Understandable keyboard controls simplify data capture information.

System debugging

System debugging is generally started by monitoring the address lines on the microprocessor. All that is needed is to connect the 16 "data" lines of the logic state analyzer to the address bus and the clock line to the clock or control signal that tells your system when to read its address bus when it is valid.

Next, set the analyzer logic polarity to the same polarity as the information on the address bus and set the analyzer clock edge to be the same as the active edge of the signal that tells the system when to read the address bus. Also selected at this time is the data format—hexadecimal, decimal, octal, or binary—whichever is most convenient for you to read and enter (or the one that matches the program listing).

Weeding out the problem

Now, by pressing the Trace key while your machine is operating, the analyzer will capture 64 program steps in the sequence that they were executed and store them for analysis. After the data is captured, all the words in memory can be viewed by using the Display key (Next Word and Prior Word keys) to see what the machine is doing.

If your machine is hopelessly lost, such as the delinquent candy machine in Figure 3, this simple measurement will show you where it is. Once the Trace key is pressed, all 64 words in memory can be viewed by using the Display keys to see what the machine is doing. The trace of the candy machine's holiday

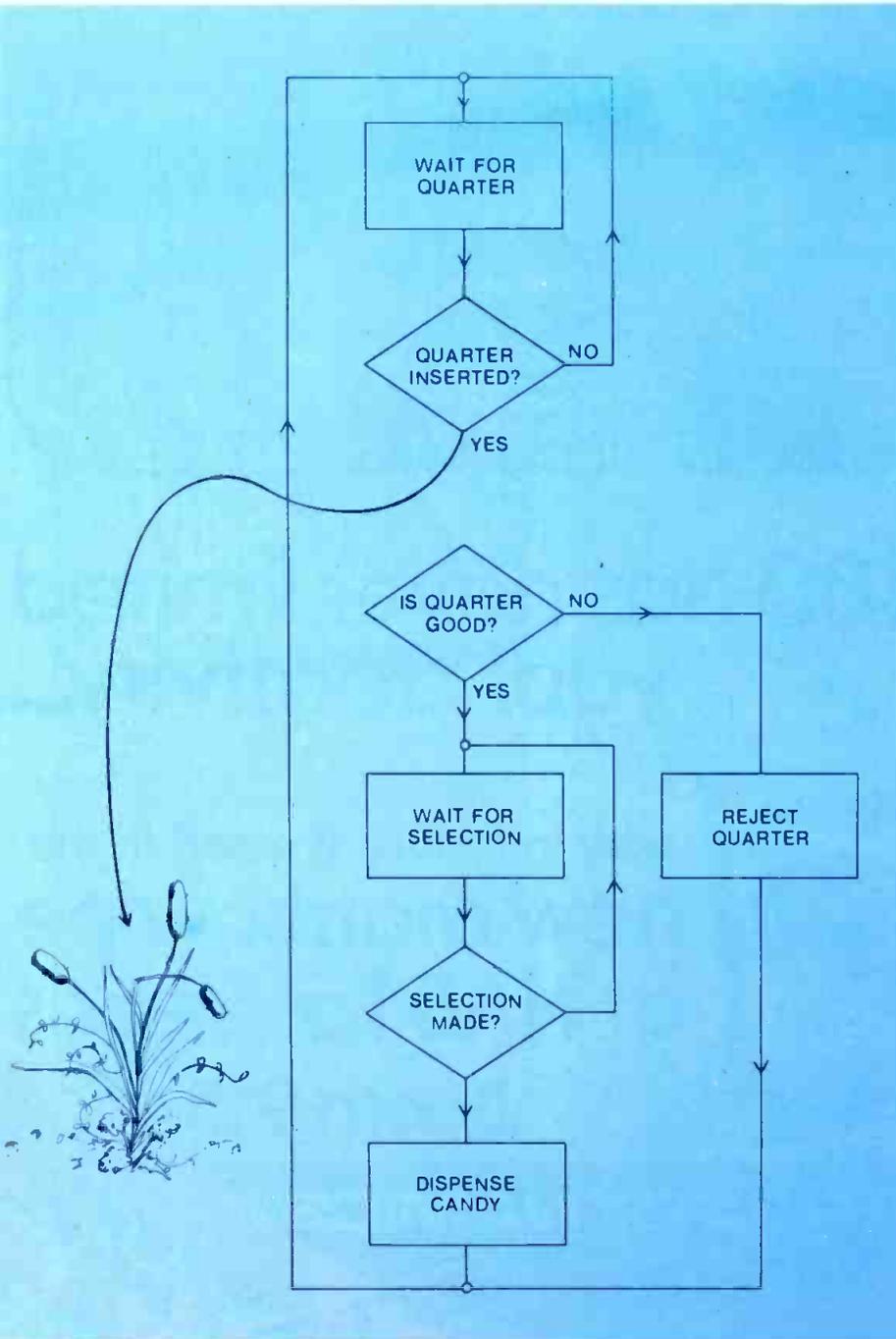


Figure 3

the "weeds" is shown in Figure

Now that the "weeds" are located, a particular part of the program flow should be captured instead of whatever is happening when the Trace key is pressed. To capture specific program execution when Trigger = key is pressed and the desired address entered into the trigger comparator. Now, whenever the machine executes the trigger word and address after the Trace key is pressed, the analyzer will either trace the addresses being executed or stop tracing them.

The Start mode is used when you want to see where the machine starts from a known address and the Stop mode is used to see how a machine got to a known address (that's right, a negative time trace). Also, the Delay = key can be used to delay the start of a trace from the trigger word or to put the trigger word anywhere within the captured words.

To solve the case of the runaway candy machine, select a trigger address from the captured address-

es in the untriggered trace (for example, 2011₁₆) and stop the trace when that address occurs. This will show how the machine got to the "weeds" and where it left your program to start executing its own program. Figure 5 shows the data that resulted from this trace.

If the problem is a simple programming or wiring error, you might be able to determine the cause once you know the address and nature of the error. In this example, the candy machine started at the reset address 0000₁₆, executed the program to 002F₁₆, and went to 0208₁₆ instead of 0108₁₆. This can be caused by either an error in the jump address program or two interchanged address lines. A look at the program listing and/or an ohmmeter will tell you which. A high percentage of the time you will be able to pinpoint the problem as soon as the address where it occurs is known.

The sneaky machine

If the machine is particularly sneaky about ducking out to execute

its own program, you may want to monitor another bus, an I/O port, or other area of the machine instead of the address bus. All the probes can be moved to another bus, or only a few probes can be moved. If only some probes are moved, you can trace part of the address bus and another bus simultaneously to relate program execution. Also, two analyzers can be cascaded to monitor two 16-bit buses at the same time.

Or, you might want to look at the waveforms and timing within the machine. The analyzer provides a Trigger Output signal so that an oscilloscope can be triggered exactly when the problem is occurring and look at related waveforms.

An experienced operator with a logic state analyzer and an oscilloscope can quickly answer questions such as: Is there a glitch? Is there a bad gate? Is there a race condition? If there a pull-up missing? Are the buffers operating properly? Is one machine talking on the bus when it should be listening? And that puts the logic back into logic. □

LOCATION IN 1602A MEMORY	YOUR ADDRESS EXECUTED
00	0216
01	0217
02	020A
03	020B
04	020C
05	020D
06	020E
07	020F
08	0210
09	0211
10	0212
11	0213
12	0214
13	0215
14	0216

Figure 4

LOCATION IN 1602A MEMORY	YOUR ADDRESS EXECUTED
50	002C
51	002D
52	002E
53	002F
54	0208
55	0209
56	020A
57	020B
58	020C
59	020D
60	020E
61	020F
62	0210
63 (TRIGGER WORD)	0211

Figure 5

John Baldwin of IBA explained the details of their recently unveiled all-digital VTR prototype. Baldwin's paper brought up some interesting questions about the future of all-digital recorders in a virtually analog field today. (Photo by Donna Foster Roizen.)



Digital VTRs: They could come as early as 1980

By Joe Roizen,
Video Editor,
Broadcast Engineering,
and President,
TELEGEN

For most of his distinguished career, John Baldwin has been at the forefront of television technology. A recipient of many society and industry awards, his most recent was the Montreux Symposium Gold Medal for outstanding technical achievement in the digital television field, including his work in developing digital intercontinental conversion equipment.

For the past two years, Baldwin and his team have continued to experiment toward the goal of an all-digital VTR, a device which would render to video recording the benefits of minimal controls, maximum reliability, and endless dubbing without loss of quality.

Baldwin has recently given some significant papers on his project, and has made demonstrations to a variety of organizations such as the EBU, IEE (UK), and the SMPTE. These have attracted great interest because the question of an all-digital VTR is an especially controver-

sial one at this time. With the expected imminent changeover in videotape recording equipment from quad to 1-inch helical, both the VTR users and manufacturers are not particularly enthusiastic about another equipment upheaval in just a few short years. The amortization period and the newly acquired operational and maintenance skills would hardly have been used up, such a drastic equipment turnaround were to occur.

Nevertheless, technical progress like time itself, is difficult to stop or even slow down. The merits of an all-digital VTR will have to be weighed against the economic and operational factors that exist when it is introduced, and subsequent hard decisions made.

To give some advance warning about this potentially important technical trend, BE has gone to the best source for information about an all-digital VTR: its most forthright protagonist, John Baldwin.

The BE interview

BE: When did work start on an all-digital VTR?

Baldwin: About two years ago; we had done a lot of digital work in other areas so we tackled a monochrome-only VTR using the VC/RANK 9000 machine. We felt that black and white was adequate to prove the principle and that theoretically there was no difficulty in going from monochrome to color. Black and white also made it easy to change the sampling rate and the first pictures we had were about one-sixth of the normal screen area. We handled about 26 megabits per second at that time.

BE: Why did you choose the IVC/RANK 9000 as the basis to work on?

Baldwin: There were two reasons. First, the format was very similar to a proposal I had made back in 1972 for such a recorder. A further reason was that I had worked at

Rank Cintel for 14 years and had good contacts there. We did, in fact, make some measurements on quad in 1972 that indicated, even at that early date, that a one mil track width would be adequate for digital recording.

BE: What were the next developments?

Baldwin: We changed from delay modulation to NRZ-type recording and tried different codes. We also discovered that a 9-bit code did not work well on color, so we went to a 10-bit per word arrangement. This worked well on color.

BE: What led you to $4f_{SC}$ sampling?

Baldwin: We actually started with $3f_{SC}$, but later shifted to $4f_{SC}$ to accommodate some peculiar PAL problems like quarter line offset. With $3f_{SC}$ sampling you would get an annoying diagonal pattern on the screen.

BE: Isn't $4f_{SC}$ hard to record on tape?

Baldwin: Our interest in $2f_{SC}$ was based on other reasons than digital video recording. It was a useful standard for network and studio operations. However, the control of group delay over the chrominance band is hard to achieve with analog comb filters, so $4f_{SC}$ was preferable. Also $4f_{SC}$ accommodates other digital devices like special effects systems.

BE: When did you make the first demonstration?

Baldwin: The EBU Working Party C saw a quarter picture playback in late 1976 which was sent by microwave from Crawley Court to our Brompton Road facility where a dinner was put on for the committee members. The equipment itself, however, was not shown at that time.

continued on page 58

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SENCORE
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In Canada:
Superior Electronics

Digital VTRs:

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BE: What was the next significant milestone?

Baldwin: In early 1977 we had switched to $2f_{sc}$ sampling and took our modified VTR to Venice in May. We were now able to show about one-half screen images, using 9-bit words. The equipment was in a van and was not shown to the EBU delegates. By Montreux (June 1977) we had gone to 10-bit words, had added effective error concealment, and had somewhat over one-half picture coverage.

BE: What equipment has been used for these digital VTR tests?

Baldwin: Up to Montreux all of our work was on the IVC/RANK 9000. However, after the paper was given in Montreux, we had some discussions with various VTR manufacturers of 1-inch machines. Bosch/Fernseh were very interested, and Henry Zahn had mentioned digital recording in his lecture on the BCN. In about six weeks we had a BCN to work on, and in a few days we had 40-megabit digital recordings making a half picture.

By November we were contemplating the IEE demonstration in January and thought it would be nice to have full pictures by then. We needed the BCN modified to be able to meet this goal, and so we asked Fernseh to double the rotational speed, narrow the video tracks, and widen the band pass of the record/replay amplifiers. Also, the digital interface for half picture had to be redone for full pictures. Fernseh provided the components to do this.

BE: How did the IEE demonstration on January 26 in London go off?

Baldwin: The schedule had been very tight, and we could not do everything we had hoped for. We did show some full pictures even though they were not quite up to our expectations. We also showed half pictures which, because of some changeover problems, were not as good as those we had been making at Crawley Court.

BE: Will you have a full working digital VTR at the IBC 78 in Wembley?

Baldwin: There is no reason why this shouldn't be possible, but I'm not saying that it will be IBC, for perhaps some other reasons.

BROADCAST ENGINEERING

E: Are you contemplating the conversion of other VTRs for digital operation?

aldwin: Yes, we are already working on another machine which Type C format. We have found we need for a new head structure and are awaiting new components to continue our tests.

E: How do the Type B and C formats differ with regard to a digital VTR application?

aldwin: Well, they are essentially different. Type B is already segmented, so altering the scanner speed upward simple means it remains segmented. However, if you alter the speed of a Type C scanner will become segmented, and you lose all the advantages of a non-segmented format.

E: In that case, do you change the type C format into a segmented TR?

aldwin: No, how we envisage the C machines being made is to have a number of heads on the drum all operating a 40 megabits and laying parallel tracks.

E: This obviously means narrower tracks; have you confirmed your theory that narrow tracks are adequate on a digital VTR?

aldwin: I can only comment in connection with the Fernseh machine. We dropped the track width from 160 microns to 60 microns, keeping the guard band the same. This kept the interchange factor equal to the normal analog BCN which has been proven. We have no tracking problem and we got an adequate S/N ratio.

E: Would you care to predict when commercially marketable digital TR will be available?

aldwin: It may be that a digital VTR will be shown at IBC, but of course that will be just to show what is going to happen in the future. It is fairly normal to take about two years to go from that stage until machines are delivered in any significant numbers.

E: Since IBC is in September of 1978, then you believe that by the end of 1980 or the beginning of 1981 there will be a digital VTR competing with the analog machines.

aldwin: Yes, I believe so!

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transmitter

How to make your automation a "genie" instead of an "ogre"

By JoAnn Burkhart, IGM

AUTOMATION PROBLEMS?

This article is based upon a manufacturer's home office contact with field engineers, those guys in the trenches between the manufacturer and the user. The assignment from *BE* was to report on the problems of operating an automation system in such a way that all users, regardless of system specifics, will benefit.

If you're not into automation, keep this material in mind when your time comes. If you're there already, find a quiet corner and let's dig in.

Ron Merrell

Nobody ever said automation is perfect, just that it's very good.

Yesterday's playback, recording and control devices were elementary, crude, and often unreliable. Today's are sophisticated, perform space-age maneuvers, and are surprisingly trustworthy; however, station personnel also must understand the care and feeding of the beasts.

Remember the repairman who charged \$70 to a car owner—\$10 for his time and \$60 for knowing where to kick it? Radio station equipment maintenance is a little like that; often a problem is very simple to remedy if you only know where to look. Let's examine some of the more common and easily remedied problems, many of which are caused by misunderstanding of capabilities or lack of routine maintenance and care.

Care starts as early as the time of purchase. Before you start discussions with manufacturers' salesmen you must have your "dominos lined up" so that you won't forget to ask important questions. Write down an outline of what you want to know and think you need. Don't discover only when the system has been installed, that it never was designed to do what you intended in your mind (but never told the salesman).

The station owner should understand the terms, conditions, and warranties thoroughly, and get them in writing. It is also well to remember that manufacturers are at the mercy of their suppliers, just as the station depends upon the equipment manufacturer. Certainly it is wise to be somewhat flexible and, if you're supposed to receive delivery of Brand X on September 1, don't make irreversible plans to yank out your existing system on August 31. This may sound elementary, but it happens.

While awaiting delivery of the equipment, the station engineer and programmer may be able to obtain and study an operator's manual from the manufacturer. Thus, on the day that the equipment is installed, key people will be ready to absorb training more readily.

Equipment manufacturers appear to stations to check the state of the

delivered gear as soon as it arrives. Sometimes delivery is made before the station is ready to install it. The crated devices are stored in the back room. Three months later, when the machine is uncrated, shipping damage is uncovered; and it is too late for the owner of the equipment to file a claim with the shipper. The resultant loss may be devastating.

Static electric zaps

The physical environment for the automation system is all-important, making control of temperature and humidity essential. Static electricity is a very common troublemaker, causing components to switch on or off, multiple starting, garbled audio, and other intermittent troubles. Yesterday's logic, relays, and tubes used voltage levels of about 30V; it would take a spurious voltage of about 10V or more to trigger a relay falsely. Today's TTL devices are more sensitive (only 5V is normal), so static electricity charges of 1½V to 2V might be sufficient to trigger an IC.

Walking across a rug during dry or cold and dry, which is worse

known carpet guaranteed not to cause static charge, not even computer carpet (which reduces but does not eliminate it). If you must have a carpet anywhere near your equipment, install a grounding plate: an exposed metal surface that goes directly to earth-ground.

Before you approach OTTO the automation, touch the plate to dissipate your static charge. A metal door to the automation room (presuming you have no carpet there) works well. Stations in a dry climate should install humidifiers to maintain 45% ($\pm 5\%$) humidity, further reducing the likelihood of erroneous electrical charges.

Too wet too long

In extremely humid locations (like the Southeastern United States or tropics), static electricity is seldom a problem, but super-high humidity adds to the possibility of corrosion on the PC boards. Sometimes you can actually see condensation standing on the metal points. Components like small springs may rust. It's simple to control: just pull the boards and clean the contacts periodically. Keep all other metal surfaces scrupulously clean.

Temperature and humidity recommendations usually are contained in operations manuals. For instance, an ideal temperature for most ICs is 25°C (or about 77°F). At temperatures significantly above that level, a component may still work, but not at its optimum level, working partially and failing sooner than normal.

Clean AC helps

Do you have clean AC lines? If possible, have no other equipment on the same line with an automation system. Any kind of DC motor that starts up from a common line is a problem. One of the most common culprits is an old calculator machine that uses relays which tend to arc and cause noise on the AC line. Other culprits include aging turntables; air conditioners that start and stop; and motorized equipment in multi-story or shared buildings.

Newspaper buildings typically are full of AC noise from the large presses, A hapless radio station in

Ohio recently traced an aggravating intermittent problem, finding that a coal mining company was on their same power line. When the company turned on big motors to grind coal, the AC noise came down the line and into the automation. To remedy the problem, the station asked the power company to place them onto a different AC line feed, then installed voltage transient suppressors as well. If you can't cure your problem by getting a single line, most noise usually can be eliminated through installation of an AC filter on the line to the equipment.

Keeping it grounded

A station in any kind of building, but particularly a multi-story building with old wiring, should install a good grounding system. A four-inch copper strap, to which all equipment is attached, goes a long way toward eliminating common problems caused by spurious static electricity or AC line noise.

So your equipment is installed and works great, for the manufacturer's installer, that is! While that expert is on hand, the station owner must make his own personnel available for training. Not even a simple automobile can be driven without a trained operator. No one should be allowed to touch the automation system without prior instruction. It's not that hard to operate; and, if you've been working with turntables, cart machines, and control systems for your whole life, you know every manufactured product has its own personality. Get off to a good start by knowing the equipment thoroughly.

Cue tone problems

Naturally, good sound is a chicken-and-egg situation: both the playback equipment and the tapes have to be correct. The placement of cue tones on the tape is of utmost importance, as improper cues will cause erratic switching, doubling, tapes that don't cue up, or tapes that stop in the wrong place—all calculated to give the program director and station owner high

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"Say, Joe, are you sure you want to install that carpet in here?"

et) weather can cause surprisingly high voltage levels to build up on our body. When you touch equipment, not only do you get "zapped," but an IC may respond. There is no

Automation

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blood pressure. The placement of the cue tones is usually subject to only a few common problems:

- The tape may be old and worn, so the oxide is down to an insufficient amount; this causes the level to be incorrect.
- You've switched brands of tapes from the one you normally use. There are not necessarily good tapes and bad tapes, just different bias settings for each type of tape. Tones on two different kinds of tapes can vary as much as 3 dB.
- The tapes have cue tones recorded at incorrect levels, caused by operator error. Everyone should have NAB reference tapes on hand. Use them to compare the levels you have recorded with the levels of the NAB tapes, and maintain absolute accuracy. It's probably elementary to most experienced personnel, but levels for differing functions are variable, so a check of current NAB standards should be made (for secondary, tertiary, logger tones, etc.).

But it used to work great!

All these elements were pinned

down and everything worked perfectly for several weeks or months. Without varying anything, suddenly you have problems. Before aiming an angry kick at the automation equipment, look at the following elements of your playback units and/or recording equipment:

- Have you mixed two kinds of carts on the same recorder? You may wind up with level differences due to physical structure variations in carts. For instance, Aristocart has a flat bottom and Fidelipak rests on the edges of the cartridge with a space underneath. Audiopak is similar to Fidelipak, but has a fractionally different structure. While recording with differing cartridges, you must use shims as necessary under the carts for proper consistent alignment (or else use all one type of cart).
- The recording head should be physically adjusted and checked for wear periodically.
- Check the tape guides. One could be bent. Someone may have jammed in a cart too hard while loading a machine.
- Are the heads dirty? This is a periodic and routine maintenance job. Oxide from tape builds up over a period of use and must be

removed. Alcohol is not considered a good head cleaner because it leaves a residue. Use a cleaner like Xylene (there are others equally good).

- Pinch rollers are a maintenance part and eventually wear out although it takes many months or even years. They become concave or get dry and shrink. Clean them (which prolongs their life) or change them (a very minor expense).

If your problem occurs no matter which playback unit is being used the problem is likely to be in the recording system. If only one playback unit seems distorted, examine that particular setup.

The most frustrating problem of all is the intermittent malfunction you'd rather have something happen all the time than some of the time because it's easier to find. In addition to AC problems and other items listed, erratic problems, like double-carting after a system has been running steadily for six months, are often due to lack of other routine maintenance. You must clean the filters in cooling fans. Where automation equipment is located in a traffic area, dust begins to lie heavy on the machines insulating the surfaces and causing



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devices to run too hot. Individual electrical components in a device may be operating within the tolerances of their specs, but at the outer limits of those specs, thus failing intermittently.

Eventually, things happen

Although all equipment manufacturers try to build in as much longevity as possible, any mechanical or electronic device eventually has parts wear out. After an automation system has been operating every day for a couple of years, it's not surprising to find relays that need replacement. After all, they have opened and closed thousands of times. A symptom might be that a tape deck won't start periodically.

Older automation systems used many relays, so consider looking at them for wear. Solenoids may need adjustment, but not all of them are designed to be disassembled and cleaned in the field. If a solenoid on a reel or cart machine is getting sluggish, clean it or replace it (probably sending it to the factory or such service).

That brings us to the subject of factory service again. All reputable manufacturers maintain customer service departments to advise cus-

tomers and correct equipment problems. Such service extends not only to failure of that manufacturer's equipment, but also to problems beyond his control. One of our men once spent seven hours on the telephone with a Florida customer, guiding the engineer step by step in the location of component failure and repair of equipment knocked out by a severe thunderstorm. Such emergency repairs were achieved because that station engineer really knew the equipment.

When you have an insoluble problem, when you've checked all the maintenance possibilities and the problem remains, phone your manufacturer and ask for help. Usually the station should not modify software or disassemble major units of an automation system without first consulting with the manufacturer. Some warranties are voided if you do. But the main point is that the manufacturer's customer service department is trained in troubleshooting and can keep you from getting into even worse difficulties.

And in stormy weather...

Spectacular thunderstorms are enemies of radio stations, but what can you do to protect yourself? Two

basic things are the use of AC line isolation transformers and installation of a good grounding system for equipment. Lightning actually gets into the automation and blows out components like ICs, transistors, etc., sometimes with such force that a component flies right off the PC board.

If you have remote lines that go from the automation to a live studio feed, like a news cart that might be remoted from the automation, try to isolate them by the use of relays and audio transformers. This decreases the likelihood of lines outside of the automation dropping lightning on your equipment.

Most stations already have spark gaps on their transmitters, lightning rods, etc. IGM puts "varistors" in their equipment which short out the AC line if voltage gets above a dangerous level instead of burning out components. If your system does not have such protection built into it, you can buy such components at your local electronics store and install them in the AC line.

Power failures caused by lightning and electrical power company knock-outs are the ultimate in big problems. Therefore, whatever your

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VTR IMPROVEMENT PLAN



VR-2000



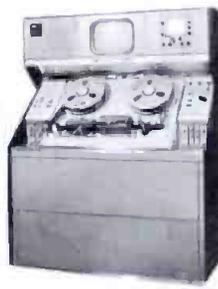
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Automation

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type of equipment, you ought to provide standby power, batteries, or generators to run the system for periods of power outage. Some control systems come equipped for a back-up battery, but remember that batteries have a specific shelf life. Gelcels typically have a shelf life similar to that of car batteries. If your battery back-up has been sitting unused for years, it is not going to do you any good in a sudden power outage. Also, battery

leads corrode and should be cleaned.

Equally distressing to a radio station are fluctuations in the incoming power lines, brownouts, or overload spikes on the AC line caused during power company load switching. These result in tapes that run slow, memories that could lose data, clocks that don't update, more than one cart doesn't start, etc. Make friends with your local power company and explain your particular problems; it might result in greater care being used during switching. You can install uninter-

ruptible power systems involving special power transformers, of course.

Garbage in, garbage out

It probably surprises no one that humans "screw up the works" most often. Automation should be protected from untrained people, many of whom cannot resist poking buttons—buttons which might change a whole day's programming. Equipment should be maintained in a low-traffic area or even behind locked doors, accessible only to those authorized to operate it. Such isolation also provides an environment as dust-free and static-free as possible.

An article by Peter Burk (December 1977 **Broadcast Engineering**) as well as a statement by the SBE, acknowledged that some busy and overworked station engineers are not abreast of current technology and are still involved with transistors instead of learning about microprocessors (increasingly becoming an integral part of modern equipment). Station owners might make an effort to release their station engineers for training seminars or provide suitable in-house training to keep such key personnel fully trained in latest methods.

A common human misdemeanor is interfacing equipment to the automation system without conferring with the manufacturer. Such add-on equipment may draw more power from the system's original power supply than it was designed to handle. This could result in poor voltage regulation, high AC ripple, and the complete failure of either the add-on piece of gear or the main system. More likely, however, it might cause an elusive intermittent malfunction.

Asking the impossible

Fascinated by the tremendous flexibility provided by modern automation systems, a program director may inadvertently program a sequence that is physically impossible. Example: Not all cartridge playback systems can play carts out of the same stack back to back. Playback of a music selection, followed by a short ID, then back to another cart in the same stack, may not allow enough time for cueing and the unit will not perform. Some cartridge playbacks provide instant random access, some cannot. Also, if tapes are produced that are of too short duration, some systems cannot handle overlapping auxiliary tones from two different sources.

When using a system that has a memory, an operator may forget to

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double-check the pre-programming self. Avail slots are not filled in time for airing; or, commercials hastily added to fill such avails are not checked for proximity to similar commercials in the same time segment. This may result in lost revenue and angry clients.

Reel-to-reel units must be set properly, or the 25 Hz sensors may chatter or fail to work at all; 25 Hz tones are recorded on the reel with the music by the music service company. Due to the variations in level between reels of tape, each new reel should be cued up to the proper reference level, and the tape will take care of itself. All services record that reference level tone at the beginning of each tape. You must check this with every new reel; you cannot assume that each reel is identical.

The fact that we've reviewed most of the common problems that can plague a station does not mean that equipment and/or automation is unreliable. We're not suggesting that you stick to a mike, a turntable, and hand-loading of single-cart machines. Humans cause even more errors than machines. Most manufacturers are putting out amazingly reliable gear, trying to "people-proof" it, and providing virtu-"genies" that give a bright, consistent sound on the air. That's why many stations buy automation: for control of format, consistency of sound, and savings in the form of greater utilization of existing personnel.

A truly creative person gets monumentally bored by manually shuffling records and carts day after day in an atmosphere of extreme tension. Automation frees talented people to earn their paychecks—checks with higher numbers on them, because the station owner can afford to hire quality instead of useless quantities of arm bodies performing mundane tasks.

Many smaller stations find themselves in the frustrating role of a training ground for ambitious creative programmers, who naturally want to move on to higher-paying or more challenging jobs after they learn their trade. With the use of well-maintained automation (which performs the mundane housekeeping tasks better and with fewer errors than humans) the creative person has time to do more planning. In addition, this person will take a personal interest in what's going out on the air, and will more likely stay and grow with the station. The automation is the workhorse; the creative person is the jockey.

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Let's preserve that musical timbre

By Dennis Ciapura

As broadcasters we are charged with the awesome responsibility of operating the limited number of available broadcast channels in a manner that best serves the public interest. This basic premise is the foundation upon which broadcast licensing policy is built. The fact that we operate in a free enterprise system that allows the physical facility to be privately owned and operated for a profit does not diminish our obligation to provide the best possible service to John Q. Citizen.

While the vast majority of broadcasters would surely agree with my opening statement, the phrase "best possible service" is subject to wide and varied interpretation. To one broadcaster, optimum service is provided by the super-modulated and super-processed facility that strives to attain maximum loudness in the hope of extending its coverage area. Another broadcaster may feel the public is best served by the station providing the most faithful reproduction of the original program material.

Obviously, the on-air sound pro-

duced by each of these broadcasters will be quite different; and, most real-world radio stations are engineered to fall somewhere between these two philosophies. Although every market has at least one staunch advocate of either super loudness or super fidelity, most stations across the band seem to be seeking the middle road. However, this middle road may involve some unnecessary compromises that prevent many radio stations from sounding as good as they could.

Audiophiles have become more vocal in expressing their disappointment with FM audio quality, and even laymen often dismiss poor AM sound with "that's AM." Unfortunately, I must admit that I can't listen to most radio stations on the FM band for more than a few minutes when using good monitoring equipment. Although most radio stations, even the over-processed ones, sound okay on small portable and auto receivers, the simple truth of the matter is that even in large markets like New York, Chicago, and Los Angeles (where there are

30 or more stations to choose from) only a pitiful handful offer tolerable fidelity to the listeners who care.

Wash and wear sound

If this seems like an overly critical assessment, spend an evening tuning across the FM band listening to each station and jot down an honest audio evaluation of each. It is little wonder that stereo shops prefer not to use FM stations as program sources for demonstrating amplifiers and speakers. It is interesting to note that this was not always the case. Years ago home equipment was less sophisticated and, more often than not, the radio broadcaster had a better phono system than the listener at home and broadcasted a relatively unprocessed audio signal. Today the situation has reversed itself. Many FM stations don't have an elliptical stylus in the house and use turntables whose mechanics are more akin to washing machines than state-of-the-art disc equipment.

Although several equipment manufacturers produce cleverly designed signal processing equipment which, when properly utilized, can provide a high-level signal virtually indistinguishable from the program input, many stations still manage to sound bad. In many cases, the latest equipment is installed, and despite the fact that its maker recommends that it be the only processor in the program chain, it is installed at the end of a series of other processors in the belief that "some is good, more is better."

This approach is likely not only to destroy the audio quality, but can actually result in less loudness. Almost all of the new breed of audio processors employ multiple attack and release characteristics arranged to provide maximum modulation capability with minimum audio degradation; but, they assume an unprocessed input.

Even if the program chain is set up according to the manufacturer's recommendations, many engineers cannot resist the temptation to run the highest compression level that the unit is capable of, once again in the belief that if some is good, more must be better. In either case, the impact on audio fidelity can be devastating.

There is more to audio fidelity than simple frequency response, noise, and distortion. Even if a station claims superlatives in the classic measurements, if there is so little dynamic range that every recording begins with surface noise at an audible level and there is 4%

“Audiophiles have become more vocal in expressing their disappointment with FM audio quality, and even laymen often dismiss poor AM sound with ‘that’s AM.’”

second harmonic distortion on the highs due to stylus tracing non-nearity, you can't lay claim to good audio fidelity.

All things being equal...

There are also the extreme cases where broadcasters equalize each record as it is transferred to tape or cart and also employ additional equalization in the program chain to form the overall "sound" of the station. The end result bears little resemblance to the original program material. We have all heard programmers talk about adding "punch", "sock," "presence," and "brightness."

To be sure, EQ has its place in correcting response deficiencies of older records and tapes, but can we in a few minutes do a better job of musical artistry than the producers and musicians who may have spent hours mixing down and equalizing each cut?

I think we come right back to the matter of defining what kind of operation best serves the public. Station management and programmers approach the question with a competitive zeal which dictates that any legal engineering approach pro-

ducing higher ratings is justified and desirable. After all, if more people listen, they must like what they hear, and isn't that serving the public better?

At first, it does seem like a convincing argument, but the fact is that most of the larger stations which have the resources to do this sort of audio manipulation also have the resources to employ the best on-air personalities and promotion. Other stations aspiring to be just as successful, emulate the successful stations as much as possible and usually find that although they cannot afford a \$50,000 promotion campaign or \$25,000 per year announcers, they can obtain the same air sound for a few thousand dollars. Fledgling programmers cling to every word that proceedeth from the mouths of the major metro messiahs.

Everyone believes that they must be doing something to the audio. To many broadcasters, it is just inconceivable that a simple audio chain adjusted for minimum alteration of the program input can be the best approach. Yet some of the very successful FM stations operate with clean, flat and uncompressed audio.

But these stations are not very vocal about what they have done to the audio because it's more a matter of what they haven't done. It's not very interesting to hear about the equalization a station didn't do, and all the AGC amplifiers and limiters it doesn't have installed, resulting in no "punch," "sock," "presence," or whatever.

In don't think that any combination can beat a good RF facility with clean audio, a good air product, and strong promotion. One wonders how much more successful the over-processed stations could be if they converted to transparent facilities. After all, there are quite a few people who will switch to a station with less-talented announcers and programs but clean audio, to give their stereo system a workout.

Does it sound better?

The incredible part of this story is that this article should actually have been entitled "New Wave Of Audio Gear Makes FM Sound Better Than Ever." Incredible, because while the last five years have seen the introduction of some fantastic devices that should be resulting in a

continued on page 68

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Musical Timbre

continued from page 67

more-and-more listenable FM band, the auto radio comparative loudness test continues to dominate engineering objectives at too many stations. There is a better way, and you can prove it to yourself if you are highly processed.

Set up a tape recorder connected to a receiver or the modulation monitor output, and record a few

selections of music and announcements from your format. Now, back off on the limiter input level controls until very little compression is indicated. Without changing the record level settings, play the exact same selections of music and announcements while cutting a second piece of tape. If you splice pieces of the before and after tests together so that you have an instantaneous comparison of loudness, you will probably find it difficult to tell the difference. If multiple AGC ampli-

fiers are employed ahead of the limiters to correct for sloppy production techniques and/or hazardous board operation, it becomes a question of whether or not the station's staff is willing to conscientiously manage more accurate levels to allow less compression.

How much is enough?

When adjusting the degree of processing, it is extremely important that before and after tapes be made so that you can tell if what you're doing really does make a difference in perceived loudness. It's very easy to be psyched-out when making adjustments without a documentation tape, because it seems that more compression should produce much more loudness; however, until you actually hear the comparison, you don't really know.

It's a shame to have more processing than is required just to be sure there is enough. Many stations have found that they can run a few dB below the threshold of limiting and still have an excellent loudness level on the air and superb fidelity. Remember that FM limiters will cause some loss of high-frequency energy when driven hard, and this can affect the spectral content in the 3-5 kHz range that the ear is most sensitive to.

Many broadcasters will find that a sensible, organized approach to determining how little audio alteration is required, rather than how much can be obtained, will lead to a cleaner signal on the air and a cleaner conscience when it comes to asking ourselves what the definition of "best service" really is. We would be most interested in your opinions on this subject and whether you agree or disagree with the ideas presented here. Clip out the short questionnaire below and send it in to us. We'll print the results in a future issue so that you can see where you stand among the other broadcasters in the country. You don't have to sign it or identify your station unless you want to, so we expect the results to be completely candid. Obviously, we are talking about FM because AM has some special requirements.

In closing, I will say that I have never heard of a listener complimenting a radio station for being the loudest sound he could punch up on a car radio. I have known many to call a station with a word of thanks for good, clean sound. I wonder if John Q. Citizen really knows that pinning the needle on 100% and keeping it there is in his best interest?

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FM SIGNAL PROCESSING QUESTIONNAIRE

My occupation is: Engineer Programming Mgr.

- | | Yes | No |
|--|--------------------------|--------------------------|
| 1. In my opinion most FM's sound:
<input type="checkbox"/> poor <input type="checkbox"/> acceptable <input type="checkbox"/> good | | |
| 2. I agree that FM stations should be processed for best fidelity? | <input type="checkbox"/> | <input type="checkbox"/> |
| 3. I feel that maximum loudness should be the primary objective? | <input type="checkbox"/> | <input type="checkbox"/> |
| 4. How is your station set up?
<input type="checkbox"/> A. Maximum loudness
<input type="checkbox"/> B. Maximum fidelity
<input type="checkbox"/> C. Compromise of both | | |
| 5. Is the station's sound the result of programming dept. influence? | <input type="checkbox"/> | <input type="checkbox"/> |
| 6. If yes to #5, would the engineering dept. have a different objective? | <input type="checkbox"/> | <input type="checkbox"/> |
| <input type="checkbox"/> A. Less processing
<input type="checkbox"/> B. More processing | | |
| 7. Do you listen to your station often at home for entertainment? | <input type="checkbox"/> | <input type="checkbox"/> |
| 8. Do you listen to other FM stations often? | <input type="checkbox"/> | <input type="checkbox"/> |
| 9. Type of home stereo:
<input type="checkbox"/> A. Very good component system (\$1000 +)
<input type="checkbox"/> B. Moderate quality system (\$300 +)
<input type="checkbox"/> C. Modest system (under \$300) | | |
| 10. Size of your radio market <input type="checkbox"/> small <input type="checkbox"/> medium <input type="checkbox"/> large | | |

Name (optional) _____ Station (optional) _____

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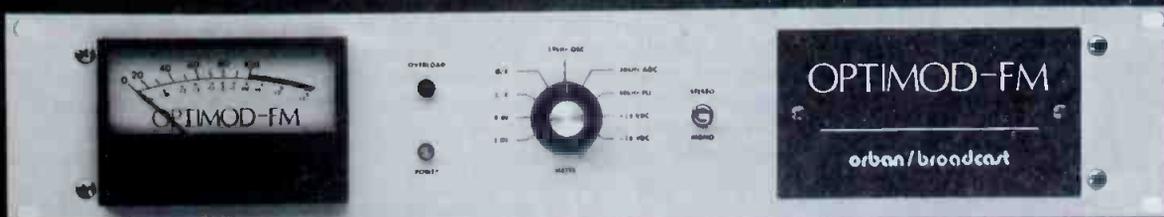
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For More Details Circle (51) on Reply Card

An easy-to-use system for calibrating a modulation monitor

By Jerry Frankforther,
Maintenance Engineer, WTOL-TV,
Toledo, Ohio

We needed a simple, stable, accurate, and easy-to-use system for calibrating our station's modulation monitor here at WTOL-TV, Toledo. Ideally, the system should contain all circuits necessary for the calibration in one unit. Of course, the unit should be cost effective.

The Bessel Function method of calibration involves the modulation of the transmitter with a specific audio frequency and detection of the resultant reduction of the carrier to zero. At the carrier nulls, the modulating tone and the percent of modulation is determined by the following formulas:

$$\text{Audio Tone} = \frac{\text{Frequency Swing}}{\text{Modulation Index}}$$

$$\% \text{Modulation} = \frac{\text{Modulation Index} \times \text{Audio Tone}}{\text{Frequency Swing at 100\%}}$$

The carrier nulls at modulation indexes of 2.405, 5.520 and 8.654. Many other carrier nulls occur at ever increasing modulation indexes. These are not normally used due to the difficulty of detecting the nulls. A frequency swing at 25,000 Hz is defined as 100% modulation for the aural television transmitter. Selecting a modulation index of 8.654 at 100% modulation requires a modulating tone of 2889 Hz. With a 2889 Hz tone, the carrier will also null at 27.8% and 63.8%, providing linearity checks. The carrier null may be set at any percentage of modulation desired by multiplying the frequency swing for 100% modulation times the desired percentage of modulation and dividing the product by 2.405.

Another modulation index could be used, but 2.405 is recommended because it provides the sharpest null indication. The Bessel Function

method assumes the audio tone modulation is a single pure tone. Therefore, the audio tone should be as low in distortion as possible. The accuracy of this method is determined by the accuracy of the audio tone and the null detection.

The audio modulating frequency may be set with a frequency counter. Unfortunately, frequency counters are expensive and inexpensive audio oscillators drift excessively. Crystal oscillators and digital dividers will generate an accurate and stable audio frequency, but only squarewaves. A sine wave may be digitally synthesized by summing the outputs of shift registers connected as a ring counter. The resultant sine wave is approximated in a number of steps equal to twice the number of registers. This method is unique in that it develops a sine wave and performs frequency division at the same time. Also, as the

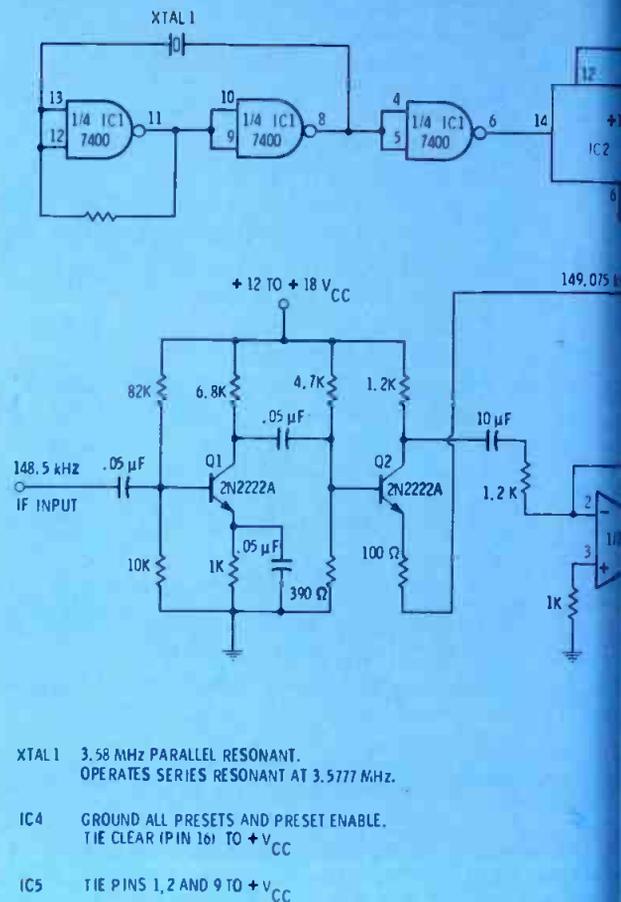


Figure 1

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Calibrating a monitor

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3.58 MHz parallel resonant color oscillator crystal was on hand. Connecting this crystal as a series resonant feedback element in the squarewave oscillator of IC1 (as shown) resulted in an operating frequency of 3.5778 MHz. With a pocket calculator, it was found that dividing this frequency by 24 resulted in a mixer frequency of 149.075 kHz. This frequency applied to point B would develop a carrier beat note of approximately 600 Hz.

Further division of 149.075 kHz by 2 yields 74,538 Hz. Dividing 74,538 Hz by 26 as the sinewave synthesizer does result in 2867 Hz tone. Note that a 2867 Hz tone is less than 0.8% in error. A 3.600 MHz series resonant crystal could have been used to reduce the error of the audio tone. Readjustment of the modulation monitor would reduce the carrier beat note to a satisfactory frequency. However, it was felt that this small amount of error could not be accurately read on the monitor and was within tolerances.

The calibrator was rack-mounted at the transmitter. The audio output was wired to a patchpanel and the IF input connected to a resistor isolation network mounted on a terminal strip in the modulation monitor.

To use the calibrator, the audio is patched directly into the transmitter and a scope is connected to the calibrator. (The scope connection is unnecessary if the aural indicator is used.) With the audio tone set at zero level, the scope is adjusted to display several cycles at full screen amplitude. As the modulation level increases, the waveform amplitude decreases and becomes distorted as the sideband beats become visible. In our case, carrier null occurred when the display returned to a low amplitude sinewave of minimum distortion but of increased frequency. Comparison tests against our former method of calibration showed this circuit to be as accurate in detecting the nulls.

Overall accuracy was increased due to the stability and accuracy of the crystal-controlled frequencies. The calibrator has met all our design goals and reduced calibration time. No more hunting patch cords; setting up the BC-221; and interconnecting a tangle of cables, cords, and amplifiers in order to do the calibration.

Nothing has been said about the power supplies. The digital circuits require +5 volts at 160 MA for the circuit shown. The dual supplies for

transistors and opamps should supply about 25 MA each at 12 to 15 volts. IC voltage regulators, such as the HEP C61XX series, are ideal and easy to use. They are also capable of powering several projects for a total of 100 MA for each project. Whichever power supply is used, be sure it is well-regulated or decoupled sufficiently at the opamps to prevent undesired output signals. (See voice of experience.)

You may find it desirable to use CMOS ICs in place of the 74XX series shown. This will allow omitting the +5 volt supply as they are compatible with the transistor's supply. The entire unit could then be powered by inexpensive 9-volt batteries. This is practical for the relatively short time the calibrator is cutally in use.

The amplifier and mixer circuit is very effective. The lack of tuned circuits makes it convenient and easy to use. The high harmonic content of the squarewave input at point B allows beats to be detected at these harmonics. This may simplify the digital circuitry supplying the mixer.

A service grade scope was able to detect a zero-beat with a signal generator set at the mixer's fundamental frequency and output level at a minimum. Even with the signal generator set at the 24th harmonic of the mixer's input, a zero-beat was detected easily with only a small increase in the generator's output level. A more accurate zero-beat is obtained by this method than by the aural method due to the better frequency response of the scope.

Switch selection of different crystal and/or division ratios feeding point A will supply tones for calibrating the monitors at any percent of modulation desired. Additional frequencies could be selected to provide audio tones for check equipment checks or any use you may have. Many other uses of the circuits shown will probably be recognized by other engineers. We would be pleased to hear of them. □

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For More Details Circle (53) on Reply Card

RENG: Creating visual images with sound

By Peter Burk



"Drivale seems to be having a little difficulty with his control."

Spring is here! Put the basketball gear away and get ready to take your station out into the sunshine with the rest of the community. For the past two months we've touted the advantages of having state-of-the-art Radio Electronic News Gathering (RENG) equipment. If your station is on the RENG bandwagon, there's no better time than spring to show off your capabilities.

As we've tried to point out before, RENG shouldn't be limited to news alone. Borrowing from our television colleagues, maybe we should use the term REF for *Radio Electronic Field Production*. Whatever you want to call it, the idea is to break out of the soundproof booth and put your announcer where the people are (or where they wish they could be). Since spring brings the folks outdoors, you'll have to be ready to cope with the special problems of outdoor broadcasts.

Tell the story with sound

The lack of a visual carrier at your station doesn't mean that you can't send visual images to your audience. In some ways, we have even greater capability than television to put pictures into the minds of our radio "viewers." It takes more than the announcer's voice to create the illusion, though. Let the viewer hear the crack of the bat and the roar of the crowd at a baseball game, the sound of crackling timber at a fire, or police sirens at the scene of an accident. The announcer has to provide the details but the color of actual sounds really heightens the impact of the story.

On a slow news day, a WQUA news reporter desperate for a story went to a pool exhibition. Hardly good radio material, right? Wrong! The newsman had the pool shark explain what was going to happen with a tricky six-ball combination shot, then let the sound at the pool table tell the story. One after another, five balls dropped into the pockets. Pause. A slight click. pause...finally the sixth ball dropped, accompanied by a soft whistle from someone. The whole story told with sound. Not exactly hard news, but good auditory imagery.

Focusing microphones

Just as a television director uses different camera angles and focal lengths to draw your attention to the subject, we must do the same thing with our microphones. Just picking up the ambient noise with the announcer's microphone is about as interesting as watching a wide-angle surveillance camera in a department store. Focus on the subject!

It's not practical to carry a wide assortment of microphones on an assignment, but you should have at least a cardioid and an omnidirectional mike available as well as enough mike cord to get to the source.

Inexpensive FM-band wireless mikes are usually less than desirable for broadcast use, primarily because of limited range. However, in RENG they can come in handy for a number of situations, and since they don't cost much, you can use several on different frequencies for simultaneous pickup. Just don't depend

one for commentary or anything else where you can't afford to lose the feed. The basic application in timing is for picking up specific sounds at an event where the source of the sound is out of microphone reach.

Windscreens are a must on almost any microphone used outdoors. In addition to filtering out the wind noise, they do a nice job of de-popping the announcer's breaths. Some windscreens are now available in colors. In a multiple-mike broadcast, the colored windscreens can be a great aid to the person doing the timing.

Boom microphones have several advantages for sports broadcasts. They leave the announcer's hands free, and keep the mike in the same position all the time. (Why is it that most announcers move closer to the mike when they talk louder?) Be careful in selecting a boom mike. If you've spent a lot of effort to establish a high-quality link from the remote location to the station, it's a shame to destroy the effect with a poor microphone. Some of the boom units advertised in this broadcast quality have incredibly poor response characteristics.

Using a cough switch can present a problem if the announce mike picks up a substantial part of the crowd noise. One solution is to put an adjustable pad between the crowd mike that is bypassed whenever the cough switch on one of the announce mikes is activated. The pad has to be adjusted for minimum level shift before the broadcast.

Watching baseball on the radio

Baseball gives an excellent opportunity to paint pictures with sound. The number and placement of microphones is the single most important element in making the sound interesting. In addition to announce mikes, a mike near home plate will help bring up the unmistakable sound of the bat contacting the ball. It'll give you the home plate umpires calls, too. Here's a good place to use a cheap FM wireless unit. You can bring it from the backstop by the wire antenna.

A wandering wireless mike in the stands will create more varied background than a stationary crowd mike. Manpower to handle additional microphones shouldn't really be a problem. Free admission is usually enough incentive to find a baseball addict willing to roll around with a wireless mike.

Other sports, too

Baseball isn't the only sport where we can apply our expertise. Almost any event we might cover has a characteristic set of sounds that help bring the audience closer to the scene. Golf can be a lot of fun to cover. The sounds at the tee are the easiest to handle—a cardioid mike with a good wind screen will capture the sounds of the swing. If the wind is blowing very strong, a high-pass filter inserted in the mike line will eliminate most of the wind noise without affecting the sound effect. Roll-off should be at about 60 Hz.

Use your imagination on every type of event your
continued on page 76

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RENG

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station covers. You can make almost any event sound interesting with the right combination of sounds and voices.

Too much sound

Working in a high ambient noise environment can be a real challenge. Most noise-cancelling microphones have the response of a carbon mike or worse, and go wild with plosives (popping). One technique that reduces the noise is to use two identical microphones connected out of phase with each other. The microphones should be placed very close to each other. The announcer speaks into either one of the microphones, but not both. The noise arrives at both microphones very nearly in phase, and cancels out. This technique can be highly effective if applied properly. A cardioid mike will reduce the noise if it is coming from a single direction. Just point the back of the mike at the source of the noise.

Outdoor oracles

Any time it is necessary to cover an event where the speaker will be using a public address system, you should attempt to get a direct connection from the PA system. If you have an assortment of connectors and pads in your remote kit, you won't get caught trying to put a round peg into a square hole.

Sometimes at an outdoor event the signal will sound very sterile. Since there are no walls for the sound to reflect from, there is little echo coming back to the speaker's microphone. To make the broadcast sound more realistic, you can mix in a little sound from a microphone located in the crowd. That will not only enhance the effect of the speaker's voice, but give you some crowd noise, too. Don't run the gain of the mike high enough to reduce intelligibility.

If you have to provide the PA for an outdoor broadcast, be prepared to contend with feedback problems. If you use a receiver to drive the PA system, the AGC in your audio chain only makes matters worse. Two practical solutions to the feedback problem are equalization and delay. In a normal situation, an equalizer can be used to notch out the primary frequency that is feeding back. Put the equalizer in just the PA line, not the program line.

The second method is a little more extreme, but can be accomplished easily from the studio. It is guaranteed to eliminate even the nastiest feedback problem. Run the remote signal into a tape recorder running at fifteen ips. Use the playback output of the recorder to feed the console. This delays the signal about sixty milliseconds, which is enough to eliminate any feedback at the remote site.

The biggest drawback to this system is that the announcer hears the delayed signal over the PA and experiences the same effect that an announcer in a large stadium does with the speakers several hundred feet away. In fact, the added delay has the same effect as moving the speakers an additional 75 feet away. Don't try recording at 7½ ips. The longer delay will drive even a 30-year veteran announcer right up the wall.

But what about news?

Many of the techniques we've discussed for better sounding RENG are too cumbersome for a daily news beat. We want the capability to do the fancy stuff fo

rogram remotes and extended news coverage, but we can't forget about Sam Scoop pounding the bricks looking for a story. It'll be a while before every newsman carries a complete production unit with him on the beat, so let's see what we can do to ease the pain in the meantime.

Each newsman should have a basic set of equipment that he takes everywhere, plus a kit of additional and back-up equipment that stays in his vehicle. Typically, the newsman will carry a cassette recorder; a microphone and mike cord; a windscreen for the mike; and means to patch the recorder into the phone or radio.

A retractile mike cord, such as Belden's 8499, works fine for normal interviews and is convenient to carry; however, it isn't much good where the mike has to be put on a stand (such as at a news conference). Alligator clips to connect to the telephone chew up the contacts on the telephone handset and are awkward to use anyway. At public places (such as the court house) where many newsmen use the same phones frequently, the phone company gets a little tired of replacing handsets. If you can get the cooperation of the appropriate officials, you can have voice couplers installed on the phones you use frequently. The cost is minimal, the convenience is great, and the phone company won't be on your case about making pretzels out of the handset contacts.

Since it isn't practical to put voice couplers everywhere, we need an alternative for use at other locations. One solution is to modify a telephone transmitter cap that takes the place of the regular one on the phone, and makes the connection without clips. It's really easy to do. Take an old carbon button transmitter apart and solder the leads directly to the inside of the concentric contacts of the button. Drill a hole in a spare transmitter cap and pass the wires through the hole. Cement the button to the inside of the transmitter cap and you're in business. All you have to do to use the beast is unscrew the regular cap from the phone and screw this one on in its place.

The back-up kit that the newsman leaves in the car should include a spare recorder, extra cassettes, an extra mike, a couple of mike cords, spare batteries, and a small mike stand. To be really prepared you should include a set of connectors that mate with some of the standard ones used on PA amplifiers, and a set of pads to accommodate different-level feeds. A few clip leads and a roll of electrical tape can be indispensable when something goes awry. If the pay phones in your area have the transmitter caps glued to the handsets, throw an inductive coupler into the

As RENG continues to make a name for itself, maybe we can get more cooperation from manufacturers to provide specialized equipment for field use. In the meantime, we have to use all the "INGenuity" we have to make the system fly.

Phil Mueller, news director at KSL, Salt Lake City, states that, "It's my belief that technological developments have not kept pace in radio news gathering only because we collectively have not opened our eyes, our minds, and put our dreams into reality. As KSL we are very fortunate to have a creative engineering staff willing to take a news department's idea and develop it into a design and eventually a workable product." Now that's what we're talking about! □

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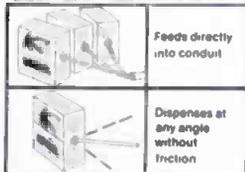
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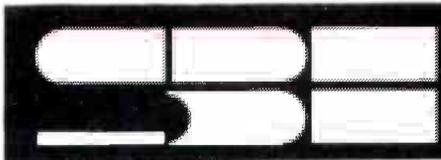
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SOCIETY OF
BROADCAST ENGINEERS, INC.
P.O. Box 50844, Indianapolis, Indiana 46250

The society is happy to announce the addition of two new chapters to the growing list of active SBE chapters throughout the country. Chapter 49—Central Illinois was organized through the efforts of Jim Newbanks, Springfield, and Chapter 50—Fort Collins, Colorado, was organized under the direction of Jim French, Fort Collins. They have done an excellent job recruiting new members and organizing these new members into an active SBE chapter. SBE congratulates both of these members and is proud of their efforts toward this accomplishment.

The national office in Indianapolis is busy scheduling the certification exams which are being given this April/May. Exam applicants cover all areas of the United States and several parts of Canada. Anyone interested in receiving information on the SBE Certification Exam Program can write to the Certification Secretary, P.O. Box 50844, Indianapolis, Indiana 46250; phone (317) 842-0836.

CHAPTER REPORTS

Chapter 2—Northeastern Pennsylvania

Charles Haubrich, president of QEI Corporation, presented a program on automatic transmitter systems at the March 6 meeting, held in the WVIA-TV-FM studios in Pittston. He was assisted by Bill Amos, marketing vice president. Actual equipment was on hand for demonstration.

Chapter 22—Central New York

The February 16 meeting, held in Syracuse, featured Spin Physics on the refurbishing and care of video heads.

Chapter 38—El Paso, Texas

Louis Brown presented a program on pulse width modulation at the February 8 meeting, held in the KDBC-TV studios. The presentation was on the method of generating a high-level modulation signal for broadcast transmitters.

Chapter 33—Southwestern Ohio

Chapter 33 held the February 1 meeting at WXIX-TV. Dave Grove of RCA's Cincinnati office presented the RCA TFS-121 TV video frame synchronizer with Don Massa, project manager for the TFS-121 Camden, New Jersey. Tom Casne camera specialist from Camden also presented the TK-760, TK-71 cameras. Both presentations were accompanied by hands-on demonstration.

Chapter 35—Kentucky

The January 5 meeting was held in the studios of KET, Lexington. The program was given by Major Tom Parker of the Lexington Fire Department. He presented a video tape about the fire hazards of plastic videotape shipping containers.

Chapter 21—Spokane, Washington

The first 1978 night meeting was held February 13 in the studios of KREM-TV. The main topic of the evening covered radio automation with special emphasis on programming. The experts on the subject were Gary Lake and Mark Hutchins from Harris Communications.

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Chapter 9—Phoenix, Arizona
Chapter 9 held a joint meeting with Chapter 32 on February 17 at the Vocational Education Building in La Grande. The program included a tour of the Casa Grande Vocational TV studio and a two-part presentation by Jeff Bixby, domestic sales coordinator, Rockwell/Collins. Bixby discussed the new Collins 828 transmitter and showed slides of the Rockwell/Collins Satellite Communications System.

Chapter 5—Atlanta, Georgia
The February 20 meeting was held at Tektronix in Atlanta. The program was given by John Owen and Dave Comstock, both of Tektronix. Owen demonstrated the use of low-frequency analyzers for troubleshooting audio systems; Comstock presented the company's newest TV modulator.

Chapter 25—Indianapolis, Indiana
Two meetings were held during February. The February 14 meeting was held at WRTV studios with a program presented by Lawrence Strom of Telemation on the General Operation of Composer in a discussion of Minicomputer vs. microprocessor Electronic Titling

Generator." The program for the February 21 joint meeting with the Audio Engineering Society was presented by Professor Feth, Department of Speech and Audiology, Purdue University. He spoke on "Fundamentals in Hearing."

Chapter 26—Chicago, Illinois

The February 23 meeting was conducted at Motorola in Schaumburg, Illinois. Norm Parker, Frank Hilbert, and Paul Galvin of Motorola presented the program on AM stereo. A status report and all proposed AM stereo systems were explained. The experts were on hand to answer all questions; and, the Motorola AM stereo system was demonstrated.

Chapter 28—Milwaukee, Wisconsin

Robert Seaberg, television products field engineer for Tektronix, was the guest speaker at the February 21 meeting. Seaberg's demonstration with videotapes and actual demonstrations of the new Tek 1450 television demodulator, and the ADC 820T analog-to-digital converter. A question and answer session followed, with hands-on examination of the new Tektronix units.

continued on page 80

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continued from page 79

Chapter 44—Shreveport, Louisiana

Jeff Bixby of Rockwell/Collins presented the program at the February 13 meeting. He gave a talk and slide presentation on ATS and pulse width modulation in medium-power AM broadcast transmitters.

Chapter 46—Baltimore, Maryland

Guest speaker at the February 15 meeting was Gene Bidun of the Harris Corporation, broadcast products division. Bidun discussed the "Pulse Duration Modulator," an advanced method of high-level modulation in medium- and short-wave broadcast transmitters.

Chapter 16—Seattle, Washington

Chapter 16 has scheduled two-day Northwest Regional SBC Convention to be held at the Seattle Center, North Court area, May 16 and 17. The hours are 9 a.m. to 6 p.m. on May 16, and 9 a.m. to 4 p.m. on May 17. May 15 has been reserved for equipment set-up. There will be 62 booths available and a room for presentation of technical papers. A banquet is scheduled to be held at noon on May 16. For further information concerning the convention, contact Ken Bass, 31033 10th Avenue SW, Federal Way, Washington 98003; phone (206) 365-5400.

Chapter 43—Sacramento, California

"Audio" was the highlight of the February 21 meeting at Ramko Research in Rancho Cordova. Ron Kohfeld, Ramko president and director of engineering, talked about what's happening in audio (including DC control, IC logic, and digital audio) and what's coming. Attendees saw the Ramko DC 38 and DC 12 audio consoles along with Technics direct drive demonstration (turntable and tape deck).

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Station-to-Station

Color burst for B&W video by digitally gating color subcarrier reference

by Dave Guerrero, A/V Dept., Northhampton County Area Community College, Bethlehem, Pennsylvania

Recently, our college bought a new special effects generator to replace the old B&W fader in the B&W CCTV control room. The reason for replacement was to give students experience on a more "standardized" unit. The new SEG has color synthesis features which we wanted to use for coloring titles and credits, along with some color synthesis of B&W video for artistic flavor.

My problem was to mix the colorized signals with existing B&W video. One way to do it is add color burst to the B&W video so when switched live, the automatic color-killing circuitry (in the picture monitors) isn't activated or deactivated, causing color flashing in the picture until the color killer stabilizes.

Figure 1 shows a circuit designed to gate the subcarrier, thus producing a burst which can be added to the B&W video. The circuit is extremely simple and inexpensive to "color sync" the B&W inputs; it may not be precise enough to broadcast, but sure does a great job in our facility.

The circuit consists of two ICs, a dual bilateral switch (CD4016), and a hex inverter (7404).

The CD4016 operates very simply.

When the control input is high (above 1.5V), the output switches from 0V to the input signal. When the control goes low, the output also goes low.

My idea is to use the 4016 to gate the subcarrier using the burst-gate signal from house sync, then add the gated subcarrier to the incoming B&W video. The monitor will think it is still getting a color signal because the burst is present; and, the production people will be happy because the color flashing will be gone.

The burst-gate (or burst-flag) is a negative-going pulse, so it must be inverted to gate the S/C only during the burst-gate pulse period. The burst-gate pulse is fed into the input of the hex inverter. The corresponding output of the inverter feeds the control input of one of the four switches contained in the 4016. The reference subcarrier is fed into the input of the bilateral switch. As the burst-flag pulse toggles the control input, the subcarrier will be gated. The gated subcarrier will be taken off the output pin of the 4016 then added through a 470-ohm resistor to the B&W video.

All components are available at any electronics distributor.

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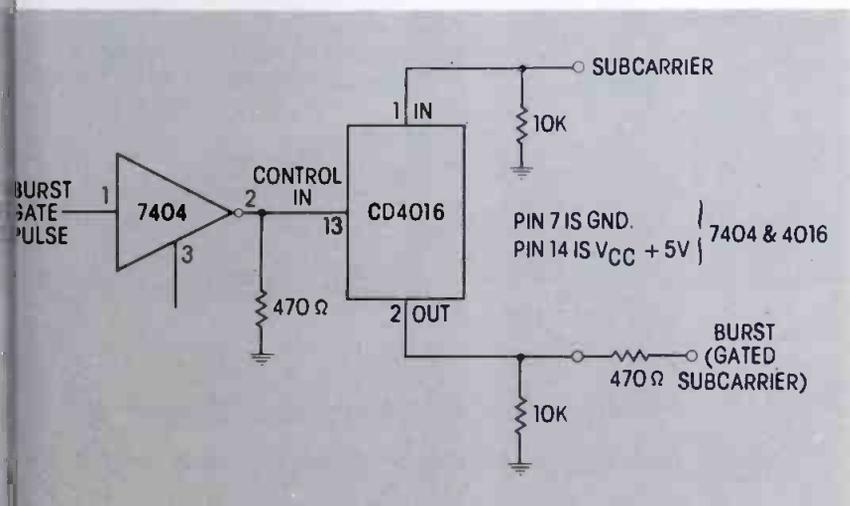
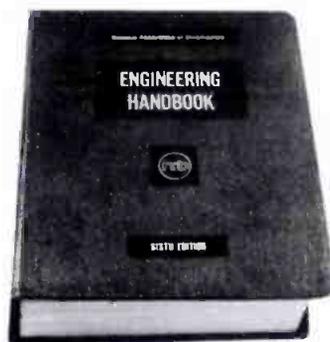


Figure 1

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Send your items to: Station-to-Station editor, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. Please indicate if you want to receive the Handbook or prefer to receive a check.

The Handbook can also be purchased directly from the NAB at \$30 a copy for NAB members and \$45 a copy for non-members. Write to: Station Services Dept., NAB, 1771 N Street, N.W., Washington, D.C. 20036.

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Station-to-Station

continued from page 81

Chroma key switcher for two cameras

By James McFarland, WMTV, Madison, Wisconsin

I enjoy **Broadcast Engineering** each month and *Station-to-Station* is one article I look forward to. I thought I would share a solution I came up with about three years ago.

I had the chance to tour a TV station in a larger market with a friend. At lunch after the tour my friend (a television news reporter) remarked that the station we had toured had the ability to use both of their studio color cameras on chroma keys while we were limited to only one. I was asked if it was possible for us to do that without major expense: I told him that I would look into it and get back to him.

I found that our chroma key generator had only three color

inputs: one for each of the three chroma key signals R G B.

Solution: Built a 6 input/3 output chroma switcher that could be fed the six chroma signals from our two cameras, then be able to select either set of chroma signals passing them while rejecting the others. I selected a low-going state as S select command from the effect row of our video switcher. This makes it very easy to use, especially in news blocks.

The desired camera is just punched up on effects and the chroma key switcher routes the signal to the chroma key generator. It works great and after three years of operation has yet to fail.

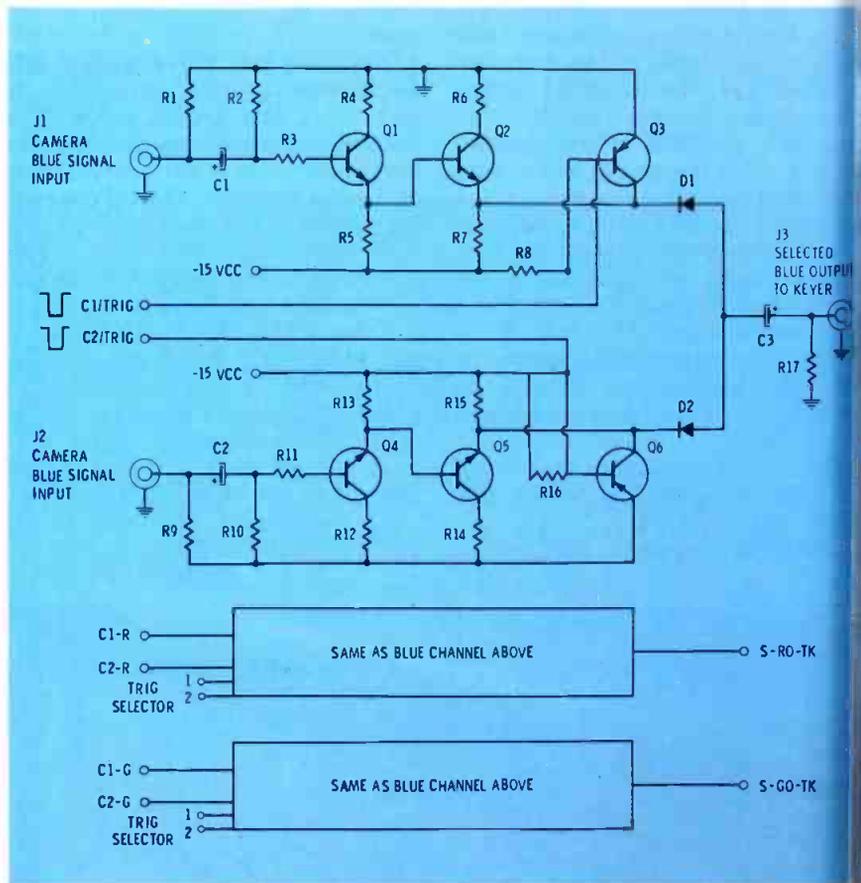


Figure 1

Ending "on air" telephone rings

By J. P. Robillard, technical director, KLUV, Haynesville, Louisiana

Being a small-market station, we do not employ a secretary to answer

the telephone. That chore is handled by the "jock" on duty. Our telephone

located next to the audio console for easy access, and therein lies the problem.

During live newscasts or community bulletin board programs, the phone will ring. This, of course, will go "on the air" because of the close proximity to the live mike. We have solved this problem with a

simple junk box relay.

Figure 1 tells the tale. We installed a phone company neon annunciator on the line to let the operator know that the phone was ringing, even though he could not hear it. When the mike switch is on the air, phone bell is not heard.

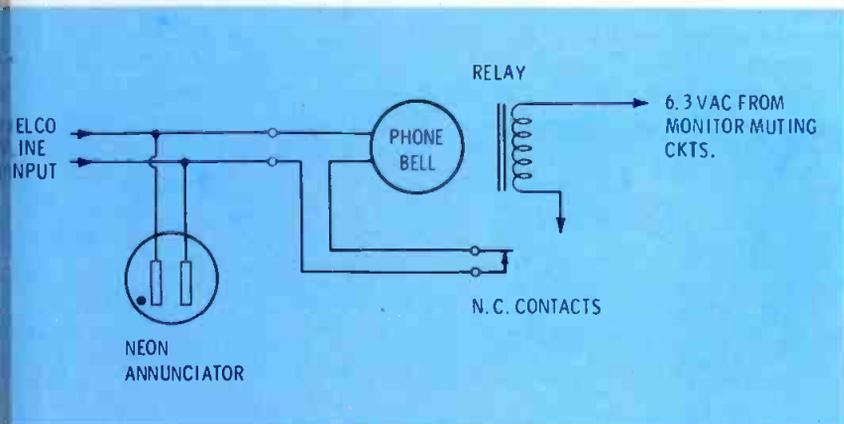


Figure 1

Adding slack to the camera cable during remotes

Ben Schaefer, WHYY, Philadelphia, and President, SBE Philadelphia Chapter

Here at WHYY we have finally solved a recurrent problem which often occurs to the cameraman

during remotes using the Ikegami HL77 cabled to a Sony VO2850.

There have been times when the

continued on page 84

ure 1



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Station-to-Station

continued from page 83

cameraman, for one reason or another, reaches the end of slack in the cable and the camera viewfinder is forcibly pushed into the cameraman's eye. (In one case, the viewfinder was pushed into a cameraman's face with sufficient force to break his pair of glasses.)

We have alleviated the problem

by riveting a "D" ring to the battery belt (Figure 1) and hooking a spring snap hook to the power cable such a position as to allow some slack for freedom of operation of the camera, but transferring any pressure on the cable to the battery belt which is secure around the cameraman's waist (Figure 2).



Figure 2

Circuit for low-cost, minimum parts count alarm panel

By W. C. Lubrech, KUFM, Missoula, Montana

When I saw Paul Bock's article (January 1978, *Broadcast Engineering*), I was reminded of a simple circuit I came up with to provide a small, low-cost minimum parts count

alarm panel. As with most low parts count circuits, this one takes advantage of several different functions of each part.

In various pieces of equipment

BROADCAST ENGINEERING

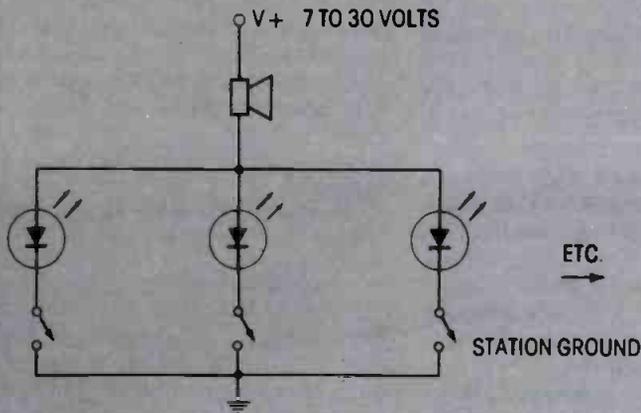


Figure 1

around the station, there are control circuits that automatically turn on when certain limits are reached. The schematic in Figure 1 shows an alarm, LEDs, and switches. Think of these switches as relay contacts or alarm closure contacts already in your equipment.

By wiring up this simple circuit, when some zaps in the night, you'll have an immediate readout on what part is in trouble.

A closure to station ground at a problem point (EBS, STL carrier, morbell, modulation alarm, etc.) cuts off the Sonalert. At the same

time, an identifier LED lights up. The Sonalert acts as an alarm, a current limiter, and if it's the pulsing type, it will even blink the active LED.

This circuit is very voltage forgiving. But eventually, you may find yourself making the additions shown in Figure 2. As you can see, this version cuts the loudness level of the alarm.

The parts needed include the resistors (multiply 2 times the V+), 20-cent LEDs, and the Sonalert. It costs about \$6. □

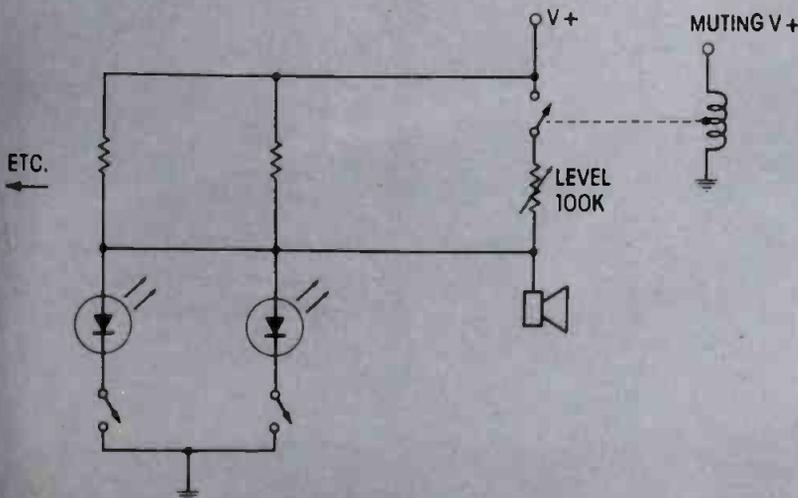


Figure 2

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new products

Television transmitters

NEC (Nippon Electric Co., Ltd.) of Tokyo has completed a new line of all-solid-state television transmitters and transposers.

In addition to the all-solid-state 1 kW television transmitters, of which NEC began the commercial production two years ago, the Japanese company has completed an all-solid-state 3 kW television transmitter.

NEC's new line of transmitters, ranging in output from 1 kW to 3 kW for VHF Band-III (170 MHz to 230 MHz) use, are designed to meet all television standards.

Since no high tension voltage supplies are required, the transmitters afford safe maintenance and operation, according to the company. Provided with a broadband impedance matching system for every amplification stage, the transmitters can cover the entire Band-III without any tuning adjustment.

The NEC all-solid-state television transposers, ranging up to 500 W output for UHF Band-IV and -V

operation, also are available for all television standards.

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Turntable

The Custom 2 turntable from QRK Electronic Products Inc. is a low rumble (-52dB) unit which uses the same drive train as the QRK 12c turntable.

The Custom 2, which has a tone arm isolation plate, also features a speed indicator light which will help minimize operator speed-selection error.

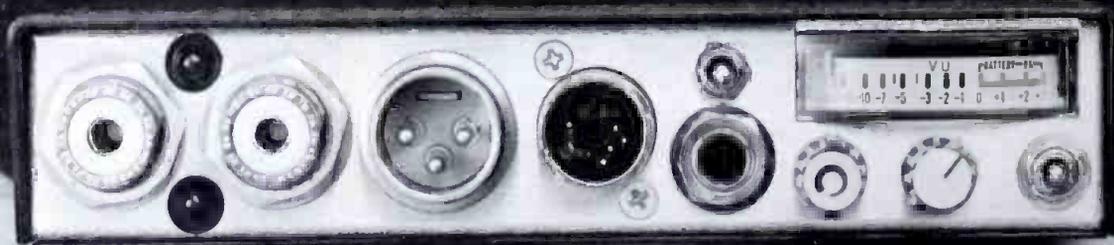
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Microcomputer system

Signetics has reduced prices more than 50% on its Adaptable Board Computer (ABC 1500), a complete 8-bit microcomputer. The ABC system is available in either card form or as a kit. The card, which is completely assembled and tested, is now priced at \$149 in unit quantities, reduced from \$275. The kit is now priced at \$89.95, down from \$190.

The ABC system includes a 2650 microprocessor, ROM and RAM, input/output ports, and a system clock. The unit can be adapted to

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multiple configurations by a system of jumper wires and additional plated-through holes that can be used to add components and change the basic board.

Additional memory or control features, input/output circuits, etc., can be added by connecting selected components to the existing circuitry with jumper wires or wirewrap connections.

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Automation system

Broadcast Electronics has expanded its product line with introduction of the Control 16, a microprocessor/CRT-based program automation system for radio broadcasting.

Features of the new system include an CRT assignment table display which provides easy change of source assignment from the keyboard; an CRT diagnostic logging display for instant review of the last 10 logging lines; and an CRT program display which provides monitoring of on-air programming while at the same time, and on the same display, permitting program changes to be made.

The design of Control 16 features low, portable, clean keyboard that

includes only those keys necessary for full system operation. To meet the needs of the individual station, Control 16 has an innovative memory concept with 3000 events and SEQUENTIAL, MAIN/SUB and TIME INSERTION programming. In addition, a 12/24 hour self-correcting digital clock system and 500-entry compare time memory with 17 programmable functions are included in the system software.

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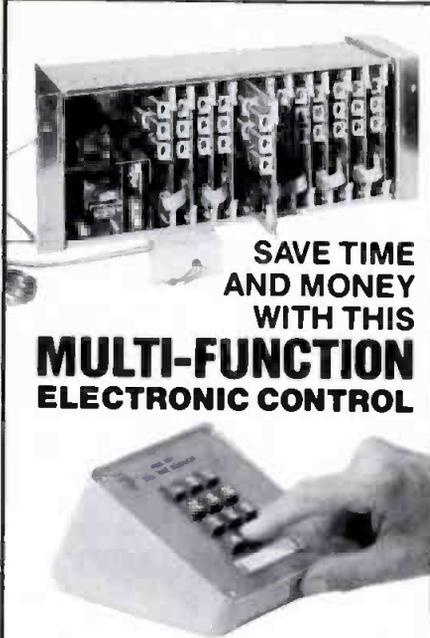
Time base system

An all-digital, advanced video processing system has been announced by Digital Video Systems.

The new system, the DPS-1, features a super-wide 32-line window, internal test signal generator, and microprocessor control. The 32-line window minimizes normal gyro errors in videotape recordings and permits expansion within the system to field-store or frame-store memory with the exchange of the memory circuit boards.

The internal digital test signal generator has eight numerically generated signals, including color bars, linear ramp and modulated stair step. It is used for system

continued on page 88



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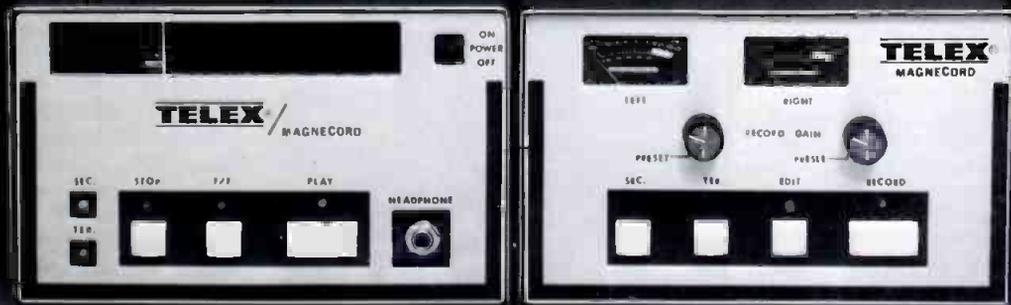
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dc solenoid and fast forward are standard features on every MC unit.

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Daniel Lee, President, discussing Stylus Replacement Policy with Howard Williams, Chief Engineer and Ken Rasek, Audio Engineer.

"Not the loudest sound in town, but the best quality" claims WXRT, Chicago, longtime Stanton user...

WXRT is a progressive rock, FM station, unique in many ways. Its whole operation, Administration, Sales, Engineering, Programming, Broadcasting, Transmitting (even the tower), is located in one place... an unusual set-up for a major market.

In a market crowded with as many radio stations as Chicagoland, the excellence of sound can make or break a station like WXRT... which plays no tapes... has no recorded commercials... and goes totally with disc-to-air and live copy.

Since WXRT uses no limiters or compression to magnify the level of their signal, their turntables and cartridges are crucial to their sound quality.

For over 10 years, the station has used the Stanton product in its turntables. Today, it even uses the 681 Triple-E for disc-to-air playback and, although this stylus was not designed for back-cueing, the engineers and announcers report no problem.

Leading radio stations around the nation depend on Stanton 681 Calibration series cartridges, because they offer improved tracking at all frequencies... they achieve perfectly flat frequency response to beyond 20 kHz. Its stylus assembly, even though miniaturized, possesses greater durability than had been thought possible to achieve.

Each 681 Triple-E is guaranteed to meet its specifications within exacting limits, and each one boasts the most meaningful warranty possible... an individual calibration test result comes with each unit.

Whether your usage involves recording, broadcasting or home entertainment, your choice should be the choice of the professionals... Stanton 681.

For further information, write to: Stanton Magnetics, Terminal Drive, Plainview, N.Y. 11803.



STANTON

For More Details Circle (76) on Reply Card

new products

continued from page 87

self-test and analog input/output calibration.

The DPS-1, an NTSC digital time base corrector system, converts video signals to 8-bit words at four times the color subcarrier frequency. It meets all the latest television industry standards such as RS-170A for the proc amp and internal broadcast sync generator.

For More Details Circle (94) on Reply Card

Generator, switcher, monitors

Electro & Optical Systems is introducing several new products.

A new portable SMPTE time code generator (model TCG MK III) is suitable for ENG or EFP use. It features keyboard entry of both time code and user bit data. The generator comes complete with rechargeable Ni-Cads, charger/battery eliminator.

A new broadcast-quality min mixer can cut, mix, wipe, key, and wipe-key between any two color sources. With the addition of the new miniswitcher, this can be extended to six sources.

Also being introduced are peak program meters and a new range of broadcast-quality monochrome video monitors. The monitors are designed to meet UL, CSA, and DHEW specifications.

For More Details Circle (95) on Reply Card

Drop out monitor

Studio Film & Tape announces the Drop Out Monitor. This device is connected to the drop out compensator and servo system of a VTR. It monitors instantaneous rate of RF signal loss, overall totals of RF signal loss, and loss of servo lock.

The results are available by means of numeric display, printouts, or specific signals to external equipment. This provides early warning of VTR and tape problems long before these problems become visible "on air."

For More Details Circle (96) on Reply Card

Switcher status light display

TeleMation, Inc., is marketing the SM-1030 status light display, designed to operate in connection with the TVS/TAS-1000 video/audio distribution switcher.

A tally device, the SM-1030 monitors the TVS/TAS-1000 party line and identifies the output users through the use of LEDs. The identi-

fication strip on the front panel allows the operator to label the corresponding lights for identification of the users. The unit can be modified to display 40, 80 or 100 outputs by changing the front panel.

The SM-1030 also interfaces with the party line by a BNC connector with a standard piece of RG-59 coax. An internal dip switch enables the unit to be programmed to monitor any source in the system.

As an option, a lever wheel switch can be placed on the front panel in lieu of the dip switch to provide easy selection by the operator.

For More Details Circle (97) on Reply Card

Demodulator

The Tektronix 1450 is a measurement-quality demodulator using a surface acoustic wave filter. Designed for VHF or UHF applications in NTSC systems, it offers synchronous and envelope detection. A quadrature video facilitates the measurement of incidental phase.

Features include: constant band-pass characteristics over the wide dynamic range of -69 dBm to -3 dBm; 30 dB of attenuation extending the operating range to +27 dBm; split- and intercarrier-wound channels for aural transmitter evaluation; a discriminator output for aural transmitter deviation measurement; and digital readout of input power in 0.1 dB increments.

For More Details Circle (98) on Reply Card

LX line extender

The LX line extender by Comrex Corporation is an encode/decode system which extends the low frequency response over standard dial-up telephone lines.

The line extender also is said to eliminate clicks, pops, and hum or telco lines, satellite circuits, and microwave links. It can be used for radio remotes, TV microwave feeds and network program audio transmission. Studio and portable models are available.

For More Details Circle (99) on Reply Card

Multitrack recorder

MCI's JH-110A/8 recorder is a multitrack system designed to meet the needs of schools, music groups and others who want to take advantage of multitrack recording techniques without the high cost of a complete 16- or 24-track system.

The JH-110 transport has been used in a new 1-inch tape configuration. Punch-in and punch-out noise during editing has been minimized. A phase-shifting network ha-

en added in the reproduce cir-
its to correct for the phase
stortion normally produced during
e record and reproduce cycle.
The recorder features automatic
onitor switching which occurs
en the machine goes into Record
ode.

For More Details Circle (100) on Reply Card

950 MHz STL

Time and Frequency Technology
s introduced the model 770/771, a
w studio-to-transmitter link in the
9 MHz band. It can be used for
dio-to-studio, intercity, network
d similar radio feeds. A fully
undant receiver/transmitter system
with automatic change-over
ven signal failure is detected,
sures continuous reliable trans-
mission. Capable of both single and
dual composite as well as dual
monaural operation, the model 770/
771 offers the broadcaster the
ability to operate two monaural
channels within a single 500 kHz
bandwidth with no crosstalk be-
tween channels or to transmit a
composite signal including stereo
and two subcarriers for the SCA
and remote control.

For More Details Circle (101) on Reply Card

Video distribution amplifiers

Dynasciences has added three
w models to its line of video
distribution amplifiers.

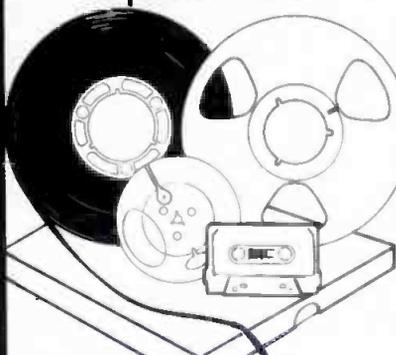
Model 72D is a differential input
A intended for use with signals
aving large amounts of hum. Hum
jection of the unit is better than
dB.

Model 72C compensates for poor
h-frequency response caused by
g cable runs. The unit provides
ustable compensation for up to
00 feet of RG59/U cable.

Model 72DC incorporates both the
n rejection and cable compensa-
n features.

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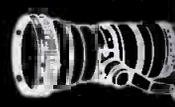
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RCA TV TRANSMITTER, Type TT5A, 5KW, air-cooled final amp. Tuned to Channel 6. No peripheral equipment such as control console, etc. Asking \$5,000. North Montco Voc-Tech School, Sumneytown Pike, Lansdale, Pa. 19446. (215) 368-1177. 3-78-2t

HELP WANTED

TV ENGINEERING SUPERVISOR—Major southwest network affiliate. College degree, thorough knowledge digital technology, 1st class FCC License, minimum 3 years experience at TV station, highly qualified in maintenance and operation of Grass Valley switchers, Chiron II, RCA film and live cameras, RCA video cart and TR70 machines, also Sony 3/4-inch Umatic editing equipment and transmitter. Equal Opportunity Employer. Send resume and salary requirements to Dept. 416, Broadcast Engineering, P.O. Box 12901, Overland Park, Kansas 66212. 4-78-1t

HELP WANTED (CONT.)

CHIEF TELEVISION ENGINEER—We are recruiting for an aggressive Chief Television Engineer to assume responsibility for maintaining equipment and space of the CCTV Unit. This primarily includes the smooth and continuous technical operation of the CCTV studio, portable CCTV system and distribution network. The Engineer must be able to evaluate new technology, solve engineering problems and repair equipment. Requirements include: B.S. in Engineering, First Class FCC license and 5 yrs. experience in colored TV systems engineering, system installation, service, repair, maintenance and operation. Experience in technical direction highly desirable. Send resume including salary history to: Dr. Martin G. Levine, Office of Biomedical Communication, COLLEGE OF MEDICINE & DENTISTRY OF NEW JERSEY, New Jersey Medical School, 100 Bergen St., Newark, N.J. 07103. Equal Opportunity/Affirmative Action Employer. 4-78-11

VTR ENGINEER—Dynamic, growing company needs experienced engineer for quad rebuilding and calibration. Must be intimately familiar with Ampex 1200 and 2000. Some light travel. Leader in VTR rebuilding and systems design offers challenging atmosphere, good benefits and location. Send resume and requirements to: Mr. Louis Siracusano, A.F. Assoc., 100 Stonehurst Court, Northvale, N.J. 07647. 4-78-11

ARE YOU READY TO MOVE UP to Assistant Chief? If you are experienced with quad tape, helical tape, ENG equipment and understand RF this may be the position you are looking for. Enjoy the sunny south and grow with an expanding young group. Salary based on experience. Call Harold Johnson, (205) 533-4848. 3-78-21

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

HELP WANTED (CONT.)

EXCITING NEW GROUP is now expanding. This is your opportunity to get in on the ground floor and grow with the company. If you are experienced in TV maintenance, including quad tape, Sony helical and other ENG equipment, then this may be the opportunity you have been looking for. Enjoy the sunny south. Salary commensurate with experience. Contact Harold Johnson at (205) 533-4848. 3-78-21

OPERATING AND MAINTENANCE ENGINEER with First Class FCC license. Immediate openings, ideal community, located in Alaska. Send resume and salary requirements to: George Howard, Chief Engineer, Northern Television, Inc., Box 2200, Anchorage, Alaska 99510. An EOE. 3-78-21

CHIEF ENGINEER—established Motion Picture/TV sound recording studio has opening for Electrical Engineer with heavy experience in audio equipment, maintenance, modification, design, and fabrication. Confidential interview. Send resume and salary history. Photo Magnetic Sound Studios, 222 East 44th Street, New York City, N.Y. 10017. 3-78-21

TELEVISION MAINTENANCE ENGINEER—Experienced with VHF transmitters and microwave. Beautiful western mountain location and excellent work facilities with an aggressive ABC affiliate. Send resume with references and salary requirements to Dept. 417, Broadcast Engineering, P.O. Box 12901, Overland Park, Kansas 66212. 4-78-21

ENTRY LEVEL OPERATIONS ENGINEER—First phone required, will train, small market, CBS affiliate, pleasant seacoast living, clean air, fishing and hunting. Write Jim Thibodeaux, P.O. Box 3E, Eureka, California 95501. 4-78-11

TELEVISION—CCTV Video Maintenance Technicians. Full Benefits. Greater New York, Suffolk County or New Jersey Area. Send resume to: VPC, P.O. Box 268, New Hyde Park, N.Y. 11040. 6-77-17

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For the candidate who can supervise technicians assigned to television production and maintenance. A solid technical background, FCC FIRST CLASS LICENSE and a minimum of 5 years of television broadcast experience is also required. Previous supervisory experience a real plus.

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Experience in studio broadcasting and FCC FIRST CLASS LICENSE are required. Background in electronics is also desirable.

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ENGINEER—NETWORK CONTROL—Statewide educational telecommunication system. Operate computer controller for statewide video network. Operate and maintain video tape recorder. First phone license required. Minimum two years television engineering experience with operation and maintenance of broadcast-type video recording equipment. At least two years post-secondary education highly desirable. Contact Phillis Gootee, Personnel Division, Indiana University-Purdue University at Indianapolis, 1100 Michigan St., Indianapolis, IN 46202, (317) 264-7617. EEO/AA. 4-78-11

MICROPROCESSOR SOFTWARE/HARDWARE—Serve as assistant design engineer for special technical development projects with statewide educational telecommunication system. Construct and test prototype systems. Degree in computer science, computer programming, electrical engineering plus first phone FCC license desired. Minimum two years experience writing computer programs, know machine basic languages. Experience with constructor digital circuits, knowledge of video systems equipment desirable. Submit resume to: Potter, Indiana Higher Education Telecommunication System, 1100 W. Michigan St., Indianapolis IN 46202. EEO/AA. 4-78-11

MAINTENANCE ENGINEER for major AM group station. Existing facility upgrade in progress. Broad technical competence, FCC Class Radio-Telephone license, and full commitment necessary. Send resume, salary history to present requirements to: Engineering Manager, P.O. Box 32046, Detroit, Mich. 48232. An Equal Opportunity Employer. 4-78-11

SOLID CHIEF ENGINEER: Escape to a Great Market in Wild Wonderful West Virginia. Make the #1 team stronger in this University City. Strong Processing, Maintenance and Construction. We are solid and stable. If you are thinking long term send resume to Garry Bowers, WC AM/FM, Box 885, Morgantown, West Virginia 26505, (304) 292-2222. Equal Employment Opportunity Employer. 4-78-11

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15	27	39	51	63	75	87	99	111	123	135	147	159	171	183	195	207	219	231	243	255	267	279	291	303	315
16	28	40	52	64	76	88	100	112	124	136	148	160	172	184	196	208	220	232	244	256	268	280	292	304	316
17	29	41	53	65	77	89	101	113	125	137	149	161	173	185	197	209	221	233	245	257	269	281	293	305	317
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19	31	43	55	67	79	91	103	115	127	139	151	163	175	187	199	211	223	235	247	259	271	283	295	307	319
20	32	44	56	68	80	92	104	116	128	140	152	164	176	188	200	212	224	236	248	260	272	284	296	308	320
21	33	45	57	69	81	93	105	117	129	141	153	165	177	189	201	213	225	237	249	261	273	285	297	309	321
22	34	46	58	70	82	94	106	118	130	142	154	166	178	190	202	214	226	238	250	262	274	286	298	310	322
23	35	47	59	71	83	95	107	119	131	143	155	167	179	191	203	215	227	239	251	263	275	287	299	311	323
24	36	48	60	72	84	96	108	120	132	144	156	168	180	192	204	216	228	240	252	264	276	288	300	312	324

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- B. FM Radio Station
- C. TV Station
- D. ETV Station
- E. CATV Facility
- F. CCTV Facility
- G. Consulting Engineer
- H. Educational Radio
- I. Recording Studio
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14	26	38	50	62	74	86	98	110	122	134	146	158	170	182	194	206	218	230	242	254	266	278	290	302	314
15	27	39	51	63	75	87	99	111	123	135	147	159	171	183	195	207	219	231	243	255	267	279	291	303	315
16	28	40	52	64	76	88	100	112	124	136	148	160	172	184	196	208	220	232	244	256	268	280	292	304	316
17	29	41	53	65	77	89	101	113	125	137	149	161	173	185	197	209	221	233	245	257	269	281	293	305	317
18	30	42	54	66	78	90	102	114	126	138	150	162	174	186	198	210	222	234	246	258	270	282	294	306	318
19	31	43	55	67	79	91	103	115	127	139	151	163	175	187	199	211	223	235	247	259	271	283	295	307	319
20	32	44	56	68	80	92	104	116	128	140	152	164	176	188	200	212	224	236	248	260	272	284	296	308	320
21	33	45	57	69	81	93	105	117	129	141	153	165	177	189	201	213	225	237	249	261	273	285	297	309	321
22	34	46	58	70	82	94	106	118	130	142	154	166	178	190	202	214	226	238	250	262	274	286	298	310	322
23	35	47	59	71	83	95	107	119	131	143	155	167	179	191	203	215	227	239	251	263	275	287	299	311	323
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- CATV and/or MS, CATV
- ITFS, Microwave
- Recording Studio
- Teleproduction Facility
- Consulting Firm (Engineering or Technical)
- Government Agency
- Dealer or Distributor of Broadcast Equipment.
- CCTV (If you check this category, please answer details listed in 1(b) below.)
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2. Check the category that best describes your title.

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3. Does your occupational responsibility extend to more than one station or facility?

Yes No

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5(a). Check the statement that best describes your role in the purchase of major communications equipment, components and accessories:

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Yes No

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- Business or Commercial (for personnel & sales training)
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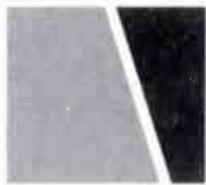
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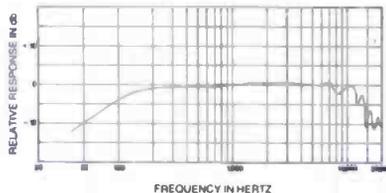


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silent...**

The SM59 is a relatively new, dynamic cardioid microphone. Yet it is already widely accepted as a standard for distinguished studio productions. In fact, you'll often see it on TV... especially on musical shows where perfection of sound quality is a major consideration. This revolutionary cardioid microphone has an exceptionally flat frequency response and neutral sound that reproduces exactly what it hears. It's designed to give good bass response when miking at a distance. Remarkably rugged — it's built to shrug off rough handling. And, it is superb in rejecting mechanical stand noise such as floor and desk vibrations because of a unique, patented built-in shock mount. It also features a special hum-bucking coil for superior noise reduction!

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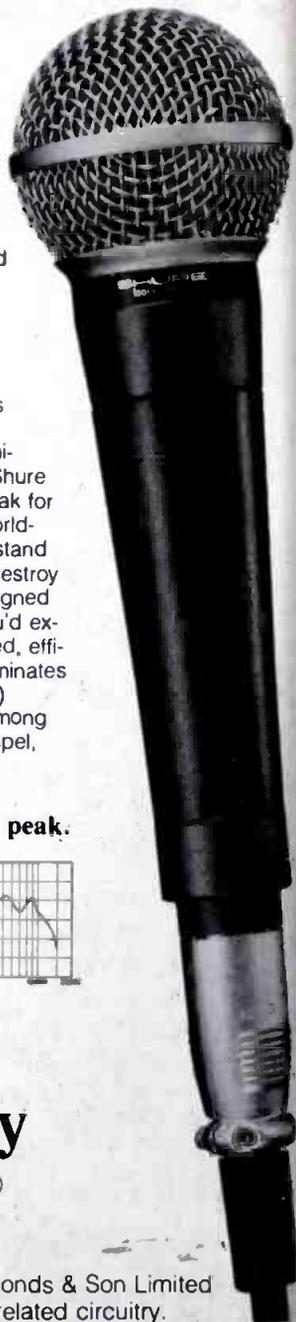
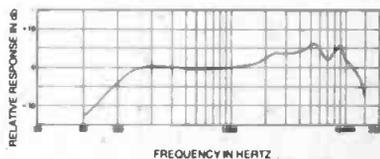


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