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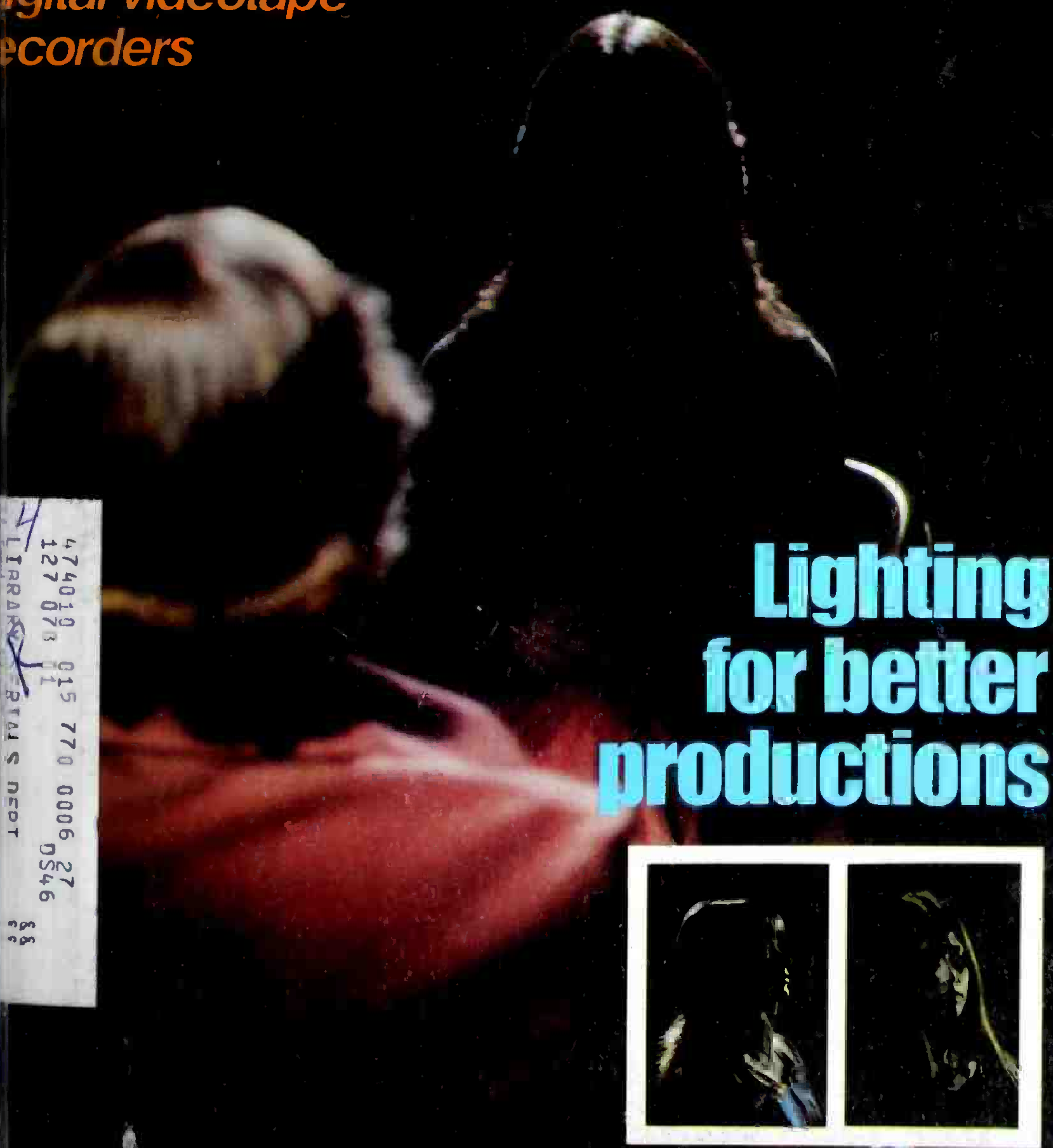

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Logic circuits built into Conrac's new 6100 monitor represent a breakthrough in video performance.

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We're more than meets the eye.

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April, 1978 ☐ Volume 20 ☐ No. 4

BROADCAST ENGINEERING

The journal of the broadcast communications industry

page 37

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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Departments

Editorial, advertising and circulation correspondence should be addressed to: 9221 Quivira Road, P.O. Box 12901, Overland Park, KS 66212 (a suburb of Kansas City, Missouri); (913) 888-4664.

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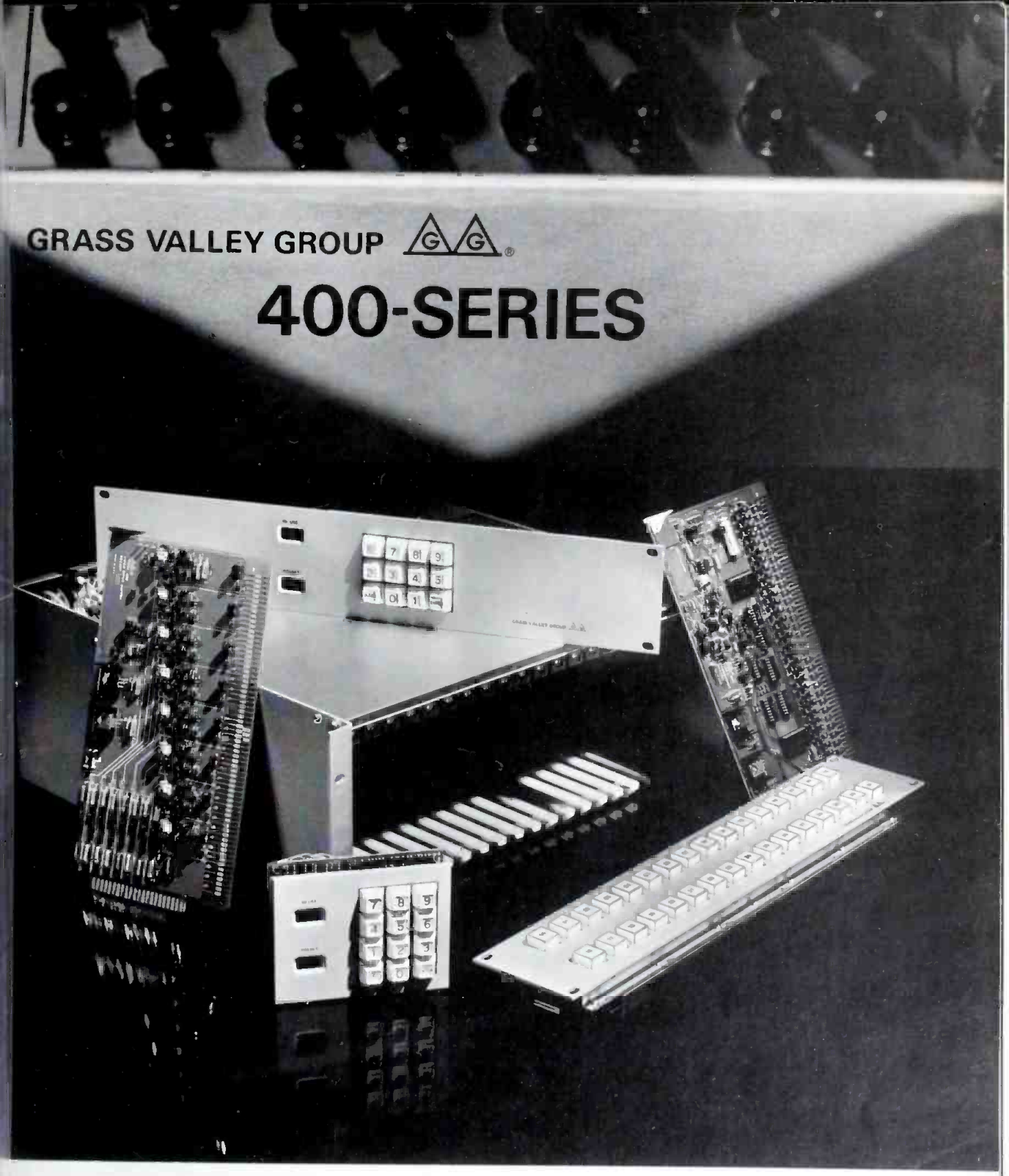

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DIRECT CURRENT FROM D.C.

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.

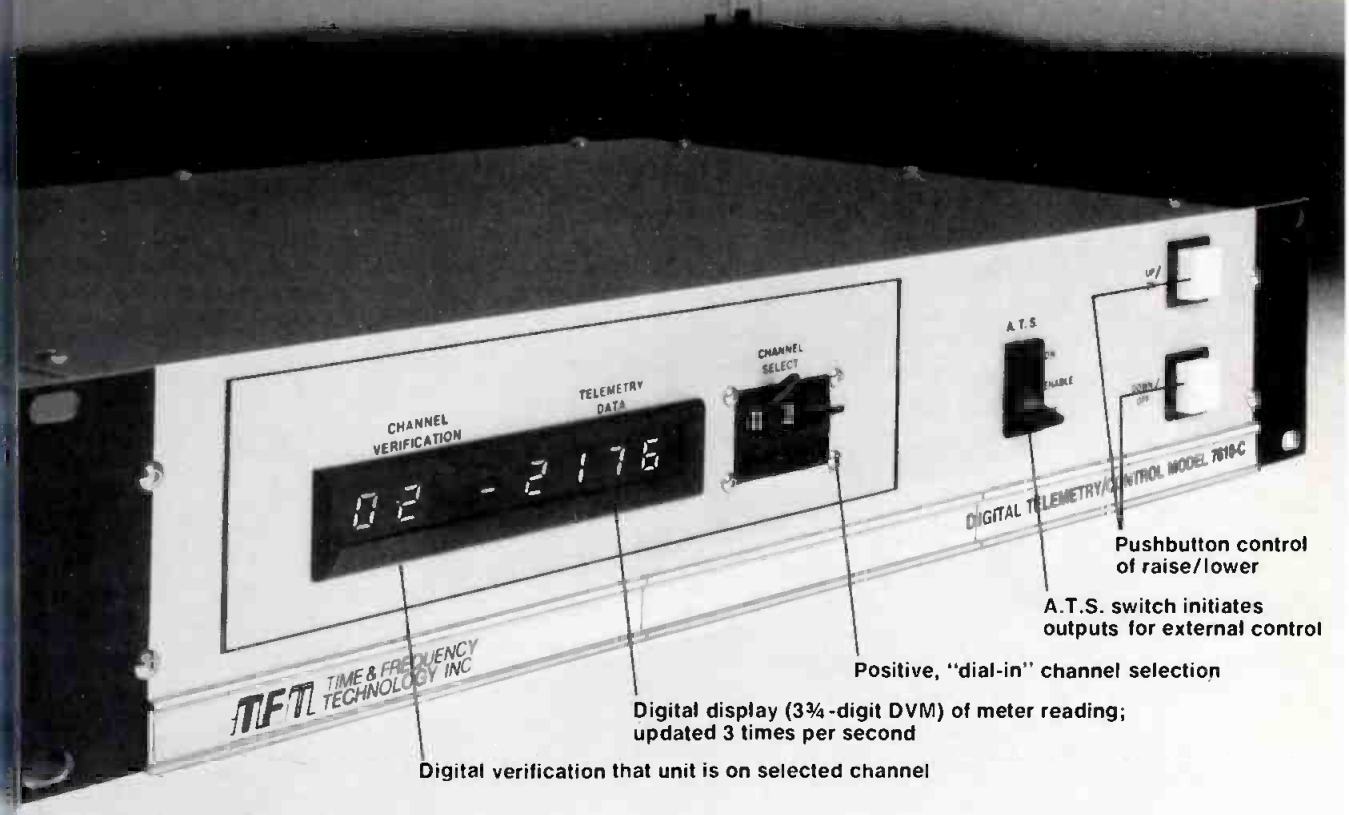
For AM, the situation is a bit more difficult. With a stack of 483 applications staring them in the face, the situation could be conservatively characterized as hopeless. However, a task force of five additional engineers has been added to processing for 60 days in an effort to get beyond those filed 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.

continued on page

Digital remote control, priced like analog

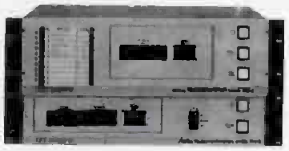


Now you can have ten channels of raise/lower and telemetry in a digital remote control system — the TFT 7610 — that costs only a little more than the most basic analog systems.

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.



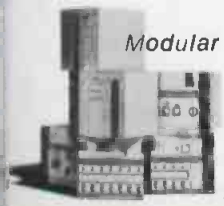
Model 7610 control point (bottom) and remote point modules.

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.



Modular digitals for remote control.

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DIRECT CURRENT FROM D. C.

continued from page 4

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 KM1CC (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."

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 bro casters to pay additional fees recording artists and record c panies. The defeat of the p formers' royalty is one of NAB's priorities, Wasilewski said.

Commenting on the size of industry, Wasilewski pointed that two-thirds of all radio stati have less than 10 employees. " though the broadcasting industr massive in terms of outreach, numbers of employees it har 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 Commission (CRTC). It also conta provisions by which policy a delegation agreements with p vincial governments can be imp mented.

Under the Telecommunicatic Act, the CRTC will continue regulate and supervise the activit of all broadcasting undertakings Canada, as well as those telec munication common carriers wh 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 Time 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 assessed our communications ne and examined the options availa to us, it became evident that use of fiber optics within our syst would be the most technologic sound and most cost-effective to proceed. In addition, an opt fiber system of the kind designed Times Fiber Communications has advantages of easy interface other portions of the statew network, a superior broadc quality video signal, and a uni capability for future expansion new technology becomes availab

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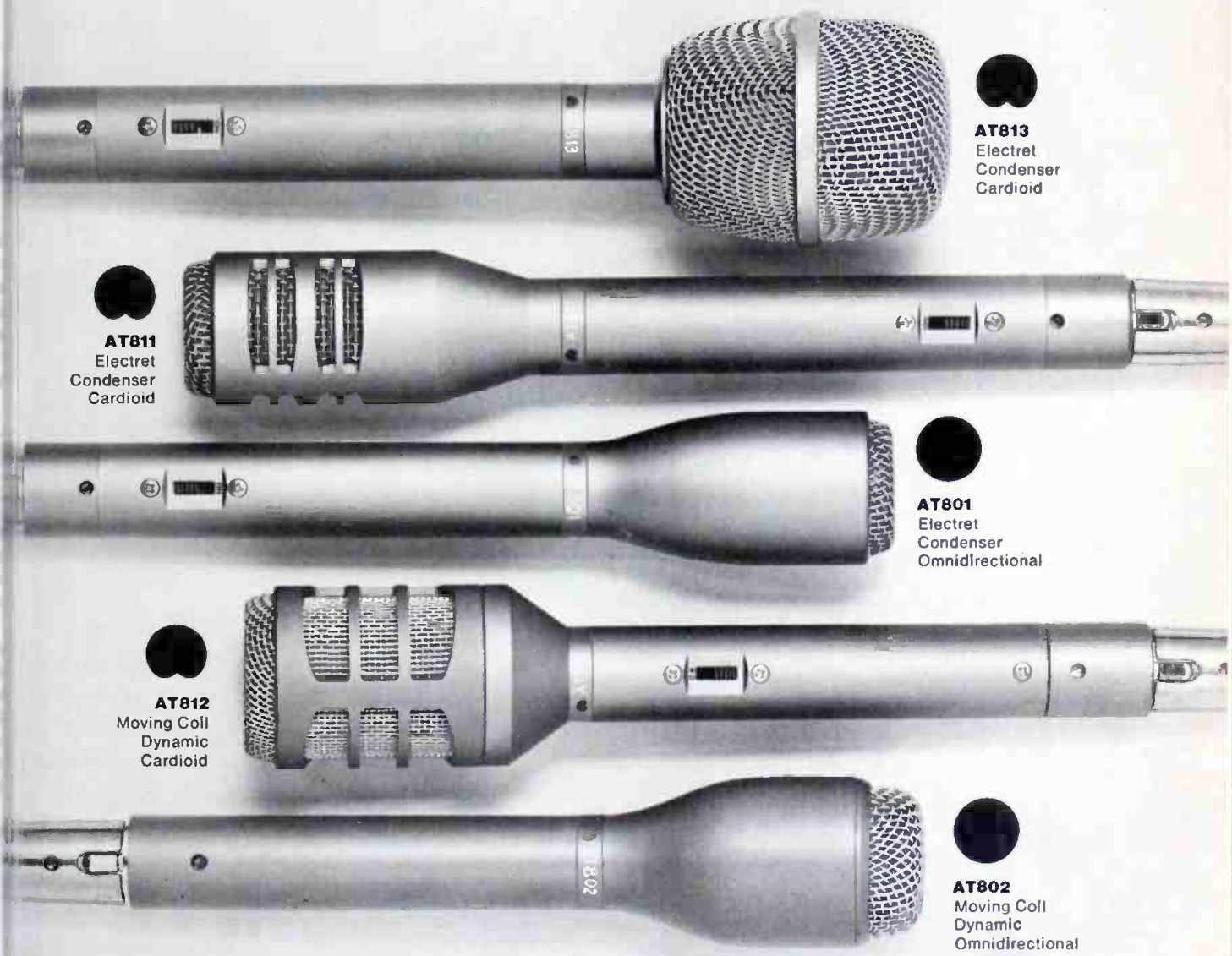
Audio-Technica introduces five new microphones... and a pleasant surprise.



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Take a close look at these new
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et condensers and two dynamics.
wo clip-on miniature electrets (not
). All are superbly finished. Care-
hought out in every detail. With the
'heft" and feel. Professional A3M
hcraft output connectors, of course.
Then listen in your studio. Full-
, 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 windscreen 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!*

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

Wherever there's been news, from natural dis-rs to national elections to sport events, Ikegami G cameras have been there with the news teams. Ikegami makes news of its own: the introduc- of our new state-of-the-art HK-312 studio and camera.

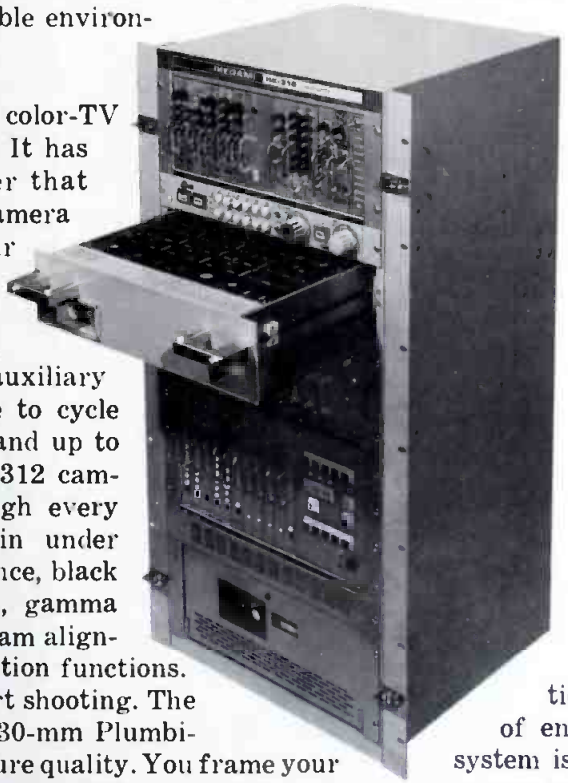
We've built ENG cameras so good in the rough-tumble of news-gathering that more Ikegami G cameras are in use than all others combined. magine how good an Ikegami era can be in the stable environ- t of a studio.

Very good indeed.

Ikegami's new HK-312 color-TV era is like no other. It has built-in minicomputer that s trim the daily camera kout from a one-hour al to an automatic through that's ter than a 20-second mercial. With its auxiliary puter, you'll be able to cycle Ikegami HK-312 (and up to other Ikegami HK-312 cam- linked to it) through every istment parameter in under minutes: white balance, black nce, flare correction, gamma ection, video gain, beam align- t, and eight registration functions. ll this before you start shooting. The 312 gives you three 30-mm Plumbi- tubes for highest picture quality. You frame your on a high-intensity, high-resolution, seven-inch ble viewfinder. Signal-to-noise ratio is better 54 dB.

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

Camera-control unit for the HK-312



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.

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 newscasting, 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 nation-wide distribution.

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For More Details Circle (7) on Reply Card

news

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 mai May 1.

NAB joint meeting with Canadian broadcasters

The first joint meeting of t National Association of Broa casters' and the Canadian Associ tion of Broadcasters' boards directors is scheduled for Thursd June 29, in Toronto, Canada.

The meeting will cover the regul tory communications policies of t two countries, technological dev opments, cable television, pay te vision, copyright, the 1979 Wor Administrative Radio Conferen (WARC), and social issues affecti both.

The agenda for the joint meeti was announced by Donald Thursto NAB joint board chairman, follo ing a meeting of executives fr both associations held in Montre 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. Gaithersburg, Maryland.

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

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With 2 channels or more, open new unlimited vistas of movie-type effects.

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.

Observe or monitor 4 TV channels on one receiver; listen to any one audio.

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Software programmability allows **ANSWER** to accommodate signal and measurement format changes or your own special requirements. You'll make a sound, long term investment with **ANSWER.**

■ 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!

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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	50.2	IRE
1.0 MHZ	49.0	IRE
2.0 MHZ	48.0	IRE
3.0 MHZ	47.5	IRE
3.58MHZ	47.0	IRE
4.2 MHZ	46.2	IRE
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	8.1	%
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	38.0	IRE
APL	41.0	%

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SYNC-VIDEO START	9.61 US
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BREEZEWAY	0.56 US
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news

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In announcing the Toronto mee ing, Thurston said, "Communic tions media are the vital li between our neighboring countrie We feel it is time to develop formal liaison and to share inform tion in order to better understa others' systems. This is especial important in light of WARC '7 which will determine the allocati of the broadcasting frequency spe trum throughout the world."

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

FCC acts on prime time access rule

The method by which the top television markets are determine each year for applying the prin time access rule has been revise by the FCC.

The commission said the chang would provide stations in marke around the 50 mark with th opportunity for more planning an greater stability in their operation by increasing the period of advan notice that the prime time acce rule would or would not apply fro approximately six months to almo two years. The change also expan the period during which a give market is subject or not subject the rule's provisions from one three years.

The prime time access rule (Se tion 73.658 [k]) limits networ owned and -affiliated stations in t 50 largest television markets to more than three hours of netwo and off-network (rerun) progra ming each evening during prim time (7-11 p.m. EST).

Under the new rule changes, t following will apply:

- Effective in the fall 1980, three-year rather than one-ye period will be specified duri which a market will be either in outside of the rule;
- A list will be issued in the sprin based on the average of Arbitr audience/rating survey (swee data of that February and t previous February, of the top markets to which the rule will ap starting in September the seco year following (e.g., a list will issued in spring 1978, reflecting average of February 1977 and 19 audience data, to be effective fr September 1980 to September 198

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NAB Booth No. 807

A Panasonic ¾" direct-drive editing system this good is no surprise.

It doesn't make much sense to build a ¾" 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™ ¾" 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

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 ¾" 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.

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NV-9500

For More Details Circle (13) on Reply Card

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 offi receipts as portentious of a healt future for the filmmaking indust He also said that integration of technologies and their innovatio will enhance visual communicati in the future.

OT publishes transmission loss analysis

The Office of Telecommunicatio (OT) has published a theoretic analysis that will permit fiber opti designers to calculate the tran mission loss in an optical wavegui due to minute bends in the wav guide. The analysis, entitled "Micr bend Losses in Multimode Optic Fibers," was prepared by Allen Howard of the University of A zona. For a copy, send $5.25 t National Technical Information Se vice, 5285 Port Royal Road, Sprin field, VA 22161, attn: OT Repo 77-136, PB 275-387/AS.

Time and Frequency opens service center

Reshal Associates Inc. and Ti and Frequency Inc. of Califor have established a new warra service center in Arlington Heigh Illinois. The first of its kind for T outside of its factory, the center w provide customers with full facto warranty and non-warranty repa and calibration service.

Videotaped microprocessor courses available

Genesys Systems Inc. is offeri four seminars and three courses microprocessors. Each of the fo seminars conducted by Dr. Rodn Zaks of SYBEX includes a compl state-of-the-art survey, and provic a user-oriented "how-to" guic These seminars and the three mo comprehensive courses conducted Colorado State University are avi able on videotapes, with associa workbooks and texts available individual study. In addition, t more basic microprocessor cour are available: An Introduction Microprocessors, and Programm Microprocessors. For more inform tion, write: Charles Martin, Gene Systems Inc., 1121 East Mead Drive, Palo Alto, CA 94303; (4 494-3701.

Applications lists for AM construction permits

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

nber, day/night coordinates, /night theoretical RMS, and mit applications for modification CPs. The lists of pending applica- s are unofficial and are super- ed in authority by the primary rces. Copies may be purchased n the Downtown Copy Center, 0 K Street, N.W., Washington, 20006; (202) 452-1422.

PTE tutorial seminar

he Chicago section of the SMPTE hold its third annual all-day trial seminar April 22 at the nada-O'Hare Inn in Rosemont, ois (near O'Hare Field). Subjects e covered include 1-inch helical a tape recorders, microphones, es, and lighting. A slide pre- ation by Eastman Kodak will n the program. William Hedden, PTE president, will speak briefly cerning on-going activities of the ety. Advance registration, by e, is $9 for the entire day, uding a prime rib of beef heon. Registration at the door be $11.

dia law seminar

he second one-day seminar ring legal problems encountered radio and television newsroom s is scheduled for May 5 at the tsburgh Hilton. The seminar, nsored by NAB, the Radio and vision News Directors Associ- n, the Reporters Committee for edom of the Press, and the ety of Professional Journalists, lesigned to supply practical ance for broadcast newspeople, ion management, and attorneys he broadcast news area. Regis- ion is $40 for members of any of four sponsoring groups and $60 nonmembers. Checks should be le out to the "Pittsburgh Media Seminar" and mailed to DA, 1735 DeSales St., N.W., shington, DC 20036.

vicon Retrofit
vice Centers expanded

alvert Electronics Inc. plans to blish a nationwide dealer net- k of Newvicon Retrofit Service ters, in an effort to provide lized technical support to com- cial and educational video pro- ers and television broadcasters. centers will be able to modify vision cameras for use with the ular low-light sensitive Newvicon es, in addition to carrying a ck of Newvicon TV camera tubes. more information, write: Calvert ctronics Inc., 220 East 23rd eet, New York, NY 10010. □

people in the news

Radio/Television

Don McGouirk recently assumed the position of gener manager at WCNI-TV in Columbus, Mississipp McGouirk has been active in the broadcast industr since 1968, when he started as a local sale representative in Macon, Georgia. Since 1974, he he served as administrative coodinator of WMAZ Radi and Television in Macon.

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

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

Thomas N. Spaight was elected assistant vice pres dent of Communicators Inc., which owns and operate KRNA Radio in Iowa City, Iowa. Spaight joined th staff of KRNA as chief engineer in November 197 and continues in that position.

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

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

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

Manufacturers/Distributors

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

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

Russ Ide, recently appointed national marketi manager for Ampex's audio-visual systems divisio

continued on page

IF YOU'RE A PERFECTIONIST YOU'VE MET YOUR MATCH

WJZ-TV, Baltimore, Maryland

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

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

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

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CONSOLES & COMPONENTS for audio control

AUDIO DESIGNS

The Audio Company

people in the news

continued from page 22

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

ELLISON

BRINSON

CORNETT

Max Ellison was named vice president for Co vergence Corporation's Eastern Hemisphere Ope ations. In this new position, Ellison will have f responsibility for all the firm's activities in Europ Africa, Australia, and both the Middle East and Fa East. Prior to joining Convergence, Ellison we managing director for Marmac Ltd. in Ireland.

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

Richard F. White has been appointed to the new created position of vice president-electronic operatio for Beldon Corp. White joined Belden in 1935. **Rog W. Cornett** succeeds White as vice president a general manager of the electronic division, based Richmond, Indiana.

ROTHFELD

SMITH

TSUNODA

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

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

Koichi Tsunoda, a veteran of 17 years with Sony, h been named president of Sony Video Produ

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.

ease a piece of a satellite.
e AET can give you and your bscribers uniform high quality. tellite transmission gives you up 15KHz bandwidth—good enough mono or stereo high-fidelity audio. e best readily available Telco vice is 5KHz. The satellite nsponder is the only repeater. ise buildup from long lines, peaters, local loops, and frequent amplification is eliminated. For at same reason, the quality is ually high at *all* earth stations.

niform low costs, too.
stance means nothing once you am your message to a satellite. The cation of earth terminals does not fect 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.

Write or call our Satellite Product Group for more information. Or circle the Bingo number.

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The faces are familiar... and these engineering updates have kept this generation on top, year after year:

- New program recording and reproducing amplifiers provide less distortion, more headroom.
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- 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.
- Improved air-damped solenoid with Teflon® coated plunger for quieter operation.
- Motor-driven recording head azimuth control to compensate for variations in cartridges (optional).
- Self-aligning top capstan bearing in 3 Deck Reproducer.
- Improved, high-reliability meters.
- Field-selectable 600 or 15k ohms balanced audio inputs.
- Improved solid-state recorder logi control for better reliability.
- Improved tone detectors for fail-sa high-speed operation.
- Improved equalization technique Recording Amplifier smooths high end response.
- RP Delay machine for program de and cartridge production (optiona
- New IC Voltage Regulators with thermal and short circuit protectio provide improved regulation.
- Two year warranty on parts and factory labor.

new:
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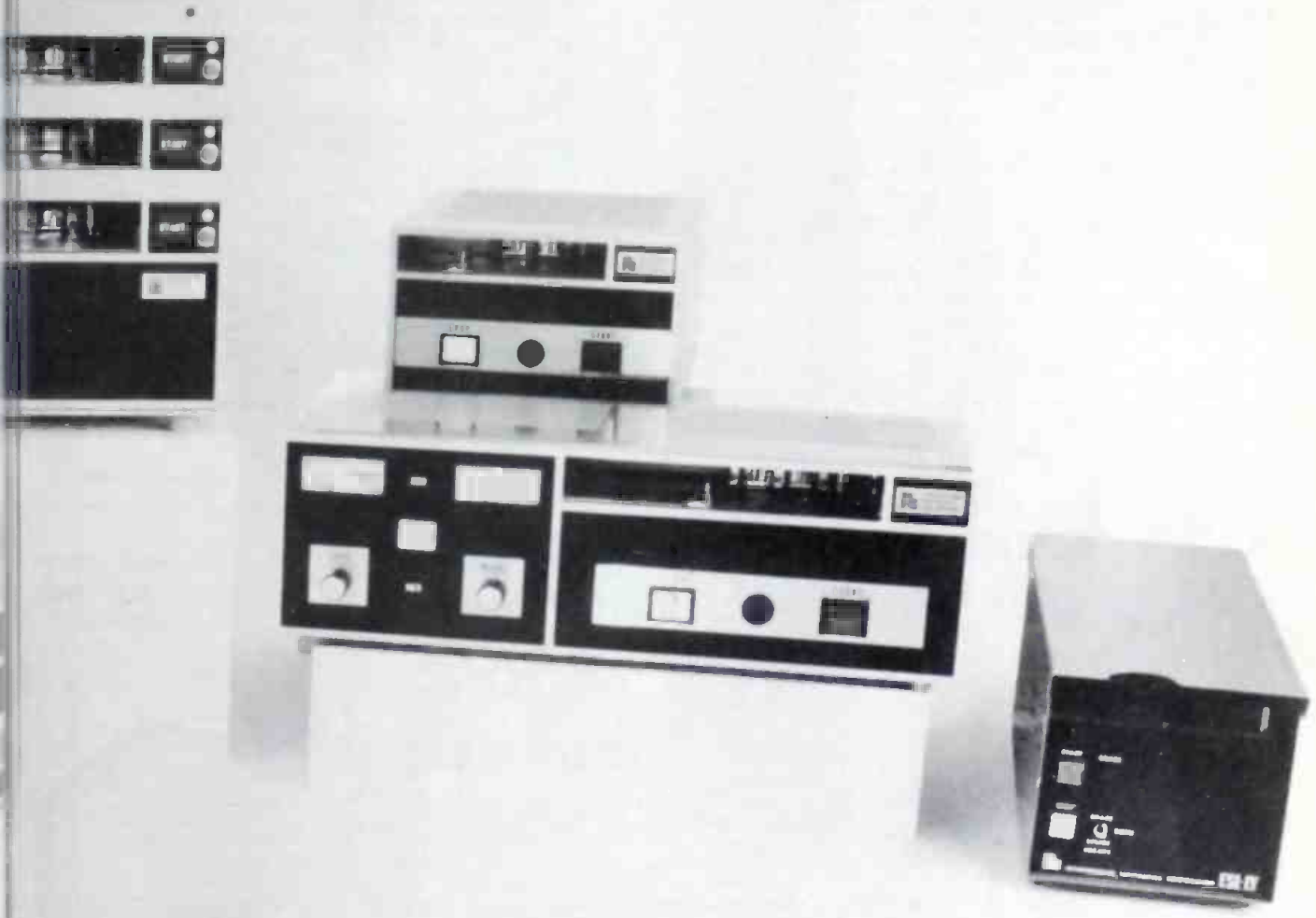

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people in the news

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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 bee formed by **Martin Jackson**, formerly vice presider and Northwest regional manager for Broadcast Com munications Devices, Inc. The purpose of the new firi will be to serve the broadcaster and other pro fessional users of audio/video electronic equipment. is located in Scotts Valley, California; (408) 438-4273

James A. Gimbel has been appointed marketin director for RCA Broadcast Systems in yet anothe move at RCA. Gimbel joined RCA in 1957 and for th past year has been sales manager for the broadcas equipment activity in Europe, Africa and the Middl East.

Dick Reilly of United Media, Inc., has become th exclusive manufacturer's representative for Add Corporation with corporate offices in Campbell, Cali fornia.

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

In recent action at American Satellite, Presiden **Emanuel Fthenakis** appointed **John Mehrhoff** assistan vice president for national accounts, and **Lawrenc Basso**, assistant vice president for Southwest sales Both men rejoined American Satellite after holdin marketing positions with other domestic satellit carriers.

Some people buy us for our fader

because ours is better than any you can buy elsewhere. Ours has all the features you need, like smooth action, accurate tracking, long life and low noise, plus a full 85 dB attenuation. And ours is coffee proof. It's just one more reason an Auditronics mixer is a better investment for the long haul. To learn more, circle reader service number or write to us for complete information.

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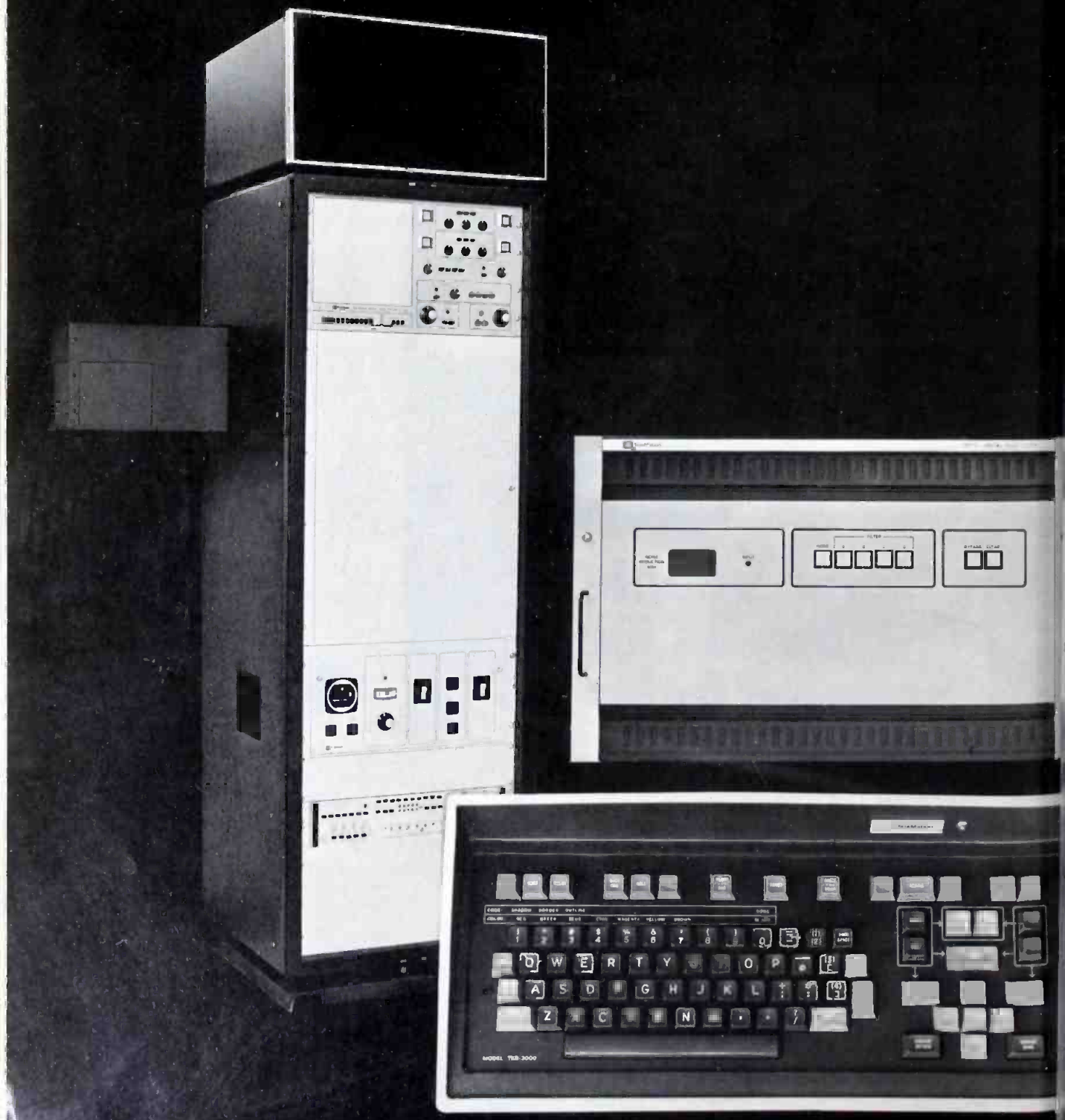
New from TeleMation



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-remotable six-vector color corrector is available as an option.

For more information about these TeleMation products, circle one of the numbers below or contact:
TeleMation, Inc., P.O. Box 15068, Salt Lake City, Utah 84115. Phone:(801) 972-8000.

For More Details on TDF-1 Circle (24) on Reply Card

For More Details on Compositor 1 Circle (25) on Reply Card

For More Details on TVS TAS-1000 Circle (26) on Reply Card

For More Details on TCF-3000 Circle (27) on Reply Card

TeleMation

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.

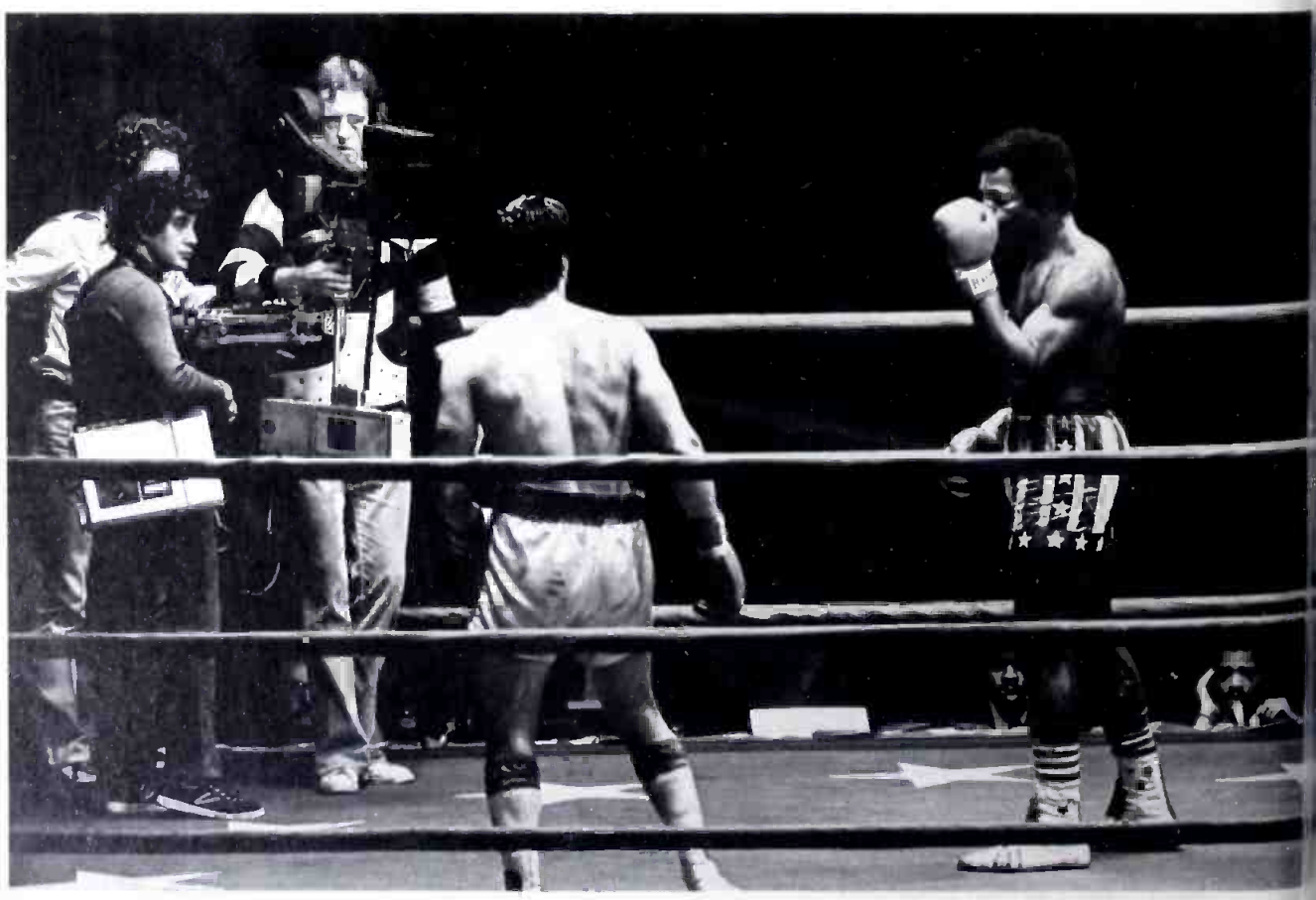
The award recognizing Steadicam's contributions is not presented for the part it played in any one film. As the picture here shows, Steadicam was in the ring with "Rocky." It also was behind the scenes with "The Marathon Man" and "Bound for Glory."

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 achievemen in coverage of special individua events.

Class II Awards are Academ plaques, and one will go this year t Eastman Kodak Company for th development and introduction of new duplicating film (type 5243) fo motion pictures.

Nagra's Class II Award is for th engineering of the improvement incorporated in the Nagra 4.2 sound recorder for motion pictur production.

EECO will receive an Academ Class III (citation) Award for de veloping a method for interlockin non-sprocketed film and tape medi 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.

For you, the new breed of video professional, the new breed of professional video from JVC.

If you're a video professional today, you're a tougher customer than ever.

So JVC's rugged professional line delivers the quality and features you demand at prices you want to pay.

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

And that attitude is, with all the people vying for your video dollar, you want more state-of-the-art technology in equipment that costs you less to own and maintain.

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

For instance:

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

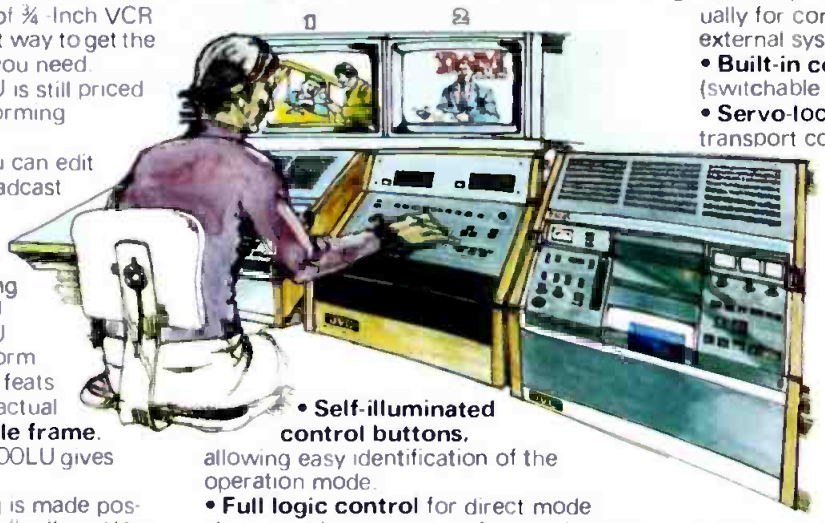
And JVC's new CR-8500LU Recorder/Editor System offers bi-directional fast/slow search from approximately 10 times to 1/20 time, with editing accuracy to ±2 frames.

It's a new generation of ¾-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.

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preview mode available, for
ersals" of actual edits.
in point search mechanism. After
edit, a Return button rewinds the
utomatically to the edit-in point, so
sier to check edit conditions.
-shift search mechanism to step
the tape speed automatically, and
quick and accurate location of the
point.
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the unit in the still-frame mode can
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a tape safety guard circuit places
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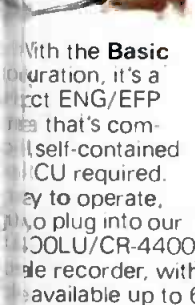

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self-contained
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available up to 66 feet.
With the **Studio** configuration it's a
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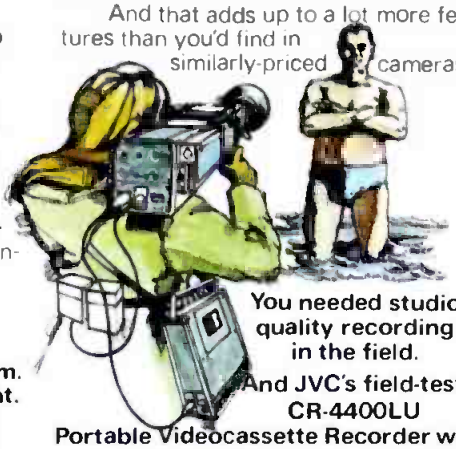

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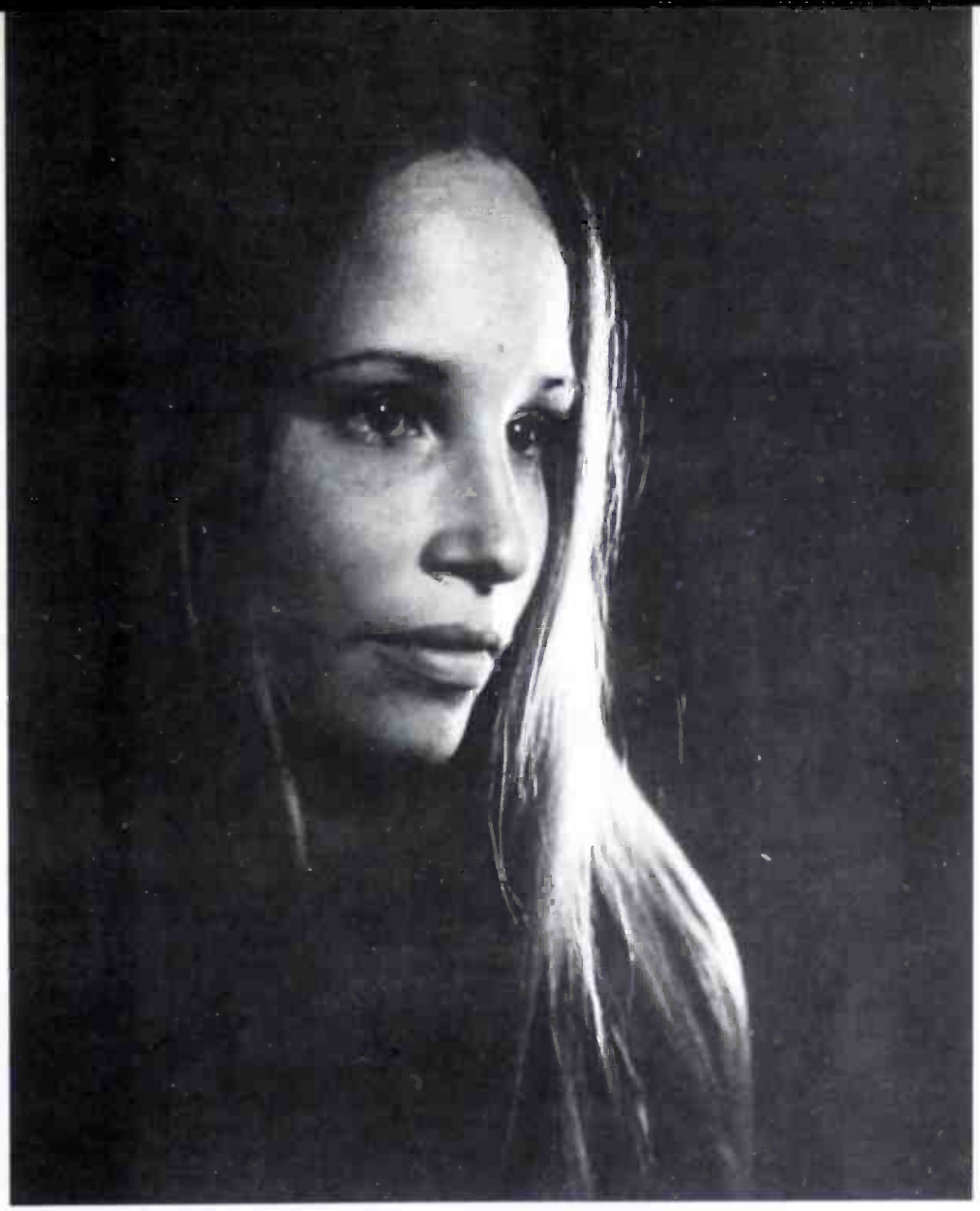

gre 1 Lighting is often
d upon to communi-
an important part of
total video message.
lighting in this scene
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ing effects and photo-
hs by author.*)

LIGHTING
s your best shot at better
roduction

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

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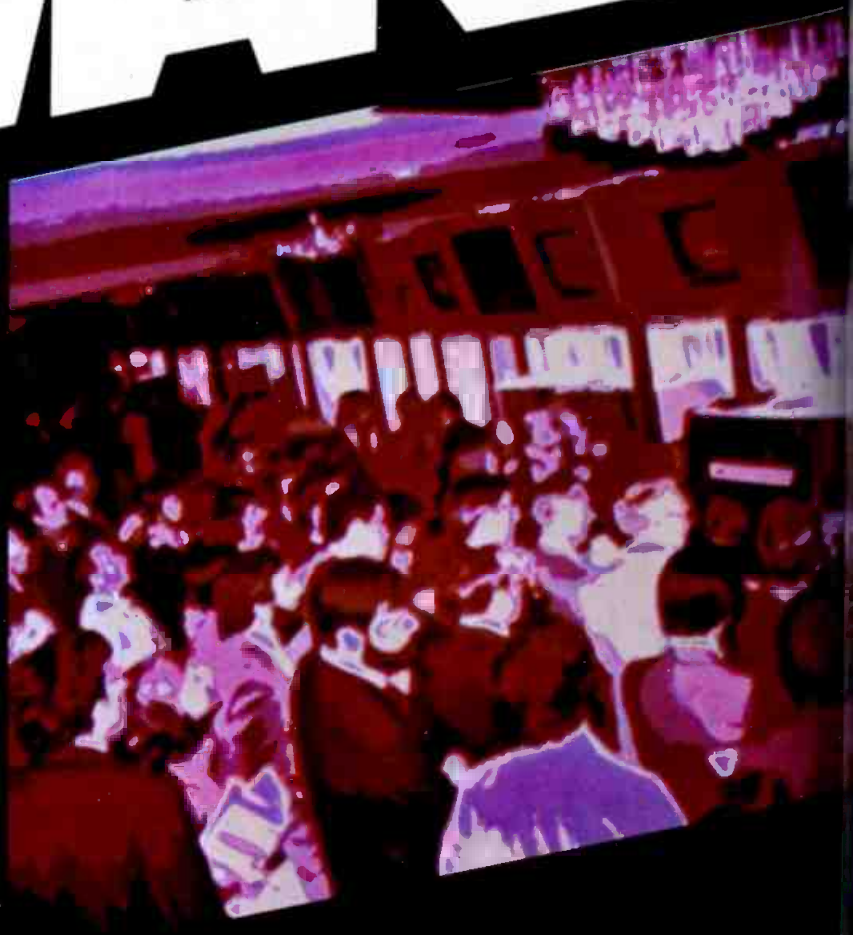

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Figure 2 A color temperature meter will quickly reveal problems between sources of illumination within a production. Once cameras are balanced on an incandescent light source, a shift of 100 degrees Kelvin in a key or fill light can be noticed.

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 eminates 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 in 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 matt 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

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Figure 3

Figure 4

The photograph on the left was made with essentially flat light. A standar formula lighting setup was used for the picture on the right. Note the differenc 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:

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

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

Although lamp-to-subject distanc manipulation is a good way o controlling intensity, there are tw others which are far more practica for quick adjustments.

First of all, the beam of man spotlights (the Fresnel in particular can be flooded out and pinne down. The former reduces th intensity over the coverage area and the latter increases the in tensity. The dimensions of the li area can then be shaped to a larg extent by barn doors.

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

Intensity control is important i balancing key, fill, back light an background lights. Normally the fi light is half the intensity of the ke light; the back light is somewher around one and one-half times th key, depending on subject matte and the background lights are abou

continued on page

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Lighting

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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. 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 lights.

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

Figure 5 A footcandle or l meter is an important aid balancing the intensities studio lights. Since dimme affect color temperatur lighting directors now a just intensity in three way altering lamp-to-subject d tance; adding scrims lights; or, in the case spotlights, pinning down flooding out the llg beams.

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The digital video people

Lighting

continued from page 46

use incandescent light, possib bounced off the ceiling.

Mixed light sources

When you have two radical different light sources present—o incandescent and one daylight, f example—life can become ev more complex. A common situati would be if you need to videotape scene inside (with standard inca descent light) and include sunlig coming in a window.

You can actually solve two pro lems here by using one or mo large sheets of straw-colored ac tate correcting gel over the outsi of the window(s). This will bri down the color temperature of t sunlight, and, at the same tim drop the intensity of the outsi light to somewhere near the a ceptable contrast range of the tel vision system.

Occasionally you will want make mixed color sources work f you. Moonlight is typically simulate by blue light. So, if you had a nig scene of a peeping-Tom looking in window, you could use blue lig from behind and yellow light simulate the incandescent light co ing through the window. This lig mix would suggest the inside-outsi situation.

As a closing word on color te perature, we might also mention t extreme color differences which t sun goes through during the cour of a day.

In early morning, sunlight mu travel through more of the earth atmosphere because of its angl The result is that much more bl light is absorbed than red (short wavelengths are more readily a sorbed) and the color temperatu is quite low (red).

During midday the temperature the direct sunlight will rise to abo 5,500 degrees, depending up where you live in the worl However, if it happens to be a ha or overcast day, the Kelvin te perature will go up to betwe 6,500 and 8,500 degrees. And t color temperature of blue skylig (no direct sun) can reach 27,0 degrees, which can impart a ve cold, blue look to skin tones.

As the setting sun drops towa the horizon at the end of the da the resulting color again shif toward the red. And, this sounds li a very good place to stop for no In the March article we tackl some more points in the "langua of light."

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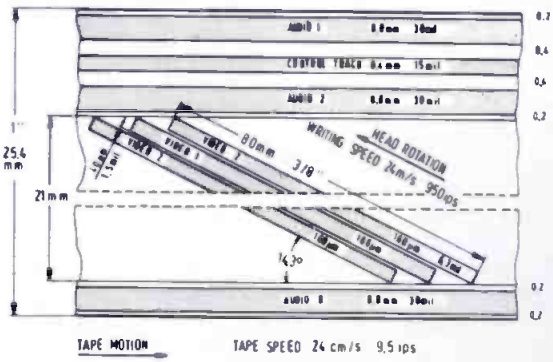
- Superior luminance signal to noise ratio because time base correctors and their inherrent analogue to digital, and digital to analogue conversions are not necessary.
- Video track tilt angle of 14,3° ensures insensitivity to longitudinal dropouts.
- **The track and scanner arrangement is suitable for reel and cassette applications.**



BCN format, basis of SMPTE-1"-Type B-Standard

The BCN-Format has three audio tracks

Apart from the video and control tracks there are three au 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 t 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 7000 for up to 5 BCN units
- A freely programmable, comp controlled editing system suc the ESC 40 K - offering an e mous range of applications.
- Editing point definition using most modern digital techniqu Unlimited "still" picture reprot tion without any danger of maging the valuable master t jogging and slow motion are possible as well as special di production effects such as "C Split".

Identical tape transport for all TV Standards

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

A guaranteed future for the BCN format with respect gital recordings

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

Cassettes or reels for portable, mobile, or stationary ation

The BCN format concept covers all operational ations:

The BCN 5 cassette version is intended for the uction of rapid, studio quality, 20 minute programme ibutions and of course, for all ENG activities. The ble, battery operated BCN 20 having 60 minute reel is ideally suitable for all mobile applications whereas the entional BCN 40/50 machines combine mobile outside dcast operation with stationary applications.

BCN 40/50 for studio OB pplications

The BCN system is based a modular building brick ept. Modules with related dons are arranged in portable units.

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

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

For monitoring purpose "monitoring bridge" consisting black and white or colour tre 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 r all conditions: BCN 20

This portable or mains operated BCN version with 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 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°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

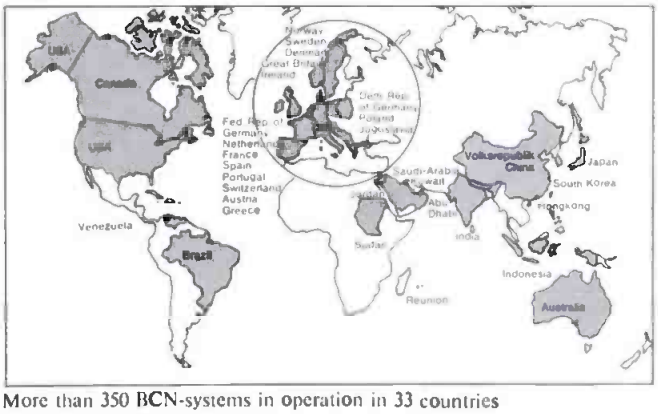
Experience gained from practical use

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 45483. 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

BOSCH

Robert Bosch GmbH, Geschäftsbereich Fernsehanlagen, Postfach 429, D-6100 Darmstadt, Fed. Rep. of Germany

Robert Bosch Corporation, Fernseh Group, 279 Midland Road, Saddle Brook, New Jersey 07662, USA., Phone (201) 797-7400

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 minicomputers, 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 ri time, pulse width, or other tir domain measurements would allo anyone to determine which flo chart a particular processor executing; yet, the ability to trac

continued on page

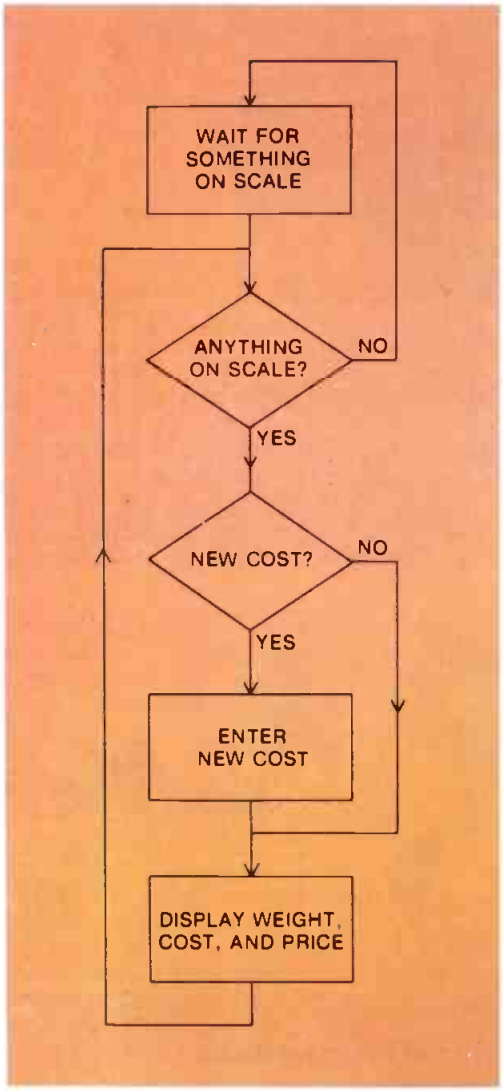


Figure 1

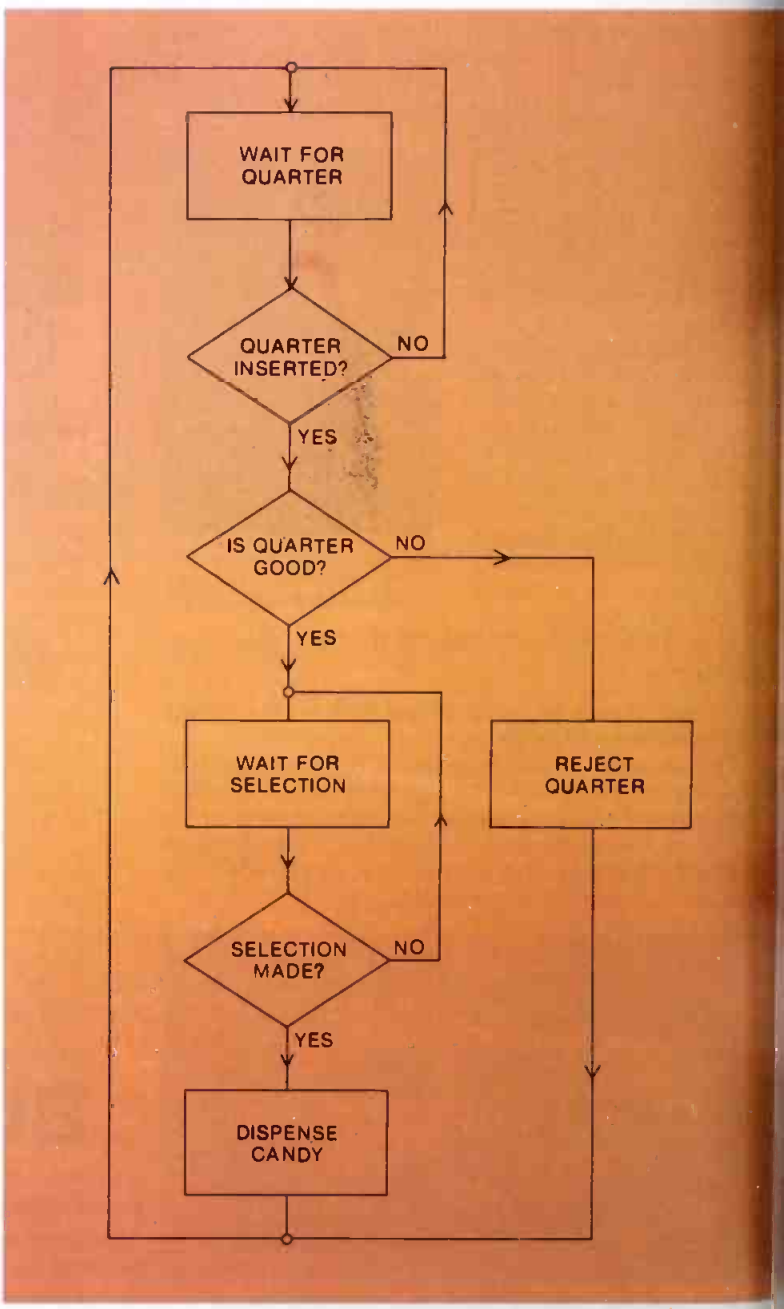
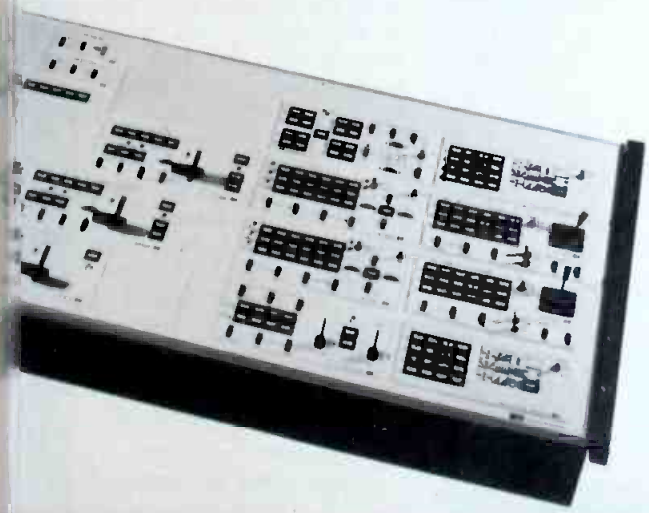


Figure 2

the CD-480 has never limited your creativity...



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For More Details Circle (40) on Reply Card

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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 b able to see exactly where yo machine goes on its errant romp through the "weeds"—or, bette yet, to see where it departs fro the straight and narrow. A log state analyzer can find either of th deviations with ease in its ow environment at its normal operatin speeds without simulation, substitu tion, or slow down.

The logic state analyzer used this example is the Hewlett-Packar model 1602A which is 16 bits wid has a memory 64 words deep, an clock speeds to 10 MHz. Unde standable keyboard controls simplif data capture information.

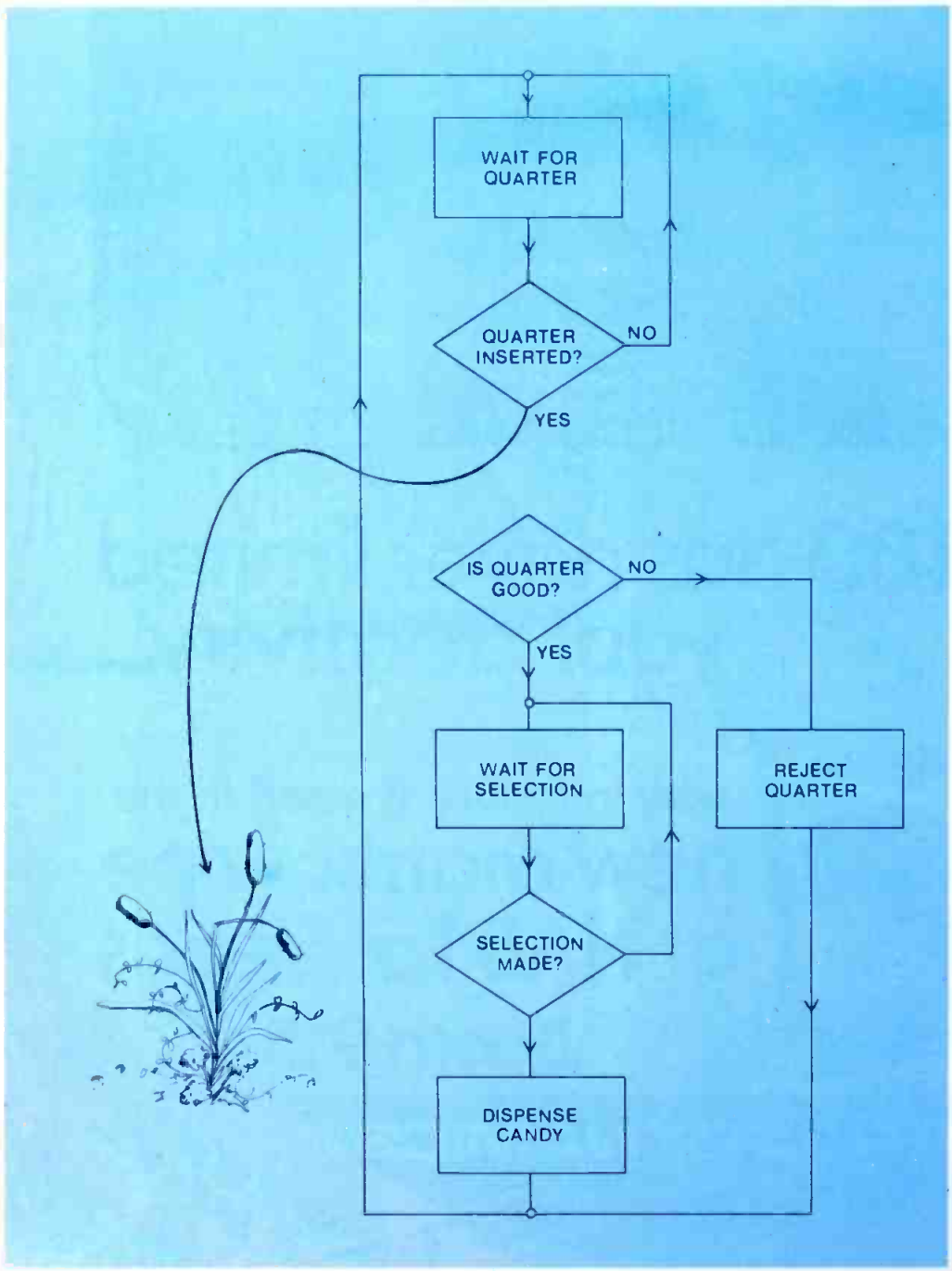

Figure 3

System debugging

System debugging is generall started by monitoring the addres lines on the microprocessor. All tha is needed is to connect the 1 "data" lines of the logic stat analyzer to the address bus and th clock line to the clock or contro signal that tells your system when t read its address bus when it valid.

Next, set the analyzer logic polar ity to the same polarity as th information on the address bus an set the analyzer clock edge to be th same as the active edge of th signal that tells the system when t read the address bus. Also selecte at this time is the data format- hexadecimal, decimal, octal, or b nary—whichever is most convenien for you to read and enter (or tha matches the program listing).

Weeding out the problem

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

If your machine is hopelessly los such as the delinquent candy ma chine in Figure 3, this simp measurement will show you where is. Once the Trace key is presse all 64 words in memory can b viewed by using the Display keys see what the machine is doing. trace of the candy machine's holid

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 the Trigger = key is pressed and the desired address entered into the trigger comparator. Now, whenever the machine executes the trigger word 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 went from a known address and the Into 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 stored words.

To solve the case of the runaway steady machine, select a trigger address from the captured addresses in the untriggered trace (for example, 2011_{16}) 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 0000_{16}, executed the program to $002F_{16}$, and went to 0208_{16} instead of 0108_{16}. 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**	**0212**
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**	**0208**
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 controversial one at this time. With th expected imminent changeover i videotape recording equipmen from quad to 1-inch helical, both th VTR users and manufacturers ar not particularly enthusiastic abou another equipment upheaval in ju a few short years. The amortizatio period and the newly acquire operational and maintenance skil would hardly have been used up, such a drastic equipment tur around were to occur.

Nevertheless, technical progres like time itself, is difficult to stop even slow down. The merits of a all-digital VTR will have to b weighed against the economic an operational factors that exist whe it is introduced, and subseque hard decisions made.

To give some advance warnir about this potentially importa technical trend, BE has gone to th best source for information about a all-digital VTR: its most forthrig 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 IVC/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 3 f_{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.

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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.

E: *Are you contemplating the onversion of other VTRs for digital oeration?*

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

E: *How do the Type B and C rmats differ with regard to a gital VTR application?*

aldwin: Well, they are essentially fferent. Type B is already segented, so altering the scanner peed upward simple means it emains segmented. However, if you ter the speed of a Type C scanner will become segmented, and you se all the advantages of a non-segented format.

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

aldwin: No, how we envisage the C achines being made is to have a umber of heads on the drum all perating a 40 megabits and laying arallel tracks.

E: *This obviously means narrower racks; have you confirmed your heory that narrow tracks are dequate on a digital VTR?*

aldwin: I can only comment in onnection with the Fernseh maine. We dropped the track width om 160 microns to 60 microns, eeping the guard band the same. his kept the interchange factor qual to the normal analog BCN hich has been proven. We have o tracking problem and we got an dequate 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 ill be shown at IBC, but of course at will be just to show what is oing to happen in the future. It is airly normal to take about two ears to go from that stage until achines are delivered in any ignificant numbers.

E: *Since IBC is in September of 978, then you believe that by the nd of 1980 or the beginning of 1981 here will be a digital VTR cometing with the analog machines.*

aldwin: Yes, I believe so! □

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 i perfect, just that it's very good.

Yesterday's playback, recordin and control devices were elemen tary, crude, and often unreliable Today's are sophisticated, perform space-age maneuvers, and are sur prisingly trustworthy; however, sta tion personnel also must understanc the care and feeding of the beasts.

Remember the repairman wh charged $70 to a car owner—$1(for his time and $60 for knowing where to kick it? Radio statio equipment maintenance is a littl like that; often a problem is ver simple to remedy if you only know where to look. Let's examine som of the more common and easil remedied problems, many of which are caused by misunderstanding o capabilities or lack of routine main tenance and care.

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

The station owner should under stand the terms, conditions, an warranties thoroughly, and get ther in writing. It is also well t remember that manufacturers ar at the mercy of their suppliers, jus as the station depends upon th equipment manufacturer. Certainl it is wise to be somewhat flexibl and, if you're supposed to receiv delivery of Brand X on September 1 don't make irreversible plans t yank out your existing system o August 31. This may sound ele mentary, but it happens.

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

Equipment manufacturers appea to stations to check the state of th

elivered gear as soon as it arrives. ometimes delivery is made before ie station is ready to install it. The rated devices are stored in the ack room. Three months later, hen the machine is uncrated, nipping damage is uncovered; and, is too late for the owner of the quipment to file a claim with the nipper. The resultant loss may be evastating.

Static electric zaps

The physical environment for the utomation system is all-important, aking control of temperature and umidity essential. Static electricity a very common troublemaker, ausing components to switch on or ff, multiple starting, garbled audio, nd other intermittent troubles. esterday's logic, relays, and tubes sed voltage levels of about 30V; it ould take a spurious voltage of bout 10V or more to trigger a relay alsely. Today's TTL devices are ore sensitive (only 5V is normal), o static electricity charges of 1½V 2V might be sufficient to trigger n IC.

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

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

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

Newpaper 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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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

evices to run too hot. Individual lectrical components in a device ay be operating within the toler-nces of their specs, but at the uter limits of those specs, thus ailing intermittently.

Eventually, things happen

Although all equipment manufac-urers try to build in as much ngevity as possible, any mechan-al or electronic device eventually as parts wear out. After an utomation system has been operat-ng every day for a couple of years, 's not surprising to find relays that eed replacement. After all, they ave opened and closed thousands f times. A symptom might be that a ape deck won't start periodically.

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

That brings us to the subject of actory service again. All reputable anufacturers maintain customer ervice departments to advise customers 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 trouble-shooting 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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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 uninterruptible 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 a 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

uble-check the pre-programming elf. Avail slots are not filled in ne for airing; or, commercials stily added to fill such avails are t checked for proximity to similar mmercials in the same time segent. This may result in lost venue and angry clients.

Reel-to-reel units must be set operly, or the 25 Hz sensors may latter or fail to work at all; 25 Hz nes are recorded on the reel with e music by the music service mpany. Due to the variations in vel between reels of tape, each w reel should be cued up to the oper reference level, and the tape ll take care of itself. All services cord that reference level tone at e beginning of each tape. You ust check this with every new el; you cannot assume that each el is identical.

The fact that we've reviewed st of the common problems that n plague a station does not mean at equipment and/or automation e unreliable. We're not suggesting at you stick to a mike, a turnole, and hand-loading of single-rt machines. Humans cause even ore errors than machines. Most anufacturers are putting out nazingly reliable gear, trying to ople-proof it, and providing virtu- "genies" that give a bright, nsistent sound on the air. That's ny stations buy automation: for ntrol of format, consistency of und, and savings in the form of eater utilization of existing perinnel.

A truly creative person gets onumentally bored by manually uffling records and carts day ter day in an atmosphere of treme tension. Automation frees ented people to earn their payecks—checks with higher numrs on them, because the station ner can afford to hire quality stead of useless quantities of rm bodies performing mundane sks.

Many smaller stations find themlves in the frustrating role of a aining ground for ambitious creve programmers, who naturally ant to move on to higher-paying or ore challenging jobs after they arn their trade. With the use of ll-maintained automation (which rforms the mundane housekeeping sks better and with fewer errors an humans) the creative person s time to do more planning. In ldition, this person will take a rsonal interest in what's going out the air, and will more likely stay and grow with the station. The tomation is the workhorse; the eative person is the jockey. □

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 produced 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.

"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.'"

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 if "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%

econd harmonic distortion on the ighs due to stylus tracing non-nearity, you can't lay claim to good udio fidelity.

All things being equal...

There are also the extreme cases here broadcasters equalize each ecord as it is transferred to tape or art and also employ additional qualization in the program chain to rm the overall "sound" of the ation. The end result bears little esemblance to the original program aterial. We have all heard pro-rammers talk about adding punch", "sock," "presence," and brightness."

To be sure, EQ has its place in orrecting response deficiences of der records and tapes, but can we a few minutes do a better job of usical artistry than the producers nd musicians who may have spent ours mixing down and equalizing ach cut?

I think we come right back to the atter of defining what kind of peration best serves the public. tation management and program-ers approach the question with a ompetitive zeal which dictates that ny legal engineering approach producing 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

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Musical Timbre

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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 amplifiers are employed ahead of the limiters to correct for sloppy production techniques and/or haphazard 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? □

FM SIGNAL PROCESSING QUESTIONNAIRE

My occupation is: ☐ Engineer ☐ Programming ☐ Mgr.

	Yes	No
1. In my opinion most FMs sound: ☐ poor ☐ acceptable ☐ good		
2. I agree that FM stations should be processed for best fidelity?	☐	☐
3. I feel that maximum loudness should be the primary objective?	☐	☐
4. How is your station set up? ☐ A. Maximum loudness ☐ B. Maximum fidelity ☐ C. Compromise of both		
5. Is the station's sound the result of programming dept. influence?	☐	☐
6. If yes to #5, would the engineering dept. have a different objective? ☐ A. Less processing ☐ B. More processing	☐	☐
7. Do you listen to your station often at home for entertainment?	☐	☐
8. Do you listen to other FM stations often?	☐	☐

9. Type of home stereo:
   ☐ A. Very good component system ($1000+)
   ☐ B. Moderate quality system ($300+)
   ☐ C. Modest system (under $300)
10. Size of your radio market ☐ small ☐ medium ☐ large

Name (optional) _____ Station (optional) _____

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

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

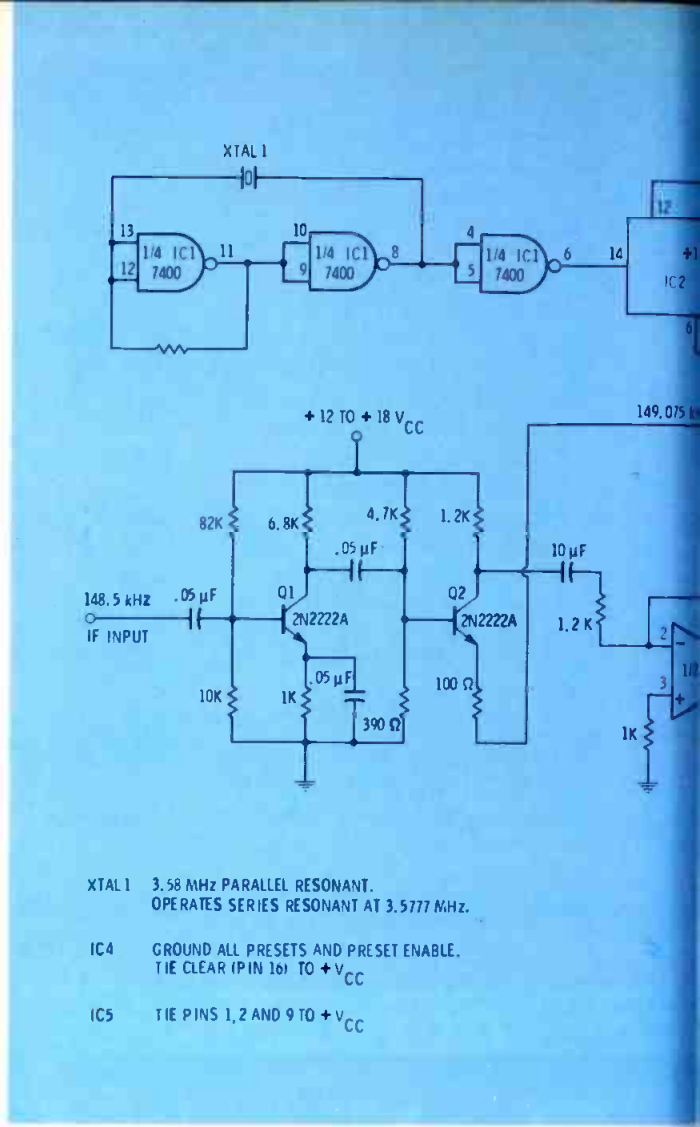


Figure 1

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:

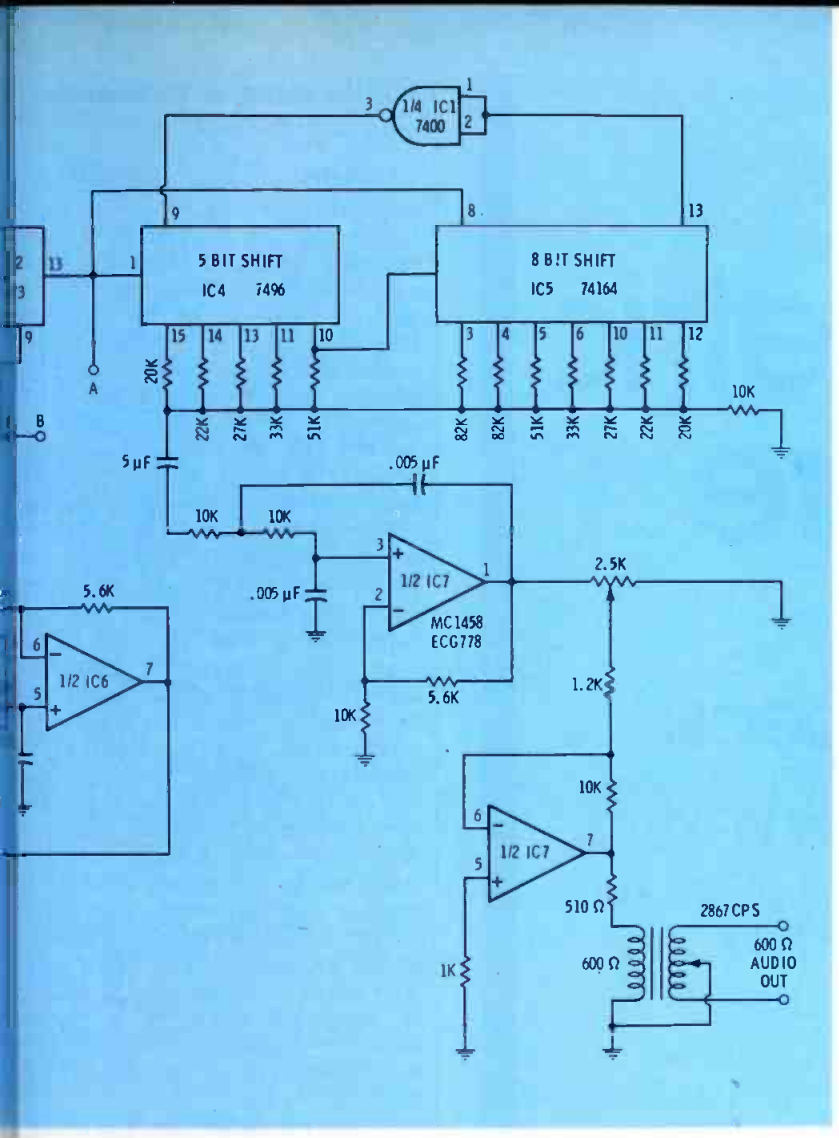
$$\text{Audio Tone} = \frac{\text{Frequency Swing}}{\text{Modulation Index}}$$

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

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 ton modulation is a single pure tone Therefore, the audio tone should b as low in distortion as possible. Th accuracy of this method is deter mined by the accuracy of the audi tone and the null detection.

The audio modulating frequenc may be set with a frequenc counter. Unfortunately, frequenc counters are expensive and ine pensive audio oscillators drift exces sively. Crystal oscillators and digit dividers will generate an accurat and stable audio frequency, but c squarewaves. A sinewave may b digitally synthesized by summing th outputs of shift registers connecte as a ring counter. The resultar sinewave is approximated in number of steps equal to twice th number of registers. This method unique in that it develops a sine wave and performs frequency div sion at the same time. Also, as th



mber of shift register stages are creased, the distortion of the newave decreases.

The 13 stages of shift registers of 4 and IC5, and the inverter nnected to one-fourth of IC1 form divide-by-26 counter and synthe-er. The total distortion before ering was less than 5% with the ue of summing resistors given. is a low-pass filter with a -off frequency of approximately 3 z to reduce the distortion to out 0.3% and supply a +14 dBm el output to drive the transmitter ectly. The sinewave generator quires an input frequency to 2889 times 26 or 75,114 Hz at point A.

Carrier null detection is the ility to determine the strength of carrier, even in the presence of sely spaced sidebands. With a dulating frequency of 3889 Hz, lebands appear every 2889 Hz ove and below the carrier frequency. Using a modulation index greater than 8.654 at 100% modulation results in a lower audio modulating tone, making it more difficult to separate the sidebands from the carrier for detection.

Probably the most common and easiest method of null detection is to take a sample of the IF signal from a modulation monitor and mix it with an output of an oscillator operating close to the carrier's IF frequency. The tone without modulation applied is noted. The carrier is at null when this tone disappears among the beats with the sidebands. The output of the mixer usually is applied to an audio amplifier and speaker; null detection is by ear.

The output of the mixer also may be applied to a low-pass filter (to greatly attenuate the sideband beats) and then to an oscilloscope for visual null indication. This is the method chosen for our circuit. However, an additional circuit, consisting of an IC audio PA and speaker, may be added for aural null detection.

The simplest mixer is a diode. However, the diode presents a low impedance and has no amplification. For isolation and sensitivity, the amplifier and mixer circuit of Q_1 and Q_2 is used. The lack of tuned circuits requires the transistors to be biased Class A for low distortion and best visual display. Q_2 is biased Class A with the emitter input (point B) at logic 0. This allows the transistor to operate as a linear amplifier and a mixer. The waveform at point B should be a square-wave (50% duty cycle) for lowest distortion of the visual carrier display. IC6 amplifies and filters the mixer output. The filter section of IC6 has a cut-off frequency of approximately 800 Hz to attenuate the higher frequency sideband beats which increase in amplitude as the carrier beat decreases.

The additional gain of the amplifier section of IC6 was not necessary. Its use as an additional low-pass filter may increase the accuracy somewhat by further reducing the sideband beats and making the scope display easier to interpret. Sufficient accuracy was obtained with the circuit as shown.

With an 800 Hz low-pass filter in the output of the mixer, the mixer's input frequency at point B must be very stable. The mixer frequency must be close to the carrier's IF frequency to ensure that the resultant beat is much lower in frequency than any possible beats with the sidebands. This allows easy separation of the carrier from the sidebands and prevents accidental null detection of a sideband instead of the carrier.

Our modulation monitor has a carrier IF frequency of 148.5 kHz. A

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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 cyrstal 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 pply about 25 MA each at 12 to volts. IC voltage regulators, such the HEP C61XX series, are ideal l easy to use. They are also able of powering several pro- s for a total of 100 MA for each Whichever power supply is d, be sure it is well-regulated or oupled sufficiently at the opamps prevent undesired output signals. e voice of experience.)

ou may find it desirable to use OS ICs in place of the 74XX ies shown. This will allow omit- the +5 volt supply as they are patible with the transistor's ply. The entire unit could then powered by inexpensive 9-volt teries. This is practical for the atively short time the calibrator ntermittently in use.

The amplifier and mixer circuit is y effective. The lack of tuned cuits makes it convenient and y to use. The high harmonic tent of the squarewave input at nt B allows beats to be detected these harmonics. This may sim- y the digital circuitry supplying mixer.

A service grade scope was able to ect a zero-beat with a signal erator set at the mixer's funda- ntal frequency and output level minimum. Even with the signal erator set at the 24th harmonic the mixer's input, a zero-beat s detected easily with only a ll increase in the generator's put level. A more accurate o-beat is obtained by this method n by the aural method due to the ter frequency response of the pe.

witch selection of different crys- and/or division ratios feeding nt A will supply tones for ibrating the monitors at any cent of modulation desired. Ad- onal frequencies could be se- ted to provide audio tones for ck equipment checks or any use may have. Many other uses of circuits shown will probably be ognized by other engineers. We uld be pleased to hear of them. □

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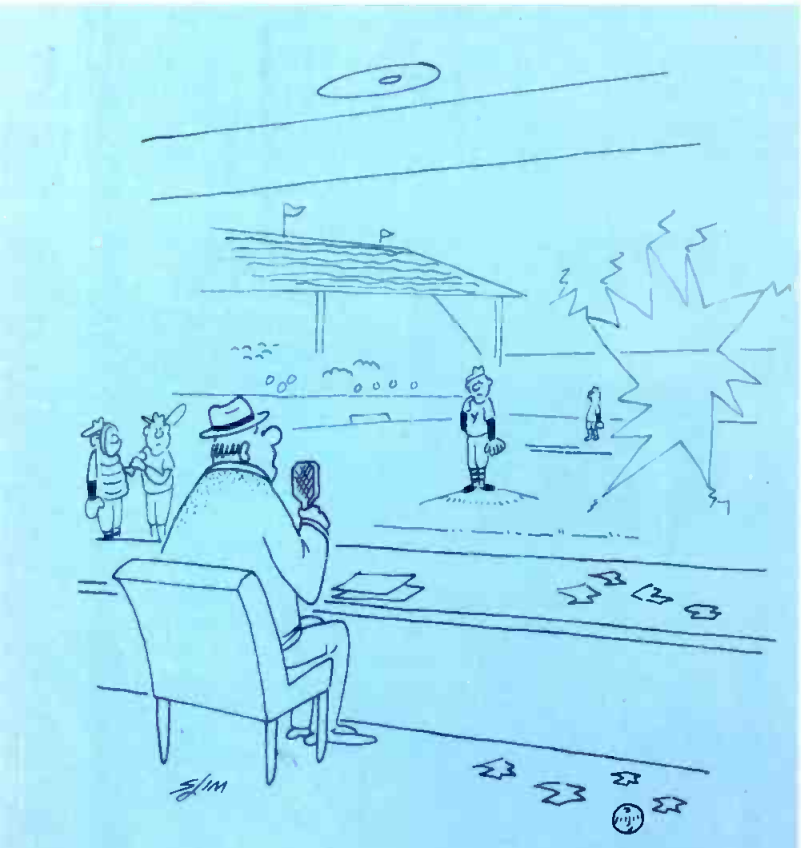
RENG: Creating visual images with sound

By Peter Burk



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

Spring is here! Put the basketball gear away an get ready to take your station out into the sunshin with the rest of the community. For the past tw months we've touted the advantages of havin state-of-the-art Radio Electronic News Gatherin (RENG) equipment. If your station is on the REN bandwagon, there's no better time than spring t show off your capabilities.

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

Tell the story with sound

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

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

Focusing microphones

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

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

Inexpensive FM-band wireless mikes are usual less than desirable for broadcast use, primari because of limited range. However, in RENG they ca come in handy for a number of situations, and sinc they don't cost much, you can use several on differe frequencies for simultaneous pickup. Just don't depe

one for commentary or anything else where you n't afford to lose the feed. The basic application in NG is for picking up specific sounds at an event ere the source of the sound is out of mike cord ach.

Windscreens are a must on almost any microphone d outdoors. In addition to filtering out the wind ise, they do a nice job of de-popping the announce kes. Some windscreens are now available in colors. a multiple-mike broadcast, the colored wind-eens can be a great aid to the person doing the xing.

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

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

Watching baseball on the radio

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

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

Other sports, too

Baseball isn't the only sport where we can apply r expertise. Almost any event we might cover has a aracteristic set of sounds that help bring the dience closer to the scene. Golf can be a lot of fun cover. The sounds at the tee are the easiest to ndle—a cardiod mike with a good wind screen will pture the sounds of the swing. If the wind is owing very strong, a high-pass filter inserted in the ke line will eliminate most of the wind noise without ecting the sound effect. Roll-off should be at about 0 Hz.

Use your imagination on every type of event your

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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 cardiod 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 for

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

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

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

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

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

As RENG continues to make a name for itself, ybe we can get more cooperation from manu- turers to provide specialized equipment for field . In the meantime, we have to use all the NGinuity" we have to make the system fly.

Phil Mueller, news director at KSL, Salt Lake City, tes that, "It's my belief that technological develop- nts have not kept pace in radio news gathering only cause we collectively have not opened our eyes, our nds, and put our dreams into reality. As KSL we e very fortunate to have a creative engineering staff ling to take a news department's idea and develop nto a design and eventually a workable product." Now *that's* what we're talking about! □

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 Arpil/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 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-7 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.

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 Schaumberg, 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.

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pter 9—Phoenix, Arizona

hapter 9 held a joint meeting h Chapter 32 on February 17 at Vocational Education Building in a Grande. The program included our of the Case Grande Vocafel TV studio and a two-part sentation by Jeff Bixby, domestic s coordinator, Rockwell/Collins. by discussed the new Collins 828 transmitter and showed slides he Rockwell/Collins Satellite mmunicetions System.

pter 5—Atlanta, Georgia

he February 20 meeting was d at Tektronix in Atlanta. The gram was given by John Owen Deve Comstock, both of Tekix. Owen demonstrated the use w-frequency analyzers for troushooting audio systems; Comstock sented the company's newest TV odulator.

pter 25—Indianapolis, Indiana

wo meetings were held during ruary. The February 14 meeting held at WRTV studios with a gram presented by Lawrence strom of Telemation on the neral Operation of Composer discussion of Minicomputer vs. roprocessor Electronic Titling

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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 SE Convention to be held at the Seatt Center, North Court area, May and 17. The hours are 9 a.m. 6 p.m. on May 16, and 9 a.m. 4 p.m. on May 17. May 15 has be reserved for equipment set-u There will be 62 booths availab and a room for presentation technical papers. A banquet scheduled to be held at noon on M 16. For further information co cerning the convention, contact K Bass, 31033 10th Avenue SW, Fe eral Way, Washington 98003; pho (206) 365-5400.

Chapter 43—Sacramento, Californ

"Audio" was the highlight of t February 21 meeting at Raml Research in Rancho Cordova. R Kohfeld, Ramko president and rector of engineering, talked abo what's happening in audio (includi DC control, IC logic, and digit audio) and what's coming. A tendees saw the Ramko DC 38 a DC 12 audio consoles along with Technics direct drive demonstrati (turntable and tape deck).

station-to-station

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

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

Recently, our college bought a w special effects generator to place the old B&W fader in the &W CCTV control room. The ason for replacement was to give dents experience on a more tandardized" unit. The new SEG s color synthesis features which wanted to use for colorizing es and credits, along with some lor synthesis of B&W video for tistic flavor.

My problem was to mix the olorized signals with existing B&W deo. One way to do it is add color rst to the B&W video so when itched live, the automatic color-ll circuitry (in the picture moni-s) isn't activated or deactivated, using color flashing in the picture til the color killer stabilizes.

Figure 1 shows a circuit designed gate the subcarrier, thus pro-cing a burst which can be added the B&W video. The circuit is tremely simple and inexpensive to olor sync" the B&W inputs; it y not be precise enough to oadcast, but sure does a great job our facility.

The circuit consists of two ICs, a ad bilateral switch (CD4016), and ex 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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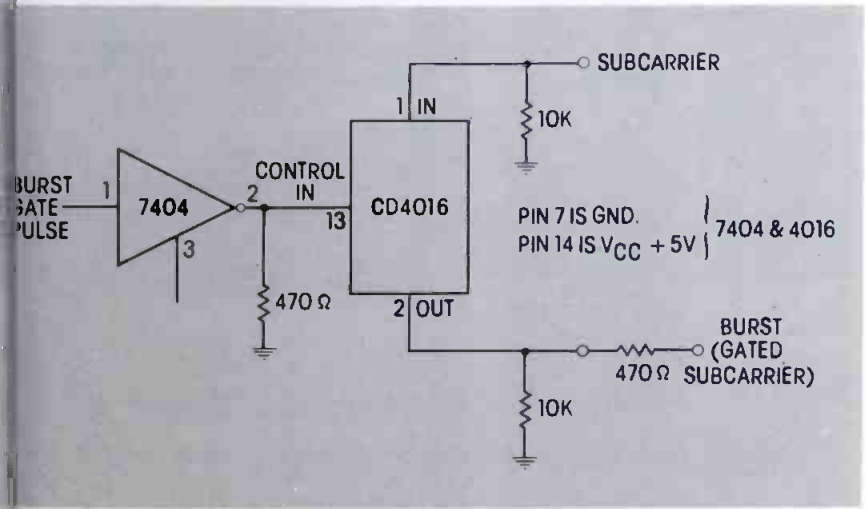
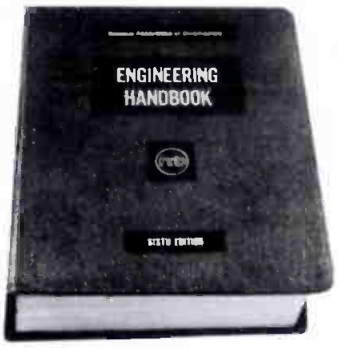


Figure 1

Send us your

station-to-station

ideas. We'll pay you cash or send you the NAB **Engineering Handbook.**



If your equipment tips or other operating ideas are selected by **Broadcast Engineering** to appear in Station-to-Station, you will receive a $30 minimum payment or a free copy of the prestigious *NAB Engineering Handbook*.

The latest *Handbook* contains over 1,000 pages and 1,000 illustrations covering every aspect of AM, FM and TV operation and maintenance: recommended procedures, fundamentals, standards, rules and how-to instructions.

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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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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 thr chroma key signals R G B.

Solution: Built a 6 input/3 outp chroma switcher that could be f the six chroma signals from our tv cameras, then be able to sele either set of chroma signals passi them while rejecting the others. selected a low-going state as S select command from the effec row of our video switcher. Th makes it very easy to use, especial in news blocks.

The desired camera is ju punched up on effects and t chroma key switcher routes th signal to the chroma key generato It works great and after three yea operation has yet to fail.

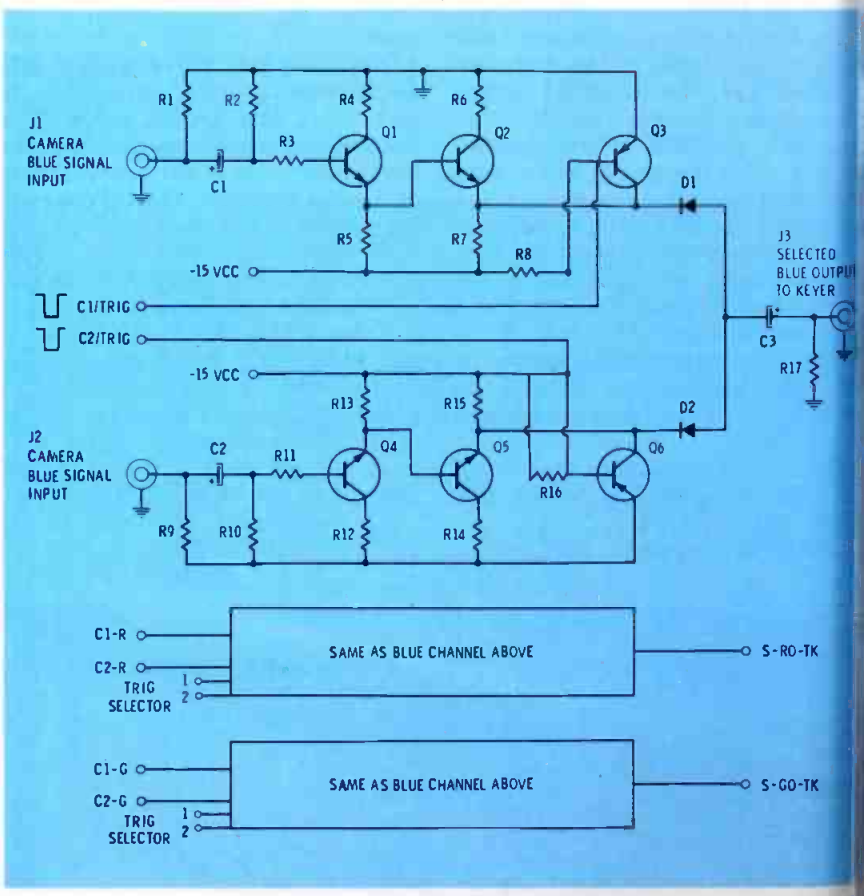

Figure 1

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 handl by the "jock" on duty. Our telepho

ocated next to the audio console easy access, and therein lies the blem.

During live newscasts or community bulletin board programs, the phone will ring. This, of course, go "on the air" because of the proximity to the live mike. We ve 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.

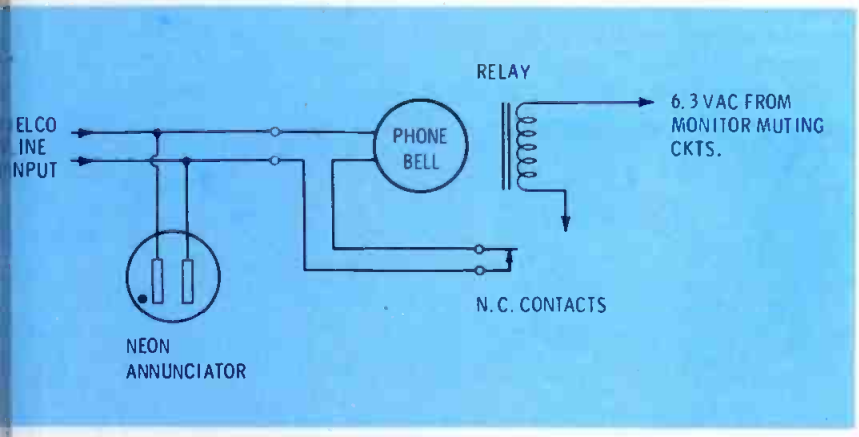

Figure 1

Adding slack to the camera cable during remotes

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

ere at WHYY we have finally ed a recurrent problem which n occurs to the cameraman during remotes using the Ikegami HL77 cabled to a Sony VO2850.

There have been times when the

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ure 1

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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 batte belt (Figure 1) and hooking a spri snap hook to the power cable such a position as to allow sor slack for freedom of operation of t camera, but transferring any p on the cable to the battery b which is secure around the camer man'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 p count circuits, this one takes vantage of several different fu tions of each part.

In various pieces of equipm

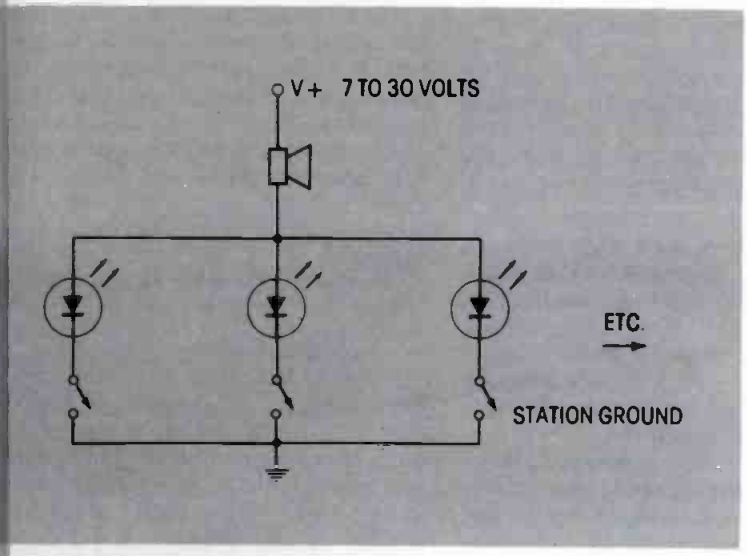

Figure 1

round the station, there are control rcuits that automatically turn on hen certain limits are reached. ne schematic in Figure 1 shows an arm, LEDs, and switches. Think of ese switches as relay contacts or arm closure contacts already in ur equipment.

By wiring up this simple circuit, hen some zaps in the night, you'll ive an immediate readout on what it is in trouble.

A closure to station ground at a oblem point (EBS, STL carrier, orbell, modulation alarm, etc.) ts 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. □

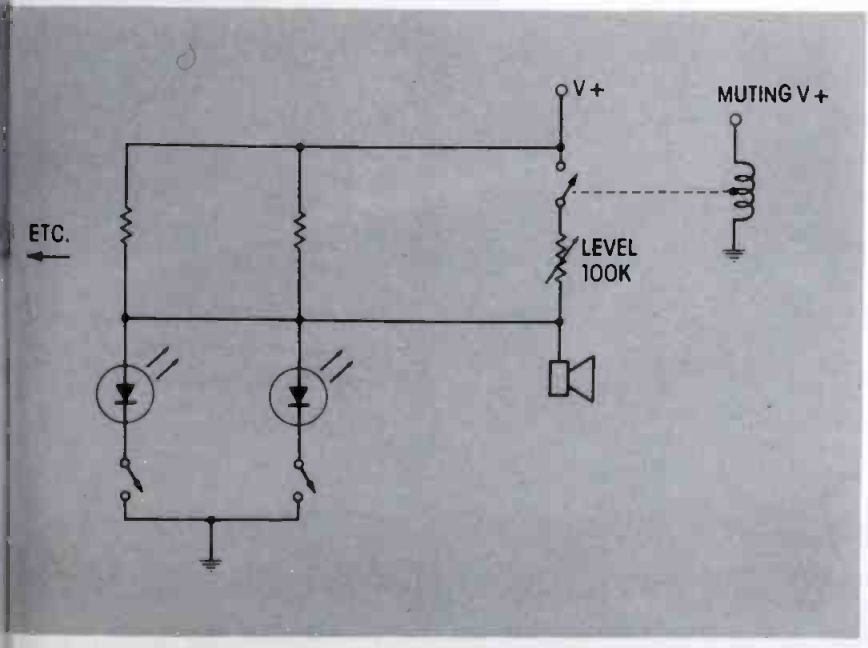

Figure 2

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.

For More Details Circle (90) on Reply Card

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.

For More Details Circle (91) on Reply Card

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

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.

For More Details Circle (93) on Reply Card

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 0 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.

For More Details Circle (92) on Reply Card

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

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new products

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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 mini-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 identification strip on the front pane allows the operator to label th corresponding lights for identifica tion of the users. The unit can b modified to display 40, 80 or 10 outputs by changing the front panel

The SM-1030 also interfaces wit the party line by a BNC connecto with a standard piece of RG-5 coax. An internal dip switch en ables the unit to be programmed t monitor any source in the system.

As an option, a lever whee switch can be placed on the fron panel in lieu of the dip switch t provide easy selection by the oper ator.

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 bandpass 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 t eliminate clicks, pops, and hum o telco lines, satellite circuits, and microwave links. It can be used fo radio remotes, TV microwave feeds and network program audio trans mission. Studio and portable model are available.

For More Details Circle (99) on Reply Card

Multitrack recorder

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

The JH-110 transport has bee used in a new 1-inch tape config uration. Punch-in and punch-ou noise during editing has been mini mized. 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
ien the machine goes into Record
ide.

For More Details Circle (100) on Reply Card

950 MHz STL

Time and Frequency Technology
as introduced the model 770/771, a
w studio-to-transmitter link in the
0 MHz band. It can be used for
dio-to-studio, intercity, network
d similar radio feeds. A fully
undant receiver/transmitter sys-
m with automatic change-over
en signal failure is detected,
sures continuous reliable trans-
ssion. Capable of both single and
al composite as well as dual
naural operation, the model 770/
1 offers the broadcaster the
lity to operate two monaural
hnnels within a single 500 kHz
adwidth with no crosstalk be-
een channels or to transmit a
mposite signal including stereo
d two subcarriers for the SCA
d remote control.

For More Details Circle (101) on Reply Card

Video distribution amplifiers

Dynasciences has added three
w models to its line of video
tribution amplifiers.
Model 72D is a differential input
A intended for use with signals
ving large amounts of hum. Hum
ection of the unit is better than
dB.
Model 72C compensates for poor
h-frequency response caused by
g cable runs. The unit provides
justable compensation for up to
0 feet of RG59/U cable.
Model 72DC incorporates both the
n rejection and cable compensa-
n features.

For More Details Circle (102) on Reply Card

professional services

advertisers' index

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assified columns are not open to advertising y products regularly produced by manu- rers unless used and no longer owned by anufacturer or a distributor.

TRAINING

RF PHONE in six to twelve weeks through recorded lessons at home plus one week nal instruction in Boston, Philadelphia, it, Atlanta, St. Louis, Seattle or Los es. Our twentieth year teaching FCC license es. Bob Johnson Radio License Preparat- 1201 Ninth, Manhattan Beach, Calif. 90266, hone 213-379-4461. 8-75-tf

FCC EXAMS with Ameco books. Each contains FCC questions plus simplified ers plus FCC-type exams and answers. 3rd includes broadcast endorsement $1.25. 2nd $2.50, 1st class $1.60. Free catalog. Ameco shing, 275G Hillside Ave., Williston Park, 11596. 8-72-tf

ATHAM'S FCC LICENSE STUDY GUIDE—377 , 16 FCC-type practice tests, 1465 ques- h with answers and discussions—covering second, and first class license exams. 5 postpaid. GSE Publications, 2000 Stoner Los Angeles, CA 90025. 10-77-tf

ETRONICS DEGREE by correspondence. No muting to class. Study at your own pace. with basics and continue, first for A.S.E.T. hen for B.S.E.E. For free brochure, write: nation Desk, Grantham College of Engineer- 000 Stoner Avenue, Los Angeles CA 90025. 10-77-tf

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IOR VIDEO & COMMUNICATION TECH- AN seeking position in 2 year college or ad school as instructor for TV mass media or d field. Will also do repair and maintenance uipment. Six years of industrial digital and 2 years of studio and equipment repair, 2½ of business and electrical background. ¾ work experience at Bucks County Com- ty College, Bucks County, Newtown, PA as ical assistant, repair and maintenance of TV o equipment and overseer of students in ol room. Presently employed as Senior al Communications Technician with a corpo- n with yearly sales of 1.75 billion dollars. complete resume, 1311 Barton Drive, Ft. ington, PA 19034. 4-78-3t

SERVICES

QUENCY MEASURING SERVICE—WE'RE #2 ONITOR REPAIRS—MOBILE UNIT—covers hern ⅔ Ill., Eastern Iowa, Eastern Minn., hern ⅔ Wis., Western Mich., and Western monthly. Radio Aids, 528 Ravine Ave., Lake , Illinois 60044, (312) 234-0953. 2-74-tf

QUENCY MEASURING AND MONITOR SER- E. Precision measurements at reasonable s. Box 20098, Birmingham, Alabama 35216 822-2184. 2-78-4t

SERVICES (CONT.)

BUILD YOUR OWN TV AND RADIO PRODUCTION EQUIPMENT. Easy, inexpensive, (mostly IC). Plans or kits: Special Effects Generator, Automatic Logger, Vertical Interval Video Switcher, Solid State Lighting Board, Preset Audio-Video Board, Preset Lighting Board, Crystal Controlled Wireless Mikes with Matching receivers. Subsonic Tone Control for audio tapes, 8MM SOF Cameras and Projectors, Distribution Amplifiers (Sync. Video, Audio), Audio Control Boards (Studio & Remote) Proc-Amp with compensation and regeneration for adapting Helical Scan VTR's to broadcast standards. PLUS specialized correspondence courses in TELEPHONE Engineering ($39.50), and Integrated Circuit Engineering ($49.50). Plans from $5.95 to $15. SUPER CATALOG plus years updating of new devices Air Mailed $1.00. Don Britton Enterprises, P.O. Drawer G, Waikiki, Ha. 96815. 5-77-32t

SAVE HUNDREDS OF DOLLARS on high quality, dependable, American Made, MATV Head-Ends, V/V, U/V Converters, Camera Modulators at factory-direct prices. Send $5.00 (or your MATV Installers Letterhead). "Information," Box 809, Boynton Beach, Fla. 33435. 1-78-e.o. 3

COMMERCIAL RADIO MONITORING CO. Precision frequency measurements since 1932. Local and mobile service covering entire midwest plus. Test instruments, counters, monitors repaired and certified. Lee's Summit, Mo. 64063. (816) 524-3777. 9-74-tf

ONE STOP FOR ALL YOUR PROFESSIONAL AUDIO REQUIREMENTS. Bottom line oriented. F.T.C. Brewer Company, P.O. Box 8057, Pensacola, Florida 32505. 7-71-tf

HELIAX-STYROFLEX. Large stock—bargain prices—tested and certified. Write for price and stock lists. Sierra Western Electric. Box 23872, Oakland, Calif. 94623. Telephone (415) 832-3527. 1-73-tf

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HAVING CRYSTAL OR OSCILLATOR TROUBLE or changing frequency on your TV, FM or AM transmitter? Call us for help at (817) 773-3901. Our many years in this field with crystals gives us considerable experience. We can probably save you time and money, and strictly first class. EDISON ELECTRONIC CO., Box 96, Temple, Tex. 76501. 3-78-3t

TOWER PAINTING AND LIGHTING: Service and maintenance contracts offered. Pioneer Tower Service, P.O. Box 253, Carrollton, Missouri 64633, (816) 542-0840. 9-77-tf

WANTED

WANTED: Two (2) used contour enhancers for PC-70 Norelco camera. Must be in good working condition. Contact Efrain Rivera, Chief Engineer, WLTV, Miami, Florida, (305) 652-4000. 4-78-1t

WANTED: 1 KW STEREO TRANSMITTER. KUOR-FM, 1200 Colton Ave., Redlands, Calif. 92373. 4-78-1t

WANTED: Recording gear of all ages and variety. Microphones, outboard gear, etc. Dan Alexander, 6026 Bernhard, Richmond, CA 94805, (415) 232-7933. 4-78-6t

WANTED: Pre-1926 radio equipment and tubes. August J. Link, Surcom Associates, 305 Wisconsin Ave., Oceanside, Ca. 92054, (714) 722-6162. 3-76-tf

WANTED USED UHF TRANSMITTER: RCA or Harris 30 or 50 KW. Must be no more than ten years old. Ph. (419) 225-3010. 3-78-2t

WANTED: RCA remote control BTR-11B studio unit. WABK, Box 1280, Gardiner, Maine, (207) 582-3303. 4-78-1t

EQUIPMENT FOR SALE

DATATRON 5050 EDITOR modified for 3 VTR's. Ideal way to break into time code editing. (216) 822-3770. 4-78-tf

EQUIPMENT FOR SALE (CONT.)

WINDSOR TOTAL VIDEO IS LOOKING FOR A FEW GOOD PEOPLE:

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RCA VTY MODIFICATIONS KITS for TR4/22/50/60/61/70. Splicer (single-frame), TEP Interface, Time Code Edit Interface Kit, Audio Splice Timing Mod (Audio Insert Editor), Wideband Audio Amplifiers, most mod kits, some modules available. LAWHED, LTD., 388 Reed Road, Broomall, Pa. 19008, (215) 543-7600. 4-78-tf

LIGHT PEN Tektronix 4501 scan converter and homemade interface. (216) 822-3770. 4-78-tf

FOR SALE—C.B.S. #410 Volumax, Wilkenson LA2-C limiter. **BOTH NEW,** make offer. Two C.B.S. Dynamic Presence Equalizers, #4500. **NEW** $1600. Call after 5:30 p.m., (805) 684-2544, California area. 4-78-1t

CARTRIDGE LABELS: New, non-smear pressure sensitive labels. Fits all cartridges. Comes white & 4 colors. Write for FREE sample—MASTERTONE COMPANY, 1105 Maple, West Des Moines, Iowa 50265, (515) 225-6122. 8-77-tf

BROADCAST CRYSTALS for AM, FM or TV transmitters, frequency change, repair or replacement of oven types. Also vacuum types for RCA, Gates, Collins, etc. transmitters. Quality products, reasonable prices and better delivery! Don't be without a spare crystal. Frequency change and service for AM and FM monitors. Over 30 years in the business. Eldson Electronic Co., Box 96, Temple, Texas 76501. Phone (817) 773-3901. 12-74-tf

CDL VS100 SWITCHER. Double Reentry, 12 x 4 with two Mix Amps, Special Effects Amp, Proc Amp, Black Gen, Power Supply, RGB Chroma Keyer, Tech Preview, Downstream Keyer. Contact Rod Hall: (213) 577-5576. 3-78-2t

BROADCAST AND STUDIO EQUIPMENT. New and used. Cart and reel recorders, consoles, limiters, monitors, mic's, turntables, preamps, speakers, racks, furniture, reconditioning services, parts (including PT6). Authorized Spotmaster distributors. Contact us for best prices and trade-in deals. AUTODYNE, P.O. Box 13036, Orlando, Fla. 32809, (305) 855-6868. 9-77-tf

28 FOOT CUSTOM MOBILE TRANSPRODUCTION VAN: 2 camera, color broadcast standard, 10x1 lenses; mics, turntable, R/R and cart tape. 11-in mixer; wave and V-scopes; SEG/chroma key; 1K-page character generator; ¾" decks, editor, TBC; all accessories included. Write Dept. 411, Broadcast Engineering, P.O. Box 12901, Overland Park, Kansas 66212. 3-78-2t

ONE-THIRD OCTAVE FILTER SET, General Radio—#1925. Thirty filters, 20Hz-20kHz, each with 50dB attenuator (1dB/step), graphic display. Thirty Parallel outputs; and summed, weighted, or serial remote-controlled scan outputs. $5500 new. Like new, $4000 or best offer. Contact: R. Koziol, GAF Broadcasting, 1180 Avenue of the Americas, NY 10036. (212) 626-1043. 2-78-2t

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 ¾-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, protable 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. 4-78-1t

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. 4-78-1t

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. 3-78-2t

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. 3-78-2t

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. 3-78-2t

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. 3-78-3t

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. 4-78-2t

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. 4-78-1t

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-tf

CAREERS IN TELEVISION ENGINEERING

RKO General, Boston Division has immedia openings for the following positions.

ENGINEERING SUPERVISOR

For the candidate who can supervise tec nicians assigned to television production a maintenance. A solid technical backgrou FCC FIRST CLASS LICENSE and a minimu of 5 years of television broadcast experienc is also required. Previous supervisory e perience a real plus.

TECHNICIAN

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

RKO General offers a liberal compensatic package.

For prompt consideration, forward your resume including salary requirements to:
Personnel Department

Personnel Department

WNAC-TV BOSTON
A CBS AFFILIATE

RKO General Building,
Government Center,
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This growth position requires at least 2 years broadcast experience in television and distribution switching systems, digital audio, and/or video. While a degree is desirable it is not essential.

Relocation will be provided to our Huntsville location, a high technology area famous for its residential qualities and cultural diversity. Cost of living is modest and recreation facilities are exceptional.

Competitive salaries, full benefits, and opportunity for technical advancement are good reasons for finding out what we're doing and where we're going. While you're at the NAB Convention in Las Vegas, why not drop by our booth for a brief career discussion. If you cannot meet with us then, please send resume with salary history, in confidence, to: **Personnel Director.**

American Data Corporation
A North American Philips Company
401 Wynn Drive, P.O. Box 5228, Huntsville, Alabama 35805
An Equal Opportunity Affirmative Action Employer M/F

ENGINEER—NETWORK CONTROL—Statew educational telecommunication system. Oper computer controller for statewide video netwo Operate and maintain video tape recorder. F first phone license required. Minimum two ye television engineering experience with operat and maintenance of broadcast-type video t recording equipment. At least two years po secondary education highly desirable. Cont Phillis Gootee, Personnel Division, Indiana U versity-Purdue University at Indianapolis, 1100 Michigan St., Indianapolis, IN 46202, (3 264-7617. EEO/AA. 4-7t

MICROPROCESSOR SOFTWARE/HARDWARE Serve as assistant design engineer for spe technical development projects with statew educational telecommunication system. C struct and test prototype systems. Degree computer science, computer programming, electrical engineering plus first phone F license desired. Minimum two years experie writing computer programs, know machine basic languages. Experience with constructior digital circuits, knowledge of video systems equipment desirable. Submit resume to: Potter, Indiana Higher Education Telecommun tion System, 1100 W. Michigan St., Indianapo IN 46202. EEO/AA. 4-7t

MAINTENANCE ENGINEER for major AM group station. Existing facility upgrade n under way. Broad technical competance, FCC Class Radio-Telephone license, and full comm ment necessary. Send resume, salary history present requirements to: Engineering Manag P.O. Box 32046, Detroit, Mich. 48232. An Eq Opportunity Employer. 4-7t

SOLID CHIEF ENGINEER: Escape to a Gi Market in Wild Wonderful West Virginia. M the #1 team stronger in this University City W Strong Processing, Maintenance and Constr tion. We are solid and stable. If you are think long term send resume to Garry Bowers, WC AM/FM, Box 885, Morgantown, West Virg 26505, (304) 292-2222. Equal Employment Opt tunity Employer. 4-7t

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13	25	37	49	61	73	85	97	109	121	133	145	157	169	181	193	205	217	229	241	253	265	277	289	301	313
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
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

Please check every section which applies to you.

BUSINESS OR OCCUPATION

- ☐ A. AM Radio Station
- ☐ 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
- ☐ J. Distributor
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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
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
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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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
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- ☐ Other: specify _____

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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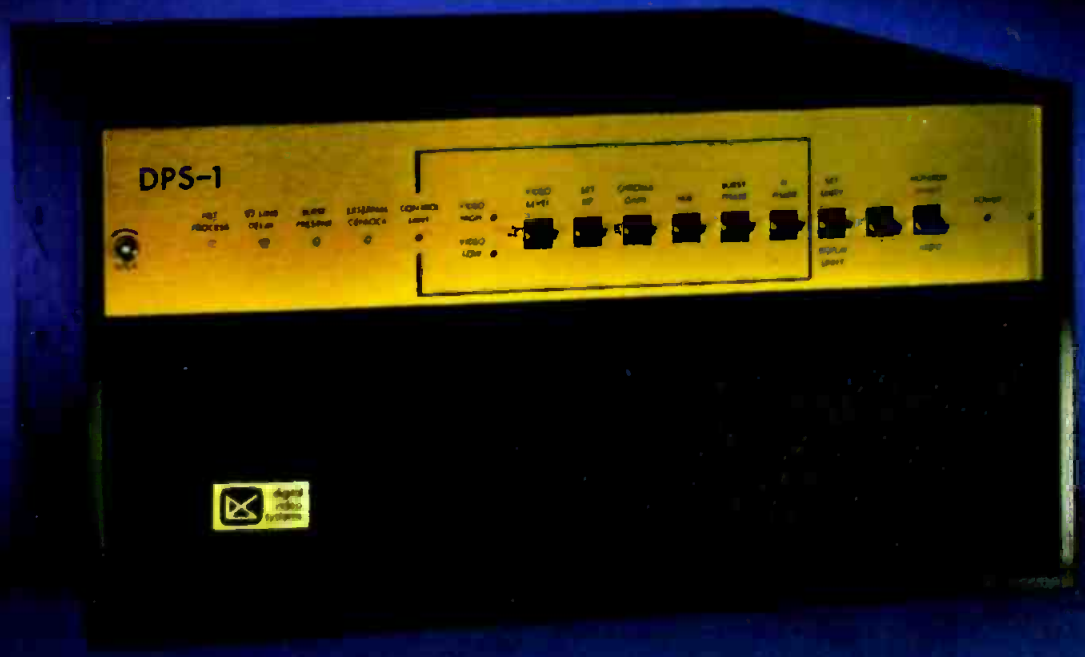

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fact:
you can choose your microphone to enhance your individuality.

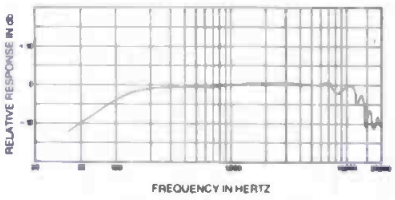
Shure makes microphones for every imaginable use.
Like musical instruments, each different type of Shure microphone has a distinctive "sound," or physical characteristic that optimizes it for particular applications, voices, or effects.
Take, for example, the Shure SM58 and SM59 microphones:

SM59

Mellow, smooth, 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!

Some like it essentially flat...



SM58

Crisp, bright "abuse proof"

Probably the most widely used on-stage, hand-held cardioid dynamic microphone. The SM58 dynamic microphone is preferred for its punch in live vocal applications . . . especially where close-up miking is important. It is THE world-standard professional stage microphone with the distinctive Shure upper mid-range presence peak for an intelligible, lively sound. World-renowned for its ability to withstand the kind of abuse that would destroy many other microphones. Designed to minimize the boominess you'd expect from close miking. Rugged, efficient spherical windscreen eliminates pops. Lightweight (15 ounces!) hand-sized. The first choice among rock, pop, R & B, country, gospel, and jazz vocalists.

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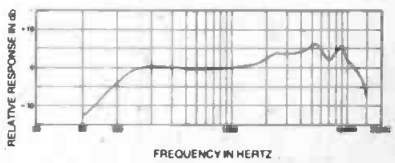

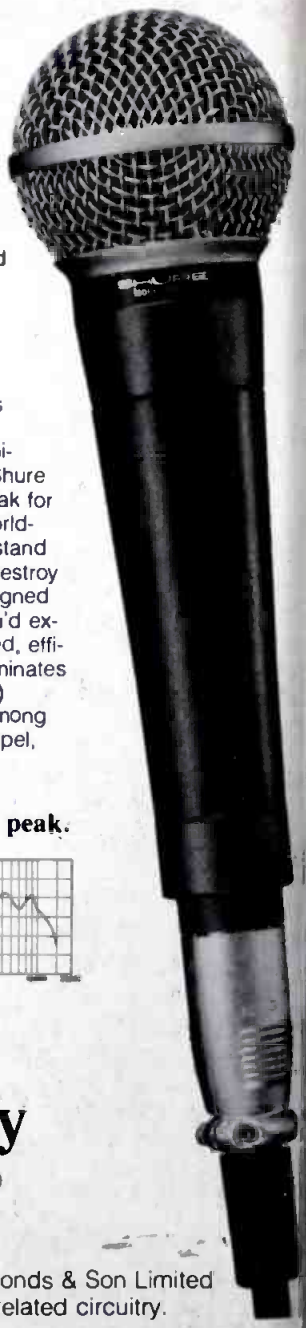

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