

December, 1973/75 cents

BROADCAST **engineering**

the technical journal of the broadcast-communications industry

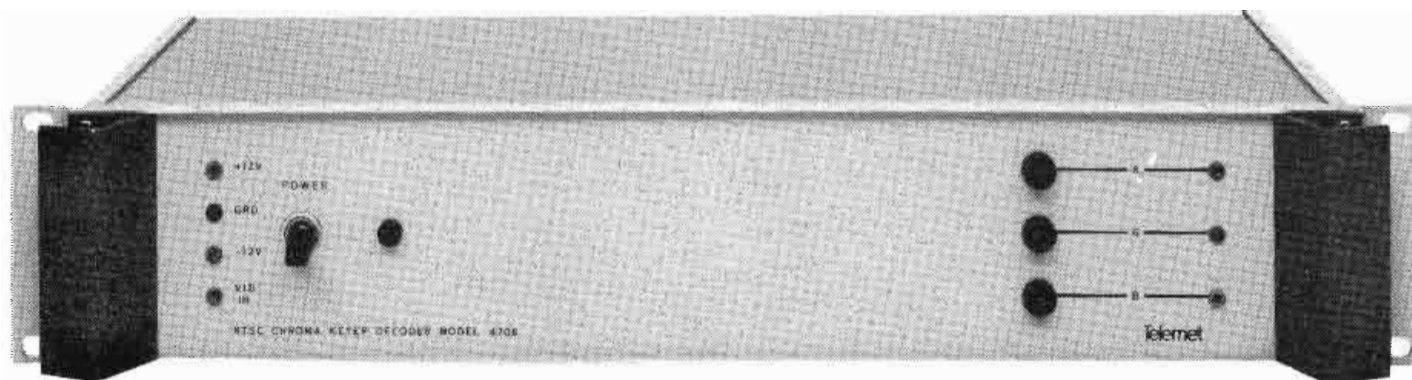


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B/E

BROADCAST engineering

The technical journal of the broadcast-communications industry ®

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-

ABOUT THE COVER

This shot is by Videotape Associates of Ft. Lauderdale, Fla., taken during the filming of commercial for MLF. The team is the Miami Dolphins. See page 18 for the story of how another station covers 210 remotes a year.

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BROADCAST ENGINEERING



THE TEN DAY TAPE

This digital cassette provides 10,000 event storage capacity for the GVG APC 2000 television automation system. Television automation from The Grass Valley Group basically means computer controlled operation of master control switching equipment, video tape recorders, and telecine projectors. Automated control of on-air operations results in smooth presentation of program material and a marked reduction in the switching errors which inevitably occur with manual operation during periods of high activity. The broadcaster benefits by an improved on-air image, as a result of the smooth presentation, and by a significant reduction in make-goods.

However, control of technical operations is but

one aspect of television automation. APC-2000 systems can be supplied to include the following additional features: • Off-line systems for storage and manipulation of booking information, contracts, availabilities, and adjacency warnings, as well as preparation of operating schedules and specialized listings. • Printout or display of management statistics. • Communication to accounting departments for billing information based on as-broadcast logs. • Communication with other computer systems for coordination with centralized business activities.

THE GRASS VALLEY GROUP, INC. 

DIRECT CURRENT FROM D. C.

December, 1973

By Howard T. Head

Fuel Crisis Affects Broadcasting

The nation's fuel crisis is likely to affect radio and television broadcasters in a number of ways. Emergency measures being considered include a possible reduction in the output power of all transmitters; a 1 dB across-the-board reduction was enforced during World War II, although the principal purpose was to increase tube life rather than to conserve power. A number of stations in the Pacific Northwest area, where hydro-electric power is in short supply, are already operating with reduced power.

Another measure being considered is a possible reduction in the 60 Hz frequency of the primary power supply. Because of large-scale power inter-ties, this would have to be undertaken on a nationwide basis. One of the important unknowns is the magnitude of hum problems which might arise in TV receivers.

Legislation authorizing permanent Daylight Saving time seems at this writing to be certain of passage. This would offer a wintertime bonanza of an additional hour in the evening for daytime - only AM stations, while those stations operating under Pre-sunrise Service Authorizations (PSA) would still be permitted to sign on with PSA facilities as early as 6:00 A.M. Daylight time. Daytime - only stations which cannot qualify for a PSA, however, would be hard hit by the late morning sign-on brought about by the combination of the short day and Daylight Saving time. The Commission is studying possible avenues of relief for these stations.

Cable TV Testing Deadline Extended

The Commission has extended the deadline for the first annual performance tests of cable TV systems (see February, 1973 D.C.). The deadline for the first tests, which was originally December 31, 1972, has been extended to March 31, 1974. New systems--those beginning operation after March 31, 1972--are required to comply fully with the cable technical standards at the commencement of service. For older systems, this deadline applies only to visual and aural signal levels, system noise ratios, and radiation from the system. Full compliance by all systems will be required by March 31, 1977.

The Commission took the unusual step of referring several of the more complex problems to the FCC/Industry Cable Television Technical Advisory Committee (CTAC) (see July, 1973 D.C.). Of the problems involved, the most urgent is that of system radiation and CTAC is hopeful of providing recommendations on this subject well in advance of the March 31, 1974 deadline.

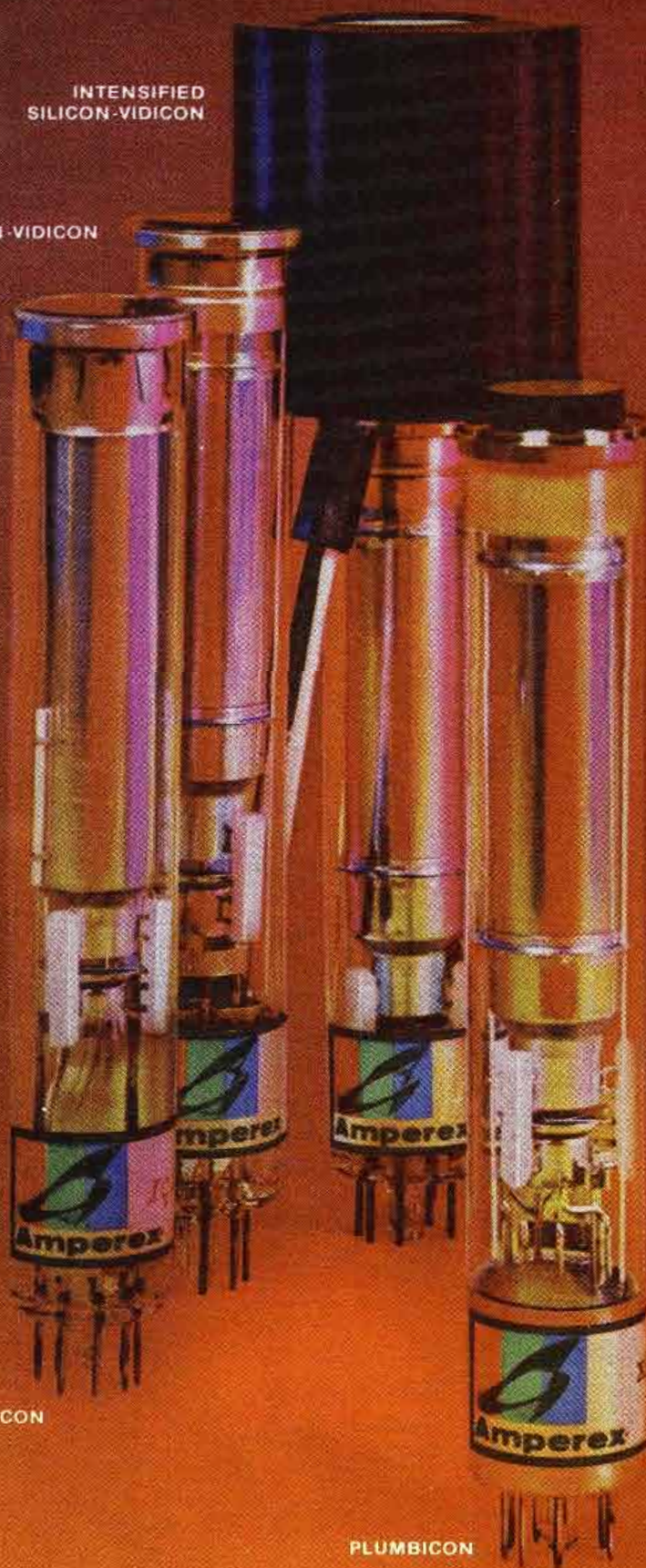
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OTP Drop-in Plan Studied

We reported last month that the White House Office of Telecommunications Policy (OTP) had concluded that 85 VHF TV channel drop-ins could be made in the nation's top 100 TV markets. When that issue went to press, the only information available came from a press conference held by OTP's Director,

Dr. Clay T. Whitehead. OTP subsequently released a report giving more details in which the number of proposed drop-ins was reduced from 85 to 62.

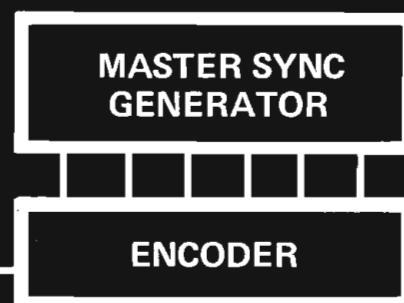
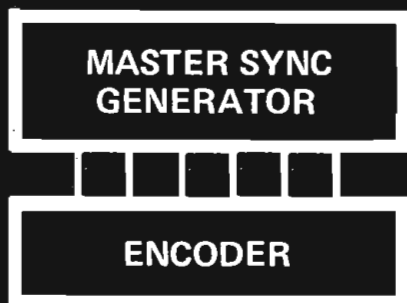
Both the Commission and the broadcast industry have made detailed studies of the OTP report, and both have concluded that the OTP report suffers from both minor and major flaws. In many instances, existing educational TV stations and Canadian TV stations were completely overlooked, and many of the OTP proposed drop-ins were predicated on adjacent-channel operation in the same market.

Some of the channels proposed would have invaded all-UHF markets, such as Fresno and South Bend, where UHF has been highly successful in the absence of VHF competition. By the time the unusable and unneeded drop-ins are done away with, less than a dozen channel assignments offer any real possibility, and even those would require reductions in mileage separations considerably greater than those permitted by the Commission in past cases.

A special article in next month's Broadcast Engineering will discuss the OTP proposals in detail.

Short Circuits

The "pirate ship" shut down by court order (see last month's Short Circuits) turns out to have had technical problems too, since the ship, a converted minesweeper, had a wooden hull which didn't provide much of a ground...Commission Rules have been changed to permit a maximum time interval of 40 days (rather than 31) between successive carrier frequency checks. The Commission is preparing a bulletin to all stations making it clear that the method of checking is left to the licensee's discretion and it is not necessary to calibrate against WWV...The Commission has extended for two years its waiver permitting relaxed standards for the International Digisignals (IDC) code...The Commission is studying reopening the AM clear channel case to examine possible expanded use of the clear channels...Two 10-Watt TV broadcast stations have been authorized on Channels 2 and 4 in the Bering Sea and the Aleutian Islands...In a New Mexico case, the Commission has concluded that TV translators operating on regularly-assigned channels are entitled to the same protection from other translators as are regular broadcast stations...NCTA has issued a call for technical papers for the April, 1974 Convention.



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Fairchild And RCA Demonstrate Solid State Image Sensors

Fairchild Camera & Instrument Corp. has announced the world's first commercially available charge-coupled area image sensor.

The device, the CCD-201, uses an array of 100 x 100 solid-state elements to create a television picture signal directly from light focused on the surface of the sensor.

The sensor is based on a new semiconductor technology called charge coupling, which utilizes electrical charges to collect, store and transfer information through small "chips" of silicon. Compared to other image sensors, charge-coupled devices (CCD's) are extremely sensitive to light and less subject to electrical noise and other effects that degrade the desired information signals.

Fairchild demonstrated the area sensor August 21 in a miniature TV camera about the size of a pack of cigarettes. Earlier this year, Fairchild introduced the first commercially available CCD image sensor, a 500-element linear device. The linear sensor is capable of providing only one line of a TV picture at once, while the area device views an entire picture area simultaneously.

Because of its small size, low power requirements and high reliability, the CCD-201 may find use in surveillance equipment, and medical instrumentation or process control applications.

The sensor operates from a 20-Volt power supply, compared with 2,000 Volts for typical vacuum tube

image sensors. Nominal power consumption of the CCD-201 is 50 milliwatts.

The array of light sensitive elements is arranged in 100 columns of 100 elements, with each element measuring only 1.2 x 0.8 mils (thousandths of an inch). These columns are spaced 1.2 mils apart horizontally and 1.2 mils apart vertically to create the standard 3 by 4 aspect ratio. Inherent spatial accuracy of the CCD-201 is 1 part in 10,000.

The entire device is packaged in a 24-lead dual-in-line integrated circuit package with an optical glass window over the sensor area. Package dimensions are 0.5 x 1.25 inches.

RCA Demonstrates Large CCD Sensor

Meanwhile, RCA demonstrated the largest solid-state image sensor announced to date—a key milestone in the creation of a new generation of tubeless TV cameras for government, commercial and consumer use.

The sensor—known as a charge coupled device (CCD)—is a nickel-size silicon chip containing over 120,000 electronic elements. Developed at RCA Laboratories, Princeton, N.J., it could be the forerunner of a new set of "eyes" for future color and black-and-white TV cameras.

"This is a key achievement since manufacturable CCD image sensors of at least this size are essential if all-solid-state TV cameras are to have the resolution to satisfy a broad range of applications," according to Dr. Karl H. Zaininger, Head of Solid State Device Technology at RCA Laboratories.

He said possible future TV cameras employing CCD's could be the size of a cigarette package or smaller, and would be rugged, highly reliable and potentially low in cost. They could be used in space exploration, closed circuit TV, military programs, surveillance systems, telephone systems transmitting TV pictures, by consumers with home video recorders and in broadcast camera applications.

The new RCA CCD image sensor was demonstrated during the 1973 Electro Optical Systems Design -

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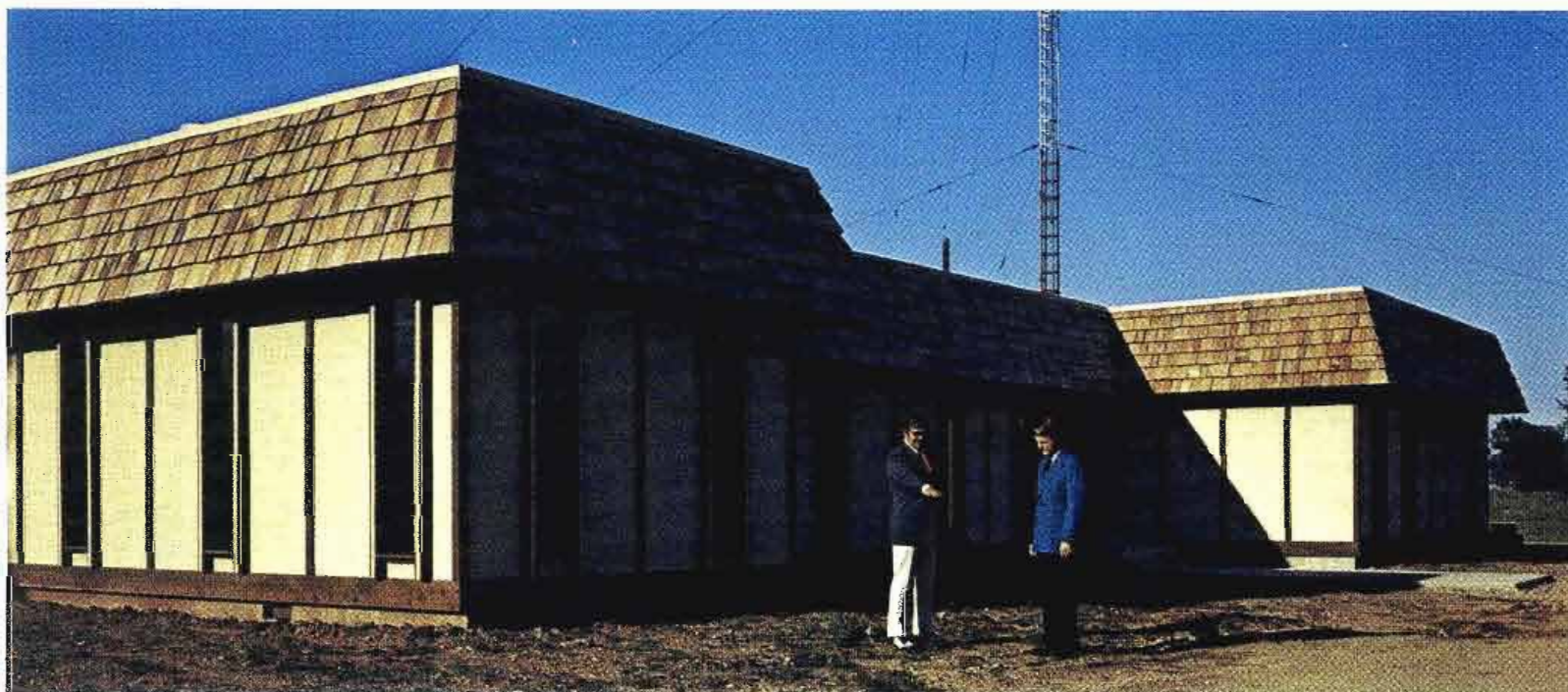
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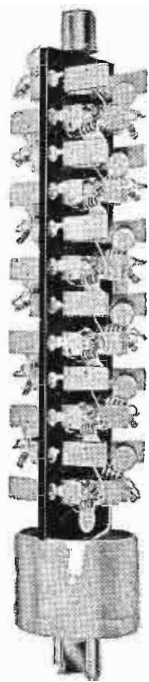
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INDUSTRY NEWS

East conference in New York, which ran through September 20.

"A goal of RCA's CCD program is to demonstrate before the end of 1973 the feasibility of a manufacturable CCD image sensor having performance substantially equivalent to that of a two-thirds-inch, silicon target vidicon tube," Dr. Zaininger said. "At present, the program is ahead of schedule. We believe this places us at the forefront of this important and exciting new technology."

The CCD approach will almost immediately become cost effective for limited applications in government, space and industry, but further technical and cost improvements will be required to make such cameras useful for the home, closed-circuit TV and broadcasting, Dr. Zaininger said.

"It seems clear that these improvements will be achieved gradually over a period of years, so the bulk of the TV camera market will continue to be served by tubes for some time," he said.

The new CCD "eye" developed by RCA works this way: when an image is focused on the CCD, the sensor's electronic elements transform the picture into individual electrical charge packets. These packets then are read out very rapidly by charge transfer techniques. The resulting information then can be processed and displayed as a TV picture.

In the RCA CCD, half the electronic elements form the imaging array and the other half are for storage and readout.

The CCD is being developed as part of a broadly-based RCA effort aimed at developing all-solid-state TV systems and applying CCD technology to a wide range of other applications as well. The program is being carried out by a team at RCA Laboratories headed by Dr. Zaininger and including Dr. Walter F. Kosnicky, Dr. Paul K. Weimer, Dr. Michael G. Kovac, Dr. James Carnes, Dr. Frank V. Shallcross, Peter A. Levine and Winthrop S. Pike.

FCC Modifies Monitor Rules

In response to a petition for reconsideration by J. G. Rountree and a supporting petition by the National Association of Broadcasters (NAB), the Commission has modified the rules concerning frequency monitors and maintenance of the operating frequency. The FCC has increased from 31 to 40 days the maximum interval between successive frequency measurements on carrier and subcarrier frequencies of broadcast stations (Docket 19712).

Rountree and NAB said that such measurements should be made once each calendar month with no more than 40 days between successive measurements. Stating that it was the practice of licensees and commercial measuring services to schedule frequency measurements on a specified day rather than date of the month, they said that it was possible to have five weeks between the measurement.

They also stated that interference caused by numerous uncontrollable circumstances could necessitate rescheduling a frequency measurement to a subsequent day outside the 31 day interval.

The Commission said that the public interest would be served by such modification, but noting that neither Rountree or NAB had made a satisfactory showing why they had not filed comments in the rulemaking proceeding, amended the rules on its own motion.

Quad-Eight Gets Four Nominations

The Academy for Motion Picture Arts & Sciences has nominated Quad-Eight Electronics in four major categories for scientific or technical awards.

In the categories of music, sound and production, The Burbank Studios Quad-Eight Scoring Console system has been nominated.

Samuel Goldwyn Studios Dubbing Console, provided by Quad-Eight has been nominated in the same categories plus editorial achievement.

New License Renewal Rules

The new rules for broadcast license renewals issued in an Interim Report and Order on May 1, 1973 have been adopted in a Final Report and Order by the FCC (Docket 19153).

Sixty-five parties participated in the proceeding, which was initiated by an Inquiry and Rule Making Notice adopted February 17, 1973. The Final Report and Order duplicates the Interim Report except for editorial changes and some modifications which resulted from the OMB clearance process.

Under the new rules, license renewal applications must be filed four months in advance of the expiration date. Commercial TV stations are required to compile annual reports. Petitions to deny licenses must be filed one month prior to the license expiration date; commercial TV licensees will have to place in their inspection files,

annually, a list of significant problems and needs of the service areas and proposed programs designed to meet those needs. And licensees will be required to broadcast announcements at definite intervals on how listeners and viewers can submit their views on the licensee's operation of the station.

Program logs for the annual composite week for commercial television stations which are used to compile statistics for the Annual Programming Report will be publicly available; and beginning six months before its license expires, stations will be required to run a schedule of announcements notifying the public of the impending expiration.

The new renewal filing dates and new renewal notices will apply first to renewal applicants whose licenses expire on December 1, 1974, and to

(Continued on page 12)

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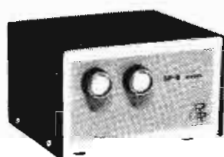
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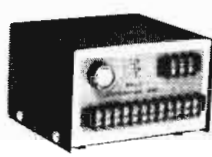
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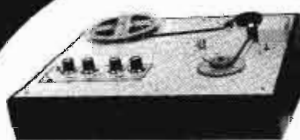
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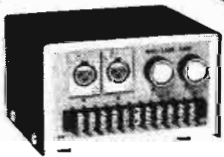
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INDUSTRY NEWS

(Continued from page 11)

all renewal applicants thereafter. The rule requiring stations to publish notice of application for license renewal in a newspaper will be deleted; all such announcements will broadcast.

The commercial television renewal applicant will no longer be required to submit, as part of his renewal application, details about his ascertainment process, but he will be required to include a statement that he followed the Commission's current guidelines in ascertaining the needs and problems of his area and that all relevant materials have been placed in the station's public inspection file.

The TV licensee will have to classify programming in three time periods in his Annual Programming Report: 6 AM to Midnight; 6 PM to 11 PM (stations in the Central and Mountain Time Zones will use 5 - 10 PM); and Midnight to 6 AM. Program classifications will include "News", "Public Affairs", "Other" (non-entertainment, non-sports), and "Local."

Australian Remotes Go Underground

According to a recent report from Australia, that country is making a move toward underground television.....literally. A network of underground TV stations is being constructed in its tropical, northern areas to extend its national service to remote parts of the state of Queensland.

Fourteen of these stations are combined microwave and transmitting stations, others are transmitters only.

These remote underground stations will be housed in all-metal construction underground. The uppermost part of each unit will be one foot below the ground. Up above will be 250-foot guyed masts.

The report states that the underground construction is expected to help keep these remote sites free from vandalism. And equally im-

PORTABLE AUTOMATIC, OR AUTOMATIC portable?



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

Whichever way you want to think about it, the portable automatic (automatic portable) **ASACA** ACC-5000 is the most flexible compact color TV camera ever developed.

ASACA has incorporated three mini-2/3-inch Chalnicon tubes in the ACC-5000 which give you full-color signal outputs (NTSC, PAL) using only the camera head (11 lbs) and back pack (14.3 lbs) — you get exceptional high color fidelity, especially red, which can be used for direct VTR. Superb mobility lets you maneuver up to 1,000 feet away from the control box, and high sensitivity assure excellent results in ill-lit hallways and cubbyholes where available light is only 200 lux — enough light for the ACC-5000. Highlight adjustment and balance are superb. Here's a portable that really lets you get around.

Once you're out there nearly 1,000 feet in dim light you can adjust the 6-power variable speed zoom lens with a simple push button, and the servo-controlled iris guarantees perfect exposures. Color registration and operation requires only minimum set-up time, and complete auto-white balancing is done in two or three seconds simply by pushing the auto-white button. Anybody can use the **ASACA** ACC-5000 with confidence and ease after minimal instructions. Here's an automatic that really lets you get around.

Parallel operation and centralized control are possible through the optional GEN-LOCK external synchronization. Power supply can be either from the stabilized power supply in the control box or by battery. Plug-in type electronic units permit easy checking and maintenance.



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Let's Promote Advancement To Fellowship

A previous issue of **Broadcast Engineering** carried a report in the SBE News Section that the Board of Directors had appointed a 3-man committee having the responsibility of nominating qualified members to the Grade of Fellow as is defined in the SBE By-Laws, Article II Section 1(b). The committee is comprised of Charles T. Morgan, chairman, and Ben Wolfe and John Wilner. This fellowship committee has requested the cooperation of SBE Chapters in submitting names of qualified persons as potential nominees. The letter sent is quoted here:

"At a recent meeting of the SBE board of directors, it was decided to promote and actually solicit candidates for advancement of their membership to that of Fellow.

"In the past 10 years of our existence, only one member of our society has been raised to this high position. This year the names of the past presidents of the society have been submitted as candidates for election to fellowship and by a unanimous decision, the board of directors voted to confer this honor to each of them.

"During 1974 and in each succeeding year a limited number of fellowships will be awarded to members who meet the criteria outlined in Article II of our By-Laws."

(Signed) Charles T. Morgan,
Chairman, Fellowship Committee
Benjamin Wolfe
John Wilner

It is urged that names of members be submitted as chapter projects although individuals may also submit names of nominees, as outlined in the By-Laws. It is the committee's intention to confer the Fellowship on successful candidates at the national Annual Meeting in the latter part of March, 1973

(probably at the opening Sunday, March 17th, at the opening of the NAB convention in Houston, Texas). It will not be necessary for the candidate to be present to receive the fellowship.

In order for the Fellowship Committee to evaluate the biographical data and submit it to the Board of Directors for consideration it is necessary that the names of the candidates be received no later than February 1, 1974. Complete data should be sent to: Charles T. Morgan, WARM Radio, Wilkes-Barre/Scranton Highway, Avoca, Pennsylvania 18641.

The portion of the SBE By-Laws referring to the grade of Fellow reads as follows: Article II, Section 1...(b) **Fellow:** A member who has rendered conspicuous service, or is recognized as having made valuable contribution to the advancement of broadcast engineering, dissemination of knowledge thereof, the promotion of its application in practice, or having rendered signal service to the Society, may be elected a Fellow of the Society.

This Is Your Journal

Here are some reminders from SBE Headquarters:

Chapter Chairmen: Be sure to apply for annual rebates from SBE headquarters. A rebate of up to \$100 annually is possible, based on membership attendance for the preceding year. To obtain this rebate it is necessary to complete the Annual Attendance Report form which is obtained from Virginia Doss, SBE, P.O. Box 88123, Indianapolis, Ind. 46208. Virginia also wants to remind members that members (only) can order attractive SBE tie "tacks" from her for \$3.50.

When corresponding with SBE about your membership, include your membership number. Submit change of address as soon as possible. Members who are not receiving **Broadcast Engineering** magazine, provided as a courtesy by the publisher at no cost to SBE members, should notify Virginia Doss. Letters to the SBE Editor, chapter news, articles for publication under SBE endorsement, and other SBE related information should be sent to SBE Editor, Joe Risse, P.O. Box 131, Dunmore, Pa. 18512. Articles need not be professionally written but they should be technical and informative. Diagrams may be hand drawn, but must be legible and accurate.

Reregulation Committee Seeks SBE Comments

The SBE Reregulation Committee, consisting of committee chairman John Wilner, and James Wulliman and Edwin T. Karl, all of whom are also members of the SBE board of directors, has requested that any SBE member, or chapter, having recommendations relating to FCC reregulation may submit these to a subcommittee chairman for coordination and forwarding to the FCC. The subcommittee chairmen's addresses are:

Television Engineering: John Wilner, Dir. of Engineering, State of N.J. Public Broadcast Authority, 1573 Parkside Avenue, Trenton, N.J. 08638.

FM Engineering: Edwin T. Karl, V. P., Engineering, Suburban Broadcasting Corp., 425 Broadhollow Rd., Melville, N.Y. 11746.

AM Engineering: James C. Wulliman, Manager, Engineering, WTMJ-TV, Milwaukee Journal Stations, 720 East Capitol Drive, Milwaukee, Wis. 53201.

SBE Convention Is A Success

The Regional Convention sponsored by SBE chapters of Northeastern Pennsylvania, Binghamton, N.Y., and Syracuse, N.Y., held October 19th at the Treadway Inn, Owego, N.Y., near Binghamton, was considered a complete success

by its originator and chairman, Larry Taylor, of WENY-TV, Elmira, N.Y. Twenty companies exhibited equipment and had sales and engineering people on hand to demonstrate gear and answer questions on applications, problems, or availability. Telemation brought along its "Video-Van" full of its latest tele-production gear. Registrants numbered approximately 200 Admission was free. Also, complimentary food and beverages were available. The companies exhibiting, for the most part, freely stated that they would be anxious to return again next year, or even sooner, if another "miniconvention" were to be scheduled. The exhibitors were: AEL, CCA, LPB, RCA, EMCEE, Gates, Belar, Telemet, CBS Labs., Tektronix, Telemation, Valtronics, Grass Valley, Professional Electronics, Commercial Electronics, Ashton Communications, Wilkinson Electronics, Communications Media, Potomac Instruments, and COMARK Industries.

Chapter Reports

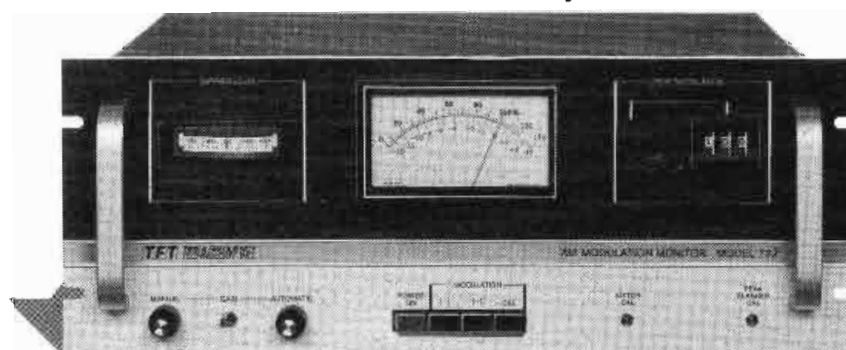
Chapter 1—Binghamton, N.Y.
Chairman: Douglas S. Colborn
Elmira Video,
Horseheads, N.Y. 14845

On October 9th, members made a field trip to visit Elmira Video in Horseheads, N.Y., one of the largest CATV systems in the country. This was followed by a visit to the new facilities of WENY AM-FM-TV, which are also located nearby. Later in October, the chapter joined with Chapters 2 and 22 to sponsor the Miniconvention at the Treadway Inn at which 20 exhibitors displayed equipment. More on this is provided elsewhere in the SBE section of **Broadcast Engineering**. New officers of Chapter 1 include Doug S. Colborn, chairman of Elmira Video; William Sitzman vice chairman; and Wiley Bates, secretary-treasurer, of Norwich, N.Y.

(Continued on page 16)

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NEW modulation only or...



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Chapter 2—Northeastern Pa.
Chairman: Paul Evanosky,
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Members and a considerable number of guests, mainly broadcasting college students, met on October 1st at the studios of WVIA-TV-FM for a discussion and tour of the technical facilities of WVIA. The meeting was planned by John Kowalchik of WILK who is also vice-chairman of the chapter, aside from being a college student himself. Tours were conducted by Paul Evanosky, Roy Hoinowski, and Joe Berish, all of WVIA. On October 19th, many chapter members travelled to Owego, N.Y. to join with Chapters 1 and 22 in sponsoring the Miniconvention at the Treadway where 20 companies exhibited broadcast gear. Sales and engineering persons were on hand for each company for the 12-noon to 12-midnight affair. Admission, food, and beverages were free.

Chapter 11—Boston, Mass.
Chairman: Ross B. Kauffman,
Asst. CE, WCVB-TV,
Needham, Mass. 02192

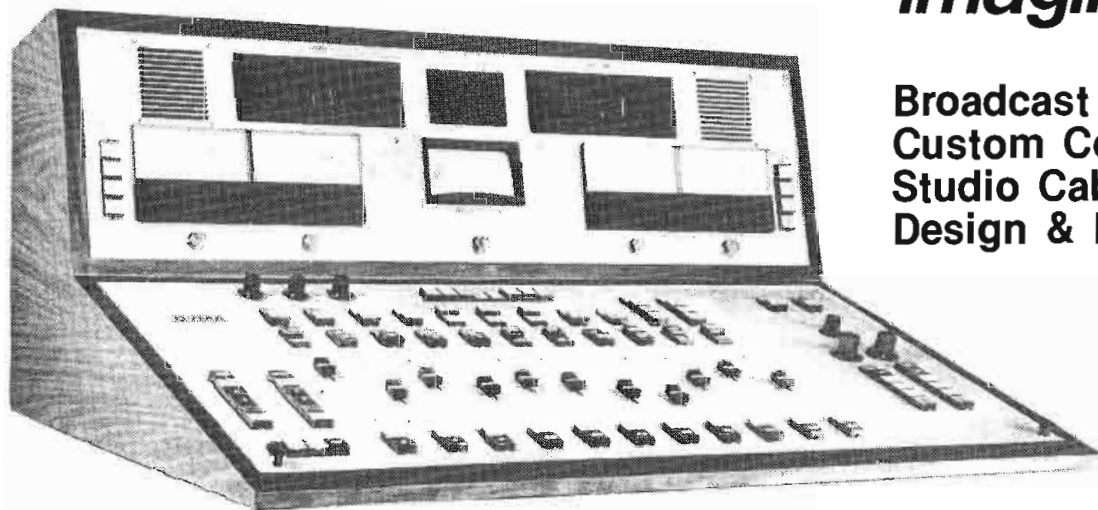
The monthly meeting for SBE Chapter 11 was held on Tuesday, October 16th at the studios of WGBH-TV, Allston, Mass. A motion was passed calling for the establishment of an official mailing address for the chapter which is now P.O. Box 216, West Side Station, Worcester, Mass. 01602. The guest speaker was Tom Vaughn of Micro-Communications Inc., who discussed The Future of Circular

Polarization in FM and Television Antennas. The program was presented in the form of a "mini-refresher" course, with emphasis on the fact that directional antenna patterns are achievable, sometimes with fewer bays. Meetings are open to members and station personnel throughout central and southern New England. Anyone interested in future meetings, contact Steve de Satnick, director of Engineering, WCVB-TV, Needham, through whose courtesy meeting notices are mailed out.

Chapter 15—New York, N.Y.
Chairman: John M. Lyons,
WWRL-AM
Woodside, N.Y. 11377

On October 11th, dinner at the New York Times Cafeteria, 11th floor of the Times Building, 229 West 43rd St., was followed by the technical session held at WQXR Presentation Theatre on the 9th floor. Anthony Ramsden of Marconi and Irving Silberg of L & M Associates, Marconi U.S. Representative, discussed test equipment and procedures usable to the AM, FM and TV Broadcaster. Question and answer session followed. The meeting coincided closely with the 66th anniversary of the Marconi Trans Atlantic Service. For information on future meetings, contact John Lyons at (212) 335-1600 or Art Silver, program chairman, at Gates Radio (212) 889-0790, or Bob Woerner, secretary, at WNEW-TV.

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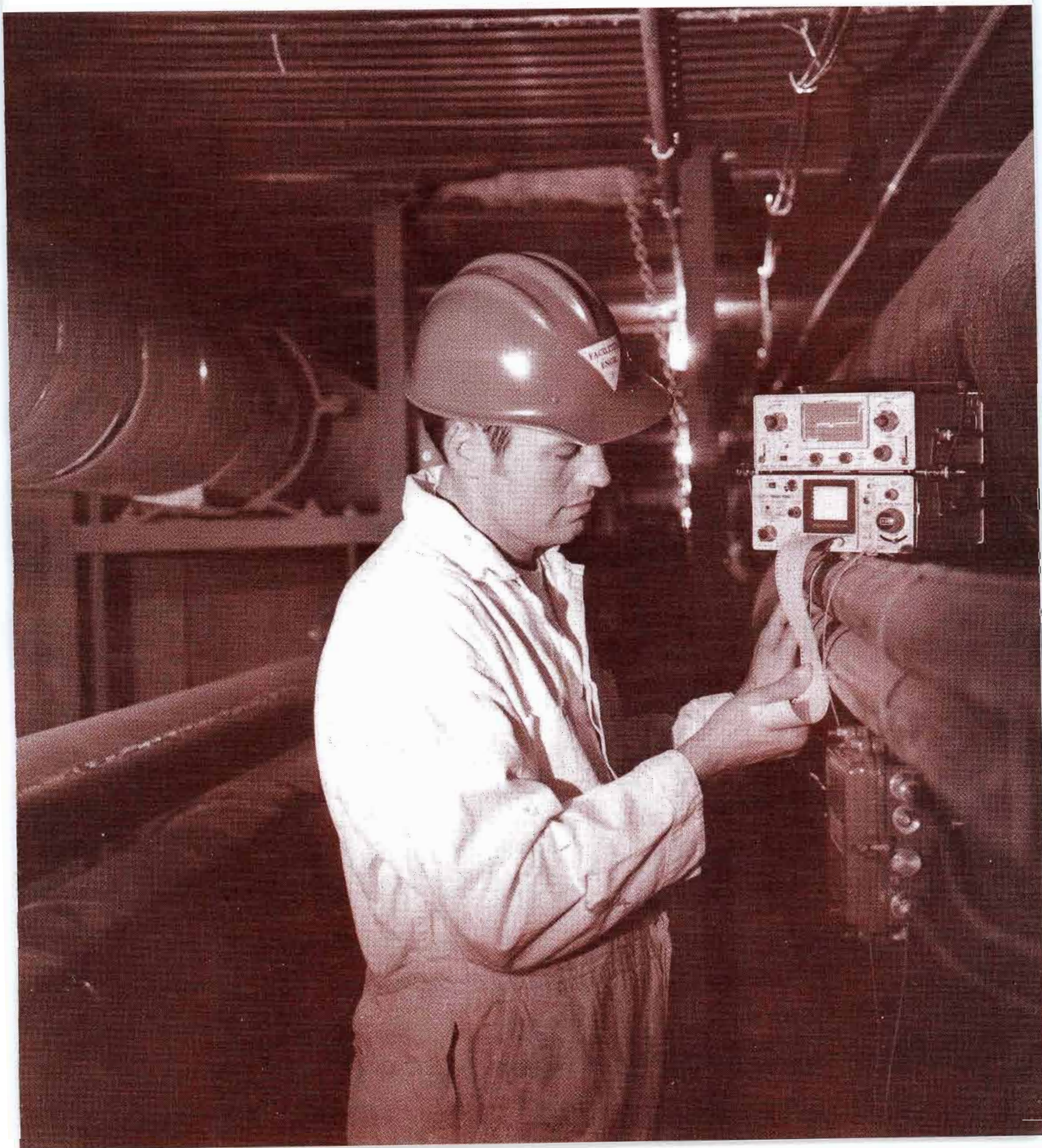
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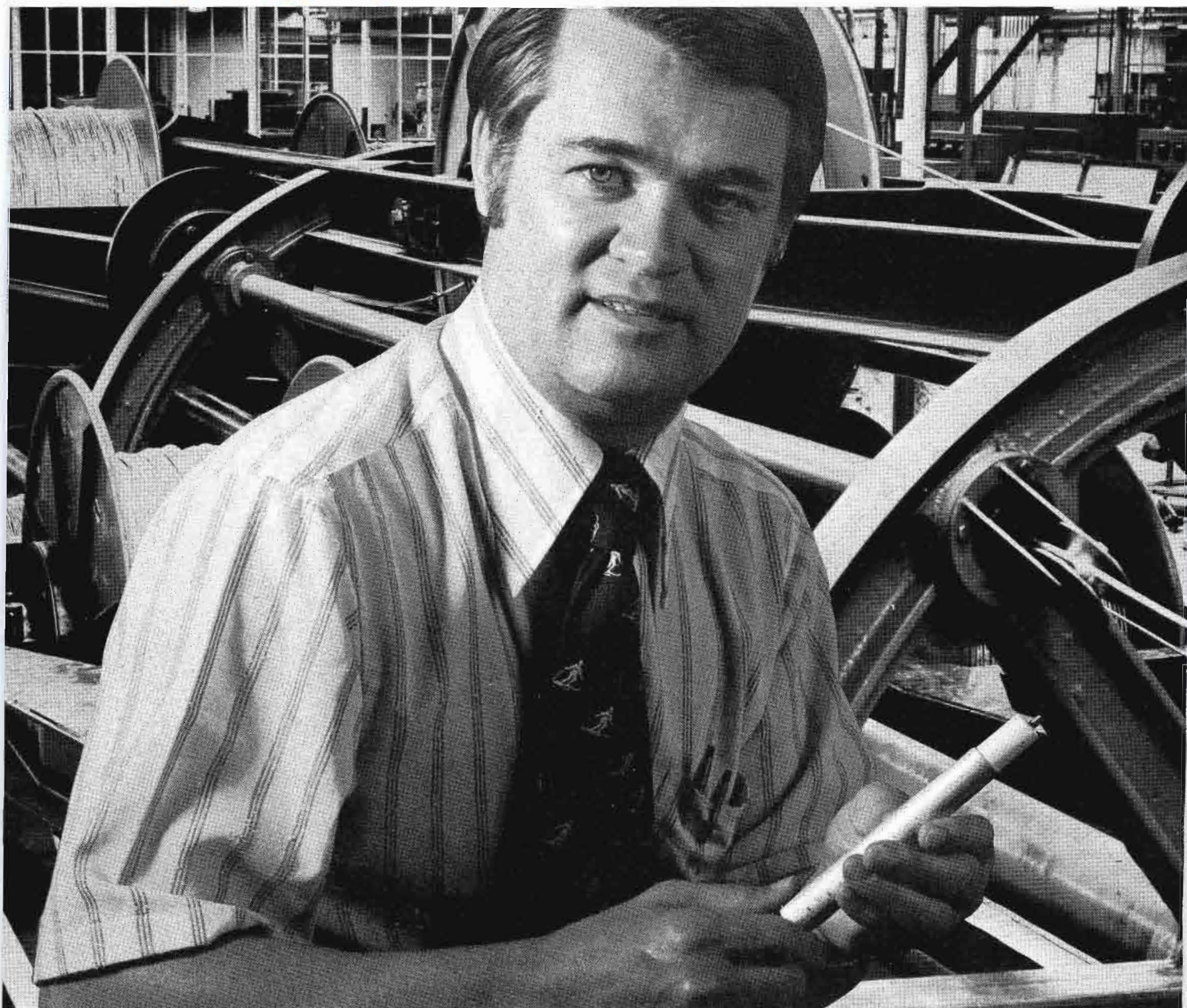
CABLE engineering

In this issue....

Shortcut For Troubleshooting Cables	CE-3
New Products and News	CE-7



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Jim Webb, Manager of Comm/Scope Manufacturing

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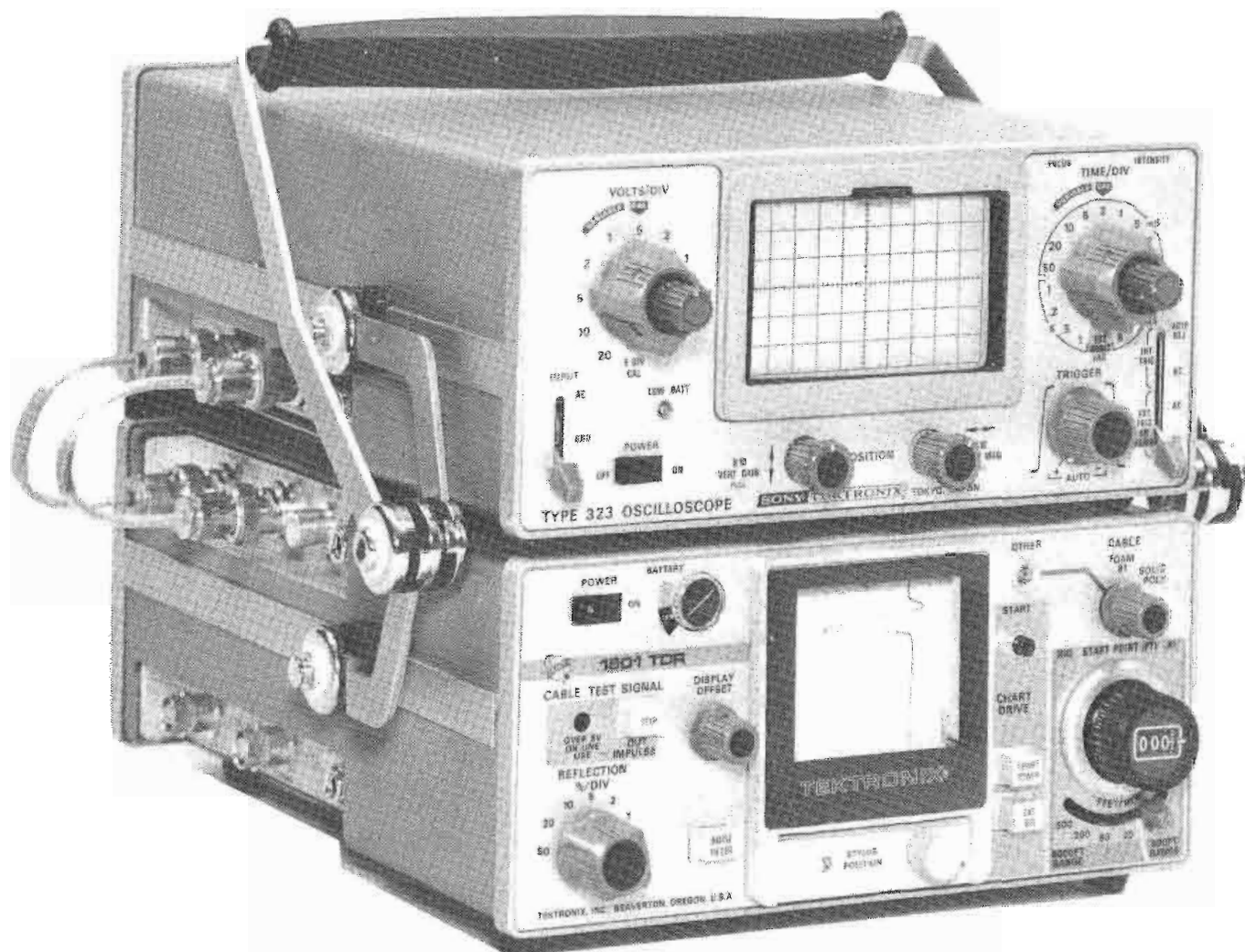
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A portable
time domain
reflectometer
from
Tektronix

Using the TDR for troubleshooting cables

By Richard Regent

One sunny day an antagonistic squirrel races along one of your system's poly-covered trunk lines, stops at a secluded mid-span section, and chews a small hole in it! The next day the weather turns bad and it rains. Water seeps through the hole and within two weeks it damages the cable—which in turn degrades signal quality with ghosting.

How would a top technician find this problem? He might first localize the problem from customer calls and drive out in his service truck to check amplifiers and cables in the area with a TV set. He would recall that it had rained recently before the problem occurred, note the heavy squirrel activity in the area, and put these facts together.

Meanwhile, a second-rate technician at another system with a similar problem might be up on a ladder beginning a careful search of

his cables with a magnifying glass.

Two streets down from the tooth-marked cable, our top technician, using a Time Domain Reflectometer, quickly locates the problem while in his truck. After checking a system map, he proceeds to where he now knows there to be damaged cable, puts up a ladder near the damaged cable location and makes immediate repairs. The customers are again happy. Besides being accurate, the Time Domain Reflectometer (TDR) does more in finding cable problems in an instant with a pulse inside the cable than the second-rate technician could do working all day long, armed with a magnifying glass, VOM, FSM, SWR bridge, and ladder up on the cable.

Radar Versus SWR

Working like a closed circuit pulsed radar, the TDR "echoes" can physically locate and differentiate between shorts, opens, several

mismatches, find impedance, measure SWR, and give a rough indication whether losses are series or shunt, anywhere along a short cable or with cables as long as several thousand feet.

The older and limited method of overall evaluation of short length terminated transmission lines was to first send a sine wave down the cable, to then measure the minimum and maximum amplitudes of standing waves resulting from cable problems, and to finally calculate the Standing Wave Ratio (SWR). Obviously, this isn't very definite for isolating squirrel problems or several discontinuities. The newer method using the TDR is precise and even easier to learn to use. But time domain reflectometry is not a new principle. It has been around for a long time to check transmission cables in the lab. However, recently the TDR unit has evolved from being the engineer's luxury test gear, to become the tech-

nician's effective problem locator.

TDR Measuring System

The TDR measuring system basically consists of three parts: a step voltage generator, a reference cable, and an oscilloscope.

The step generator develops a positive step voltage of around 0.25 Volts, which has a fast risetime of about 50 ps. Most models have a 50 Ohm impedance output (some have 75 Ohms). The longer the duration of this step voltage, the longer the cable that can be tested.

The reference cable is a known length of coax with a typical characteristic impedance, Z_0 , of 50 Ohms that matches the pulse generator output. The reference cable is long enough to delay reflections so that any ringing on the incident step is smaller than the smallest reflection to be observed, but not so long that it substantially increases the risetime.

Actually any good quality oscilloscope can be used to display the step voltage waveform and reflections. It should have a high impedance input and wide dynamic range. A fast risetime of generally 90 ps allows measuring shorter cables, and high sensitivity can better separate adjacent cable problems. The scope's X axis divisions represent location on the cable, while the Y axis divisions can represent cable impedance.

Before analyzing a few waveforms produced by CATV cable problems with the TDR system, it might be helpful to first look over some simplifications that were made to label the X and Y axes of the scope.

The X axis has simply and conveniently been boiled down to units of distance. This comes from the fact that in the distance, D , a pulse travels through the cable and it is proportional to the velocity of propagation, V_p , multiplied by the travel time, T . More specifically, the path length of a pulse traveling down a cable to the reflection location and back to the scope is $2D$. The distance the pulse travels to a particular point is then related by

$$D = \frac{1}{2} V_p T.$$

Thus knowing the constant V_p of the cable, the scope's X axis can be calibrated from some standard

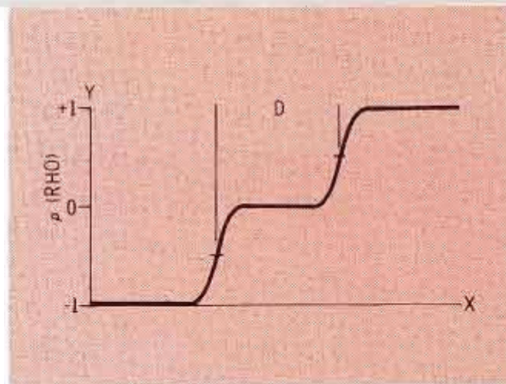


Fig. 1 Using the TDR to measure length.

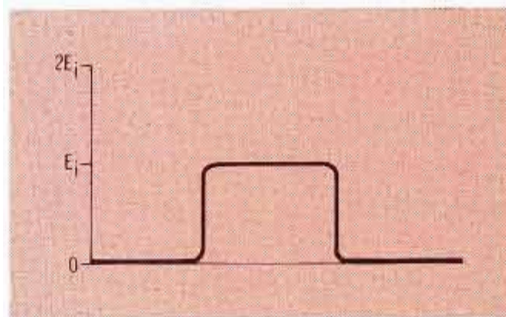


Fig. 2 Indicates a short.

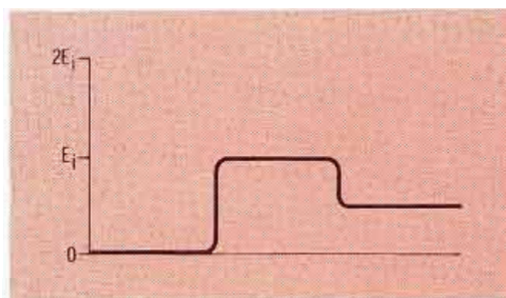


Fig. 3 A low mismatch.

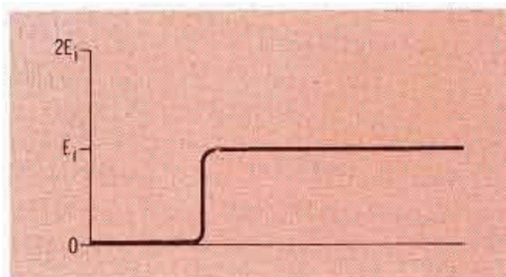


Fig. 4 Matched.

length of cable in terms of distance. The velocity of propagation is dependent on the dielectric constant, with air, foam, and polyethylene filled cable all having different dielectric constants that can be set on the TDR variable dielectric control. The actual cable length of the reference cable for example is measured between midpoints of leading edges of waveforms as shown in Figure 1.

The Y axis can in practice be used to represent impedance. This comes from the fact that it shows the amplitude ratio, P , of the reflected voltage, E_r , to the incident voltage step, E_i . This in turn is

related to the impedances Z_c of the CATV cable and Z_0 of the reference cable. These relationships can be expressed in an equation:

$$P = \frac{E_r}{E_i} = \frac{Z_c - Z_0}{Z_c + Z_0}.$$

As examples of this equation, if $Z_c = 2Z_0$, then one-third of E_i is reflected, or if $Z_c = \frac{1}{2}Z_0$, then a negative (out of phase) one-third of E_i is reflected.

Noting that Z_0 is a constant, characteristic of the reference cable, and Z_c at any location along the CATV cable must be between zero and infinity, requires that P correspondingly be between -1 and +1.

The calibration of the Y axis can be checked by adjusting the P/div. control to a known impedance (such as Z_0 and short circuit of zero).

Pulse Into Cable

Now let's follow a step pulse from a typical TDR into the CATV cable. At the same time the step is sent out from the generator, the oscilloscope sweep starts. A display of the reference cable shows up first on the scope since the step is initially sent through it. There are no reflections due to this carefully matched cable, so it appears as a straight horizontal line on the scope.

After the step moves to the end of the reference cable, it next comes to the CATV cable, which has impedance Z_c , of 75 Ohms. A reflection voltage occurs here because of the 50 to 75 Ohm mismatch at the junction of the cables, and adds to the incident step to return to the scope. The CATV cable also produces a straight horizontal line, but now it is up at the 75 Ohm level. The exact details at the 50 to 75 Ohm mismatch, which joins the two horizontal lines, depends on the connectors used.

The step finally continues to move farther down the CATV cable. If the cable is properly terminated and is free of problems (75 Ohms impedance throughout), nothing further exciting happens to the step voltage. It is eventually lost due to cable attenuation or is absorbed in the termination.

But if the cable has some discontinuity—a short, open, or mismatch somewhere along it, a reflected voltage is set up at one of

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We know you've got enough problems already, having to make do with helical recordings made under far from ideal conditions.

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With our proc/amp, you get a second chance at a master tape because you can virtually rebuild all your color and monochrome helical recordings during playback and dubbing.

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video and chroma level, sync and setup automatically.)

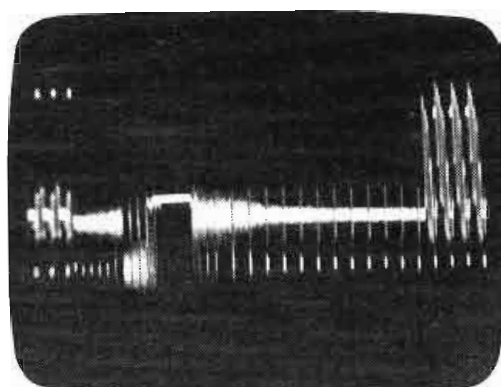
And if that's not enough, you can add our D-100 plug-in dropout compensator to give you a complete video processing system for any color or monochrome helical format. It replaces all lost video information with signals perfectly

matched for luminance and chrominance, with no transients, no white or color flashes, no color mismatches.

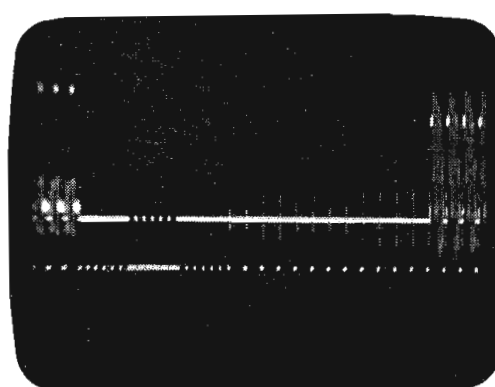
Whether you use the combination for playback and dubbing or on-line CATV and CCTV systems, it's as close to the perfect picture as you

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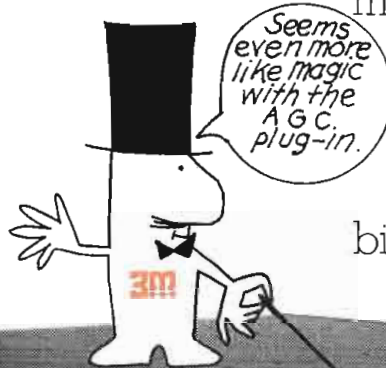
And that's what you're looking for, isn't it? Mincom Division, 3M Company, 300 S. Lewis Road, Camarillo, California 93010. Telephone (805) 482-1911.



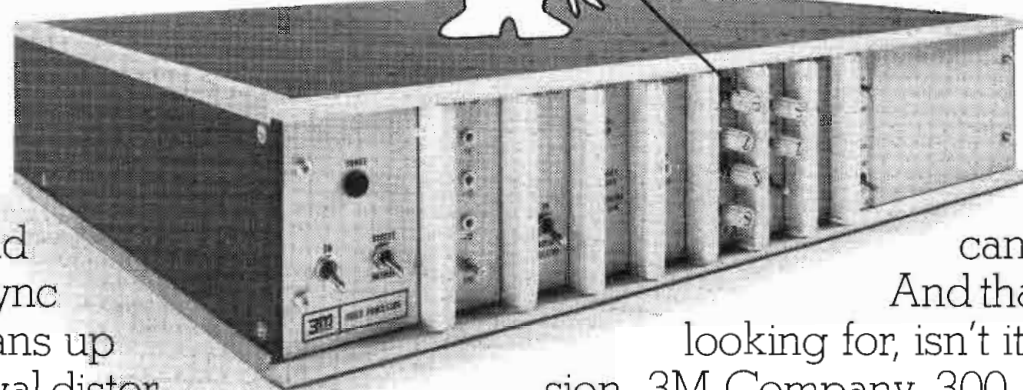
Raw signal.



3M processed output.



Seems even more like magic with the AGC plug-in.



VIDEO PRODUCTS

Mincom Division



For More Details Circle (46) on Reply Card

these points which adds algebraically to the incident voltage. The result is an interesting scope waveform. Its shape reveals at a glance the type of discontinuity or mismatch, and cable or terminator impedance.

After proper set up adjustments, an unknown impedance can be approximately found by comparison to some known impedance, and it can be located to some known system length.

Waveform Shapes

The type of fault can be recognized by analyzing the waveform shape.

Short. Perhaps the easiest to recognize is the short circuit, $Z_c = 0$ shown in Figure 2. A complete reflection due to a short circuit causes E_r to be out of phase ($E_r = -E_i$) with E_i and they cancel so that the total voltage is zero. Here P equals -1.

Low Mismatch. A little pure resistance in a cable slightly departs from a short circuit. With pure resistance the reflected pulse has the same general shape as the incident step. A partial out of phase reflection occurs for $Z_c < Z_0$ with $E_r < -E_i$. The total voltage result, as Figure 3 roughly indicates, is between 0 and E_i . Now P is between -1 and 0.

Matched. When $Z_c = Z_0$ in a perfect match, no reflection occurs allowing the step voltage E_i to continue unaffected. Figure 4 shows this condition. This is $P = 0$.

High Mismatch. If $Z_c > Z_0$, a partial in phase reflection occurs and $E_r < E_i$, drawn in Figure 5. The total voltage is between E_i and $2E_i$, with P from 0 to +1.

Open. Finally another easily recognized waveform is the open circuit of Figure 6, when $Z_c = \text{infinity}$. Complete reflection occurs at the open circuit causing E_r to be in phase ($E_r = E_i$) with E_i and they add so that the total voltage is twice E_i . This case P equals +1.

More Complex Waveforms

The shape of the voltage waveform gets more complex for cable losses other than pure resistance. Ideally, CATV cables only have pure resistance terminations, but in practice frequently cables also have some distributed or localized ca-

pacitance and inductance, making waveforms more complicated. For a small value inductance, L , or shunt capacitance, C , the value of E_r is proportional to the time derivative of E_i , with the slope of the curve determined by the magnitude of L or C .

For a shunt L or series C , E_r is an exponentially rising waveform. When Z_c goes to 0, the total result, $E_i + E_r$, goes to $2E_i$. By using some calculus and the curve slope, the L and C values can be roughly

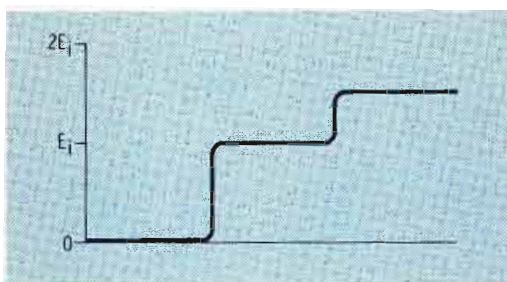


Fig. 5 High mismatch.

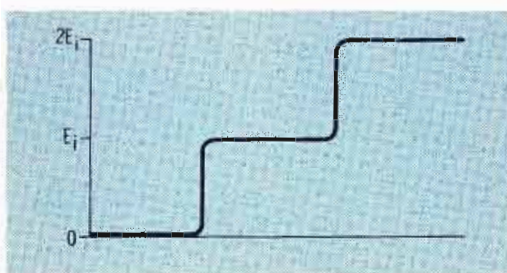


Fig. 6 Indicates open

found for this discontinuity. Generally, the series loss has a rising characteristic as sketched in Figure 7, and the shunt loss has a decaying characteristic as in Figure 8. The SWR, although usually not useful, can be found by noting the values of E_i and E_r and using the equation:

$$SWR = \frac{E_i + E_r}{E_i - E_r}$$

TDR Uses

The TDR can be used for looking over many parts of the system. It can check out new reel cable before it goes into the system, preventing trouble and saving or eliminating repair time, or test cable in a new construction project before the crew leaves. Even a carefully installed aluminum cable installation can be "dinged" by rocks or objects. So those dents, kinks, and bends that are im-

pactance mismatches which cause signal degradation to customers can be quickly found using the TDR.

The old wet connector problem, such as occurs when rain water and chemical impurities in the air attack the copper braided cable at the connector, shows up with the TDR. A large number of connectors can be effectively checked at once on a trunk line by properly setting the distance controls.

Ever have nearby lightning heat up some cable section, or burn out or change the value of a terminator? The ghosting problems that may result can be found by comparing the suspected cable or terminator with a reference cable, a calibrated potentiometer, or a good terminator in short order.

How about the time the carpenter accidentally pounded a nail into your trunk line in a new apartment building? In any new construction project like an apartment, motel, hotel, or school, the TDR is often handy for finding unmarked cable lengths, shorts or breaks in cable, where a customer has some mismatch, or the carpenter's nail.

Newly installed or weatherworn transmission lines to the system's antennas at the tower can be conveniently and carefully checked out on the ground first with the TDR. Then the tower crew can be sent up to fix the trouble spot.

Damage to cable from rubbing or falling trees and branches can be checked accurately with the TDR.

Whether your system is attacked underground by some rodent or at mid-span by a squirrel, the TDR can find many problems and reduce all that extra digging and climbing.

Limitations

Using the TDR is not all peaches and cream however. Several limitations exist. It is not intended to be used to look at the whole system at once, but instead it must check out only one cable at a time. Confusion can happen with multiple cable problems, where resulting reflections may interact. But somewhat fortunate, the first discontinuity is unaffected by the others, so the TDR can show what must be done to make improvements, discontinuity by discontinuity. The reflectometry method will not check the

INDUSTRY NEWS

cable after an amplifier, which is essentially a one-way device that stops step voltages from returning.

If the reference cable does not properly match the generator output, multiple reflections could occur which distort and complicate the display.

The input circuitry can be damaged by large voltages or static buildup on the cable. The safe level is below ± 5 Volts (DC + peak AC). Some equipment has an automatically switched AC voltage couple that extends protection to ± 100 Volts. An external optional voltage block can also be purchased for large voltages to avoid input component failure.

Resolution

Being able to clearly distinguish two discontinuities of similar magnitude on the scope display is called resolution. The system risetime, which is about 170 ps, limits resolution to around one inch of cable minimum to several inches on a long cable. The risetime of the test pulse tends to decrease down the line, reducing resolution on long lines or larger loss lines.

What's Available?

What TDR equipment is available? If you're clever enough, you might try building your own simplified small scale TDR.*

But for the expansive CATV system, there are several commercial units available. One is the Hewlett Packard 4920A, coaxial fault analyzer, that measures up to 5,000 feet of cable and costs \$1825. If you already have a HP 180 series scope mainframe (that starts at \$950), you can just buy the type 1818A plug-in TDR unit for \$1200. This unit claims resolution of one inch and will display cable lengths up to 1000 feet.

The Tektronix model 1501 is a battery operated portable TDR that runs eight hours on six rechargeable NiCd C-cells or on AC. This handy unit has a built-in chart recorder and sells for \$1900. But if you have a good scope it costs \$1425 without the recorder. For the 561B or 564B scopes there is available a combination plug-in pair for TDR operation, the 3T7 sweep for \$575 and the 3S7 sampler for \$620.

All these TDR units or plug-ins have an optional distance scale in either feet or meters at no extra charge.

There has been a definite need in the CATV industry for test equipment that can locate and display individual cable problems to indicate fast repair or installation. Although there are other methods, the TDR can find those tricky problems with minimal downtime.

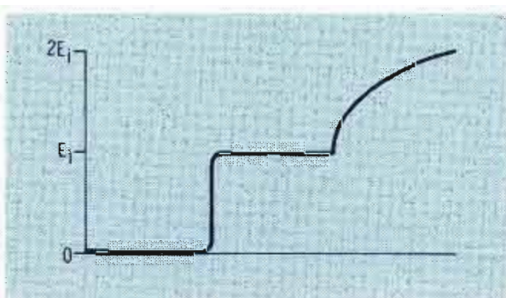


Fig. 7 Series Losses.

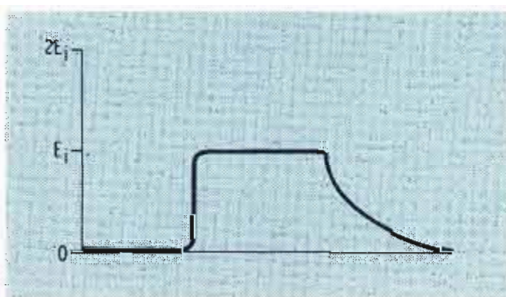


Fig. 8 Shunt losses.

References

- *Warren Jochem, "An Inexpensive Time Domain Reflectometer," *QST*, LVII (March, 1973), pp. 19-21.
- Halverson, Harvey. *Electronic Engineering Measurements Filebook*. How to Measure Transmission-Line Discontinuities with Pulse Reflections. Blue Ridge Summit, Pa.: Tab Books, 1967, pp. 141-147.
- Jochem, Warren. "An Inexpensive Time-Domain Reflectometer," *QST*, LVII (March, 1973), pp. 19-21.
- Lenk, John. "Time Domain Reflectometry," *Electronics World*, Sept., 1966, pp. 48-50, 70.

FCC Changes Performance Test Dates

New deadlines have been adopted by the FCC for completion of performance tests by cable television systems.

Systems which came into operation after March 31, 1972 must complete tests by March 31, 1974. Systems in operation before March 31, 1972, come under a stretch-out program, in which a different series of tests is due each year until 1977, when all performance tests will be applicable (Docket 19659).

Under Section 76.601(c) of the rules, cable television systems must conduct complete performance tests at least once each calendar year to insure that the system complies with technical standards specified in Section 76.605.

Cable systems in operation before March 31, 1972, the effective date of the new cable television rules, do not have to meet the full technical requirements until March 31, 1977. Systems that began operation after March 31, 1972, are subject to compliance with the start of service.

The first performance tests were originally required December 31, 1972. This deadline was extended a year in order to resolve questions involving test methods, availability of equipment and engineering personnel to carry out the tests, and financial burdens imposed on small cable television systems. The Commission said that the March 31, 1974, deadline would permit systems awaiting the resolution of these issues, to complete their performance tests.

The purpose of the stretch-out is to ease the financial burden imposed on the older system by pur-

chase of testing equipment and the requirement for additional technical personnel. The Commission determined most of the systems in operation before the effective date of the cable television rules were limited in size and in physical and financial resources. It said that by March 31, 1977, when all the technical standards become applicable to these systems, they would be ready to carry out all needed tests by buying or renting equipment and performing the tests themselves, if necessary.

The first group of tests, which can be carried out with basic equipment common to most operating systems, is due for the older systems March 31, 1974. These are concerned with visual and aural signal levels, system noise ratios and radiation. Additional tests re-

quiring more complex equipment and procedures are due each succeeding March 31 through 1977.

In certain technical matters, where actual measurements are not required, the Commission said by way of clarification that a "simple statement of facts" by the person carrying out the tests is all that would be required.

Other technical standards, such as matters involving co-channel interference, were referred to the Cable Television Technical Advisory Committee for study and consideration of possible modification of the standards. Tests involving these matters were suspended pending further action by the Commission. The question of the development of visual test methods was also referred to the Committee.

NEW PRODUCTS

CCTV Color Package

Panasonic is now offering a color TV package. The heart of the system is a camera that uses two identical $\frac{2}{3}$ -inch separate mesh vidicons. One is for luminance, the other for chrominance. And, it has resolution over 500 lines, with a minimum requirement of 50 foot-candles of illumination.

Panasonic claims only one half hour is needed for setup, followed only by the need to adjust horizontal and vertical centering.

The package includes their new WJ-5000P special effects generator that has internal and external keys. This allows fade-in, fade-out, lap-dissolve, and nine wipes. And you have a choice of normal, normal-reverse, or reverse wipe modes.

The system is completed with a color sync generator and a phase shifter.

For further information, use our Reader Service Card in the back of this issue or write directly to: Panasonic VTR-CCTV Dept., 200 Park Avenue, New York, N.Y. 10017.

For More Details Circle (95) on Reply Card

Low Cost Character Generator

A low-cost broadcast performance character generator with high legi-

bility characters, a built-in broadcast synchronizing generator and plug-in options for system expansion was shown at the NAB Show in New Orleans, November 12-14.

A new system built especially by **Telemation** for the Educational and CATV market; the TCG-1432 Television Character Generator provides 14 lines of 32 characters each and a 15th line for preview. The characters are 20 lines high and have edge shadowing to provide readability over all background pictures. The TCG-1432 mattes characters directly into input video.

TCG-1432's built-in broadcast synchronizing generator locks to input video and provides stand-alone operation without the need for drive pulses.

Two basic configurations for the TCG-1432 are available: TCG-1432A is a single, self contained unit and TCG-1432B comes with rack mount electronics and a separate keyboard.

For More Details Circle (76) on Reply Card

Sweep-Function Generator

Wavetek announces a new sweep/function generator Model 164 with several unique features.

The 30 MHz top frequency gives the widest frequency range available, and the 9 selectable outputs result in good versatility for a function generator. The normal outputs of sine, triangle, square, positive pulse, negative pulse and DC voltage are augmented by a balanced trapezoid, a positive trapezoid and a negative trapezoid.

The rise and fall of these new waveforms may be adjusted resulting in an infinite number of pulse and ramp outputs. All waveforms may be generated in the continuous, triggered or gated mode.

The sweep mode is also unique in that the sweep can be from low to high or from high to low frequency.

For More Details Circle (77) on Reply Card

Video Monitor

Displaying a remarkable sensitivity to a rapidly increasing market, **Sanyo Electric Inc.**, now has available a high performance 9-inch video monitor that has broad applications in student or employee education and training, as a surveillance or information display monitor, in studio applications as a camera or program monitor and in time lapse VTR applications as a record and/or playback monitor.

The Sanyo Model VM-4092 features 38 sq.-in. of sharp, clear video in an industrially styled video monitor and is considered excellent for the most demanding CCTV and VTR applications.

With all solid state circuitry, the state-of-the-art circuit design incorporates the latest developments in silicon semiconductor technology, as well as a rugged construction to assure reliable operation in a wide range of environments.

A high impedance bridging input with switchable 75 Ohm termination permits the VM-4092 to be used singly, or to be connected in a loop-through configuration with other video monitors.

For More Details Circle (78) on Reply Card

Ultrasonic Film Splicer

The price of the Model 2001 Ultrasonic Film Splicer has been reduced to \$1560, according to an announcement by A. W. Hall, Jr., President of **Metro/Kalvar Inc.**

The Model 2001, with interchangeable bed plates to accommodate Super 8, 16mm, 35mm or microfilm, has received wide acceptance in the industry.

Hall stated that Metro/Kalvar is now able to produce the splicer in

SUPER 8 IS HERE.

The new KODAK SUPERMATIC 8 Processor lets almost anyone on your staff get expert film processing results.



the push of a button. And a little light goes on to tell you when it's time to push the button. Automatic threading and no special plumbing installation...just an ordinary tap and drain will do.

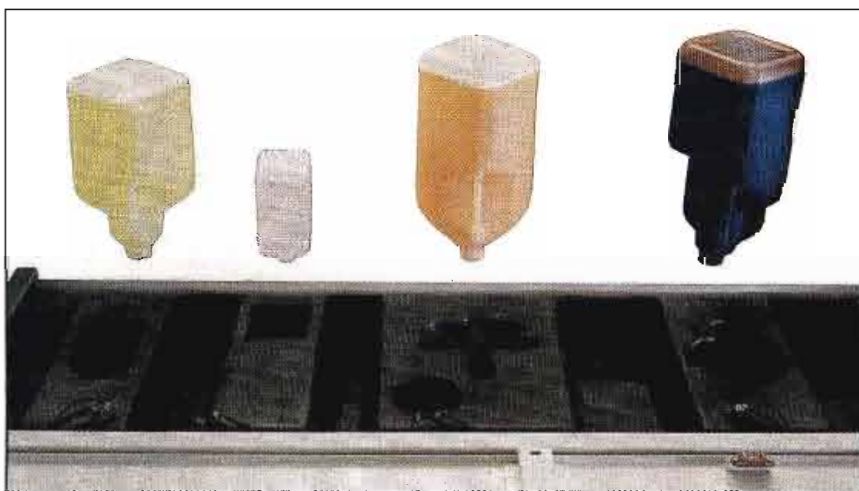
It all boils down to this: Super 8 film is economical. Our new KODAK SUPERMATIC 200 Sound Camera gives you the portability you need for local features, news and commercials. With quality thrown into the bargain. And our new SUPERMATIC 8 Processor develops your film fast.

Take a closer look. Take advantage of easy super 8.



The SUPERMATIC 8 Processor is a complete film processing lab in a cabinet-size unit that virtually anyone can operate. It features a rapid-access operation that processes a 50-foot roll of the new KODAK EKTACHROME SM Film 7244 in just 13½ minutes.

And it's so easy to operate.



The chemicals come in color-coded bottles that fit only in the proper slots. It automatically flushes and cleans itself at



Please send me more information on all your new professional super 8 products, including the new KODAK SUPERMATIC 200 Sound Camera, pictured here.

Return this coupon to:
Eastman Kodak Company, Dept. 640-PR
Rochester, New York 14650

Name _____

Address _____

City _____

State _____ Zip _____

larger quantities at a lower manufacturing cost and these savings are being passed on to the customer.

The Model 2001 was demonstrated at the 114th SMPTE Technical Conference along with a 70mm version, the Model 2070, and a small, portable Super 8 splicer, the Model 2008.

For More Details Circle (79) on Reply Card

Antenna Site Hub Amplifier

An all new multiple output antenna site/hub amplifier is being introduced to the cable television industry by **C-COR Electronics**.

This unit is a wideband, active multicoupler that provides four outputs from one input, and each output is amplified by its own trunk-quality, integrated circuit amplifier. It has very low distortion characteristics and is intended for use as an antenna site, trunkline splitter. The integrated circuit configuration is such that the unit introduces no more distortion than a single trunk station at each of the four outputs.

The amplifier is packaged in a 19 by 5¼ by 8¾" rack mountable housing with RF input and output connectors at chassis rear. Test points for monitoring input and output levels are located on the front panel of the housing. All RF connectors are type "F".

The bandpass is from 50 to 300 MHz at ± 25 dB minimum with gain from -6 to +6 adjustable at input. Input and output return loss measures 18 dB minimum at 75 Ohms. It has an output isolation of 30 dB typical. Cross modulation is -84 dB at 40 dBmV output (12 channel flat). It is powered by 117 Vac at 60 Hz. Model number is 1801.

For optional equipment, the 1801 has an equalized attenuator which enables each of the four outputs to be individually slope adjusted and attenuated. Consult factory for more information.

For More Details Circle (80) on Reply Card

One-Line Caption Generator

Datavision, Inc. is now marketing a Video Message Generator, Model MG-1, designed for applications where repetitive or non-changing messages are required.

The rack-mounted unit takes up only 1-3/4 inch of rack space; locks to



any sync or video; provides internal video mixer; and allows positioning of the one-line message anywhere on the display.

Each unit offers one row of sixteen alpha/numeric characters with height adjustable in six selectable steps: 18, 36, 54, 72, 108 and 144 scan lines high. Characters are clear and easy-to-read.

Uses include: channel identification for translators, CATV, ETV and closed-circuit television systems; camera/monitor identification; special announcements such as...PLEASE STAND BY!...DON'T ADJUST SET; and, often-used program headings such as...HOTLINE BULLETIN... SPECIAL REPORT.

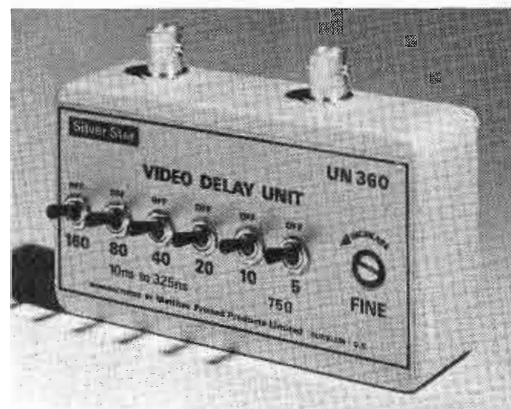
A data connector is provided to allow cascading of this and other Datavision video modules such as: Time and Temperature; and Date and Time units. Combined modules produce a multi-row display with a choice of character size per row.

For More Details Circle (81) on Reply Card

Adjustable Video Delay

Matthey Printed Products is introducing a new delay unit—the UN.360—which should be of interest to the television industry. Fitted with BNC connections as standard, the unit has a range of 10ns to 325ns in 5ns steps by switches, and a fine trim of ± 4 ns by screw adjustment.

This delay unit can be used for delaying up to and beyond 360° of phase at color subcarrier in either PAL or SECAM, or NTSC systems.



The performance has received special attention so that the response of amplitude/frequency is controlled to within 0.2dB ripple up to 5.5 MHz, thus preserving transmission quality video signals.

For More Details Circle (82) on Reply Card

Linear Slide Audio Controls

Waters announces the release of a newly designed series of economical linear motion audio controls (faders).

The LM4-200/LM6-200 series features a ruggedized design with "professional" feel. Resistance elements and slip rings are made with Waters' own MystR(R) conductive plastic for long, noise-free life, minimum 100,000 operations. Standard impedance values are 600 and 10,000 Ohms and functions are linear, audio-taper, or logarithmic. Maximum attenuation guaranteed is 85 dB. Cue-switches and detents may be specified. Both mono and stereo are available.

Two types of escutcheon plates are available — black anodized aluminum 3/16" thick, or a self-adhering lithographed black vinyl for sub-mount application.

For More Details Circle (83) on Reply Card

Memo to Consult- ing Engineers

Broadcast Engineering's "Professional Services Section" is your most economical and effective way to display your Professional Card.

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\$16 per monthly issue, 12 or more times
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Greater at-station circulation: FM, AM and educational radio; TV, ETV, CCTV and CATV; recording studios.

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Your Professional Card in BE is a full column wide!

Chapter 16—Seattle, Wash.**Chairman: John Maxson,
KETO (FM)****Issaquah, Wash. 98027**

A social hour starting at 10:30 AM on October 10th was followed by lunch and then a discussion by Bob Adams and Jack Barnes, both of KOMO-TV, Seattle, who spoke on "counters". Adams and Barnes both have built counters from scratch. They covered the design aspects and circuit and construction data. Bob Dietsch of the FCC reported on the latest Commission actions.

Chapter 18—Philadelphia, Pa.**Chairman: Jack Jones, WCAU-TV,
Philadelphia, Pa. 19131**

On October 23rd at Williamson's Restaurant, William Raventos of Electro-Voice introduced two new microphones and also spoke on monitor speaker systems, filters, power supplies, remote power sources for condenser microphones, and proper microphone usage for remote and live pickups. Slide and audio tape demonstrations were included.

Chapter 20—Pittsburgh, Pa.**Henry R. Kaiser, WWSW,
Pittsburgh, Pa. 15212**

On October 18th a 12-noon meeting was held at the Pewter Mug, next door to Buddies, at 435 Market St.; main discussion centered around plans and programs for the coming season. Anyone interested in future meetings contact Hank Kaiser at 322-5500, or Roy Hoover at 391-3000.

Chapter 21—Spokane, Wash.**Chairman: T. O. Jorgenson,
Chief Eng., KXLY-TV,
Spokane, Washington 99201**

The chapter meets every Monday at noon at the Castle Restaurant in Spokane. Members, guests, travelers, manufacturers, sales and engineering people, and others interested are always welcome. Call Jorgey at (509) 328-9084 for information.

Chapter 22—Central New York**Chairman: Hugh Cleland,
WCNY TV/FM
506 Old Liverpool Rd.,
Liverpool, N.Y. 13088**

On September 20th, the chapter met at the Northway Milton Motor Inn. Bob Mahoney of Tektronix talked about the vertical interval reference signal and demonstrated the Tektronix 1440 Automatic Video Corrector. A nominating committee was formed for upcoming elections. On October 19th, the chapter joined with Chapters 1 and 2 in sponsoring the Miniconvention at the Treadway Inn, Owego, N.Y.

Chapter 26—Chicago, Ill.**Chairman: Bradley Anderson,
Univ. of Ill.****Chicago, Ill. 60680**

On September 18th, the chapter met at Chicago Stereo Mastering for a tour of the facilities of tape duplicating and lacquer masters and the nearby pressing facilities of Musical Productions, Inc. The chapter provided refreshments for all who attended. The October

(Continued on page 54)

Paragraph 73.69 of the FCC's Rules and Regulations states:

... every standard broadcast station employing a directional antenna must use a type-approved phase monitor.



OUR AM-19 (204) IS THE ANTENNA MONITOR THAT MEETS ALL FCC REQUIREMENTS!

WHAT THIS MEANS TO YOU

1. If you're a new station or if you're making significant changes—you must have a type-approved antenna monitor by June 1, 1973.
2. If you operate your station with less than a first class radiotelephone licensed engineer, you must have a type-approved antenna monitor by June 1, 1974.
3. If you are presently operating your station by "remote control", you must have a type-approved antenna monitor Now! Or—you can use a monitor "properly configured", if such a monitor was manufactured after 1965.
4. Every other directional station must have a type-approved antenna monitor no later than June 1, 1977.

YOUR BEST CHOICE?

The AM-19 Antenna Monitor from POTOMAC INSTRUMENTS. The proven instrument for measuring phase and loop current ratio, the AM-19 can monitor up to 12 towers and accommodate DA-1,

DA-2 and DA-3 patterns. Phase meter resolution is 0.5 degrees. Loop current accuracy is $\pm 1.0\%$ with a 0.5% resolution.

AND—the AM-19 (204) is the only *type-approved* antenna monitor that meets all FCC requirements NOW!

YOU MUST HAVE A TYPE-APPROVED ANTENNA MONITOR—CHOOSE THE AM-19 (204) TODAY!

For complete information, please write or call:



Producers of
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POTOMAC INSTRUMENTS, inc.
932 Philadelphia Avenue
Silver Spring, Maryland 20910
Phone: (301) 589-3125

For More Details Circle (18) on Reply Card



WGN updates their TV mobile remotes

Fig. 1 WGN displays their new mobile TV trailer that is the workhorse of their heavy remote schedule.

By Robert Splithoff and Fred A. Geyer
WGN Engineering, Chicago.

Can a TV station handle 210 remote operations in one year? WGN can....and will.

Six months ago WGN-TV placed its new color television trailer into service. This marked the culmination of a project which had its beginning in the Spring of 1970. Many months of preliminary planning and layout preceded assigning the final responsibility of design, fabrication, assembly installation, factory check-out, and testing to F. & M. Systems Company of Dallas, Texas.

Based on over 25 years of remote telecasting experience, and over 13 years of remote color experience,

WGN-TV has provided a new unit which can best serve its heavy remote schedule. It becomes immediately evident when touring the color trailer that the station has a very functional unit; it is roomy, comfortable and certainly has all of the necessary electronic hardware to support the station's day-to-day remote telecasting schedule.

To support this claim, a general description of some of the features provided in the mobile unit follows.

Production Area

The production area is roomy. The director, video switcher and producer can operate effectively

and comfortably and can give their full attention to an elaborate audio and video monitoring facility that is at their immediate disposal. Also, they can effectively communicate to cameramen, announcers, studio and other production personnel.

A 20-input video switcher manufactured by Central Dynamics Corporation provides two special effects systems, chroma key, modulator, down-stream keyer, quad split, and color matte on eight switch busses. A dual tally system is evident on the 20 production video monitors. Behind the production console is a fold-away table and cushioned bench for use by ad-

ditional production personnel.

Audio Control Booth

Directly behind the production area is an isolated audio control booth. This room contains a custom audio console and adjacent rack containing essential auxiliary audio equipment. The audio operator is seated so as to be in full view of the production area. Front and rear doors to the booth allow for passage through the trailer. In fact, you can walk through the full length of the 40-foot trailer without stepping outside.

The heart of the sound control system is a 16 input, four channel custom audio console. Its features include a reverberation unit with echo send and receive on each input, equalizers, compressor, pre-view system, dual monitoring system, remote control of two cartridge record/playback units and reel/reel tape machine and features a solid state modular construction using vertical attenuators.

All external audio cabling and telephone company lines terminate on a convenient panel located in the patch rack within the audio booth. The bulkhead connector panel interfaces to the audio jack field located in the rack adjacent to the audio console.

Camera Shading Area

Located to the rear of the audio booth is the camera shading area. Three custom racks contain necessary control equipment for the RCA TK/44 color cameras. The mobile unit is normally equipped with four cameras. Two additional camera chains are completely wired and have the necessary monitoring facilities installed. It is a relatively simple transition for the addition of some studio equipment to make the mobile unit a six camera facility.

Convenient to the shading operators are necessary switching equipment—vectorscope, line scopes and color monitors. Total video patching of the entire video system, utilizing more than 300 video jacks in the video patch rack, is within easy reach of the shaders.

Since all incoming audio, video and camera cabling enter the trailer



Fig. 2 In the Audio Control Booth, the engineer looks into the production area.



Fig. 3 Kenton Morris (L) and Bob Splithoff are ready to begin control in the production room as Ron Ose looks on from the Audio Control Booth.

through small cable ports and terminate on connector panels within the mobile unit, there is a three-fold advantage: (1) There will be no fear of corrosion of panel cable connectors that are exposed to the outside weather conditions; (2) Space under the vehicle can be freed for added storage; and (3) Troubleshooting of line problems can now be done inside the van under desirable conditions.

Utility Area

In the rear portion of the color trailer—the utility area—is housed the Ampex slo-motion, stop-action HS/100. This gear will be a fixture

within the trailer, although it is easily removable through the rear doors. Typically, the HS/100 will be controlled from the camera shader's position; however, control cabling allows for the control unit to be operable from the production desk or even external to the vehicle itself.

Three utility racks contain pulse generators, pulse amplifiers, off-air tuner, modulator and additional monitoring of audio and video systems. There remains in these three racks space for expansion (microwave receiver, auxiliary camera chain and/or a character generator).

The main power distribution rack



Fig. 4 George Ervo (background) and Lewis Scott on duty in the Camera Shading area of the van.

contains all circuit breakers and distribution of AC to the 14 equipment racks, utility outlets, lighting and air conditioning. Metering of current, voltage and frequency of incoming power is provided. The top panel contains the control facilities for the air conditioning and heating.

Power enters the vehicle through two four-wire cables to the power connectors on the lower rear curb-side bulkhead panel. Directly behind this panel and accessible through a roadside belly compartment door, power is fed through three manual disconnect switches and to two 15 KVA input transformers for the technical load and also to one 30 KVA transformer for the air conditioning load.

Within the power compartment the technical load is fed to two 15 KVA voltage regulators which will

assure constant voltage to the technical equipment. In this same general area are the battery and charger that feed the DC lights and roof hoist. Telephone company distribution and key equipment are also conveniently located in this compartment.

Communications

The four basic operating areas are in full communication via a microphone/speaker talkback system. In addition, all positions may converse with the studio and cameramen. Five IFB outputs are provided for announcers and production personnel. The isolation between areas and choice of speaker and microphone locations allows for excellent control of talkback levels without fear of feedback.

A headset interphone system also interconnects all areas including

cameramen and other production personnel.

Outside communications is accomplished through five jack-equipped, wall-mounted business telephones—each capable of receiving five business lines with hold buttons. Two voice couplers allow for two simultaneous interconnections of any two business lines to the trailer talkback system as well as furnishing emergency program backup to the studio.

Trailer Interior

One-inch plywood covers the floor surface over two inches of insulation. The floor is completely carpeted by a durable Antron fiber carpet with anti-static characteristics. This carpet extends up the side walls to a height of 30 inches. A wood grain laminate surface extends to the ceiling. This same



Fig. 5 Those responsible for the mobile van changes at WGN are from the left: Robert Splithoff, Engineer-in-charge, WGN TV remotes; Fred Geyer, administrative supervisor, engineering, WGN Radio and WGN Television; Woodrow Crane, Chief Engineer, WGN radio, WGN Television; and Ralph Batt, vice president, Manager of engineering, WGN Continental Broadcasting Company.

lamine was used on the production desk and audio console.

Within the off-white laminate ceiling surface are the AC-DC work lights for general illumination and dimmable spotlights for on-air lighting.

Two five-ton air-conditioner units are located in the front of the van and provide a combination of heating, cooling, ventilation and dehumidification. The two compressors operate individually or sequentially. Maintenance of the air conditioning is simplified in that there is full accessibility to these fixtures through the full length double doors at the front end of the trailer.

Trailer Exterior and Storage

Located beneath the floor and accessible from the outside are

eight spacious belly storage compartments. In these areas six cameras, their zoom lenses, tripods, dollies, power cables, camera cables and miscellaneous audio and video cables are stored. Slide-out doors and bins are provided in all cable storage compartments. Each compartment has its own AC-DC ceiling light fixture.

A DC operated hoist, contained within the center of the curbside wall, may be used to raise cameras or heavy equipment to the roof of the trailer. A secondary use of this hoist is to "fly" overhead cabling used on many of the remotes.

The 40' by 8' expanse of roof is accessible from two ladders located on the front and rear sides of the unit. The roof surface is constructed to support cameras and necessary production and engineering personnel for on-the-spot reporting of

parades, etc. The one-piece aluminum roof skin is painted with a non-skid carborundum particle paint. Ninety-six feet of 36" pipe railing (removable) can be mounted on the outer edge of the roof surface.

Vehicle Chassis

The color mobile unit is 40 feet in overall length, 8 feet wide and 12 feet six inches in height. Eight 10:00 by 20:00, 12 ply tires are mounted on tandem rear axles. The rear axles and the front coupler are cushioned on air bellows affording the best road performance of this vehicle.

With over 210 remote operations anticipated for 1973, WGN-TV welcomes its new television mobile facility. Wouldn't you? □

Filmchain Projection Simplified



The new Bell & Howell Model 562 Optical/Magnetic Filmchain projector is delivered complete with a base which contains the projector controls and height adjustment to align the projector with TV camera or multiplexer. The projector is very much like the reliable 500 series design manual thread 16mm projector which is widely used in industry and education.

The Model 562 utilizes a synchronous motor, chain-driven film transport system including an automatic loop restorer to assist in providing picture and sound into the camera for transmission over closed circuit or antenna-signal distribution. The pedestal includes facility for easily installing remote operation from a control panel.

Other Features You'll Like

Optical or magnetic sound play back. Choose from a wide variety of standard lamps and Bell & Howell lenses to obtain the optimum lumen input to the camera. A special torque release lever is provided when using reels with small hubs.

Other Important Details

Projector reel arms are gear driven, which provides quiet, reliable operation and constant take-up torque. The "Stellite," 3-tooth shuttle and ground and polished aperture plate, provides careful film handling in the projector transport system.

Self-lubricated bearings and other fine engineering details provide long life. The 500 series product design is well known to the hundreds of Bell & Howell service stations across the country, providing a ready facility to service any projector when maintenance or repair is required.

A Final Thought

The instruction books and service manuals provide the details necessary for installation, both electrical and mechanical, as well as remote control. Contact Bell & Howell, Chicago, for technical literature and the name of the local sources who will help you select the best combination of lens, lamp and equipment to project 16mm films for TV program distribution or local display.

AUDIO VISUAL PRODUCTS DIVISION
7100 McCormick Road, Chicago, Illinois 60645



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is also what you get.

When you look into our coaxial cables, the completeness of the line is the first thing that strikes you. It's unique. We're the only manufacturer to offer a coax to meet every need: copper corrugated, smooth aluminum, foam dielectric and air dielectric; both types with a choice of constructions in a wide range of sizes and continuous lengths. A check on the performance of these coaxial cables in the lab or in the field would present convincing evidence of a high degree of mechanical integrity and outstanding electrical characteristics. Request a quotation and a glance at price and delivery will be the clincher.

These qualities are obvious to anyone who cares to look for them but our coax customers get still more not so readily seen. For instance, fast reaction to your RFQ's and prompt, accurate, response to requests for technical data and assistance in system or subsystem design. Perhaps a custom cut length of coax or a special assembly, terminated and ready to slip into place is what you need. No problem. After-sales service is not an empty statement with us. It's an article of faith.

May we tell you more? Write for your copy of our new 64-page catalog today. Cablewave Systems Inc., 60 Dodge Avenue, North Haven, Connecticut 06473. (203) 239-3311.



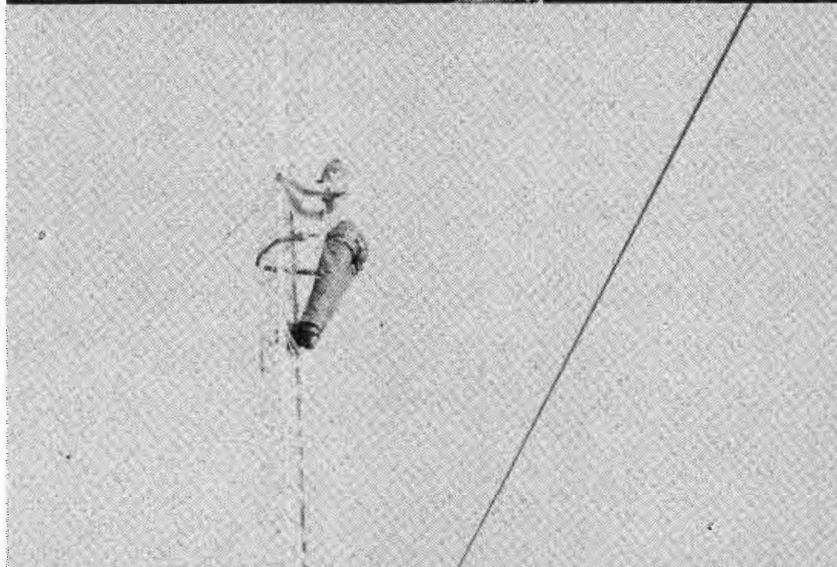
Cablewave Systems Inc.

A Corporation owned by Phelps Dodge and Kabelmetal

For More Details Circle (23) on Reply Card

Keeping costs in the black

By Pat Finnegan



We don't care if our audience understands our business or technical operation.

Their big view of broadcasting often is more exciting. The viewer/listener picks it up as either an entertainment or news vehicle (or both). And then in the early morning hours with more dread than excitement, he reacts to it as an alarm, or he shakes out the cobwebs while trying to remember the expressways you say are already loaded bumper to bumper.

Unfortunately, within the industry we forget the total professional picture that keeps it viable and operating at a reasonable profit figure. The tendency is to get comfortable in segmented organizational patterns.

A high percentage of those engaged in broadcasting devote most of their time and attention to the business of signal content. Meanwhile, considerable effort must be spent on availabilities, sales, and billing.

It's not too hard to see the connection between these departments with costs and profits. What is hard to see is how some costs and profit are affected by station engineering. Harder yet, is to visualize how management/engineering decisions - or the lack of them - fit into the picture. Just as other departments torque down their thinking to solely specialized areas of responsibility, so it also can happen in engineering.

Since the broadcast station must carry on its business through a technical complex, the operation of this complex constitutes a large share of station costs. And, since engineering personnel, and particularly the chief engineer, are responsible for this operation, the activities of the chief engineer and his engineering personnel contribute directly to the bottom line figure of station operation.

In any highly specialized activity, it is easy to become immersed in the problems at hand and lose sight of the broader purposes. Or, to use an old saw, "can't see the forest because of the trees." And, in broadcasting, rather than being the **means**, the technical complex to

BROADCAST ENGINEERING

some engineers can become the ends.

This article hopes to bring into perspective the broader cost factors of this technical complex as they affect station activities and "local" decisions. And at the same time, we'll endeavor to broaden the viewpoint of those in a position of profit responsibility, as well as those in the ranks who aspire to such a position, so they may view their own activities not as isolated endeavors, but as a positive contributing factor in overall station economics.

True Costs

It's easy to fall into thinking of costs only in terms of immediate dollars spent on some activity or equipment. And this can just as easily lead to erroneous conclusions. True costs also take into consideration longer term values and expenses, balanced against income at the end of the year or other costing periods.

Income is not only the dollars received from the sale of time. It includes credits, goods, services, refunds, rebates, and insurance proceeds. In a larger sense it includes such intangibles as good credit standing, good will, and audience loyalty.

True costs, then, are costs as they fit into the overall picture. Assessing true costs for any particular activity requires both a knowledge of and an interest in the total operation, then fitting that particular activity into the total operation. This aspect is important, for although time and dollars spent on a particular activity may seem high, they may be low in terms of true costs.

Costs vs. Attitudes

Individual attitudes may narrow and develop into personal "hang-ups" that militate against objective management decisions. Overtime pay can become one of these—yet there are times when premium pay is justified.

Consider this situation: Studies show that a large percentage of the regular audience rises in the morning long before the local station

signs on. These people "use" other stations to bring them up to date. There is an audience waiting, so consideration is given to an earlier daily sign-on. But manpower is already stretched to maximum and an earlier sign-on will mean overtime wages.

Wages are not the only factor that should be considered. There is also the cost of facilities use, utilities and equipment. Even so, you can almost count on the strongest argument **against** an early sign-on being overtime wages!

Income potentials from time sales, listener loyalty and good will must be considered against the total cost. If a "go" decision is made, it can only come after a reasonable trial period when the profitability of that decision can be determined, and this will be in relation to the overall station picture. Although particular cost factors in that time period may be relatively high, so may the income factors. And in the overall picture, this time period may be more profitable than many other time periods of the broadcast day!

The chief engineer will not likely be deeply involved in such a decision. But in many similar instances, he will be called upon for cost figures within his area of jurisdiction. So, it is well to realize that estimating true costs will help others make sound decisions.

Immediate Cost Long Term Profit

Consider this situation: An FM station is operating on an emergency antenna with low power and a severely restricted coverage area. It is the Spring of the year and weather can be most **unpredictable**. Repaired parts arrive on Tuesday, the riggers and outside engineering are immediately available.

An argument is advanced that work should be delayed until sign-off Saturday night and then there will be no revenue loss. This sounds reasonable, but consider the cost route: Riggers and engineering may not be available the next weekend, weekend and night work are at premium pay, night work goes slower and thus there will be longer

hours at premium pay, plus the loss of audience for a longer period of time.

The decision was made to go with the weather, which was clear on Tuesday. Parts were installed the next day, and the changeover and tune up actually took the station off the air 1½ hours, although in drive time. All work was completed before the weather closed back in at 6:00 PM. Most of the "spots" were made up, so the revenue loss was small, and the work progressed rapidly at regular rates.

The weather, incidentally, did not clear again for a few weeks, and the particular weekend in question was treated with a severe ice storm!

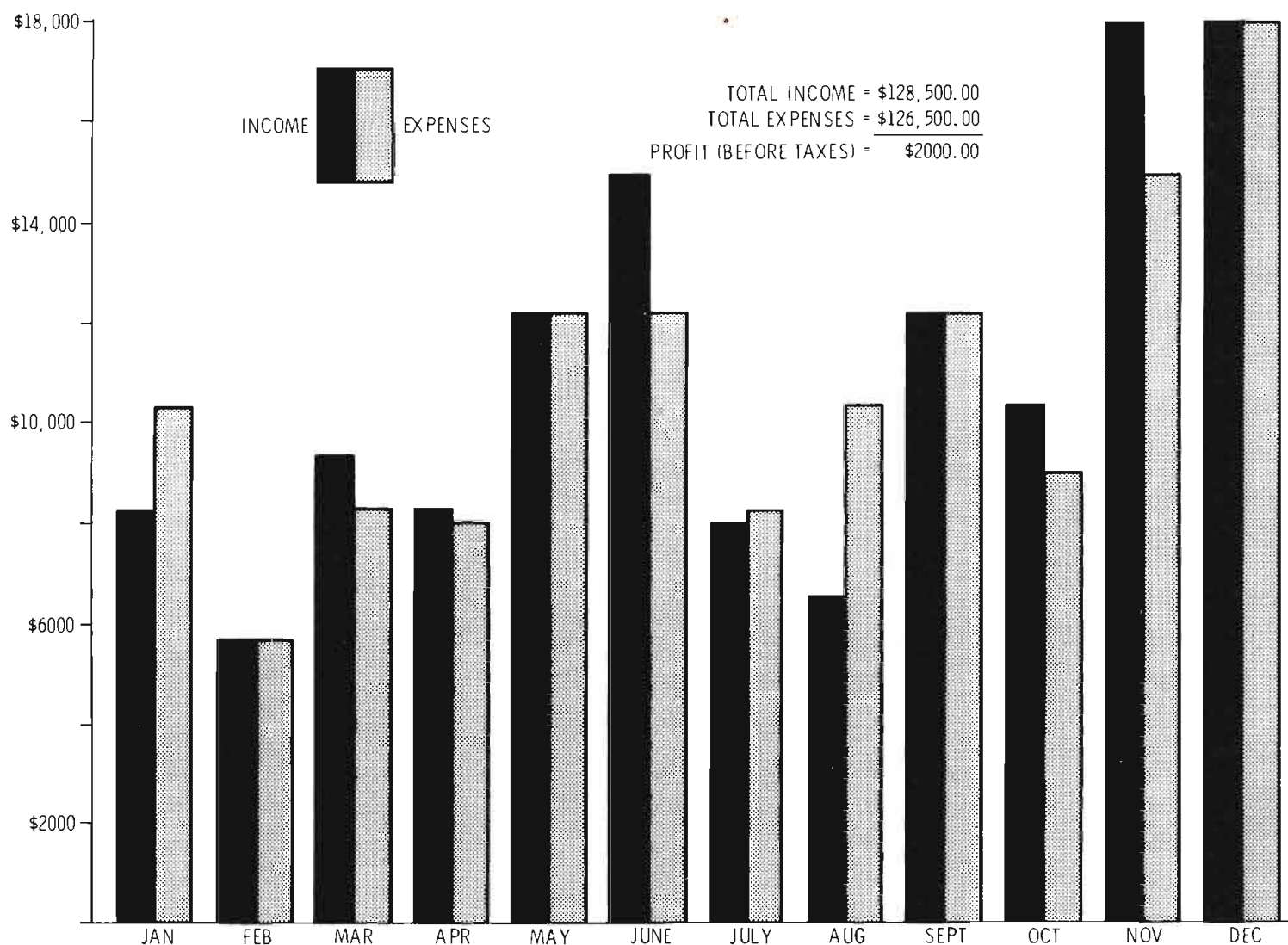
Luck? Perhaps, but if direct revenue loss had been a strong enough hangup, it could have prevented objective judgment in making what turned out to be the correct decision.

As mentioned earlier, cost of facilities use or major items such as a transmitter, VTR, etc., can be reduced to a cost per hour basis to aid in making decisions, or when working up recommendations. The transmitter power tubes, for example, can be easily translated into cost per hour figures. All it takes is some record keeping that should be done anyway. From the tube records, you can determine the average life span of the power tubes and divide the total cost of a new tube by this life figure to arrive at cost per hour.

Time and wages of personnel are cost factors, and just how important they are not only depends upon dollars for wages, but also productivity. Of course, there are

Management Highlights

If yours is a profit-making station, there are ideas here that will help you better understand how management/engineering decisions affect the potential. If you're not making a profit, it's all the more important.



Costs must be considered against time. Individual months may be high. When the visual charts - or bookkeeping records - indicate abnormal costs, it's time to investigate.

low and the high productive periods, but also consider other situations where one can become less productive without realizing it.

This can happen in the "do-it-yourself" projects. The time devoted to the project must be considered as a cost factor in the finished product or result. Some will say "he wasn't doing anything anyway"! Be that as it may, the engineer's time is just as much a part of the cost of that item as are the dollars spent for components. Unless the engineer can turn out a workable, reliable product **in a reasonable period of time**, the true cost of that project can be far more costly than a commercial unit!

It's also true that engineering time seems very well spent. After all, the Chief is constantly on the move. He's busy reworking something here or rebuilding something there. But the truth of the matter may be that the Chief and the entire engineering staff may be spending most of their time keeping the technical complex barely on the

air! Just barely, because the old equipment keeps the Chief and his staff from doing what is more obviously creative engineering. However, the fact that the station is on the air may be a good indication of their creativity.

Depreciation

When major equipment items are purchased, their cost may be depreciated over a period of years for tax purposes. The actual amount allowable each year is determined by tables and agreement with the IRS. Once on the books, this is an expense item and when many major assets are placed on the books suddenly, depreciation can become a sizable portion of station costs. Until these assets are through their depreciation period, these costs must be figured into overall station costs as well as in any cost-per-hour figures you may develop.

The other side of assets expense is the actual dollars spent to purchase the assets. There will be an expense whether the station pays

cash in full at purchase or uses a deferred payment plan. On the deferred plan, there will be an interest expense. In full cash payment, there is the loss of interest that money could have earned if left on deposit in a bank or other investment.

Delegation of Authority

The station licensee, whether this be an individual or a corporation, is responsible to the FCC for operation of the station, according to the FCC Rules and in accordance with the station license. The chief engineer and his engineering personnel are carrying out the technical provisions of this operation through an implied delegation of authority from the licensee through the station organizational structure. To what degree a chief engineer is permitted to operate in this fashion will vary from station to station.

With this fact in mind, the chief engineer has a duty to the licensee to make known technical situations that are at a variance with the

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

Proven Flexibility in Standalone Time Base Correctors

Regardless of your VTR—power line-locked, capstan servo'd/V-locked, or H-locked—our Delta Series Time Base Correctors and Hue Shift Correctors offer standalone processing of all color signals—either NTSC direct, "NTSC-type" or heterodyne "color under." And in monochrome—either RS-170 or RS-330 industrial sync.

Offering the best economy and flexibility, the Delta 44-328 HETROCOLOR™ TBC works with all types of monochrome and color VTRs. Particularly in cassette VTRs without our TBC, the color tape will be a long way from FCC acceptance. Aside from independently varying sync and sub-carrier frequencies, editing capabilities are marginal. The HETROCOLOR TBC is the only unit on the market that allows transfer of heterodyne record VTR signals to a broadcast VTR. Second generation playback of this tape through the TBC corrects the color signal for broadcast with clean electronic splices.

For the best cost/performance package in the business, select the standalone Delta 44-200 NTSC Direct Color TBC coupled with the Delta 7 VELCOR Hue Shift Corrector for the finest in broadcast color processing.

And if you're staying with monochrome somewhere in your system, our Delta 44-028 TBC combines broadcast specs with our lowest price.

For more flexibility, we've added the Delta 23/3.58MHz subcarrier generator as an accessory to the Delta 44-328 TBC for combined outputs that are the equivalent of a broadcast stable NTSC color sync generator.

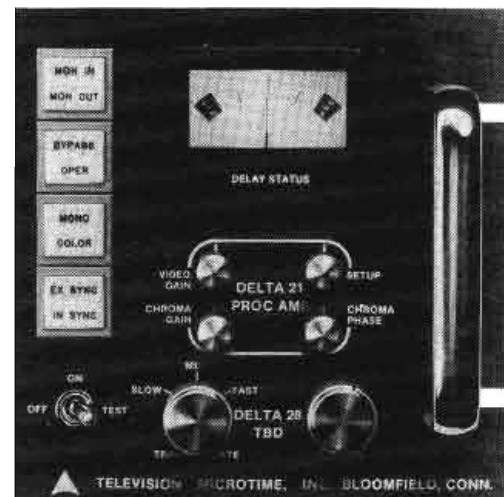
Exclusive Features of Our Growing TBC Family

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

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

Universal Color Corrector. In "NTSC-type" and "color under" playbacks from 1/2", 3/4" and 1" VTRs, all you need is our exclusive HETROCOLOR TBC, despite the wide variety of color recording and recovery techniques.

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



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

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

Experience is Our Guide

We introduced the first of our Delta family at the Chicago NAB Show in April 1972 and delivered our first production unit to the University of North Carolina two months later. In March 1973 at the Washington NAB Show we introduced two additional TBC models, the Delta 7 Hue Shift Corrector and several accessories. We are now delivering this family of products that work with the whole spectrum of VTRs from 1/2" helical to 2" quad.

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

Look at Who Has What in Time Base Correctors

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

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

	Ampex	RCA	IVC	TMI	CVS
MONO					
All Mono VTRs				44-028 🍏	
COLOR					
1/2" line/V-lock				44-328 🍏	*502
3/4" line lock				44-328 🍏	*502
1" line lock				44-328 🍏 7-001 🍏	*502
1" V-lock				44-328 or 44-200 (with 14) 🍏	500
TBC				7-001 🍏	
HSC				44-328 or 44-200 🍏	500
1" H-lock				7-001 🍏	
TBC	790		4102	44-328 or 44-200 🍏	
HSC	VELCOMP (Optional built-in)			7-001 🍏	
2" Quad				44-200 or 44-328 🍏	500, If VTR has AMTEC or ATC
TBC	AMTEC COLORTEC PROC AMP	ATC CATC PROC AMP		7-001 🍏	
HSC	VELCOMP	CAVEC			

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

🍏 How do you like them apples?

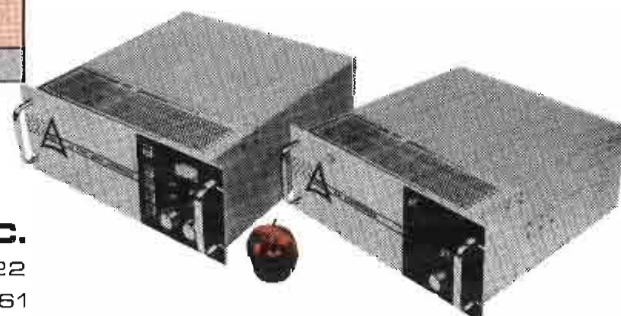


TELEVISION MICROTIME, INC.

1280 Blue Hills Ave., Bloomfield, Conn. 06022

(203) 242-0761

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Adding It All Up

The depreciation allowance each year for tax purposes on large equipment purchases becomes an expense item and can skyrocket station expenses. In (a) is a yearly technical expense budget, in (b) the depreciation allowance from the new purchase is added the next year, assuming the first year expenses were identical the 2nd yr.

(a) Salaries	\$90,000.00
Payroll taxes.....	4,200.00
Repairs & Supplies	15,000.00
Wire charges	6,000.00
Power.....	9,800.00
Engineering fees	1,500.00

Eng. Expense: = \$126,500.00/year

- (b) \$150,000.00 new major equip. purchase, 10 year amortization period allowed
then: \$150,000.00 divided by 10 = \$15,000.00 per year allowance

old expense figure:	\$126,500.00
add depreciation	+ 15,000.00

new expense figure: \$141,500.00/year

this is an increase in expenses of approx. 11.9%

- Although paying premium wages, adding the hour a day for 6 days a week can be a profitable move.
- The added hour may be more profitable than some other hour period of the broadcast day.

(a) Expense:

facilities...\$20.00/hour x 6 days = \$120.00/week
OT wages ...\$15.00/hour x 6 days = 90.00/week

total expense = \$210.00/week

Income:

sold 18 min./hour x 6 days = 108/week at 10.00 minute = \$1,080/week

income	\$1,080/week
expense	- 210/week

profit \$870/week

(b) Expenses:

facilities.....\$20.00 x 6 days = \$120.00/week
wages.....\$10.00 x 6 days = 60.00/week

\$180.00/week

Income:

sold 10 min./hr. x 6 days = 60 min./week at \$8.00/min. = \$480.00/week

income	\$480.00/week
expense	- \$180.00/week

profit \$300.00/week

Cost per hour for technical facilities expense can be estimated from the yearly average budget figures. Wages will be included in this figure. Assume the station is on the air 18 hours a day, 7 days a week.

365 days in year \$132,000.00 engineering budget for year
x 18 hrs./day

6,570 hrs./per year

then: \$132,000 divided by 6,570 = \$20.00 per hour approx.

station license, or items which must be purchased to meet the minimum requirements. This information would pass, of course, through the normal organization channels.

The annual audio Proof of Performance, for example, must be made with test equipment that has acceptable specifications, and equipment in this category is not exactly inexpensive. When you recommend a certain test equipment package to the station manager, and you're talking a price tag of perhaps \$2,000, he may see his carefully nurtured balance sheet slipping. In defense, he may insist that he has seen equipment and

kits (service types) in catalogs for a hundred bucks that would do the job just as well.

It is your duty to explain the specifications needed in the test equipment that would make the results acceptable to the FCC.... anyway, it is not your desire (or shouldn't be) to have some glittering test baubles for toys.

Creditability is important to all areas of management. Before making recommendations or purchases, ask yourself if you have really made an objective decision and have considered all models, specifications, prices if this is the best station decision you could

make. Giving this type of objective review to all your recommendations and decisions will go a long way toward building a better understanding between engineering and other areas of management and the licensee.

After all, the licensee, comptroller, station manager or whoever is most concerned with the station's books, must feel confident that figures placed in the books are authentic and represent true values and are not the inflated figures of ego satisfaction or the understated figures of bad guesses. □

Require Accuracy?

(and peace of mind)



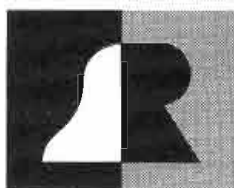
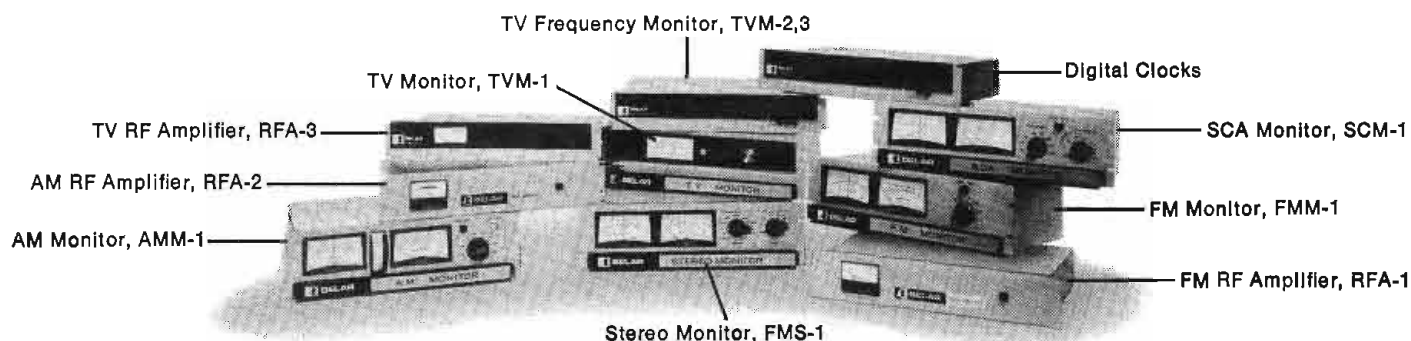
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Here's why:

- Separate 100% negative modulation peak indicator lamp—detects the absence of carrier on program peaks for a true 100% negative indication.
- Normal peak indicator lamp may be set to +125%—an accurate measurement to keep you within FCC modulation limits.
- Built-in true modulation calibrator—means that you can check the modulation calibration at any time.
- True peak reading modulation meter—switchable to read either positive or negative peaks, to accurately measure the short duration program peaks encountered in today's programming.
- Expanded scale carrier level meter—allows the accurate measurement of carrier shift.
- Extremely low distortion demodulator—permits accurate proofs at

- 100% modulation as well as accurate measurement of program peaks.
- Built-in off-frequency alarm drivers—permits unattended measurement of frequency—alarm alerts you to any off-frequency condition.
- Digital counter circuit—will measure any standard broadcast band frequency spaced 1kHz.
- Built-in ± 20 Hz frequency calibrator—allows you to check the calibration of external equipment such as automatic loggers.
- Built-in carrier-off alarm—tells you when the transmitter is off.
- Off-air monitoring with the addition of the RFA-2 RF Amplifier—wide range AGC means hands-off operation at the studio.
- 100 μ V sensitivity with RFA-2—handles the most difficult receiving problems with ease.

For further information call or write today.



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Video crosspoint control via audio cable

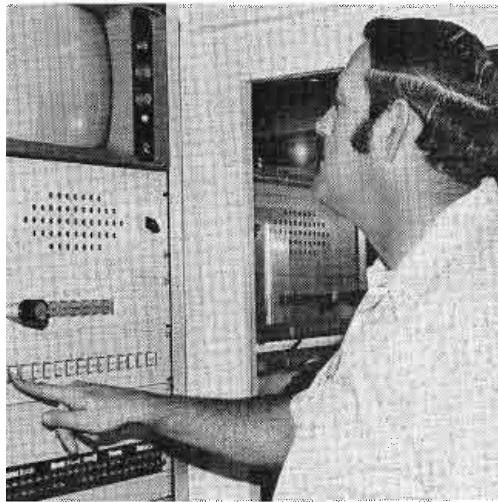
By Fred Fowler

KOMO-TV, Seattle, Wash.

The needs of a complex and continually changing TV station spawn problems in such quantity that it seems a fertile idea bank. Simply choose the most pressing requirement and begin the attack. In this case we defined the first order of business as reducing the number of conductors between control points and the Video Audio switchers in TV Master Control, without reducing the performance capabilities.

A control point may be an Executive Office, Viewing Conference Room, VTR, or any place we wish selection of several Video/Audio sources. There is no point in changing workable existing controls, it was expansion and changing locations that caused us to look in this direction. Presently each control point uses 40 or more conductors. To achieve economy, with regard to cost of cable as well as conduit space, we designed a system which passes all information on 2-conductor shielded cable.

Environmentalists may even look kindly on the plan as a step in the



VTR Operator Dale Graves selects input for video tape machine at a Master Station control panel.

direction of conserving copper.

Design Considerations

The concept envisioned was to have a Master station with memory, and capable of selecting by push button any one of 16 crosspoints. The decision processed by the Master would be transmitted on two conductor shielded cable to a Slave station for decoding and actual video switching. Versatility was built in to allow the option of controlling our Grass Valley 1800

routing switchers directly from the Master board or remotely controlling either the G.V. or RCA TS-40 switchers. The change of personality is accomplished by the simple expedient of leaving parts off the board or including them.

Our Engineering Department policy is to incorporate widely used, readily available semi-conductors in new designs. This keeps the maintenance inventory lower, assures low parts cost through quantity buying, and creates less likelihood of early obsolescence. Thus, 2N4124, 2N4126, 1N4005, etc., were selected because they are already widely used in our plant.

Functions Provided

The Master station is designed to control 16 crosspoints, and may be used as a single interface unit to control the 1800 routing switchers. This use would require the addition of 16 NPN transistors to the board. It may be operated in conjunction with a Slave station to accomplish long distance control using two conductor shielded cable. In the Master-Slave configuration, each station has its own regulated 5 Volt

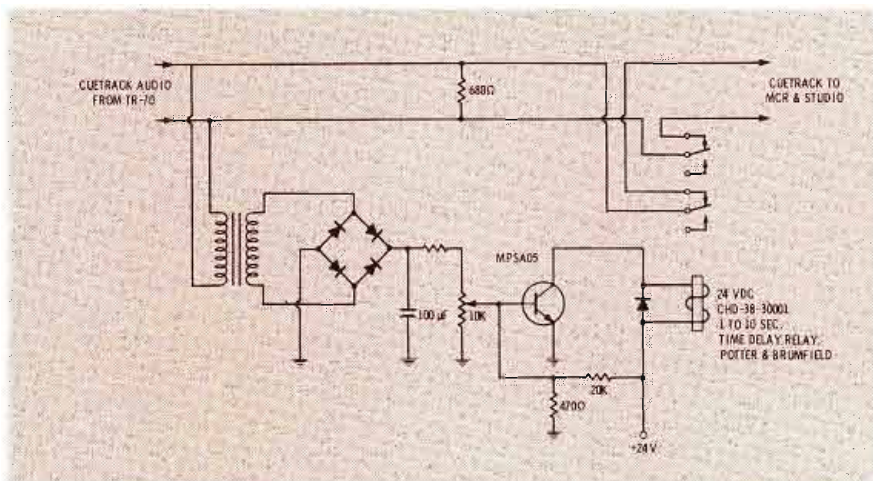


Fig. 1 Schematic of the noise muting circuit with time delay to delete edit data from the cue track. One unit per TR-70 located in cuetone chassis in the associated equipment rack.

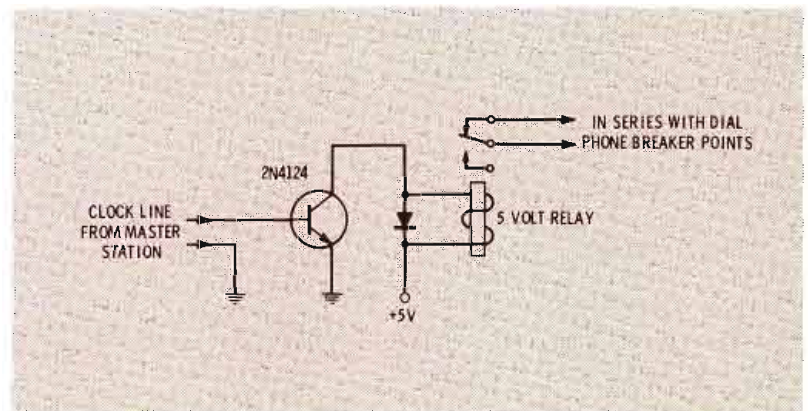
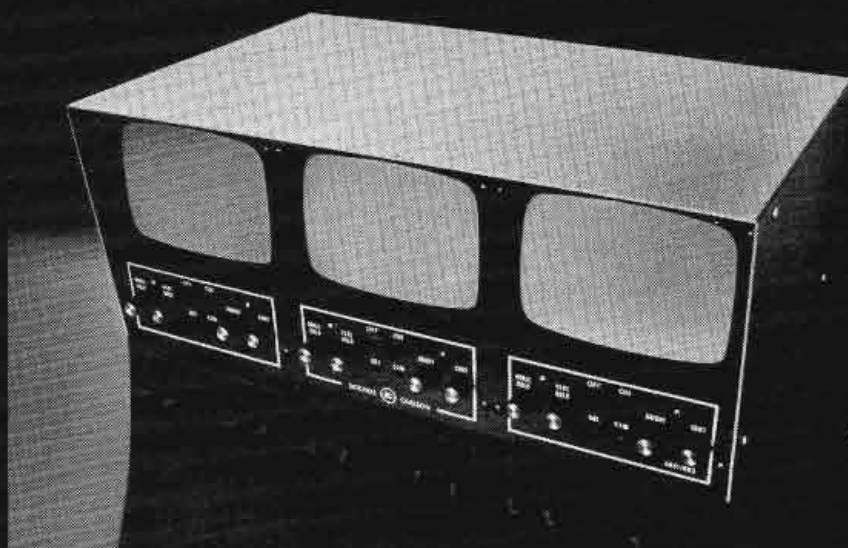


Fig. 2 A further demonstration of the versatility of the Master Station is shown in this schematic. Addition of these parts and use of a .25Mfd. clock capacitor makes a neat push button dial system for a telephone. It requires no modification of the telephone and leaves the phone dial operable.

If you haven't seriously considered the new Setchell Carlson triple-six monitors, brace yourself...



you're in for a pleasant surprise!

Setchell Carlson Triple-six monochrome monitors offer outstanding performance and quality, maximum number of monitoring points in a minimum area, and an exceptionally low price. Most people are noticeably surprised when they get the full picture.

It's true. At only \$575.00 suggested user net, Setchell Carlson gives you three attractive, highly compact, uniquely designed, American-made monitors ideal for desktop, rackmount, or console-mount applications. That's three screens for cameras, VTR's, line monitoring, or preview, in only seven inches of vertical panel space. And yet, because of effective shielding, there is no interference between adjacent units.

Each unit offers 100% solid state circuitry, a horizontal resolution of 600 lines, and the most advanced SINGLE MODULE circuit board available.

The unique single module construction gives you a one-piece, easily removable chassis which permits rapid, on-the-spot maintenance for a substantial reduction in maintenance costs and down-time. All components are readily accessible for ease of maintenance and testing.

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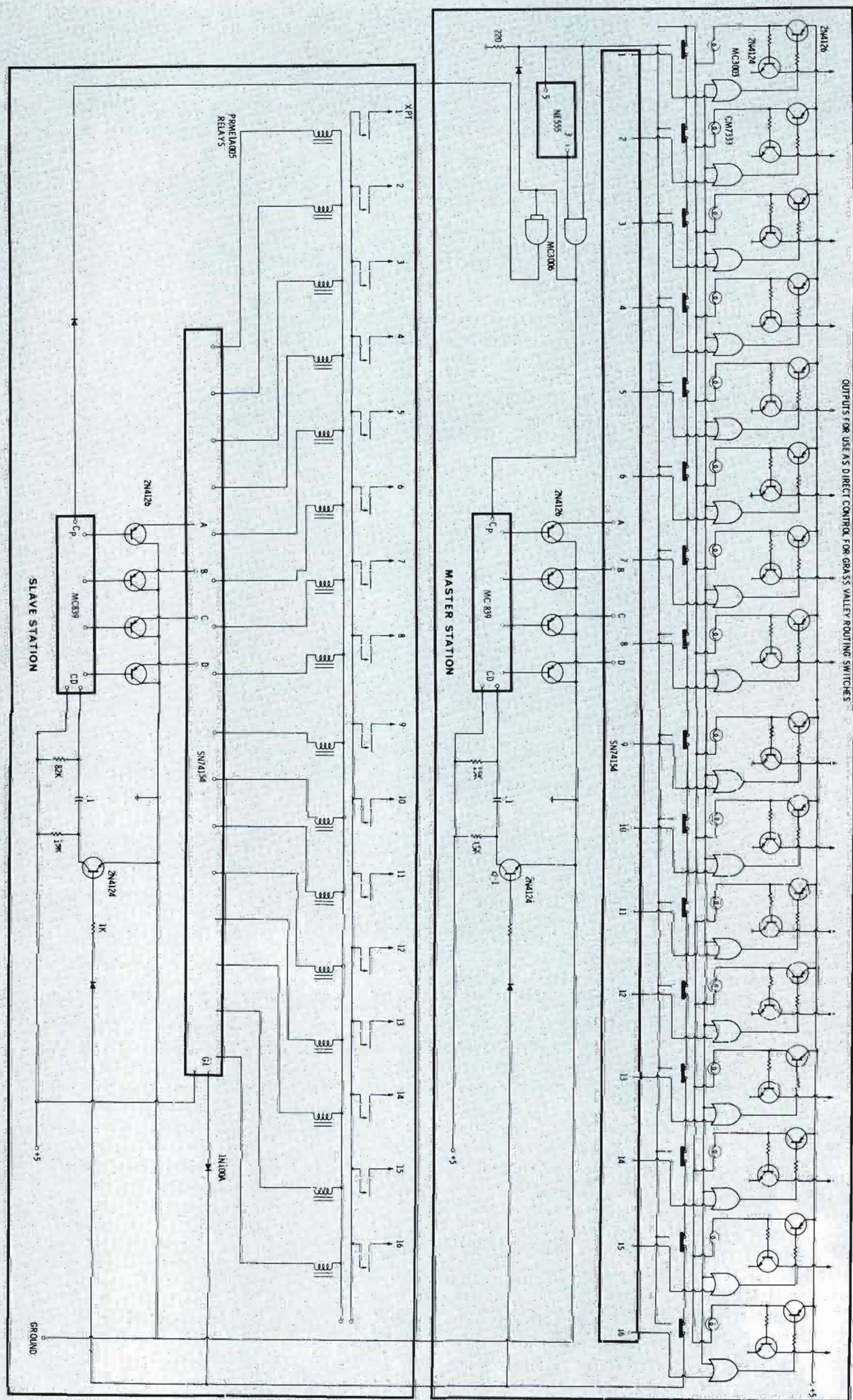


Fig. 3 Three-wire digital control and memory, showing the Master Station and Slave Station.

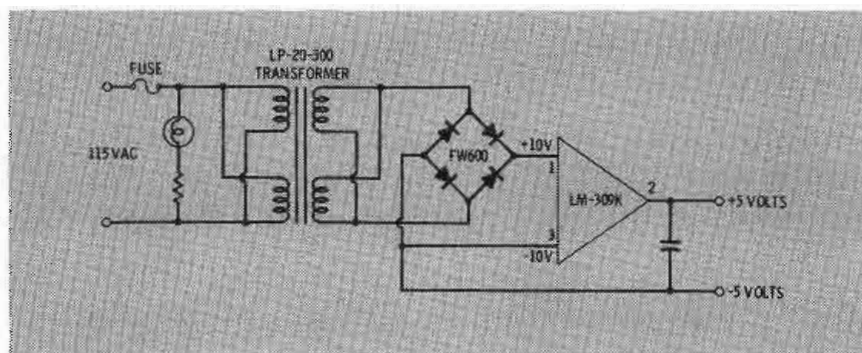


Fig. 4 5-Volt regulated power supply.

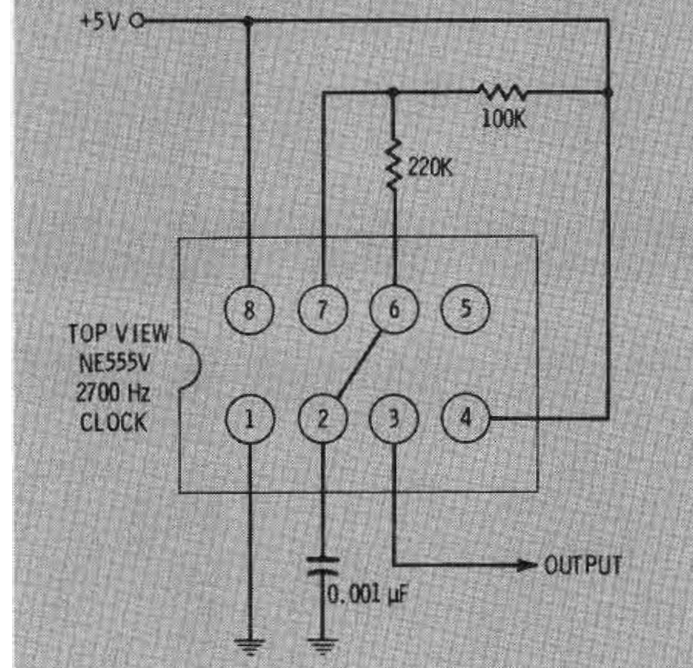


Fig. 5 An NE555V is used as a 2,700 Hz clock.

Fig. 6 Truth Table from Texas Instruments' integrated circuit catalog.

CIRCUIT TYPES SN54154, SN74154
4-LINE-TO-16-LINE DECODERS/DEMULTIPLEXERS

TRUTH TABLE

[illegible]

H = high, L = low, X = irrelevant

ABSOLUTE MAXIMUM RATINGS OVER OPERATING FREE-AIR TEMPERATURE RANGE (UNLESS OTHERWISE NOTED)

Supply voltage V_{CC} (see Note 1) 7V

Input voltage (see Note 1) 5.5V

Operating free-air temperature range: SN54154 Circuits -55°C to 125°C

Operating Area and Temperature Range	SN74154 Circuits	0°C to 70°C
Storage Temperature		-55°C to 150°C

Storage temperature range -65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

power supply. In a Master-Slave mode it is capable of controlling either the TS-40 or routing switcher with minor alterations.

The Master generates a 2.7 kHz count, but only counts up to the number of the button which was depressed....then it stops. The same count pulses trigger the Slave station but the Slave and Master will first be synchronized to zero (No. 1 crosspoint) to keep them in step at all times. The Slave gives relay control to apply trigger pulses to the TS-40, but when used with the routing switcher it may control directly by grounding the appropriate crosspoint. Blanking is provided to disable all outputs during

the "Search and Remember" operation. Only after the memory locks **on**, and the switch button is released does the command go to the slaved video switcher.

Sync and Blanking

These terms, familiar ones to Broadcast Engineers, have slightly different meanings here. They are descriptive, and in the true meaning of the words, both were required for accurate performance.

Let's look at sync first. The choice of crosspoints as signaled by pushing a switch button also selects a given number of clock pulses. These pulses control the Slave station. Ponder that a moment and

it will appear satisfactory if the Slave is resting on the same count as the Master. Power failure at either end may see them at rest, but on different crosspoints. Before the count is applied sync-to-zero occurs at both stations, insuring that they will begin to count from the same point. (Details are covered under "Circuit Theory.")

Blanking is furnished to conceal the synchronization and search processes from the video switcher. It is conceivable that 15 unwanted cross-points could be turned on as the ripple counter searches for the switch which was depressed. At the Master, depressing any switch disables all OR gates: all outputs are



Engineer Lloyd Jones assembles circuit boards in a professional assembly approach.

blanked until the switch button is released. The Slave is blanked in a different manner, but likewise does not reflect its final choice to the video switcher until the button is released. Again the technicalities are discussed under "Circuit Theory."

Basic Logic

An NE555V Clock, MC3006 (three AND gates), MC839 (divide by 16) counter, and an SN74154 (4 to 16 line) decoder are connected to form a ripple counter. Memory is affected by feeding back one output of the 16 from the decoder via a switch. When the ripple counter arrives at and grounds the selected output, the AND gate closes and inhibits further passage of the Clock pulses. The memory is locked **on** and will remain so until another switch is depressed. Logic of the Slave includes only MC839 and SN74154, as the count and memory information are furnished by the Master.

Circuit Theory

Design was aimed at utilization of a new, low priced switch developed by Pendar. Significance of this is notable as previous switches were \$20.00 each, and the new type is in the vicinity of \$3.00. Actual price is dependent on the quantity of the purchase. The switch uses a floating armature, allowing two independent circuits to be controlled with one push of the button.

The MC839 and SN74154 are not directly compatible. Four low priced 2N4126 PNP transistors between the BCD outputs of the MC839 and inputs of the SN74154 provide smooth interface. Connection is shown in the logic diagram.

In the static state, (before pushing a switch button) it may be assumed that one switch lamp is on and one crosspoint of a Slave station is activated. The OR gate of this crosspoint is being used as a negative logic AND gate. (This means if the ON condition requested at the output of the gate is a low, it is necessary to have a low at both inputs. Low in this description may be defined as near ground potential and a high will be a positive voltage high enough to

perform the function of turn-on or turn-off as each unit warrants for its assigned task.)

One input is seeing a low from the series wired normally-closed switch section, and the other input is seeing a low from the ON SN-74154 output. These two lows at the OR gate inputs generate a low at the output, which turns on a PNP transistor. This applies voltage to the CM7333 (5 Volt) lamp in the switch. An NPN transistor is turned on by the same voltage. This may be used for direct wire control of the Routing switcher if desired. The

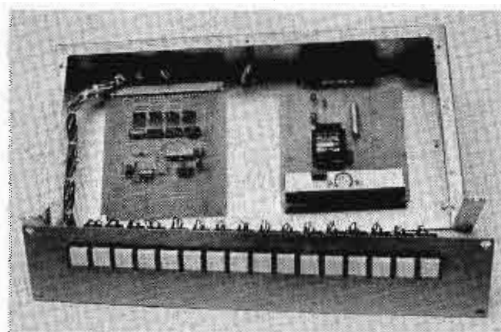


Fig. 7 A complete master station logic board and the 5-Volt power supply.

Management Highlights

Solving this problem should give you an idea of what a professional engineering staff can do to facilitate station operations and keep costs down. The flexibility of this approach also will allow these lines to be used for a security system.

NPN transistors may be left off the board if a Master-Slave use is required.

Depressing No. 3 switch is chosen as an example. As the switch armature moves down, it opens the series wired grounding circuit. This disables all OR gates by raising one input of each to high. (All crosspoints are blanked.) The same high also turns on an internal NPN transistor (Q-1) causing a momentary ground to appear at the CD (direct clear) input of MC839, clearing it to zero. The stations are

synchronized, awaiting the arrival of the count pulses.

The switch armature, continuing downward, next closes the normally open contacts of the switch connecting the No. 3 output of the decoder to AND gate MC3006 input No. 1 and raises it to high. Then the square wave clock pulses, which are at the other input of the AND gate, will go through the gate and step the counter at the clock frequency until it arrives at the No. 3 output of the decoder and drops it to low. This low closes the AND gate, the ripple counter stops because no more clock pulses are forthcoming, and the same low is applied to one input of OR gate No. 3.

As the switch is released, the series wired ground circuit furnishes a ground at the other input of OR gate No. 3, its output drops to low and remains there. The output low fires the PNP transistor (No. 3) and lights the lamp. The memory is locked **on** number 3 crosspoint and all information has been passed on to the Slave station.

Slave Circuit Theory

The Slave accepts incoming information via the two conductor shielded cable and three guiding diodes. The high from the OR bus fires the NPN transistor, clearing the MC839 to zero. It also lifts the ground from G1 (the decoder strobe input). The decoder Truth table shows G1 and G2 must be low before an output shows. Thus the count pulses step the counter, and settle into the chosen position but the SN74154 ignores all, until G1 returns to ground.

When the switch button is released at the Master, the ground returns, and only then will the output of the decoder turn on to ground the correct relay. All relays have +5 Volts at one coil terminal, so the ground from the decoder output will close the relay. One contact of each relay will be the TS-40 trigger pulse bus, and the ON condition will route the trigger pulses to the internal crosspoint giving a vertical interval switch. The same Slave board has printed circuitry for routing switcher control. Leaving the relays off the

board and adding a through the board jumper wire gives direct wire grounding to the 1800 routing switcher.

The Slave stations are grouped in a rack-mounted card frame near the Video switcher. Since they draw 70 ma., two may operate from one power supply. Audio follow is a simple matter and may be added to any video switcher. Thirty two crosspoints will answer the Master if audio is connected to switch with video.

Testing

High speed and multiple functions made testing an interesting process. First we used a dual trace scope to determine that reset to zero was completed before the clock count was transmitted. Quite by accident we found a more simple test procedure which did not require an oscilloscope. Clip a 2.2 μ fd capacitance across the clock capacitor to slow the count to about

2 per second. Next, parallel the OR bus pull-down resistor with 150 Ohms at the Master. Now the clear to zero shows at both stations and the lights blink slowly in sequence as the ripple counter searches for the button being held down. Blanking at the Slave shows because the crosspoint does not close until the switch button is released.

Security

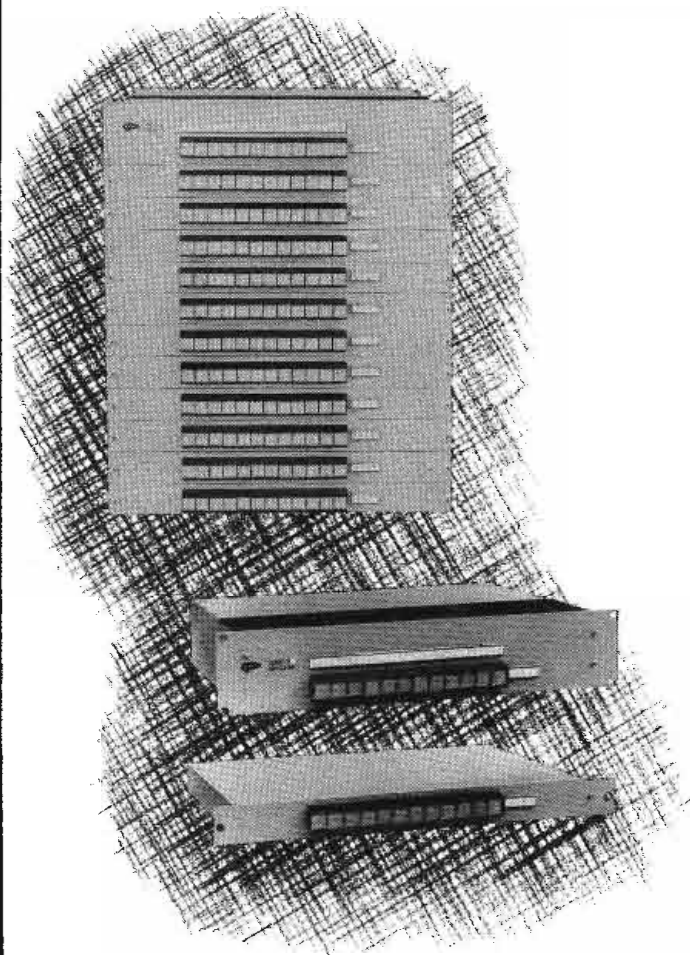
After testing our system successfully on 1,000 feet of wire, more than four times the length it actually operates on, we began to suspect it may have other uses. One would be in the area of security. The 16 outputs of the Master decoder may be fed to door switches via 2-conductor shielded cable. The door switch should be open when the door is closed. Then as a door is opened the ground is fed back to the AND gate. With all doors closed, the ripple counter is a continuously operating scanner. The 5

Volt indicator lamp comes on whenever an open door stops the scanning process. This lamp indicates which door is open and remains on until the door is closed. Then scanning starts again to continue vigilance.

The AND gate would require a pull up resistor and the OR bus a lower value (75 Ohms) pull down resistor to defeat the blanking and display the lights during the scan process. A 1 μ fd clock capacitor makes a pleasing scan speed.

Counting the contents housed in the integrated circuit packages revealed they contain 335 transistors. These plus the diodes and resistors also included indicate the size would be considerably greater and the cost over \$200.00 more if individual transistors and parts were used. It is no longer necessary to refer to the vacuum tube era to illustrate rapid evolution toward miniaturization of size and cost in our technology. $\square$

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Helical vs. Quad

A report on how two manufacturers assess their VTR format—formats which will meet head on in 1974.

It would come as no surprise if a survey of video tape users around the world showed the quad format in the drivers seat. And this still would be true if you added in the machines being used in Educational and Instructional TV.

But another movement has been underway for some time now: the smaller size tapes and helical machines in use at schools, in industrial TV, and in CATV.

With the surge of Consolidated Video and TV Microtime and their time base correctors, helical valley has reason to consider the mountains....or the solid quad world foundation.

So it was that not long before press time we spotted an RCA release that, as you'll see, speaks for itself. If we could leave it there, we'd certainly have to wonder why International Video has decided to climb the quad mountain with a broadcast quality helical format.

In the marketplace of ideas and goods, all levels of acceptance and rejection are possible. And just as surely, one of the major questions at the upcoming NAB convention will be focused on helical vs. quad.

Quad Still Best

The quadruplex format is a better approach than helical scan for high-quality video tape recording now and in the foreseeable future, RCA broadcast equipment engineers have concluded after a two-year comparative study of design considerations and performance of the two systems.

This was reported recently by Jerome L. Grever, Manager, Electronic Recording Equipment, RCA Broadcast Systems, in a paper delivered at the Society of Motion Picture and Television Engineers' 114th technical conference at the

Americana Hotel, New York.

Since its introduction 17 years ago, the quadruplex recorder has become the broadcasting industry's preferred standard type, Grever said, and 7,000 such machines are in world-wide use, and 4,000 of these in this country. The helical scan recorder has been used principally for industrial and similar TV applications.

The study, which covered seven key areas of investigation, also pointed up suggested modifications in the industry's present quadruplex recording standard that would take full advantage of recent technological advances, Grever said. These modifications would be minor, and compatibility would be maintained between today's standard and the revised format, which RCA has dubbed Quad IA.

The RCA study found that a helical machine, which is essentially equivalent in performance to a quadruplex recorder, enjoyed only a 9 percent advantage in manufacturing cost or sales price. If the price differential is greater than 9 percent, there are tradeoffs in one or more areas of performance, operating features, reliability, and maintainability.

Operating cost studies slightly favored the helical scan recorder. However, the newly-introduced improved helical recorders use about the same amount of tape as quadruplex recorders operating at the alternate speed of 7½ inches per second, as compared with the normal 15 ips speed. Signal performance of older helical machines is inferior, however, according to the report.

In analyzing the relative merits of head-to-tape interface, the RCA team concluded that the quad-

plex head-tape relationship was more precise and consistent than that of the helical design. The latter also produces pressure variations along the video track length, and showed chroma level flutter and a higher number of dropouts.

Banding, a TV picture effect caused by misadjustments in quadruplex recorders, does not exist in single-head helical scan machines, Grever said. However, two-head helical machines exhibit a defect which the eye sees as a color flutter. This is especially visible in the high chroma areas of the picture.

In studying interchangeability of tapes between recorders, the RCA engineers took into account the high degree of dimensional stability required between the tape and the video scanner.

The study determined that the quadruplex format is essentially immune to tracking errors caused by environmental and tape tension variations. As a result, quadruplex recorders show a high degree of tape interchangeability — tape recorded on one machine can be played back on another — under extreme variations of temperature, humidity and tape tension.

On the other hand, the Grever paper noted, helical recorders by the nature of their format are susceptible to tracking problems and have not been reliably interchangeable.

The RCA-proposed modification to the industry's present standard would accomplish two important objectives. The first, to reduce the cost of operation, and the second, to provide an additional signal for automating the adjustments required to obtain optimum picture quality from quadruplex recorders.

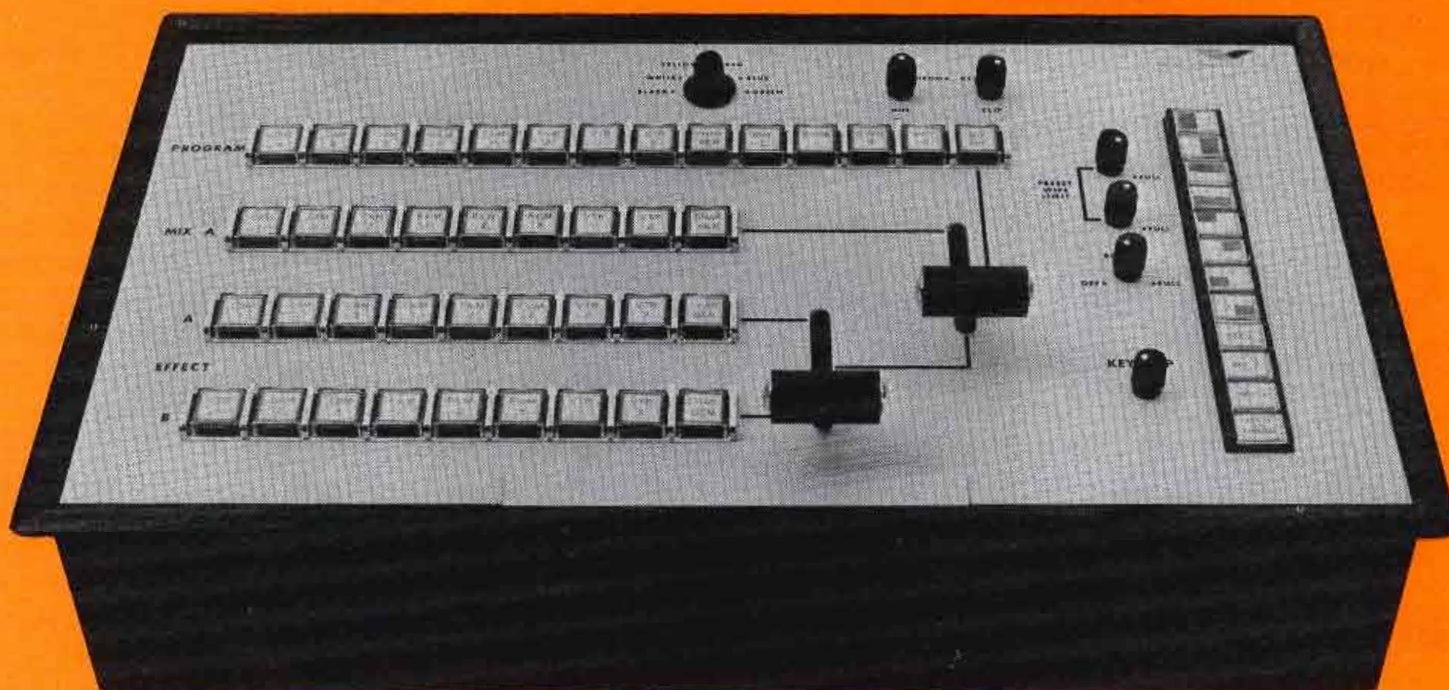
The lack of a standard format for helical scan recording is a particularly serious limitation, the study noted. World-wide compatibility of quadruplex machines is well known and a tape recorded on one machine in Hamburg, Germany, for example, can be played back on another manufacturer's quadruplex machine satisfactorily in Sydney, Australia.

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of Motion Picture and Television Engineers, is the result of a study begun in 1971 to provide broadcasters with the best possible recording format, according to an IVC spokesman.

Barrett E. Guisinger, International Video Corporation Vice President and Technical Advisor to the President, states that the 17-year-old quadruplex recording format has inherent design limitations that will prevent it from being altered or improved except in a minor way. And, says Guisinger, despite the

wide use of quad recorders, many broadcasters would like a less expensive format and one more flexibility for editing. He says his remarks are based on an international survey of broadcasters in which he personally participated.

"We felt that the best way to design a better format was to ask the broadcasters what they wanted, rather than to try to tell them what they needed. The improvements they wanted most were a second high-quality audio track, lower machine prices, lower operational

costs, and improved editing facilities. We kept refining the concept until we felt we had the ideal format."

The IVC-9000 format is based on a two-head, segmented helical-scan approach using two-inch tape. It provides five longitudinal tracks, including two high-quality audio tracks and separate cue, address and control tracks.

The format was designed from the start to meet the more demanding PAL and SECAM color broadcast standards used in Europe and elsewhere. The IVC-9000's performance for the less-demanding NTSC standard therefore is significantly better in such areas as color moire and video signal-to-noise ratio. The helical format permits the use of hot-pressed ferrite video heads with superb electrical characteristics, permitting the use of a frequency deviation in the 9-12 MHz range. Specifications match those of quadruplex VTR's in almost every area and exceed them in some critical areas.

Since the IVC-9000 uses two rather than four video heads, and because (in NTSC) each field is covered by a different head in successive passes, cyclical errors are substantially reduced as compared to quadruplex machines. A totally new tape tension servo design and an air-bearing scanner have eliminated the pressure variations along the video track length that cause chroma level flutter and dropouts in some helical-scan VTRs. Tracking and interchangeability are also excellent, says Guisinger, due to careful servo control design. He reports a maximum mistracking error due to worst-case environmental changes of just one mil for the IVC-9000.

IVC has also met design goals for reduction of price and operating costs. The IVC-9000, for which IVC reports a backlog in excess of \$2,000,000, is priced in the \$70,000-\$90,000 range for an NTSC color unit. The IVC-9000 records at 8 ips, using 50 percent less tape than a 15-ips quad recorder with its wider video tracks. Guisinger also points out that head-to-tape contact is much gentler in the helical format, permitting longer useful tape life and a minimum of 1500 hours' head life.

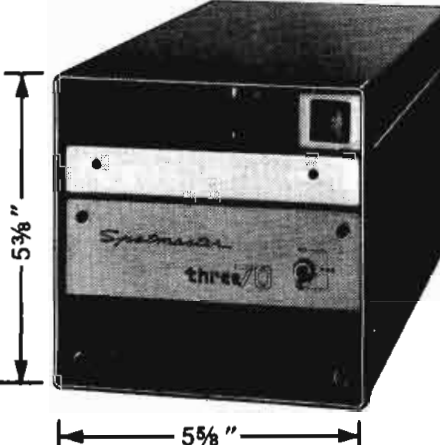
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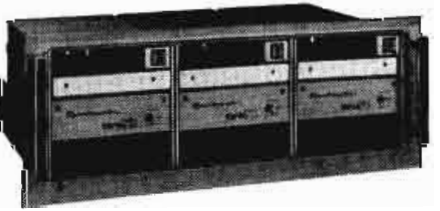
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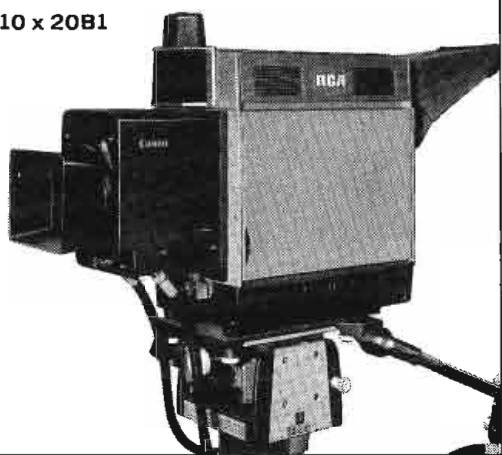
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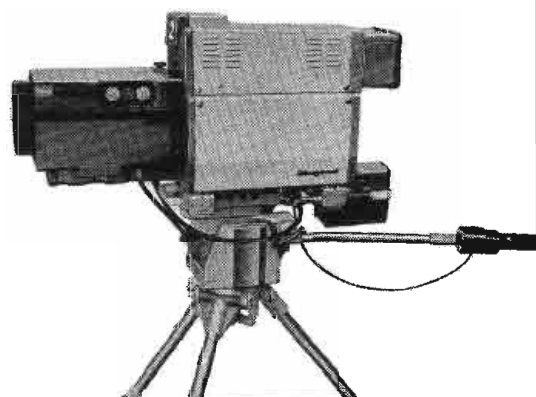
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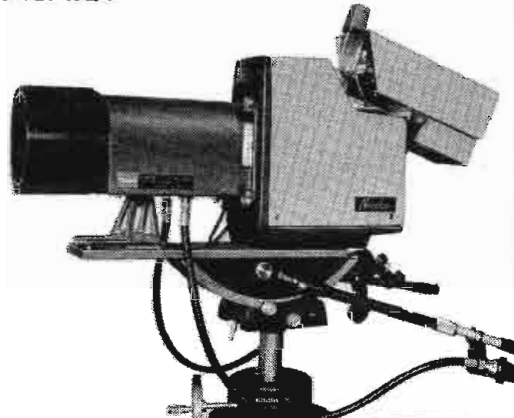
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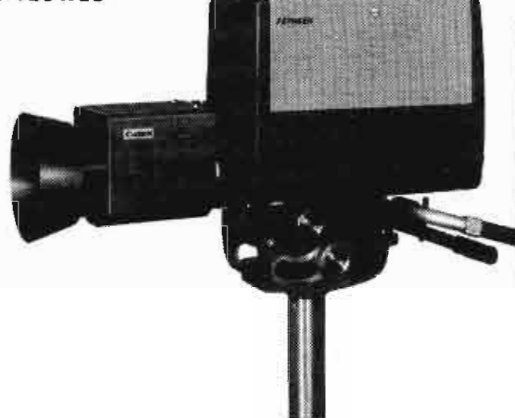
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Redesigning the remote facility

By
Doug C. McDonell

At the time of construction, the author was the CE at WSPT AM/FM. He is now an associate of Robert Jones, Consulting Engineers, LaGrange, Ill.

The major rebuilding of a broadcast facility can be a welcome change from the conglomeration of "Temporary Patch Work" of more than two decades of operation and an opportunity to build a showcase station. This chance came to WSPT.

When Evans Broadcasting Company put WTWT (now WSPT) on the air in 1949 as a 250 Watt daytimer, FCC Rules required an engineer to be on duty to take all readings and actually control the

transmitter. This required a facility large enough for the duty engineer as well as the single transmitter and one rack for equipment.

From the beginning, as now, the studios were located in a shopping area while the transmitter was located on the cities' northwest side. Remote control was added in the early '50's with that change in operator rules.

The station was built in the theory of the day, with the tower a distance at least as far from the building as the tower was high. Obviously in case the tower fell, it could not strike the building.

The first improvement came with an increase in power to 1000 Watts in 1958. The only real change at this time was a new transmitter to provide the higher power.

FM was added in 1962 with 15 kW ERP and a horizontal only antenna. This was thought sufficient for the time and did serve quite well, providing a background music source sponsored by a local grocery chain. The FM equipment took the space formerly occupied by the duty engineer and didn't leave much space for work.

In the late '60's it was seen that both building and equipment maintenance was becoming more difficult and that some of the original FM equipment was not holding up

well. The 20 year old wood frame construction and fiber board walls no longer provided a "clean" atmosphere for the equipment.

Remote Site Overhaul

Through the advice of Consulting Engineer Robert Jones and the foresight of company president Peter A. Barnard, a decision was made to make major changes in both the AM and FM stations. After a complete discussion of all avenues of travel it was decided to begin from the ground-up, using only that equipment which could be expected to function satisfactorily for years into the future.

With these guide lines in mind, it was planned to increase the power of the FM, install a new antenna and taller tower, as well as to construct a new transmitter building.

The possibility of moving to a new site was investigated since the original site had become the center of a residential area with the expansion of the city. A location west of a river which bisects the city was ruled out because of distance from the studio on the north side. And since there is only one bridge at the heart of the shopping area, it is sometimes difficult to make a speedy trip through town. Locating an adequate site at a reasonable distance was also a factor to the south and northwest. The Stevens Point airport blocked locations to the east and northeast. Thus the original property continued to serve as the WSPT transmitter site.

Looking at the equipment at hand, it was obvious that some items would be satisfactory in the new operation. This included the AM transmitter (a BC-1T), the audio limiting equipment, and the rack cabinet. Each transmitter had

Management Highlights

Sooner or later that remote site will get you. When it looks like it might, you'll want to consider referring to this article for ideas and plans. And as the residential areas move toward the site, the ecological aspects will be even more important.

been remotely controlled by a separate system with the associated mechanical problems and the cost of four pairs of control lines. However, the FM transmitter was unstable and unreliable, but expected to last until application was made to the FCC and the construction was begun.

Since the unwieldy remote control systems were the most easily solved problem, a new Moseley System was purchased and installed. This was done early to allow time to design and construct interface units for the transmitters and provide thoughts on what else could be installed in the new building.

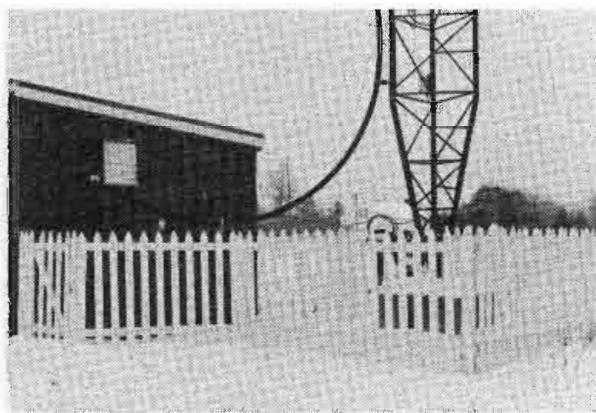


Fig. 1 The WSPT AM/FM remote site after redesigning and rebuilding.

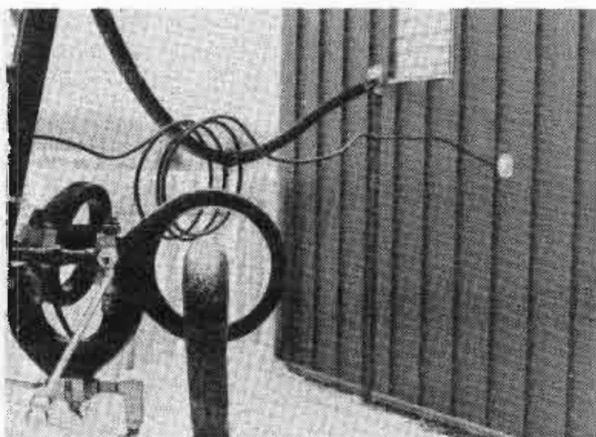


Fig. 2 The building is 12 feet from the tower. An insulated quarter wave stub was used for isolation with the bottom bonding point at the building exit. From there it was tied to the ground system with 3-inch copper strap.

Building Considerations

Going into the summer, the FCC paper work was being completed, replacement equipment was being selected and bids were solicited on the building itself. Because of severe cracking of the concrete floor in the old building, extensive discussion was held on ways to prevent this in the new building. The design contractor chose a monolithic or "floating" reinforced concrete slab with assurances it would not crack. To this date it has not.

Several types of construction were investigated including concrete block, wood frame and metal. From a cost and maintenance standpoint, a metal building was selected. It is interesting to note that this type of pre-fab building was less expensive than comparable buildings of other construction. It also made a very attractive and serviceable building.

One of two hitches in the planning finally showed up. The old transmitter was becoming even more difficult to keep on the air and the cost of repair and lost air time made it imperative to replace it "now". When looking for a replacement, several items were checked, including the brand and power level. Ample literature and specifications were secured and requests for bids were made to several manufacturers. A Gates transmitter was finally selected.

Because it was necessary to operate at 5 kW TPO (that already authorized for 15 kW ERP) pending FCC action on our applications, an investigation showed a 10 kW transmitter could be operated at half power. More difficulty was expected trying to operate a 20 kW at the lower power and it was felt buying a 5 kW transmitter now and then replacing it in several months was foolish. This meant that, after approval, a maximum ERP of 50 kW would be obtained with an 11 bay antenna and the 10 kW transmitter. A larger antenna to gain additional ERP was thought to be impractical.

Since several other area stations operated at 100 kW, a study was made on the effects of doubling the power. From the FCC 50/50 chart, the distance gained would be about 4 miles!!! After consultation with Barnard and Jones, it was decided to apply to the FCC for 50 kW ERP with a circular polarized antenna and purchase the 10 kW transmitter.

The new unit arrived, tuned and tested for a 5 kW operation. After a long nights work and much re-bending of Heliak, the FCC was notified that a new transmitter had been installed. This unit would later be retuned for 10 kW in the new installation.

On The Way Up

The second hitch was with the FAA. An earlier attempt to increase height to 600 feet was rebuffed by FAA concern about commercial traffic into the local airport. Since that time a centrally located regional airport opened 20 miles north of town and it was expected that most commercial objections would be overcome.

We knew 600 feet was not possible because of FAA restrictions to IFR traffic at the Stevens Point Airport, but we still wanted an increase in tower height above 240 feet. We had requested a tower 488 feet tall to provide a 1/2 wave on the AM frequency and to get the FM antenna as high as possible. However, there was still sufficient objection from area pilots and the FAA. So in consultation with the FAA staff, we settled for a 400 foot tower, which, incidentally, provided one of the stronger sounding stations in the state on both AM and FM.

By the time construction permits were issued by the FCC, the equipment purchases had been made and delivery was scheduled. The coordination of the various subcontractors went smoothly and deliveries were very close to being on schedule.

In the original 1948 installation, the tower was located off center on

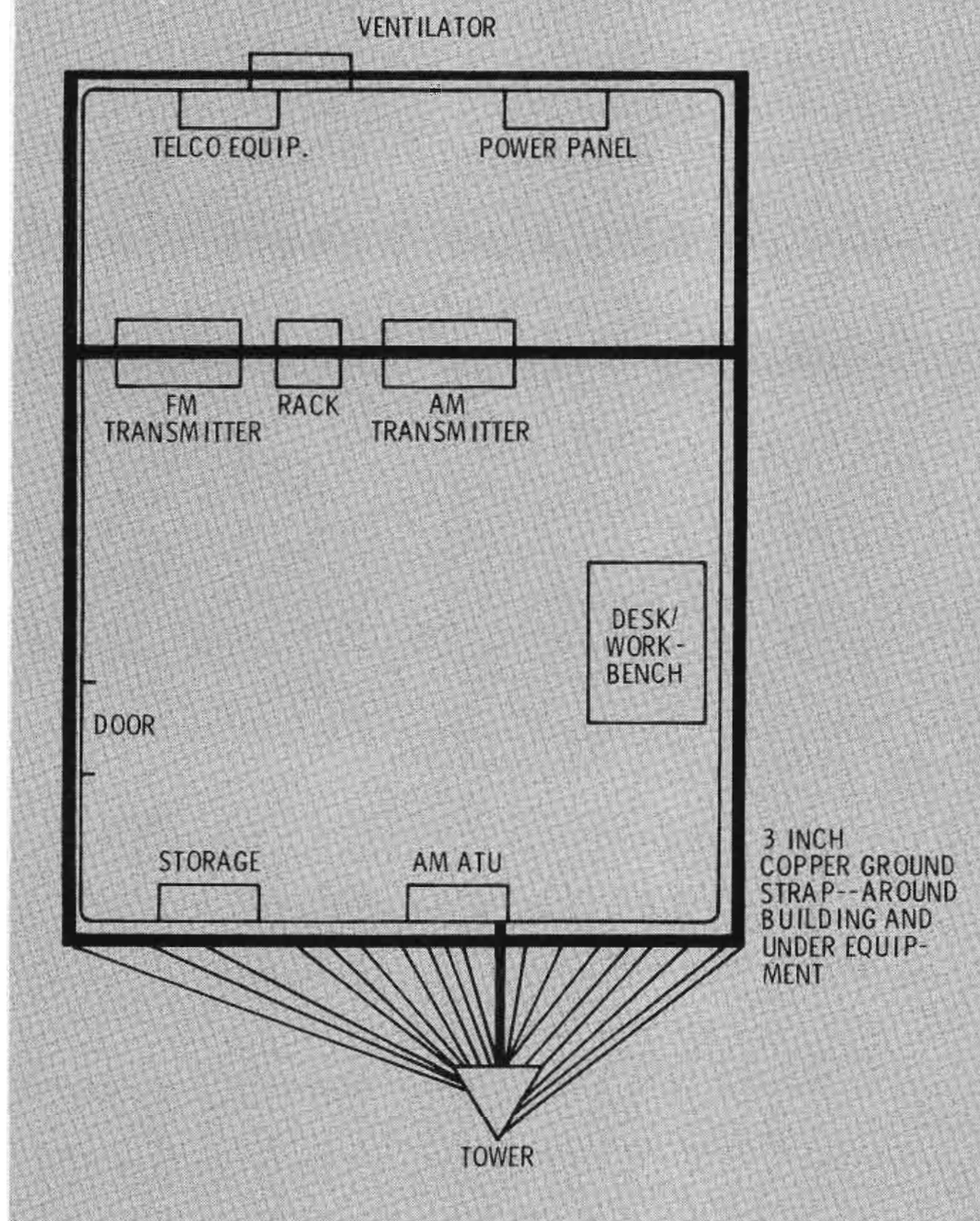


Fig. 3 Inside arrangement of the WSPT remote facility.

the square lot. With the new 400 footer, the tower was centered, since the guy wires needed the entire distance to the boundaries to support the tower. However, during construction the two structures were only 30 feet apart.

Trying to erect a new tower, install an FM antenna and build a new building while remaining on the air seemed easy.....at first.

The WSPT transmitter was not capable of reducing power from the licensed 1 kW and even by detuning as much as possible, the new tower and drag lines were quite "hot" with RF. At critical heights of construction it was necessary to shut down the AM. However, little time on the air was lost and at no time did both the AM and FM leave the air simultaneously. In retrospect, if the same type of rebuilding is used at other stations in the future, it would be advisable

to rig a temporary AM antenna to prevent RF burns to the tower crew.

The 11 bay circular antenna was mounted near the top and fed with 3-inch Heliax. Because the base impedance of the tower was quite high, Austin type transformers were used to get AC to the lights and antenna heaters.

The building itself was constructed 12 feet from the tower pier to provide a direct route for the transmission lines, saving quite a sum of money in Heliax alone.

The FM transmission line leaves the building through the wall and goes directly up the tower. An insulated quarterwave stub was used for isolation with the bottom bonding point at the building exit. From there it tied to the ground system with 3-inch copper strap.

All nitrogen fittings were inside the building and the tank was

located in a conveniently vacant corner. The AM tuning unit was mounted inside the transmitter building with the RF lead going through a porcelain bowl insulator to the tower. This way, all work on the tuning unit, such as resistance measurements and maintenance, can be handled from inside. With Wisconsin winters sometimes approaching 30 degrees below zero, this was considered a necessity.

An item of concern was the possibility of ice or other materials falling and damaging the roof or even breaking through it. The building supplier convinced us that because of the metal roof, the likelihood of this happening was quite rare. With proper antenna maintenance there should never be anything on the tower which could break loose.

Equipment placement in the building was quite typical. All interconnecting wiring was done through overhead electrical conduit. This method is preferred because of neatness and the elimination of the "catchall" trench. Separate conduits were used for audio, control and AC. Careful attention was paid to this separation to prevent future problems. All transmitter control was done through the remote control system and used 24 Volt DC relays.

Ventilation uses the "force feed" method where the hot air is exhausted into the building and then the entire building is ventilated. Because of the high heat output of a 10 kW transmitter, this was not necessarily the best method. Additional duct work had to be installed later to guide the heat from the FM transmitter to the exhaust fan. This did prove more satisfactory, but still not as good as a direct exhaust outside. Louvers were used to allow outside air into the buildings.

Included in the "new" WSPT are three generations of style. The original rack cabinet of 1949, the AM transmitter of 1958 and the new FM transmitter.

As a final touch, a white picket fence was installed around the tower itself and a lawn planted around the building to provide a showcase remote site of which WSPT can be justly proud. □

Station to Station

Teletype Alarm System For Automated Stations

Many broadcast automation systems in operation today utilize the Teletype Corp. Model 33 as a terminal device for input/output or logging. The ASCII coding which most of these teletypes use have enticed broadcasters to create ingenious methods of control or alarm while logging the days programming.

The simplest procedure for systems which have Verified Encode Logging (teletype message directly recorded on control track of program tape) is to type the "BELL" character into the encode logging message. If a series of "BELL" characters are encoded onto a particular tape, the Logging Teletype will respond accordingly when the tape is played on the air and is

logged. This is usually adequate to awaken any bored operator. But if a system runs as well as ours does, little attention is given to the "Monster" and therefore an alarm message such as this can be easily ignored.

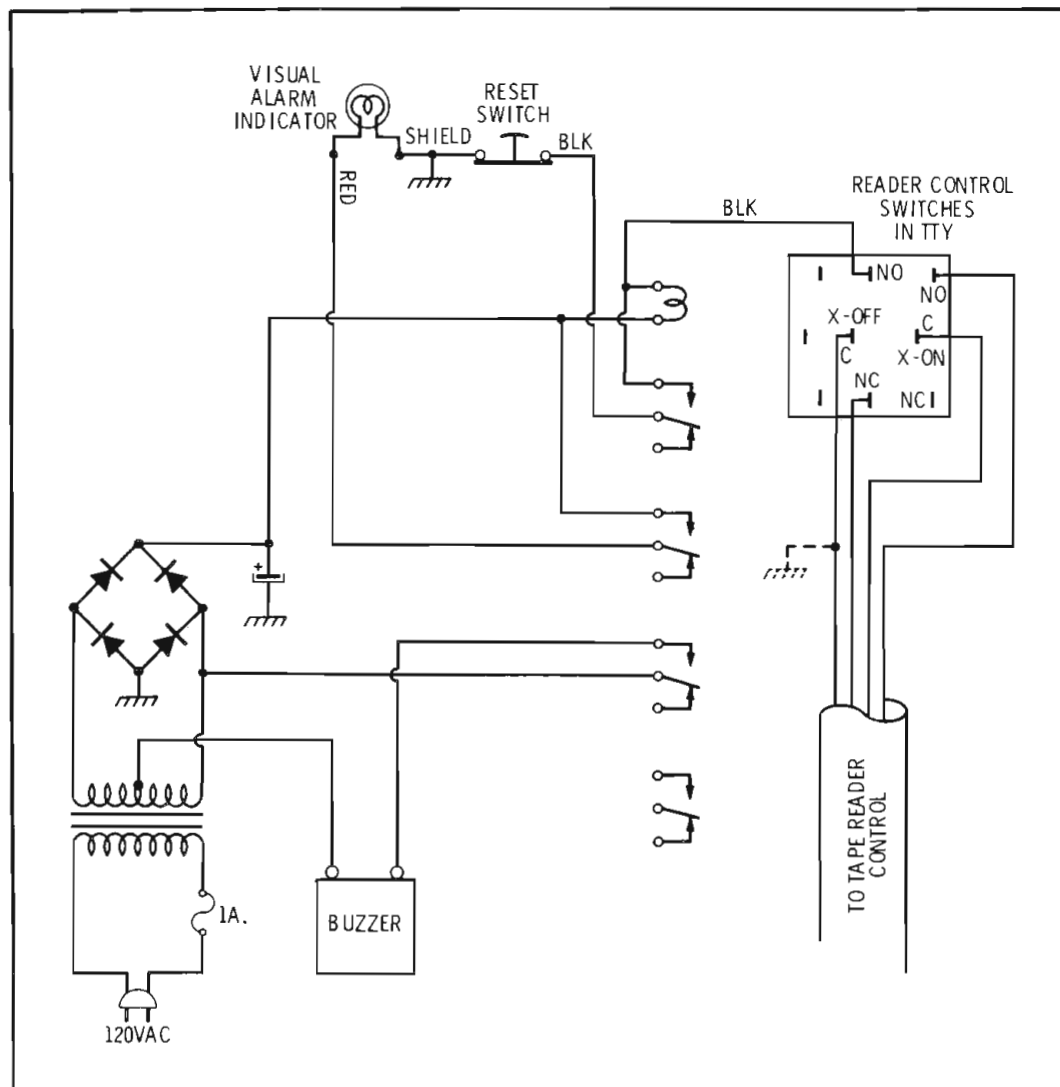
The teletype alarm which was built to be used with our Schafer 8000 system is a little more complicated than the "Bell Message" technique but has the advantage that it must be reset manually. Construction is simple and could easily be built from spare parts. Alarming occurs when the teletype attempts to print the character "X-OFF". The printing of this character causes the activation of a single-pole, double-throw switch in the teletype. The rotor of this

switch is at ground potential, the normally-closed contact is connected to the teletype reader control, and the normally-open contact is not used in our Model 33's as delivered. The alarm circuitry is connected to this unused normally-open contact. Therefore, when the teletype prints the "X-OFF" character, the switch makes momentarily and fires the alarm. Holding contacts on the alarm relay keep it sounding until the reset button is pushed.

Since the Schafer 8000 has a MESSAGE FILE in its software, some messages were modified (i.e., SILENCE, SET TIME, BUSY, RECOVERY, etc.) to cause the X-OFF to be printed when these critical messages were logged. Our system has some other unique modifications which use this alarm technique. One of these is a logging message which tells the operator that a carousel tray is empty as soon as it cues to the empty tray (minutes prior to its actual air call).

With a little imagination it's possible to use this alarm so the automation system will work for the broadcaster instead of being cursed by him.

Steve Hundt
Engineer
WFAH Radio
Alliance, Ohio



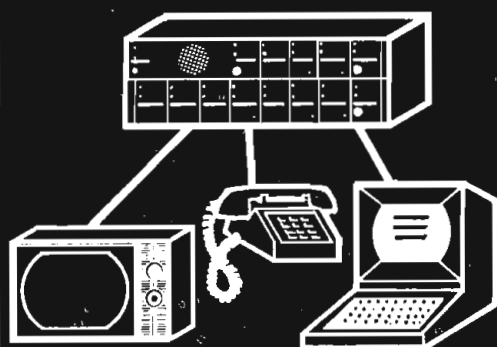
Antenna Switch Reduces Down Time

Those AM stations fortunate enough to have an alternate main or standby transmitter might be able to further reduce down time or allow daytime transmitter maintenance with automatic antenna switching as shown in the schematic.

Cross switching with an RF contactor between a dummy load and the antenna ensures a load to both transmitters at all times, and provides minimum loss of time during change over.

The EF Johnson type 145-102-13, DPDT RF contactor, rated at 25 amps, 17 KV peak can be used for low power applications. The type 145-202-13, DPDT RF contactor rated at 25 amps and 22 KV peak

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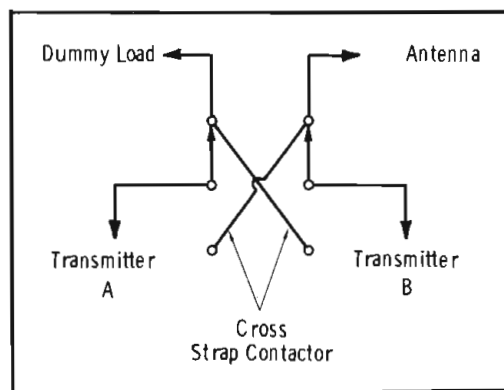
Station to Station

(Continued from page 43)

can be used at higher power levels.

Both are latching type contactors, with auxiliary micro switches that can be used for status lights. These units are available with either 220V (standard) or 110V coils.

Although automatic antenna switching of the type described does provide a wider safety margin than manual switches, the equipment should be constructed in a cage or behind a safety shield, in accordance with FCC standards.



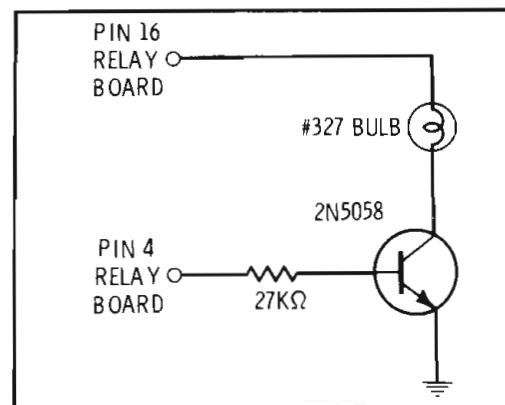
Simultaneous operation of two nearby AM transmitters often causes a "beat" between the two oscillators due to feedback through either or both transmitters. This can usually be corrected by offsetting the oscillators by a few cycles.

M. W. Massey
Field Service Dept.
Gates Radio Co.
Quincy, Ill.

Visual Indicator For Tape Signal

When an Auxiliary Cue pulse is recorded on a Tapecaster 700 series machine, there is no visual indication that the signal actually went on the tape. If there was doubt about a cart, our only way of testing was to play it over the air.

This circuit has saved many such hassles. It is connected to the output of the 150 Hz playback detector, and indicates when the cart



machine is receiving a 150 Hz Auxiliary Cue tone. Since it draws only 1 ma from the detector, it can be connected without disturbing other equipment in the system. The transistor may be replaced with a 2N2219 or 2N3053.

John A. Beckett
WGTS-FM
Takoma Pk., Md.

KPEN Solves An All Too Common Stereo Problem

Even though equipped with an extremely complex and expensive program control amplifier consisting of cascaded AGC, limiter, and clipper, our transmitter still produced occasional overmodulation on excessive high-frequency program material, an all-too-common FM stereo problem.

We re-equalized all tape decks and recorders, checked cartridges, and even installed "scratch filter" rolloff devices for temporary high-frequency response control, but were unable to completely eliminate the problem, which was hindered by the fact that our format is half-popular, half-classical.

The classical records didn't seem to be cut with the "sizzle" that afflicted many pop discs, but attaining consistent peak modulation levels with classical records would be difficult if the limiter output were set for optimum "pop" programming levels.

The "scratch filters" were very effective, but only if each individual operator remembered to use them, and to return them to normal when necessary. And the automation unit could decide which cart to play, but couldn't begin to come to grips with a little black knob marked "Hi-Freq. Atten." So I reasoned

that what we needed must operate by itself, and not reduce all program material to an automatic response ceiling below the over-modulation point. I designed and installed an economical substitute in under three hours which has proved surprisingly satisfactory.

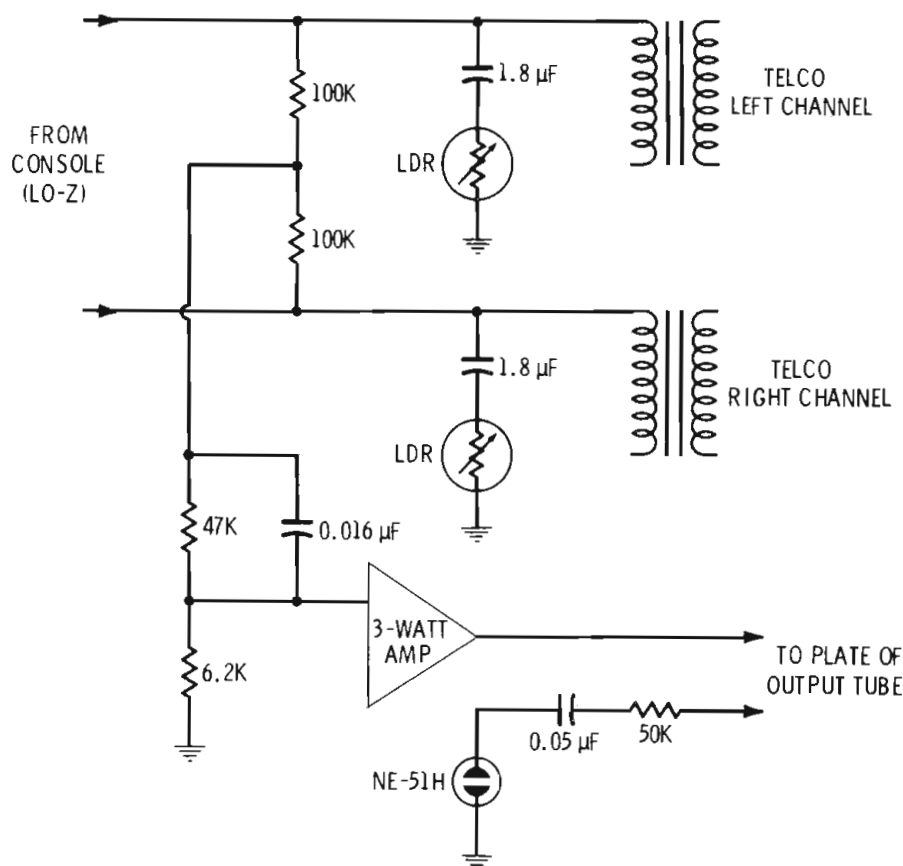
The low-impedance output of our control board is fed by balanced lines to the input of Telco transformers. Across the line for each channel is connected about a 1.8 μ fd non-polarized capacitor to ground, in series with a light-dependent resistor. The two LDR's are positioned around an NE-51H neon bulb, connected to the plate of the output tube of a 3-Watt utility amplifier through a 50K dropping resistor and a .05 μ fd capacitor.

The amp is fed with a composite pre-emphasized mono signal mixed from the two audio channels. When the high-frequency material becomes excessive, the neon light becomes illuminated, and the resistance of the LDR's changes from several hundred thousand ohms to a couple of hundred ohms resistance. Some of the high-frequency audio is then shunted through the 1.8 μ fd capacitor to ground.

Values were chosen experimentally, taking into consideration the impedances of our particular set-up. Steady-state high-frequency sine waves which would have caused over 133 percent modulation now register between 90—100 percent. However, both the modulation monitor and a wide-band scope show that the first cycle of transients like cymbals will sometimes overshoot, but for a half-hour at a time the mod meter always peaks out just under 100 percent. Only in a direct A - B from "air" to "program" will the slightest difference in apparent audio response be evident.

A listener with state-of-the-art equipment and electrostatic headphones reported that our signal seemed just as bright and clean and undistorted with the device in place as it had been before installation.

Stephen R. Waldee
Program Dir.
KPEN
Mountain View, Cal.



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PEOPLE IN THE NEWS

Broadcast

American Data Corporation announces the appointment of **Dave Spindle** as regional sales manager for southwestern US and Puerto Rico. He was formerly with Gravco and has been CE at WLXT and WTCG TV. **Russell Trevillan** assigned to southwestern US after similar position in same area with Telemet. He'll be located in Dallas. And **Joe Rosswog** up to senior development engineer for TV products after a tour in R&D with Vital. Parent company is Airpax....

The promotion of **Scott E. Goff** to product sales manager, video products, has been announced by 3M Company's Mincom Division....Also for 3M's Mincom Division, **David A. Bixler** has been promoted to product sales supervisor, test and instrumentation products....**James Andrews** has been appointed marketing manager for Conrac Corporation's Turner Division....**David E. Fischer** has joined the Corporate Research and Development staff of Superior Continental Corp. in the capacity of Transmission Systems Engineer.

James V. Ball has been elected Vice President of Research and Development by the Board of Directors of INTERDESIGN, INC....**Harry Neil**, marketing manager of MOS integrated circuits for Nortec, has joined Signetics Corp. as product marketing manager for bi-polar memo-

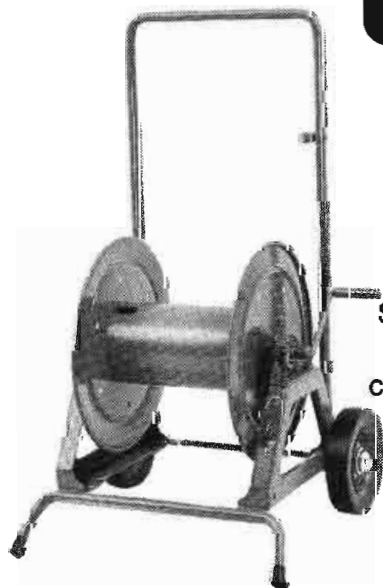
ries....Koss Corporation has named **Guido Francolucci** to the post of national sales manager-stereophones, and **Fred Forbes** has been appointed to the new position of national sales manager, safety products division....Audiotronics Corp. announced the appointment of **Solbert (Sol) Green** as a District Manager for the Audio Division.

Norman L. McLean, founder and president of Turmac Industries Ltd., Lachine, Que., and vice president of Anixter Bros., Inc., has been elected to the board of directors of Anixter Bros....**Jack Kent Cooke** has been elected chairman and chief executive officer of Tele-Prompter. The appointment of **George Rivers** to the post of Director of Product Planning and New Business Development has been announced by the Systematics Division of General Instrument Corp....Scientific-Atlanta, Inc. has announced the appointment of **Robert Holman** as Regional Manager of the newly formed Rocky Mountain Region with offices located in Denver, Colo.

Shure Brothers Inc. has announced the promotion of four executives within the company's domestic and international sales departments: **Kenneth R. Reichel**, formerly product manager, has been named sales engineering manager. **Jerry H. Schroeder** has been promoted from his former position as a manufacturer salesman to assistant manufacturer sales manager. **John Santos**, formerly an export salesman, has been named a regional sales manager in the international sales department. **Charles R. Asher** has also been promoted from export salesman to a regional sales manager.

Lynn J. Davis has been appointed to National Accounts Manager for the OEM Division of ADC Products....**Mark J. Stanek**, Ph. D, has been named vice president, research

Portable Cable Reel



Handle up to 600 feet of 1/2" O.D. cable on this low-cost reel on wheels. Solid steel construction for years of service. Easy crank rewinding. Adjustable drag and brake control. Steel disc wheels with rubber tires.

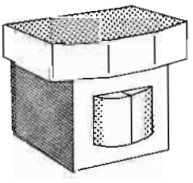
Send for complete catalog of standard and custom-built reels to handle cable for broadcast equipment.



HANNAY REELS

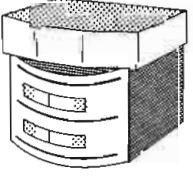
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MMI HEADS EQUAL OR EXCEED ORIGINAL EQUIPMENT SPECS.

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36 HOUR SERVICE — LOANERS AVAILABLE

INSTALL YOURSELF. Buy MMI heads with complete written and pictorial instructions.



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BROADCAST ENGINEERING

and development, and corporate officer of Sigmaform.... Richard L. Bloch, chairman of the board of Filmways, Inc., announced the appointment of **Andrew Szegda** as president of Broadcast Electronics, Inc., a Filmways subsidiaryThe Selectronics Division of Oak Industries has announced the appointments of **James C. Wells** as vice president and general manager, and **William J. Cole** as vice president, marketing.

CATV

Cable Information Systems announced the appointment of **Theodore Baum** as Vice President-Corporate Development....Warner Cable of Kingsport has promoted **Rudy Hall** to the post of chief technician....Warner Cable Corp., the cable television subsidiary of Warner Communications Inc. (WCI), has named **Donald Giesler** district plant manager for all Warner Cable plant operations in its systems in Kingsport, Greenville and Erwin, Tenn. and Abingdon, Saltville and Galax, Va....Warner Cable Corp. has also named **Gene Kois** as program director for Warner Cable of Canton, Ohio.

Independent Cable, Inc. announced the appointment of **Dr. Norman R. Bodine** as Vice President—Engineering, and **A. W. Herman** as Vice President—Marketing and Sales....Cable Information Systems, Inc. announced the appointment of **Ira Katz** as General Manager of Good-Vue CATV, Inc....TeleCable Corporation has announced the appointment of **Nicholas E. Worth** to the position of Director of Engineering....**Edwin W. Maneval**, formerly Anixter-Pruzan's CATV sales representative in the Upper Midwest, has been transferred to the firm's Seattle headquarters. Maneval will serve CATV as well as telephone companies in Washington and Oregon.

Richard J. Thorpe has been appointed to the new position of Product Sales Manager for the CATV Equipment & Installation Operation of GTE Sylvania Incorporated....Two organizational changes have been made in the Wire and Cable Group of Superior Continental Corp. **Joel Reece**, former general manager of Superior Cable Division, moves up to Director of Manufacturing, Wire and Cable. **Edward E. Schott** becomes general manager of Superior Cable Division.

C-COR Electronics, Inc. announces the appointment of **Curtis "Fred" Cannington** as south-eastern regional sales manager for cable television products, **Willard S. Truckenmiller** has been appointed to the newly created position of Customer Service Manager for both cable television and industrial products, and **Edward J. Robinson** has joined the State College, Pa.-based Cable TV Equipment manufacturer as Personnel Manager.

Radio-TV

Promotions to newly-created positions in the engineering departments of KSD-TV and KSD Radio have been announced. **J. E. Risk**, chief engineer for the stations, has been promoted to director of engineering for both KSD-TV and KSD Radio as well as for KOAT-TV, Albuquerque, N.M. **Monte L. Walpole**, an engineering supervisor at KSD-TV, who has been promoted to manager of engineering for KSD-TV; and **Johannes Oelke**, an engineering supervisor at KSD Radio, who has been promoted to manager of engineering for KSD Radio.

KFXM (San Bernardino, Cal.) is happy to announce the appointment of **Ted Brown** as its' new midnight to 6 AM DJ....Jack Sumroy, vice president of programming at WSNL-TV, Channel 67 UHF has announced the appointment of **Albert Becker** as the station's new production manager.

"I jumped from tugboat to television



after I got my First Class FCC License"

What do you do with your off-duty hours if you work in the engine room of a tugboat? Well, if you're Richard Kihn of Anahuac, Texas, you learn electronics with CIE. As he tells it: "Even before I finished my course, I passed my First Class FCC License exam and landed a job as broadcast engineer with KFDM-TV in Beaumont, Texas. Then in my first year at KFDM, I finished my CIE course, earned two raises and became a "two-car" family! Not bad for an ex-tugboat hand! "I'd recommend Cleveland Institute of Electronics to **anybody** interested in broadcasting."

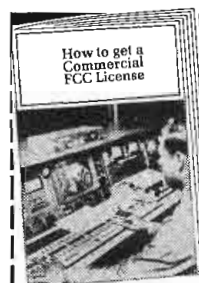
You **need** an FCC ticket to move ahead in broadcasting, and five out of CIE's seven career courses prepare you to "sit for" the Government FCC Commercial License exam. In a recent survey of 787 CIE graduates, better than 9 out of 10 CIE grads passed the Government FCC License examinations. That's why CIE can offer this famous Money-Back Warranty:

When you complete any CIE licensing course you'll get your FCC License or be entitled to a full refund of all tuition paid. This warranty is valid during the completion time allowed for your course. You get your FCC License . . . or your money back.

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INDUSTRY ACCEPTANCE

CHANNEL TWO TELEVISION COMPANY

KPRC TV

July 13, 1972

Mr. Morris T. Covington
Director of Research
Taft Communications Systems, Inc.
4808 San Felipe Road
Houston, Texas 77027

Dear Morris:

This long overdue letter will let you know how very pleased we are with the continuing good service from our Taft Audio Distribution Amplifiers.

As you know, I had six of these amplifiers on the test bench for six weeks and abused them in every way possible. I did not experience a single failure; in addition, they held their specifications in every way.

I had evaluated several "well-known" distribution amplifiers before I tested the Taft DA, and I knew then that this was the DA for us. It is right in every way: size, individual power supply, number of outputs and performance. After several months of hard and continuous service, I am still well pleased with all fifty two of them.

I will recommend your Model 5002 Audio Distribution Amplifier, and also your Model 4002 Monitor/Power Amplifier without a moment's hesitation.

Yours very truly,

William E. Thomson
William E. Thomson
Audio Engineer



Note these unique features of the Taft Model 5002 Audio Distribution Amplifier:

- (1) 18 isolated 600 ohm outputs (80 db)
- (2) 20-KHZ $\pm$.25 db, .25% total distortion (with "EQ" and "Rolloff" in flat position)
- (3) Equalization and Rolloff feature provided for signal conditioning before distribution
- (4) Input and outputs are balanced
- (5) 20 db gain (can be increased to 40 db)
- (6) Noise better than 80 db below 0 dbm signal
- (7) All integrated circuits for very efficient operation — units may be stacked without air spaces
- (8) Output level is continuously monitored
- (9) Two year parts and labor warranty

New Price: \$295.00 (includes input transformer — specify 150, 600 or 15K input impedance)

If you are interested in evaluating the 5002, call us collect or check the information card.

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Formerly

COMMUNICATION SYSTEMS, INC.

bookreview

Transistor-Transistor Logic, by George Flynn, has been written to provide the reader with the background needed to understand the operation of integrated circuit devices. With a good understanding of the basic devices, it is possible to work with the logic systems that have invaded the communications industry.

Chapter 1 discusses the digital families of which transistor-transistor logic, or TTL, is a part. It also covers the basic units—the gate, the various basic circuits, and the voltage and current requirements. The next five chapters discuss the different types of circuits used in a logic system, while Chapter 7 explains the mathematics used in TTL. Chapters 8 and 9 examine the devices and methods used to determine information priority and storage. Chapter 10 discusses how TTL logic can be joined to other type circuits and logic families.

The final chapters are concerned with how fast TTL logic will operate, how many units can be combined in a single IC package, and how basic counting and data transmission systems work. Appendices and a glossary are provided to further understanding of gates, flip-flops, counters, logic numbering, and power systems.

A design engineer or service technician, needing an understanding of the internal and external circuit construction of logic devices, will find the information in this book an invaluable aid.

This book is available through Howard W. Sams & Co., Inc., Indianapolis, Ind.

For More Details Circle (85) on Reply Card

Television Measurement Techniques, written by L. E. Weaver, is a review of the techniques and equipment used in the checking and standardization of the apparatus in television signal chains, from source to transmitter.

This monograph fills a gap in the literature on television technology. It includes a great deal of material previously accessible only with difficulty, and a certain amount of original work. Although a comparative approach is made to available methods, with emphasis on local and national differences, the techniques advocated are, wherever applicable, the ones recommended by those international broadcasting bodies which for years have been working to achieve world-wide agreement on standards of quality, equipment and procedures.

This book is written from the point of view of the television broadcast engineer, though much of the material is directly applicable to related fields, such as closed-circuit television for educational and industrial purposes. Like other books in the IEE Monograph Series, it is intended for the professional engineer and those in training.

This book is available through Peter Peregrinus Ltd., London, England.

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NEW PRODUCTS

TV Color Contrast Evaluator Kit

Imero Fiorentino Associates, TV Lighting Consultants of New York, Las Vegas and Hollywood, have designed a new Color Contrast Evaluator Kit. Its purpose is to facilitate good separation of all scenic components when shown on color or black-and-white television systems and to insure that all colors used are within the limitations of the TV system.



Scenic elements are viewed through a specially-formulated, decolorizing filter; comparison is then made with the chips on the IFA Grey Scale which is included. Full instructions explain the requirements of the TV system and how to obtain optimum picture quality.

Designers, Graphic Artists, Art Directors and Lighting Designers will all find the Kit an invaluable tool in either film or television production.

Cost of the complete kit is \$19.50 including postage.

For More Details Circle (60) on Reply Card

Mixer System

The QM-8 Mixer System from **Quantum Audio** is designed for recording, production or sound reinforcement. Its small size (19"x19"x7") and light weight (37 lbs) make the new QM-8 console equally at home as a permanently installed console or as

a portable remote unit.

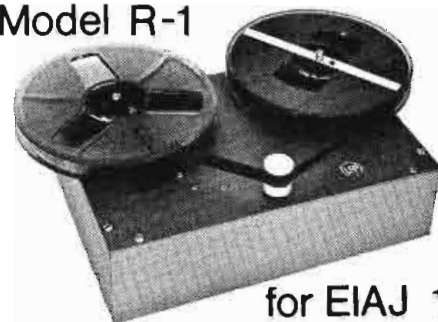
The QM-8 contains all the features and functions of a full size console. All inputs are XL type female connectors. Mic inputs are 200 Ohms balanced, line inputs 10K Ohms unbalanced. Buss outputs are XL type male connectors. Monitor outputs on 1/4 inch phone jacks. The electronics in QM-8 were designed and evaluated over a 2 year period before being placed in production.

Designed for stereo or quad operation, the 8x4 console includes monitoring and headphone cue systems. The input module contains high and low frequency selector switches and high and low frequency boost-cut controls. An input selector switch selects the signal for the module and controls microphone pre-amp gain. A pan selector switch that switches pan pot operation to front or rear. Buss as-

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Ultra Audio Products

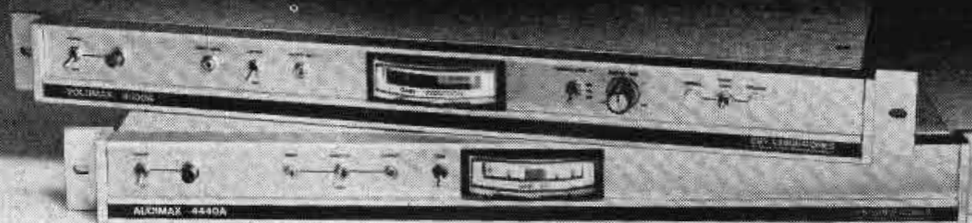
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Request Bulletin No.

BE-123

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Send only the best.



Only the best is good enough. And that's exactly what you get with CBS Laboratories power twins, Audimax and Volumax. Audimax delivers a distortion free signal by eliminating thumping, background "swish-up" and audio "holes." And Volumax prevents overmodulation and permits maximum per-watt coverage power. The power twins! From CBS Laboratories, of course.

CBS LABORATORIES

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- Lifetime guarantee
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- Standard & Dolby versions
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Spotmaster and Revox have joined forces to develop this ruggedized, rack-mounted version of the A77 stereo recorder specifically for broadcast use. Choose the standard version, or the Dolby model with its incredible 70 dB S/N ratio. All basic parts except heads, capstan and pressure roller are guaranteed for life. Your choice of 2- or 4-track stereo operation at 7-1/2 and 3-3/4 ips. Other speeds, full-track heads, accessories optional. Call or write:

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For More Details Circle (35) on Reply Card

NEW PRODUCTS

signment switches an echo send control, and a slide pot module level control.

Low frequency equalization at ± 12 dB max at 50Hz or 200 Hz. High frequency equalization at ± 12 dB at 3kHz or 10kHz. Output at ± 18 dBm before clipping. S/N ratio is 70dB. Response ± 1 dB 20-20,000 Hz.

For More Details Circle (61) on Reply Card

Video, Audio Pulse Distribution Modules

Cooke Engineering Co. has introduced a new series of broadcast quality audio, video and pulse distribution modules called the DYNA-MITES. Small and powerful, they have the exacting specifications for advanced studio use, and they are priced low enough for the smallest CCTV installation. All modules feature plug-in construction with self-contained power supplies.

Six DYNA-MITES are offered as follows: Video Distribution Amplifier, Video Equalization Amplifier, Pulse Distribution Amplifier, Audio Pre-

amplifier, Audio Monitor Amplifier, and Audio Distribution Amplifier. Each module measures only 1 3/4" high,



4 1/2" wide, and 6" deep. A rack mount housing permits installation of any 4 modules in only 1 3/4" by 19" of rack space.

For More Details Circle (62) on Reply Card

Tower Lighting Kit

Moseley Associates, Inc. is now offering their new Model TLK-2 Tower Light Kit, which provides inductive sampling of any AC current in the range of 2 amperes to 50 amperes. The current sampling loop need only be installed around one side of the AC line.

Direct connection is not required to the AC circuit of the tower, or any other current-drawing devices.

For More Details Circle (63) on Reply Card

Digilog Mixer

For the first time ever, anywhere, OMNIX is offering the only digitally operated mix amplifier. No LDR's, No FET's, No differential amplifiers. All mixing is performed with resistors. Therefore the crossfade linearity is within 1 percent.

No linearizing circuits are required so setup is super easy. Phase shift over the fade is less than 2 percent, and frequency response is relatively constant. Dynamic range is 38 dB.

For More Details Circle (64) on Reply Card

Low Cost Dual Trace Scope

Tektronix, Inc. announces the TEL-EQUIPMENT* D75. At \$1375 it's one of the lowest priced dual trace, 50 MHz, portable, delayed sweep oscilloscopes on the market.

Portability is optimized in the small sized, horizontal configured package

STL Symbol of Test Tape Excellence

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STL test tapes are distributed exclusively by TABER Manufacturing & Engineering Co.



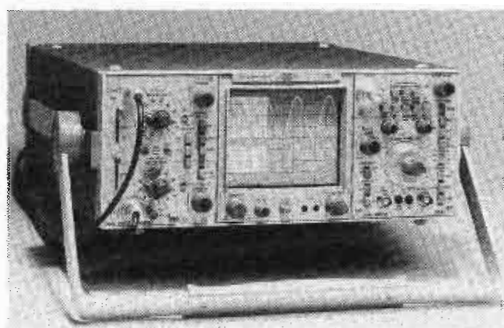
STANDARD TAPE LABORATORY, Inc.

2081 Edison Avenue
San Leandro, CA 94577
(415) 635-3805

For More Details Circle (36) on Reply Card

(5.4" high, 15" wide, 18.6" deep). This lightweight, portable oscilloscope (25.5 lbs) carries conveniently in a taxi or subway and fits easily under an airplane seat or in the trunk of a compact automobile.

The D75 was designed with troubleshooting in mind. The multi-position tilt handle (15 positions), when placed in the forward position, allows the D75 to be handcarried very easily. The tilt handle feature also permits optimizing display viewing from various angles.



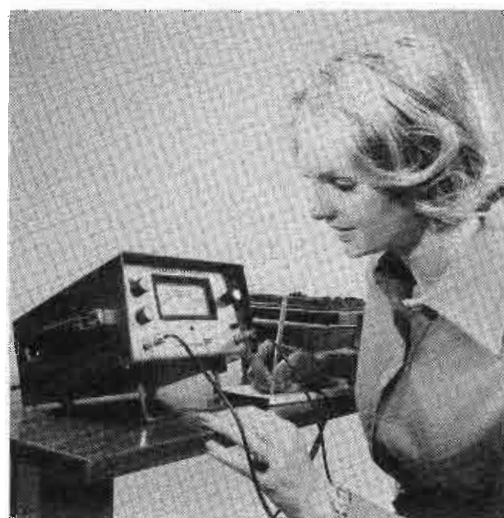
For low amplitude measurements, the 50 MHz dual-channel, vertical amplifiers have deflection factors starting at 5 mV/div, accurate within 3%. For measuring even lower amplitude signals a gain control (X5) extends the minimum deflection factor to 1 mV/div with 15 MHz bandpass. For high resolution measurements the 50 MHz bandwidth displays pulses with fast risetime of 7 ns or less. Five vertical modes are available, including alternate, chopped and summed.

For More Details Circle (65) on Reply Card

Tape Recorder Test Set

A test set that shows at a glance if tape recorders and other audio systems are operating correctly has been introduced by **3M Company, Mincom Division**.

The 3M brand Model 6500 Recorder Test Set was designed to simplify the testing process for the recorder manufacturer, user and serviceman. 3M says special skills are not required



to operate the Model 6500. The instrument's "quick look" meter has calibrated color bands to indicate acceptable, marginal or unacceptable performance of the device being tested.

The lightweight, portable unit's meter reads a composite signal for testing input and output levels, frequency response, harmonic distortion, signal-to-noise ratio and tape transport flutter for a wide cross section of audio tape recorders and systems, 3M says.

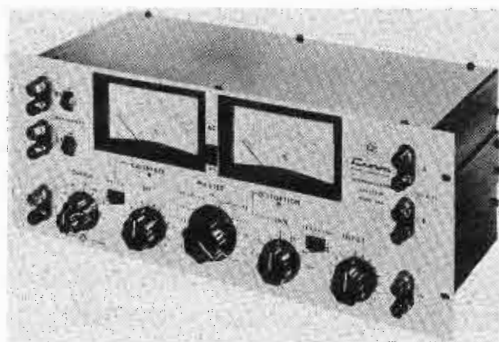
For example, the flutter and harmonic distortion levels can be measured up to 3 percent maximum and signal-to-noise ratios from 20 to 50 decibels.

By the flick of a switch, the operator can select any of three individually calibrated sets of test parameters to cover different quality recorders—from those of relatively low performance to those of professional quality.

For More Details Circle (66) on Reply Card

Intermodulation Distortion Analyzer

We've discussed IM measurements at some length this year, so when this product information crossed our desk, we couldn't pass it up. It comes from **Crown** and they call it their IMA intermodulation distortion analyzer.



IMA was basically designed to make SMPTE-type IM measurements of audio equipment for quality control and service purposes.

The Crown IMA makes a complete check of IM at 10 different levels over a 45 dB range (in steps of 5 dB) using only a single control.

Test frequencies are generated by FET controlled bridge oscillators and are independent of line voltage. Typical residual IM is 0.005% and accurate to within 5% of full scale. Also, both input and output are metered.

Other uses of the IMA are: testing transistor noise; mag-tape drop-out; mag-tape recorder distortion; stylus wear and tracking; as well as osc/amp amplitude stability.

For More Details Circle (67) on Reply Card

VTR Color Framer

A. F. Associates, Inc. has introduced a new 15 Hz color framer system, AF/103, for VR-2000's and VR-1200's. The system will provide

(More...)

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For More Details Circle (38) on Reply Card



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For More Details Circle (39) on Reply Card

NEW PRODUCTS

true in-phase color edits, as well as eliminating the 140 nanosecond horizontal video shift in the playback machine.

It can be used in all modes of the Editec and with any previously recorded 15 Hz tape. Models for TR-70's and AVR-1's are to be available soon.

For More Details Circle (68) on Reply Card

Film-Balanced Three-Color Meter

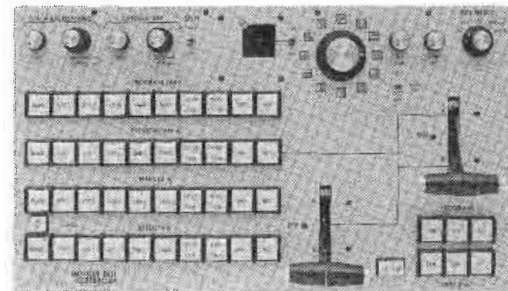
A new instrument to assist the photographer and the lighting man in obtaining correct color balance has been announced by the **Photo Research Corporation**. The new Spectra Film-Balanced Three-Color Color-Temperature Meter "sees light just as the film does," and reads-out in either color temperature or color-balancing filters.

A successful test program conducted by the impartial Motion Picture and Television Research Center of Hollywood was described in a paper given at the recent SMPTE Convention in New York.

For More Details Circle (69) on Reply Card

Production Switcher

American Data Corporation, an AIRPAX Company, has recently released their all new Model 556 Production Switching System. The system is a real "mini" when it comes to price and size, but boasts "maxi" features usually found only in larger systems.



The standard 556 has ten composite or non-composite inputs, which includes blackburst, and four busses. The Special Effects system incorporates the twelve "most used" wipe patterns, including a circle. A "joy-stick" positioner with a spotlight effect and a three input downstream keyer are also standard.

Downstream keying enables the operator to key **without** defeating the pattern generator so that special effects can be done behind any key including a chroma key. The keyer also includes both "Wipe" and "Blink" Key features and color matting of monochrome keys. Re-entry of Effects-Key into Mix allows the operator to Mix into or from an Effect or Key, or Key on top of an Effect.

Other standard features of the 556 system are Program and Preview output switching, a Color Background - Blackburst - Color Matte generator, a processing amplifier on the program output channel, momentary illuminated barrier switches, and provisions for an RGB chroma keyer.

For More Details Circle (70) on Reply Card

Audio Consoles

New prestige 6, 8 and 10 channel broadcast audio consoles have been announced for immediate delivery by **AMPRO CORPORATION**. Each configuration will be available in mono, dual mono and stereo versions. Handsome buff non-glare front panel and walnut side decoration is standard for all models.

Units also feature: step type, silver contact faders; four switchable inputs per fader, user adjustable for Mic or High Level; quality lever key switches; and 4 muting relays with programming board for feedback-free origination from 4 locations.

They also include: high gain 104dB mic to program output; shielded PC

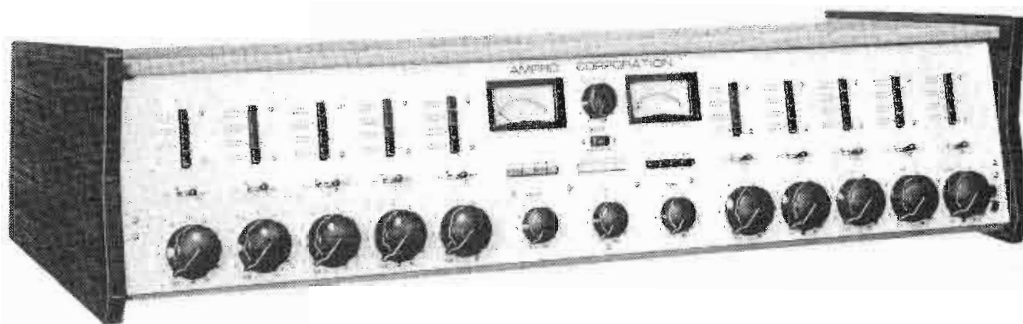
PRODUCTION

Dave Daniels, program director at Heftel Broadcasting Corporation's WKQT-13Q in Pittsburgh gave us his dream design for easy production... Pacific Recorders made it a reality... twice! First with a complete NEW SOUND at 13Q in Pittsburgh and then again at Heftel's WLQY-Y100 in Ft. Lauderdale... Pacific Recorders builds complete systems!... maybe it's time for your "new sound"...



PACIFIC RECORDERS AND ENGINEERING CORPORATION
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TELEPHONE (714) 453-3255 TELEX 695008

For More Details Circle (40) on Reply Card



mixing bus to eliminate maintenance problems; total noise, hum and cross-talk 68dB below +18dBm output with -50dBm equivalent power microphone input; 10 Watt electronic dissipation

limited monitor amplifier completely protected from shorts and overloads; built-in cue/talkback system; and built-in headphone amplifier.

For More Details Circle (71) on Reply Card

Tone Sensor

Control Design Corporation announces the availability of their CD25S 25Hz Tone Sensor. This all solid-state unit, designed to update similar units in virtually all automation systems presently on the market, provides control functions for sensing the presence of prerecorded 25Hz tones on audio material. Exclusive built-in fixed tone alarm with

8 second tone activation allows flexibility in source switching, automatic rewind of tape and other uses including the obvious end-of-tape function.

Other features include: built-in 25Hz program filter; delayed stop contacts - 0-10 seconds nominal; bridging input; 600 Ohm output (balanced available); IC logic and audio; and a built-in power supply.

For More Details Circle (72) on Reply Card

Announcing something new* from **TEPCO**

Tepco Corp. has been in business since 1957 supplying television translators and microwave to the industry. Now we are expanding to become a notable contributor, especially in the microwave and computer data acquisition field.



New solid state audio sub-carrier equipment for all microwave systems . . .

. . . and a new low price.

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December, 1973

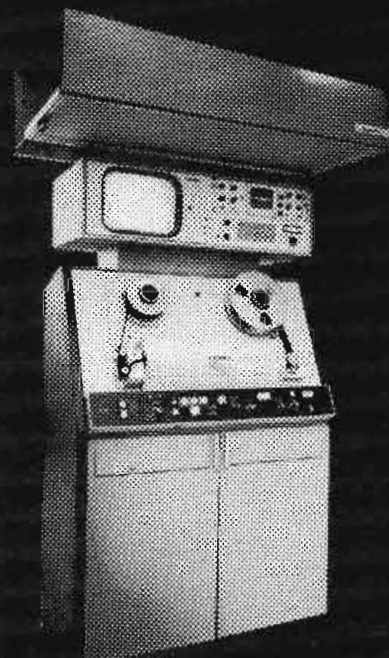
TV Camera Lens

The **Angenieux 18x27.5E61 f/2** can zoom from 1000mm to 27.5mm in one second. At 1000mm, the lens is only f/6. The 18 to one has three 18x zoom ranges with electrically positioned range extenders and automatic iris compensation for a constant video level.

This lens can be interchanged between various types of cameras within three minutes.

For More Details Circle (73) on Reply Card

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Envirazone II[®] was the first clean air module designed to isolate dirt and contaminants from VTR equipment. After three years of operation, more than 400 stations report significantly longer headwheel life, even on the newer improved heads.

Prices on Envirazone II[®] and replacement filters have been dramatically reduced. You can save now by installing Envirazone II[®] units or ordering replacement filters for your present equipment.

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For More Details Circle (34) on Reply Card

Helical vs. Quad

(Continued from page 38)

"Lack of compatibility with the quad format has been discounted by many broadcasters and teleproduction people as a drawback of the machine," said Guisinger. "This is apparently because the need for simpler editing and higher quality in the preparation of masters outweighs the need to dub in the same format. Incidentally, we'd like to point out that the two machines introduced at Montreux

were shipped overseas, used for teleproduction in France and England, trucked to the show, and demonstrated continuously for seven days straight—without a minute of downtime. We got the same performance from the machines that appeared at SMPTE. It appears that these helical-scan machines can match any machine made in terms of dependability."



(Continued from page 17)

meeting, held at the University of Illinois Medical Center was on Digital Time Base Correctors. The November meeting was to be at RCA on the TCR-100 and the Sears Building Antenna at ABC-TV.

Chapter 28—Milwaukee, Wisc. Chairman: Ed Wille, KENCOM, Milwaukee, Wisc. 53218

On September 18th, members, guests, and student guests heard Verk Killeon of Gates tell about the Gates Dual Transmitter System. He first reviewed the common problems of difficulty of obtaining high power output, distortion, excess video voltage, varying modulator

loads, and phase shift. His talk included audio and visual aids, showing how Gates has overcome these problems, and the techniques of operating two transmitters in parallel with emphasis on the Gates new IF-modulated rig. On October 23rd, Ken Reichel, manager and sales engineer of Shure Brothers talked on Shure Audio Products. Meetings were held at WTMJ Auditorium.

Chapter 32 - Tucson, Ariz. Chairman: Hobart Paine Tucson, Ariz. 85711

The September 18th meeting was held at the University of Arizona Micro-campus. Many organizational details were discussed. Bill Row volunteered and was appointed Membership Committee Chairman. Gene Stough was appointed Program Chairman. On October 15th, at Roh's Inc., a demonstration was provided on the new Sony TV Projection System and the Norelco LDH-1 Color TV Cameras.

The September meeting speaker, Dr. Roy H. Mattson, Head, Electrical Engineering Department, University of Arizona, spoke on Transmitting Color TV by the Numbers, based on a sampling system that uses the binary number system. Professor Mattson also hosted a tour of the college Microcampus engineering facilities.

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WANTED

WANTED: All surplus broadcast equipment especially clean A.M. & F.M. transmitters, contractors, capacitors. Surplus Equipment Sales, 2 Thorncliffe Pk. Dr. Unit 28 Toronto 17, Ont; Canada. 1-73-tf

TUBES WANTED—All types—CeCo 2115 Avenue X, Brooklyn, N.Y. 11235, 212-646-6300—Anytime. 7-73-12X

"WANTED type approved microwave system to pass color. Respond to Box 4371, Inglewood, Cal. 90309. 12-73-2t

WANTED (Cont.)

WANTED: Two used 3,000 to 5,000 Watt late model FM transmitters with associated stereo and SCA generators. One 3,000 Watt AM transmitter. Other associated equipment necessary with the establishment to complete AM and FM station operation. Contact: Jim Davis, P.O. Box 727, Deland, Florida 10-73-3t

WANTED: Retired audio and FM gear for Community College Station. Tax advantage through established foundation. Need all. console, TT cart, reel-to-reel, freq. monitor, excitors, Xmitter. Contact Charles Hintz, Telecommunications Dept., Napa College, 2277 Napa Vallejo Hwy, Napa, Calif. 94558. 12-73-1t

WANTED: VR 1100 and VR 1200 or any parts for either. Vidtec Systems, 12676 Pierce #20, Arleta, Calif. 91331 12-73-1t

BROADCAST EQUIPMENT, tower, console, wanted a donation to Christain College for new educational station. Full tax deductions. Calvary Christain College, Paris, Ohio 44669. 12-73-1t

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EQUIPMENT FOR SALE CONT

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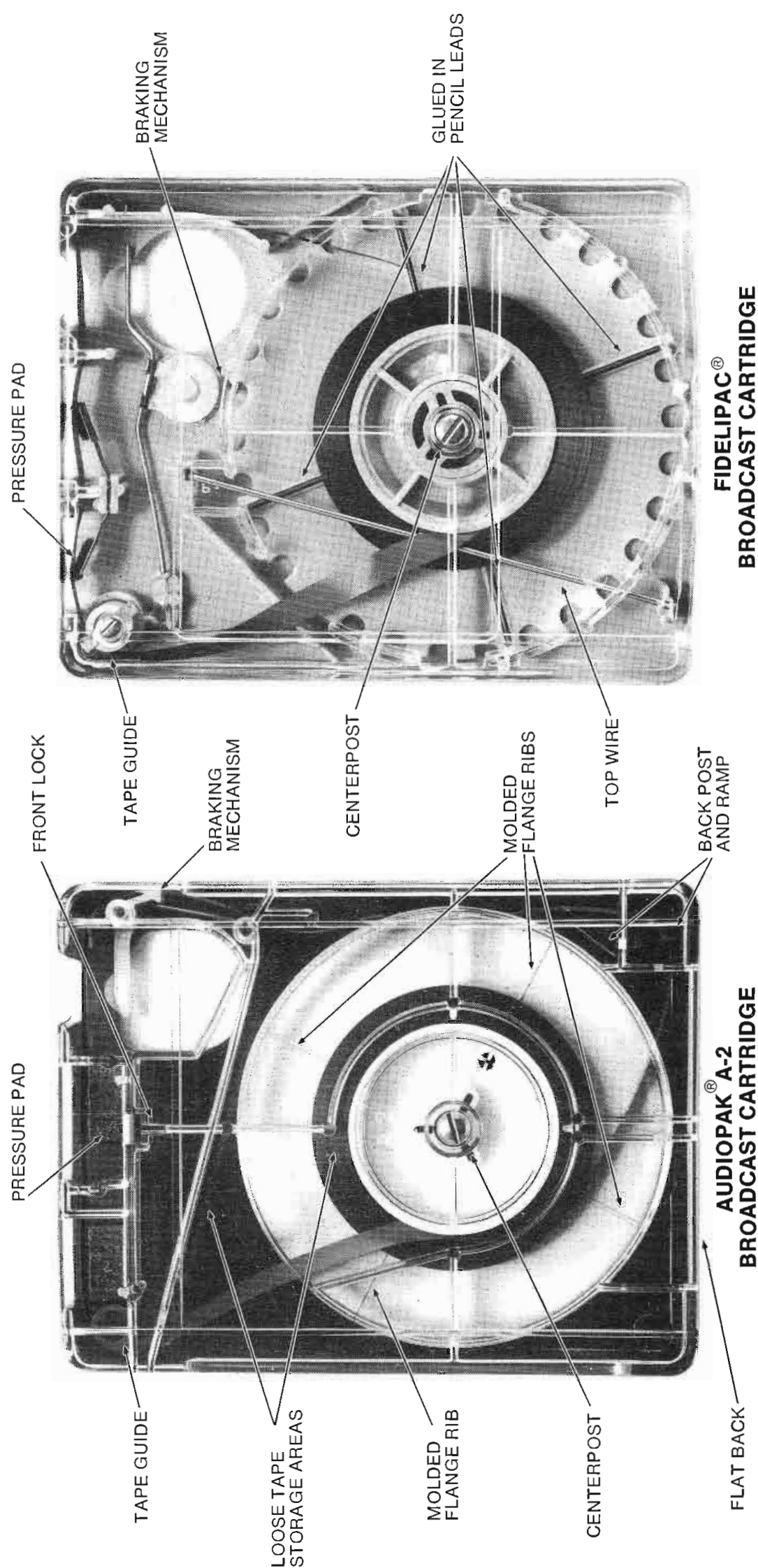
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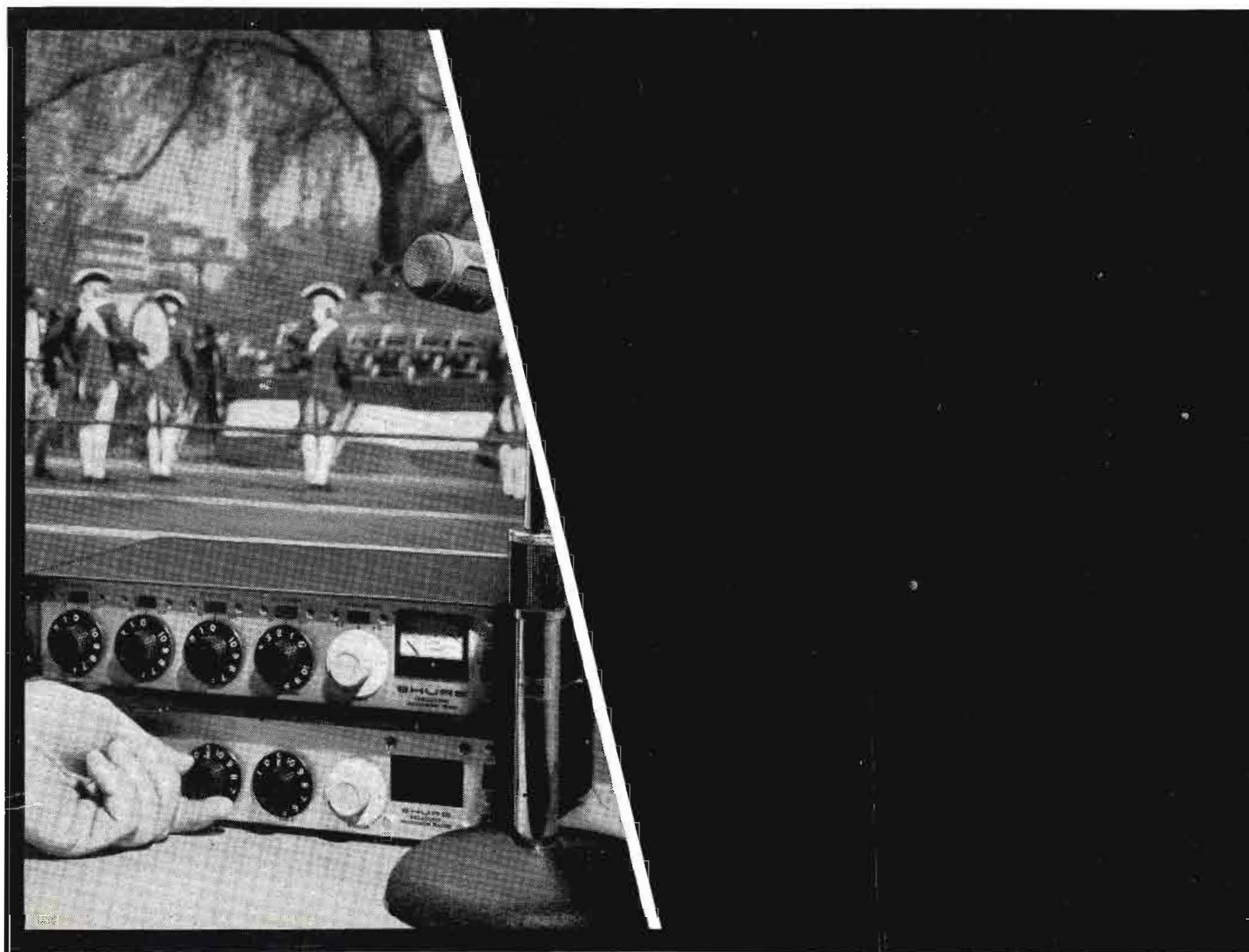
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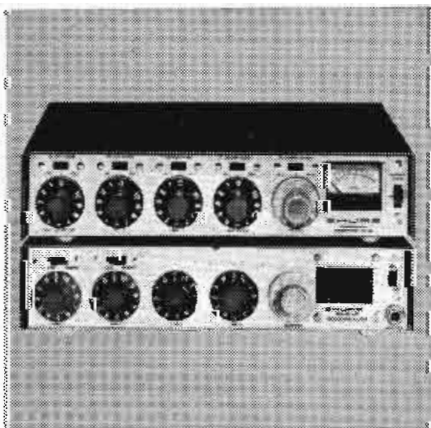


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