

BROADCAST ENGINEERING®

***What you see
isn't always
what you get***



ATS REVIEW

PULLING THE PROOF

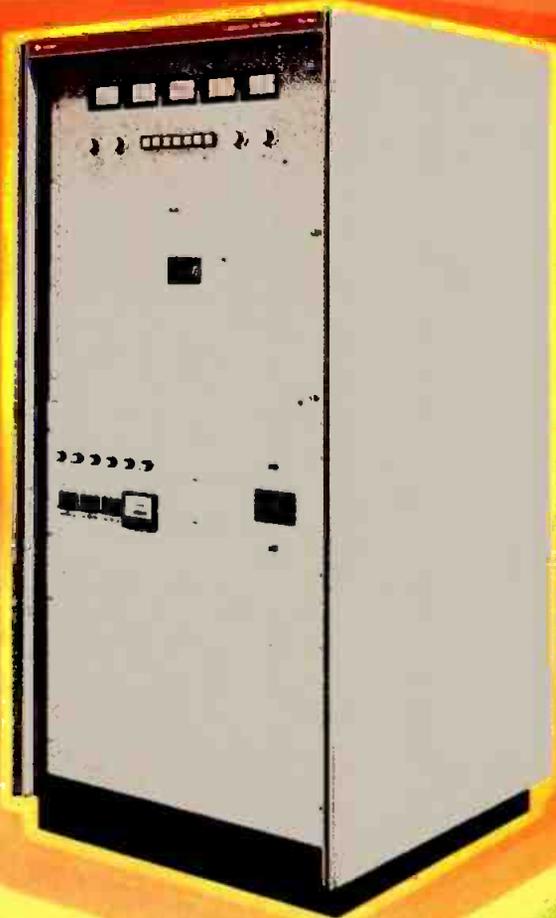
WEATHER RADIO

27 2

TWO NEW COLLINS SOUNDS:



THE MARK 8 & THE POWER ROCK



A new high efficiency 5-kW AM transmitter and a new high performance stereo console at lower prices . . . They're here! The new Power Rock AM transmitter with high performance, super-efficiency and a super-competitive price. And a Collins eight channel stereo console that offers superior performance at a price 50% less than our ten channel model.

The new Collins 828E Power Rock 5-kW AM transmitter: Uses switching modulation (the time-proven technique used in most high efficiency regulators) and a new high efficiency RF amplifier. This adds up to lower power bills • Features an advanced output network called Q-Taper which improves frequency response and reduces adjacent channel cross-modulation interference • Other goodies: Automatic power output and modulation control. 125% modulation capability. Built-in diagnostic aids. Plus other features that foreshadow the day of automatic transmitter operation • And it's all in a cabinet the size of a 1-kW unit!

The new Collins Mark 8 Stereo Console is an engineer's delight: All plug-in construction — switches, PC boards, attenuators and amplifiers. Plus a host of other maintenance aids • Performance that equals consoles several times its cost: 22 dB of headroom. ½-dB frequency response. ¼% harmonic and inter-mod distortion. Big 25-W monitor amps. 5-W headphone amps. And optional machine control functions for ease of operation.

For more information on the Power Rock and the Mark 8 or any of the full line of Collins quality broadcast products, contact your local Collins Broadcast salesman. Or Broadcast Marketing, Collins Commercial Telecommunications Division, Rockwell International, Dallas, Texas 75207. Phone: (214) 690-5574 or 5424.



Rockwell International

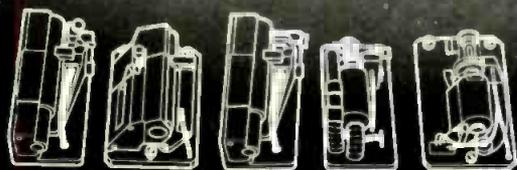
...where science gets down to business

For More Details Circle (1) on Reply Card



THERE IS A LOT MORE TO REBUILDING A QUAD HEAD THAN MEETS THE EYE*

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of a four page folder identifying
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- 18 **What You See Isn't Always What You Get.** In other words, this article talks about how tonal values translate. Tells how to avoid costly and disappointing surprises. *Ron Whittaker and Jacqueline Tornberg.*
- 32 **Radio Workshop.** Our workshop editor covers the AM Proof of Performance this month. It's a simplified approach and plan of attack on the system. *Peter Burk.*
- 40 **Automatic Transmission Systems In Review.** This paper was given during an engineering session at the March NAB convention. It's straight from the FCC. Includes answers to the most-asked questions on ATS. *John Reiser.*
- 50 **Let's Do More Of What Comes Naturally.** The National Weather Service is concerned over lack of emergency preparedness in broadcasting. This tells how their system works and how the broadcaster can get involved. *Joseph J. Conte.*
- 56 **Digital Lab.** This is Part 3 of our series on troubleshooting digital circuits. *Harold Ennes.*

About The Cover

Our cover features Lybee Pedonti, displaying the Tornberg-Whittaker approach to chroma and tonal values and how they translate. (Photo by Ron Whittaker)

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EDITORIAL

Ronald N. Merrell, *Editorial Director*
Carl Babcoke, *Technical*
Ron Whittaker, *Production Spotlight*
Howard T. Head, *FCC Rules*
Robert A. Jones, *Facilities*
Karen Gaines, *Editorial Assistant*
Dudley Rose, *Graphic Designer*
Joe Roizen, *Video*
Peter Burk, *Radio Workshop*
Dennis Ciapura, *Audio Editor*

CIRCULATION

Greg Garrison, *Director*
Evelyn Rogers, *Manager*

ADMINISTRATION

George H. Seferovich, *President*
Mike Kreiter, *Publisher*

ADVERTISING SALES

Gloria Parmenter, *Production*
P.O. Box 12901
Overland Park, KS 66212
(913) 888-4664
Regional advertising sales offices listed on ad index page.

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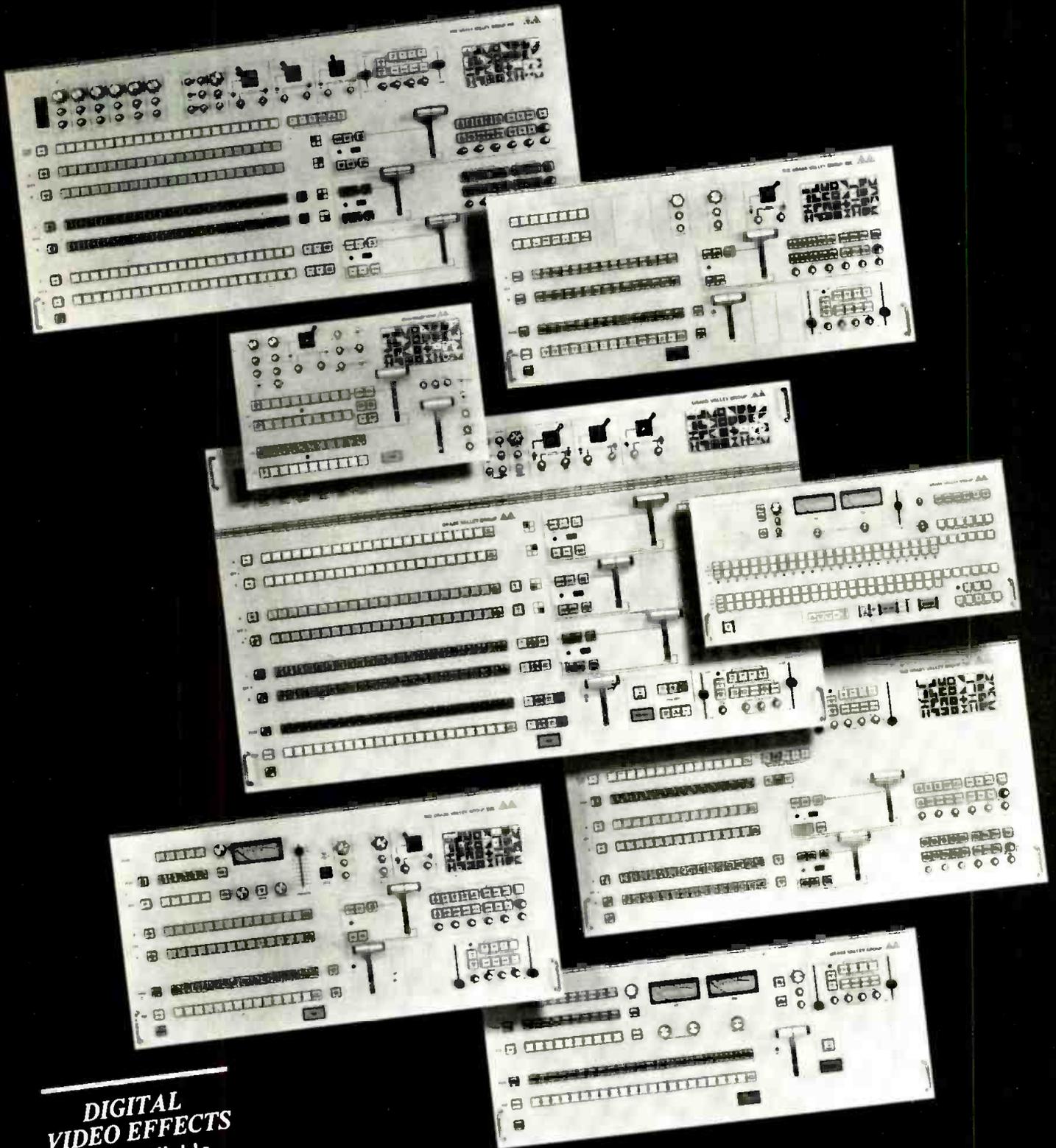
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DIRECT CURRENT FROM D.C.



June, 1977/By Howard T. Head and Harold L. Kassens

Nobody's Perfect

In a recent initial decision, an FCC Administrative Law Judge has denied a renewal of license for an AM station. The station is licensed to operate with different directional patterns and powers day and night and was found guilty of:

- (1) Installing and utilizing a hidden "relay device" so that the station could operate in the non-directional mode either day or night. "The switch was installed in such a manner that, to a casual observer inspecting the transmitting equipment, nothing would seem out of the ordinary." (The FCC Inspector detected the violation by noting incorrect monitoring point measurements and no change in readings at sunset.)
- (2) Failure to maintain proper phase relationships. During a visit, the FCC Inspector found the phase reading for the nighttime pattern off by 7° and the current ratio off by 8.9 percent. No figures were given for daytime operation.
- (3) Failure to measure field intensity at proper intervals and points. The indicated measuring location was approximately 500 feet from the true location. Another was 100 feet away.
- (4) Failure to comply with various sections of the Commission's rules--1972 inspection. The station was inspected in 1972 and several citations issued. The chief engineer stated that the deficiencies had been corrected but, apparently, they were not.
- (5) Failure to comply with various sections of the rules--1975 inspection. In this inspection, the following citations were issued:
 - (a) Removal of transmitter interlocks
 - (b) Failure to make equipment performance measurements
 - (c) Improper maintenance of transmitter power
 - (d) Failure to perform frequency checks
 - (e) Failure to have operator on duty at proper position
 - (f) Failure to instruct operators
 - (g) Failure of chief operator to review logs

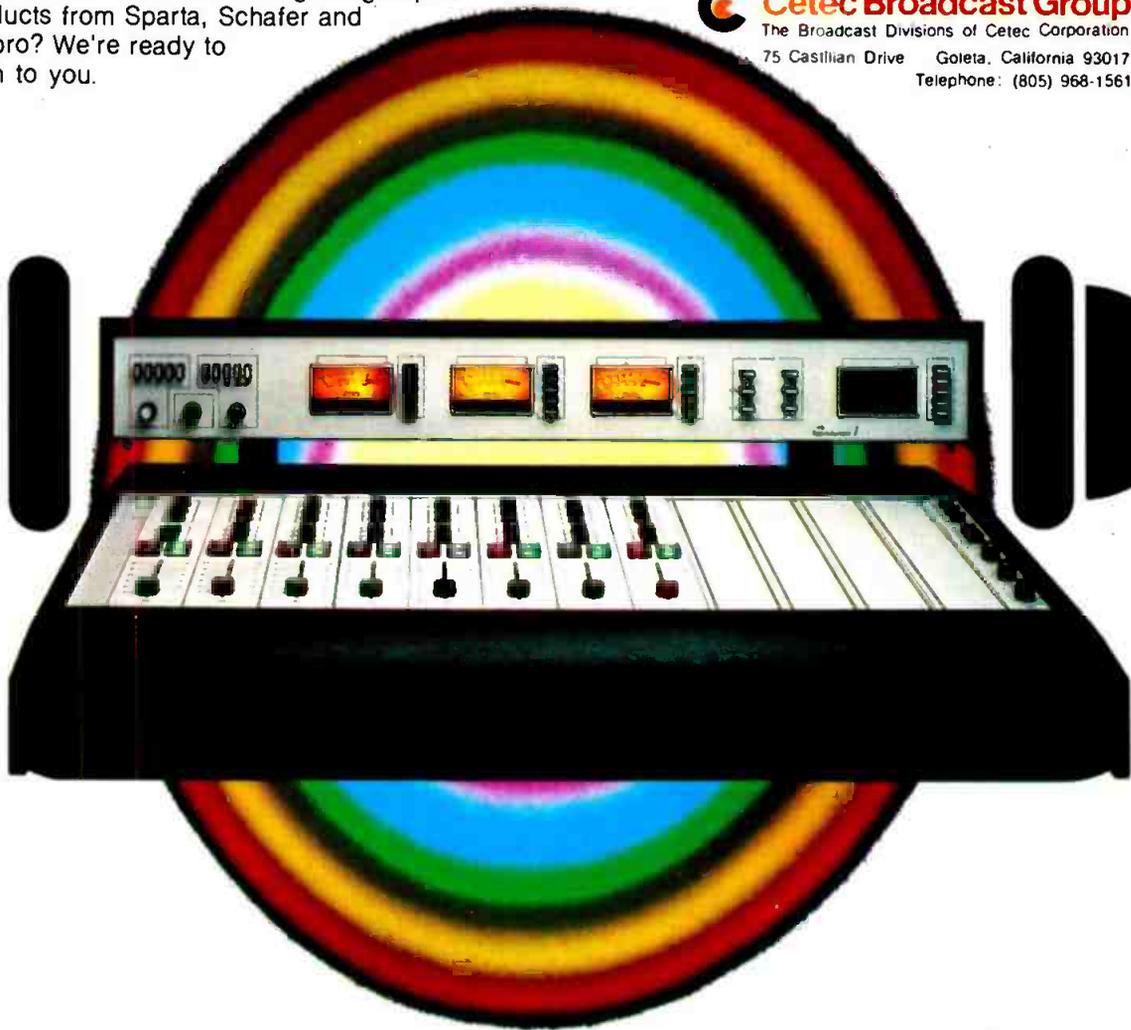
Continued on page 6

BROADCAST ENGINEERING

CETEC Sparta's Centurion Consoles are really worth listening to.

If you talk to a broadcaster who has a Centurion Console, you wouldn't have to read this. Centurions simply work — flexibly and reliably — for less money. A fact or two . . . Flexibility? Centurion I and II handle 12 mixers, with extender panels to 24 mixers. Each mixer has pushbutton selectivity from three audio sources. Furthermore, mixer input is not dedicated. A built-in switch provides change to any of three input levels! Incidentally, mono or stereo mixer modules are interchangeable. They can be turned off or on by a remote command. In turn, any mixer can turn remote equipment off and on. That's flexibility! Reliability? A quick example. Noiseless optically isolated switching. Motherboard and ground plane PC techniques eliminate crosstalk. Unfortunately, Centurions have many more features than we have room. To sum up, Cetec Sparta offers TWELVE consoles, from 4 to 24 mixers, with many, many options. Last word. Wouldn't you as a 'professional broadcaster', prefer to talk to a 'broadcast professional'? . . . about the good group of products from Sparta, Schafer and Jampro? We're ready to listen to you.

 **Cetec Broadcast Group**
The Broadcast Divisions of Cetec Corporation
75 Castilian Drive Goleta, California 93017
Telephone: (805) 968-1561



Centurion I and III are mono.
Centurion II and IV are stereo.

For More Details Circle (4) on Reply Card

DIRECT CURRENT FROM D. C.

Continued from page 4

- (h) Failure to inspect transmitting equipment
 - (i) Failure of operators to sign off duty
 - (j) Failure to make entries in maintenance logs
 - (k) Failure to monitor EBS
 - (l) Failure to perform EBS tests
- (6) Falsification of logs when operating non-directionally.

WARC-79 Decision

In a closed FCC meeting, some staff members attempted to steer the Commission into a reallocation of a large portion of the UHF-TV spectrum for land mobile and other purposes. Fortunately, four Commissioners saw through the plan and voted for a Fifth Notice of Inquiry which will propose retention of the present allocation structure for UHF-TV. Three Commissioners voted for the re-allocation.

Terrain Roughness

In May 1975, the Commission adopted new FM and TV propagation curves and provided procedures for using terrain roughness corrections in predicting the location of field strength contours. Then in October 1975, the Commission deferred use of terrain roughness corrections until May 1, 1976, largely because of complaints from several sources that the procedures set forth in the rules could in certain circumstances, give greatly erroneous results. In April 1976, the use of terrain roughness was again delayed--this time until May 1977. In a recently issued Order, the Commission decided to withhold the use of terrain roughness corrections to an indefinite date in the future, pending a new study of the subject.

New FCC Forms

The FCC has issued new forms for certain applications. These should be used as soon as they can be obtained because use of old forms can result in delay:

Form 301-A	AM-FM-TV Remote Control
Form 318	Subsidiary Communications Authorization (SCA)
Form 347	Applications for TV or FM Broadcast Translator Station License

Standardized CB Fines

The Commission has standardized the amount CB operators are fined for various offenses. For excess power or use of other than CB frequencies, the fine is \$100. For "skip" communications and for overheight antenna, the levy is \$75. For repeated failure to reply to Commission correspondence and for failure to identify transmissions with the authorized call sign, it will cost \$50.

When you're shooting ENG, two things are certain: You never know where news will happen next. And you never know what will happen when you get there.

For the first, you need lenses with proven performance. The kind of versatility to handle most any kind of shooting situation. Plus the ruggedness and reliability to withstand daily use. And abuse.

For the second, you need lenses backed by service. To keep your lenses in top condition. And solve the problems no one can foresee, but everyone faces.

At Canon, we offer the widest selection of ENG lenses in the business. Premium lenses, engineered by the same people responsible for our Academy Award in lens design.

Built by the people who helped make our Scoopic camera the network newsman's favorite silent '16'. And backed by a dedicated

group of servicepeople, in key cities, nationwide.

When you're shooting ENG, you need more than lenses that work when the going's easy. You need lenses you can depend on. To reliably handle everything you'd reasonably expect to find on location. Backed by loaner lenses and quick-turnaround service when the unexpected shatters your peace of mind.

You need Canon.

For more information about Canon ENG lenses, please contact Jack Keyes or Ken Morishima in New York; Matt Miyazaki in Chicago; or Harry Hirai in Costa Mesa.

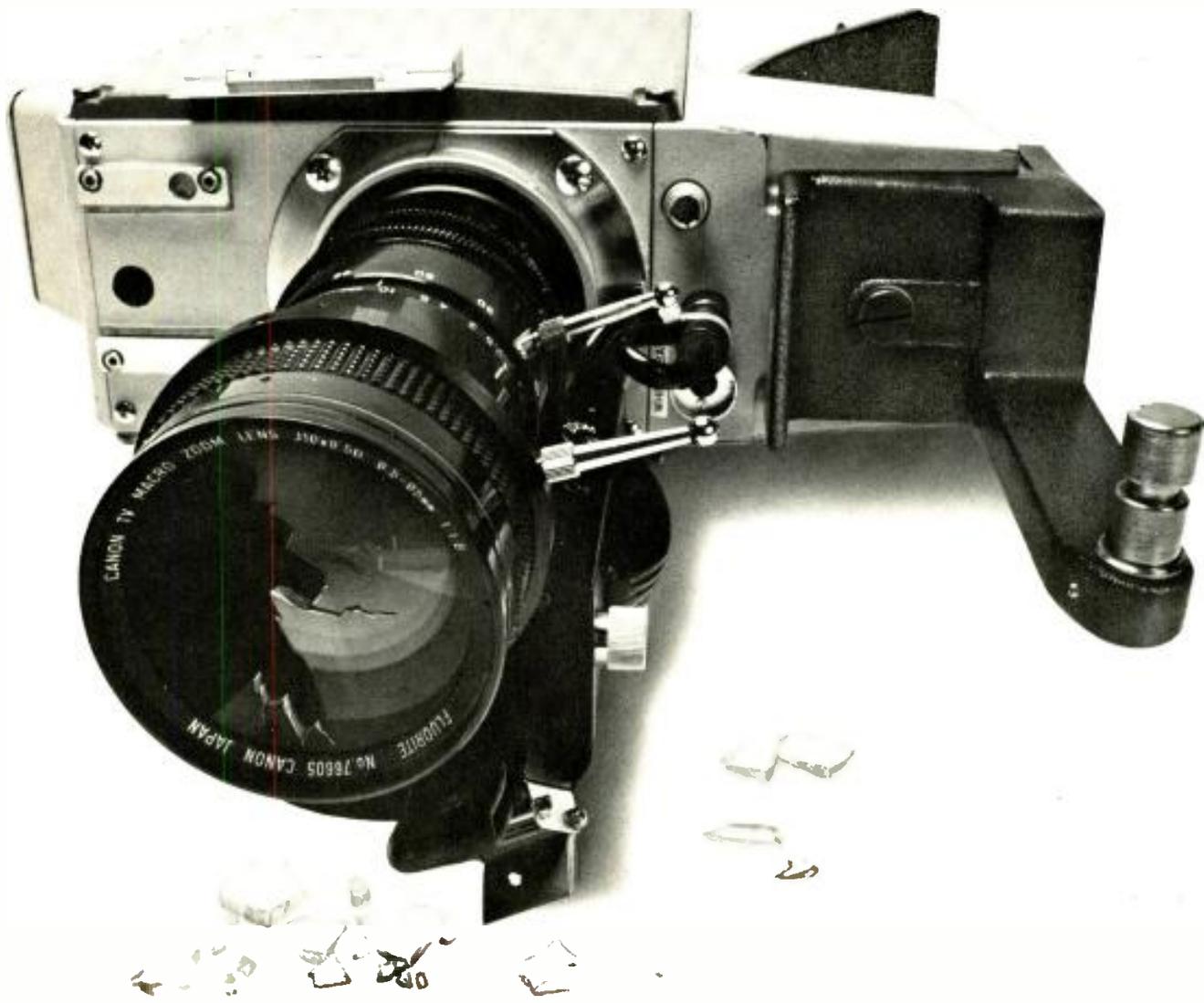
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SOMETIMES, THE NEWS CAN HAVE TOO MUCH IMPACT.



INNOVATION

...the full lineup of innovative cameras and camera technology that set NAB '77 on its ear and has truly earned Philips the reputation of "the INNOVISION company".*



Since the first decade when Philips creative technology changed color television forever with the Plumbicon™ tube and the Philips Norelco PC-60 camera, it has been one innovation after another.

3-Plumbicon tube design, beam-splitter prism, C.L.U.E. (Color Line Up Equipment) etc., etc., etc. Right into Decade TWO with the world-wide acceptance of LDK and LDH cameras ...the finest, most advanced, most complete family of cameras available anywhere.

Now Philips proudly presents the "INNOVISION family" of television products to meet every need, every budget.

VIDEO 80—NEW...an incredible, broadcast-quality camera/camera system for ENG, Field Production, Studio. Converts to each configuration with just a simple change of slide-viewfinder and plug-in electronics.

Simple to set up...simple to operate because all the test features are built-in with "no compromise" performance. And there are even more automatic features in its ENG configuration, for total mobility. It's compact, rugged and lightweight. Designed to go anywhere, do anything on AC or power pack.



But the greatest innovation is Video 80 economy. Economical to purchase, economical to operate. Its versatility lets you do more with less equipment for true cost/effective operation. And since Video 80 can interface with most of your existing equipment, it saves all around. That's economy three ways.

LDK-25—the finest, state-of-the-art multicore studio and field camera system available today. With *all* critical components Philips designed... Philips made, for optimum performance of the entire camera system. Like computer matched yokes, beam-splitting prism, deflection circuitry, Plumbicon 1" anti-comet tail tubes.

Couple these with innovations like C.L.U.E. for ease of color balance, electronic temperature control, auto white balance, flexible auto iris and con-



trust compression and you have a camera system unsurpassed in stability, picture quality and performance.

The LDK-25 family also has a digitally controlled triax version, the LDK-5, for remotes and modernized studio installation. Its built-in memory system maintains settings up to a week and its automatic cable compensation eliminates timing and power supply problems to beyond one mile.

The LDK-15 is the LDK-5 in a portable configuration...the ultimate port-



VISION

TV

able production camera for field production or for use as a compact studio camera. Operates in a self-contained mode or interfaces with either the LDK-5 or 25 CCU in system configurations with absolutely no compromise in performance.



VHF/UHF Transmitters—an advanced, new television transmitter line. Pictured is the 17.5 kW VHF transmitter which can be paralleled for 35 kW. UHF transmitters range from 1 to 55 kW and may be paralleled to 110 kW. All use a unique, common 1-watt I.F.

exciter which can also be retrofitted into earlier competitive systems. Over 1,000 Philips transmitters have been sold world-wide.



LDH-20S—with increased sensitivity and a wide selection of zoom lenses. It's the acknowledged leader in 3-tube economy broadcast-quality cameras, with over 1600 in use world-wide. Philips patented prism beam-split optics, contours-out-of-green enhancement, C.L.U.E. adaptor for easy color alignment, balance and camera matching make it unmatched in its class.

LDK-11—with exclusive Philips design and performance. The full broadcast camera that started everyone thinking both ENG and Field Production in a hand-held camera. But LDK-11 does it without compromising quality or operational features. A remarkable battery or AC powered portable camera with full control remotely or at the backpack. And with studio camera features like famed 3-Plumbicon tube picture, beam-split prism, bias light and Philips linear ma-



trix for superb colorimetry, H&V contours, auto iris, auto white balance, genlock sync generator, switchable gain and gamma, built-in color bars, remote VTR and zoom controls and two audio channels. All this and more make the LDK-11 like no comparable broadcast camera in the world.

And check out these other innovative new Philips products:

New LDK-65 Telecine Film Chain with parts commonality and outstanding performance of the LDK-25 camera family.

New BCN 1" helical scan Video Tape Recorders and new compatible 1" cassette version.

They all add up to a complete innovative family of cameras and technology to serve the television industry.

Send for more information (indicating product interest). Or, better still, have your Philips representative set up a demo for you. But do it today. Philips Broadcast Equipment Corp., 91 McKee Drive, Mahwah, N.J. 07430 (201) 529-3800.

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NRBA Sponsors National Seminars

A nationwide series of one-day Seminars on Radio and Newspapers will be sponsored by the National Radio Broadcasters Association, announced Jim Gabbert, president. The NRBA has contracted with Maurie Webster, president of the Webster Group and one of the nation's authorities on newspapers and radio to design and conduct the seminars.

"We believe radio station managers and sales departments need the best and most complete information they can get about the newspapers," said Gabbert, "and our seminars will be informative, professional meetings which will give sales people the ammunition they need to compete more effectively."

Webster, who originated the Radio Commercial Workshops in the Mid-1960s said that there are several ways in which radio offers

superior advertising effectiveness to local retailers, and that the seminars will show how to make more specific comparisons of the two media.

The remaining seminars scheduled through July are:

July 13: Boston, Mass.
Ramada Inn—Logan airport

July 15: Memphis, Tenn.
Sheraton, Airport

July 20: Chicago, Ill.
O'Hare Hilton

July 21: Kansas City, Mo.
Marriott at K.C. Airport

For more information and convention registrations contact NRBA at 1705 DeSales Street N.W., Washington, D.C. 20036.

Ground Station Approval To Christian Broadcast Network

The National Association of Broadcasters has asked the U.S. Court of Appeals for the District of Columbia for a 30-day stay of its decision overturning pay cable rules, in order to permit NAB to ask the Supreme Court to review the case. The NAB Executive Committee has decided to make such an appeal.

NAB requested the stay because the Court's resolution of the issues raises "serious and substantial

questions" concerning other decisions of the Supreme Court and the Appeals Court. This is because the setting aside of the various FCC regulations could foreclose effective reestablishment of the regulations in the event they are affirmed by the Supreme Court, and because the Appeals Court has directed the FCC to undertake further proceedings without sufficient time to allow the Supreme Court to act on the case.

NAB Asks U.S. Appeals Court For Pay Cable Decision Stay

The Federal Communications Commission has approved a request by the Christian Broadcasting Network to begin transmitting and receiving TV signals 24 hours a day from its satellite earth station. This

makes the first time the FCC has granted permission to an independent broadcast owner to build its own ground station to transmit and receive signals by satellite.

Continued on page 12

A custom TV sound production console... from stock! System 5305.

Waiting five or six months for a custom mixing console can seem like an eternity!

Neve is changing all that with the introduction of System 5305 — a complete range of console frames and facilities.

You specify what you want. We put it all together in a custom console package from the numerous options available, some shown at right.

Some compromises? Yes — but far less than with other standard consoles. And we'll reduce delivery time, often shipping within weeks rather than months. And the pricing is very attractive, starting at approximately \$14,000 F.O.B. Bethel, Connecticut.

The 5305 console frame is available in 12, 20, 24, 32 and 36 input channel configurations. All versions include 4 sub-masters, reduction to 2 main outputs, echo and foldback sends, 4 channel monitor, and various other basic features. If, for some reason, it does not suit your requirement, we'll show you more than 20 other stock console designs starting around \$8,000. And we build more custom consoles than anyone else!

Contact us and we'll give you more details.

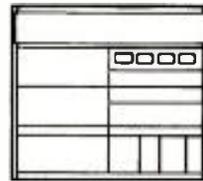
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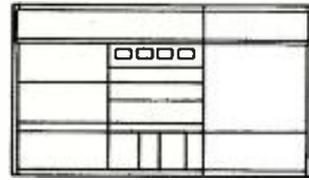
The evolution of a System 5305.



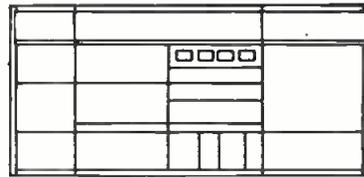
1. Start with the basic 12 in 4 out table top console.



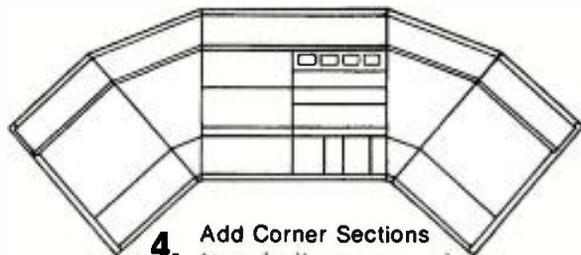
2. Add Console Extension Unit to house patch and auxiliary facilities.



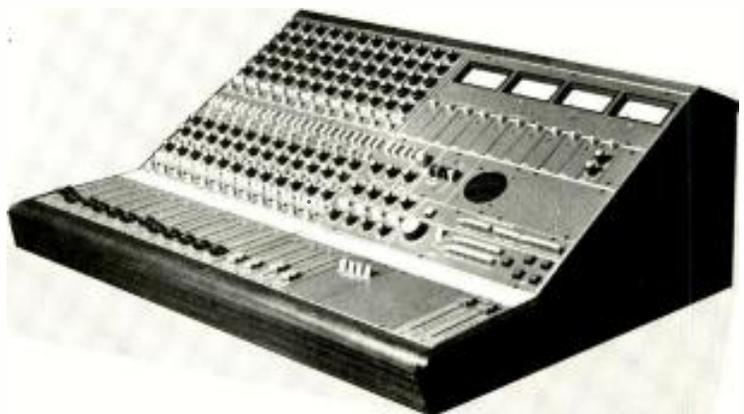
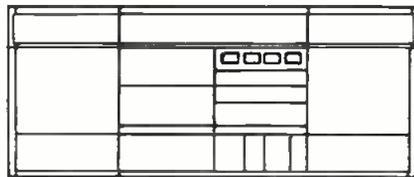
3. Add another 8 channels to make it a 20 in 4 out console.



4. Add Corner Sections to make it wrap around.



5. Add just a stylish table arrangement to the console.



Continued from page 10

CPB Ties Down Satellite Contracts

The Corporation for Public Broadcasting (CPB) and Comtech Laboratories, Inc., Smithtown, New York, signed a \$1.4 million contract calling on Comtech to build the main origination terminal for the projected public broadcasting satellite interconnection system.

The contract, the third and final

major agreement involving the \$40 million CPB-financed satellite system for public television, calls for the construction and installation of the principal transmitting station at a site near Springfield, Virginia, a Washington suburb. The station is to be owned and operated by the Public Broadcasting Service, the

program distribution arm of public television.

The contract, which was signed in April, covers all equipment and installation except for the construction of the terminal building and calls for the completion of the project by October 31 this year. The public broadcast satellite system is expected to be fully operational at the beginning of 1979.

NRBA Plans For '77 Convention

James Gabbert, president of the National Radio Broadcasters Association, named Stephen Trivers as convention chairman of the association's 1977 New Orleans conference.

Trivers, president of WQLR, Kalamazoo, Michigan currently serves on the NRBA Board of Directors.

Announced as convention coordinator, Claude Hall of Billboard Magazine, will arrange workshops and panel discussions. Hall is Radio-Television Programming Editor at Billboard.

The NRBA's Convention and Radio Broadcasters Conference and Exposition will be held October 9-12 at the New Orleans Hilton. Attracting radio broadcasters, equipment manufacturers, and others associated with the radio industry, the convention features exhibits and discussions devoted exclusively to radio.

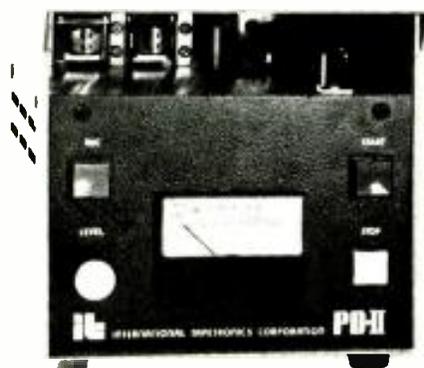
The Hilton, which opens this July boasts a 24,000 square foot exhibit area to accommodate an expected large turnout.

Conventioners' free time won't be neglected either. A block from Canal Street and a short stroll away from the French Quarter, the hotel is located amidst the new International River Center on the Mississippi. A racquet club, 14 tennis courts, health club facilities, shopping areas and restaurants are available to participants.

The Hilton's own restaurant, the Spectacle, atop the hotel, sports entertainment nightly and artificial indoor thunderstorms hourly. For further convention information, write to Al King, NRBA, Suite 500, 1705 De Sales Street, N.W., Washington, D.C. 20036 or call 202-466-2030.

Continued on page 16

No other tape cartridge machine can do so much for so little



Recorder/reproducer \$790

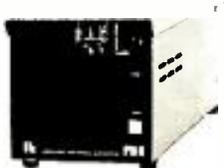
PD II SERIES

At last—a machine that records and plays mono tapes in the "A" size cartridge, stops automatically on the 1kHz cue tone and—offers you longer life, less maintenance and better performance than any other cartridge machine at an economy price.

Compare for yourself

- ITC's famous air-damped solenoid with Teflon coated plunger assures super-quiet operation.
- Deck is milled from a solid block of ½ inch thick aluminum. It won't warp...presents the same flat, stable surface to cartridges every time. Assures correct azimuth of heads.
- Heavy-duty micro adjustment head assembly with adjustable tape guides. Designed for easy, accurate adjustments.
- Direct-capstan, 450 RPM, hysteresis-synchronous drive motor—with an electrolyzed shaft—minimizes wow and flutter. Eliminates need for rubber belts and separate flywheel assembly.
- New trim-line design lets you place three units side-by-side in a 19 inch rack. Each unit is only 5¾ inches wide, 5¼ inches high and 15 inches deep.
- Features latest solid state components, even for switching applications. No relays. Printed circuit cards plug in.

Reproducer \$590



Call us and we'll prove it to you

For complete information call us collect at 309/828-1381. You'll be talking to experienced broadcasters who not only know what ITC equipment can do—but know what you want it to do.

INTERNATIONAL TAPETRONICS CORPORATION

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*In this studio,
you don't get a second take.*



When you perform in front of a live audience, you put everything on the line.

That's why you're so careful in selecting sound reinforcement equipment. Because once the music starts, you can't afford to have it stop.

At Yamaha, we know that the show must go on. Regardless.

That's why we designed our PM-1000 Series mixing consoles to the highest standard of quality and reliability. Professional.

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INDUSTRY NEWS

Continued from page 12

NAB Against Broadcast Minority Ownership Plan

The National Association of Broadcasters has refuted suggestions by three groups that the FCC should adopt a new policy to promote increased broadcast ownership by minorities.

In a filing with the Commission, NAB responded to petitions by the Congressional Black Caucus, the National Black Media Coalition and the Human Relations Commission for Gary, Indiana.

NAB emphasized that it is "dedicated to the goal of increased broadcast employment and ownership by minorities" and said it supports the proposal made at the World Administrative Radio Conference to expand the standard radio broadcast band. It noted that the proposed 21 additional channels would provide minorities "with a real opportunity for ownership of a significant number of stations."

Responding to the proposals, the Association said:

- A Minority Affairs Office is not needed because the Commission now has the administrative machinery to assist minority groups.
- Expedited comparative hearings should not be granted whenever minority applicants oppose each other because it would be discriminatory against all other applicants.
- A minority impact statement should not be required with each assignment or transfer application because there is no explanation for the proposed need, purpose or content of such a statement. Furthermore, in 1952, Congress took a position against the use of a minority impact statement or any other mechanism to be used to compare the ownership composition of the proposed buyer with the seller or any other third party.
- Financial assistance and consulting services to minority applicants would constitute financial subsidization by the federal government to a segment of the population based on race. This is beyond the Commission's authority, and adoption would require Congressional approval.

For a copy of the filing contact NAB's Public Affairs Department, 1771 N Street NW, Washington, D.C. 20036.

WKBS-TV Engineer Wins Datatron Tempo 76 At NAB

The engineering manager from WKBS-TV in Philadelphia won the \$7,600 special drawing prize of a Tempo 76 Editor awarded by Datatron as part of their participation in the 1977 NAB Convention held in Washington, D.C.

The winner, Glenn Romsos, received both the Tempo 76 Editor keyboard and the electronic package needed to operate two VTRs for Control Track editing or SMPTE Time Code, depending on interfacing.



The new CEI-310. Is it really that good?

A lot of people who saw our new broadcast quality field production camera at NAB could hardly believe it. They asked us a lot of incredulous questions.

Is it really that small? That portable? Is it really making those incredibly good pictures we're seeing on the monitors? Even at those outrageously low light levels? Is the resolution actually as good as it looks?

Does it really require only one lightweight cable out to the electronics unit—for video and broadcast quality audio? Up to 400 feet? And up to 2500 feet with a systems integration unit?

Is it really that automatic? Does it really have full signal pro-

cessing? Does it really accept different tube types—2/3 inch Saticons or Plumbicons?

Can it really operate from battery belt? Battery pack? Any 12-volt DC source? Or normal AC power?



Is this studio camera really the same as the portable one above?

Is it really totally modular? Can it truly be reconfigured in minutes to a full-fledged studio camera—self-contained or system—with a big 8-inch viewfinder?

The answer to all these questions, of course, is yes. Now ask yourself this question. Shall I play it safe with a big name like Philips or RCA or Fernseh? Or shall I show a little initiative and take a look at this new CEI camera everybody's talking about?

Just give us the chance to show you. Call your local CEI representative now. Or get in touch with us directly at 880 Maude Avenue, Mountain View, California 94043, (415) 969-1910.

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What you see isn't always what you get

Part 1 of a 2-part series

By Ron Whittaker and Jacqueline Tornberg



One of the big problems in television has always been the area of unpredictability associated with the way things appear to the human eye and how they subsequently appear on a TV screen.

Sometimes the changes in color and grey scale value introduced by the television process are not too important. But often, they are responsible for significant surprises and disappointments; generally on the part of advertisers who have assumed that their products will look the same on television as they do in "real life." Unless you, as a producer, director, engineer, or art director know what to expect from the television system, you will probably be in for some disappointing and costly surprises.

To address this important issue, the writers conducted an extensive study in which over 500 separate colors were carefully and systematically analyzed. The sole purpose of this study was to remove some of the guesswork from the issue of how colors are affected by the television process. As a result of these findings, a number of important precautions and guidelines for using color emerged.

This report will be in two parts. Part one will focus primarily on background information related to color, tonal values and the television process. This information will be important to the findings of the study. Part two will focus on some of the specific findings in the analysis.

A Need For Practical Information

Although much information has been published about television color reproduction, most of it is not of practical use to the television artist, set designer or director, since it is related primarily to the electronic aspects of color reproduction. Color standards have been specified for television signals, but they typically specify color in an electronic sense, not from an esthetic or purely visual standpoint. Most of the other information appears to be mainly in the form of general hints for the television director, the set designer, the make-up expert, the lighting director and

the television artist. These suggestions are usually too general and imprecise to be of use in critical decision-making situations.

Actually, the lack of useful information is not surprising when you consider just how complex, unexplored and subjective the entire area is.

The process of human vision is exceedingly complex and has not been totally explained to this day. The human visual experience is psychological as well as physiological in nature. In addition, the television system is beset by countless variables all along the line from the original signal source to the final picture on an individual receiver. Television standards remain constant for the most part, but equipment, lighting and production materials and approaches vary greatly. Such variables make color standardization and predictability very difficult.

Predetermining Color Compatibility

According to the latest figures, about 54 percent of homes viewing television during prime time are equipped with black and white receivers only. This figure does not represent the true number of viewers watching black and white sets, however. There are many color-equipped homes that have black and

white receivers as their second or third sets. When you add these viewers to the first figure of over 50 percent, you can see that the important issue of color compatibility will be a concern for TV producers, directors, set designers and artists for some time to come.

There are countless colors and color mixtures possible, yet there are only 10 grey scale steps at the most that are generally distinguishable on the home black and white television screen. How can the artist, set designer or director know that they have not placed two colors together that will appear identical and indistinguishable in black and white?

There are few truly reliable methods currently available for predetermining color compatibility. Probably the most accurate method of judging the compatibility of colors is to place the subject matter in front of a color camera and to view it on both a color and a black and white monitor. There are obvious disadvantages to such a trial and error process.

A second method is to translate colors roughly into their grey scale equivalents through the use of black and white film in a Polaroid-type camera. However, black and white reproduction in the photographic process is different than it is in television. For one thing, the range of grey tones is much greater

in most film reproduction.

Another method for judging the compatibility of colors is through the use of the 2.0 density glass. This is a type of filter which absorbs all color, leaving only brightness distinctions. This method falls short of being accurate, however, since the glass is not coordinated with the limited number of steps in the television grey scale.

A widely used method is to compare sample color swatches with colors displayed in a standard color classification system. There are many such systems. One of the most complete is the Munsell System of Color Notation. Munsell's system consists of an extensive arrangement of over 900 colors, each matched on the basis of reflectance to a grey scale equivalent. One fault with this system, however, is that you must find the color that most resembles the color in question (not an easy task) and then interpolate the grey scale value. Once again, the eye becomes the final judge. In addition, Munsell's system does not really tell you how subject matter will reproduce electronically, either in color or in black and white.

This whole problem area of color compatibility was one of the concerns of this study. Many of the findings will speak directly to this issue.

Continued on page 22

Color Terminology

Brightness—that property of a hue that places it in a position on a grey scale; the degree to which a color reflects light.

Color classification system—an arrangement of pure and desaturated hues which are matched in brightness to steps of a grey scale; more generally, an ordered arrangement of hues corresponding to some organizational pattern.

Color compatibility—the acceptable translation of colors into their grey scale values, while achieving adequate black and white tonal separation.

Color purity—the degree to which a color is free from mixture with white, black, or any other color.

Complementary color—with paint or pigments (subtractive color), any color which is produced by an equal mixture of two primary colors, and when mixed in equal proportions with the third primary, produces a neutral grey; in most broadcast camera and CRT applications (additive color), any color which is produced by an equal mixture of two primary colors, and when mixed in equal proportions with the third primary, produces white light.

Desaturated color—with paints and pigments, any pure hue which has been diluted with white, black or grey; in broadcast terminology, any pure hue which has been mixed with white light.

Fully saturated color—any hue, red for example, which is comprised of, or reflects only its characteristic (red) wavelength of light.

Hue—the property (commonly measured in wavelengths) by which one color is visibly distinct from another; the quality of possessing redness, greenness, brownness, etc.

Luminance—a measure of light intensity per unit area emitted by a light source and measured in foot-lamberts; commonly, but inaccurately, known as "brightness."

Pigment—any of the mass-produced coloring substances (ink, tempera, crayon, etc.).

Primary colors—colors which cannot be produced by any combination of each other or other colors, but can be mixed in varying proportions to produce all other colors; in broadcast terminology, colors which can be mixed in varying proportions to produce virtually any other color.

Saturation—the degrees to which a hue differs from a neutral grey of the same brightness; the degree to which a hue is pure and free from mixture with white and/or black.

Shade—any hue which has been diluted with black.

Tint—any hue which has been diluted with white.

Tone—any greyed hue.



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

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

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

We've built ENG cameras so good in the rough-and-tumble of news-gathering that more Ikegami ENG cameras are in use than all others combined. So imagine how good an Ikegami camera can be in the stable environment of a studio.

Very good indeed.

Ikegami's new HK-312 color-TV camera is like no other. It has a built-in minicomputer that helps trim the daily camera checkout from a one-hour ritual to an automatic run-through that's shorter than a 20-second commercial. With its auxiliary computer, you'll be able to cycle your Ikegami HK-312 (and up to four other Ikegami HK-312 cameras linked to it) through every adjustment parameter in under two minutes: white balance, black balance, flare correction, gamma correction, video gain, beam alignment, and eight registration functions.

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

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

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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 news-casting, check out the Ikegami HK-309. It can be operated remotely or simply turned on and left in fixed position.

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

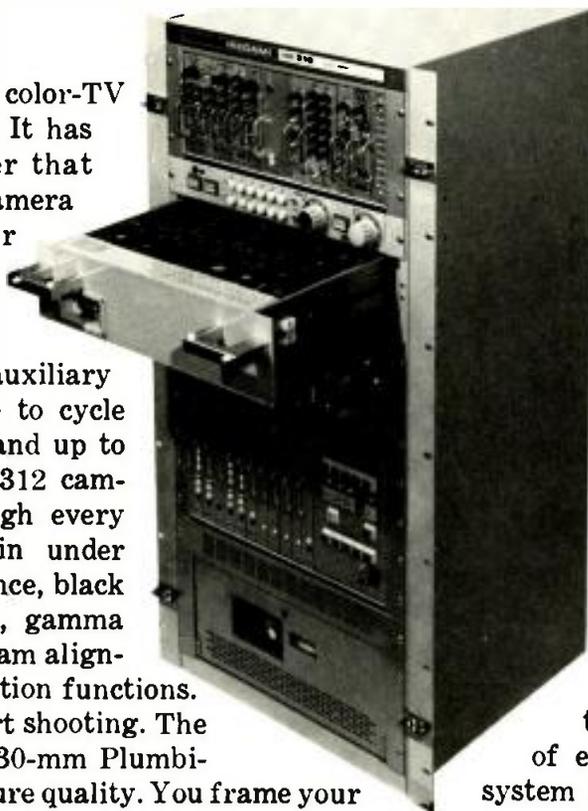
Ikegami has been famous for its ENG cameras for a long time. Now take a look at what we can do with studio cameras. For specs or a demonstration, get in touch with us. We have nation-wide distribution.

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Camera-control unit for the HK-312



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What you see

Continued from page 19

A Sea Of Uncharted Colors

Since many paints available to television artists and set designers are not geared exclusively for TV use, they are generally unsuitable for several reasons. Some paints and papers are glossy and reflect too much light, some colors undergo major shifts when used in television, some fluorescent colors appear to bleed into each other on the screen, and some paints chip and peel under the intense heat of television lighting.

Each manufacturer of paint and art supplies has his own color specifications, and even within one manufacturer's line of products, color will vary with the characteristics of the chemical media with which they are bound. For example, the red of any red ink may be different from the red of any red crayon. In addition, colors vary between brands, so one manufacturer's red tempera may differ from another manufacturer's red tempera.

The television professional then, is faced with a profusion of slightly different colors, often with no knowledge of how they will be reproduced by the television system. Ordinarily, it would be helpful to have the widest selection of colors from which to choose. But, because of the limited time factors generally associated with television productions, color decisions must be made both hastily and accurately without the luxury of being able to carefully check the results on cameras and then re-doing whatever doesn't meet standards.

Additive And Subtractive Color

Before going on, we should take a look at some of the major problem areas in the whole issue of color as we see it and understand it, and as it is reproduced by the television process.

First of all, one of the major areas of misunderstanding about color lies in confusion between the additive and subtractive color processes. In a sense they are totally the opposite; literally the difference between black and white.

The additive mixing process deals with the interaction of colored

lights and the subtractive mixing process primarily applies to paint and pigments.

Color, as viewed on the television screen, results from the additive mixing process. The eye performs additive color mixing by combining (adding together) the three primary colors of light (red, green, and blue) given off in different proportions by the phosphor dots on the face of the television tube.

The television artist or set designer works with the subtractive color mixing process. The three subtractive primaries are magenta, yellow, and cyan. An object appears to be yellow, for example, when it absorbs all wavelengths of white light except that of yellow, which it reflects.

In the additive process the primary colors added together equal "white." Colored pigments subtract colors of light, and, therefore, when the subtractive primaries are mixed together, the result, theoretically, is "black." (In actuality, a very dark grey.)

Color Temperature Problems

When all wavelengths of visible light are present in equal proportions (such as in sunlight from a clear sky at noon), the light is colorless or white.

Light may appear white to the eye, however, and actually contain more wavelengths of certain colors than others. For example, the light from ordinary studio lights contains a greater proportion of red than does pure sunlight. Color film which has been balanced for sunlight will prove this when used indoors with tungsten-type illumination. So will color TV cameras if they are not rebalanced.

"Color temperature" is the term applied to the color balance of white light, and is measured in degrees Kelvin. A light source that is predominantly yellow has a low color temperature, while a bluish light source has a high color temperature. As would be expected, lights of different color temperatures affect color significantly. For television, a light source which is reddish-yellow would tend to reproduce reds accurately, but it can make blues and greens appear "muddy."

Shifts in color temperature can occur from something as simple as attaching an extension cord to a light source. The extra length of cord will slightly lower the voltage, changing the color temperature about 10 degrees for every volt. Color temperature for television studio lighting is standardized at approximately 3,200 degrees Kelvin. Sunlight is about 5,600 degrees Kelvin.

Different light sources vary in their distribution of energy. Certain fluorescent light sources, for example, are rich in some areas of the spectrum and poor in others (broken spectrum). Although the human eye will tend roughly to adapt to different light sources, the apparent color of objects will be affected when viewed under these lighting conditions. Often, a television artist prepares visuals under fluorescent illumination. When these visuals are then aired in different lighting conditions, some unexpected results may occur.

The same type of problem is encountered in many ENG assignments where fluorescent lights are in use. Sometimes the resulting color problem (slightly green faces, for example) is impossible to correct by standard procedures. Special fluorescent camera filters often will help. But, since there are a wide range of fluorescent tubes in use, no standard approach or solution is possible.

The human eye is capable of adjusting to slightly off-color light and will see the colors in a (real life) scene illuminated by such light correctly. This automatic adaptation feature is called "approximate color constancy."

An object which is known to be white by the viewer, such as snow, but is actually reproduced as slightly blue or yellow, will cause the viewer to adjust his perceived color balance to what he remembers snow to be like, and to see the area as white. Having adjusted to this, he judges adjacent colors accordingly.

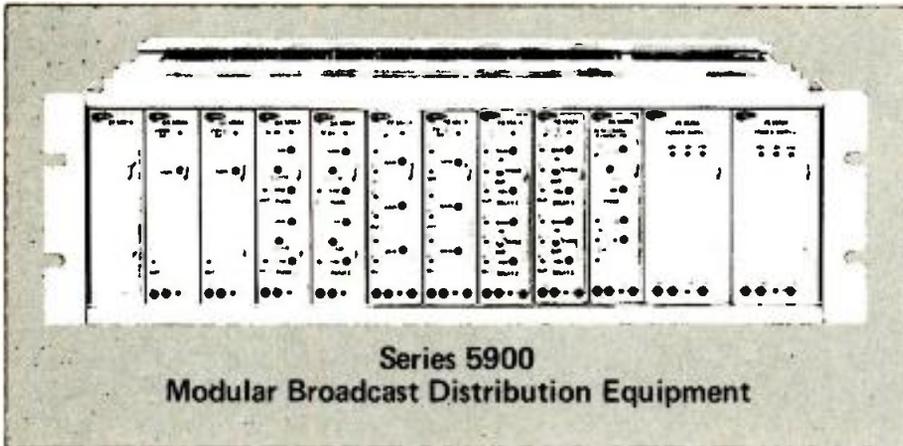
Home television viewing (as opposed to theater viewing) complicates this tendency, since a color reference or standard does not have to be in the television picture, itself.

Continued on page 24

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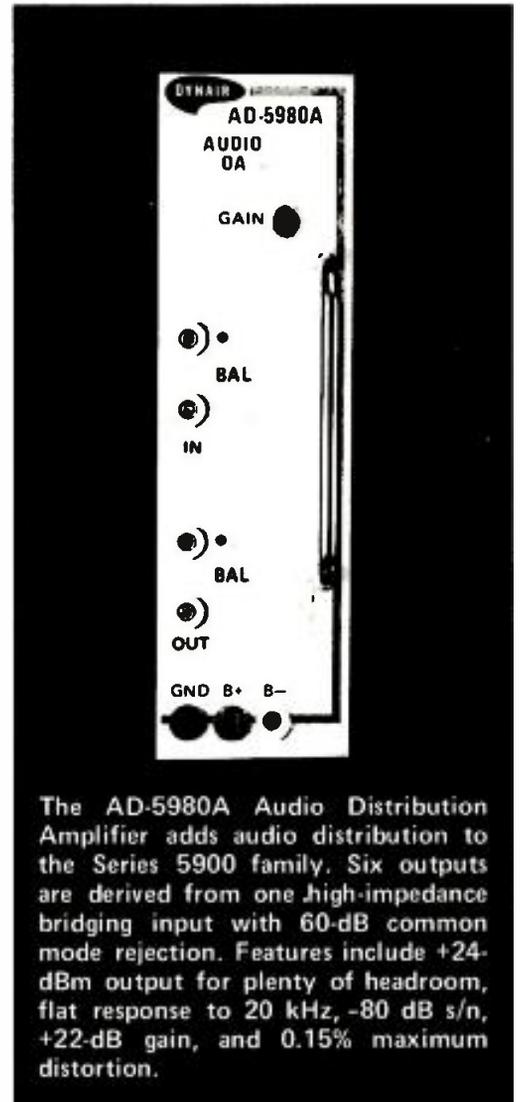


A few of the other Building Blocks...

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What you see

Continued from page 22

A "reference white" may be any object or available source of illumination in the room, within the viewer's field of vision. Because of this, color balance for television is typically more critical than it is for theater films, where the only thing you can generally see is the screen.

Viewing conditions and memory must be considered in the reproduction of colors for television. Viewers have described colors reproduced on the screen as being inaccurate, when, actually, they were exactly the same as the original. For example, flesh tones are preferred by the average viewer to be more yellow and saturated than they really are.

Simultaneous And Successive Contrast

When the eye focuses on a highly saturated color for an extended period of time, the color's complement may appear in an adjacent area of the screen. This phenomenon is known as "simultaneous contrast." For example, after viewing bright yellow over a period of time, an adjacent neutral grey or white area may appear blue.

"Successive contrast" is the term applied to this same phenomenon when it affects the colors in following scenes. That is, the complement of a highly saturated color may remain in the same area of the screen even after the scene has changed.

The human eye detects three distinct aspects of color: hue, saturation and brightness, each of which may be varied to change the overall visual sensation of color. Although the response characteristics of the human eye relate directly to the three primary colors of light, the eye does not perceive these primaries in equal proportions. The eye is most sensitive to green, less sensitive to red and least sensitive

to blue, the percentages being .59, .30, and .11, respectively.

Color Reproduction By The Television System

The television camera detects color differently than does the viewer, if only because it sees exactly what is in front of it, while the viewer tends to interpret. Most broadcast television cameras have three "chrominance channels" which respond to the three primary colors of light. They are designed with a panchromatic color response; that is, they can distinguish (most) colors throughout the entire visible spectrum.

In order to approximate the color response of the human eye, the television camera is designed to be more sensitive to certain areas of the color spectrum than others. This seldom corresponds perfectly to the viewer's response, yet the overall reproduction tends to be natural in appearance (except for some important exceptions which will be noted later). There has been much discussion about the ability of the television system to reproduce all colors faithfully. The following are some generally accepted limitations of the system.

Contrast Range

For the color television camera, tonal values should ideally be kept within a contrast range of 20:1. This means that the brightest spot in a scene must not be more than 20 times brighter than the darkest spot, as measured in footcandles. Since the eye is most sensitive to green and least sensitive to blue light, green will appear somewhat brighter than blue, even when both colors reflect the same amount of light. Should a scene contain colors that extend past the 20:1 contrast range (a bright yellow and a deep

blue, for example), faithful reproduction of the blue must be sacrificed in order to squeeze the yellow within the contrast range, and vice versa. To state this another way, colors with reflectances over 70 percent or less than 3 percent cannot, in general practice, be reproduced accurately by the television system without some grey scale compression or distortion.

Color Phosphors

Color specifications for the United States system of television were originally matched as closely as possible to the "pure visual primaries" chosen by the C.I.E. (Commission Internationale de l'Eclairage, or International Commission on Illumination) in 1931. The C.I.E. primaries could not be adopted as is, however, because the colored phosphors necessary to reproduce color electronically were available only in certain prescribed hues. Thus the range of color mixtures possible with television phosphors is somewhat more limited than the color capacities of human vision.

Fluorescent And Metallic Colors

Fluorescent paints and papers available to the television artist and set designer absorb light at one wavelength and radiate it at another. They can be reproduced by the television system, but they have a tendency to either appear much brighter on the screen than they appear to the eye, or they tend to "bleed" into adjacent neutral areas.

Although metallic colors (gold, silver, brass, etc.) retain their shimmering qualities on the television screen, their characteristic colors are often distorted. For example, gold tends to appear greenish.

Continued on page 26

About The Authors

Jacqueline Sams Tornberg has had extensive experience as a television artist. In this study she mixed over 500 separate colors for analysis through the television system. The project took almost a full year to complete.

Ron Whittaker, who is Production Spotlight Editor for **Broadcast Engineering**, supervised the study and took part in various phases of the work. Dr. Whittaker has had over 20 years experience in television production and broadcasting.

The VTR Format of Tomorrow. While others are still talking about it... Bosch already has it: the BCN System.

Since the BCN was first introduced, more than 370 of these systems have been ordered from all parts of the world.
More than 150 of them have been delivered and are in operation.

The four basic requirements placed on a new VTR format:

- Top broadcast quality for all TV standards.
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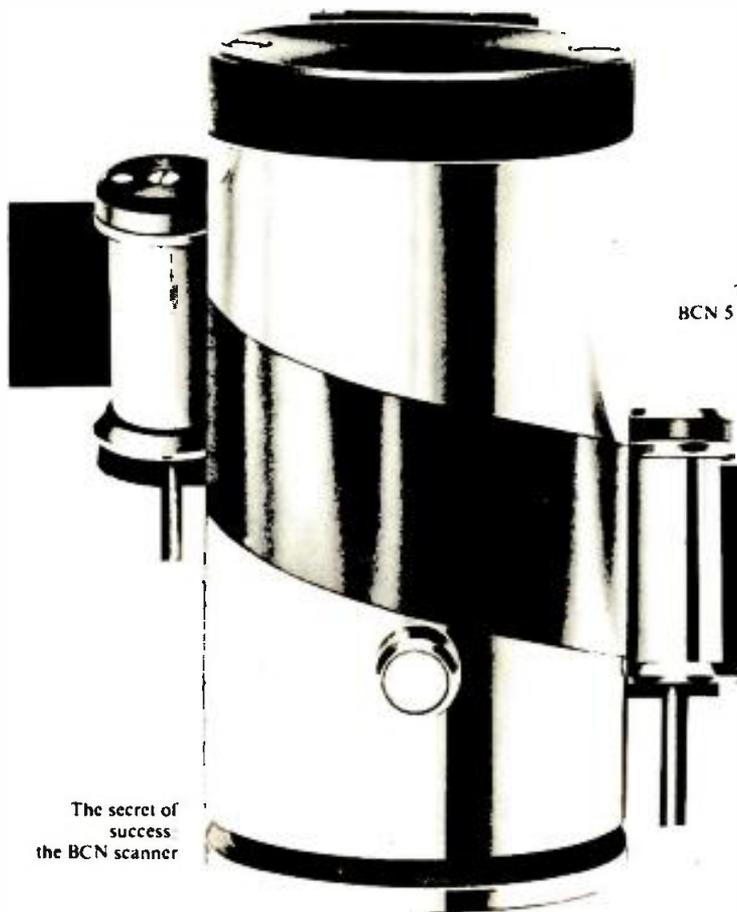
The portable BCN 20

The BCN System offers two different portable versions: the portable BCN 20 with a tape capacity of more than 60 minutes on one reel - and the BCN 5, the 20-min. cassette recording and play-back version. Both versions operate under all conditions with full broadcast quality. In the future, the BCN cassette version will also be used in an automatic multi-cassette VTR.

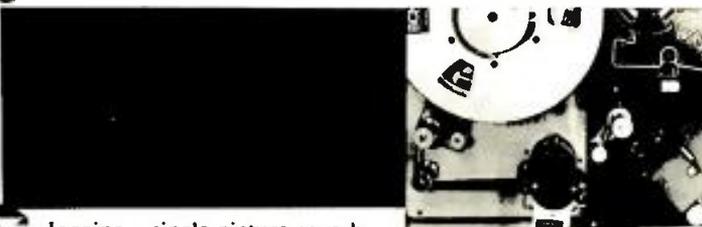


The BCN 5 cassette VTR

The BCN System features electronic editing with: Single-picture display - for an unlimited time with no danger to the tape.



The secret of success: the BCN scanner



Tape guidance system in the BCN 20

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For More Details Circle (21) on Reply Card

What you see

Continued from page 24

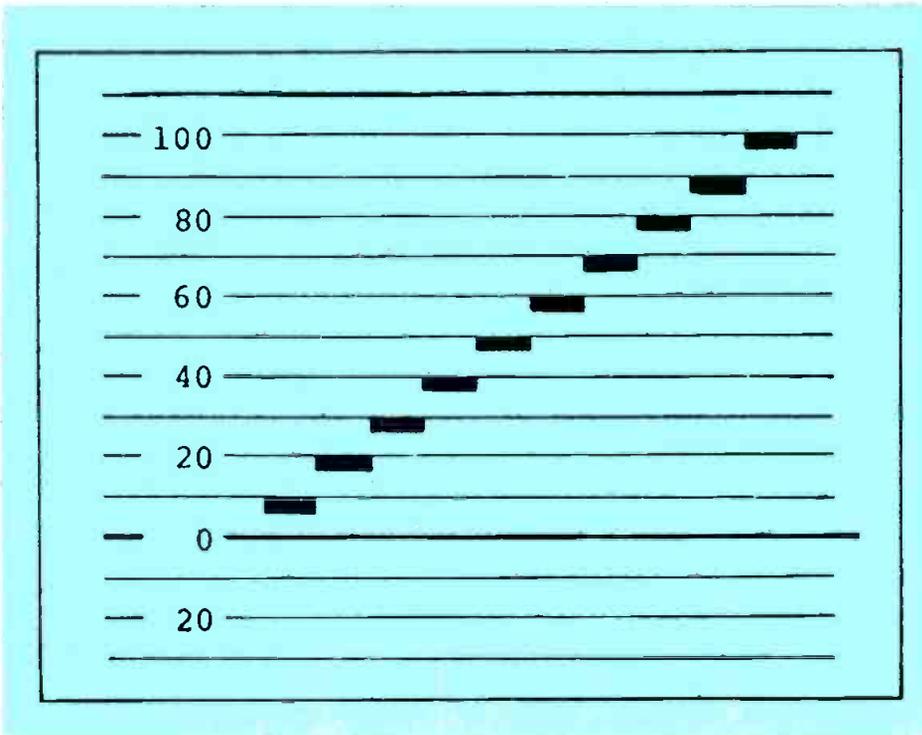


Figure 1 illustrates the standard staircase test signal which is discussed in the text. This range does not represent a linear progression of subject matter reflectance values, however, since 50 on the scale represents subject matter with 18 percent reflectance.

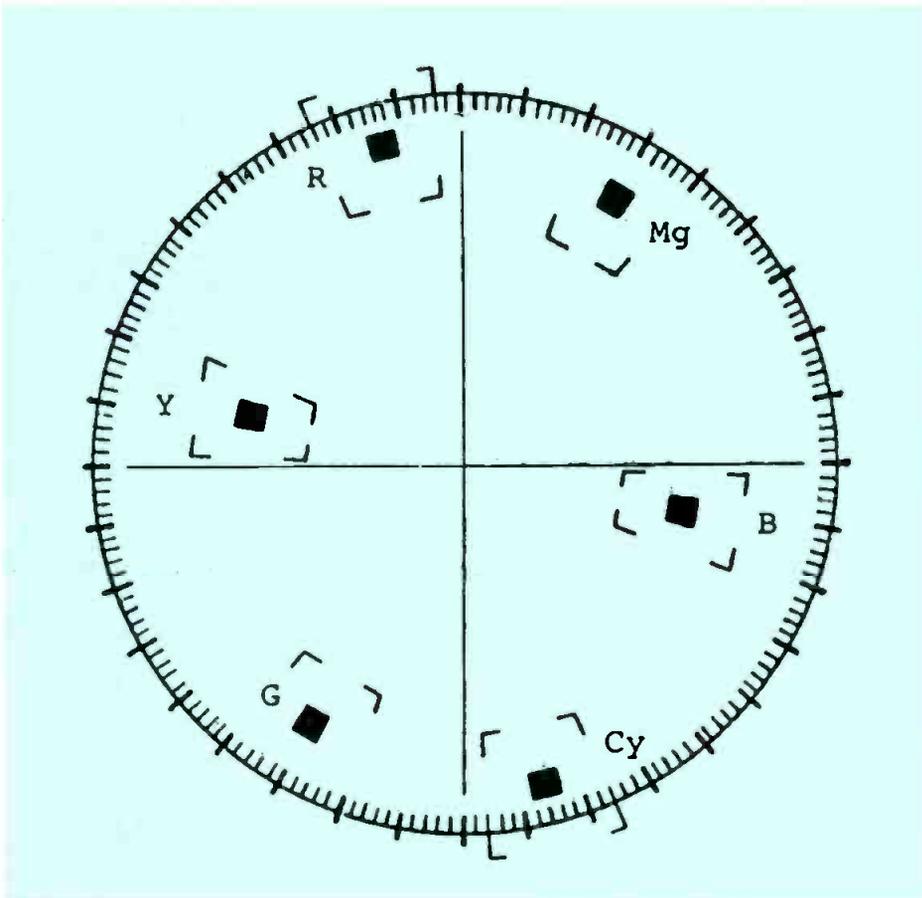


Figure 2 illustrates the standard vectorscope configuration, used for determining vector relationships for the primary and secondary TV colors. Figure 3 shows the actual color phase degrees.

Surface Characteristics

The color of a surface cannot be considered apart from its texture, since both are determinants of how much light that surface will reflect or absorb. In general, slick, shiny surfaces reflect more light than they absorb, while denser surfaces, having some sort of pile, tend to absorb more light than they reflect. When reproduced on the television screen, highly reflective glossy surfaces tend to scatter light or cause "hot spots," while dense surfaces tend to absorb so much light that they appear to lose their textured quality. In addition, uneven surfaces, having ripples, embossing, or tiny identical raised areas, tend to reflect light unevenly, with the result that the entire surface reproduces as looking fuzzy. This is not to say that the television system is incapable of reproducing textures accurately, only that the texture of a surface will have an effect on the color reproduction of the surface.

Electronic Measurement Of Brightness

The 10 steps of the television grey scale range from "television white" (70 percent reflectance) to "television black" (3 percent reflectance). The logarithmic scale is not a linear progression, and its middle step (step 5) is not equivalent with the center of the light reflectance range. A color that reproduces somewhere in the center ranges of the television grey scale usually measures about 18 percent reflectance. This figure, in fact, is used to define the reflectance of "average" subject matter.

Another characteristic of the television grey scale is that each step is 10 video response level steps away from its neighbor. On a waveform monitor the television grey scale, sometimes called "the staircase signal," appears in 10 staircase-like steps ascending in levels of 10 units, from video level 10 (3 percent reflectance) to video level 100 (70 percent reflectance). Therefore, step 5 (approximately 18 percent reflectance), for example, would appear on a waveform monitor as having a video response level of 50. (See Figure 1.)

Continued on page 28

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The digital video people

June, 1977

For Demonstration Only Circle (22) On Reply Card
For Literature Only Circle (23) On Reply Card

What you see

Continued from page 26

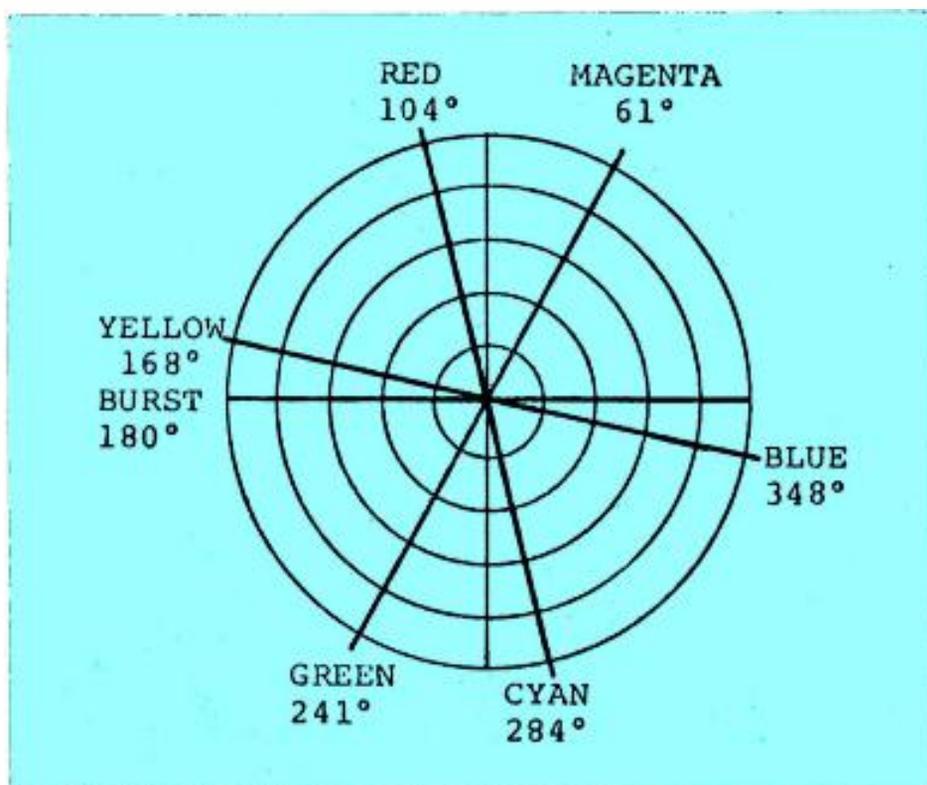


Figure 3 illustrates the standard NTSC color standard phase difference vector relationships for the three primary and three secondary TV colors. The zero point is just above blue, 180 degrees from the color burst reference. Note that although the primary colors are about 120 degrees from each other, the secondary colors do not fall at the mid-points between the primary colors.

Measurement Of Hue

The dimension of hue is measured electronically by degrees of instantaneous phase difference on a vectorscope (See Figure 2). Each time an electron beam scans just one line of information on a television screen, all hues that make up that line are instantaneously compared with a reference signal, the color burst signal, located at 180 degrees. (See Figure 3.)

The color-bar waveform is a display of six electronic colors, three primary, and three complementary colors, which are used by engineers to align color cameras (See Figure 2). The colors of the waveform are 75 percent saturated and have standardized phase differences: yellow, 168 degrees; red, 104 degrees; magenta, 61 degrees; blue, 348 degrees; cyan, 284 degrees; and green, 241 degrees. In addition, each of the colors of the waveform has a standardized video response level: yellow, 70 percent; red, 30 percent; magenta, 40 percent; blue,

20 percent; cyan, 60 percent; and green, 50 percent.

Electronic Measurement Of Saturation

In normal television usage, the term "saturation" means the degree to which a color is free from mixture with white light. White light contains all the wavelengths of visible light in equal proportions. A fully saturated color, then, is one in which only the wavelengths of that particular color are present.

Saturation varies with hue and brightness, and a change in either of the latter will cause a corresponding change in saturation. Saturation may be measured either on a waveform monitor or on a vectorscope, and is expressed in the form of a "chrominance-to-luminance ratio." On a vectorscope, hue is measured by the angle of the vector, while saturation and brightness correspond to the length of the vector. On a waveform monitor,

saturation may be measured by dividing the chrominance amplitude by the luminance amplitude. Each of the six colors of the color-bar waveform has a standardized chrominance-to-luminance ratio: yellow, .50:1; red, 2.10:1; magenta, 1.44:1; blue, 4.05:1; cyan, .90:1; and green, 1.00:1.

The term "saturation" is used by artists to mean the degree to which a hue differs from a neutral grey of the same value. A fully saturated hue, then, is one which is free from mixture with white and/or black paint. The Prang tempera colors used in this study (and reported on in part two of this article) are referred to as being "fully saturated" when they have been used without mixture with any other color. They will be referred to as being "desaturated" when they have been mixed with either white or black paint. The word, "saturation," then, represents two slightly different concepts.

In addition, an artist or set designer cannot "saturate" a pigment any further than its characteristic manufactured saturation. The artist can only desaturate a pigment by the addition of white and/or black paint. Therefore, all manufactured pigments have a saturation or purity limitation which may not be equivalent to the purity of the fully saturated colors of the color-bar waveform.

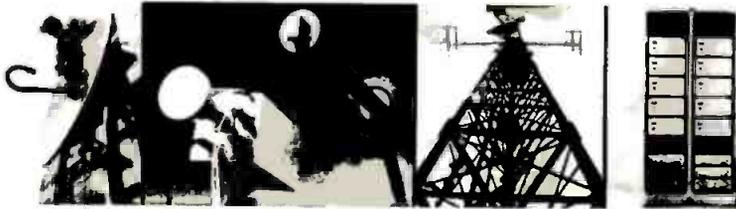
In fact, there are many colors which an artist or set designer can create in graphics or in a studio which cannot be accurately reproduced by the television process; and, conversely, there are some colors which can be produced by the television system which cannot be created by pigments.

These problems will be one of the central topics for part two of this article. Also in part two, a full-page color chart will be reproduced from the findings of this study which many TV artists, set designers, engineers and directors will want to tear out to keep for a reference. The chart will show how colors translate, in terms of both brightness and hue (grey scale values and vectorscope phase). Part two will also include many practical do's and don'ts for using color which emerged as a result of this study. □

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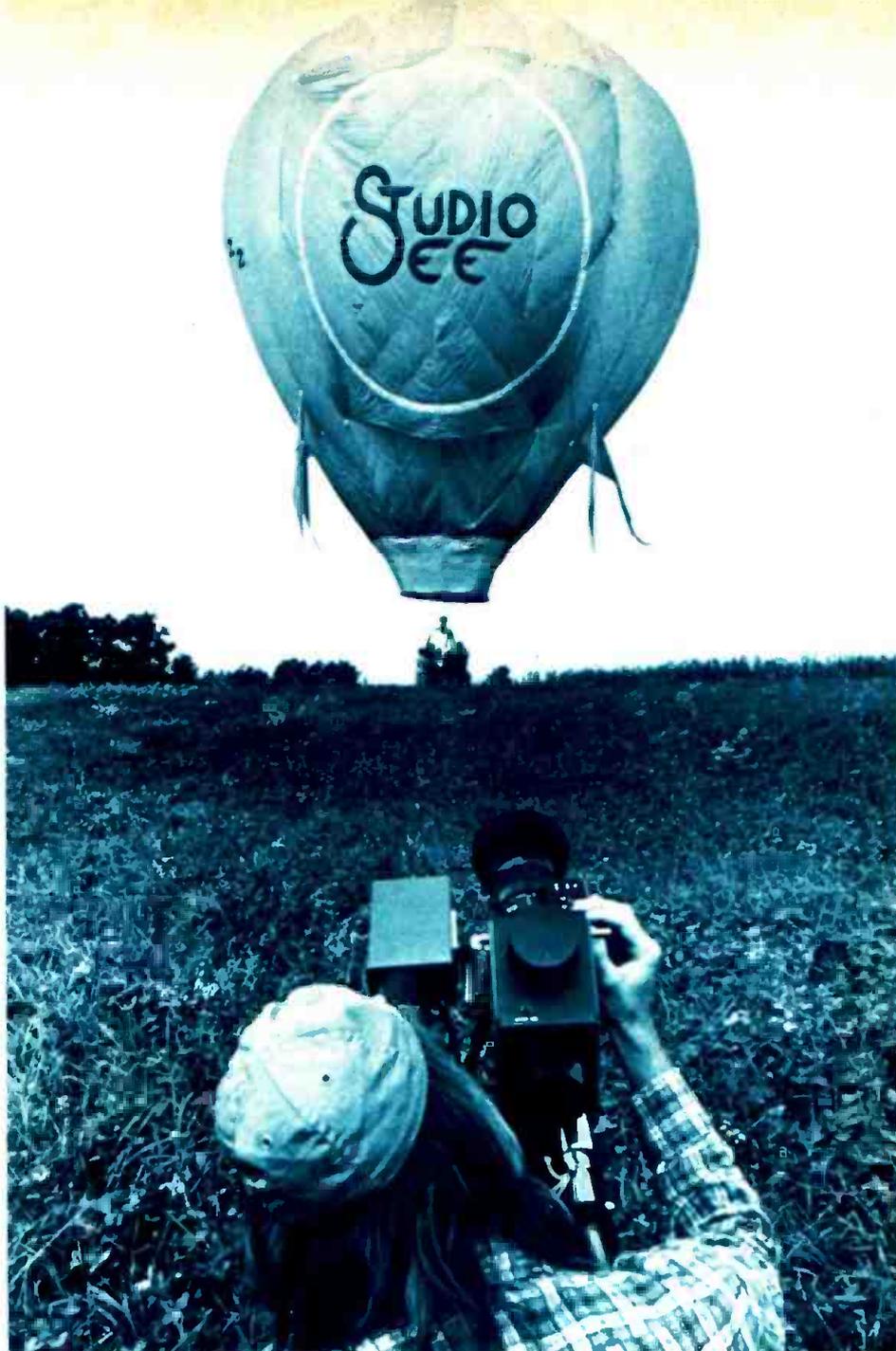
By Jayne Adair, Producer
and Doug Bradley, Videographer
for Studio See

When one of our crews returned from the field with videocassettes proving they'd mounted a Sony DCX-1600 on a hang-glider, the response from our engineering department was predictable: "And what if it had crashed?"

As crew members of STUDIO SEE, a new total-video series for children produced by South Carolina Educational Television for the PBS Network, we try not to let speculation like this keep us from testing our two video units (now the Sony three-tube plumbicons) in every possible situation. In the past six months, we've chased wild bears on Kodiak Island, Alaska, we've dangled inches above the open sea from the bow of the Coast Guard cutter EAGLE, we've been stampeded by a herd of wild horses, and witnessed an Iowa grain harvest from the inside of a farm tractor's hydraulic scoop. All with video cameras in hand, powered by nickel-cadmium batteries that are legal baggage on airplanes.

When the video is clean, we'd like to propose knighthood for the first brave soul who believed that electronics could function outside a studio. When the batteries fail and the heads gunk, we'd gladly take a sword and break it over the camerahead. When you're producing with portable video systems, it's a toss-up as to whether the joys compensate for the frustrations.

Despite the occasional problems, the interconnect is secure between the "minicam," TV technology's new kid on the block, and STUDIO SEE, a new kind of kids' show. Funded by public television stations and the Corporation for Public Broadcasting, STUDIO SEE is 26 weekly, fast-paced, action-filled, unpredictable half-hours, with that marvelous "it's happening right now" quality that only video on location can produce. Each program is composed of 10 to 15 separate segments, taped on locations from Nova Scotia to Alaska,



Even The Kids Dig Electronic Field Production

and designed to contain something of interest to every viewer. Given the nature of today's pre-teen television audience, this is quite a challenge!

Unlike adults, kids don't watch TV as background noise for other activities. They tune in expecting to become immediately and totally

involved, and if that doesn't happen, they channel-flip to the least objectionable alternative. Because media-wise youngsters reject many children's programs as dull, condescending production, STUDIO SEE is intentionally designed not to look like the standard "kids' show." No peanut gallery, no costumed

host, no regular "club" of kid stars, and no television production studio.

We call it STUDIO SEE because we're trying to re-define the meaning of the word "studio" in the context of educational broadcasting. Ideally, a studio should be a window, not a corner. It should be the place not where meanings are obscured, but where actions are seen most clearly—that is, right in the place where they naturally occur. Hence our title, STUDIO SEE, and our studios have ranged from remote islands to city skyscrapers.

Our general procedure, once a location is selected, is to fly to the airport nearest the shooting site and drive the rest of the distance. Since we resolved the liquid-cell battery problem, there has been no major hitch about flying with the cameras, except for loading and unloading the 18 cases that accompany each crew in addition to personal luggage. It's a melange of audio equipment, battery chargers, tools, and registration charts, and by now the aluminum cases look like they've been through two world wars and a season with Ringling Brothers.

A four-member STUDIO SEE crew—director, videographer, producer, and audio man—spends two days per location, and anywhere from two to four weeks out on the road before winging it back to South Carolina. Once home, cassettes are transferred to quad tapes through a time-base corrector. Directors edit segments using the CMX-340X system. The final auto-assembly results in a completed program two generations removed from the original cassettes.

On location, our video cameras generally elicit curious questions from adults and some rather sophisticated comments from kids who've worked with black-and-white video units in their schools. We appoint kids as honorary production assistants, and give them a badge to prove it. Naturally, the major duty is that of grip, but they also do sound tests and check playbacks. The playback option

makes the video camera a less intimidating tool to work with, especially with kid talent. Once a kid sees himself through the viewfinder, the camera becomes more familiar and understandable. At least the child is convinced that it's not going to betray him and make him look bad. It's a standard policy with STUDIO SEE that if a kid doesn't like the playback, we'll do the take over again, weather and light permitting.

Field Production Tips

After several months on the road with video, we've arrived at the following procedures which make a big difference in the quality of the material we bring home:

1. Clean recorder heads before each day's taping.

2. If a tape malfunctions inside the recorder, clean the heads again before proceeding with the taping. A malfunction usually leaves a residue on the heads which must be removed.

3. Take five minutes to re-check registration at convenient intervals. This should particularly be examined if the camera or CCU has been handled roughly. Also, check registration whenever the power source is changed.

4. Check filter wheels and white balance when moving from inside to outside or vice versa.

5. When shooting outside, white balance at frequent intervals. The white balance must be checked more often late in the afternoon when color temperature changes rapidly. Also, check white balance whenever power source is changed.

6. Whenever possible, run off AC power. When you're battery-dependent, it's a constant worry about how long the batteries will last, and whether they're going to hold through an important scene.

7. Guard against moisture. When shooting under damp conditions, placing equipment in ordinary plastic trash bags serves to protect it.

8. Guard also against sand, which can instantly wreck a recorder if it gets inside. Plastic bags work well here, also.

9. Never leave tape exposed to direct sunlight. Cassettes will melt and/or deteriorate.

10. Always take a tool box on location. Include pliers, an assortment of screwdrivers, flashlight, and a soldering iron. A hemostat is invaluable in recovering small screws from tight places.

11. If possible, take schematic diagrams of your equipment on location.

12. The secret to good video in the field is to constantly stay on top of the equipment. Whenever frustrated, hit something, preferably another human being. Never strike the equipment, for it will surely take revenge.

Sitting back in the viewing room, watching the finished product, we forget the day on Carmel Beach when hundreds of kids were building sandcastles and our batteries wouldn't hold a charge. We forget the afternoon our CCU touched water in the middle of a pony roundup and blew its fuse. We forget those hours spent in airports waiting for replacement equipment to arrive. The final video is smooth, clean, and crisp. We wonder why film is still being manufactured. There's no worry about choosing the right stock for the right situation because there is only one type of videotape. There's no worry about accidentally exposing the tape to light. There are no headaches involved with labs and processing. Best of all, video is immediate gratification. By using portable video, a director can view a playback and get excited enough to work through two more hours of re-takes. Once the taping is completed, video can even be "doctored" to a degree. Color can be altered and corrected, enhancement can be boosted, brightness and color improved, and the black and white levels adjusted.

Everything considered, portable video is a pretty good kid. It has its faults and belligerent spells when it refuses to do anything. If portable video is just a kid beginning to mature, you certainly want to be around when it grows up! □



Radio Workshop

A simple approach to

THE PROOF

By Peter Burk, Chief Engineer for WKBW, Buffalo, NY, and Radio Workshop Editor.

WQUA Chief Engineer Michael Moore adjusts the audio generator and records values for an annual proof of performance. The importance of a qualified operator at both ends of the system should not be overlooked.

Seems like it happens every year ...suddenly it's time to do the annual proof of performance. Well, the station passed last year, but let's see...what did I do to make that noise measurement pass? What about that RF problem with the analyzer? How did we finally get the hum out?

If this sounds a little too familiar, this month's workshop might be for you. We'll try to ease the pain a little on AM measurements this month and tackle FM measurements next month.

Test Equipment

Before we look at the station's equipment, we should go over the test equipment. You don't need the best that money can buy to run a proof on your station. On the other hand, the test gear does have to be accurate enough to insure that you are within limits on performance. A good rule of thumb is that the test equipment should have an accuracy of at least 10 times the tolerance of the measurements. This really isn't as tough as it might sound. Since we have a 2 dB response tolerance, the oscillator and audio voltmeter must have an accuracy of at least two-tenths of a dB over the audio range. The combined noise and distortion of the oscillator and distortion analyzer should be something around one- or two-tenths of a percent to insure accurate results.

A very handy option on the distortion analyzer is an automatic nulling feature. You can save a lot of time doing a proof this way, since you can be writing down the results of the last measurement while you wait for the unit to automatically null. Most better tests oscillators have a built-in output level meter and attenuator. This also greatly facilitates the proof, allowing more m.p.m. (measurements per minute).

Recently, audio spectrum ana-

lyzers have become available at fairly reasonable cost. This is a nifty way to look at the system quickly and can even provide some types of measurements not available any other way (such as transient intermodulation distortion). The only problem is that there is presently no acceptable way to conduct an official proof of performance with a spectrum analyzer. There are plenty of uses for the beast, but at least once a year you'll have to pull out the conventional distortion analyzer for the official proof.

Test Gear Tests

Test the test equipment by measuring the generator directly into the distortion analyzer. If possible, you should also try to test the modulation monitor, too, since it will be an important part of the test setup. Calibrate the monitor according to the manufacturer's instructions, then hook up the distortion analyzer to the output and make sure that the output is clean. For a quick check, make sure that the reading is below -60 dB with the carrier off. With the carrier on and the transmitter audio input disconnected, the reading should be well below -45 dB. If it isn't, you have a problem to solve before you can go any further. Excessive noise in the measurements not only affects the noise reading, but also the distortion. To a lesser extent, it affects the response readings. Noise should be the **first** thing you check.

Frequently, RF from the transmitter will get into the analyzer and make it difficult to get an acceptable noise reading. Determine first of all how the noise is getting into the instrument. Terminate the input with an appropriate resistor and see if the high reading persists. If it does, try reversing the power

connection or lifting the ground on the power cord. Sometimes just moving the analyzer to a different spot in the room will reduce the RF sufficiently. If the RF is coming in on the input to the analyzer, try using a good audio transformer on the input. **Broadcast Engineering's Proof of Performance** manuals deal more specifically with this problem.

Some distortion analyzers have an RF detector built in. This may be used instead of the modulation monitor, but several precautions are in order. Be careful not to apply too much RF to the detector input. It's easy to blow the diode. It's a real bear to replace on some models, especially in the middle of the night. Also note that some diodes are better than others. If you have your unit factory calibrated, ask them to measure the distortion of the detector so that you'll know just how good it is.

A small but important part of the test equipment is the interconnection paraphernalia. When you check the test equipment, make sure that you check the leads and cables at the same time. This also applies to any necessary pads, transformers or "black boxes" used for the proof.

Plan Ahead

If tonight's the night you have to run the proof, we can't be much help. Allow yourself plenty of time before the proof is actually due, just in case things aren't as rosey as you thought.

Several weeks before the scheduled proof, test each element in the system separately. The transmitter itself is a good place to start. If it won't pass by itself, why waste time trying to get the overall system to work? As you check transmitter, phone line and studio performance, strive for no more than one-half the allowed tolerance for each element.

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THE PROOF

Continued from page 33

That will assure you that the composite system will most likely pass.

The Pre-Test Proof

Once everything is in order and all problems are ironed out, schedule a night for the official proof. Plan a sequence of events carefully to minimize the amount of knob twirling you'll have to do. Start with a pre-test of the station. Since you've already been through each element in the chain, you shouldn't have any problems, but now's the time to find out.

You may find that a slight adjustment is necessary to make the system pass. This is no problem if you find out early, but if you've completed most of the readings and then have to readjust something, you'll have to take a whole new set of measurements. The pre-test should include measurements at the extreme frequency limits, since that's where problems will most likely occur. An excellent pre-test procedure is presented in the *BE Proof of Performance* manuals.

The Front End

The rules say that the generator is to be connected to the main microphone input terminals. In the 1930s when the rules were written, this wasn't a problem. Now, with many stations fully automated, finding something resembling microphone input terminals can be a bit of a trick. Someday, the rules will be rewritten to reflect current practice. In the meantime, we have to use a little common sense. If you don't regularly use a live microphone, you don't need to use a mic input for the proof. A fully automated station, for instance, can feed the system from the output of the automation equipment. Another example would be an all-news station that has 10 studios that rotate on the air. It is perfectly acceptable to feed the signal from the point where the studios are all brought together and fed to the transmitter.

It really isn't practical or advisable to use a tape as a source for the measurements. It's very difficult to come up with a tape-recorded

signal with sufficiently low distortion to be useful for these measurements. Of course, for your own information, you'll want to know how the tape transports are performing, but don't try to include them in the overall system measurements.

Once you've found something to use for a main mic input, you'll want to carefully match the generator output with the input. Be careful about putting 600 ohm generator output into a 150 ohm mic input. A 600 to 150 ohm 40 dB pad works well. The 40 dB of attenuation enables the generator to operate at a higher output level, which reduces the amount of noise present on the output.

Set the console for normal operation, and adjust the generator output for a normal indication on the board. While it's quite possible to improve the noise and distortion by juggling the settings of the mic attenuator and the board master, this doesn't reflect normal operation of the station, and is not a valid means of solving the problem. Set them where they normally run, then leave them alone for the remainder of the proof.

In Or Out?

Everyone knows that you have to disable the AGC amplifiers, but what about those equalizers that are hanging on the line? Do we leave them in? It's really simple, but the answer isn't the same for every equalizer. If the purpose of the equalizer is to correct for deficiencies such as phone line losses, **leave it in**. If the equalizer was installed to make the station sound something other than flat, **pull it out**. Better yet, flatten it out for the measurements, but leave the active stages in the line.

The idea is that the station must be capable of operating flat, even if you normally operate with, say, several dB of presence boost. A graphic equalizer in the chain that is used to alter the sound of the station should be switched out for the proof. Note that it would be improper to readjust the equalizer to make the system look flat, then return it to its previous settings. It's either in or out.

Transmitter Output

There has been a lot of debate

recently about the validity of sampling the output of the transmitter directly for the proof. The antenna system definitely has an effect on the audio, since few systems are perfectly flat across both sidebands. There are far more problems, though, in trying to do the measurements away from the transmitter. The modulation monitor output of a non-directional transmitter is the accepted point to sample the RF for the proof. A directional station really should pick up the sample at the common point. In either case, it is required that the antenna—not a dummy load—is connected to the transmitter.

If there are special circumstances that make it difficult to conduct the proof into the antenna, it may be possible to obtain special authority from the FCC to conduct the proof into a dummy antenna. This is handled on a case-by-case basis, and requires: (1) that the station has an auxiliary transmitter; (2) that the dummy load closely resembles the characteristics of the antenna; and (3) that there is no suitable time when the proof can be conducted into the antenna.

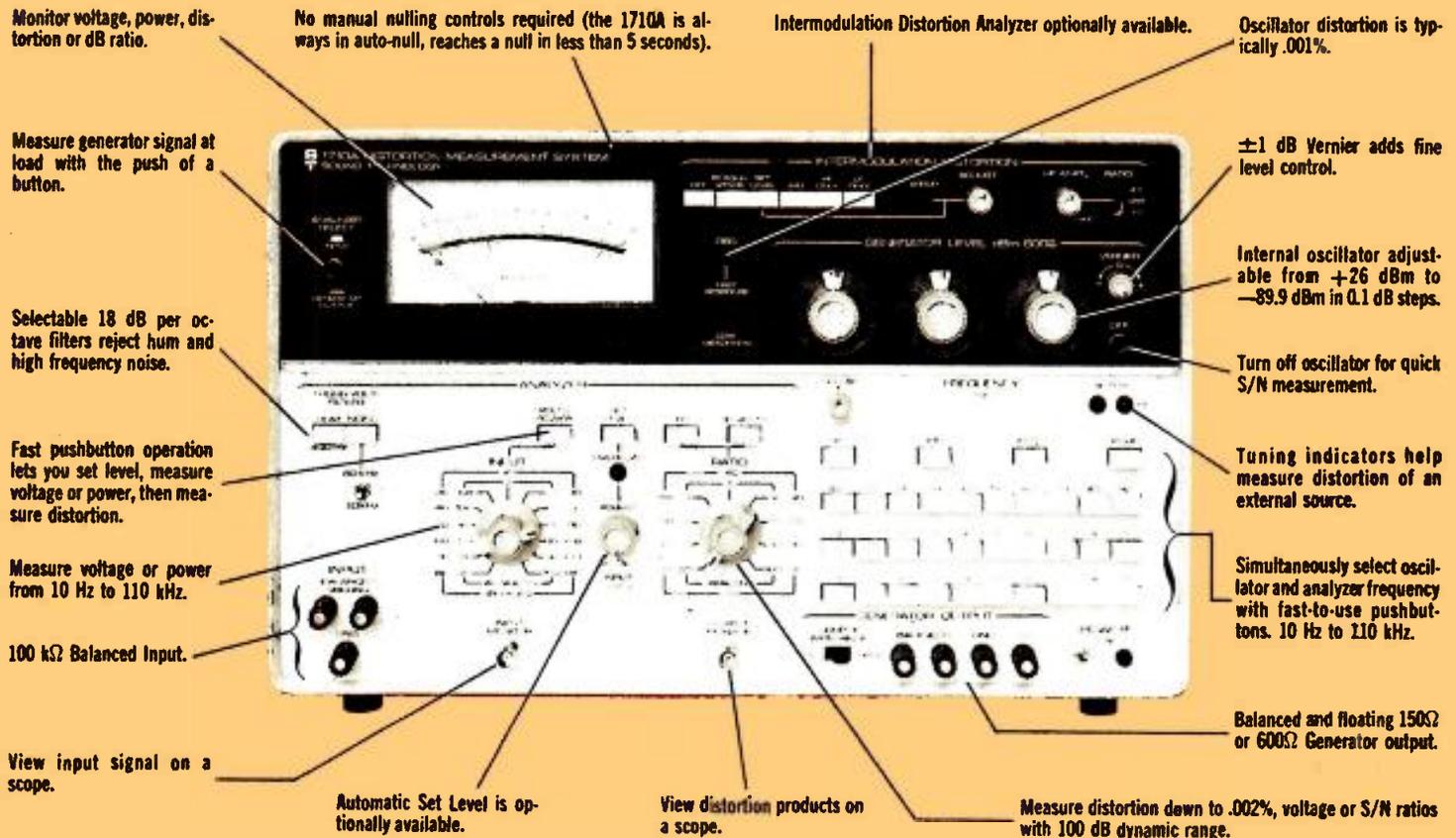
Running The Proof

The actual measurements are not that difficult, if you have established an orderly procedure. The *BE Proof of Performance* manual contains a simplified procedure which speeds up the measurements. Whether you use this method or one of your own, the important thing is to know ahead of time exactly what you are going to measure so that you can do all the measurements at each frequency without resetting the generator.

One of the things that is easy to get confused about is the method of measuring response. It really isn't a response measurement at all, but a **modulation sensitivity** measurement. The object is to hold each frequency at the proper modulation level (as indicated on the modulation meter) and record the generator output necessary to produce that level. The values that you record as the generator output level will be the inverse of the actual system response. In other words, if it takes a -10 dB signal to produce 100 percent modulation at 1 kHz

Continued on page 36

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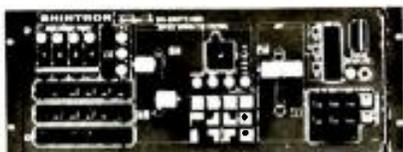
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THE PROOF

Continued from page 34

and a -12 dB signal to produce 100 percent at 5 kHz, the response is 2 dB high at 5 kHz. The requirement for an inverse type of measurement is one of the reasons that a spectrum analyzer is not suitable for doing an official proof of performance.

Noise Measurements

For some reason, the noise reading is to be referenced to 400 Hz instead of 1 kHz, like the response measurements. In most cases the system is probably flat enough that the difference is insignificant. Nonetheless, make sure that you use a 400 Hz tone when you establish a reference level to read noise. After the reference is set, remove the tone and terminate the mic input with an appropriate impedance. Don't turn anything else down! We want a true measurement of the system noise, not just part of the system.

By the way, with most generators, it isn't necessary to actually remove the generator and replace it with a 600 ohm resistor. Merely turning off the power to the generator will suffice in most cases...the output pad provides the source resistance for the mic preamp.

Carrier Amplitude Regulation

Carrier amplitude regulation, or carrier shift, is easy to measure and, in fact, can be measured at the same time that you're taking the 400 Hz response and distortion readings. Most modulation monitors provide a carrier level meter that is calibrated in percent. Just record the difference between the carrier level without modulation and the level with 400 Hz modulation at each required percentage. For example, with the carrier level adjusted on the monitor for 100 percent with no modulation, modulate 400 Hz at 100 percent. If the carrier level meter now reads 98 percent, the carrier shift is -2 percent for 100 percent modulation.

If your monitor doesn't have a calibrated carrier level, you can read the level on the AC voltmeter, if the unit has adequate bandpass. Apply the RF sample directly to the undetected input and set the level

control for 100 percent with no modulation. Read the carrier shift with modulation as before.

Spurious And Harmonic Measurements

For some reason, measuring the station's spurious and harmonic radiation seems to pose a big problem at many stations. Really, the requirements are pretty easy. No sophisticated test equipment is required, and the results don't even have to have any numerical values attached to them. However, it is really an important measurement, as a spurious or harmonic problem could cause serious interference to another service.

An ordinary communications receiver is all that is needed to check both spurious and harmonic radiation. Actually, it's pretty hard to check spurious right up to the edge of your signal, but any significant spurious indications close to the signal will show up as increased distortion, if you use a fairly wide band distortion analyzer. Harmonics are easy to check, especially if the receiver has a crystal calibrator that enables you to tune right to the harmonics.

How close should the receiver be to the transmitter? It's hard to come up with a precise answer, as there are so many variables. Generally, one-half to two miles from the transmitter is far enough to avoid images and close enough to receive an adequate ground wave signal on the harmonic.

How much is too much? Another toughie, unless you can take a calibrated reading. In general, a one-kilowatt station should not have any readable harmonics at a distance of two miles. If you want to attempt a more accurate measurement, you can read the AVC voltage (with the AVC turned off) at both carrier frequency and the harmonics. Calculate the difference in decibels. To be totally correct, the antenna length should be taken into account by converting the readings to millivolts per meter.

A much simpler and totally acceptable method is to verbally describe what is heard at each harmonic frequency... "faintly readable" or "no signal heard."

If the station doesn't own a communications receiver, a local ham may be able to help out. Just

Continued on page 38

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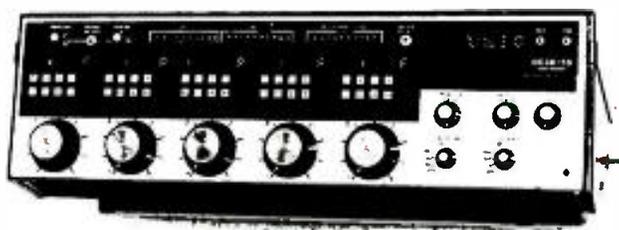
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The Proof

Continued from page 36

make sure that he's located a suitable distance from the transmitter. You should personally go to his house and directly observe the measurements.

The Paper Work

We won't go into detail on the written proof report; since a complete outline including forms is contained in the *BE Proof of Performance* manuals. A couple of points should be made, however. The purpose of the written report is two-fold. First, to assure the FCC that the station is operating within the prescribed limits and second, to provide the station with a record that can be used to determine what corrective action might be necessary in the future.

We're not disciplined scientists, but we should use good scientific practices in putting the written report together. Another engineer should be able to duplicate your procedure after reading your report.

Although not specifically required, a conclusion should be a part of the proof. If there were some areas that passed, but were not as good as they had been in the past, make note of the problems in the conclusion. If any changes had been made in the system since the last proof, indicate what effect they may have had on this year's proof. In general, make a comparison with the previous proof.

Still More Paperwork

Of course, an operator log must be kept during the proof period (and legal ID's given at the proper times). Something that is sometimes overlooked is the maintenance log. Be sure to include a statement about anything that you had to do to make the thing play...new finals, bias adjustment, or whatever.

It's impossible to cover all of the details of proof measurements in one short column. Hopefully, we've covered some of the trouble spots. A much more detailed treatment of this subject is available from BE in two separate *Proof of Performance* manuals...one for AM, one for FM.

Radio Workshop thanks Dennis Ciapura, BE audio editor, and John Reiser, FCC Policy and Rules Division, for helping to clear up some of the issues concerning performance measurements. □

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Automatic Transmission Systems In Review

This review, presented at the recent NAB Engineering Conference, is intended to answer the most-asked questions still hovering over ATS. It also tells how ATS can be beneficial to the station.

By John W. Reiser
Reregulation Task Force
FCC Broadcast Bureau

I appreciate the opportunity of discussing with you today some of the details of the standards for the operation of automatic transmission systems included in rules adopted by the Federal Communications Commission in December, and some of the interesting questions and developments that have been brought to the Commission staff in the past few months.

I will briefly outline the provisions of the rules and then report on some of the questions and comments we have received from licensees, broadcast engineers and equipment manufacturers who are attempting to develop or use equipment that will truly provide beneficial operation and comply with the ATS standards as given in the rules.

It was certainly obvious from the onset of the ATS rulemaking proceeding that there was a considerable variation in concept, both within the industry and the Commission staff, of what an ATS could or should be. There is absolutely no doubt that electronics and broadcast technology are available to develop and operate a fully unattended automated transmitting plant—and with program automation, a fully unattended broadcast station, as evidenced by some of the equipment on display at the NAB convention. Assuming that a highly sophisticated automated transmit-

ting system can be developed, there was the question of how much automation should be required, is necessary, or would be totally practical for a large number of broadcasters to use.

In the rulemaking process, whether it involves technical matters such as the standards for a directional antenna sampling system or administrative or licensing issues, consideration must be given to the great variation which there is in the nearly 9,300 operating stations. A number of compromises and carefully balanced decisions are necessary in the rulemaking process—hopefully successful, but unfortunately not completely satisfactory to all. Experience under the adopted standards and rules will indicate that revisions may be necessary or desirable. One example of a technical rule which may require some revision is that of the standards for approval of directional antenna sampling systems. These standards do not now permit the use of current transformers as sampling devices at the base of self-supported antenna towers.

Some engineers tell us now that such transformers can be effectively used if certain precautions are taken, and that the rules should be amended accordingly.

There has been some comment that the rules for ATS may not be practical for most broadcasters—that ATS offers no great advantage over the present remote control operation. In this respect, I feel somewhat like the father of a newborn child...one who has looked

forward to the birth of the child with great expectations, then after the child arrives wondering what the future holds for it. Will there be a fruitful life of joy and good fortune, or a life of desolate failure? Only time will tell, but constant encouragement, example and correction, when appropriate, is required for the child and perhaps also with ATS.

A New Approach

I would particularly like to point out that the adopted ATS rules are somewhat a noted departure from many rules ushering in previous technical changes in broadcasting. While researching some rules of long standing, I was looking at the regulations and broadcast engineering standards published in 1939... many of which are still in effect today. I was amazed at the very explicit detail that was included on the construction and installation of the transmitting equipment, including design considerations, tube operating parameters, component specifications, sizes of conductors, thickness of insulation, etc. In the ATS rules, we attempted to avoid the inclusion of specifications on the design of the ATS equipment. We tried to concentrate on the desired system performance. The problem with rules that cover the specific equipment and design details is that they hinder the development and use of new technology. We hope that you, as broadcast engineers and equipment manufacturers, will devise effective equipment to meet station licensees' varied requirements.

Chairman Wiley included the following in his statement on the adoption of the ATS rules:

"In my opinion, the Commission's approval of ATS marks the beginning of what, hopefully, will be a new regulatory philosophy for the FCC, one which focuses more on the end product desired (in this case, the technical integrity of a station's signal) and less, much less, on complex rules and procedures to achieve that objective. Our action today permits licensees themselves, rather than the government, to select the best means of maintaining the technical compliance of his or her particular circumstances."

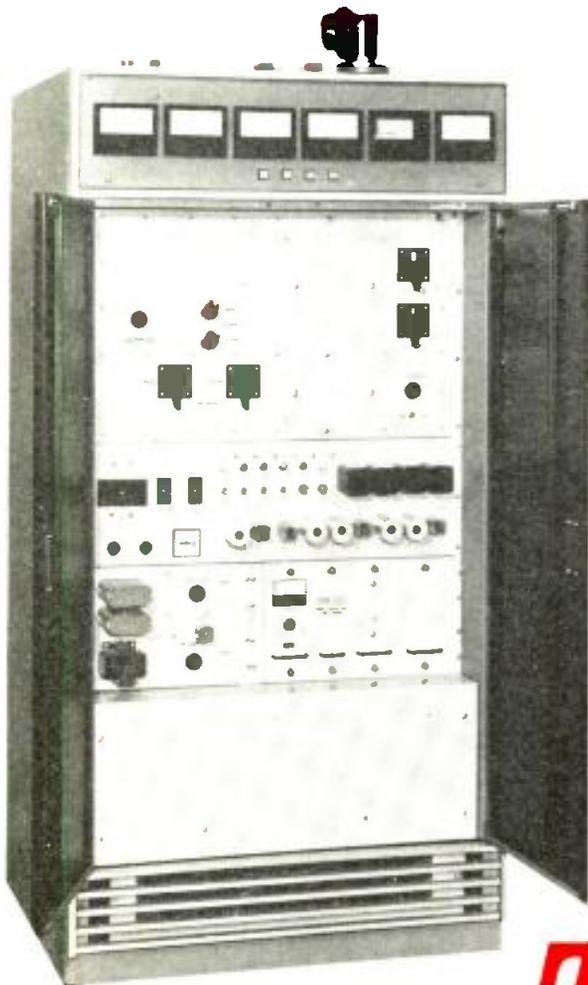
Now, I would like to briefly out-

Continued on page 42

John W. Reiser is the engineering member of the FCC Broadcast Bureau's Reregulation Task Force. Prior to assignment to the Broadcast Bureau, Reiser served as a field engineer at the Commission's Detroit and Buffalo field offices, was Engineer in Charge of the Buffalo Radio District, and served as Chief of the Radio Operator and the Inspection Branches of the Field Operations Bureau in Washington. He holds an electrical engineering degree from the University of Michigan and prior to joining the FCC staff, was employed at radio station WATT, WUOM, and WHRV in Michigan. Reiser is a senior member of IEEE, and a member of the Audio Engineering Society and the Society of Broadcast Engineers.



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ATS In Review

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line the provisions of the rules for ATS:

1. ATS is a technology whereby the routine transmitter operating functions can be performed automatically without operator supervision or control to insure transmissions are within specified standards and license conditions. These functions include, making changes in the operating mode at the times required, maintaining operating power and modulation, and alerting the licensee of a condition that requires technical attention.

2. The use of an ATS relieves the licensee of the need to have a technician-type operator on duty responsible for observing the performance of the transmitting system and to make adjustments at prescribed times.

3. The use of ATS by any licensee is entirely optional. Licensees may use ATS for a portion of the broadcast day and direct or authorized remote control at other times.

4. Type approval or type acceptance of ATS control equipment is not required. Licensees may either design their own equipment, have it custom designed or constructed, or obtain it from a broadcast equipment manufacturer.

5. No construction permit or prior authorization is required to install or test ATS equipment. After the licensee has completed the installation and testing to insure it is functioning correctly, an informal request to use ATS may be submitted to the FCC for authority for ATS operation. A detailed technical showing of the equipment is not required.

6. At the present time, all FM stations and AM stations, when using non-directional antennas, may use ATS. (It is anticipated that ATS rules for operating with AM directional antenna systems and TV stations will be adopted within the next nine month period...by early fall for AM directional operation, and by the year's end for TV stations.)

7. Upon receipt of the ATS authorization, the station can immediately begin ATS operations, during which one station employee must be on duty monitoring the transmission. Under the existing

provisions of the Communications Act, that employee must hold a radio operator license or permit. However, a restricted radiotelephone operator permit obtained by mail registration is adequate. That operator is not restricted to a particular room or area, or in the other duties that can be performed. It is only necessary that that person monitor the station's transmission and an aural malfunction alarm signal.

8. The ATS equipment is to monitor and adjust the operating power by the direct method for AM stations and by either the direct or indirect method for FM stations. The indirect method of power determination and maintenance also can be used at AM stations, under the same conditions—when necessary—such as when there has been damage to the antenna or when antenna construction work is in progress.

9. The ATS must have a means for observing the depth of modulation, correcting excessively high modulation and terminating the station transmission if modulation corrections are not made. Automatic correction of low levels is desirable but not required by the rules.

10. For those AM stations operating only during daytime hours, operating under presunrise service authorizations or with more than one power mode, and stations sharing operating hours with other stations on a specified schedule, the ATS must include a time clock for performing all switching functions at the prescribed times. The clocks are to be accurate to within one minute of National Bureau of Standards time.

11. Each ATS station must have one or more monitoring alarm points at which the station employee monitoring the station is on duty. The points may be at the transmitter site, the authorized studio or remote control point, or at another location, if specifically requested and authorized by the Commission. The monitoring alarm point is to be equipped with an "Off-Air" monitor, and an SCA program monitor, if SCA programming is transmitted, and an aural alarm signal that will indicate certain transmitter malfunctions. The signal must indicate an inter-

ruption in the station's transmissions—either carrier or modulation—for a period exceeding three minutes or uncorrected underpower operation. The monitoring alarm point must also be equipped with a means to turn the transmitter on and off.

12. The ATS is to be equipped with fail-safe devices that will terminate the station transmissions in event of certain serious malfunctions. These malfunctions include any uncorrected over power operation exceeding three minutes, uncorrected overmodulation, failure of the circuit permitting the transmitter to be turned off at the monitoring alarm point (a requirement similar to remote fail-safe requirements), failure of the mode switching time clock and failure of the parameter sampling or alarm signal system.

13. The transmitter parameters to be automatically monitored may be checked continuously or sequentially at least once every minute, however, the modulation monitoring must be continuous.

Additional Features

There are several other ATS operating requirements or features for ATS that I will briefly list:

1. The beginning of operation for each broadcast day or period is to be manually activated. For daytime stations, the time clock must prevent the station from signing on before the authorized time.

2. AM stations using a time clock for mode switching may have a switch to override the clock controls at the monitoring alarm point to transmit emergency information with full daytime power at any time.

3. Stations using ATS must fully comply with all Emergency Broadcast Systems (EBS) requirements.

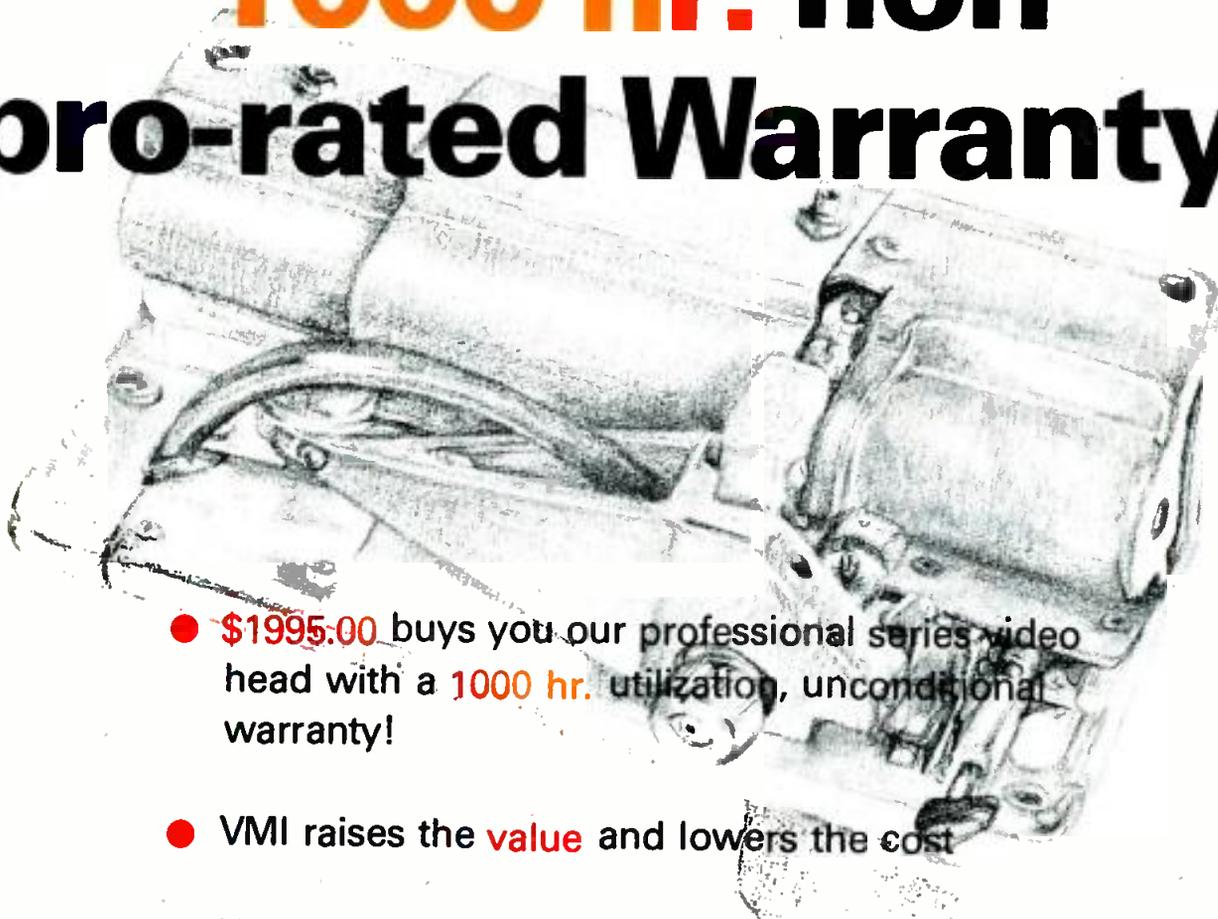
4. The equipment must have some method for the maintenance operator to test the functioning of the automatic controls, fail-safe switching limits and alarm circuits. However, it is not necessary that the transmitter actually leave the air during the testing. The testing can then be done during the regular broadcast operation.

5. All mode switching is to be accomplished without manual tuning or other adjustments.

Continued on page 44

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ATS In Review

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6. The licensee may install additional alarm features in the ATS equipment, however, there must be a distinction between required and any optional alarms.

7. The use of auxillary or alternate main transmitters can be incorporated into the ATS system.

8. The ATS automatic alarm monitoring for tower lighting failures is optional. The licensee can continue to make daily observations of the tower lighting, either directly or by remote telemetry if desired.

9. There were no changes in the transmitting equipment or signal transmission standards in the ATS rules. All stations using ATS must meet the same power and modulation standards as those not using ATS. However, modulation peaks of frequent recurrence is specifically defined for ATS control purposes.

Will It Be Beneficial?

As already mentioned, questions have been raised as to whether

there would be any interest in ATS, and what the advantages were under the rules as adopted. The ATS proceeding certainly generated considerable comment and supporting interest from broadcast licensees. A number of manufacturers have developed equipment for marketing. I am aware of one licensee that has already been authorized to use ATS, and others have told us that they are now building, installing, or testing ATS equipment.

In the long run, I am sure you realize that the acceptability of ATS will rest in the economic or operational advantages that it provides—hopefully both advantages. And we also trust that it will provide a more reliable quality service to the public. During the ATS rulemaking proceeding, we were neither given information, nor could we possibly develop any prediction on the economic advantage that stations may realize by using ATS. This would be almost entirely dependent upon a station's existing facilities, its type of operation, location, staff resources, cost of ATS equipment and a number of

other factors. I suggest a few of the benefits of using ATS:

1. Licensees may have employees on duty who are no longer required to take and pass a written operator license examination. Licensees have greater flexibility in the selection of station operating staff and staff duties.

2. The station employees on duty during station operation are relieved of all technical responsibilities for transmitter operations, or from being restricted to staying at a particular room or operating position. For example, the duty employee could be an announcer, receptionist, switchboard operator or watchman.

3. Licensees will be relieved, we assume, from their expressed anxiety concerning the reliability of operators in performing their duties such as switching power modes on time, (a problem experienced with many "combo" announcer/operators).

4. ATS can provide a more reliable service to the public, including the lessening of potential to interference to other stations caused

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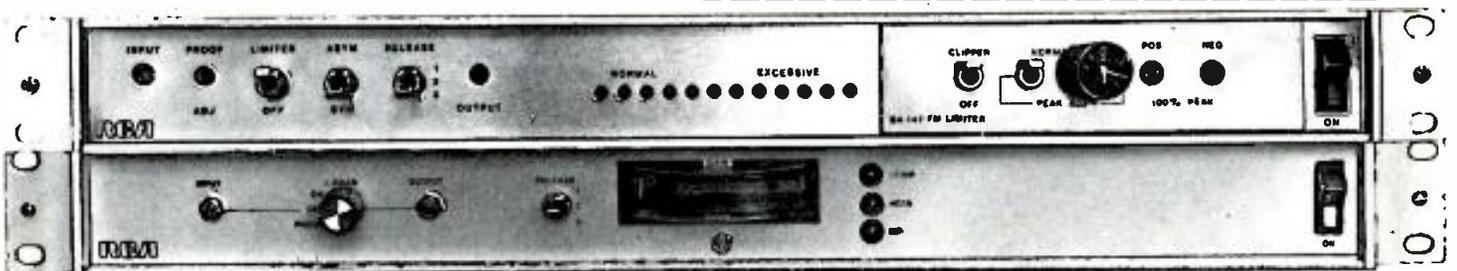
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by improper attention to mode switching or excessive modulation.

5. The alarm system will immediately call attention to a technical malfunction rather than the malfunction detection being dependent upon the operator's observations.

6. Reduction in the number of inspections that must be made at the transmitter site. ATS stations may inspect the transmission systems on a monthly schedule.

7. Stations using ATS may employ the services of a first class operator on a contract or part-time basis.

8. We do have for the first time, in the 43-year history of the FCC, a standard for that previously ambiguous phrase "peaks of frequent recurrence" with respect to maintaining modulation levels.

9. Routine transmitter meter readings and logging of operating parameters are not required with ATS.

ATS Could Improve Station Operations.

It has been mentioned that many

of the technical devices required for ATS operation could have been, or may be used by any station to achieve many of the advantages listed here without ATS. The equipment may have been easily and economically built and used...but it wasn't. Many stations, even under the existing operator logging and inspection requirements, failed to comply with the most basic technical responsibilities such as switching operating modes at the prescribed hours. We trust that the ATS rules will be successful in providing the regulatory basis for improved station operations.

There are a number of methods by which the requirements for an ATS can be accomplished, and a number of excellent systems have been, and probably will be, developed. This equipment will surely also be used to improve the operation of those stations that do not elect to implement full ATS operation.

Looking very briefly to the future of ATS, I see no reason why AM stations with directional antenna systems can not use ATS. The few

problems remaining to be resolved concern use of existing antenna monitors, interval of parameter samplings, reasonable limits for directional antenna parameter deviations before the station must actually terminate operations, and procedures for use of ATS when there is damage to the antenna or when modifications are in progress. Similarly, we expect that TV stations will also be able to use ATS, and our attention will be directed to those signal parameters which must be automatically corrected, the parameters that must be alarmed for manual correction and the appropriate video test signal necessary to accomplish ATS monitoring and control of the visual transmission.

I would like to review some of the questions and comments that have been received since January concerning the ATS rules and requirements.

Q. Is it necessary that the ATS system actually adjust the output of the transmitter, even if alarms are

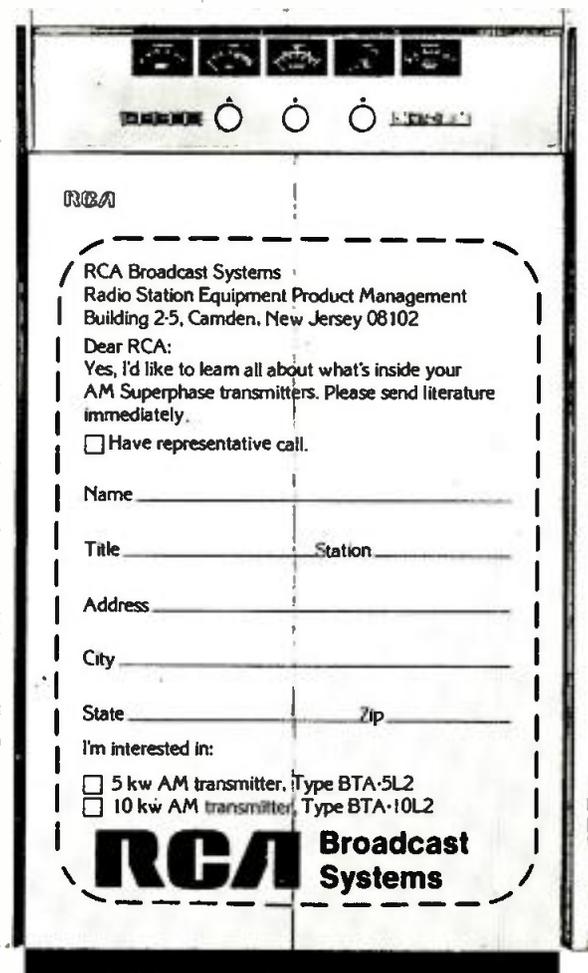
Continued on page 46

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RCA Broadcast Systems

ATS In Review

Continued from page 45

provided for over or under power?

A. Yes. One purpose of ATS is to keep the station operating as close to the licensed power as possible without operator involvement. This is to be accomplished by automatic adjustment of the transmitter operating power.

Q. Can a transmission line sampling or in-line Watt meter be used to maintain the output power of an FM transmitter if the sampling device is calibrated using the indirect method of power measurement?

A. No. A transmission line power sampling device must be calibrated with a Wattmeter using an artificial antenna, or the indirect method of determination and maintenance of the operating power of FM transmitters is to be used (the product of the power amplifier voltage, and current, and efficiency factor). It may be desirable to make some revisions in the rules covering the determination and maintenance of operating power for all stations, to permit other methods to be used.

Q. If a microwave STL is used to transmit composite stereophonic signals from the studio to the transmitter, can the modulation monitoring and control function be located at the studio where the stereo generator is located?

A. Yes. The ATS rules do not specify where the particular components of the system must be located. For FM, an "Off-Air" monitor, if used with a receiver of RF amplifier of adequate bandwidth, can give an accurate representation of the depth of modulation. Off-air monitoring for modulation control may not be practical for AM stations unless the monitoring point is very near the transmitter. Atmospheric noise and co-channel or adjacent-channel interference will affect the accuracy of off-air AM modulation measurements.

Q. Do stations using ATS require a modulation monitor, and if so, where is it to be located? Is it necessary that the modulation monitor be in continuous operation?

A. All stations are still required to have a type approved modulation monitor. However, it does not have to be in continuous operation. It

can be located at the transmitter site for test and maintenance purposes, or at the monitoring and alarm point and used as an "Off-Air" monitor receiver.

Q. The ATS standard for a burst of modulation differs from the specifications for type approval of modulation monitors. Why?

A. The specifications for AM monitors, FM monitors used for monaural signals and stereophonic modulation monitors all have some variations. It was not possible to adapt the existing monitor specifications to ATS operation. Therefore, a new basis was established for defining excessive peaks of modulation for ATS control purposes.

Q. Can existing modulation monitors be used for ATS purposes?

A. Yes, if they can be adapted for such use. The ATS logic will probably be external to the monitor signal terminals. Caution is required to insure that the modulation indication is accurate for each AM station power mode used, and the accuracy of ATS modulation peak sensing device must be immune to possible variations in the RF input level.

Q. Can FM SCA or subaudible tones on AM stations be used for transmitting alarm functions to the monitoring alarm point?

A. Yes. The SCA FM rules or the AM rules were not specifically amended to provide for ATS alarm or control signals, but rule changes will be included in the second Report and Order for such use if necessary.

Q. Is it necessary that the ATS alarm circuit be self-testing at least once every minute, or that subaudible tones be transmitted continuously to indicate that the alarm circuit is not functioning?

A. The ATS fail-safe system must have a provision for determining that each component of the alarm function is operating—the sensors at the transmitter, the link from the transmitter to monitoring alarm point and the alarm circuitry. If a wireline is used to transmit the alarm from the transmitter site, then an interruption of that line should result in a turn off of the transmitter. If AM "Off-Air" monitoring is used for the link, a continuous tone would not be needed, assuming that either an alarm fail-

ure at the transmitter site or at the monitoring and alarm point would turn the transmitter off.

Q. Is it necessary that the ATS system provide for automatic alarming of tower lighting failures and, if so, must it indicate if any single lamp fails?

A. Automatic alarm for tower light failure is not required for ATS operation, although it would be desirable. If such alarming is used, it must indicate if there is any failure of a lamp. The licensee would be obligated to determine which lamp has failed so that the FAA can be notified if necessary. Note that FAA notification is required only if the topmost lights on the tower or any flashing code beacon have failed. If automatic lighting failure alarm is not used, licensees may use either direct observation or telemetry checks of tower lighting each day. A log must be kept of daily tower lighting observations.

Q. Why did the rules for AM stations not include a provision for determining power by the indirect method?

A. The Report and Order stated that the indirect method of power determination could be used with ATS under the same temporary conditions as permitted under present rules. This was not included in the ATS AM rules through oversight and will be corrected in an order to be released soon.

Q. Can FM stations that have a combined compressor-limiter-stereo generator meet the ATS modulation control requirements?

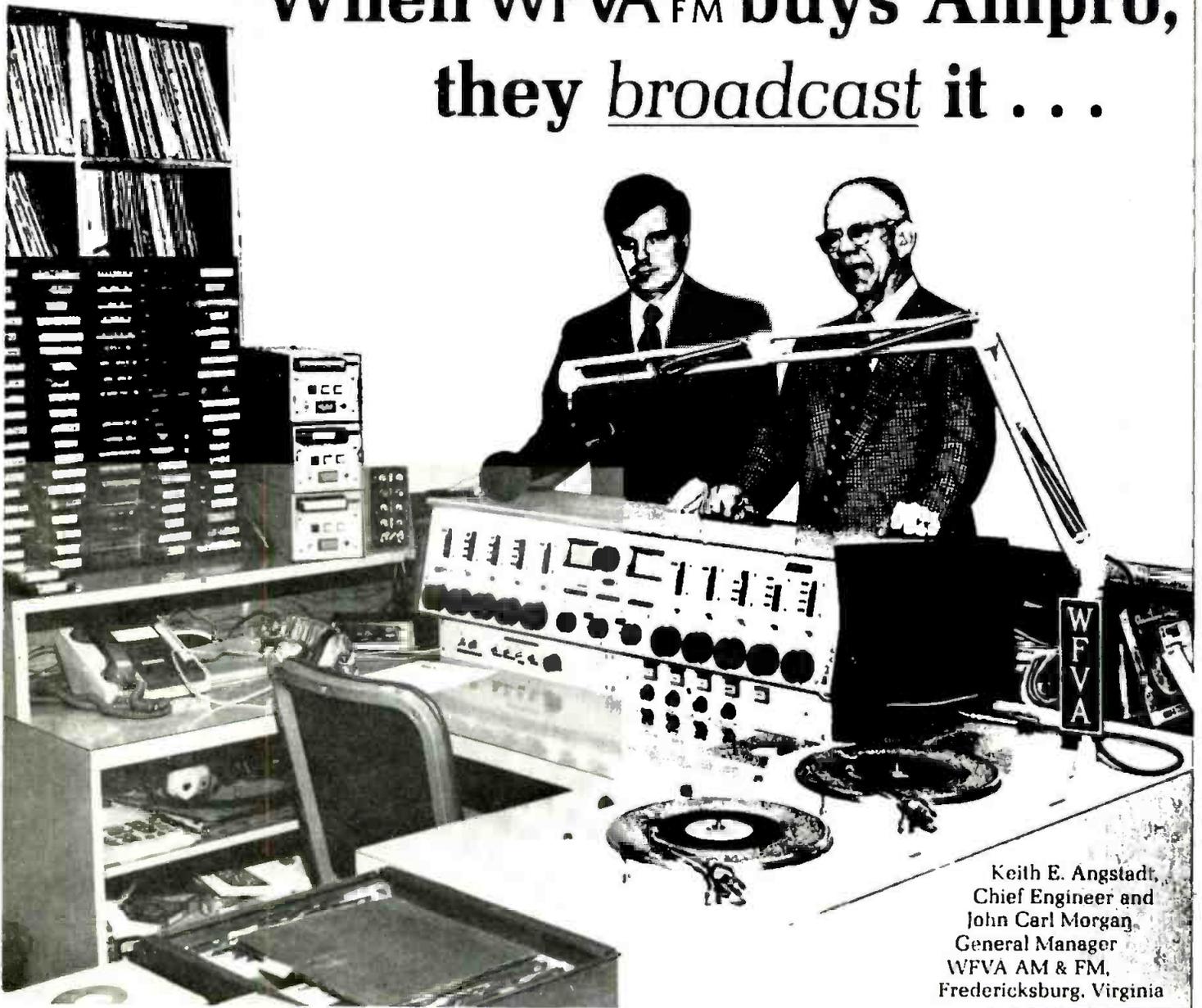
A. Some modifications of the combination unit may be necessary, and it is suggested that licensees using such devices contact the equipment manufacturer. No station was prohibited from using ATS because of the type of equipment now in use, and modifications are permitted as long as signal transmission standards are maintained.

Q. The proposed ATS rules stated that control time clocks required presetting for at least one month in advance, but the adopted rules did not require this. What happens if a station forgets to adjust the clock for the first day of the month?

A. A clock for presetting for the following month was not required because we believe that the licensee should have greater options in selecting ATS equipment for the

Continued on page 48

When WFVA^{AM}_{FM} buys Ampro, they broadcast it . . .



Keith E. Angstadt,
Chief Engineer and
John Carl Morgan,
General Manager
WFVA AM & FM,
Fredericksburg, Virginia

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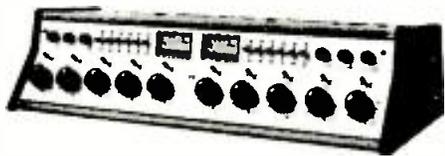
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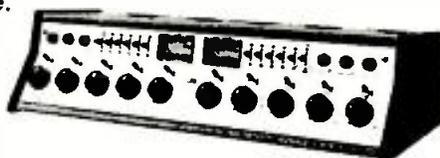
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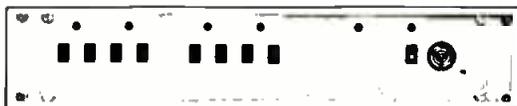
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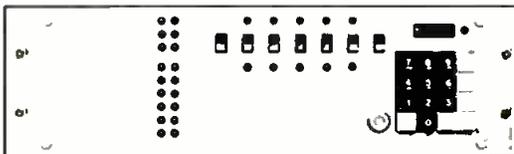
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ATS In Review

Continued from page 46

particular station operations. If the licensee forgets to have the clock adjusted for the first day of the following month, he or she would be subject to the same penalties for operating at variance with the license terms as under manual operation. If experience shows that there is a general problem with stations not resetting the clocks when necessary, some modification of the rule may be necessary. I understand that one manufacturer is using a clock calendar integrated circuit to provide preset switching for the entire year, with a reserve power supply to keep the clock running during a power failure.

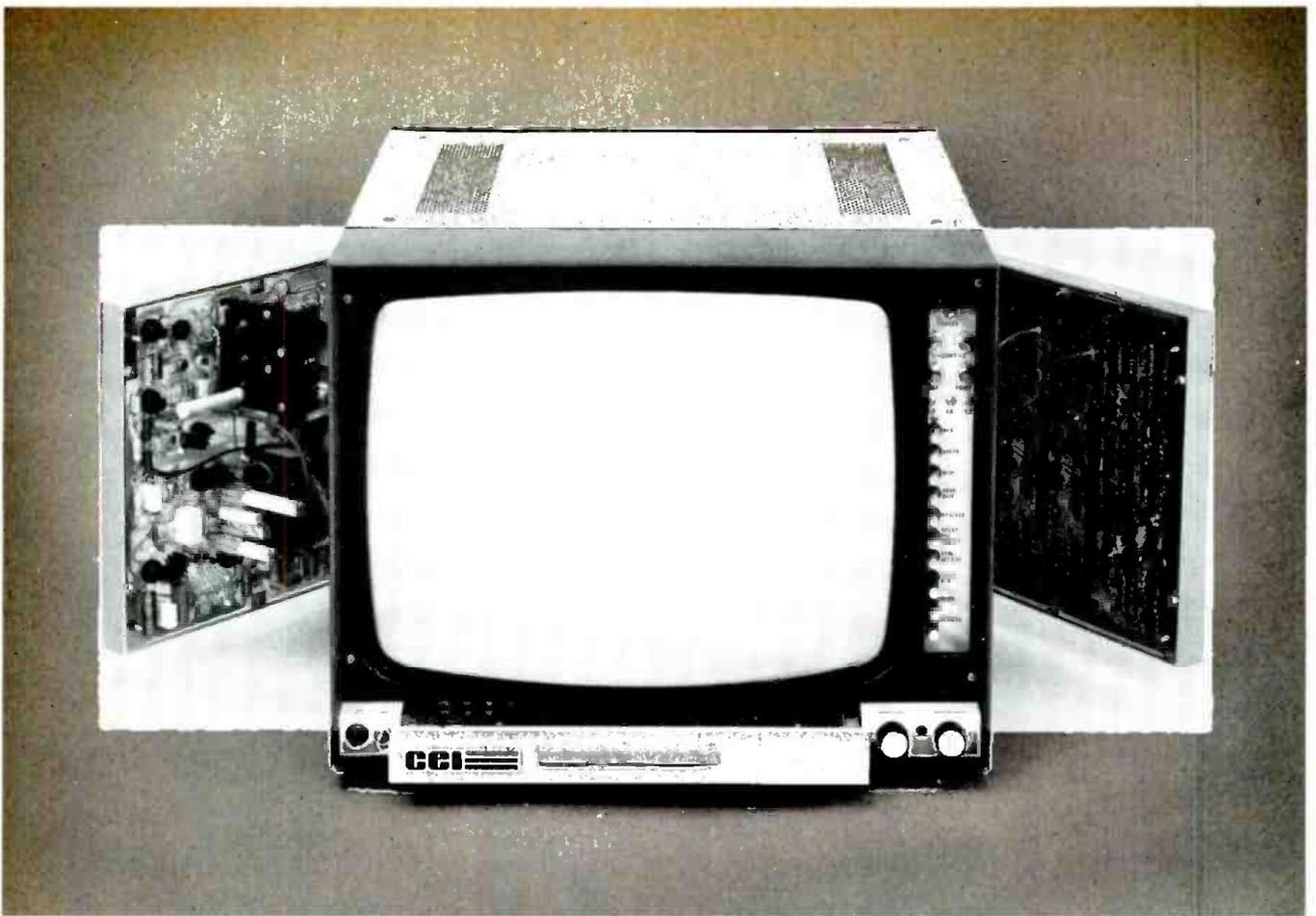
Q. Why was not automatic frequency control or fail-safe for off frequency operation made part of the ATS rules?

A. Off frequency is such an infrequent problem in broadcasting that the additional equipment required for an ATS frequency monitor is not justified. The monthly frequency measurements are usually sufficient to detect any abnormal frequency drift. Some older stations using crystal ovens may be off frequency after a long period of power interruption, but frequency monitoring equipment is also subject to similar problems. All licensees using transmitters that could be off frequency after extended power interruptions should take steps to insure that the frequency is within tolerance when resuming operation.

Q. If a station goes off the air because of some interruption at the transmitter, can it return to the air by ATS control?

A. Many transmitters have the ability to recycle after brief power interruptions, lightning strikes, or overloads. This automatic recycling of the transmitter is normal broadcast procedure and is not affected by the ATS rules. However, there could be a situation where there are longer interruptions in the power service to the transmitter.

Since the ATS alarm must activate for a transmission interruption lasting longer than three minutes, we think that it is reasonable to have manual transmitter turn-on if the interruption lasts longer than three minutes. □



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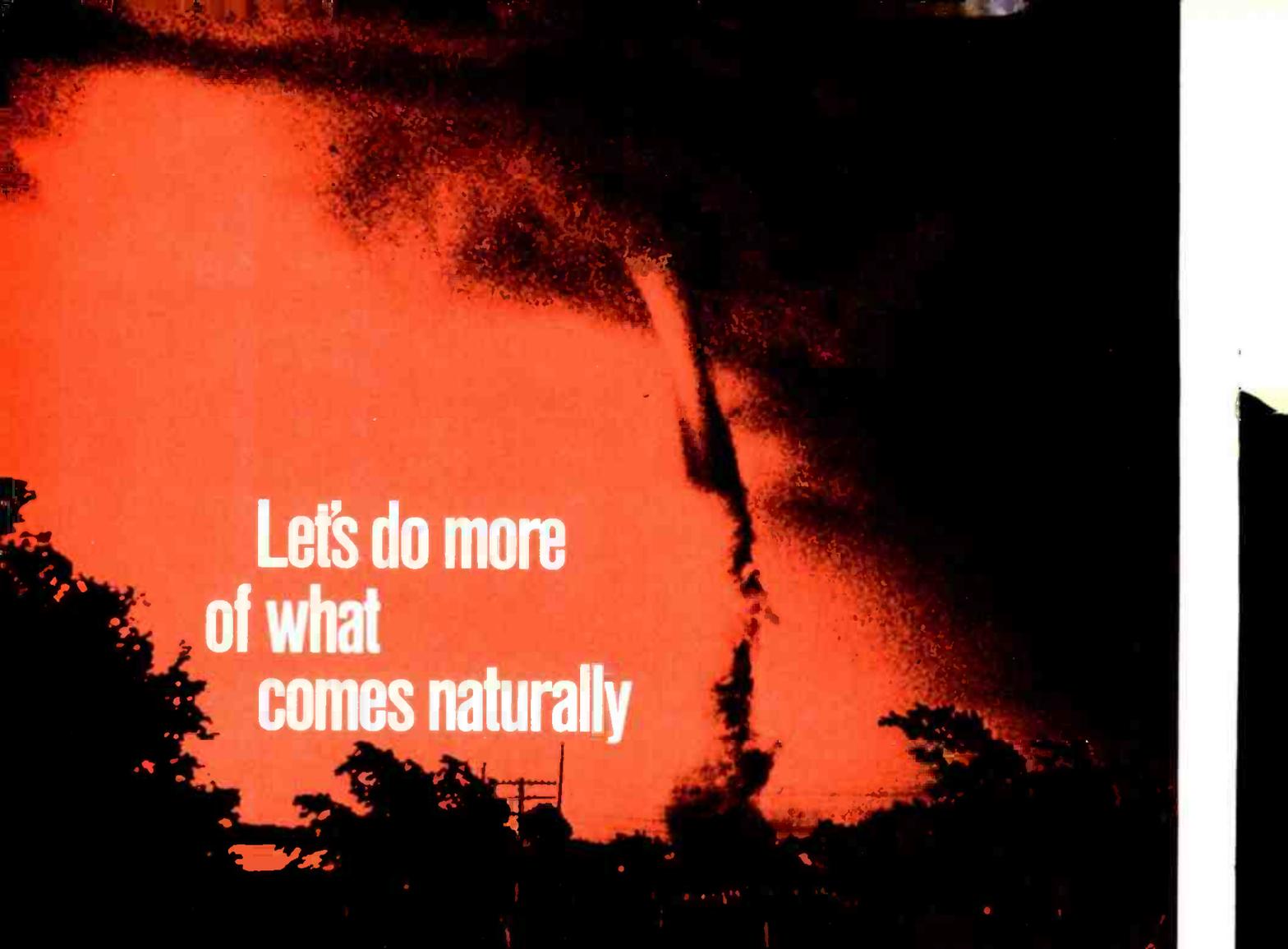
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Let's do more of what comes naturally

Photos courtesy of National Oceanic and Atmospheric Administration (NOAA).

By Joseph J. Conte
National Weather Service
EBS Program Manager

For as long as one can remember, the broadcast industry has given its audience tremendous public service value at very little cost. For example, emergency information via radio or television, before and following, a natural or man-made disaster, has unquestionably saved countless numbers of lives.

In some instances, local and adjacent communities have developed plans and procedures with the broadcast stations to disseminate such warning information moments after it is received. Yet, in too many instances, in other communities, the quick channels of communication are not organized

and in some cases, not available. The result is that large segments of the broadcast industry respond singularly to emergency events daily.

Recent examples of natural disasters were the early spring tornadoes through the deep south (26 deaths), part of Michigan (one death), and the Ohio Valley. Industrial fires and noxious gas spills on several U.S. highways and waterways are examples of recent man-made disasters. Each of these events indicates a need for immediate response by public warning dissemination systems. The National Weather Service (NWS), a component of the National Oceanic and Atmospheric Administration (NOAA), and the Defense Civil Preparedness Agency (DCPA) have several such systems. Only one provides warnings for natural disasters

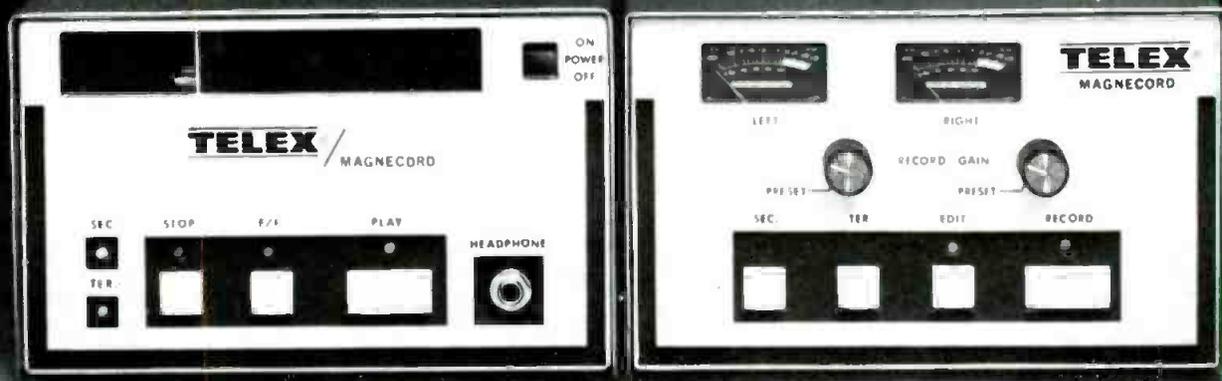
and nuclear attack directly into peoples' homes.

The NOAA Weather Radio, a 24-hour VHF-FM broadcast system with the latest weather information broadcast directly from NWS offices, is that system. Citizens who want to hear NOAA Weather Radio broadcasts must purchase special high band receivers, ranging in price from less than 20 to 100 dollars or more. Because of this system, NOAA Weather Radio and the broadcast industry have almost an exclusive link to the public during emergency situations.

On October 1, 1976, a two-year nationwide plan of action was set into motion to revitalize and prominently place the Emergency Broadcast System (EBS), formerly CONELRAD, on the most wanted list. This plan, unlike many before

Continued on page 52

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Doing what comes naturally

Continued from page 50

it, began with a purpose, timetable, and a schedule. The purpose is to have local and state broadcast stations in the U.S. develop written plans that outline the procedures for disseminating information about fast-breaking natural and man-made disasters to the public. The plan is endorsed by the National Industry Advisory Committee and the National Association of Broadcasters. Their support has steadied the EBS tightrope between the FCC, the NWS, DCPA, and the broadcast stations.

Many broadcasters think of the state and local EBS as incomplete and of little value in its present form. In most areas today, this is true, but the current two-year effort is coordinated and is proving to be a workable program.

As a beginning, EBS organizational seminars and workshops are held in each state. The meetings are arranged and co-chaired by the State Emergency Communications Committee (SECC) chairperson (the state broadcast representative) and by a representative of the state and local Office of

Emergency Services, or Disaster Preparedness.

During the seminar period, the FCC, NWS, and DCPA explain their roles in EBS. Following each presentation, there is a question and answer period. Next, a writing workshop, which is probably the most important part of the program, is used to confirm or change, if necessary, monitoring assignments. For example, only the individual broadcasters know which station(s) they need to monitor to get emergency information quickly. Consequently, they are asked to decide who they should monitor.

Following this workshop, the current Operational Area configurations are displayed and discussed. Dissemination problems unknown to broadcasters are inherent in the operations of the NWS, DCPA, State and Local Civil Defense, and local authorities. Because of this, discussions between the broadcasters and the government agencies are necessary. These discussions generally provide solutions. Ultimately, the chairpersons conclude the discussion by asking for recom-

mendations by the broadcast station representatives to accept, reject, or reconfigure the Operational Area Plan for their state.

The most important feature of the seminar and workshop is the fact that the broadcasters are working directly with local and state representatives whose own lives may depend on the EBS plan they develop.

Finally, the workshop participants are asked to read the Parkersburg, West Virginia Plan. This plan is a prototype guide provided to assist the broadcasters as they begin to write an initial draft EBS plan for their area. At the close of the workshop, the broadcasters are asked to take the initial draft plan back to their local area and to meet again with the Operational Area chairperson and local NWS and Civil Defense representatives to develop a workable plan within two months.

Perhaps at this point a broadcaster feels this task is long and time-consuming. In most instances this view is incorrect. Figure 1 shows a basic pattern for an Operational Area plan. The Common Program Control Station (CPCS-1, 2, 3, etc.) in an Operational Area receives the basic emergency information for that area.

In the plan, stations agree to monitor the CPCS using the new two-tone EBS equipment. These stations further agree to activate the two-tone signal for the stations that monitor them, and to rebroadcast the emergency information. The plan should define, as needed, the activation, procedural, and dissemination instructions to make it work. It should explain who the CPCS receives emergency information from, what types of information the station will accept, how the information will be received, and what will be done with it when it is received.

Figure 1 shows examples of who may have emergency information for the CPCS. The information can be received in various ways, telephone, radio, etc. For the NWS, NOAA Weather Radio is a suggested means as input into the CPCS wherever it is available. Cable TV stations, as well as AM, FM, and other TV stations, are placing weather radio receivers in

Continued on page 54

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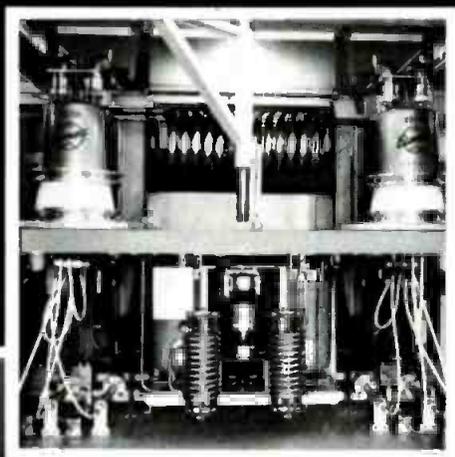
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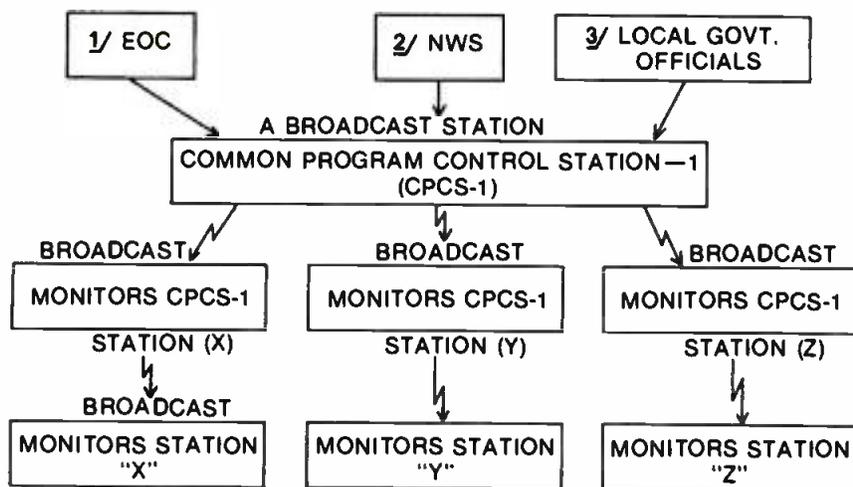


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EBS—HOW IT WORKS



- 1/ Emergency Operations Center (Community)
- 2/ National Weather Service
- 3/ Governor, Mayor, etc.

strongly contributed their support to this program.

To date, seminars and workshops have been held in Washington, Oregon, Nevada, Arizona, Kansas, Missouri, Arkansas, Ohio, West Virginia, Georgia, Maine, Vermont, Massachusetts, New York, New Jersey, South Carolina, and Hawaii. The Hawaii meeting included representatives from Guam, Samoa, and the trust territories. Besides these states and territories already mentioned, Connecticut, Rhode Island, North Carolina, and Florida, also have planning underway.

If you have doubts whether the system will work...WHBC Radio in East Central Ohio will remove all doubts. This is the third year that East Central Ohio has used this plan successfully (over 70 times). The statement that is printed in the broadcasters' copy of the East Central Ohio plan is appropriate: "The EBS is set up for the protection of you, your family, and your listeners. Remember, you are the final link in the EBS chain." Contact your SECC or state broadcast association president today. □

Continued from page 52

their stations not only to pick up the warning information, but also to get the general weather information. Some have hard-wired a NOAA Weather Radio receiver into their consoles or into a tape recorder for rebroadcast.

All of these things, leading up to

a final plan which all parties sign and agree to carry out, are not difficult. Strong leadership by the SECC's and the State Broadcast Association Presidents have made the difference in the states that have planning underway. The local NWS and Civil Defense offices have

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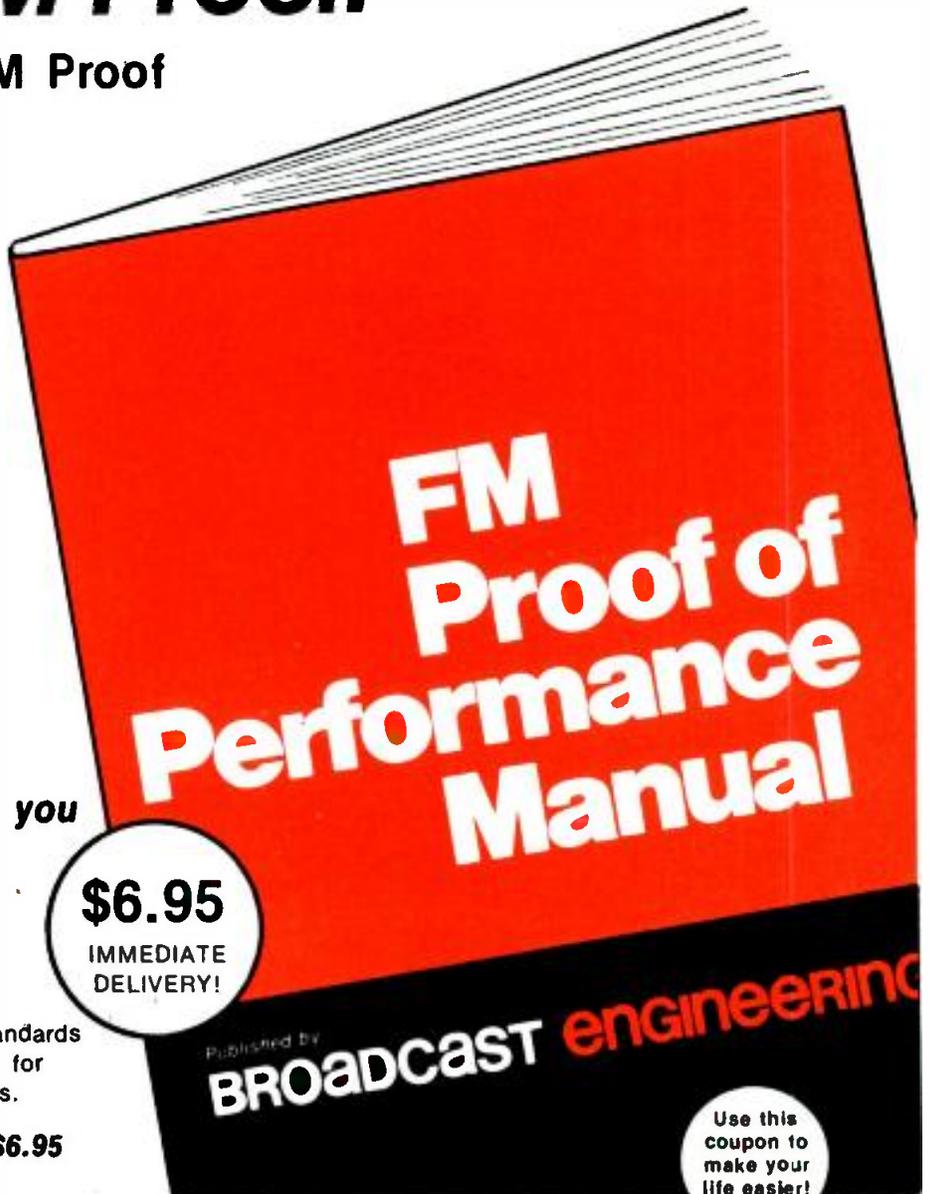
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DIGITAL TROUBLESHOOTING

By Harold Ennes

NAND is a NOT AND operation; NOR is a NOT OR operation. Recall that these are simply inverted in operation from the straight AND and OR gates and are more commonly used. Also recall that there are two types of OR gates: (1) the inclusive OR (either one or both), and the exclusive OR (either one but not both). Table 3 reviews all the truth tables for these operations.

Operator NAND

Plug in your type 7400 NAND gate, Figure 6, and note that the pin numbers for inputs and outputs are identical to that of the 7408 AND gate. The small circles on the output pins indicate phase inver-

sion. The internal schematic is identical to that of the AND gate except that the steering circuitry between inputs and outputs invert the signal at the output. The input and output circuits are identical.

Repeat steps 1 to 6 with the NAND gate instead of the AND gate. Note that the output is now just the reverse of the original experiment for the specified inputs. Also note that an open pin is interpreted as a HIGH level. For the NAND gate, both inputs must be HIGH (or a bad level) to get a LOW output. When either input (or both) is LOW (below 0.7v approximately) the output is HIGH.

Note that in steps 1 and 2, you

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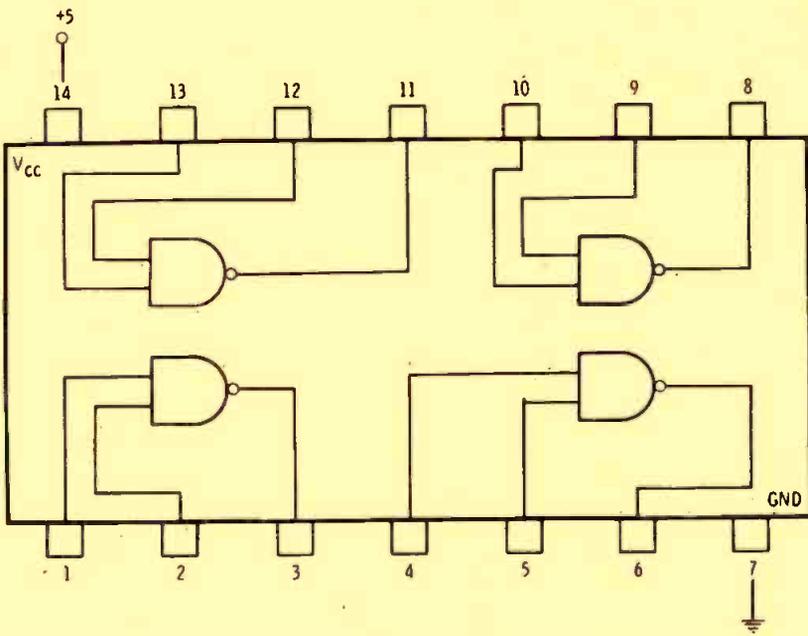
TABLE 3

Review of truth tables; NAND, OR, NOR, EXCLUSIVE OR

A	B	NAND \overline{AB}	OR A+B	NOR $\overline{A+B}$	EXCLUSIVE OR A⊕B
0	0	1	0	1	0
0	1	1	1	0	1
1	0	1	1	0	1
1	1	0	1	0	0

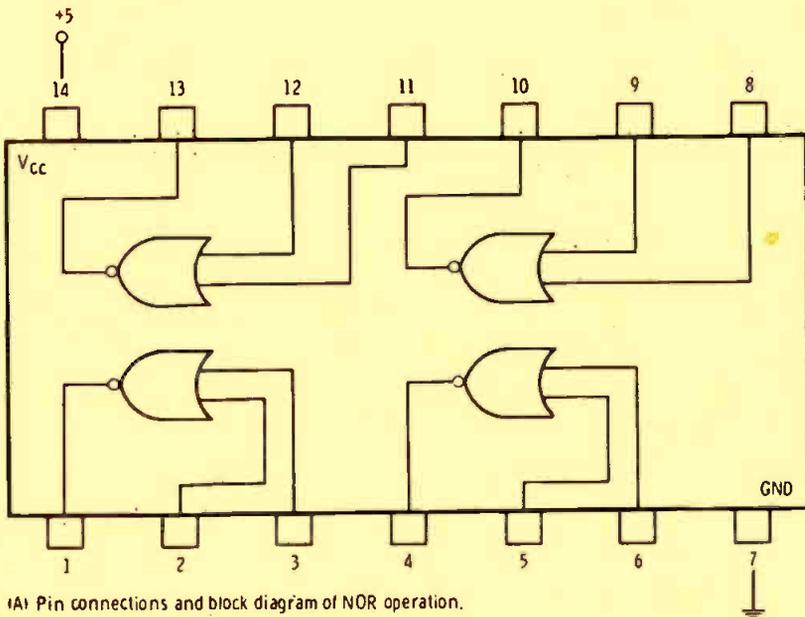
Typical operation:

0 = LOW <+ 0.7 V
1 = HIGH >+ 2.4 V

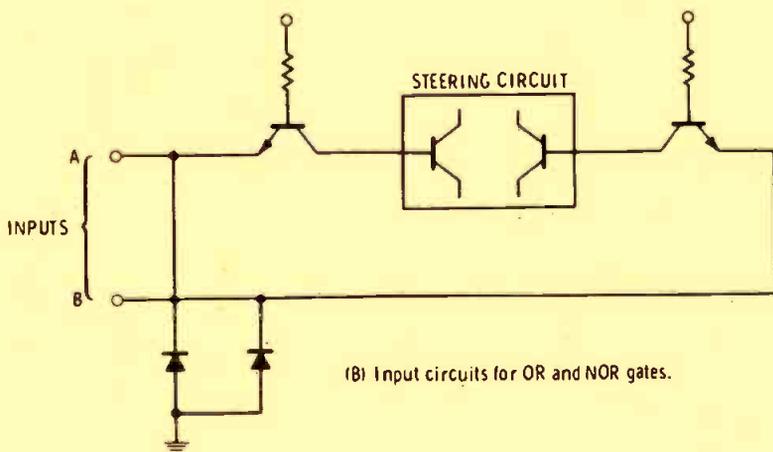


The SN7400 NAND gate. The circle on the output of each gate signifies inversion of signal.

Figure 6



(A) Pin connections and block diagram of NOR operation.



(B) Input circuits for OR and NOR gates.

Pin connections, functional diagram and input circuits for SN7402 NOR gate.

Figure 7

now have a LOW on the output pin. Now measure pin 4, which is the input to the next gate. You will have about +1.6 volts. Run a jumper to connect pin 3 and pin 4. Pin 4 now drops to the 0 of pin 3. What is happening?

Pin 3 is now **sinking** the current from pin 4. (Typically 1 to 2 ma.) When pin 3 supplies a "1" (about +4 volts), it must **supply** a current of between 30 and 80 microamperes (typical). The number of gates an output can supply is called the **fan-out** capability of the gate. This "supply" considers both the capability to sink current from the driven gates and the ability to supply currents to the gates. For the 7400-series, typical fanout is a maximum of 10.

Operator NOR

We will skip the OR gate and go to the more popular NOR gate (SN 7402) of Figure 7A. Note carefully that the input and output pins are NOT the same as before. For gate 1, pins 2 and 3 are inputs, and pin 1 is the output. Figure 7B shows the internal schematic of the input circuit. Observe that the inputs, instead of to a dual-emitter transistor, are completely isolated by running to separate transistor emitters.

Repeat steps 1 to 6, being careful to substitute pin 2 for pin 1, pin 3 for pin 2, and pin 1 for pin 3. Get used to this procedure in your experimental work.

Observe that in the step involving changing one input pin from +5 to ground, the opposite input pin does not change value because of the isolation of inputs. Also observe that an open pin is interpreted as a HIGH level. You will get a HIGH output **only** when both inputs are 0, which is just the inverse of that if the straight OR gate was used. For example in step 4, with the clock on pin 2 and pin 3 open, output is 0. Thus, again, open pins are interpreted as a HIGH level.

You can double-check the opposite characteristic to the OR gate by using your SN 7432 OR chip. But note from your specification sheet that input and output pins are now the same as the AND and NAND gates; pins 1 and 2 are inputs, pin 3 is the output.

Figure 8 will aid in your understanding of the results from step 6 for the NOR operation. The clock

Continued on page 58

Digital Lab

Continued from page 57

waveform is on input pin 2, and the divided clock waveform on pin 3.

Prior to t_1 , the divided clock waveform is HIGH, so no output can occur. This agrees with the truth table. At t_1 , both inputs are LOW (ground) so the output (pin 1) goes HIGH. At t_2 , the clock input (pin 2) goes HIGH, so the output goes LOW (falls from +4 to ground). At t_3 , both inputs are again LOW, so the output switches from ground to HIGH. If you visualize DC operation (ground to positive and back to ground) on the inputs, you will understand dynamic (waveform) operation of logic gates. You should also note that the clock waveform is inverted by the NOR logic.

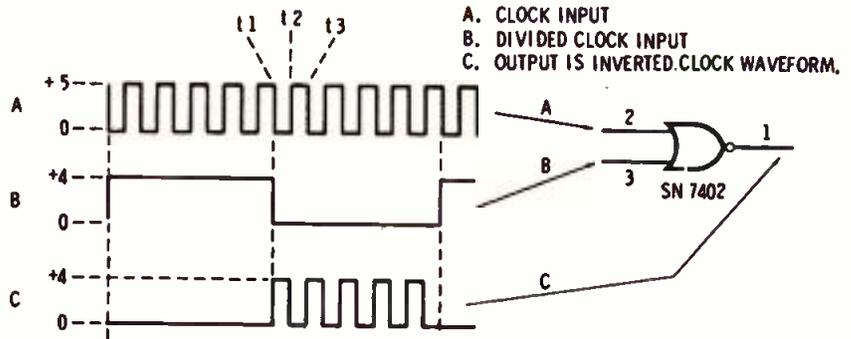


Figure 8

The Exclusive OR

Figure 9 shows you the pin numbers and block diagram for the 7486 Exclusive OR gate. Note from the truth table of the exclusive OR that inputs must be of opposite polarity to obtain an output. Plug this into your board and connect the +5 to pin 14 and ground to pin 7, as with the other logic gates. Note that inputs and outputs are identical to the AND and NAND gates; inputs on pins 1 and 2, and output on pin 3.

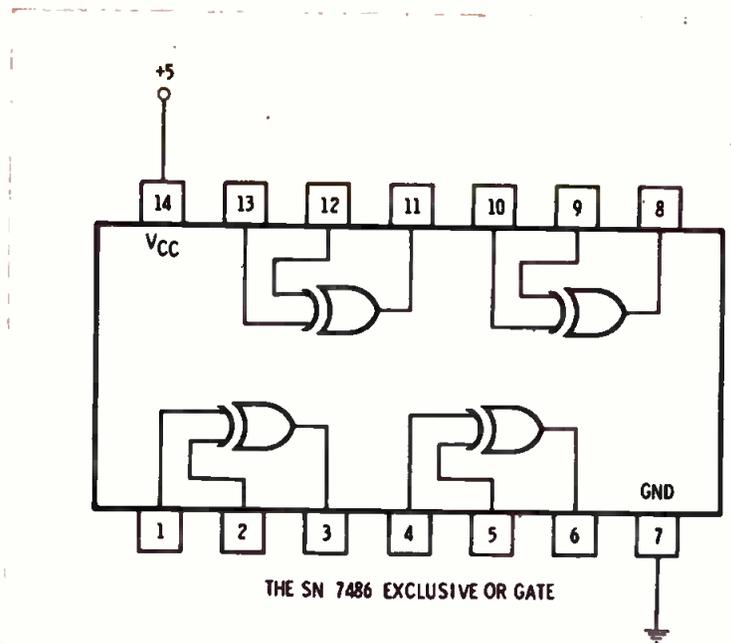
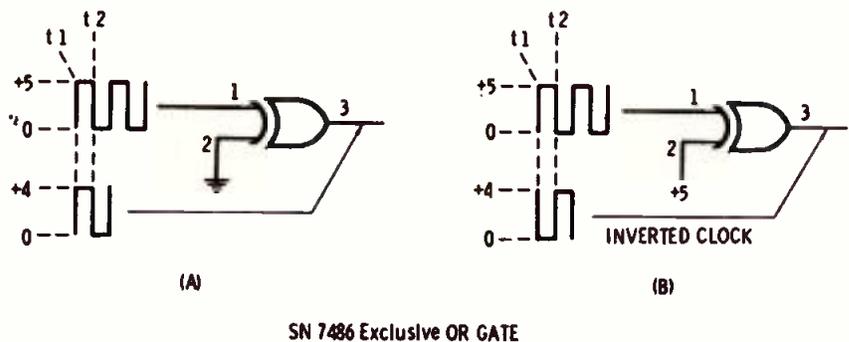


Figure 9

Figure 10

STEP 7. Feed the clock to pin 1, and ground pin 2. Opposite polarity inputs cause a HIGH at the output. Study Figure 10A. At t_1 , pin 1 is HIGH (clock) and pin 2 is ground or LOW. So, according to the truth table, you have a HIGH output. At t_2 , the clock (pin 1) goes to ground (LOW), and both inputs are LOW. So the output falls from +5 to ground (LOW). This process is repeated for the train of pulses, and you have a non-inverted clock pulse output.



SN 7486 Exclusive OR GATE

STEP 8. Now apply +5 to pin 2. (Figure 10B.) Prior to t_1 , the clock is LOW, making the inputs of opposite polarity, so the output must be HIGH. At t_1 , the clock goes HIGH, making like polarities on the inputs, so the output must go HIGH. So now you have an inverted clock pulse at the output. Repeat this step with pin 2 open. Note that you have exactly the same

result; an open is interpreted as a HIGH level on that pin.

Why DC Analysis?

You should observe the reason why we have stressed DC analysis in the early part of this series; it is the best way for you to visualize dynamic (waveform) operation of the logic gate. In every case, it is

important to remember that the waveform is just a switch between ground (0) and +4 or +5 (1). Then if you know the truth table, or can review the truth table, you will be able to derive the waveform output for any given input(s).

In the concluding part of this series, we will "tie it all together" in troubleshooting a logic system. □

**From
BLUE
BANANAS
to
SAG TAILS**

Some years back when the first wave of \$29.95 battery operated tape recorders hit the market, a well known San Francisco disc jockey stuffed one into the bottom of the announce booth waste basket with a few prerecorded messages for the newsmen who used the booth for the hourly news.

The newsmen was about a minute into the cast when this tiny voice, just loud enough for him to hear, started saying things like:

"Help! Help! Get me out of here! Help! etc."

The messages from the trapped pixie were spaced at intervals not unlike those used in water torture. The disc jockey swept up the newsmen, put him in a bowl with some whipped cream and had him for dessert.

Roy H. Trumbull
Laney College, Oakland

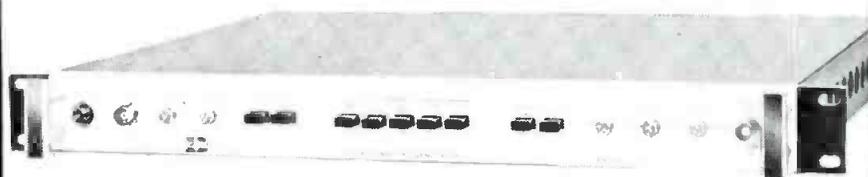
I recall our news director at channel six in Greenwood, Mississippi in 1973 (the year the studio was underwater from excessive rain, and employees were shuttled to and from work by boat) always saved a tidbit of wire news for the closing of the six o'clock block, followed by a comment. As he read toward the end of the story, "if this rain continues in the Mississippi Delta (strong with cotton and soybeans) farmers will have to go to milo (a water-loving grain)." Our director's closing comment was, "and I hope it's not raining in Milo, Mississippi".....Fade to blue.....

Jim Juneau, ET
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THE BETTER WAY

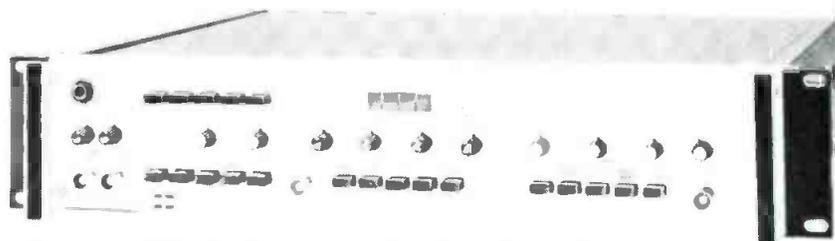
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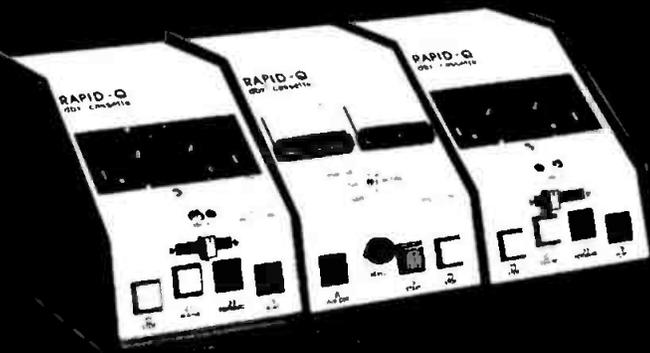
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PEOPLE IN THE NEWS

Mort Fujii has been elected president of Cetec Audio, a division of the Cetec Corp. Fujii joined the company two years ago as vice-president and general manager and has had a 25-year administrative and engineering career in the sound and tape industry starting with RCA, then moving to Ampex, Bell Sound Studios and Electro Sound.

Phil Stack is the new assistant vice-president and national sales manager for the video products division for the Sony Corp. of America....**Robert N. Blair** joins Hitachi Denshi America, Ltd. as the national marketing manager.

James K. Young steps into the position of regional sales manager for Telemet's western division. Young will be responsible for all sales activities of television broadcast, non-broadcast and telephone communications.

John Quinn is the new sales manager for the Devon, Pa. firm of Belar Electronics Laboratory, Inc....**Donald D. Depinto's** appointment as western regional manager for sales, service and warehousing has been announced by the GBC CCTV Corp.

Constantine A. "Gus" Spyrou is the new manager of engineering development for the CCA Electronics Corp. Prior to this appointment, Spyrou was the manager of the broadcast division of AEL and is presently succeeded by **Lloyd A. Proctor**....**Richard J. Reilly**, former regional sales manager for IVC, joins United Media in television equipment sales and marketing.

Robert Henson, formerly with the International Video Corp., is the new eastern regional manager for Eigen Video....**Fred Bergstrasser's** appointment as vice-president of marketing was announced by Sound Systems, Inc. His major emphasis will be in the expansion of video systems....**Sharp Electronics Corp.** announces the appointment of **Larry Musen** as sales promotion manager of the Consumer Products Division.

Rolla D. Cleaver moves to general sales manager of KORK-TV, replacing **Rick Richardson** who was appointed vice-president and general manager of their AM and FM stations....**Kops-Monahan Communications** announced the appointment of **Thomas G. Osenkowsky** as chief engineer of WAVZ/WKCI.

Larry W. Ocker advanced from chief engineer to director of engineering for WTTW-TV....and **Kathy Wold** has moved from news anchorwoman to assistant news director of KRNA.

KATA announces the appointment of **Edward Lapple** as chief engineer....Former football coach **Jack Ellis** has joined the staff of WEAW as station manager....**Lynn Willoughby** joins WNOE-AM/FM as chief engineer.

Norman W. Ealy's promotion to assistant chief engineer was announced by WPTV-TV. Ealy will be assisting **Ed Roos** in his job as chief engineer as Roos

replaced **Law Evenden**, former director of engineering, who retired in February.

Systems Resources Corporation, the manufacturing subsidiary of **CHYRON Corporation**, appointed **Joseph L. Scheuer** as president.

John Iselin, president of **WNET/Channel 13**, has announced the selection of **Mal Albaum** as director of engineering and operations...**D. Thomas Smith III** joins the engineering staff at **WGHP-TV8**, High Point, North Carolina.

FCC Reviews TV Tech Plans

The FCC's Office of Chief Engineer has announced the limited availability of a report entitled "A Review of Technical Planning Factors for VHF Television Service" by **Gary S. Kalagian**.

As a result of issues raised in Docket 20418 (VHF-TV Drop-ins), the Commission said a review of the planning factors for determining coverage areas, interference criteria and minimum separation requirements of adjacent and co-channel VHF-TV stations was deemed desirable.

The purpose of this report is twofold:

(1) To make available in one document the values, definitions, explanations and sources of the original planning factors. An extensive bibliography is included for those who might wish more detailed explanations of specific factors.

(2) To identify values that should be updated because of technological advancements (i.e., receiver noise figures), re-evaluation of physical phenomena (i.e., new propagation curves), changes in environmental factors (i.e., higher man-made noise levels) or changes in the Commission's policies.

While new values are proposed for several of the planning factors, no evaluation is presented concerning the effect these changes may have on the predicted coverage range and minimum separation requirements of TV stations. Before these changes are considered, the FCC said, all of the proposed new values should be discussed further and more information should be collected. In addition, it is recognized that public policy considerations beyond the scope of this report must play an important role in this determination.

The report is available by sending a self-addressed label to Research & Standards Division, Room 7202, Federal Communications Commission, Washington, D.C. 20554.

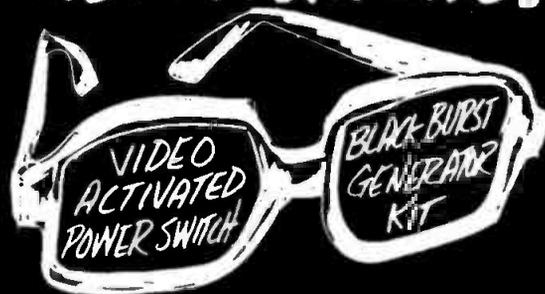
FCC Stays Terrain Rules

The Commission has stayed until further order the effectiveness of its rules providing for the use of terrain roughness factors in predicting FM and television broadcast station field strength contours. The rules were to have become effective May 1.

On May 29, 1975, the Commission adopted rules making certain changes in the methods of predicting FM and TV station field strength contours. These

Continued on page 62

LOOK, at what's NEW from VACC



TRULY, TWO UNCOMMON VALUES IN VIDEO EQUIPMENT

FROM VIDEO AIDS CORPORATION OF COLORADO

Video Aids Corporation of Colorado's Model VPS-1 Video Power Switch. Reduces color monitor maintenance, electrical energy consumption, and viewer distractions when no video is applied to a color monitor. The Power Switch turns monitors or other devices on and off automatically by sensing the horizontal sync of a composite video signal.

Ideal for race tracks, universities, airports and other locations where monitors are located or mounted in high inaccessible locations, the Video Switch eliminates the need for special ac or dc control lines or the use of tall ladders to turn the monitors on and off. Turn-on time is 0.5 seconds with a 1 volt plus 3db minus 6db video input. Turn-off time is 12 seconds minimum. The video monitor will not turn off when color black is present and the Power Switch is immune from most radiated or superimposed ac noise. Cost of the easy to install Video Power Switch is \$95.00 list.

Video Aids Corporation of Colorado (VACC) Model BBG-1 black burst generator kit provides easy addition of black-burst to any NTSC color sync generator for driving new color cameras and for users of video switchers who desire to fade to color black. Only eight wires connected to the sync generator's outputs and +5 volt power supply makes electrical connection fast and easy to do. The generator kit is self-contained on one small printed circuit board for easy mechanical installation. Typical installation time by a video technician or engineer is less than 30 minutes. Cost is \$89.00 list.

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Terrain Rules

Continued from page 61

rule changes included revised charts for use in predicting the location of pertinent contours, procedures for conducting field strength measurements as a substitute for use of the prediction method and procedures for using terrain roughness corrections to refine the results obtained from use of the charts alone.

On October 30, 1975, the Commission deferred use of terrain roughness corrections in filings by FM and TV stations May 1, 1976, finding there was a need to develop methods of dealing with atypical terrain configurations. Last April 27 the FCC extended the compliance date to May 1, 1977.

In issuing its indefinite stay, the Commission said that while its study of ways to deal with atypical terrain configurations and develop appropriate procedures for using the sound concepts on which terrain roughness corrections are based was essentially complete, the results of that study lead to the conclusion that a further rulemaking proceeding would be required.

Considering the amount of time needed to complete this rulemaking proceeding, a further stay of the effectiveness of the rule sections was necessary. The Commission noted that during this period of the additional stay, the situation will remain as it was during the preceding stay—predicted contours will be calculated using the new curves but without regard to terrain roughness.

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BROADCAST ENGINEERING

ENG Delay Device Needed

Robert Flanders, Vice President of Engineering for McGraw-Hill Broadcasting Company and Chairman of the NAB Engineering Advisory Committee, has called on broadcast equipment manufacturers to develop a 10-second delay device for television electronic news gathering equipment.

"Now that so many stations are frequently going 'live' with the ENG gear, it's important that we develop the electronic capability for delaying the broadcast," Flanders said.

His concern for the lack of such equipment grew out of WRTV's "live" coverage in Indianapolis of a gunman who held a hostage for several hours with a shotgun wired to both the victim's neck and the gunman's trigger finger. The gunman demanded, and got, "live" television coverage of the event from WRTV, a McGraw-Hill Broadcasting Company station.

"Radio has the capacity to delay broadcasts and so does television, if we had the time to rig a series of pulleys from one videotape machine to another," Flanders said. "But too often with 'live' news broadcasts there isn't time to make mechanical alterations to the equipment. Equipment manufacturers need to find some method for doing this electronically."

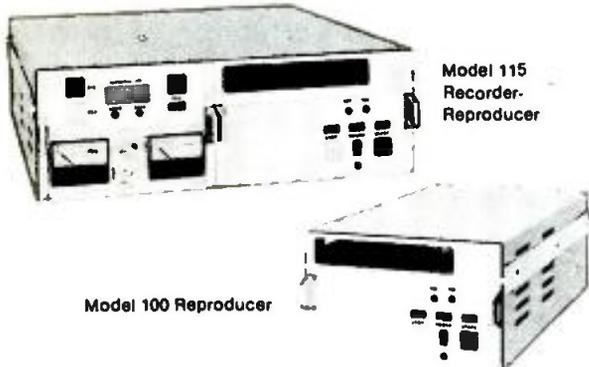
"That's why the development of this equipment is so important," Flanders said. For further information, contact Robert P. Rimes, (714) 262-2421.

Continued on page 64

Straight talk from AUDI-CORD

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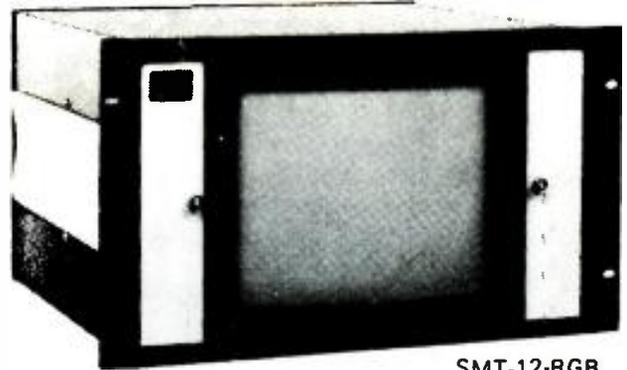
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**NAB, CPB Study
 All-Channel Radio**

The Executive Committee of the National Association of Broadcasters has agreed that NAB will join the Corporation for Public Broadcasting in a study to determine the cost differential between AM and AM/FM automobile radios.

The study will be conducted by Booz-Allen Applied Research.

Both CPB and NAB support legislative efforts to require that all automobiles be equipped with AM/FM receivers and the study will:

- Determine the basis for the present cost differential between AM and AM/FM automobile radios.
- Identify the potential areas for cost reduction by combining common functions and evaluating manufacturing techniques.
- Determine the feasibility of a "single-chip" integrated circuit AM/FM automobile radio.

**Car Radio Prices
 Are Under Fire**

Chairman John Breckinridge (D-Kentucky) has indicated his intention to hold hearings before the Small Business Subcommittee on Antitrust and Restraint of Trade Activities to investigate complaints over the pricing of automobile radios.

The pricing structure has been the subject of complaints by broadcasters as well as small manufacturers of after-market radios for automobiles.

The Subcommittee will announce hearing dates shortly after the Congressional recess.

Chairman Breckinridge intends to look at all facets of the parallel pricing (on a 1-2-3-4 ratio for AM-FM-stereo-tape players) by all three major auto manufacturers to determine what if any relationship exists between cost of manufacture and retail price.

Prior hearings in the 93rd Congress revealed these questionable pricing practices. Since that time the Justice Department and the Federal Trade Commission have looked into the matter but taken no action.

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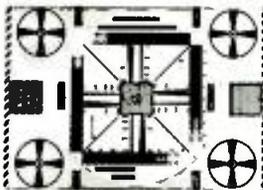
All test slides are mounted in optical glass and are electronically accurate to ± 1% of vertical and horizontal tolerances. Test patterns include:

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jects New Officers, arnizes Its Structure

Two major organizational changes were put into effect during the annual election of officers held by the Board of Directors of the Association of Maximum Service Telecasters, Inc., at the Washington Hilton Hotel, Washington, D.C.

To modernize the Association's structure and operations, the titles of the officers were changed and the dues structure modified in accordance with amendments to the Bylaws adopted at the annual membership meeting held in Washington, March 27, 1977.

The MST President's title was changed to Chairman of the Board, the Vice Presidents' title to Vice Chairman, and the Executive Director's title to President.

The decision to modify the dues structure was based on studies made over a period of several years by the MST Dues Committee and recommendations of the outgoing Board of Directors which had been outlined at the annual membership meeting. The change takes effect October 1, 1977.

In addition, the following officers were elected:

Chairman of the Board—Franklin C. Snyder, The Hearst Corporation, Pittsburgh, Pennsylvania.

First Vice Chairman—Wallace J. Jorgenson, Jefferson-Pilot Broadcasting Company, Charlotte, North Carolina.

Second Vice Chairman—Robert F. Wright, WTOK-TV, Meridian, Mississippi.

President—Lester W. Lindow, AMST, Washington, D.C.

Secretary-Treasurer—Ralph S. Jackson, Orion Broadcasting, Inc., Louisville, Kentucky.

Vice President—Roy W. Easley, AMST, Washington, D.C.

Vice President—Lee C. Hanson, AMST, Washington, D.C.

June, 1977

Perfect Timing



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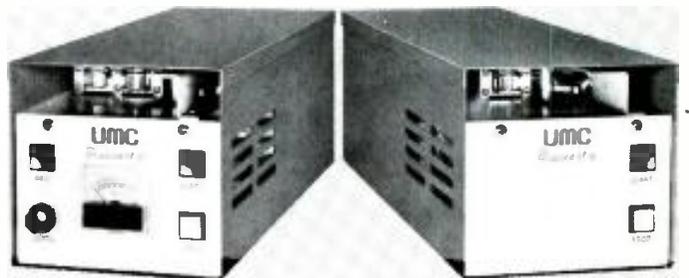
ES-172 12 Hour Clock	\$125.
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ES-572 12 Hour Clock/Timer	\$150.
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65

Zoom In!

This is the official column of the American Society of TV Cameramen (ASTVC). The ASTVC can be contacted by writing to: P.O. Box 296, Sparkill, NY 10976. (914) 359-5895.

Take 1!...Letters to the Editor

From time to time, letters come addressed to the ASTVC Editor asking questions relevant to the aims and goals of the Society and questions regarding membership requirements. The following represent questions of general in-

terest and are published herein for the reader who may be contemplating membership.

"Dear Editor: I have just come across a copy of **Broadcast Engineering** and was interested in reading about the ASTVC in Zoom In. Are you a guild or union? Please

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Dear

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BT." **Dear**

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"Dear Editor: I have

about your organization

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accept students? (Ms.) **GLG."** **Dear**

(Ms.) **GLG:** Your instructor was

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category open to young people en-

rolled in the TV courses at any

University, college, or tech school.

"Dear Editor: I am currently em-

ployed as a program director. I

wonder if I might qualify for

membership. I am a former camera-

man, and in the past have qualified

for an **EMMY** for my camera work.

Sincerely, **JBS."** **Dear**

JBS: You would be welcome, indeed!

The category that you might apply for is

Affiliate. Affiliates are those

persons who have qualified as

regular members by virtue of their

job experience, and have then gone

on to some related area of TV

production.

"Dear Editor: I have been read-

ing about Honorary membership in

the ASTVC. Just who does that

category apply to? Sincerely,

HVH." **Dear**

HVH: To name a few,

Harry Reasoner, Walter Cronkite,

Tom Snyder and John Chancellor

have been nominated in the past

for Honorary membership in the

ASTVC. The award is made to

performers, public officials (ie:

legislators), research engineers and

all others who have contributed

directly to the growth and develop-

ment of the TV industry. At this

time, there are several being con-

sidered for nomination from the

areas mentioned. The membership

Nobody has it like the new Spotmaster 3000 Series



Model 3100 Slim Line — the space saver for A size cartridges. Available in mono and stereo playback.



Model 3200 Compact — for A and B cartridges. Available in mono and stereo, record/playback and playback only.



Model 3300 Standard — for A, B and C cartridges. Available in mono and stereo, record/playback and playback only.

A new family of professional cart machines with all the standard features: large air-damped solenoid, a direct drive synchronous motor, and a rugged machined deck.

PLUS the Spotmaster exclusives: Phase Lok III head bracket for optimum stereo phasing; a superior, up-to-date, modular electronic package; a unique cartridge guidance system; and a full range of options including manual/automatic fast forward, additional cue tones and microphone input. Available in desk top or rack mounting.

For details call or write Broadcast Electronics, 8810 Brookville Road, Silver Spring, Maryland 20910. Telephone: 301/587-1800.

BROADCAST ELECTRONICS, INC.
A FILMWAYS COMPANY



For More Details Circle (54) on Reply Card

Accurate Field Strength Measurements Can Be Easy

With the Model FIM-21, electromagnetic field strengths can be measured to within 2% across the entire 535 to 1605 KHz AM band. And to intensity levels as low as 10 $\mu\text{V}/\text{m}$. Its integral shielded antenna in the cover, front panel speaker, large illuminated mirrored meter, and ganged oscillator/receiver tuning, make it easy to operate in the field. An optional telescoping stand adds convenience. It's also a versatile instrument — use it as a tuned voltmeter for RF bridge measurements.

Contact us now for complete details on our line of field strength meters.



POTOMAC INSTRUMENTS

932 PHILADELPHIA AVE.
SILVER SPRING, MARYLAND 20910 (301) 589-2662

For More Details Circle (57) on Reply Card

AK: Here is how it works. As you possibly know, the ASTVC is fortunate in having Corporate Sponsor members such as Canon, Sony, IVC, Ampex, CDC, etc., etc., etc.... We forward all requests for seminars (or any other training material) to our respective liaison contacts with each of these organizations. Should the requesting ASTVC Members be located in an area which might be within the zone of our Sponsor Member's Regional Rep, a seminar or other training activity can be planned. Keep these points in mind. First, there should be a reasonable minimum number of members and their guests to justify any request. Secondly, if one of our Sponsors has no facilities or regional rep in any given area, an alternate seminar might be substituted by any one of the other Sponsor members.

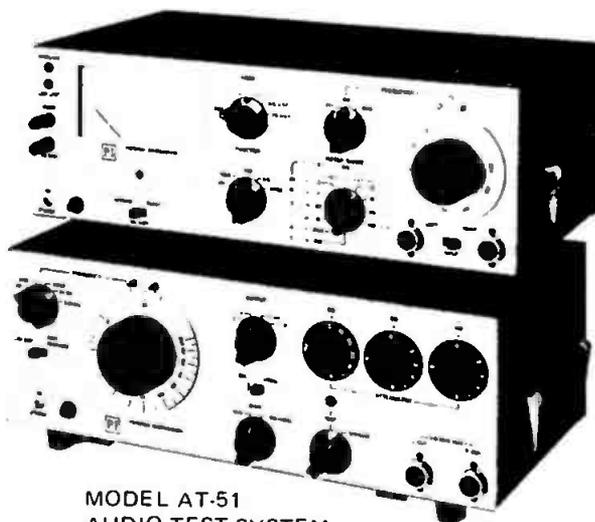
There are many fine organizations, such as the 3M Company, who, while not a Sponsor member at the present time, still participates in the presentation of seminars. We are lucky to have the cooperation and support of these leaders in the industry!

is encouraged to make known their selections for nomination.

"Dear Editor: I have read about the possible affiliation between the ASTVC and the British Guild of TV Cameramen. If I join your outfit, do I automatically become a member of the British Guild? Sincerely, OBE." **Dear OBE:** At the present time, no affiliation or International Federation is an accomplished fact. When the affiliation does take place, and we hope that will be soon, you would be a member of the entire federation composed of whatever number of countries are in at that time. You would not be a member of the British Guild (or any other foreign association) unless you specifically applied for membership in that organization.

"Dear Editor: I know that the ASTVC holds (or plans) seminars from time to time. Are these only in the large metropolitan areas such as New York, Chicago, LA, etc., etc.... Or can we plan on having some while working and living in some remote area? Just how does that work? Sincerely, AK." **Dear**

The AUTOMATIC Audio Test System That Measures...



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AUDIO TEST SYSTEM

- Harmonic Distortion
- Intermodulation Distortion
- Volts
- dB
- Signal + Noise / Noise Ratio
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- Stereo Phasing
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For More Details Circle (56) on Reply Card

First Open Message From SBE's New President

When I realized a few months ago that I might become President of the SBE, I began to think long and seriously about the Society, its mission, and its goals. Now that I have indeed been elected, I feel it is

my responsibility to let you know my philosophy and thoughts regarding SBE and its future.

The SBE is the only organization which undertakes to serve the needs and interests of all broadcast

engineers. This applies equally to engineers engaged in AM, FM, or TV broadcasting, commercial or educational, in large or small markets, and to engineers in broadcast-related activities, such as consulting engineers or those engaged in the design, manufacture, and sales of broadcast equipment. Since the SBE is the only society which serves the whole broadcast engineering profession, we are truly distinctive.

The SBE seems to be most effective in areas where active, well organized Chapters exist. The monthly meetings and programs of these Chapters can be not only stimulating but also helpful in keeping engineers abreast of the state of the art and increasing their general knowledge of what is going on, both in their local areas and in the industry in general. They also afford excellent opportunities for fellowship with other broadcast engineers. I believe that one of the primary functions of the National SBE and its officers should be to provide guidance, coordination, and support for our Chapters.

To this end, I would like to make one of my primary goals—and one of the SBE's primary goals—the stimulation and encouragement of local Chapter formation. The National office will provide as much information and support as it can to any group of broadcast engineers desiring to form a Chapter. All it takes is a call or letter to Vince Flanders in Indianapolis, at (317) 842-0836 or at the above address.

For those members located in the more remote areas, and those who find it difficult to attend Chapter meetings, we propose to expand our efforts to provide timely articles and information in *The Signal*. It is important to us that SBE members be kept informed about developments and news of our industry and profession.

Whether through local Chapter meetings or our national newsletter, the SBE pledges to do everything we can to advance the professionalism of the broadcast engineering fraternity.

Robert B. Wehrman
President, SBE

NORTRONICS preferred replacements for 1,753 heads.



**If that's
not enough...
we're the industry leader!**

Actually, our wide range is only part of the story. Because for many people, local availability is even more important. That's why we have a nationwide network of local distributors. So you can get your replacement head when you need it . . . now! Of course, you demand quality, too. So we have the most rigid quality control program in the industry. When you install a Nortronics replacement head you can count on it working. For more information, contact your local Nortronics Head distributor.

Recorder Care Division



NORTRONICS

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Telephone (612) 545-0401, Telex 290304

For More Details Circle (55) on Reply Card

Chapter 1—Big
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introduc-
Analyzer/
Hardware
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Campus. Tom McCarthy of North Star Sound demonstrated the Hewlett-Packard calculator with accessory optional memory, read-only memory and math read-only memory. This calculator, model 9821, has many applications that could benefit the broadcast engineer.

meeting was held at the Northway Inn in Syracuse on April 21st. "Electronic Video Editing" was the subject of this month's program. Tony Fiori, president of Spectra-Vision Corp., explained the intricacies of backspace editing and demonstrated by using the latest model editors produced by his firm. A unique feature of Spectra-Vision editors is that it doesn't use control
Continued on page 70

Chapter 22—Central New York
The Central New York chapter

meeting of Chap- at KSCB, Kansas City, Manhattan. Del engineer of KSCB, con- a tour of the Kansas State ersity radio facilities. Rea Bow- an, broadcast consultant, pre- sented a program on the "Theory, History and Maintenance of AM Directional Antenna Systems." This program was the second in a series covering broadcast antennas.

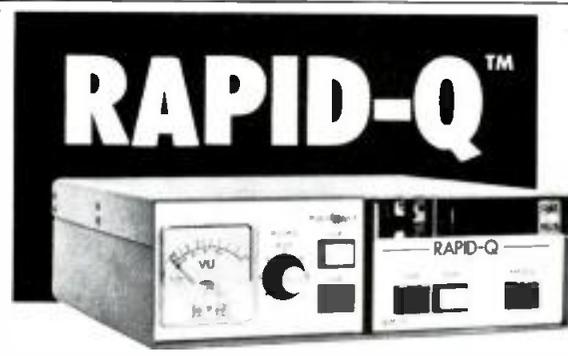
Chapter 16—Seattle, Washington

Chapter 16 met on April 13th at the Swedish Club. Bob Dietsch, FCC, reported on some AM radio rulings and typical violations. Stu James, Pacific NW Bell, reported on local Bell Telephone marketing personnel changes. Jack Shawcraft, KING-TV/AM/FM, recapped NAB Washington D.C. Convention activities and equipment displays. He reported an intense interest by broadcasters in one-inch videotape recorders.

Chapter 17—Minneapolis/St. Paul, Minnesota

The March meeting of Chapter 17 was held on March 16th. Ed Fitzgerald, broadcast sales product manager for Telex Corporation, gave a brief talk about the company, and then turned the proceedings over to Mike Aronoff, project engineer for Telex. Aronoff gave a presentation on the MC Series broadcast cart machine. Afterwards, Fitzgerald discussed some of the other projects currently underway at Telex, and then led us on a tour of the Telex facilities.

The April 20th meeting was held at the Department of Media Resources, U of M West Bank



**SPACE-SAVING
CARTRIDGE
TAPE
EQUIPMENT**

Automatic super-fast forward
Exceeds NAB standards
IEC and CCIR standards available

Record, playback; mono, stereo.
Custom 3000 Series: for "A" carts.
RQ-71 Series: for "A", "B" and "C" carts.

EDCO PRODUCTS, INC., 680 Bizzel Drive, Lexington, Kentucky 40504

For More Details Circle (59) on Reply Card

Electric Rain Gauge

Model 525

Now you can report minute-by-minute rainfall amounts and not get wet! This new, low cost, remote-reading gauge shows announcer rainfall accumulations in 1/100 inch increments. Transmitter can be located several hundred feet away and is completely automatic—needs no service or attention. Ask for Spec. Sheet, Model 525. Free.

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For More Details Circle (68) on Reply Card

**When accuracy Counts... Count on Belar
for AM/FM/TV MONITORS**



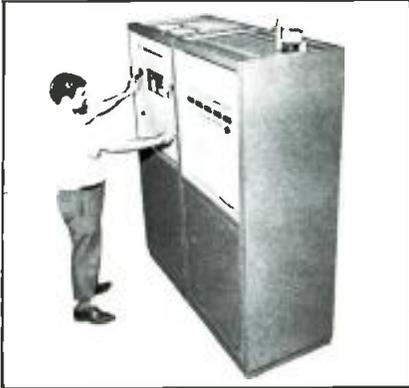
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For More Details Circle (66) on Reply Card

QUALITY TALKS FOR CKPT

Peterborough Ont



Continental's new 5/10 kW AM transmitter is setting records for acceptance. It has performance and efficiency, with the cleanest sound around. Listen to Continental: quality talks.

Write for brochure Continental Electronics
Mfg Co Box 270879 Dallas Texas 75227
(214) 381-7161

Continental
Electronics

For More Details Circle (71) on Reply Card

Continued from page 69

track for timing. In addition, a report of the national SBE meeting was given. For further information about the September 30th SBE regional convention at Syracuse, contact Charlie Mulvey, WNYS-TV, 315/446-4780.

Chapter 24—Madison, Wisconsin

The Madison chapter of SBE met Thursday, March 31st, at WISM Radio. Their program was a tour of WISM's facilities and a look at their new D.B.X. system. An overview of the 1977 NAB convention was presented by several members.

Chapter 33—Southwestern Ohio

The April 12th meeting of Chapter 33 was held at the Holiday Inn North with a presentation by Lee Marvin, vice-president of marketing for Television Research International (TRI). The subjects covered were inherent problems in NTSC video recording and Trichroma-U and a new concept in video recording for 3/4-inch VTRs. Midwest Corporation's Tele-Com-

munications L equipment ex electronic news, tronic field produ

Chapter 37—Washington Maryland-Virginia

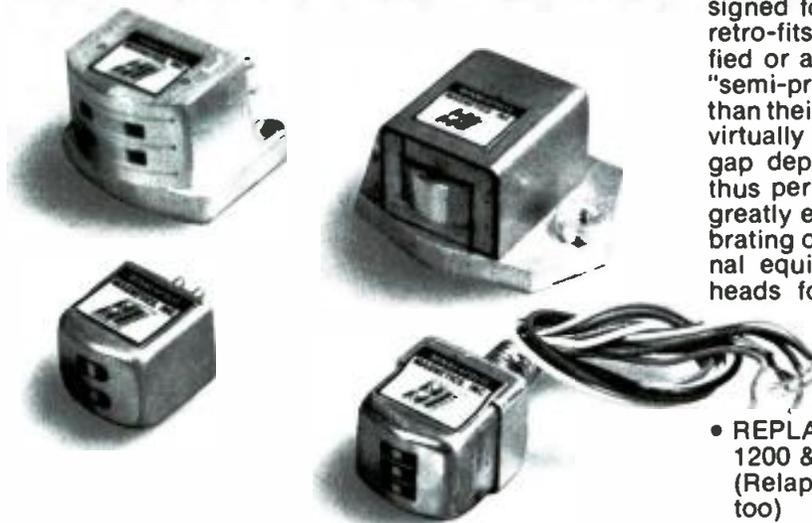
The March meeting, 37 was held at the Sho during NAB and we we to have some out-of-t members attend this meet. Onnigian of Jampro Ant gave a presentation on c polarization.

Our April 27th meeting at Broadcasting Service, Washing D.C. featured Dave Harry of Potomac Instruments. Harry spoke of Potomac's new audio test set, consisting of a new precision-controlled oscillator and an amazing distortion analyzer. He covered proof of performance measurements, inter-modulation distortion, wow and flutter and phase difference measurements. A closed-circuit transmitter was provided for actual proof measurements of a working FM station.

MINNEAPOLIS
MAGNETICS, INC.



-SYMBOL OF PROFESSIONAL TAPE HEADS



MMI Replacement Heads are professional heads — designed for the machines they will be used with — direct retro-fits, both mechanically and electrically — not modified or adapted heads originally intended for "home" or "semi-pro" recorders. But there is more to MMI Heads than their professional performance: An all-metal face that virtually eliminates oxide loading ... More than twice the gap depth-of-metal of some original equipment heads, thus permitting relapping (under normal head wear) for greatly extended head life ... Individual testing and calibrating of each head to insure meeting or exceeding original equipment specifications ... MMI has 1/4-inch tape heads for Ampex, ITC, Magnequad, Revox A-77, and Scully. Professional heads for professional recorders — from MMI.

ALSO FROM MMI
(PROFESSIONALLY, OF COURSE) ...

- REPLACEMENT AUDIO HEADS FOR AMPEX VR-1100, 1200 & 2000 VIDEO RECORDERS (Relapping and refinishing of the complete columns, too)
- HEAD ASSEMBLY REFURBISHMENT AND REBUILDING (Loaner Assemblies available for only the shipping costs)
- HEAD RELAPPING AND REFINISHING (No-Charge head evaluation)

NEW! MMI HAS HEADS FOR CART MACHINES!

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8125 PLEASANT AVE SO MINNEAPOLIS, MINN 55420

(612) 884-7393

For More Details Circle (58) on Reply Card

NEW PRODUCTS

Amplitude Modulation Controller

Delta Electronics, Inc., has announced the availability of their Model AMC-1 Amplitude Modulation Controller which provides automatic control of the modulation levels of an AM broadcast transmitter.

The AMC-1 provides a closed loop system around the transmitter which allows the broadcast engineer to maintain modulation at the desired level despite variations in the audio level between different program sources and variations in transmitter characteristics and supply voltages that are beyond the control of conventional audio processing equipment.

This controller features:

- Automatically controls the modulation level of an AM transmitter to prevent excessive or undesirably low modulation.

- RF sample voltage from Delta's TCT series of current transformers or from modulation monitor output of transmitter. Provision for selecting up to three signal sources.

- Interfaces audio signal with 600 ohm balanced input and output circuits.

- Provides up to plus or minus 8 dB adjustment to audio level.

- Front panel meter indicates audio operating gain of system and RF carrier level.

- Four one-digit counters with overflow indicators separately display positive and negative over modulation peaks for present and previous one-minute count period.

- Recessed front panel controls provide adjustment of seven modulation control levels and the increment and decrement rates for audio level variation.

For More Details Circle (110) on Reply Card

Continued on page 72

TRANSMITTING TUBES
EIMAC RCA EEV
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Guaranteed Lowest Prices

Factory-Fresh New Tubes.

Guaranteed Fastest Deliveries

All Tubes in Stock.
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Ask for complete details on our Exclusive Price Insurance Policy.

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220 East 23rd Street
New York, NY 10010

For More Details Circle (61) on Reply Card

NEW INTELLIGENT VTR

"Installing R-MOD is like a college education for your old VTR"

Now available for
VR-1200, VR-2000 and AVR-2



Also available for
TR-22, TR-70 and TR-600



The R-MOD (Reel-Servo Modification) makes your quad VTR handle tape with intelligence. R-MOD provides gentle tape handling, fast lock-up and fully automated operation including end-of-tape sensing. It provides all the desirable transport features

offered by the latest, higher priced VTRs. If the cost and variety of new VTRs is causing you to postpone a decision, yet you wish to have up-to-date quads, R-MOD is an economical investment that will pay off rapidly and at the same time extend the use-

ful life of your old VTRs. Before you submit a budget to equip your operation with the new VTRs, consider R-MOD as an alternative. It may give those quads enough intelligence to be worth keeping. Call or write for details.

RECORTEC, INC. 777 PALOMAR AVE., SUNNYVALE, CA 94086 TEL: (408) 735-8821 TELEX: 910 339 9367

For More Details Circle (60) on Reply Card

New Products

Continued from page 71

Rack-Mount Color Monitor

World Video is introducing the CR6220 12-inch professional rack-mount color monitor as the latest in a long line of color video monitors. The CR6220 is designed for those installations where a high quality display is needed without automatic circuitry to artificially effect the display, as is often found with the converted home receiver, CCTV

type color monitors on the market.

The CR6220 features pulse-cross, pre-set controls, underscan, keyed back porch clamp, high voltage regulation, modular construction and front panel controls for full color set-up are but a few of the features found on this reasonably priced color monitor.

The CR6220 carries a full one year warranty and is also available in a cabinet version at no extra charge. A high resolution RGB model is also available.

For More Details Circle (111) on Reply Card

Solid-State 1 kW AM

The new solid state Cetec Sparta AM transmitters now in production have undergone severe and prolonged testing.

The SS1000A 1 kW model's sensitivity to load variations is no greater than conventional tube transmitters. An optimized audio system produces less than 1 percent harmonic distortion. Its two digital meters have identical capabilities, so that one can be switched to substitute for the other, meeting the FCC 'spare meter' rule for digitals.

RF systems are better than 90 percent efficient. The 125 percent modulation produced by the SS1000A is a result of circuitry so advanced that some of it is being patented.

For More Details Circle (112) on Reply Card

Replaceable Audio Record Card

N*O*V*A Corporation is now making a directly replaceable Audio Record Card for Ampex VR-1200 and VR-2000 recorders.

The AR-1200 has almost complete freedom from record thumps, clicks, pops or holes when making

TO CORRECT FOR MONO SUM ERROR



STE-100

PHASE ENHANCER

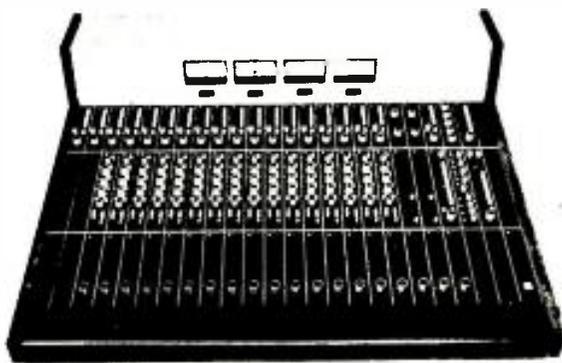


Affects phase only . . . does not degrade stereo signal.

EDCO PRODUCTS, INC., 680 Bizzel Drive, Lexington, Kentucky 40504

For More Details Circle (63) on Reply Card

OKAY, YOU ASKED FOR IT AND GRANDSON HAS IT



"It" is more. That's what broadcasters have been asking for in production consoles. Flexibility. Capability. And totally unique Grandson has it all.

There is nothing else like it anywhere!

Equalization at each input position. Don't laugh. If you don't think it's needed, that's because you haven't tried it. EQ is only the most useful, creative tool in audio. And Grandson's EQ is something special. One major network has bought a bunch. That's special.

Monitoring and foldback flexibility to let you and the talent have separate monitor mixes! And changes of monitor mode at the push of a single button. Here's the key to fast, creative production.

Internal patch point, after mic preamp before fader, brought out to permit inserting special devices. How about plugging in a limiter just ahead of the pot for the screamer, or mic swallower. Think that would be neat? So do we. Grandson will let you do it!

Four reasons Grandson was selected by ABC-TV, Hughes Sports Network and WWL in the Superdome. There are more. None accidental. Because you said it's needed.

Grandson is "it." A totally unique approach. Want more details? Write or phone today.

 **auditronics, inc.**

P.O. Box 12637 Memphis, Tn. 38112 901-276-6338

The closer you look, the better we look.

For More Details Circle (62) on Reply Card

audio edits. These annoying sounds will be difficult to hear, even at full monitor gain. The N*O*V*A AR-1200 exhibits better distortion, noise figures and more than twice the headroom. More accurate record equalization can be made for both tape speeds.

The price is \$295.

For More Details Circle (113) on Reply Card

Audio Proof Equipment

Potomac Instruments fired up their newest test gear, the AA-51 audio analyzer and AG-51 audio generator in their booth at the convention.

These two units were designed specifically for broadcast use and contain features that should take the pain out of audio proofs. Designed for companion operation, these units measure harmonic distortion, intermodulation distortion, volts, dB, signal plus S/N, wow and flutter, stereo phasing, and differential gain in stereo channels.

There are no set level or balance controls. Input signals between 0.3V RMS and 30V RMS are automatically leveled to the proper reference for distortion measure-

ments. Out of range lights are provided to indicate that input levels are within the 40 dB range. There are a host of other features built into these units with the broadcaster in mind.

For More Details Circle (114) on Reply Card

Professional Splicing Tape

A tape designed especially for manual professional splicing of magnetic tapes is new from 3M Company's Magnetic Audio/Video Products Division.

Scotch brand 67 general purpose splicing tape offers high statistical reliability for maximum performance in commercial magnetic splicing applications, and provides strong splice bonds. Splice bonds remain intact under environmental conditions ranging from -30°F (-34°C) to 150°F (65°C) and at 80° F (26°C) with 80 percent relative humidity. Splices are removable as required in bin loop applications.

The blue-tinted polyester-base tape utilizes a high-performance

Continued on page 74

ATTENTION BROADCAST SYNDICATORS Real Time Duplication Quality 16-Times Faster

The ASCO 2400 produces copies at 7½ ips; 30HZ to 18KHZ with less than 45 degrees phase error. Features: automatic recueing of master for preset number of cycles. Reload slaves while master rewinds. Precision-mounted ferrite heads. Head assemblies contain equalization level calibrations. State-of-the-art tape motion control includes constant tension holdback, motion sensing, dynamic, & mechanical braking. Two channel systems from \$7500. Write for our illustrated catalog.



2400 SERIES



accurate sound corporation

114 5th Ave., Redwood City, CA 94063
Phone (415) 365-2843

For More Details Circle (90) on Reply Card

Increase Your Modulation...



...with the new
MSP-100



HARRIS
COMMUNICATIONS AND
INFORMATION HANDLING

MAXIMUM signal loudness and performance...
minimum distortion...with Harris MSP-100 AM/
FM/TV Audio Processor.

Extremely flexible, the MSP-100 optimizes your signal no matter what the format. A tri-band AGC processes separate segments of the audio spectrum.

A sophisticated limiter program sampling circuit automatically selects the proper attack/recovery times.

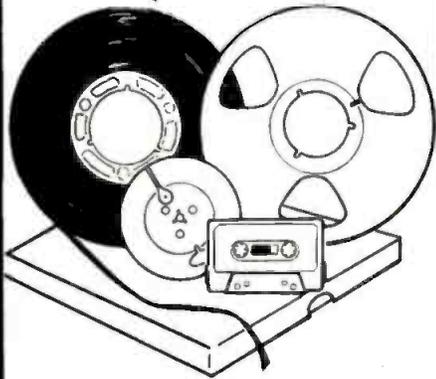
Ease of adjustment and repeatability of settings is assured by use of precision step switches.

Peak reading output...rugged modular construction...simplified maintenance...LED's for monitoring and troubleshooting.

The MSP-100 has it all, and packs a powerful sound. Write: Harris Corporation, Broadcast Products Division, Quincy, Illinois 62301.

For More Details Circle (64) on Reply Card

Audio Tape for professionals



REEL TO REEL TAPE

Ampex, 3M. All grades,
On reels or hubs.

CASSETTES, C-10—C-90,

with Agfa, Ampex, 3M Tape

LEADER & SPLICING TAPE

EMPTY REELS & BOXES

All widths, sizes.

— COMPETITIVE • FROM STOCK —



Recording Supply Co.

1233 Rand Road
Des Plaines, IL 60016
312/297-0955

Div. of
Polyline Corp.

For More Details Circle (72) on Reply Card

New Products

Continued from page 73

synthetic adhesive. The tape demonstrates superior plate adhesion and creep properties, plus extended roll shelf-life—a year minimum—over other splicing tapes, according to 3M.

Scotch brand 67 general purpose splicing tape is available from local 3M Magnetic Audio/Video Products Division sales representatives, boxed or in bulk, in 100 foot rolls in 7/32, 1/2, 2/3 and 1 inch widths.

For More Details Circle (115) on Reply Card

Stereo Wafers Headphone

Stanton Magnetics is now offering a new version of its stereo wafers headphone called the Stereo Wafer XX1-1. The phone is a standard Stereo Wafer XX1 with special acoustically and mechanically designed cushions. These cushions slip on the Stanton XX1 without removing the standard cushions, and are put on by the consumer.

The open audio design gives

lightweight comfort with a top quality sound. The ultra thin headphones have been designed and engineered to meet professional needs: comfort over long listening periods; a particularly wide frequency response; and a broad dynamic range. The soft foam-cushioned headband is exceptionally comfortable. The earpiece yokes incorporate specially designed pivots which allow the earpieces to fit perfectly against the ear, whatever the shape of the head.

For More Details Circle (116) on Reply Card

Total Radio Automation

Automation Electronics exhibited their total radio automation system. It's called "Autotron," and it's one of the most complete automation paperwork systems on the market.

The Autotron is truly automatic, handling scheduling, analysis, logging, billing and bookkeeping. The Autotron also can handle program control and ATS supervision.

Autotron utilizes the Honeywell Level 6 mini-computer, which allows multi-terminal and multi-station usage.

For More Details Circle (117) on Reply Card

Tomorrow is today as NAGRA leads the way...

NAGRA TIME CODE SOUND RECORDERS



**NAGRA... FIRST WITH THE NEW
AND SECOND TO NONE WITH THE BEST!**

**1/4" Tape Sound Recorders,
for any known Coding System
including SMPTE TV Standard
Code, German IRT, French TDF**

New Time Code techniques are being used to great advantage in both film and video tape picture production. These new techniques simplify and save money during production, special effects shooting, picture editing, scoring, sound rerecording and release. These techniques also eliminate slating, clapsticks, scene number announcements and edge numbering. Fortunately, with Nagra, the producer can move slowly into these techniques which can be programmed to his needs and prepare him for the new systems of "show enhancement" and simplicity.



United States Distribution, Service and Sales

NAGRA MAGNETIC RECORDERS, INC. 19 W. 44th St., Rm. 715 • New York, NY 10036 • (212) 661-8066

West Coast Sales, Service & Technical Center — **RYDER MAGNETIC SALES CORP.**, 1147 N. Vine St. • Hollywood, CA 90038 • (213) 469-6391

Available in Canada — **BRAUN ELECTRIC CANADA, LTD.**

For More Details Circle (67) on Reply Card

BROADCAST ENGINEERING

Stereo/AGC Limiter

Broadcast Electronics is introducing a new Stereo/AGC limiter designed specifically for the FM broadcaster. Designated the FM-601, this unit ensures that the audio signal delivered to the transmitter is maintained at optimum levels.

The FM-601 provides automatic level control and maximizes transmitter modulation while preventing over-modulation. It accomplishes this through a combination of automatic gain control, selectable pre-emphasis, compression and peak limiting.

In an FM stereo station the FM-601 will do the job of two conventional AGC amplifiers and two limiters.

For More Details Circle (118) on Reply Card

FM Audio Processor

Harris Corporation, Broadcast Products Division, introduced the new MSP-100 FM Audio Processor at the 1977 NAB Convention.

The Harris MSP-100 (Maximum Signal Performance) is a flexible audio control package. It is specially designed for ease of adjustment, enabling stations to tailor sound to their individual format.

This single unit incorporates a tri-band AGC which processes separate segments of the audio spectrum independently. Operational parameters, including frequency bandwidths, thresholds and shapes, and attack/recovery times, are variable to user tastes in each band.

The AGC module may be quickly set for use as a gentle AGC, spectral equalizer, fast parallel split-band compressor, or anything in between.

The limiter module, when in the automatic setting, analyzes program content and selects the optimum attack/recovery time constants. The signal within the protection module, which follows the limiter, is split into two frequency bands to optimize the limiting of the high frequency signal content.

For More Details Circle (119) on Reply Card

Production Switcher

Shintron announces the 373-DX chromatic switcher with built-in

Continued on page 76

PERFECT TIMING

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ES-300: Four digit incandescent display, one hundred minute timer (99:59) with six controls: Count Up, Count Down, Min-Set, Sec-Set, Stop, Reset. **\$180.00**

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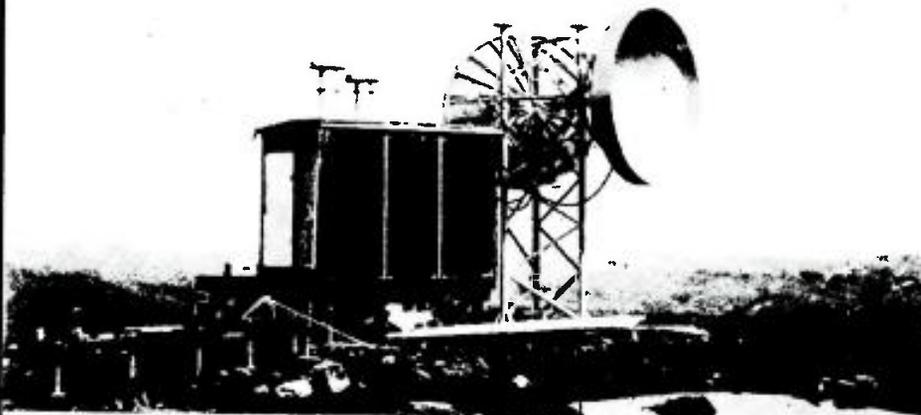


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New Products

Continued from page 75

sync generator which is fully plug-to-plug compatible with Sony DX 1000, 1600 and 1610 series cameras. Universal interface for other cameras will be available soon.

The 373-DX features downstream cross point for preview, program and non-sync inputs. Similar to other Shintron switchers, the 373-DX has an advanced switcher design with (A/B)-C bus structure. There are 10 wipe patterns, adjustable soft, border wipe (BW adjustable in size and color), an external key and wipe/key.

Other assets of the 373-DX are: built-in color bar generator, color black generator and color background generator. The built-in color sync generator is equipped with a multiple distribution amplifier for pulses and front panel controlled subcarrier phase adjustment for subcarrier distribution.

Standard equipment also includes Digi-Tally® numerical indicator for tally and "On-Air," and intercom. Each bus is fitted with LED lighted, high reliability push buttons and the printed circuit boards are front loading for easy maintenance.

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Record/Playback Tape Machine

The Beucart Division of UMC Electronics Co. has announced the availability of the Beucart Type 10 combination record/playback broadcast audio cartridge tape machine.

Housed in a compact, 4-1/8 inch high by 11 1/2 inch wide by 15 3/4 inch deep housing, the Beucart Type 10 record/playback combination is used by radio stations for handling A-size cartridges. Available in either mono or stereo, the Type 10 combination mounts side-by-side for desk or rack mounting.

The cartridge reproducer is furnished with a primary (1 kHz) cue, with secondary (150 Hz) and ter-

tiary (8 kHz) cues optionally available. Cue tone detectors utilize reliable L-C networks to provide relay contact output information. Front panel lamps on the reproducer indicate the presence of secondary and tertiary cue tones.

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Dynamic Scratch Filter

Non-Linear Filter's Model DSF-1C Dynamic Scratch Filter almost completely eliminates scratch, dust and surface discontinuity noise without any bandwidth reduction or loss of high frequencies. This is done by detecting and instantaneously suppressing scratch disturbances with a unique patented non-linear filter.

The filter has two channels with bandwidth at 40 Hz - 20 kHz $\pm 1/2$ dB for balanced output and 20 Hz - 20 kHz for unbalanced output.

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Fieldstore Synchronizer

A new fieldstore synchronizer, only seven inches high and utilizing the latest 16K RAM technology, was introduced at the NAB by Micro Consultants, Inc.

The Quantel DFS 1500 Digital Fieldstore Synchronizer is both a synchronizing device and a time base corrector.

The new unit complements the Quantel DFS 3000 Digital Framestore Synchronizer and is ideally suited for ENG, field production and multi-unit installations where it is used in addition to a DFS 3000, and for broadcasters who need synchronization but not all the special effects of the DFS 3000.

The DFS 1500 weighs only 50 pounds and dissipates just 250VA. Unlike most fieldstore synchronizers, its store is more than 1 1/2 fields—a full field plus additional storage needed to handle VITS and VIRS without corruption. The store also has a sophisticated circuitry to insure that FCC regulations concerning blanking widths are met at all times.

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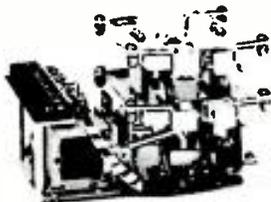
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June, 1977

switching modulator to provide high performance amplitude modulation up to 125 percent positive, with lower power consumption.

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Audio and DC feedback from the modulated voltage, but excluding the RF output network and load, are utilized to provide nearly perfect power output control and to improve distortion, response, and transient performance with processed audio waveforms. By avoiding the RF output network and load in the feedback loop, the stability and response problems associated with high-Q non-symmetrical antenna loads are eliminated.

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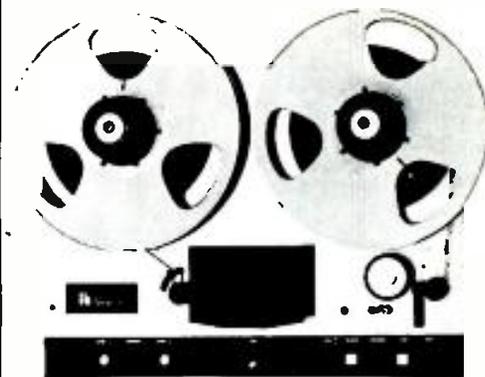
Magazine Adapter

The Professional Motion Picture Products Division of **Canon U.S.A., Inc.** has announced the availability of a 400' magazine adapter, which greatly increases the capacity and versatility of Canon's popular Scoopic 16M and new Scoopic 16MS cameras.

Designed to quickly attach to the top of either camera, the new 400' adapter permits snap-on, snap-off use of either Cinema Products' new lightweight 400' Lexan™ magazine, or a standard 400' Mitchell Magazine. Power is furnished by the camera's own battery, which can run four 400' magazines through the camera on a full charge.

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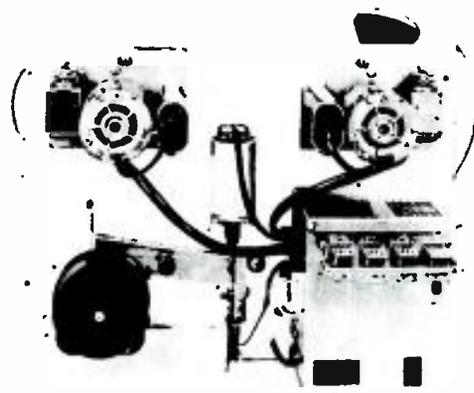
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HELP WANTED

DIRECTOR OF TELEVISION SERVICES—Duties: (1) Supervise activities of television production and engineering services, i.e. (a) production and direction of studio and remote television programming, (b) maintenance, operations and inventory control of electronic systems associated with the television function; (2) Assist in teaching of courses in television production/direction; (3) Provide instruction and assistance for faculty in the utilization of electronic equipment for instructional or research purposes. **Qualifications:** Masters Degree—Minimum 5 years experience in Educational and/or Commercial Closed Circuit Broadcast television. (1) Experience in design, operations and maintenance of electronic systems (i.e., TV Studio, Audio Recording/Duplication, etc.); (2) Experience in production/direction of television programming. Salary negotiable. Effective September 1, 1977. Equal Opportunity Employer. Submit (prior to July 15, 1977) resume to: Dr. Joseph S. Gardiner, Instructional Resources Center, State University College, Oneonta, New York 13820. 6-77-1f

ASST. DIRECTOR OF ENGINEERING—Transmitters Education, extensive experience and knowledge of television transmitters—1st Class FCC licensure—Supervisory background. Contact: Iowa Public Broadcasting Network, Personnel Office, P.O. Box 1758, Des Moines, Iowa 50306, (515) 281-4500. AN EQUAL OPPORTUNITY EMPLOYER. 6-77-1f

TELEVISION BROADCAST MAINTENANCE ENGINEERS, licensed. Experience necessary in maintenance of broadcast cameras, videotape recorders, and other studio equipment. Experience in television remote broadcasting desirable. Salary commensurate with experience level. Send resume or contact Rod Hunter, KTCA-TV, 1640 Como Avenue, St. Paul, MN 55108, 612-846-4611. 6-77-1f

VTR MAINTENANCE SUPERVISOR: All formats 1/2" to 2", Helical and Quad. Must be experienced. Send resume to: Gene DeSantis, S/T Videocassette Duplicating Group, 500 Willow Tree Rd., Leonia, N.J. 07605. 6-77-1f

CABLECASTING MANAGER—\$2M revenue Cable TV system needs experienced innovative manager for studio, news, advertising, extensive video recording and playback operations. Now producing daily local/world news, commercials, sports remotes and specialty programming. Moving into fiber optics and Pay TV. Excellent opportunity for asst. station manager to move up. Five years of management experience or MBA desired. Preference to 2nd or 1st class license holders. \$15K-\$20K base salary, override, stock, benefits. U.S. Pacific island location. Reply to Dept. 377, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. 6-77-1f

TELEVISION CHIEF ENGINEER, management oriented, for leading network affiliate in Gulf Coast area. All new equipment and excellent facilities. Equal Opportunity Employer. Dept. 378, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. 6-77-4f

ENGINEER—TV STUDIO: We are seeking an engineer to supervise technical operations and maintain color TV studio. Candidate must be familiar with IVC camera, quad and helical VTR, & ITFS transmission equipment. Requirements: 1st Class FCC and several years experience. Liberal benefits, including one month vacation and paid hosp. Respond in writing, with salary requirements, to: Mercer County Community College, Personnel Services, Dept. U, Box B, Trenton, N.J. 08690. Equal opportunity/affirmative action employer. 6-77-1f

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ENGINEER FOR 2 AM 1 FM small group. Audio very important. \$13,000 starting salary. South, E.O.E. Immediate opening. Reply to Dept. 379, **Broadcast Engineering**, P.O. Box 12901, Overland Park, KS 66212. 6-77-2f

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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. 6-77-1f

WANTED: FCC First Class Engineer (Chief Engineer). Must have at least 4 years experience as a First Class FCC Engineer. Must have directional array experience. Must have worked FM stations and know transmitters, and automation. Send resume to: 136 East 55th Street, New York, New York. 6-77-2f

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Mountain View, California—Dennis Triola, 2680 Bayshore Frontage Rd., Room 102, Mountain View, Ca. 94043, (415) 961-0378

London W.C. 2, England—John Ashcraft & Co., 12 Bear St., Leicester Square, 930-0525

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2	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
3	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
4	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
5	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
6	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
7	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
8	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
9	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
10	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
11	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
12	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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- A. AM Radio Station
 - B. FM Radio Station
 - C. TV Station
 - D. ETV Station
 - E. CATV Facility
 - F. CCTV Facility
 - G. Consulting Engineer
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 - I. Recording Studio
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2	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
3	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
4	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
5	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
6	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
7	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
8	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
9	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
10	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
11	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
12	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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7	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
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