July, 1971/75 cents

Broadcast Engineering®

the technical journal of the broadcast-communications industry

A HOWARD W. SAMS PUBLICATION

National Public Radio page 34

Originating With Film
WWV Time Announcements
New Grade B Proposals

EV STEREO-4™
compatible four channel

4-CHANNEL SOUND

Electro-Voice is making it happen for you...today!

(Being more a progress report than an advertisement.)

The Promise

Thousands of people have heard 4-channel stereo reproduction at hi-fi shows and special demonstrations in the last few years. Others have read about this fascinating and rewarding technique that promises more faithful reproduction of musical performances. Early experiments have also shown 4-channel to be an effective tool in creating new sonic environments for both serious and popular musical forms. The concept has met with almost universal critical acclaim, and strong general approval.

The Problem

But alas only a handful of enthusiasts are actually enjoying this advance today. Because only a few 4-channel tapes have been produced for sale. The problem is simple, but basic: 4-channel means just that—four separate signals. And to reproduce it properly demands four of everything, right down the line.

It's possible (albeit expensive) with reel-to-reel and cartridge tape. But the stumbling block has been to put four completely independent signals in a record groove, or to broadcast them over a standard stereo FM station.

And if you can't make 4-channel discs, or play them on FM, the market is limited to a precious few 4-channel tape owners. But their numbers are so small that the record industry just can't afford to release four channel material. So the industry continues to produce 2-channel stereo that anyone *can* play (and that can be sold in volume).

The Way Out

Now Electro-Voice has moved to break the impasse. With a system that can offer the significant advantages of discrete 4-channel, yet is compatible with present record manufacturing and playback equipment and present FM broadcasting. It is called STEREO-4.

STEREO-4 is a system that encodes four channels into a stereo signal that CAN be transmitted over FM or recorded on a disc, stereo cassette or cartridge. The home listener adds a STEREO-4 decoder, plus another stereo amplifier and a pair of rear speakers. The result is reproduction that closely rivals the original 4-channel sound. Four different signals from the speakers, with a feeling of depth and ambiance you have never before heard from any record.

Admittedly, STEREO-4 is not quite the equal of 4 discrete signals. But while there is some loss of stereo separation, there is no reduction in frequency response or overall fidelity. We might note that this reduced separation actually seems to aid the psychoacoustic effect for many listeners in normal listening situations. And on the plus side, STEREO-4 offers an advantage that even discrete 4-channel cannot provide.

The Remarkable Bonus

Playback of almost all present 2-channel stereo discs and tapes is greatly enhanced when fed through the STEREO-4 decoder. It's the result of multi-microphone recording techniques that include a remarkable amount of 4-channel information on ordinary stereo discs and tapes. Adding STEREO-4 releases this hidden information for all to enjoy.

Model EVX-4 STEREO-4 decoder

The Decoder

A STEREO-4 Model EVX-4 Decoder costs just $59.95. And with it, plus 4 speakers and dual stereo amplifiers, the listener is equipped for almost any kind of sound available. Encoded 4-channel, enhanced stereo, regular stereo, *and* discrete 4-channel (assuming suitable source equipment). Even mono. So STEREO-4 is the one system that is compatible with the past, present, and foreseeable future.

The Present

And what about encoded 4-channel discs and broadcasts? Well, that's where you come in. Already recording companies have started mastering STEREO-4 records, and their ranks are growing. And STEREO-4 is now being broadcast in many major cities around the country.

Model 7445 Professional STEREO-4 Encoder

The Encoder

All that is needed is a Model 7445 Professional STEREO-4 Encoder $795.00 net, direct from the factory. The encoder is patched into your console. No other changes in equipment or handling, whether broadcasting or recording (except that you'll want to add 4-channel monitoring, of course). No increase in costs. And your performance standards are unaffected. The encoder doesn't add noise, distortion, or limitations on response. And listeners without a decoder still enjoy all the music in conventional 2-channel stereo. Some record producers even feel that the STEREO-4 encoder results in better 2-channel stereo than conventional mix-down techniques.

The Future

Like you, we hope for the day when discrete 4-channel sound will be commonplace on records and FM, and when STEREO-4 decoders will be relegated to enhancing present libraries. But that day will have to wait until some very knotty design problems are solved. And probably after a host of new FCC regulations define an utterly new system. Indeed, there is serious question whether these problems can be solved at all.

In the meantime, the STEREO-4 system is getting 4-channel recordings into the marketplace in increasing numbers, in a form that people can enjoy. EVX-4 STEREO-4 decoders are now on the market in quantity. And STEREO-4 decoder circuits are being designed into mass-produced stereo phonos and receivers. Even STEREO-4 juke boxes are now in use!

What Can You Do?

Write us today for all of the technical details, plus up-to-date news of STEREO-4. Make news yourself by adding compatible STEREO-4 for your audience. It's not too soon to start planning for tomorrow!

ELECTRO-VOICE, INC., Dept. 714V
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Circle Number 4 on Reader Reply Card

July, 1971 • Volume 13, No. 7

Broadcast Engineering

The technical journal of the broadcast-communications industry

in this issue...

ABOUT THE COVER

This month's cover kicks off the National Public Radio Network and their unique programming. For network briefing, see page 34. Photo courtesy of Jack Neff and Broadcast Electronics.

DEPARTMENTS

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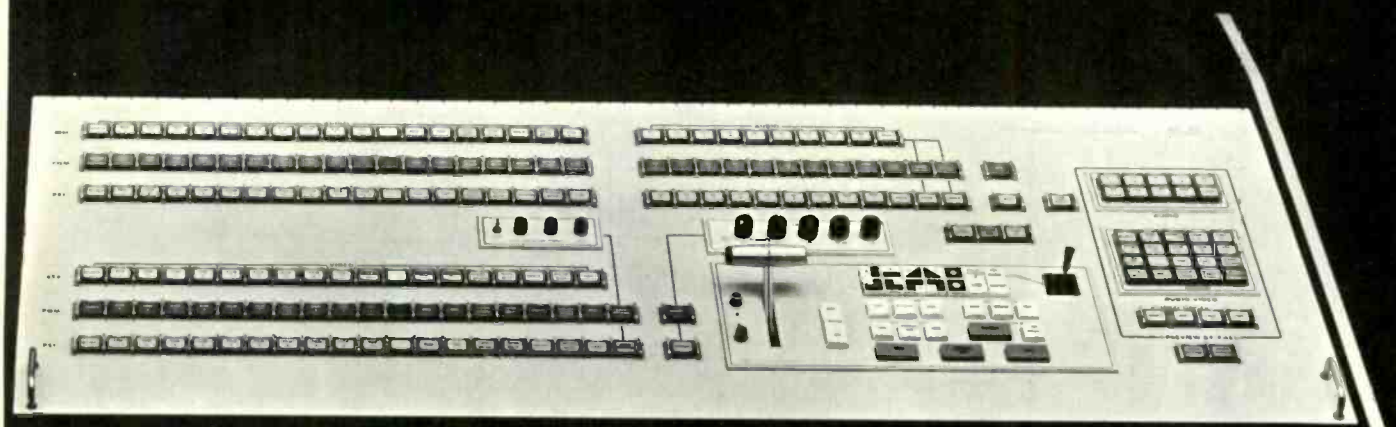

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Circle Number 5 on Reader Reply Card

DIRECT CURRENT FROM D. C.

July, 1971

By Howard T. Head

Court Rejects Commission Cable Origination Requirements

The Eight U.S. Circuit Court of Appeals (St. Louis) has held that the Commission had no authority to require all CATV systems with more than 3500 subscribers to originate program material. The Commission regulation took effect April 1, 1971, but the requirement was waived in a large number of instances.

The Court ruling is being hailed as a victory by both CATV operators and broadcasters, both of whom opposed the requirement but for entirely different reasons. The Commission has decided to appeal this ruling to the U.S. Supreme Court. An appeal would require the concurrence of the Justice Department.

Court Rules On Liability of Adjoining Property Owner for Directional Antenna Distortion

In a decision believed to be the first of its kind, the Massachusetts Supreme Court has ruled on the complaint of an AM directional antenna licensee that construction of a building on the property adjoining the antenna site would distort the directional radiation pattern.

The AM licensee had asked a lower Court to enjoin the adjacent property owner from construction of the building on various grounds, including the directional pattern distortion. The Massachusetts Supreme Court upheld the lower Court's refusal to do so, holding that the adjoining property owner had the right to make use of the space above his property as he saw fit.

Cases of directional antenna pattern distortion have become increasingly frequent as city suburbs have mushroomed onto formerly isolated areas surrounding directional antenna sites. In past instances, problems of this nature have been solved informally, often by antenna pattern readjustment, without seeking court intervention. The Massachusetts case may well establish a precedent for handling of similar future complaints.

The National Association of Broadcasters (NAB) has been working quietly and effectively with Federal agencies and public utilities to minimize problems of this sort arising from new highway construction or the building of new high-tension lines. The success of these activities, however, has been due primarily to effective informal coordination, and only public and quasi-public agencies have been involved.

(Continued on page 6)

Look what we did to the world's finest tape cartridge system...

we made it better and named it Criterion 80!

We took the features which have made Criterion stand for excellence in cartridge tape equipment, such as: The rugged deck and tape drive assembly; massive high-torque direct drive capstan motor; and our exclusive Micro-Set precision head assembly . . . and made some significant improvements:

Such as — All new silicon transistor electronics on plug-in glass-epoxy printed circuit cards, all RFI proofed to make them impervious to strong RF fields; higher output level (10 dBm capability); lower distortion; automatic audio muting and transient suppression.

And — New control circuitry; improved pushbutton switches; latching connectors for external cables; independent gain controls for cue amplifiers; up-front output level adjustment; fully regulated plug-in power supply — and more.

We think you'll like Criterion 80. For a closer look, write Gates, 123 Hampshire Street, Quincy, Illinois 62301.

HARRIS INTERTYPE CORPORATION

GATES

A DIVISION OF HARRIS-INTERTYPE

Circle Number 6 on Reader Reply Card

(Continued from page 4)

JTAC Proposes NCTSC

The Joint Technical Advisory Committee (JTAC) of the Institute of Electrical and Electronics Engineers (IEEE) and the Electronic Industries Association (EIA) has proposed to the Commission the formation of a National Cable TV Systems Committee. JTAC points out the need for a thorough review of cable television technical specifications, and emphasizes the success of such earlier technical committees as the two National Television Systems Committees (NTSC) establishing standards for black-and-white and color television, and the Television Allocations Study Organization (TASO). JTAC, however, was not active in any of these earlier committees, nor instrumental in their formation.

The JTAC proposal was discussed at a recent informal meeting of the Commission's staff. As a result of these discussions, it was concluded that such a sweeping proposal should not be submitted to the Commission until a decision is reached in the various CATV proposals now before the Commission, including those for the adoption of CATV Technical Standards. The JTAC proposal may, however, be taken up after the Commission acts in CATV.

In the meantime, the Institute of Electrical and Electronics Engineers has formed a new CATV coordinating committee under the aegis of IEEE Division #3, which includes the IEEE Groups on Broadcasting, Broadcast and Television Receivers, and Communications Technology. This committee has met twice in recent months, and has become active in the development of IEEE Standards for cable television.

AM Modulation Proposal Ready for Commission Consideration

The Commission's staff has completed a draft of a final order which would limit positive modulation peaks for AM broadcast stations. The present AM Technical Standards require that negative modulation not exceed 100 percent (a rather obvious requirement) but establish no limit on positive modulation peaks. Some transmitters now being offered for sale achieve positive modulation peaks as high as 170 percent (see 6/70 D.C.). We predicted in our March, 1971 Pompous Predictions that the Commission would reimpose a requirement for maximum positive modulation. Our prediction was for a value of 115 percent, whereas the document now under Commission consideration would set the level at 120 percent; close, but no cigar.

Short Circuits

The North American Regional Broadcasting Agreement (NARBA), which governs AM assignments in most North American countries (Mexico excluded) has broken down in almost all countries except the U.S. and Canada . . . An antenna manufacturer is experimenting with circular polarization on television Ch. 10 at Altoona, Pa. . . . Final comments have been received on the Commission's proposal to require a VIT signal as a prerequisite for television transmitter remote control, and the new remote control form (Form 301-A) will be out as soon as approval is received from the federal Office of Management and Budget (OMB) . . . A North Carolina regional channel station employing a directional antenna has been fined for failing to reduce power after sunset as required by the station's license . . . Studies of the UHF TV allocation "taboos", undercut in the U.S. by the failure of OMB to approve an FCC budget request for the next fiscal year, are under way in Canada.

Collins FM transmitters have the best record for uninterrupted service.

Meet our newest: the 20-kW 831G-1

Collins new 831G-1 transmitter gives the quality- and economy-minded broadcaster uninterrupted, dependable performance.

The 831G-1 uses solid-state on-off switching and is equipped with automatic power output control. It offers front panel tuning with complete metering and control facilities on the extended control panel. The direct FM all-solid-state exciter offers such options as stereo multiplex and an SCA generator.

For more information, contact your Collins representative or Collins Radio Company, Dept. 400, Dallas, Texas 75207. Phone: (214) 235-7863 (direct line).

COLLINS

COMMUNICATION / COMPUTATION / CONTROL

Circle Number 7 on Reader Reply Card

LETTERS TO THE EDITOR

License School Reply

Dear Editor:

As a new reader of **Broadcast Engineering** and a relatively new First Phone Licensee, I was interested by Mr. Nornhold's comments in the May issue. I, too, believe that the First Phone License should provide opportunities to learn. Although I am a graduate of one of the "quickie" schools and in many ways am considered a "First Phoney" by more educated members of the trade, I am trying to learn more about the engineering end of the radio broadcasting business than the school teaches, and practical experience with station operations will indeed help.

It might be interesting to solicit your readers' comments on the schools that in a short time prepare their students to pass the tests for the "First Ticket" (Radio Telephone First). The school I attended encouraged in us no delusions of grandeur whatsover. On our first day we were told that the school would help us get the license . . . it would not make us technicians or engineers.

In view of the facts that there are graduates of these schools who are chief engineers (hard to believe, but true) and that the FCC now proposes to change some operator requirements. What do your other readers (especially the "real" engineers who have spent much time and money learning their craft) think? Is a special license necessary to separate the "sheep" from the "goats"? Or, should we develop an apprentice system whereby a newly licensed operator would be required by the station licensee to attain a prescribed competence by training under the guidance of the chief engineer before he would be allowed to operate equipment? If the chief engineer can be fined for violations, wouldn't it be worth his time to be certain that the persons he places in charge when he leaves the station are qualified? And what about the chief engineers who merely glance at station equipment as they pass through on their way to more lucrative, full-time jobs elsewhere? (Please note that none of the difficulties mentioned apply at WEEO Radio.)

I do not aspire to become a chief engineer. My main interests are in programming and management; however, since I am on transmitter duty a minimum of thirty-five hours per week, in addition to other very interesting jobs, I am curious about the operation of most of the equipment in my charge. **Broadcast Engineering** will help to supply some of the information I'll need to satisfy my desire to learn. Keep 'em coming.

R. Dennis Alexander
WEEO Radio
Waynesboro, Pa.

Instructor Speaks Up

Dear Editor:

I am an avid reader of **Broadcast Engineering,** and especially your column (Letter's to the Editor), and the technical school where I teach is a regular subscriber. For some time now I have wanted to make myself heard on the subject of "fast memory courses" and "six week wonders", for FCC licenses.

To begin with, the first ten minutes of my class is used to impress upon the student the fact that we do not claim or attempt to make engineers out of them in six weeks. We do teach the information necessary for a man to be a qualified operator, and for many years it has been my humble understanding that this is what the FCC intended for their examinations to prove, that a man has the basic knowledge required to act as an operator of a radio transmitter. True, an engineer must also have the license. If the equipment falls under the watchful

eye of the FCC, and the personnel who operate it do also then so should the personnel who have attained the enviable title "Chief Engineer".

A man leaving this course with his FCC license is, as an operator, as well qualified on the job as a BS in Electronic Engineering. And I will say in closing, at the largest station I have worked at, I was responsible for 40 transmitters, ranging up to 60 kW. The smallest station I have worked at had five transmitters ranging up to 2 kW. If it is electronic radio equipment, I can operate and repair it or at least I can learn to. And if I were in the market for a job, that fact and my past employment record and educational background would be what I would rely on. Not my FCC First Class Tickets. And it doesn't scare me at all that anyone can obtain an FCC Operators License. I think it is up to the individual stations to be critical of the qualifications of their employees and prospective employees, not leaving the load on the FCC. Because the information on those examinations, no matter how well understood, makes no man an engineer.

The foregoing are my opinions, not affected in any way by the opinion of my employers.

Bobby R. Ridgeway
Instructor In Licensing
Elkins Institute of Radio Electronics
San Antonio, Tex.

Suggests Use Of WWV For Emergency Warning

Dear Editor:

After reading Mr. Jorgensen's open letter to the Federal Communication Commission, I think a few things should be brought to his attention. It is a matter of record that his station is a member of Associated Press—the same as WWNC. The reason his station did not receive the false alert is that AP did not feed the message from Atlanta.

Mr. Jorgensen's primary method of receiving the alert is from WWNC. We rely on the CBS Net of the alert we received ran as a story on AP after the matter was clarified.

Mr. Jorgensen also states that he could not receive an alert between 12 midnight and 5 A.M. because WWNC is off the air, and that he has no teletype at his transmitter studio. I would suggest that he either build or buy an EBS receiver for the transmitter studio to monitor a clear channel, 24-hour station in order to comply with FCC Rules and Regulations.

I would agree with Mr. Jorgensen that the system has many flaws and that something should be done. Maybe WWV could be the key station, using subaudible tones for the alert.

Glen A. Bell, III
Chief Engineer
WWNC
Asheville, N.C.

On Paying More, Enjoying It Less

Dear Editor:

Now that most of us have mailed to the FCC our annual fee for supporting the Commission . . . I wonder if we the BROADCASTER will have more say so in how the Commission is operated? Chances are we won't.

In addition to all the other burdens attached to the backs of broadcasters, we now have to foot the bill, yet we, the BROADCASTERS, have little say so in how an agency concerning broadcasting, is operated by mostly non-broadcasters.

How can someone regulate a business he knows little about? He can't, for this reason—the FCC needs to be made up for more BROADCASTERS, from all parts of the country, small market radio to metro-market.

More broadcasters need to voice their approval or disapproval of the actions of the FCC.

William K. Hoisington

Letters

(Continued from page 9)

VIT A Culprit

Dear Editor:

At the bottom of Page 4 of the April, 1971 issue of **Broadcast Engineering** you asked for reports from readers regarding audio buzz caused by the VIT signals.

Two years ago we investigated several such reports from our viewers. In each case we found a severe buzz caused by antenna or antenna and lead-in combinations. Antenna orientation, proper matching, and often more AGC voltage cured the problem. It made us feel better that the problems were found on other channels, too, but we made careful checks to be certain that we were not cutting off RF in the transmitter due to overshoot or any other reason, just to be sure.

We concluded that severe overshoot caused by very high standing waves in the receiver antenna system resulted in IF cut-off by the VIT signal—which gave the same effect as transmitter over modulation.

Considering the appalling devices sometimes used for receiver antennas, the awful condition of lead-in and the unbelievable paths often taken by 300 Ohm lead-in, we are surprised that reception is as good as it is. We decided to delete the VIT signals to cure the problem. Since that time we've had no buzz complaints.

When we wish to check system performance during the day, we switch the VIT signals in long enough for the necessary measurements.

Curtis B. Willard
Chief Engineer
WKRG
Mobile Ala.

Units For Handicapped

Dear Editor:

In the January issue of **Broadcast Engineering** I was very much interested in one of your Letters to the Editor from Rev. Larry King.

that might make things easier for Rev. King. I realized that in order to do my job well I had to take many things into consideration . . . 1) The layout of the equipment should be as simple as possible, 2) each function of the equipment should be understood, and readily accessable, 3) each function should be plainly marked, and 4) each piece of equipment should be carefully evaluated as to the function and subfunction it would be called upon to perform.

With simplicity as the key, I found that it became easier for the non-handicapped to use the equipment as well as the handicapped. There is less equipment breakdown and less replacement of expensive parts.

As to information on products—in every copy of **Broadcast Engineering** there is a reader service card. I have found this card to be one of the best sources of information. A letter to the respective company's explaining my special needs has also brought the help I needed.

The only problem I have is finding a simple transmitter that does away with all of the laws of electronics . . . and will repair itself.

George Morrell
Chief Engineer
KVOC
Casper, Wyo.

Gates Schematic Needed

Dear Editor:

I would like to ask the help of your readers in obtaining a diagram for a Gates Transmitter model number 1271. This is an AM transmitter, a 1941 model still in operation. It uses tubes such as 45's, 2A3's, 805 & 814's. Also a diagram for a Gates Model 31 broadcast console.

Hollis M. Suber
WPAX Radio
Box 129
Thomasville, Ga. 31792

Military Clearance

Fairness Doctrine Tested

In response to two complaints of Fairness Doctrine violations directed at Armed Forces recruitment announcements, the Commission has found that no violations have been demonstrated, and has denied the complainants' requests for free time to respond to the announcements.

The complaints were filed by the Citizens Communications Center, in behalf of Hunter College National Student Association Peace Committee, against WNBC-TV, New York, N.Y., and the Citizens' Organization for a Sane World, Inc., against WRC-AM-FM, Washington, D.C.

It was alleged that the announcements presented the viewpoint that regular military service "is a highly desirable endeavor for a young man," and that the stations, in violation of the Commission's Fairness Doctrine, refused to grant time, on an approximately equal basis, to present spot advertisements giving the opposing point of view.

The Commission said that while it recognized that a decision whether to enlist involved the weighing of a number of different factors, it could not find that the recruiting advertisements raise a controversial issue. It noted that on June 4, 1970, the Commission had ruled in response to similar requests that free time need not be afforded to "answer" recruiting announcements . . . **San Francisco Women for Peace,** 24 FCC 2d 156 (1970); **David C. Green,** 24 FCC 2d 171 (1970); and **Alan F. Neckritz,** 24 FCC 2d 174 (1970).

Jones gets the sign from his monitor.... goes into his windup.... and...

INDUSTRY NEWS

FCC Rules On Indy 500 Showing

Network television broadcast of the 1971 Indianapolis 500 Motor Race on a delayed basis will not place any restriction on release of the race on a subscription basis in future years under present rules, the FCC has ruled.

The Commission pointed out that under a pending rule making (Docket 18893, July 1, 1970, 35 Fed. Reg 11040) sports events would not be eligible for subscription showing in a community if it had been televised there live or delayed on a nonsubscription, regular basis during any one of the five years preceding proposed subscription showing.

The Indianapolis Motor Speedway Corporation asked for a ruling from the Commission to determine whether Sections 73.643(b)(2) and 74.1121(a)(2), governing the transmission of sports events on a subscription basis over-the-air or by cable, applied to the delayed broadcast of the Memorial Day Race. The rules prohibit subscription showing of sports events broadcast live, on a nonsubscription, regular basis in a community during the two years prior to the proposed subscription showing.

The rules are intended to prevent STV and cable from "siphoning" sports events from conventional television and making the public pay for programs formerly received without direct charge.

The 500 in its entirety has never been broadcast live to the public on either a conventional or subscription basis. Full length, live pictures and descriptions of the race have been available to the public on closed circuit television in theaters for the last seven years.

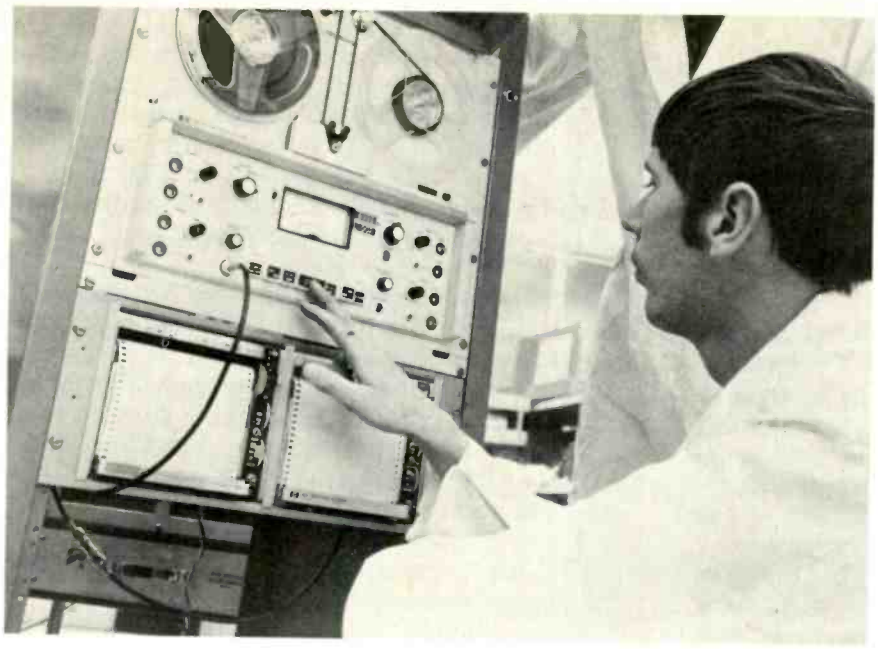
The Commission said that sports events televised on a delayed basis may be "siphoned" under present rules. Under the proposed rules in Docket 18893, however, sports events would be ineligible for subscription showing in a community if it has been televised there either live or delayed on a nonsubscription, regular basis, during any one of the five years preceding proposed subscription showing.

Microwave Tests Set To Measure Rain Attenuation

A single hop transmission link installed near Montreal recently will be used to measure microwave attenuation caused by rainfall. This program may affect the design of future microwave radio-relay transmission systems which will operate above the 10 GHz region.

The cooperative Canadian project brings together the Communications Research Centre, McGill University and Bell-Northern Research in a three-phase program, the first two phases to run concurrently. In these, the results of past attenuation studies in the lower frequencies will be surveyed and extrapolated for higher frequencies, and the resulting values will be tested experimentally using the McGill weather radar to gather rainstorm information on an experimental transmission system operating during rainfall. The third phase will geographically extend the findings to cover all of Canada.

For frequencies below 10 GHz



Automatic recording receiver undergoes final adjustment.

where long path lengths are used, multipath type of fading is the dominant mechanism. Above 10 GHz, fading due to rainfall attenuation plays an important role as the frequency increases. Since shorter hops are required, the multipath fading soon becomes insignificant and rainfall attenuation is the dominant factor.

Data for phase one are readily available. Meteorological observations of rainfall with the tipping-bucket type of rain gauges have been made in the USA since the turn of the century and in Canada for 50-60 years. Most of these recordings are available from Federal weather bureaus, but since they are for point rainfall rates, and designers need path average rates, existing records are not directly applicable to radio-relay systems. Also needed are the extreme values of very short duration. Since these are not adequately recorded by a tipping-bucket rain gauge, additional data must be collected.

Phase two will use the McGill radar station, situated west of Montreal, which has a 30-foot diameter antenna rotating about a vertical axis once every 10 seconds. The radar will measure signal reflections due to rain cells in the path of the experimental microwave link, sited some 20 miles away. This five mile long microwave link has been equipped with special solid state transmitters and receivers to measure path loss during rainstorms. Using this information, optimum path lengths, which are very sensitive to attenuation, can be designed more accurately.

In addition to the attenuation studies, this link will be used to investigate the problem of microwave polarization. Droplets in a rainstorm rotate the angle of polarization of any transmitted signal, thereby causing interference. To measure the extent of this effect, two signals, polarized at right angles to each other will be transmitted along the link. The measurements will help determine the amount of interference between the signals, an effect which cannot be deduced from the radar results.

At the conclusion of the experiments, data will be tabulated to determine parameters for optimum hop length and design criteria for high frequency radio systems.

CCA To The Rescue

Radio Station WLFH, Little Falls, N.Y. was completely destroyed by fire on Saturday, May 22nd. Thirty-six hours after being notified, CCA Electronics of Gloucester City, N.J., with the support from its Radio affiliate WABY, Albany, N.Y., completely re-equipped this station with a new transmitter and operating studios. WLFH was back on the air with full power the following afternoon at 4:20 P.M.

ITT Scientist Probes Future Communications

New ways in which the telephone will be used, the extent to which videophones will gain acceptance, the prospects of data displays in the home, and many other aspects of telecommunications over the next 30 years were outlined by Dr. Henri Busignies, chief scientist of International Telephone and Telegraph Corporation.

Dr. Busignies spoke before the annual meeting of the Industrial Research Institute, Inc., which awarded him their medal for "outstanding accomplishment in, or management of, industrial research which contributes broadly to the development of industry or the public welfare."

Technical advances mentioned by Dr. Busignies ranged from new services from the telephone network to be introduced in the near future, to electronic mail and simultaneous translation of languages. These will need further technical development and careful economic consideration before they are widely applied, Dr. Busignies said.

Regarding public telephone network development in the next decade, he concluded that 10 to 30 percent of subscribers will be using such facilities as call transfer, call waiting tone, abbreviated dialing, and conference calls by 1980. By then, electronic exchanges will service more than half of the USA, he indicated.

Videophones?

Video telephones, however, are another matter. They involve exchange switching of an entirely different type —broadband switching. Although technically feasible, this is complex and costly. A one-percent market introduction would call for an investment equal to that of the entire present no-picture telephone system. Thus, a 2-to-5-percent use by the year 2000 in the U.S. would be an "enormous achievement."

Dr. Busignies said that, although the technology will be available for advanced applications, many countries will have to consider carefully what they can afford. He predicted however, that computer assistance to individuals and organizations would grow. In education, for instance, he said the 5-to-10-percent of students in high schools would be using it by 1980, and many more by the year 2000.

Private telephone exchanges integrated voice and data facilities were another of Dr. Busignies "nearer-future" predictions. The user would have dialing access to various computerized information files as well as to present-day telephone services.

Touching on satellites and cables, Dr. Busignies made the point that although the technology for multi-access satellites was available, administrative agreement on their use presents "a large international diplomatic problem." He predicted that coaxial cables, waveguides, and optical fibers will have to assume the greatest role between high-traffic areas of the world. "There is no radio-spectrum saturation on cable or optical-fiber systems," he stated.

FCC Clarifies Stance On Adequacy Of Community Surveys

Replying to a letter from Tom Dargan, Station Manager of television station KATU in Portland, Oregon, the Commission has emphasized that "an individual licensee is solely responsible for the adequacy of its survey of community leaders." It said "each licensee's survey must meet all the requirements of the Primer," which "contemplates a person-to-person dialogue between the decision-making personnel of the licensee and the community leader being interviewed."

Dargan had requested an opinion as to the adequacy of a plan of several licensees in Portland to conduct joint interviews of community leaders to ascertain the needs and problems of the community, in order to make a thorough canvass with the least amount of inconvenience to community leaders and undue strain on broadcasters.

The proposal provides for compilation of a master list of commu-

nity leaders from which a group of 25, picked at random, would be invited to attend a meeting, with each to speak for the group or organization he represents. To take credit for the interview, broadcasters of management level would be required to attend. Other leaders on the list would be invited to later meetings.

The Commission pointed out that in a recent letter to Ves R. Box of Station KDFW-TV, Dallas, Texas (28 FCC 2d 265 (1971)), that he would be free to use a method he had suggested for joint consultation between each community leader or official and as many station representatives as cared to participate to determine community problems, although each licensee was still responsible for the results of his own survey. "Our concern . . . was in saving time for the community leaders, not necessarily for station representatives," the Commission said.

The Commission pointed out that interviews of groups of community leaders by groups of licensee representatives could inhibit the "free flow of communication" which is vital to draw out real problems. It said "There may be a tendency on the part of those leaders interviewed to be more influenced in the presentation of their ideas by the presence of other leaders than might be the case in person-to-person contacts."

Most Powerful Xmtr On Air At WDCA-TV

The world's most powerful television transmitter, a 220,000 watt UHF model, built in Quincy, Ill., by Gates Radio Company, is now on-the-air in Washington, D.C.

Station WDCA-TV, UHF Channel 20, signed on with the Gates' BT-220U as scheduled when Dean Burch, Chairman of the Federal Communications Commission, pushed the button during inaugural ceremonies held at the station.

According to Lawrence J. Cervon, Vice President-General Manager, "This has been the most challenging and important project in the 49 year history of Gates Radio Company. The design and manufacture of the world's most powerful television transmitter was a companywide team effort involving every department of Gates."

To operate the BT-220U transmitter requires one million watts of electricity which the Washington power company will provide WDCA on a continuing basis. When operating, the BT-220U ejects enough heat to warm comfortably 30 large homes for a year, and consumes as much electrical power as most small towns.

It is the first time that four 55 kilowatt klystron amplifiers have been harnessed for 220 kilowatt visual output. The function of each of these klystrons is to take less than a single watt of power and convert it to 55,000 watts! With four klystrons performing the same function, the end result is 220 kilowatts . . . a power gain of over 100,000 times per klystron tube. An additional klystron tube is used as the aural amplifier.

WDCA-TV's decision favoring such a dramatic increase in power . . . the BT-220U replaces a 60 kilowatt transmitter . . . resulted from an interest in upgrading the station's coverage and improving the quality of reception.

SCANNING THE CATV SCOPE

Local Origination

The On-Again Off-Again FCC Rule

Follow the bouncing ball. That's the game, and its name is local origination. Now you see it, now you don't.

Some operators want it, others don't. Some can't afford it, others prosper by it. But whatever it is, and no matter who has it, the FCC still has two shots left at controlling Cable and originations: Take it to the Supreme Court and if it fails there, try Congress for legislation giving the FCC the kind of regulatory power it says it needs.

As it works out, about every time a decision is given, a test case is scheduled. Obviously, the Commission knew some time ago that this "prove it to me" attitude of conscientious operators would throw the brakes on the industry. Some feel now that if this latest decision were pushed to the limit, it could mean state regulation . . . which is mystifying, since it would put the operators in a greater two-way stretch.

Quarter Finals

A U.S. court of appeals has overturned the FCC's order requiring cable systems with 3,500 or more subscribers to originate local programming. Following that decision, the NCTA issued the following statement.

The Court of Appeals for the Eighth Circuit in St. Louis unanimously ruled that the FCC's order "goes far beyond the regulatory power" conferred upon it by the Communications Act and earlier court decisions. Midwest Video Corp. had appealed the FCC order.

In effect, the court's decision means that no existing cable system can be compelled to originate. The FCC has apparently not yet decided whether or not to seek Supreme Court review of the appeals court decision.

In its ruling the circuit court did not act on Midwest Video's appeal of pay cablecasting rules and rules governing program origination by all CATV systems. The three-judge court declared that having been granted its petition on the compulsory origination rule, the cable firm no longer had standing to contest the other orders.

In overturning the cablecasting requirement the court, in a 15-page decision, basically relied on the Communications Act and court decisions in the **Southwestern** and **Fortnightly** cases.

It noted that the FCC has no direct authority to regulate cable, that it does not receive limited authority in the **Southwestern** decision, but that such authority is restricted to that "reasonably ancillary to the effective performance of the Commission's various responsibilities for the regulation of television broadcasting."

"The compulsory origination rule here," the court said last week, "goes far beyond the regulatory power approved in Southwestern Cable Co. The traditional CATV operation differs greatly from that of originating programs. For origination substantial investment in entirely new and different equipment is required. Additional personnel is needed for program origination. The record, as the Commission impliedly concedes, provides no accurate estimate of the increased cost that would be involved.

The court also said that the **Fortnightly** holding whereby the CATV operator is not a broadcaster and that the operation falls on the viewer's side of the line "affords strong support for the petitioner's contention that the Communications Act does not authorize the FCC to compel program origination. We find no balance of public interest which requires stretching the Act to confer such authority. In so holding, we are not passing on the power of the FCC to permit CATV's to originate programs and to prescribe reasonable rules for such CATV operators who voluntarily choose to originate programs."

With respect to the pay-cable rules and rules governing program origination the court noted that "petitioner has stated that it has no intention or desire to cablecast. Since we have held that petitioner cannot be compelled to cablecast, it would appear that petitioner has no standing to challenge such rules. Moreover, some rules are still before the Commission on petition for reconsideration filed by other parties. Under such circumstances, we pretermit consideration of the validity of the rules promulgated with respect to CATV operators who voluntarily elect to cablecast."

Cable On Power Poles

In other court actions, Cypress Cable TV has finally made its case with the Supreme Court in Ohio.

The Supreme Court of the State of Ohio rendered a landmark decision involving cable television, it was announced May 19 by Don F. Shuler, president of Cypress Cable TV of Ohio, Inc.

In reversing the State Court of Appeal's ruling, the Supreme Court ruled that cable operators have the right to use power and telephone company poles; all easements pertaining to those poles may be assigned to cable TV operators. CATV companies customarily attach their cable and amplifiers to utility poles under joint use agreements.

The test case involved the question of whether or not the Ohio Power Company could be restrained by the courts from permitting Hardin Cable Television Company (now Cypress Cable TV) from using the power company's poles located on private property.

A group of four residents of Kenton, Ohio (where Cypress Communications Corporation's subsidiary operates a cable TV system) contested in the issue in the courts. Had the Court of Appeals' ruling been upheld by the Ohio Supreme Court, it would have forced all cable operators in Ohio to individually negotiate easements with local property owners. The case will have wide interest in other areas of the United States, where the question of easement rights is a contested issue.

In unanimously reversing the judgement of the Court of Appeals, the Supreme Court concluded that, "An easement granted to a power company, 'its successors, assigns, lessees, and tenants to construct, erect, operate and maintain a line of poles and wire for the purpose of transmitting electric or other power, including the purpose of transmitting electric or other power, including telegraph or telephone wires,' is, by its terms, apportionable and that the grantee of such easement may by sub-lease assign a portion of its interest in the easement to a television cable company. In such case, the attachment of the television cable constitutes a use similar to that granted in the easement and does not create an additional burden on the land of the original grantor."

Meanwhile . . .

The Commission has decided to request the Solicitor General of the United States to seek a writ of certiorari in this case. Pending the outcome of further judicial review the Commission is suspending application of Section 74.1111.

This suspension, of course, does not affect the right of CATV systems to cable-cast upon a voluntary basis, or to make channels available to local citizens, nor does it affect the continuing applicability of other rules governing cablecasting operations.

Two-Way System Ready In Kansas City

TeleCable Corporation began testing two-way television in a suburb of Kansas City on June 23.

For the first time in the U.S., a disabled child will be able to work from her home via cable with a teacher in a classroom. They will be able to both see and hear each other.

The experiment was made possible by the development of a terminal unit by Vicom Manufacturing of Dexter, Michigan, and the increased sophistication of cable television equipment.

The disabled child will be able to "raise her hand" in the classroom by punching a button on a terminal in her home. The teacher can answer by punching a button on a terminal in the classroom and the two can then converse. The teacher will be able to see the child on a TV screen in the classroom.

The system is designed so that one teacher can handle many children on one circuit, creating, in effect, a classroom. School districts would eventually realize substantial savings in time and money because a teacher would not have to go to each child's home for tutoring purposes.

The operation will be handled by a computerized switching and control network in the TeleCable control room.

On the same day that the child gets her two-way television lesson, an Overland Park housewife will demonstrate shopping from her home through two-way television with the cooperation of a Sears Roebuck store in Overland Park.

Sears will put on three live presentations—a fashion show and two presentations of specialty items —and the housewife will be able to make choices on the spot, such as quantity, color and size, by punching her terminal.

A high speed printer at Sears will give an instantaneous printout of the housewife's name, and address, and her order through prearranged codes.

Other experiments will include a fire and burglar alarm network and an opinion survey, but the emphasis in the initial test period will be on the education of disabled children in the area. Overland Park, a city of 75,000, has more than 200 children who are unable to attend school regularly because of some disability. (There are more than two million in the nation.)

TeleCable officials are working with the local school district to set up a network so that handicapped children can actually participate in classroom work during regular school hours.

If the experiment proves successful, the school system will seek an educational grant to make the experiment permanent. TeleCable will then extend two-way television to other areas it has under franchise. All costs for the current experiment are being borne by TeleCable.

TeleCable is a subsidiary of Landmark Communications, Inc. of Norfolk, Virginia. Landmark publishes six newspapers in North Carolina and Virginia. TeleCable holds 14 cable antenna franchises throughout the country.

Tired of Hand-Me-Down Copies of Broadcast Engineering?

As a member of the broadcasting industry you probably qualify to receive your personal copy of B.E. FREE! We have enclosed a postage-paid reader service card for convenience—see back section of this issue. Just complete the card and drop it in the mail box. We'll do the rest.

If this is your personal copy of B.E., why not pass along the reader's service card to an interested friend? (Remember, he must be in the broadcasting industry).

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Walter S. Wydro Consultants

P. O. Box 285 Pineville, Penna. 18946 • PHONE 215-968-4403

February 26, 1971

Mr. Louis N. Seltzer, President
Chester County Cable Company
809 East Lincoln Highway
Coatesville, Pennsylvania 19320

Dear Lou:

With little doubt, we can now say that the Coatesville system meets all of the critical technical objectives for a high channel capacity system.

From my observations, the minor corrections made to the system by AEL have cleared up the remaining problems.

During these visits to the system, including the most recent one with NCTA and FCC officials, system distortion characteristics were closely examined with my spectrum analyzer. The system distortion products were as good and in fact better than other systems I have recently examined using the latest push-pull amplifiers.

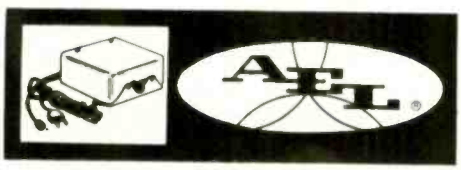
Again, my congratulations and best wishes for the continued success of your CATV plant.

Sincerely,

Walt. Wydro

Walter S. Wydro, President

CATV • COMMUNICATIONS • RECEIVERS • UHF-VHF AMPLIFIER SYSTEMS



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Circle Number 17 on Reader Reply Card

Film in local Origination

Part I of a 4-part series

By John A. Pistor*

If you're in the cable television business today, you must look seriously at the potential in local origination, despite the fact that any requirement for CATV local origination by Federal or state authority is a major regulatory question mark.

The cablecaster, with the ability to transmit over many channels, enjoys an unparalleled opportunity to develop a unique role in his community as a truly "neighborhood communications center."

Utilizing existing local origination facilities—live, film, videotape—the cablecaster has unlimited source material at his command within his own community to offer programming that can compete heavily with commercial stations in his area.

CATV in-depth coverage of local events that never appear in the metropolitan media can stimulate two potential income sources: subscriber fees and additional ad revenue as local sponsors seek exposure during popular CATV programming.

There are substantial profits awaiting the cablecaster who can produce a 'commercial package' and sell it to local advertisers at a low cost, including ad message and visuals in slide or motion-picture format.

Not all programming need be locally originated. There are almost limitless resources for original program material for CATV—fresh, exciting, appealing—in existing 16mm films. Many of these motion pictures are available free of charge and cover popular topics, from fashion and gourmet cooking to sports and travel in faraway places.

Making More Money

Some cable systems are presently generating as much, or more, income from their local origination activities as from their subscriber fees. For example, one cable system in North Carolina, with 800 subscribers, reports that they are selling local sponsors a commercial spot package—three slides and a 30-second audio track—at $30 a month for continuous rotation showing as the camera sweeps across the weatherscope. At last count, there were 20 advertisers whose messages were repeated once every half-hour on the weather channel. Total income to the system: $600 a month.

This CATV operation used a similar format, slides and audio track, to gain both public relations and advertising mileage from sponsor's messages during a recent two-and-a-half-hour cablecast of the 25th anniversary celebration of the VFW.

As the general manager puts it, "In all, we sold 60 sponsors a four-spot package, including two slides and a recorded patriotic message for each. The ad revenues were important, but we gained even more recognition for our cable system through the public relations value of the whole project—the cablecast itself and the advertising tie-in."

Potential response from viewers and sponsors to CATV local origination, in terms of increase subscriber and advertising income, can be a powerful incentive to a cable manager.

Viewer Interest

Even a small cable system that has any kind of studio transmission, such as weatherscope or stock market ticker, can get into local origination with available equipment. Live,

*Eastman Kodak Company

Why is Norelco the magic word in television?

Probably the single most important factor is the spectacularly successful performance of the most wanted, most used —and of course, most imitated—Norelco 3-Plumbicon* PC-70 color camera.

But beyond that, discerning TV practitioners have found Norelco systems the direct route to excellence in an exciting variety of applications. In schools and universities, Norelco systems are extending the teacher's reach, with live and taped instruction. Coupled with microscopes on the one hand and telescopes on the other, Norelco cameras are showing us the invisible, and transporting us to the distant.

At the Fernbank Science Center Observatory, a tiny Norelco monochrome camera helped NBC show the Moon's surface to the world during a lunar landing.

In California, a midget Norelco camera provided continuous coverage of a front-page trial for overflow journalists outside the courtroom.

In dimly lit Mission Control, a Norelco color camera was eyes for the Earth's population, peering over the space team's shoulders.

Norelco cameras multiply men's senses by monitoring heavily trafficked highways, bridges and tunnels. They help the night nurse guard precious lives in the nursery and intensive care. They stand sentinel over doorways and corridors, stockrooms, warehouses and parking areas—even in utter darkness. They keep an eye on priceless paintings, and they are the vital link in a great hospital's "tele-diagnosis" system.

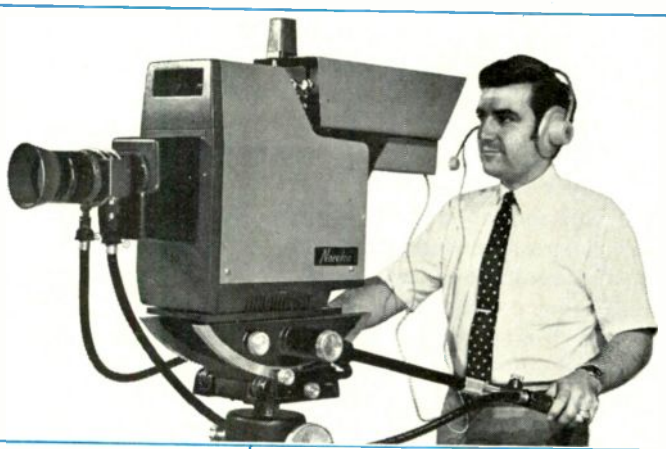
The self-same monochrome camera that captures the Moon through a Fernbank telescope is showing a golfer the error of his ways at the club. And the self-same color camera that brings you Walter Cronkite is helping teach tomorrow's doctors and dentists at the University of Texas Medical Branch.

Reliability—Performance—Professionalism.

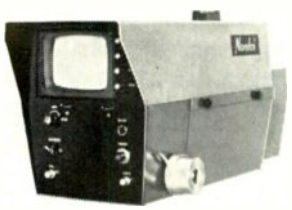
In television, the magic word is Norelco. The way we strive to serve our customers is the best indicator of how dearly we value our reputation.

These cameras are only part of our full line of Norelco color and monochrome origination systems. We can help you most if you describe your particular needs or goals.

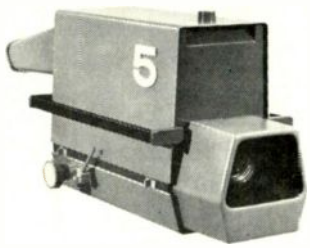
High-performance Norelco viewfinder cameras for a variety of purposes



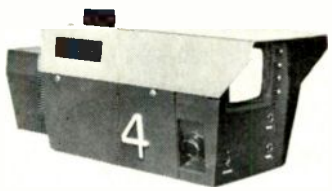
Norelco color at economy prices! The LDH-1 Norelco Compact Color Camera is an unusually stable, 3-Plumbicon* (or Vid.con) camera that brings faithful live and film color within easy reach of cable, educational and business TV. The real thing, it comprises the major design advantages of the PC-70.



VF-150 Vidicon camera is an adaptation of the fully automatic Norelco Mini-Compact. An extremely simple-to-operate self-contained camera, it has a 5" viewfinder and features perfect interlaced scanning.



LDH-0200, is the top-of-the-line monochrome camera, has the 1" separate-mesh Plumbicon tube (or Vidicon), solid-state plug-in circuitry, 6½" viewfinder. Optimum performance for studio, field and laboratory. 10:1 Angenieux zoom lens.



VF-250 monochrome viewfinder camera provides a choice of Plumbicon or Vid con sensor, various zoom lenses, 5" viewfinder. Transistorized circuitry. Remarkably versatile and reliable.

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in-studio programs, such as panel discussions on important local events and issues, interviews with prominent local officials, and on-camera commentaries by system personnel, can be very popular with people who are looking for a little more out of television than mundane entertainment.

However, continuous live, in-studio programming can become visually dreary. Today's sophisticated viewers, who have immediate access to spectacular productions and on-the-scene telecasts from commercial and public television, want to go where the action is. A steady diet of live, in-studio local origination could be a system's undoing.

As one cablecaster puts it, "We're at the stage in the television industry where people expect to see the highlights of important events, not just hear about them. CATV must compete in the same arena."

The proper balance of programming locally originated outside of the studio, live or video-taped in-studio programming, and "canned" film programming can economically fill an entire programming day. The advertising revenue that can be generated from local merchants and businesses is virtually unlimited.

Consider for a moment the impact upon parents of seeing a film on television perhaps shot at a local school, one in which their son has participated. Then consider the impact upon their friends, their son's friends, their family doctor, the owner of the grocery store they shop at every week. . .

Speaking of grocery stores, consider the impact upon the store owner who purchases a 30-second spot commercial on cable television that was filmed in his store. Think of the impact upon any local merchant who knows: one, that the commercial will be filmed on his premises, and two, that the audience his commercial will be reaching is the immediate community where his store is located. Add to that film's relatively low cost that will permit merchants to buy commercial time on cable where they might not be able to afford the higher advertising rates of commercial television stations.

With film, it isn't difficult to go into a local merchant's store, or the mayor's office, or a neighborhood school, or to an area park or athletic field. A film crew of one or two people can usually adequately cover any event on color film with sound. The equipment itself is lightweight, portable, and not dependent upon external power supplies (other than for lights, if they are used). It can go anywhere, anytime and be ready for use on a second's notice. If a photographer needs to climb a tree to shoot an overall view, he can do it with a portable hand-held 16mm camera.

Film is quite versatile. The same color film, with the use of filters, can be used in bright sunlight or indoors under low-light conditions. If lighting conditions are extremely low, the film can be exposed as if there were more light and the "pushed" in processing to compensate for the difference in exposure, giving the cablecaster a useable picture where he might normally not be able to obtain one.

System Expenses

The film equipment itself is relatively inexpensive (although very expensive equipment can be purchased). For example, a small, hand-held 16mm motion-picture camera and a lightweight audio tape recorder are all that's necessary for shooting most situations. If lights are required for a shooting assignment, lightweight, portable lighting 'kits' are available.

Editing equipment is also inexpensive and editing itself can be a relatively simple process. The editor merely clips and splices film wherever necessary. He sees everything he edits out as he edits. There is little 'guesswork' involved in editing film.

Film definitely offers a number of advantages in local origination outside of the studio. It can provide the cablecaster with low-cost, color coverage of hard news and events taking place in the community. It can also provide low cost advertising that can produce many times the revenue generated through subscriber fees. And film processing is no longer the 'hassle' it once was many years ago. In most areas of the country today, sound, color film can be processed and ready to go on the air within a few hours.

Film is a standard. A 16mm film can be purchased, processed and projected (on a movie projector or on a telecine chain) anywhere in the world. Duplicate prints can be made economically in small or large quantities. Many cablecasters have already discovered valuable subsidiary uses for film, such as public showings at community meetings.

If one were to add up all of the film photographed for television in 1970 alone, he would have more than 300 million feet of film, which would take him 15 years, without a break, to view!

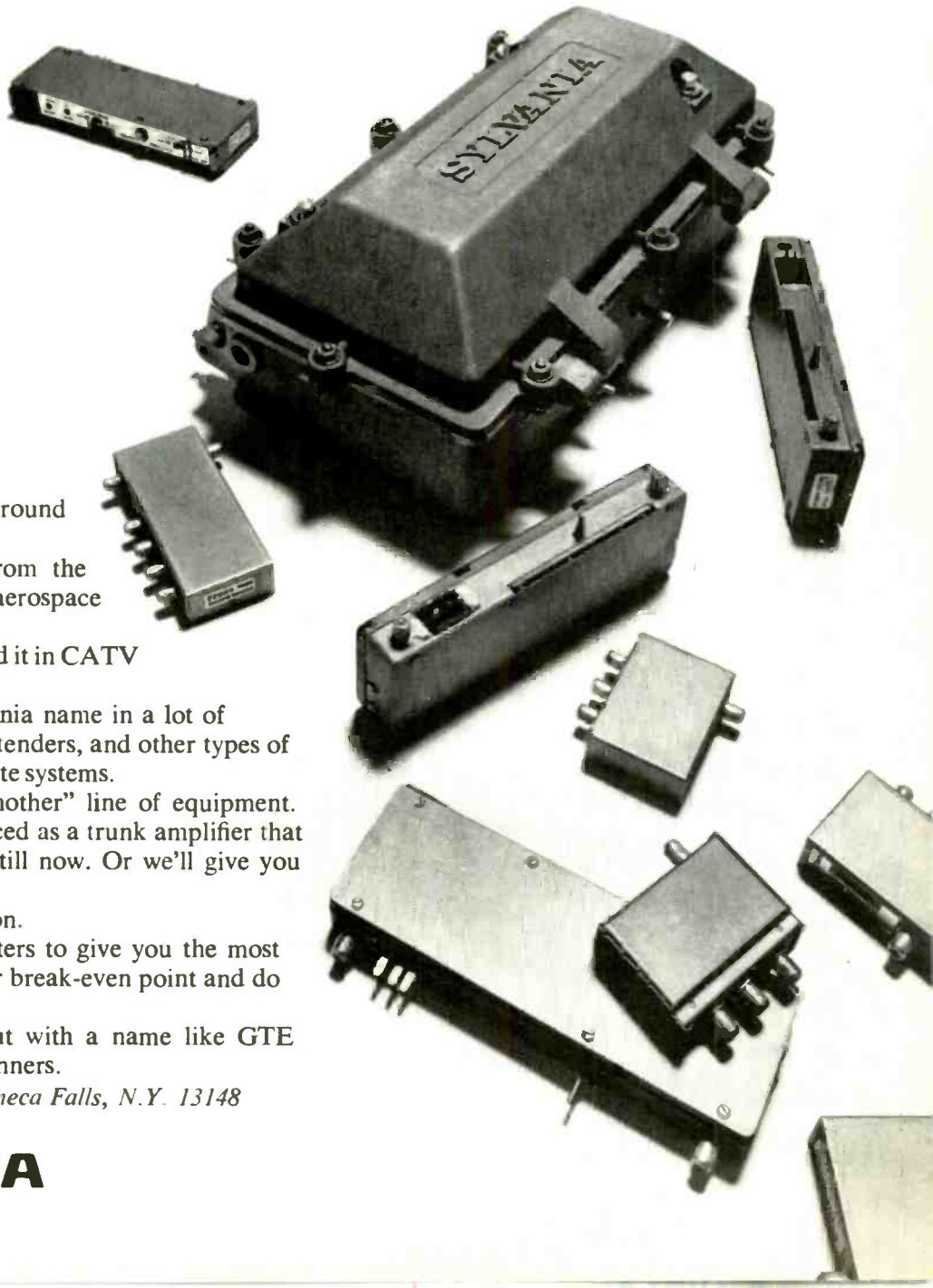
Increasingly, more cablecasters, as they get into local orignation and a heavier usage of film for location coverage are finding the tremendous profit potential available in film. Many are finding that film is an important element in an economical, common-sense approach to building towards becoming a "neighborhood communications center."

A prominent cable spokesman, speaking at a recent regional cable meeting, stated the challenge and opportunity local origination presents to cablecasters quite succinctly:

"There is no real local television in the United States today. The crusading daily newspaper went out of existence 50 years ago. Witness the amazing growth of the suburban weekly-newspaper, which is doing very well in this television era. Today, there is a very serious question as to whether cable will pick up this challenge and become the weekly newspaper of the television industry."

(Editor's note—Future articles in this series will discuss in detail the building-block approach towards originating color film coverage, purchasing equipment, techniques in using film and film personnel, and will highlight the activities of cable systems throughout the country.)

GTE Sylvania, the oldest new company in CATV.



The Sylvania name has been around for a long time.

You'll find it on everything from the earliest receiving tubes to complex aerospace equipment.

But, up till now you haven't found it in CATV equipment. We've changed that.

You'll be seeing the GTE Sylvania name in a lot of places. On trunk amplifiers, line extenders, and other types of CATV equipment. Even on complete systems.

And we're not just offering "another" line of equipment. We'll give you something as advanced as a trunk amplifier that has features you just couldn't get till now. Or we'll give you something as simple as a key.

The key to a "turnkey" installation.

We'll even program our computers to give you the most efficient system layout, project your break-even point and do signal surveys.

We may be new to CATV, but with a name like GTE Sylvania you can hardly call us beginners.

Sylvania Electronic Components, Seneca Falls, N.Y. 13148

GTE SYLVANIA

A VHF transmitter site is a nice place to visit, but you don't have to live there.

RCA has developed the most advanced VHF color television transmitter on the market. So you don't have to live with it, if you don't want to.

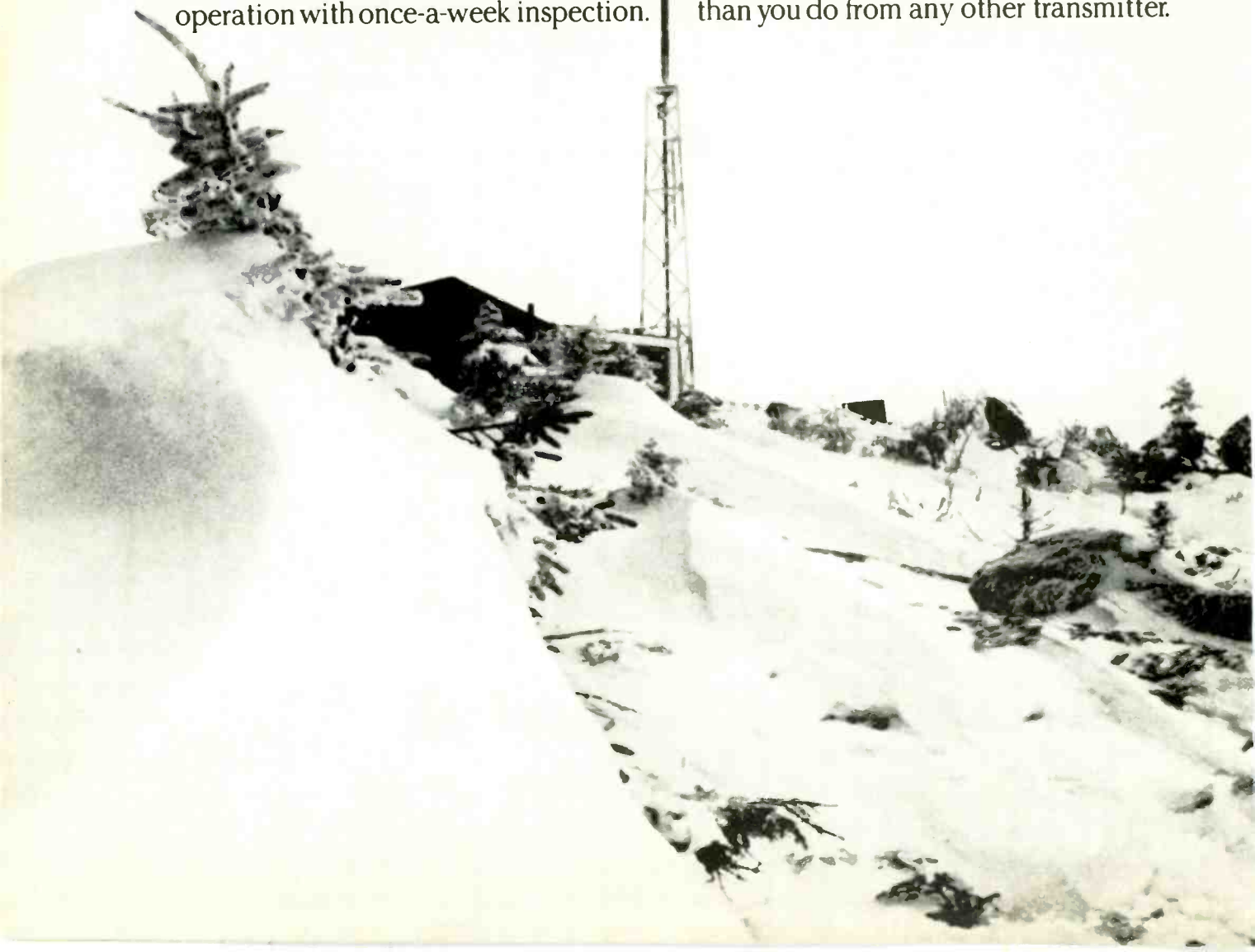
The 50 kW TT-50FH. It's designed for unattended operation, with provisions for automatic logging and remote control. When you're ready, so are we.

In fact, the TT-50FH is the only high band VHF transmitter specifically designed as a twin system, which fulfills the FCC's requirements for remote operation with once-a-week inspection.

It's actually two complete 25 kW transmitters with true parallel design and instantaneous automatic exciter switchover.

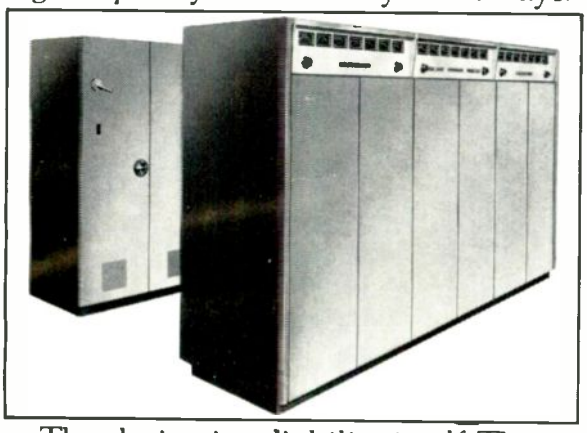
Barring failure of primary power, it's virtually impossible to lose your signal. Which just happens to be the best in the business.

For one thing, the TT-50FH gives you solid state diode modulation at carrier frequency and our sideband shaping takes place at the output, so you get greater assurance of spectral purity than you do from any other transmitter.



The TT-50FH has only two tuned visual amplifier stages, so it's easy to maintain, too. The fewer stages you have, the fewer adjustments you have to make, and there's less chance for trouble.

With the TT-50FH, you make an adjustment, and it lasts. We'll guarantee signal quality and stability for 30 days.



The design is reliability itself. The circuits are solid state design up to the IPA. There are only three tubes in each transmitter. Only two tube types. And the control logic is solid state. That's more solid state than any other transmitter.

One more thing. To make things even easier for you, our optional Opto-Switcher puts everything that goes between the transmitter and antenna into one package, factory adjusted for maximum performance.

It all adds up to superior performance. The TT-50FH performance specs are 100 per cent better than any previous generation transmitter.

We've been the leader in TV transmitters since television began. Now we have something really new for you. The best signal. The most reliable design. The best performance. The ideal transmitter for remote control. The most advanced transmitter on the market.

The TT-50FH. By RCA.

RCA

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Grade B TV Contours... The Shape of Things To Come

The story behind the FCC's proposed new television coverage standards.

By Neil Smith*

■ Among the Federal Communications Commission's current mass of proposals is an idea by which would change the levels of signal specified as Grade B Service for television. This proposal is associated with two others by which the curves of field intensity versus distance, now contained in the Rules, would be revised and by which the measured contours of a station would be preferred to the predicted contours in certain types of proceedings.

These changes could have significant effects on most stations. The history of the whole matter provides an interesting insight into the workings of the FCC, so let's add some perspective.

The "service contour" is one of the basic tools of the broadcast engineer. The broadcaster uses it to define his area of coverage, both for internal purposes and for promotional uses. The FCC uses it constantly in its regulation of broadcast stations, in allocations proceedings, applications, and all types of disputes. Despite this usage, seldom does the service contour of a station agree precisely with its true area of coverage!

Back in the not-so-distant past, broadcasting was confined to the Standard Broadcast Band, and life was simple. At these medium freqencies, propagation followed prediction reasonably well as long as the effective ground conductivity was known. However, when FM broadcasting began in the VHF band, followed by television on VHF and then on UHF, things became more complicated. Terrain became an increasingly important factor, and received signals varied from location to location and from time to time, behaving in a manner not unlike that of AM skywave fields.

In the late 1940's the Ad Hoc Committee developed propagation curves for the VHF and UHF bands, and these same curves have survived to the present day, coupled with a procedure for establishing effective antenna height by averaging the ground elevation between 2 and 10 miles from the transmitter.

Not Enough Data

The existence of these curves and procedures has resulted in no end of controversy. The curves were based on extremely meager data, and in the case of UHF, so little information was available that the Commission simply adopted the low-VHF curves as the UHF curves. In addition to the imprecise nature of the curves, there was nothing to provide for the presence of a substantial mountain which might be a limiting factor in a particular direction, especially if the mountain was not along a standard radial or between 2 and 10 miles from the transmitter.

Thus a great many Commission decisions were based on a predicted loss or gain in service area when in actuality no such gain or loss would have existed. While the legal profession has seemed able to live with the situation, most engineers have found it hard to keep a straight face when discussing imaginary coverage.

Coupled with these curves and procedures was a further ingredient necessary to establish coverage, namely, a specification of the signal level required to provide service. These figures were arrived at rather arbitrarily but were based on assumptions of typical receiving equipment thought to be in the hands of the public. It was determined that an FM station could provide coverage in rural areas with a signal as low as 50 μv/m and service to a metropolitan area with 1.0 mv/m or more. In order to hedge that determination, the Commission required that an additional 10 dB above and 1.0 mv/m level be provided over a station's principal city.

In television, the assumptions were much more complicated, involving estimates of receiver noise and antenna gain and efficiency. These calculations resulted in the familiar Grade A and B Standards and are tabulated in Figure 1.

Over the years, a great deal of data on VHF and UHF propagation was accumulated by the Commission. The Television Allocations Study Organization (TASO) was responsible for much of it, and the balance came from various measurement programs carried out by the FCC, the National Bureau of Standards, and individual broadcasters. Staff engineers at the FCC worked with these data, and on May 10, 1965, the Commission issued a Notice of Proposed Rulemaking (Docket No. 16004) in which it proposed the adoption of a new set of VHF and UHF propagation curves utilizing this further information.

The response to the proposed new curves was almost entirely negative. Although most engineers welcomed the idea of new curves, each seemed to have his own reason for rejecting those which were proposed.

In order to resolve the problem, the Commission called an Engineering Conference to discuss the matter, and the conference (as such bodies are inclined to do) appointed a working group to explore the new curves and make additional revisions as required. The group consisted of both industry and FCC engineers, and it produced a new set of revised curves which were

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BASIS FOR GRADE B SERVICE STANDARD

Required Field Strengths (dbu)
(to overcome receiver noise)

	Channels 2-6	Channels 7-13	Channels 14-83
(1) Thermal Noise	7	7	7
(2) Receiver Noise Figure	12	12	15
(3) Peak Vis. Car./RMS Noise	30	30	30
(4) Transmission Line Loss	1	2	5
(5) Antenna Effective Length	-9	0	3
(6) Local Field Intensity	41	51	60
(7) 50% Terrain Factor	0	0	0
(8) 90% Time Fading Factor	6	5	4
(9) Median Field Intensity	47	56	64

BASIS FOR GRADE A SERVICE STANDARD

Required Field Strengths (dbu)
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	Channels 2-6	Channels 7-13	Channels 14-83
(1) Thermal Noise	7	7	7
(2) Receiver Noise Figure	12	12	15
(3) Peak Vis. Car./RMS Noise	30	30	30
(4) Transmission Line Loss	1	2	5
(5) Antenna Effective Length	-3	6	8
(6) Local Field Strength	47	57	65
(7) 70% Terrain Factor	4	4	6
(8) 90% Time Fading Factor	3	3	3
(9) Median Field Strength	54	64	74

COMPUTATION OF THE REQUIRED FIELD STRENGTH AT THE GRADE B CONTOUR

	VHF CHANNELS 2-6				VHF CHANNELS 7-13				UHF CHANNELS			
	NEW		OLD		NEW		OLD		NEW		OLD	
Geometric mean frequency (MHz)	69		69		195		195		619		647	
Available thermal noise (4 MHz bandwith) (dBW)		−138		−138		−138		−138		−138		−138
Receiver noise figure (dB)	5 (fr=3.2)		12		6		12		10		15	
Rural noise figure (dB)	10 (fam=10)											
Overall noise figure [10 log (fr + fam −1)] (dB)		10.8		12		6		12		10		15
Receiver input noise (4 MHz bandwidth) (dBW)		−127.2		−126		−132		−126		−128		−123
Required S/N ratio, Grade B (dB)		30		30		30		30		30		30
Minimum signal necessary at receiver input (dBW)		−97.2		−96.0		−102		−96		−98		−93
Effective area of ½ wave dipole (dBm²)	3.9		3.9		−5.1		−5.1		−15.1		−15.5	
Receiving antenna gain over ½ wave dipole (dB)	6		6		8		6		13		13	
Effective area of receiving antenna (dBm²) (sign reversed)		−9.9		−9.9		−2.9		−0.9		2.1		2.5
Line loss (dB)		1		1		2		2		3		5
Required power flux density (dBW/m²)		−106.1		−104 9		−102.9		−94.9		−92.9		−85.5
Required local field strength (dBu)		39.7		40.9		42.9		50.9		52.9		60.3
Time fading factor (90%) (dB)		6		6		7		5		7		4
Required F(50,50) field (dBu)		46		47		50		56		60		64

published in FCC Report No. R-6602 in September of 1966. These new curves became the officially proposed curves, and additional comments were filed by a number of parties, most of whom continued to be in opposition to the proposal.

Interestingly, one of the engineers who had been most active in the revision of the curves filed in opposition to them. The most significant argument came from the UHF broadcasters, whose contours would have shrunk substantially upon the adoption of the new curves.

At this point the Commission chose a familiar approach to such problems. It simply ignored the whole thing and left the new curves in the limbo of proposed-but-not-adopted Rules, where they proceeded to gather dust.

Then Came Docket 18052

As part of their comments in Docket 16004, the Washington engineering firm of Kear and Kennedy proposed a revision of FCC Rules regarding the acceptance and usage of measurement data in Commission proceeding. They argued that measured contours were more meaningful than calculated ones and that the proposed Rules would encourage the filing of measurement data by which the Commission could further update its standards. They also pointed out that the method of measurement specified in the Rules had long since become antiquated and should be replaced by the generally accepted TASO technique.

After due deliberation (about two years in this case) the Commission issued a Notice of Proposed Rulemaking based on the Kear and Kennedy proposal and labeled it Docket 18052. Once again a number of comments were received, most of which were favorable, if not enthusiastically so. Since the use of measurements, was to be on a permissive, rather than mandatory, basis, and would not affect allocations as such, few parties were concerned by it. Even so, Docket 18052 was relegated to another of the Commission's pigeonholes, and nothing more was heard of it.

In the intervening years, the only change in coverage standards adopted was the change in the specification of ERP, to use the power radiated toward the radio horizon, rather than that radiated in the horizontal plane, for the prediction of coverage. In this case, the Commission acted promptly and wisely, since more and more stations, particularly in the UHF band, were employing high gain antennas and beam tilt, which made the power radiated horizontally out into space a meaningless value.

Finally, on April 19, 1971, just short of six years after the date of the original proposal to revise the propagation curves, the Commission issued a Further Notice of Proposed Rulemaking in which it combined Dockets 16004 and 18052 and proposed that changes be made in the levels of signal specified for Grade B television service. No additional comments on the new curves, or the change in measurements, were requested except in regard to the overall "package," which includes the new definitions of Grade B Service. It appears that the Commission intends to adopt the two earlier proposals if the change in Grade B Standards is adopted. If the proposal is rejected, the other proposals might or might not die with it.

The changes in the computation

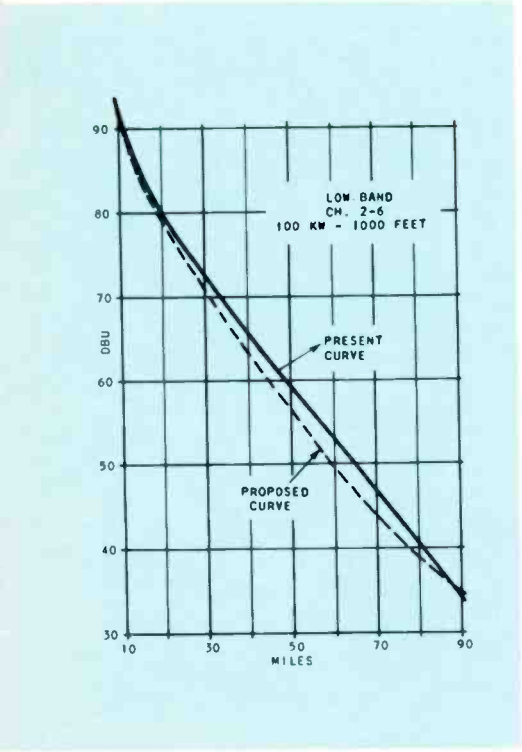


Fig. 4 Field vs. distance in the low bands.

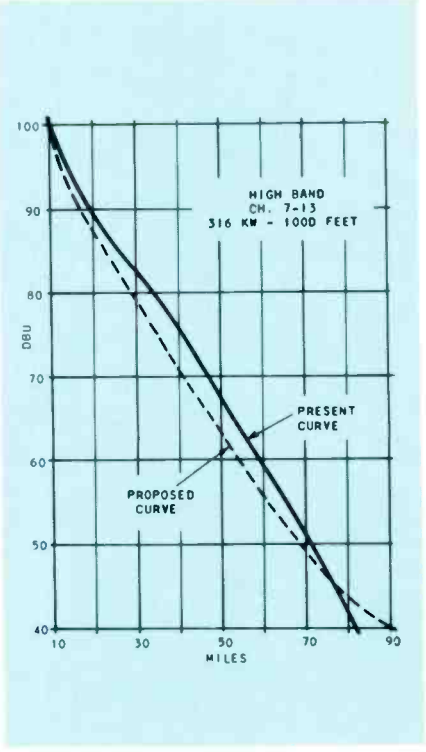


Fig. 5 Field vs. distance in the high bands.

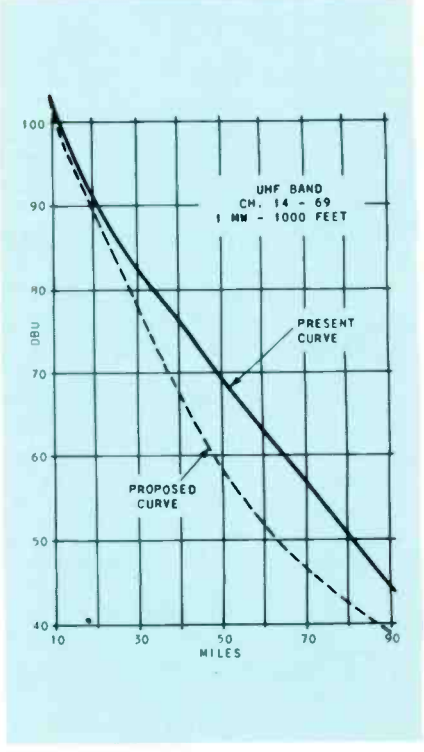
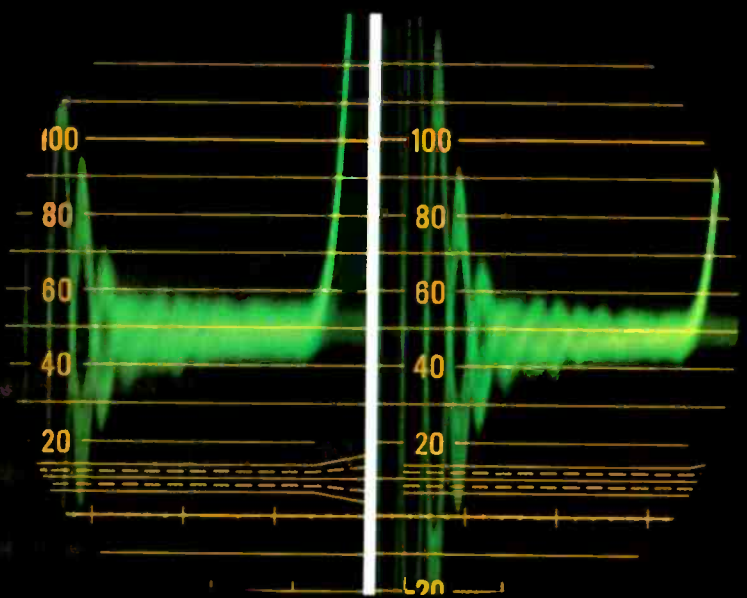


Fig. 6 Field vs. distance, UHF.

New Memorex Chroma 90 has the highest signal-to-noise ratio of any conventional video tape.



Chroma 90 averages 2 db less noise than any competitive broadcast tape. Look at it on a waveform monitor. Chroma 90 (right) shows a 20% lower noise level than the leading broadcast tape. You get cleaner masters, sharper dubs.

of the signal required for Grade B. Service are shown in Figure 3. The changes involve the assumption of lower receiver noise figures for all channels, higher antenna gain for high-VHF channels, lower line loss for UHF, and a slight improvement in antenna efficiency for UHF (since the geometric mean frequency for that band became lower when the upper UHF channels were reallocated to other services).

Juggling The Facts?

To some engineers, the new proposal seems a classic instance of the juggling of engineering facts in order to satisfy non-engineering problems. As mentioned, the basic objection to the new curves came from UHF stations, whose predicted contours would have shrunk significantly if based on the new curves. Since it is the policy of the Commission to encourage UHF television, the adoption of curves showing less optimistic coverage for such stations was hardly appropriate. Therefore, no action was taken on the new curves until the Commission got the idea of changing the definition of Grade B Service. In this way, the Commission would reduce everyone's contours by adopting the new curves and then expand the contours by virtue of the redefinition of Grade B.

In Figures 4, 5, and 6 are shown comparisons of the old and new curves for typical transmitting facilities on the three bands. The curves for low-VHF television are also to be used for FM, and there is no great change involved, as is the case for high-VHF television. The UHF curves, however, show a substantial change.

The Effects Of Change

In terms of service contours, the effects of the proposed changes may be seen in Figures 7, 8, and 9. For a low-VHF station operating with 100 kW @ 1000 ft., the predicted Grade B Contour now extends 70 miles. The new curves would reduce this distance to 64.5 miles, and the new contour value would push it back out 2 miles, to 66.5 miles. Since the new curves would also apply to FM stations, but the 1.0 mv/m service standard would remain, there would be a general slight reduction in predicted service for such stations. With facilities of 50 kW @ 500 ft., a station's 1.0 mv/m contour distance would be reduced by approximately one mile.

For high-VHF stations, there would be a net gain in predicted service areas. With 316 kW @ 1000 ft., the present Grade B Contour extends 63.5 miles. The new curves would place it at 59.5 miles, but the new service standard would push the contour out to 68.5 miles. Thus,

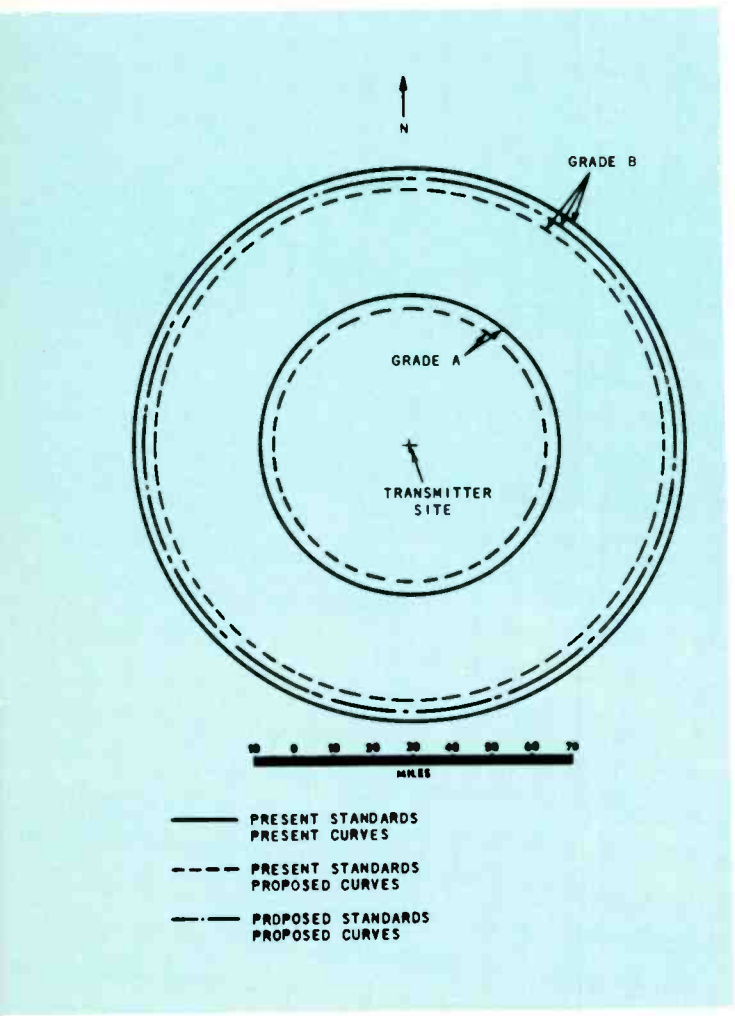


Fig. 7 Low band comparison of service contours.

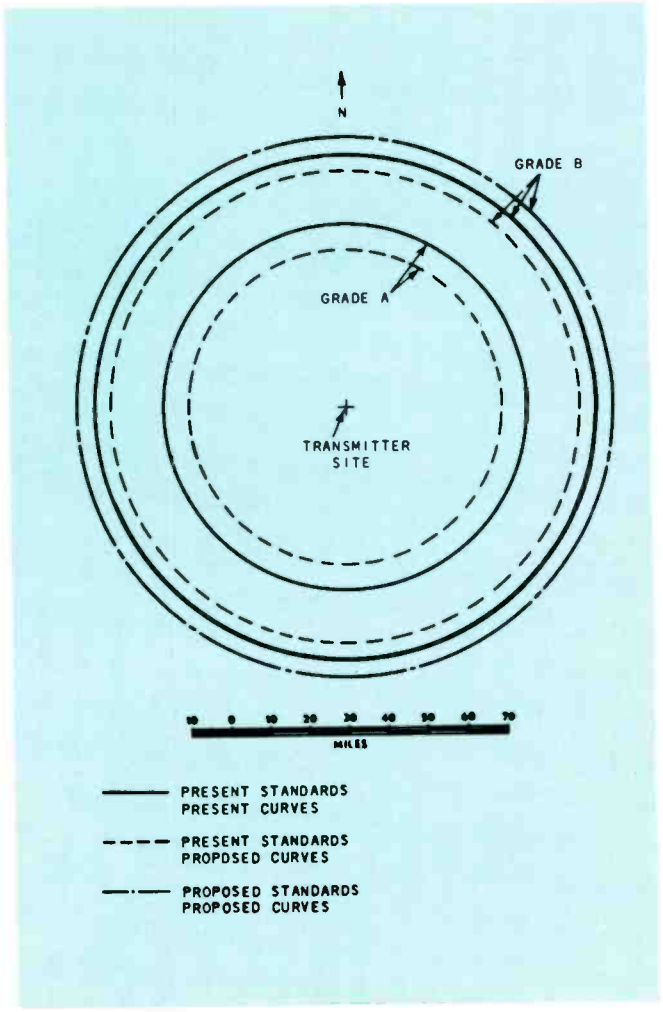


Fig. 8 High band comparison of service contours.

New Memorex Chroma 90 gives the best color performance of any conventional video tape.

See how Chroma 90 virtually eliminates chroma noise during programming. Here it's playing back 100% color bars. Try that with anybody else's tape and see what happens.

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for comparable facilities, high-VHF stations would show service to greater distances than would low-VHF stations.

For a 1000 kW @ 1000 ft. UHF station, the present method results in a Grade B Contour at 58.5 miles. The new curves would cut this by 15 miles, to 43.5 miles, and the new standard would then give back 4.5 miles, resulting in a contour distance of 48 miles.

The Commission is not proposing to change the standard for Grade A Service since the Grade A figures result largely from the effects of urban noise, and receiver noise is of less significance in such situations. The adoption of new curves, however, would tend to reduce predicted Grade A Contours. Assuming the facilities discussed above, the low-VHF Grade A Contour would decrease by 3 miles, the high-VHF Contour would decrease by 6 miles, and the UHF Contour distance would be reduced by 9.5 miles.

How Realistic Are The New Curves?

Are these new curves, standards, and contour distances realistic? Only Mother Nature knows for sure. The differences in the VHF curves are largely academic in most cases. The UHF curves are an improvement over those in the Rules, but almost anything would be since the curves now in the Rules bear little resemblance to the facts. The changes in Grade B Standards may be supportable by updated receiver noise figures, as the Commission has said, but there are those who wonder how the standards can show that high-VHF coverage is superior to that for low-VHF when experience shows otherwise.

For those who can afford to know the truth, Docket 18052, if adopted, will provide a chance to demonstrate it. For most stations, actual coverage has very little to do with prediction. Figure 10 is an example of how a measured contour and a predicted contour can disagree.

Although the Commission often accepts measurement data in hearing proceedings and other special circumstances, when the Rules specifically sanction such data the broadcasting industry will at least be able, on occasion, to show a reasonably accurate view of station coverage regardless of what curves and specifications are finally adopted. ▲

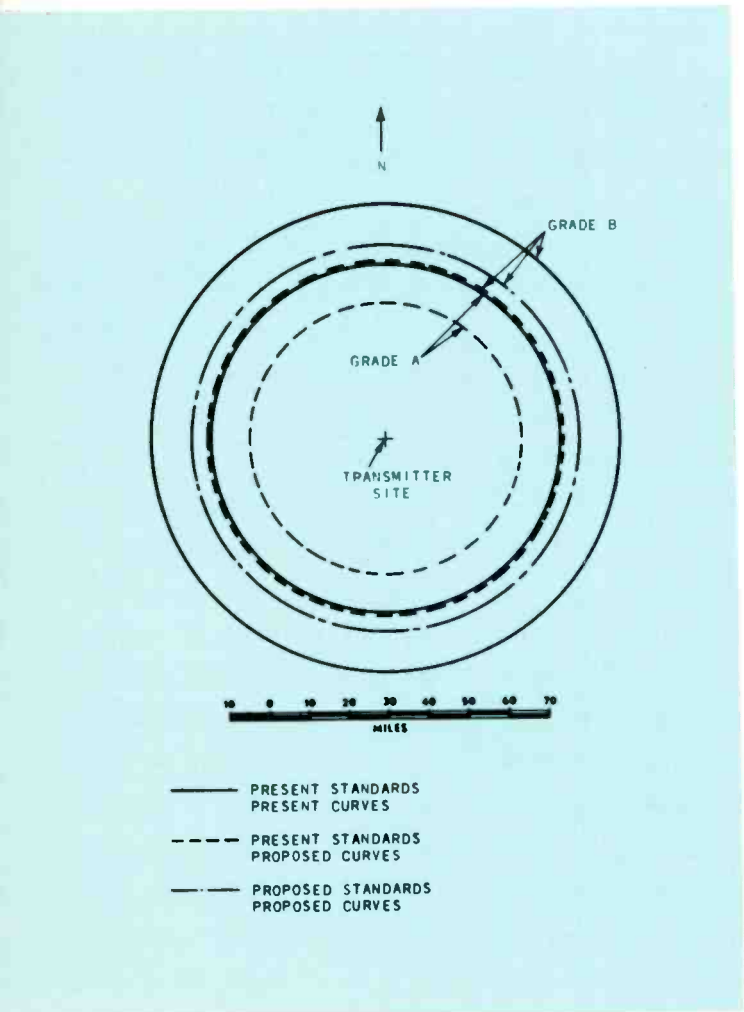


Fig. 9 UHF comparison of service contours.

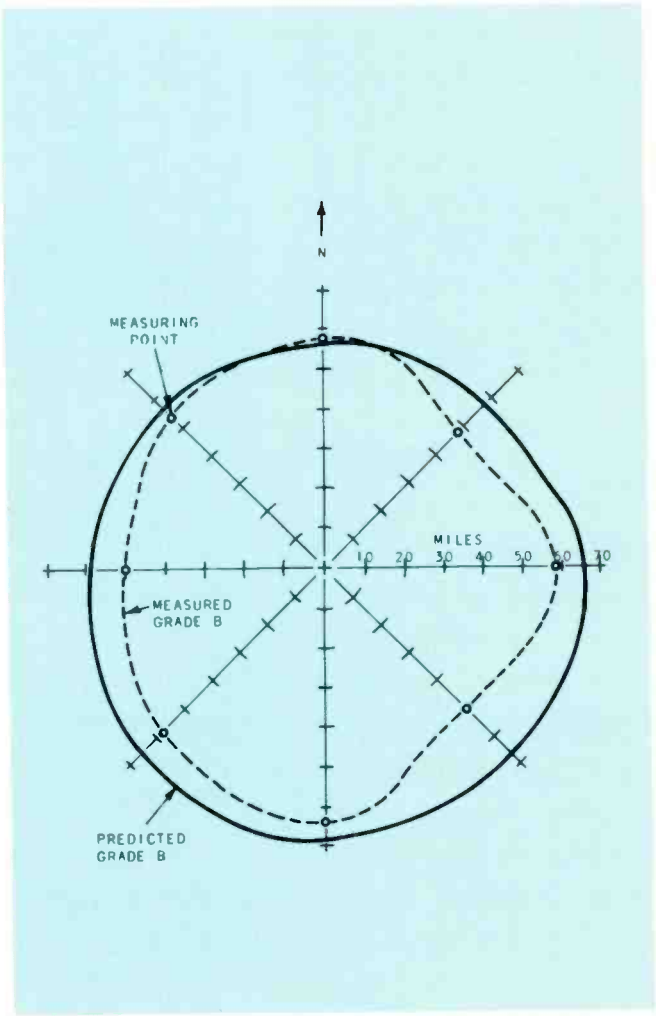
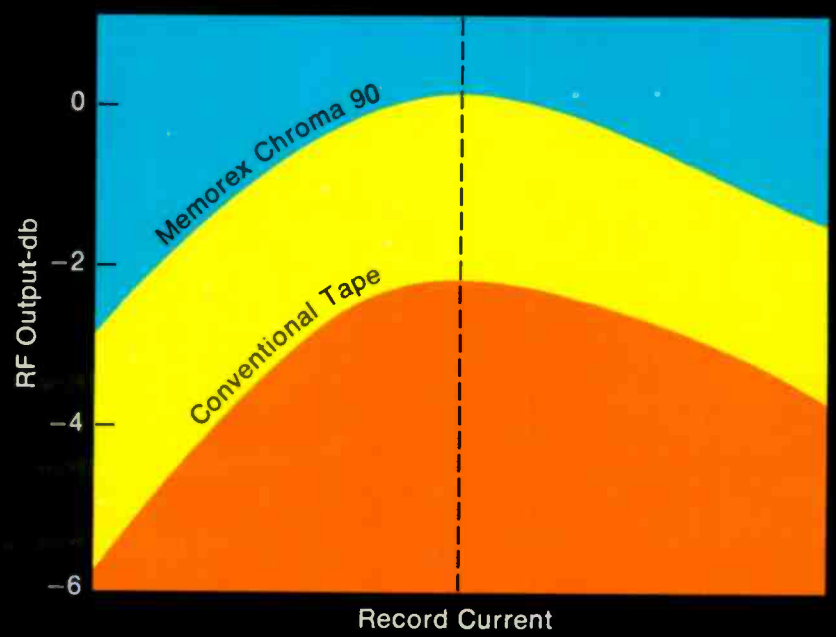


Fig. 10 Predicted and measured Grade B contours.

New Memorex Chroma 90 has the highest RF output of any conventional video tape.



For a given amount of head current, see how much more energy you get from Chroma 90 than from other tapes. Yet it's perfectly compatible with systems set up for conventional tapes.

Associate Executive Director William H. King of the New Jersey Public Broadcasting Authority, helps launch WNJT-TV Channel 52 from Trenton with a greeting during opening ceremonies on April 5. Others participating in the on-air ceremonies were (left to right) John T. Wilner, Director of Engineering; Dr. Lawrence T. Frymire, Executive Director and Robert G. Crager, Authority member from Vineland, N. J. Channel is the first of four UHF Public and Educational TV stations to be operated by the Authority. The four-station network will also have stations in New Brunswick, N. J., Montclair, N. J. and Camden-Atlantic City, N. J.

PUBLIC RADIO and TELEVISION INAUGURATE NETWORKS

National Public Radio (NPR), a network of more than 90 noncommercial stations in 36 states, began broadcasting May 3. And it has elected two new members to its board of directors: Kenneth A. Cox, a former commissioner with the Federal Communications Commission (FCC), and Wilson Riles, California state superintendent of public instruction.

This announcement was made by Bernard Mayes, chairman of NPR's Board of Directors.

Cox joined the FCC in 1961 when he was named chief of its broadcasting bureau. From 1964 through 1967, he was chairman of the Commission's Advisory Committee for Land Mobile Radio Services. He was also acting defense commissioner of the FCC Telephone and Telegraph Committees.

Before joining the FCC, Cox was named special counsel for the Senate Commerce Committee where he helped direct the 1956-57 television inquiry. He returned to his Seattle, Washington law practice in 1957 and continued to conduct hearings for the Senate committee from 1958 through 1960.

A resident of Sacramento, California, Wilson Riles was chairman of the Nixon administration's 59-member Task Force on Urban Education before being elected state superintendent of public instruction in November, 1970. He also has taught and administered public schools in Arizona and has served in Los Angeles as regional executive secretary of the Fellowship of Reconciliation, a religious organization.

As a result of 12 years of distinctive service in the California State Department of Education, Riles was appointed associate superintendent of a $100 million-a-year federal compensatory education program for low-income families in 1965.

He considers schools a "natural bridge across the generation gap" and also suggests that "we tap the talent and expertise that lie outside the school's walls."

Unique Programming

"ALL THINGS CONSIDERED . . .," National Public Radio's 90-minute news series, took an unprecedented approach to broadcast journalism when it premiered on NPR's inauguration of the new non-commercial network.

Broadcast weekdays by NPR affiliates, "ALL THINGS CONSIDERED. . ." goes beyond the traditional transmission of data or "hard" news. According to NPR programming director William H. Siemering, "It will plow new ground in the field of investigative broadcast journalism and, at the same time, serve the individual with a more human view of his environment."

"People will be valued and treated with respect by the program staff," Siemering adds. "The listener will have a sense of reality, of authentic people sharing the human experience with emotional openness. The series also will deal with the arts and humanities and other subjects not usually considered public affairs."

"ALL THINGS CONSIDERED. . ." will provide news summaries and short documentaries as well as an examination of the top three or four stories of the day through a variety of techniques: interviews with newsmakers, special background and analytical features, music, man-on-the-street opinion polling, listener phone-ins, and in-studio discussions with experts.

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I'd like a free 15-minute reel of Chroma 90.

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(Limited time offer. Only one free reel per firm.)

Everybody says they have the best tape on the market. So we don't blame you if you're skeptical about our claims.

That's why we're willing to let our tape speak for itself. Send for a free reel of Chroma 90. Use it on your own equipment.

We don't expect our talk to convince you. But our tape will.

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It will be hosted by NPR managing editor Robert Conley, formerly a contributing editor to **National Geographic,** an NBC correspondent for the "Huntley-Brinkley Report" and "Monitor" and **New York Times** correspondent at the United Nations, in Washington and Africa.

Using a relaxed pace, unique for new broadcasting, "ALL THINGS CONSIDERED. . ." will allow form to organically follow function. News will not be jammed into regulated time limits or regular time slots but instead will take whatever time necessary to give the listener the information he needs to become a more informed and responsive citizen.

National Public Radio has begun another network special with live coverage of the Senate Foreign Relations Committee hearings on the termination of the Vietnam War. NPR is making this news special available to its radio affiliates and is the only media to cover the entire proceedings.

Chaired by Senator J. W. Fulbright (D-Ark.), the long-scheduled public hearings provide a new forum for Vietnam critics in Congress as well as witnesses for the Administration. The Committee began with testimony from the Senate sponsors of various legislative proposals to end or limit American military involvement.

These legislative sponsors include Sens. George S. McGovern (D-S.D.) and Mark O. Hatfield (R-Ore.), who are calling for a final pullout by December 31; Vance Hartke (D-Ind.), sponsor of a resolution for immediate withdrawal; and Walter F. Mondale (D-Minn.) and William B. Saxbe (R-Ohio), co-sponsors of a resolution prohibiting any American support for a South Vietnamese invasion of North Vietnam.

A Public TV First

With WNJT-TV Channel 52 on the air in Trenton, New Jersey has its first Public and Educational TV station owned and operated by the citizens of the Garden State.

Channel 52 is operated by the New Jersey Public Broadcasting Authority. It is the first of four full color UHF TV stations to be operated throughout the state. The four stations will link together one of the finest Public TV networks in the entire country when all are in operation by the end of 1971.

The other channels will be located in Warren Twp. (Channel 58 serving the New Brunswick area) Montclair (Channel 50) and Waterford Works (Channel 23 serving the Camden-Atlantic City area.) When in operation, the four overlapping signals will cover 97 percent of the ground area in the state.

Since CATV systems are required by law to carry the local Public Television Station, it is expected that the entire state will be able to see programs over the New Jersey Public Broadcasting Authority network.

No Competition

The four NJPBA stations will not be attempting to compete with their neighboring commercial stations. It is the goal of the Authority to fill the void that now exists in New Jersey programs consisting of detailed state news reports, sports, state cultural and entertainment activities and state events of public interest.

As well as the plans for four UHF stations, the Authority will also operate two low-powered closed-circuit systems at each of the four transmitter sites for educational instruction in schools, other state agencies and private industry.

The Authority was established and funded by the 1968 New Jersey bond issue. Its annual operational costs will be financed by state appropriations and grants from private concerns. There will be no commercials on the station since it is a public endeavor.

Dr. Edward J. Meade, Jr., of the Ford Foundation, whose blue ribbon panel of New Jersey citizens recommended the establishment of a public television system in New Jersey, is the first Chairman of the Authority. ▲

Now There's a Difference

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The RCA Vistacon is a direct replacement for the lead-oxide target camera tube you may now be using. It has direct interchangeability, with exactly the same physical dimensions, the same performance characteristics.

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RCA	REPLACE
4592/R, 4592/G 4592/B, 4592/L	XQ1020R, XQ1020G, XQ1020B, XQ1020L
4591/R, 4591/G 4591/B, 4591/L	55875R, 55875G 55875B, 55875L

And equally important, it's fully compatible with any mix of tubes. For example, you can put a Vistacon 4592/G in a camera with XQ1020L, R and B tubes.

The difference? Vistacon is made by RCA and serviced by RCA. That means a top quality tube backed by the same RCA Field Engineers you have come to depend upon for consultation or help whenever you want them.

Next time you need a replacement, try an RCA Vistacon. Then maybe you won't think about interchangeability any more — you'll go RCA all the way.

For complete specifications and delivery information, call your RCA distributor.
RCA | Electronic Components, | Harrison, N.J. 07029.

RCA

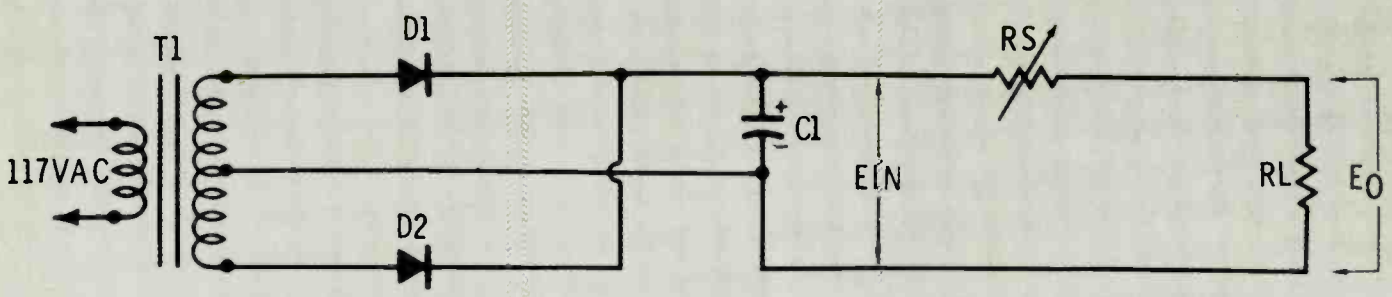

Fig. 1 Basic concept of series regulation.

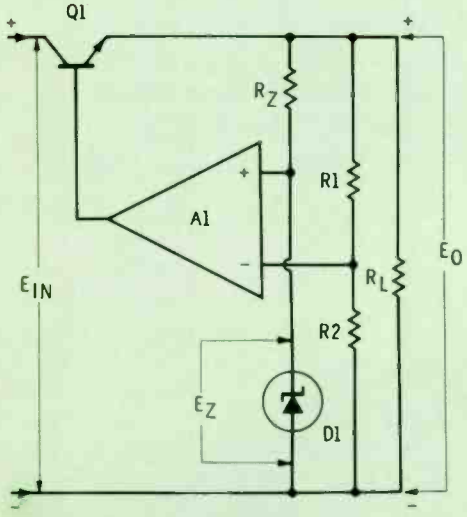

Fig. 2 Components of an electronic voltage regulator.

Specialized Circuits to...

Power Up With IC's

By Walt Jung

The integrated circuit has invaded several areas of electronics with more than a little depth. The largest of these of course is the digital world, and second to digital IC's is the operational amplifier. Both of these are examples of large volume applications. Another example, perhaps one a little closer to home, is the voltage regulator IC. Nowadays this is the heart of many system power supplies. This month we'll look at what this type of IC is, learn how to understand it, and see how it is used.

Any piece of electronic equipment has a power supply, and most professional broadcast gear has regulated supplies to reduce the effect of temperature and line/load variations upon circuit operation.

In the tube days the familiar standbys were the OA2 or OB2, the 12AX7 and the 6080. Of course many of these are still alive and well, but most new equipment is solid state. Power supply voltages have reduced to tens of volts rather than hundreds of volts as the norm.

Many of the basic circuit elements which make up a top quality voltage regulator are natural to the IC process. In fact some of the techniques work so well that better performance is available with monolithic construction than is possible or practical with discrete components. Let's look at some fundamental power supply circuits to see how it all fits together. Then we'll go inside representative IC's and see how they perform.

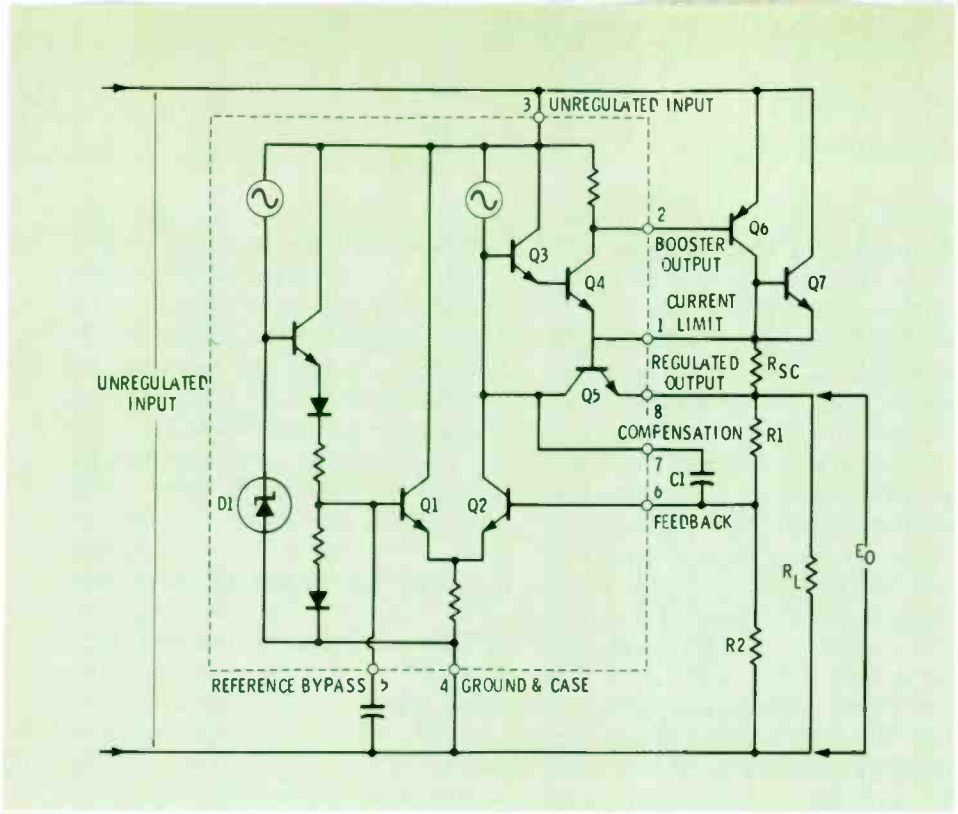

Fig. 3 The LM100-300 simplified schematic. Booster transistors Q6 and Q7 are optional. Basic regulator omits Q6, Q7. Single booster adds Q6. Double booster adds Q6, Q7.

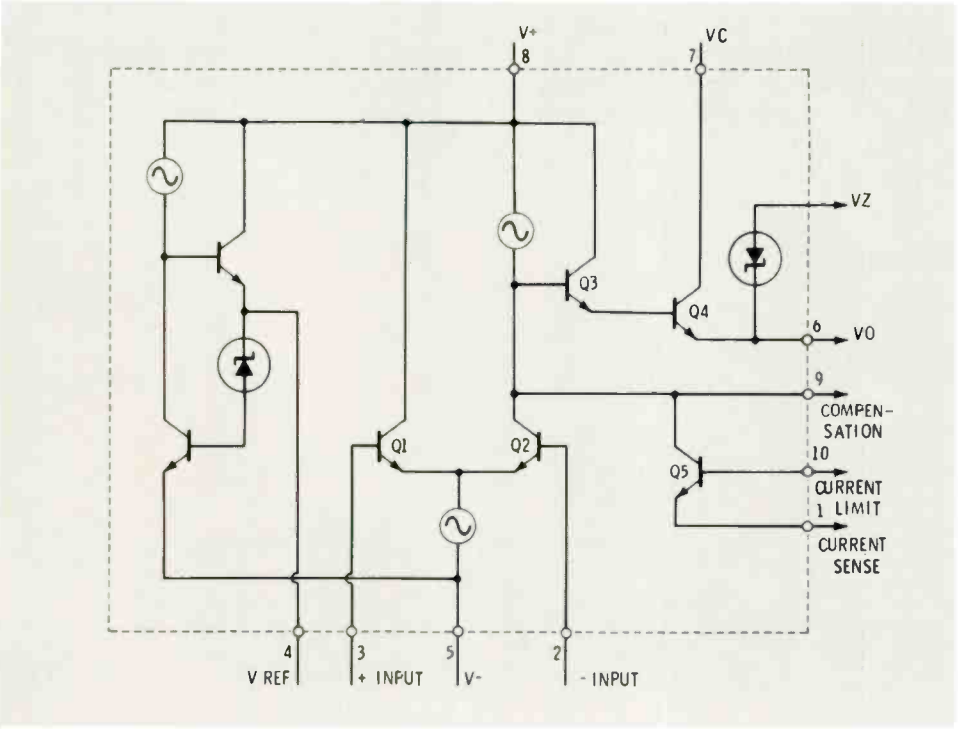

Fig. 4 Simplified schematic for the 723-723C. Pins shown are for TO-5 style package.

To review the basics of what a voltage regulator does, see Figure 1. Here T1 furnishes transformer isolated power to a full-wave rectifier (D1-D2) and filter (C1). The rectified DC voltage across C1 represents a raw DC voltage (Ein). This voltage is nominally a fraction higher than the desired output (Eo). It also is susceptible to load current changes and AC line input changes, as it is unregulated.

The series resistance (Rs) represents the resistance which is controlled to maintain the output within the desired accuracy. In theory, automatic and appropriate adjustment of this resistance can maintain the output voltage to any desired degree of accuracy and provide excellent immunity to load and input changes. All **this** is necessary to provide a means of controlling the resistance by the use of an amplifier. This is where the electronic regulator comes in.

Figure 2 illustrates a series control transistor (Q1) connected to an amplifier (A1) to regulate its output voltage Eo. The amplifier is a high gain, differential input, operational type, and Q1 is a power transistor with sufficient voltage and current capability to suit the application.

Circuit operation looks like this: the control amplifier is fed a reference voltage on its + input from a stable zener diode, D1. This voltage is constant and independent of any other effects (such as load and line changes and/or temperature variations). The input of the amplifier is fed from a divider across Eo, R1-R2. This is an output sample, used by the control amplifier to compare the output to the reference voltage and make a correction to maintain regulation.

Assume a reference of 7 volts at A1's plus input. Remembering our discussions on closed loop control of op-amps, we recall that the opposite input will be very close to this potential also, within a few millivolts. This means the R1-R2 tap will be 7 volts also. If this is true, the voltage Eo must be greater, since Ez is a fraction of this by the voltage divider action. This is precisely correct. The Eo voltage is related to the reference voltage by the fractional relation

$$Eo = \frac{R1 + R2}{R2} Ez.$$

Stated simply, the output voltage is a multiple of the reference voltage Ez, the multiple being determined by the R1-R2 divider ratio. An example would be where R1=R2: in this case Eo=2 Ez or 2x7=14 volts. In this manner the closed

loop around A1, Q1 and R1-R2 maintains the output voltage at a fixed relationship to the reference.

Output load voltage changes are sensed by the R1-R2 divider and fed to A1. A1 amplifies these changes and feeds a correction signal to Q1, which changes its conduction characteristic to counteract the original change, thus accomplishing regulation. Immunity to line voltage changes (and a corresponding change in Ein) is provided by the inherent supply rejection of the amplifier and a stable zener reference circuit.

Components For IC Regulator Systems

If we move from this general regulator discussion to what goes on inside an IC type regulator, we find that in concept there is little if any difference. In fact, Figure 2 could be a block diagram of a typical IC regulator. The differences are in the detail of the circuits various manufacturers use to accomplish the end result. To understand these, we'll examine a few representative IC regulators.

National Semiconductor introduced the concept of the IC voltage regulator with their LM100-300 series. A simplified schematic of this unit is shown in Figure 3. The three basic components of reference (D1), amplifier (Q1-Q2), and series control transistors (Q3-Q4) can be recognized easily in this circuit. R1 and R2 are external resistors used to set the output to a desired value. C1 is a Miller feedback capacitor used to stabilize the loop.

There are a few basic facts to remember about this regulator. The reference voltage (pin 5) is fairly low (1.8 volts) and permanently connected to the control amplifier (Q1). Q3-Q4 form a Darlington connected series pair transistor. The basic output current of this chip is 40 ma, but this can be raised to higher current levels using external booster(s) such as Q6-Q7.

An additional feature of these IC regulators is a built-in short circuit protection, provided in this case by Q5. The output current passes through Rsc (externally connected) which is across Q5's B-E junction. When load current becomes high enough to develop a drop across Rsc equal to the turn-on voltage of Q5, Q5 turns on and removes drive from Q3-Q4. This process reduces the output voltage to a point where $Io = \frac{Vbe\ Q5}{Rsc}$. This action is automatic; removal of the overload or short from the output automatically biases off Q5 and Q3-Q4

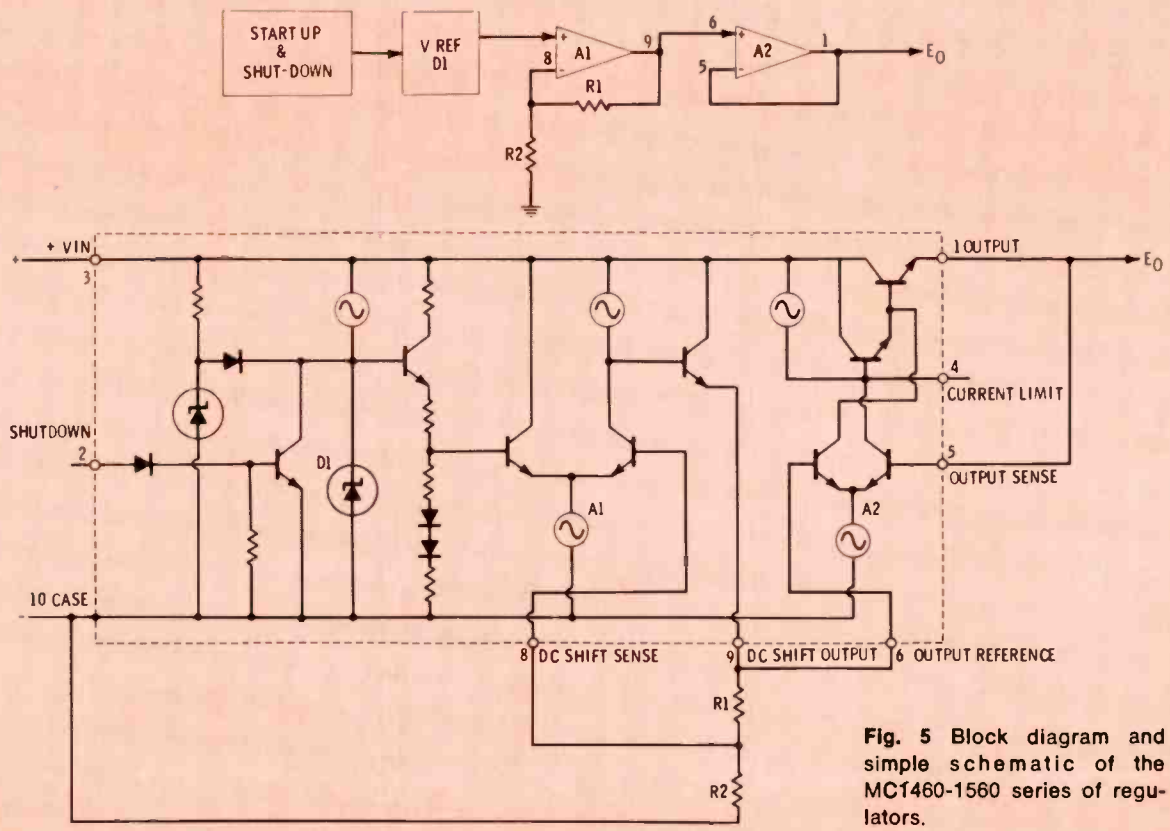

Fig. 5 Block diagram and simple schematic of the MC1460-1560 series of regulators.

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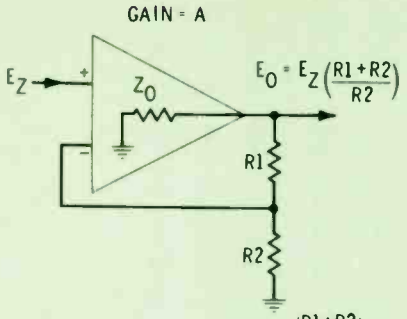
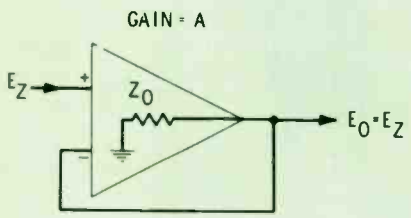


$$Z_O \text{ CLOSED LOOP} = \frac{Z_O \text{ AMPLIFIER}\left(\frac{R1+R2}{R2}\right)}{A}$$

WHERE A = OPEN LOOP AMPLIFIER GAIN

Fig. 6A Illustration of regulator Zo with voltage gain.



$$Z_O \text{ CLOSED LOOP} = \frac{Z_O \text{ AMPLIFIER}}{A}$$

WHERE A = OPEN LOOP AMPLIFIER GAIN

Fig. 6B Regulator Zo with unity gain.

return to a normal mode.

Fairchild introduced the 723 regulator which allowed a greater degree of flexibility and also had some improved specifications. A simplified diagram of this one is Figure 4. Notice the control amplifier is a differential pair (Q1-Q2) and a Darlington pair series pass connection is used (Q3-Q4).

The big difference in this case is that Q4 is rated for up to 150 ma of output current. The zener reference supply of the 723 is a complete mini-regulator in itself, providing a stable 7.15 volts at the Vref terminal at up to 15 ma of output current. Both inputs to the Q1-Q2 control amplifier are brought outside the package for unlimited flexibility. A current limit transistor (Q5) is provided which can be connected in a variety of ways since its base and emitter are uncommitted.

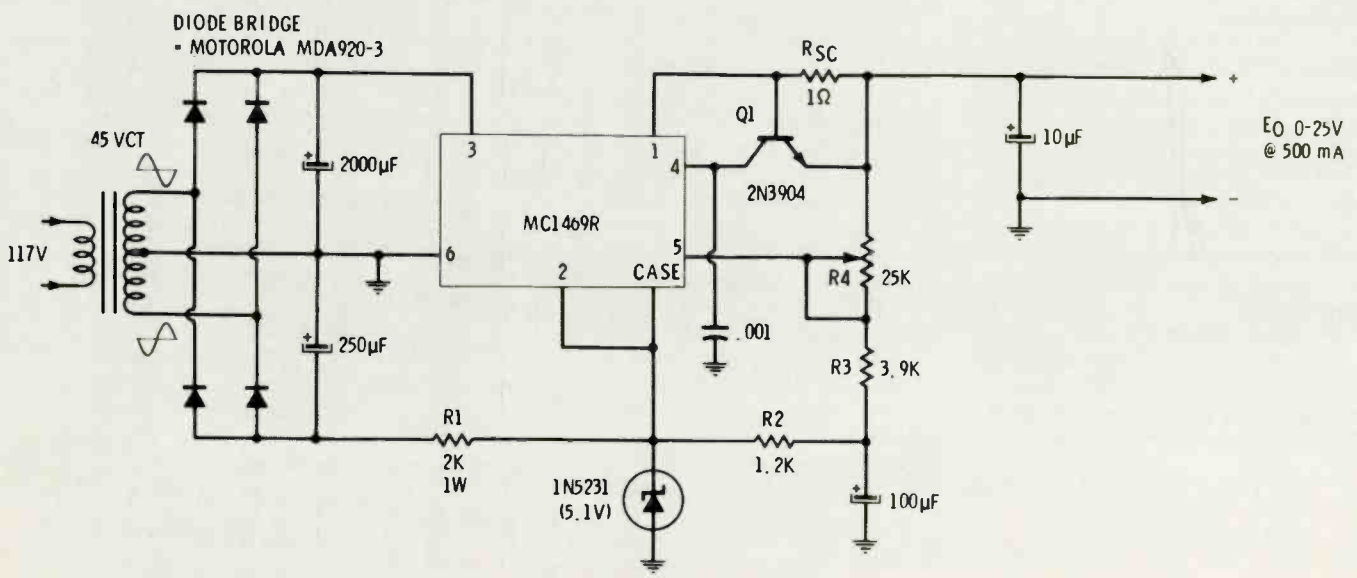
MC1460-1560 Series

Further along the evolutionary scale came an entire family of voltage regulators by Motorola which incorporated some new concepts and marked improvements. These devices, the MC1460-1560 series, raised the level of performance available in IC regulation to a new high in a number of ways. Figure 5 shows a simplified schematic that reveals these differences.

Regulation in these regulators is accomplished in two stages rather than a single amplifier as we have seen in the two just discussed. D1 and its associated components form the reference voltage of 3.5 volts in this circuit. This is applied to one input of a differential amplifier A1. A1 and its associated circuit form a low power regulator which shifts the 3.5 volts up to the desired level, R1 and R2 being chosen in a similar manner to Figure 2.

Up to this point the concept is similar to the LM100 and 723, in which this output is used as the main source. But Motorola goes a step further and uses a second stage

Fig. 7 Wide range, general purpose power supply using a MC1469R.



A2, connected as a unity gain stage (follower). What this buys is a tremendous reduction in the output impedance of the regulator, which in turn improves the regulation. The reason output impedance rises in single regulator designs is due to the R1-R2 divider which causes high attenuation ratios.

This can be understood better by Figures 6A and 6B which compare the two conditions. For a given amplifier gain, the output impedance of circuit 6B will be lower than 6A because of the absence of the voltage divider. So in the composite circuit, the addition of the second unity gain stage removes the variations in output impedance due to different divider ratios for different voltages. The result is a very low and constant output impedance from these regulators, a feature the others cannot provide.

Another improvement of this series is its output current capability. The TO-5 style package (G) can handle a 200 ma maximum output and the TO-66 style package (R) can handle 500 ma max. This allows it to drive a larger number of circuits without a booster transistor.

By virtue of the high frequency response of the internal circuitry this regulator is also able to maintain a lower output impedance to a much higher frequency than either the LM100-300 or the 723. Short circuit protection is also provided in these regulators.

IC Comparison

Having seen the differences in the internal structure of these three IC's now compare them on a common basis in Table 1. This chart lists rated performance specs for an industrial temperature range device of the three classes; LM300, 723C and MC1469 G and R.

We haven't gone into circuit detail, because this is not really necessary in order to understand the concept of how they work. But one further aid may be to see a few representative circuits using the devices.

Figure 7 is a general purpose wide range (0-25 volts) supply with a 500 ma output current. The MC1469R is used here with just its output stage in the circuit. The full-wave CT bridge supplies two voltages, a positive unregulated side (pin 3) and a negative bias supply which powers D1, furnishing a −5.1 volt bias for the IC's control circuitry.

The reference side of the output stage (pin 6) is grounded and the sense side (pin 5) is fed a bias current of −1 ma through R2-R3. Since feedback theory dictates pin 5 will be the same potential as pin 6 (zero volts), the output voltage will create a current of +1 ma in R4 to cancel the current in R2-R3. With R4 variable and the current constant, R4 can control the output from 0 to 25 volts. Short circuit protection is provided by Q1.

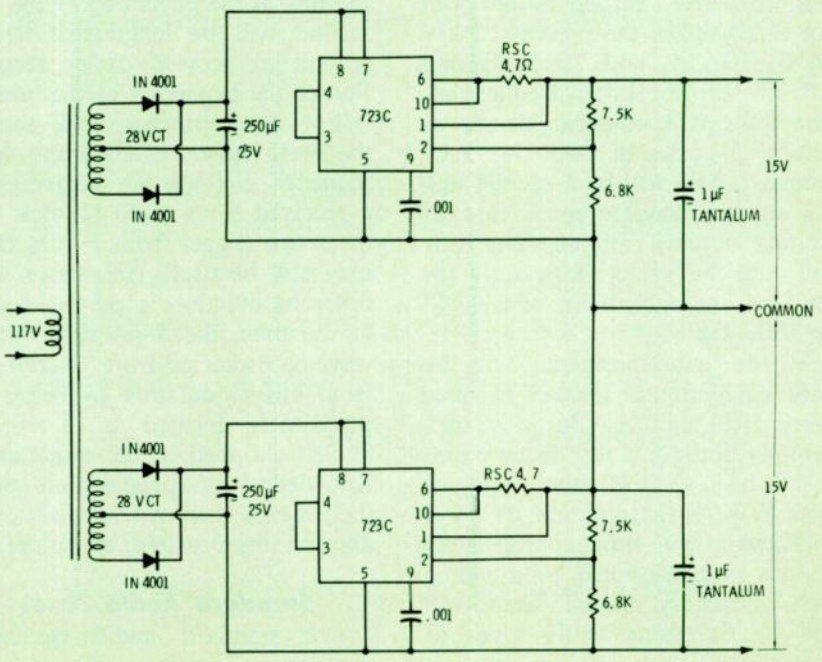
Figure 8 shows another practical hookup, using two 723's to regulate ± 15 VDC. Here a pair of 14 VRMS windings supply identical regulator circuits with their outputs in series. This regulator will supply ± 15 volts at 100 ma with short circuit protection.

Summing Up

We realize that this short course has not gone into great detail with these devices. If you would like more details it is recommended that you contact the manufacturers.

What we have attempted to cover here is a basic working knowledge of the techniques used in this class of device. With a fundamental understanding of these ideas you should be able to work your way around one of these circuits when the occasion arises. ▲

Fig. 8 Regulator using two 723C's. Pin numbers are for TO-5 type package.



New Signals from an Old Timer ... WWV

By Lowell Fey*, WWV, Ft. Collins, Colo.

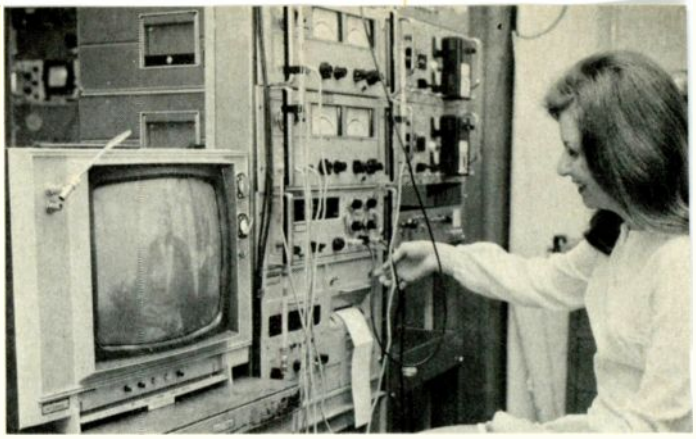


Fig. 1 On occasion, operator makes television time comparisons at NBS Boulder. Sandra Danielson of the Broadcast Services is at the controls.

Although many other changes have occurred in broadcasting over the years, those who tune in to the National Bureau of Standards time broadcast stations WWV and WWVH have come to expect the same familiar time signals year after year. But not much longer. Soon a new broadcast will be heard with more kinds of services than before for a wider variety of time and frequency users.

Starting July 1, 1971 there will be more frequent voice time announcements, a different way of marking hours and minutes, no silent period, and no more Morse Code or the fast NASA time code. Instead, a slow time code will be added along with some other changes.

In many respects the services will be the same. The WWV transmitters will remain at Fort Collins, Colorado, broadcasting on the same frequencies of 2.5, 5, 10, 15, 20, and 25 MHz. Power output will not change from the present 10 kW on 5, 10, 15, and 20 MHz and 2.5 kW on the other frequencies. The ticks will continue nearly as before: 5 cycles of 1000 Hz each second. There will be a special tick 0.8 seconds long to mark the beginning of each minute. This tick will also be 1000 Hz except for the first one each hour, which will be 1500 Hz.

Voice announcements will be once each minute instead of once every five minutes. But . . . apparently nothing is safe from Women's Lib . . . time announcements from WWV's sister station, WWVH in Hawaii, will now appropriately be in a woman's voice, even ending with a friendly Aloha! There will still be the same audio tones as before, 440 and 600 Hz, but rearranged into new places with some periods where 500 Hz is added for good measure. All use of the Morse Code will be dropped along with the NASA 36-bit "buzz saw" code which will be replaced with a one-bit per second IRIG H time code on a 100 Hz subcarrier. There still will be geoalerts and some other announcements. There no longer will be any completely silent periods.

Now, let's look at the new format from the user's standpoint. The casual clocksetter will never have to wait longer than a minute to get time-of-day information. This feature will also benefit those who wish to time tape recordings of various occurrences; for instance, intermittently occurring conversations between a radio dispatcher and outlying stations. To time the occurrence of short exchanges, the tape recorder need run no more than one minute. For all these uses the tick at the beginning of the first second will be lengthened to 0.8 second to provide easier recognition of the beginning of the minute.

For more precise clock setting, the well-known oscilloscope technique of aligning the beginning of a received 5 ms 1000 Hz tick with the scope trigger from a local clock may still be used. No matter what other modulation is on the station at the time, the 5 ms tick will always be protected from interference from this modulation by being appropriately located in a 40 ms "hole" chopped in the modulation. Knowledge of propagation delay then makes time synchronization to about 1 ms possible, as before.

Standard Audio Tones

For standard audio frequency comparison purposes the 600 Hz tones every other minute (with some exceptions) or the 440 Hz tone once per hour may still be used. In addition, the 45-second slots not used for announcements will be used for a 500 Hz tone. NBS takes the point of view that some kind of modulation should be present nearly all the time to make the signal easy to find when tuning it in.

The new format is designed to serve a new class of users. These users make slow-speed strip chart recordings and desired timing marks. At speeds of 1″ per hour, marks once per hour should serve. These can be obtained from either of two sources. In a high signal-to-noise area the 0.8 second 1500 Hz tick can operate a frequency sensitive circuit such as a resonant reed relay to provide a marker signal.

The same use could be made of the 440 Hz hour marker, but since it lasts 45 seconds much better noise discrimination can be obtained. Absence of this signal at 2400 hours can be used to mark the beginning of the Greenwich mean time 24-hour day. For faster strip chart recordings the same technique can be used to mark each minute with the 0.8 second 1000 Hz tone, or every other minute with the 600 Hz tone.

If complete identification of the time of occurrence of a recorded event is required, this also may be obtained using the IRIG H code. This code has a bit rate of once per second and gives the day number of the year and the hour and minute. This information is presented in binary coded decimal form and is repeated each minute. On the new WWV and WWVH format, the code will be amplitude modulated on a 100 Hz subcarrier, which may not be audible using an

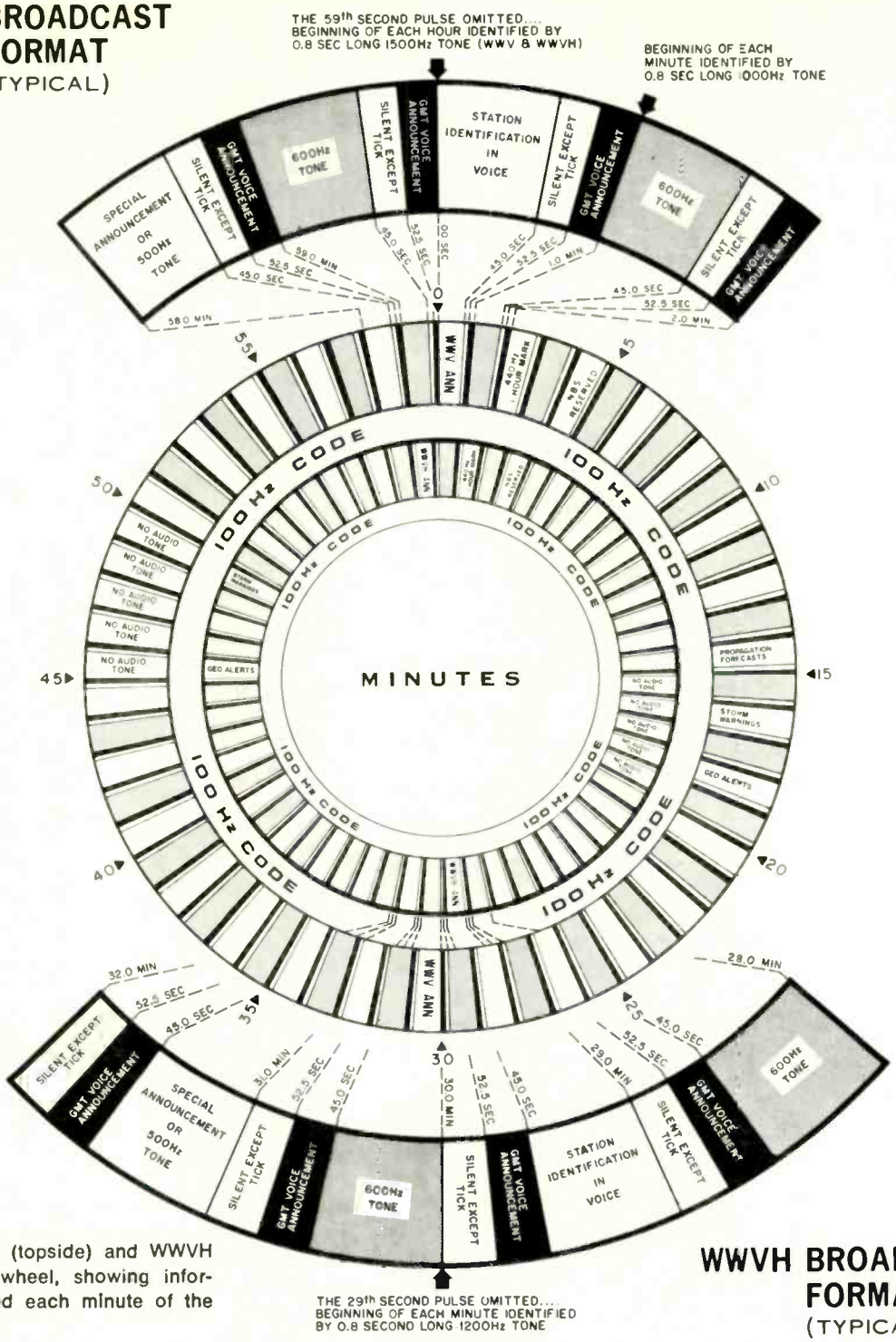


Fig. 2 The WWV (topside) and WWVH (bottom) format wheel, showing information transmitted each minute of the hour.

ordinary receiver. With filtering and clipping, however, it will be suitable for recording on a strip chart recorder and can be easily read by eye with a little practice.

Another new feature of the broadcast is provision for 45-second announcements every other minute (again with some exceptions) from other government agencies for their own purposes. The geoalerts and propagation forecasts presently broadcast by WWV would fall into this category. There is room for 24

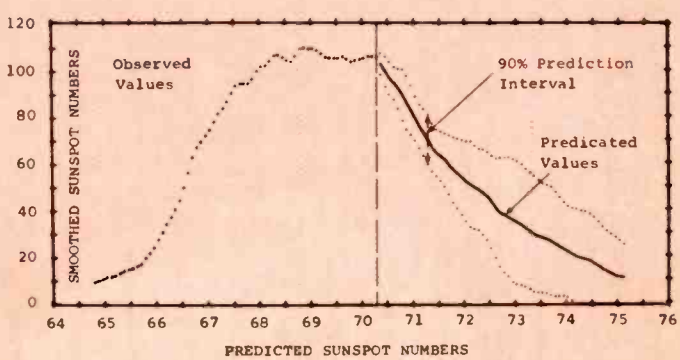


Fig. 3 The 11 year sunspot cycle, showing the years 1964 through 1976 across the bottom.

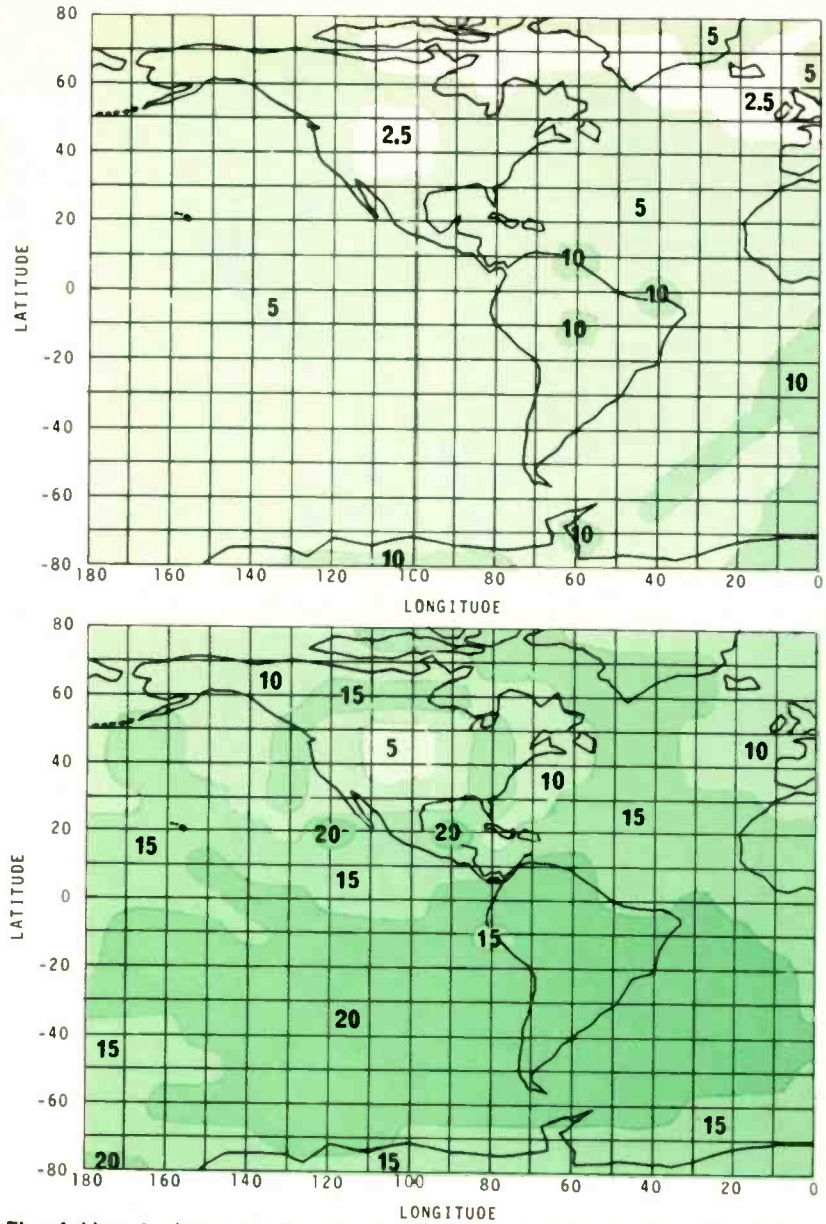


Fig. 4 Map A shows the frequencies (in MHz) around the Western Hemisphere that are predicted to be the best for WWV time announcements for December nighttime. Map B is for December daytime.

such announcements each hour on WWV and 23 on WWVH.

Commercial Use

Even with all these changes, one might never think of hearing WWV time signals coming from anywhere but the WWV transmitters at Fort Collins, Colorado. But, that also may change. The new time announcements are arranged so that WWV on-the-hour time signals can be rebroadcast as a public service by any commercial broadcast station capable of tuning them in on a receiver. The National Bureau of Standards only requires that the rebroadcast be direct and not delayed, and that NBS is identified as the origin of the announced time.

To allow this, the new on-the-hour broadcast will say: "At the tone (pause) 23 hours Greenwich Mean Time." (tone) (pause) "National Bureau of Standards Time." (pause) "This is radio station WWV, . . ." The part to be rebroadcast would be only the tone marking the beginning of the hour and the words "National Bureau of Standards Time." The local announcer would identify the hour of the tone according to his own time zone.

In order to make sure the time announcement can be rebroadcast reliably, the WWV signals must be continuously receivable at the commercial transmitter locations. Due to propagation variations, this is not generally the case on a given WWV transmission frequency at an arbitrary transmitter location. In the continental U.S., however, at least one of WWV's frequencies should always be receivable. A frequency diversity receiver should thus provide the reliability needed for rebroadcast purposes. Such receivers are available commercially from at least one company specializing in WWV receivers.

For general listening use, almost any short wave receiver will suffice. However, there are a number of special purpose timing receivers available capable of being fix-tuned to any of WWV's frequencies. For those who are interested in WWV's geographical coverage on its various frequencies in the Western Hemisphere, some maps giving best usable frequencies are provided. These plots are the result of computerized calculations of coverage predictions made by NBS before relocating WWV from Greenbelt, Maryland to Fort Collins, Colorado in 1966. They take into account seasonal and day-to-night variations and also variations due to the 11-year sunspot cycle. The peak of the sunspot cycle occurred in 1969.

So far, nothing has been said about the source of WWV's time. This is, of course, the world-famous NBS atomic clock located in the NBS research laboratories at Boulder, Colorado. Fort Collins is located 50 miles away and has its own clock system, so intercomparisons must be made with the Boulder clock to insure that the Fort Collins clock is kept in agreement. These are made every day using the signals from a Denver television station to relate the times of the two clocks. The time of reception of a specific "sync pulse" is noted at both Boulder and Fort Collins. Knowing the television signal propagation delay between the two locations then permits a time comparison accurate to a few billionths of a second.

While this is a much better accuracy than can actually be received on WWV, it insures that the almost incredible accuracy of the atomic clock—about a part in 10^{12}—is available to prevent any long-term drifts or fluctuations from occurring in the WWV clocks. That will also make sure that old timer WWV keeps right on ticking away.

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Two Views on Telephone Remotes

Couplers Reduce costs

By Gerry Gibbs, CE, KMNS, Sioux City, Ia.

When the telephone company introduced its long sought increased rate schedule to the broadcasting industry last September, many in the industry found it necessary to review their fall line up of sports coverage.

Just when everyone was getting their fingers in the sticky mess and thinking they had it all figured out, the Northwestern Bell Company came up with the answer to the dilemma in their own device, commonly known as a voice coupler. The coupler, which is a simple device that mounts on the rear of any telephone, can be rented by anyone for a mere 50 cents per month. The coupler provides a protective interface for the electrical connection of an audio amplifier to the public telephone network.

Since many radio stations have a number of local radio channels they use on a daily basis the year around, the new flat rate of $10 a month can add up to a costly sum in a hurry. This article deals primarily with ways to put the coupler to an even more extensive use and extend the savings to local radio loops in addition to the long lines it is more commonly used for.

Enter The Coupler

The telephone company introduced the voice coupler attachment for use with any business phone installation on a direct dialing system. Many stations are familiar with these and are already using them. Reviewing briefly, the voice coupler eliminates the need for a broadcast loop over a long haul, which under the new rates can be too expensive for many smaller market stations. With the voice coupler,

Build Your Own

By Terence King, CE, WALL, Middletown, N.Y.

I noted with interest Elliot Full's article on program transmission over the regular telephone system in February **Broadcast Engineering** and would like to expand that discussion with the information developed from our recent investigation of the subject. WALL has converted three of its daily remote broadcasts to dial system operation with excellent results. We have also used the system for sports and other remotes.

Consideration of this type of system must begin with the major component . . . the commercial telephone system. The system uses a DC bias voltage that is modulated by the varying resistance of a carbon microphone. In our location the DC source from the phone company central office has an effective source resistance of about 500 ohms. The DC supply is nominally 48 Volts; therefore, the short-circuit loop current is about 100 Milliamperes.

To keep audio-frequency changes in loop current from having high losses, inductance coils are inserted in series with the line. In this way the impedance at audio frequencies is much higher than the DC resistance and losses are low. The inductance coil in a regular phone (the phone company calls it the "network") has several windings and one feeds the handset earpiece. The DC resistance of a regular phone is about 200 ohms.

Now . . . we want to feed audio on and off the line and do this without disturbing the necessary DC system levels or introducing unnecessary losses. Audio voltage in the regular system is divided across the inductance coils at each end of the local circuit. To get maximum level in receiving, we can go to a higher-than-usual DC resistance and AC reactance at our end. Up to 2500 ohms DC will reliably "hold" the circuit, but we found that about 1000 ohms gives almost maximum audio takeoff with no chance of an unintentional "disconnect".

Audio Feed

So much for DC: Now audio. We are normally going to feed audio and receive it at an impedance of 600 ohms, so let's look at the series and parallel reactances required for minimum losses.

First, we must use capacitors to

only a normal business phone line is ordered at the remote site, and the broadcaster hooks up his telephone with the voice coupler and dials his way through to the radio station. As the contact is made, he has normal two-way communication as with any regular phone call, and can establish that he has a good clean connection. If not, he can hang up and re-dial for a better connection. Once this is established, then he connects his audio amplifier to the voice coupler with a phone plug and he is ready to broadcast through his regular microphone and audio equipment.

The phone handset is laid aside . . . not hung up. Order an exclusion key on the phone too . . . it mutes the handset. The only costs involved are for the installation of the business line, the regular monthly rate, and normal toll call rates for the time and distance of the call. In terms of cost comparison, the small sacrifice in voice quality, which usually is hard to detect, is well worth the difference in cost. In most cases it's nearly 50 percent cheaper!

Extension Phones

Some broadcasters may be having difficulty in obtaining their own voice coupler telephone to carry with them in their "ditty" bag. The easiest way to get one is to contact your local phone company office and order an extension phone with a coupler attached. Make it a "portable" extension phone so you'll be sure to get the mating plug that matches the IFL connector. You will want to order one for each of the phone lines you have installed at remote sites.

The extension phone need never be physically installed at your station. You just order it that way to get the portable phone which you then carry around with your regular remote broadcast gear. An extension phone normally costs $1.75 per month and the coupler 50 cents, making the total cost $2.25 per month for the convenience of having your own phone.

Most of the data released concerning the voice coupler hookups deal with the cost savings on long distances and interstate connection rates, usually starting at 30 miles and above. However, there are cases and areas which the new rates have hit the local station pocket books that can be further allieviated by using the voice coupler.

In the past it was feasible to have several local channel radio loops permanently installed on a yearly basis for daily programs, since the costs generally ranged from $3.00 to $7.00, depending on distance. Now, however, all local channels within a 25 mile radius of the station cost a flat $10 a month, even if it's just across the street!

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block the system DC from our equipment. The reactance of a 2 Microfarad capacitor such as Mr. Full was using (the same value is in the Western Electric 30A voice coupler the Phone company supplies) is 1256 ohms at 100 Hz, which we may set as our low-frequency point. This much reactance introduces a loss of about 10 dB at 100 Hz. The only answer is more capacitance . . . say 50 to 100 Ufd. . . . which can be obtained with non-polarized electrolytics. A 50 Ufd. capacitor gives us a reactance of 50 ohms at 100 Hz and small losses. This series reactance is in the circuit at both ends and is important in sending AND receiving.

Now for parallel elements. First, there is line shunt capacitance that tends to increase losses at high frequencies. We have no control over that factor. Then we have the parallel inductive elements which consist of the reactance of any telephones "off-hook" in the system, the isolation transformer in our receiving equipment (we can assume it to be high in a wide-range transformer), and the impedance (reactance plus resistance) of the "network" we build into our coupler unit. The reactance of a regular telephone "network" is not very high down at 100 Hz. Our system uses a 7 Hy. inductor rated at 50 Milliamperes (Allied Radio #54D-1408, $1.53) which has a DC resistance of 550 ohms and a reactance of 4400 ohms at 100 Hz. To bring the total DC resistance to the 1000 ohm level mentioned earlier, we add a 470 ohm resistor in series with it for a total of 1020 Ohms.

Coupler Layout

Figure 1 shows the arrangement of components for a coupler unit with minimum losses in sending and receiving. The unit "holds" the line so that after contact is made all phones in the system can be hung up. NOTE: Do NOT punch "hold" in a system that has that feature as this terminates the line in a low, lossy resistance. The zener diodes and fuse provide positive protection to the Phone Company against any application of dangerous voltages to their lines or equipment.

Notice that the two electrolytic capacitors are connected back-to-back to give a non-polarized characteristic. This is necessary because in many exchanges the line polarity actually reverses when connection is made to an out-of-town line. (I

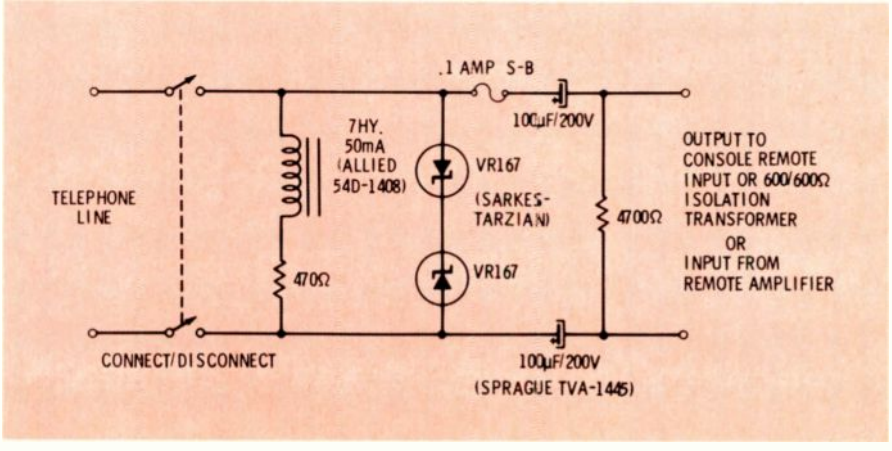

Fig. 1 A basic coupler.

Before you cancel some of these local loops . . . consider the use of the voice coupler again, if the location of that line already has a business phone installed there. All you need do is have the phone company install a voice coupler on the existing phone, and bill you for the installation and the monthly fifty cents for the coupler. Then connect your amplifier into the coupler, check it out, and have that $10 radio loop removed. You'll save $9.50 a month on every one of these loops that you might have situated around town.

It would be a good idea to talk to the business place where you have your remote and explain your plans, because you're also going to have to instruct whoever is going to use it on how it works. The coupler will have no affect on their phone, and you pick up the tab for the coupler cost. Everyone should be happy.

Other Advantages

There is one other distinct advantage in using the coupler. If your remote amp should develop some difficulty before or during the broadcast, the person doing the broadcast can always pick up the phone handset and do the program right on the phone.

At our station we had a radio loop that crossed over into another state. This automatically put it on a long line connection. With the old rates this line was costing us $7.50 a month on a year around connection. Under the new rate structure the same line went up in price nearly triple, to $20.30 a month. That's hard to live with, especially when the remote location was only about 3 air miles away. However, an interstate hookup is what made the price jump so high.

Rather than lose the remote facility, we simply had a voice coupler installed on the business phone located there and now, the cost is only 50 cents a month for the coupler. We don't even have a toll charge to pay, because its close enough to be classed as a local phone call. As you can see, we came out better than even the old rate would allow.

In summary, we now have three local channels which cost $1.50 a month total, as compared to $30 with the radio loops, and one long line loop that costs a mere 50 cents instead of $20.30. I'm sure many stations with one or more of these local channel radio loops can find some areas in which they can save money. After all, that's part of what it's all about. Who knows, maybe the boss will recognize the savings by giving the engineer a raise. It's worth looking into.

Your local phone company can furnish any details on exactly what you'll need for your particular hookups. ▲

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don't know why either!). This unit is universal and is used for coupling at both ends of the line. Of course the lines are bi-directional and material can be sent either way with equal results.

Automatic Answering

Figure 2 shows a coupler with an automatic answering feature. We find this very convenient in our operation and have it installed on an unlisted number dedicated to this function only. Any incoming call is instantly connected into our remote input system and the "call" light located on top of the console lights. The operator may then feed cue (if he is busy) or talk and listen to the remote with his regular talkback system. At the end of the remote broadcast the "disconnect" switch (part of the call light in our case) is pushed to clear the line.

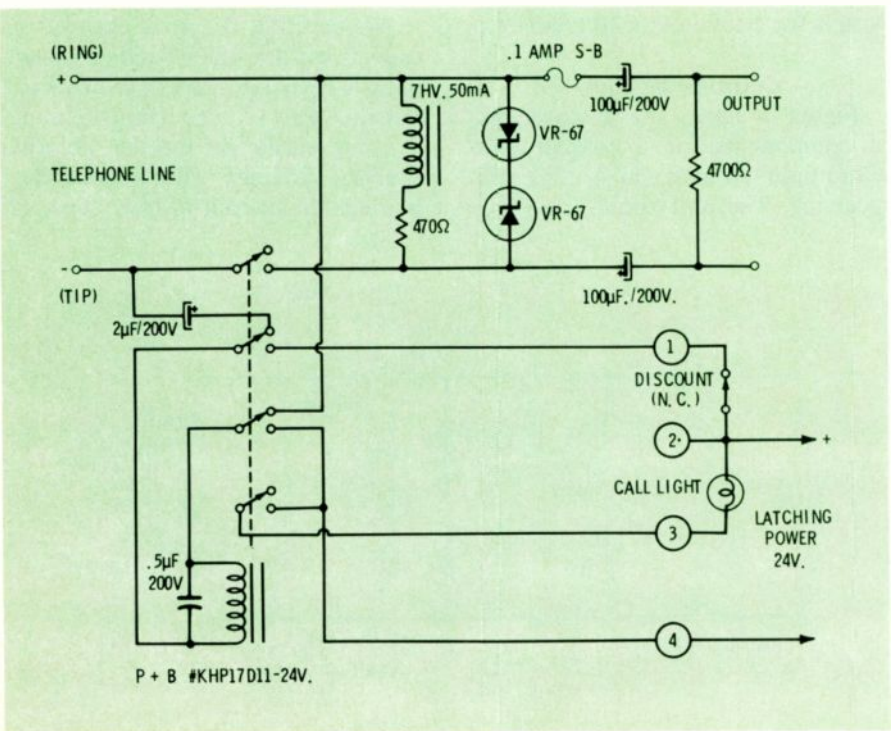

Fig. 2 Automatic answering coupler.

This unit consists of the coupler of Figure 1 with a relay-operated connect/disconnect switch. In the ready condition the relay coil is connected across the incoming line through a 2 Ufd. capacitor. (This can be an electrolytic, if line polarity is observed). When a call comes in, the ringing AC is coupled to the relay and the .5 Ufd. capacitor across the coil holds a charge long enough for the 24 volt local supply to latch it. Without this, the relay would act as a self-interrupted buzzer. Once the relay is latched on, it connects the coupler to the line and lights the "call" light. Pushing the "disconnect" switch breaks the latching circuit momentarily to open the relay.

If no convenient source of latching power is available, a mechanical latching relay can be used and reset mechanically or electrically. If a

different type of relay is used, you may have to experiment with the capacitor values to get reliable latching without latching on dial pulses. Our system receives calls from three remotes daily with excellent results.

On the question of levels, measured audio on local telephone calls in our area reach + 10 VU. We have fed over + 20 VU before waveform distortion begins locally. The headroom of intercity loops is less and suggests that levels should be held to less than + 10 VU when feeding such circuits. In practice, we simply feed the normal + 4 VU from our remote amplifiers with excellent results.

System Fidelity

What type of overall fidelity can be expected from this type of system? Within the local calling area results have been outstanding. Within 5 miles or so we get a frequency response of about 50 to 10,000 Hz plus or minus 2 dB. Noise runs about 45 dB below received program. On intercity circuits the Phone Company equipment is the limiting factor. If it goes through a carrier multiplex system (as it probably will), bandpass filters will roll the response off sharply above 3500 Hz. This roll-off is fast enough to limit crosstalk in the multiplex system and not much improvement can be made with equalization. The low end can be improved if you have an equalizer that provides a boost there. A good, clean 300 to 3000 Hz voice signal sounds good for news and sports remotes, however.

We hope this information will prove helpful to those setting up dial system program equipment. We don't expect this to be the last word on the subject and would be interested in other work being done in this area. There must be a broadcast engineer with telephone experience who can fill us in on the workings of the commercial system. We use it every day, but we might be hard-pressed to produce a working schematic of the components involved in an across-the-town call.

The implications of the "Carterphone" decision allowing connection to telephone facilities make it important to all of us to better understand their technical possibilities and limitations. ▲

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Enter the Curve Tracers

Part II of 2 parts

By Carl Babcoke

Because transistors often are soldered to circuit boards, in-circuit testing can save valuable time while troubleshooting, also, in-circuit testing reduces the possibility of damaging the transistor.

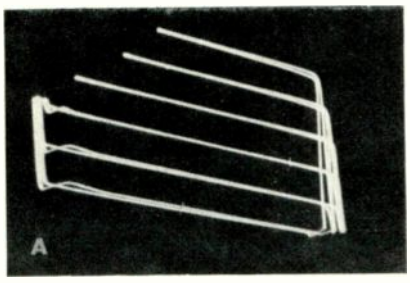
The Jud Williams Transistor Curve Tracer Model A is designed to locate defective transistors in most circuits.

The family of curves produced by in-circuit tests are radically different from those produced with the transistor out of the circuit. (See Figure 1.) Williams advocates that these displays be called "signature patterns", and suggests that they be added by engineers to their schematics after the pattern for each normal in-circuit transistor has been determined.

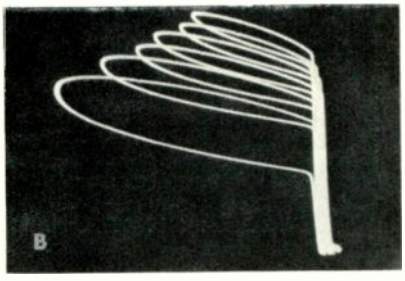
Capacitances and inductances in the circuit often make loops out of the curves, while resistances cause the curves to tilt as though the transistor were leaky. For example, a .25-mfd capacitor (without any transistor) connected between the base and collector clips of the tracer probe produces an oval shape, as shown in Figure 1.

Higher setting of the BASE CURRENT switch (often to the full 1000 μA position) and the VOLTAGE control are required to overcome the loading of some circuits. By comparison, most transistors can be tested out of circuit with only 10 μA of base current.

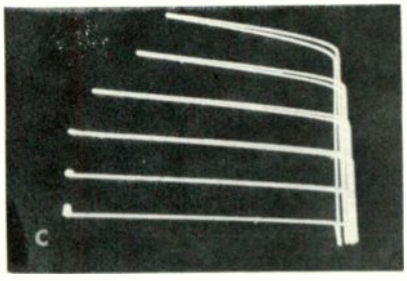
Distortion of the signature patterns often can be reduced by con-



(A) Curves of a 2N408 PNP transistor in a resistance coupled audio amplifier. Base-emitter conduction in the following transistor amplifier stage causes what appears to be an avalanche condition at the end of the zero base current line.

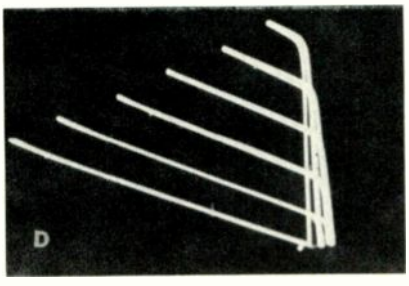


(B) Signature pattern curves of a 2N408 PNP transistor in an output circuit which includes a transformer in the collector circuit, but with the speaker disconnected. BASE CURRENT set for 10 μA.

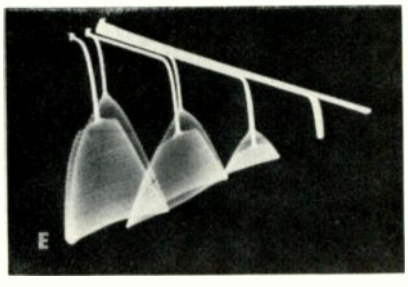


(C) A NPN audio output transistor with a transformer and speaker connected to the collector circuit produced curves resembling out-of-circuit ones. BASE CURRENT switch set for 20 μA.

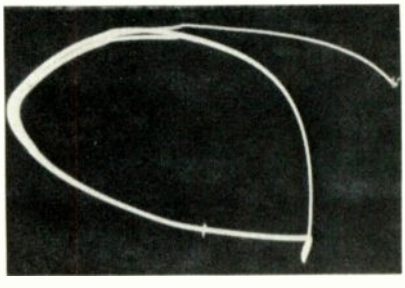
Fig. 1 Examples of in-circuit transistor curves.



(D) Signature pattern curves of a mixer-oscillator PNP transistor in a portable radio resemble those of a leaky out-of-circuit transistor. However, a BASE CURRENT setting of 1000 μA was necessary because of loading by the circuit.



(E) The same transistor and circuit as in (D) gave this set of false curves which include pulses of RF oscillation when the POLARITY switch was changed to the incorrect NPN.



(F) A near-ellipse is produced by connection of a .25-mfd capacitor between the base and collector clips of the probe.

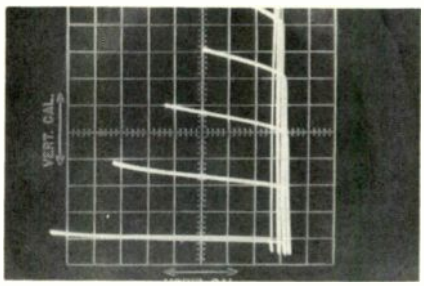


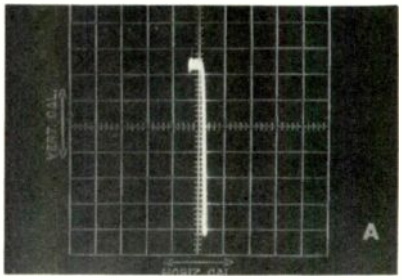
Fig. 2 Curves of a transistor measuring a beta of 40. Calibrate the scope for .1 volt per vertical division on the graticule, then with the BASE CURRENT switch set for 10 μA, each division between the curves represents a beta of 100; at 20 μA each division represents a beta of 50. In this example, the BASE CURRENT switch was set for 50μA, therefore each division represents a beta of 20.

necting together the positive and negative voltage supply terminals of the circuit under test (no power is applied to the circuit during in-circuit tests with the tracer).

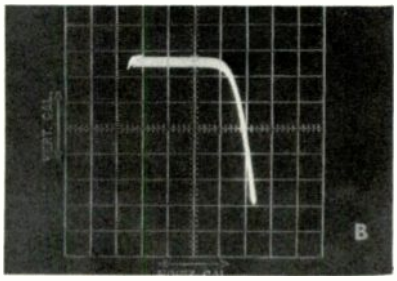
Several typical signature patterns of good in-circuit transistors and one interesting pattern resulting from the use of wrong polarity are shown in Figure 1.

It is clear that effective in-circuit testing of transistors can be done with this curve tracer, especially if comparisons with known good transistors are used to aid interpretation of borderline cases.

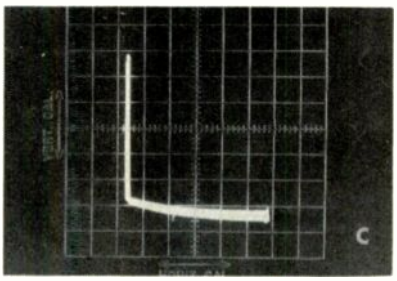
Although it is seldom necessary in practical servicing to measure accurately the DC beta (the height of the curves tell the approximate gain), such a reading is possible. Calibrate the gain of the vertical amplifier of the scope so that each vertical division of the graticule is .1 volt. Then with the BASE CURRENT switch set for 10 μA, each division represents a beta of 100, when the space between the two desired curves is measured. Figure 2 shows transistor curves for a beta of 40. Each division represents a beta of 50 when the base current is 20 μA, etc.



(A) Curve of a power supply diode connected between the emitter and collector clips of the external probe. POLARITY switch is set for NPN. Reverse the polarity and a horizontal line should be obtained, indicating an open circuit.

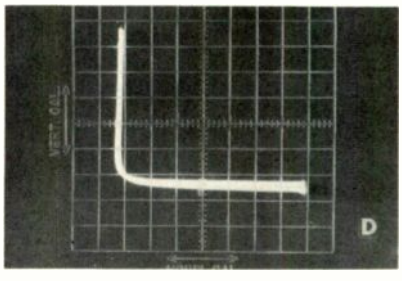


(B) The right angle curve of (A) widened by increasing the horizontal gain of the scope. A good diode should have this horizontal part of the angle, while a shorted diode will produce only a vertical line.

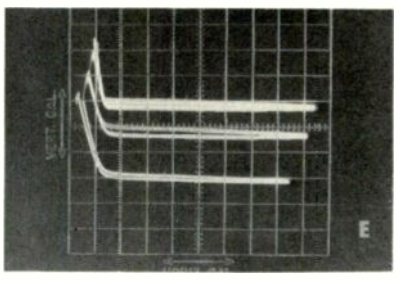


(C) Curve produced by a zener diode connected with its cathode to the emitter clip and its anode to the collector clip. The POLARITY switch should be set for PNP. The base-emitter junction of a silicon transistor shows the same zener curve. Incorrect setting of the POLARITY switch produces the normal diode curve shown in (A).

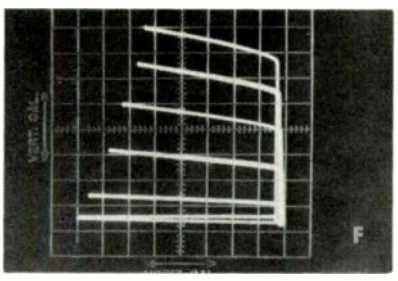
Fig. 3 Out-of-circuit tests of diodes, FET's and SCR's.



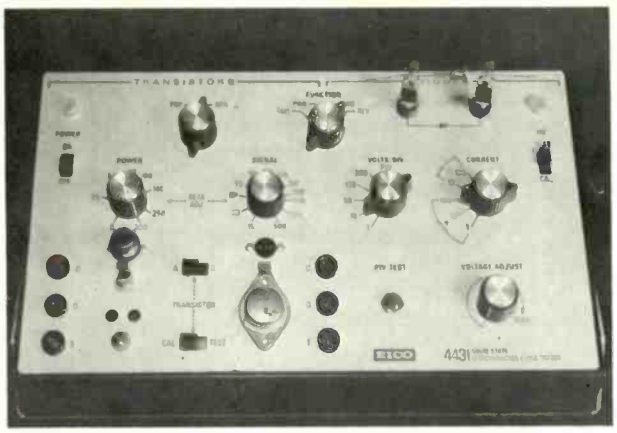
(D) Leakage and avalanche voltage are best shown with the base disconnected, but emitter and collector connected normally. This 2N410 transistor was not leaky, but showed avalanche at about 28 volts.



(E) A FET of unknown characteristics produced this unusual waveform. It seems advisable to test a known-good FET as a standard before testing a suspected one.



(F) Surprisingly, one SCR produced a set of curves very similar to those of a power transistor.



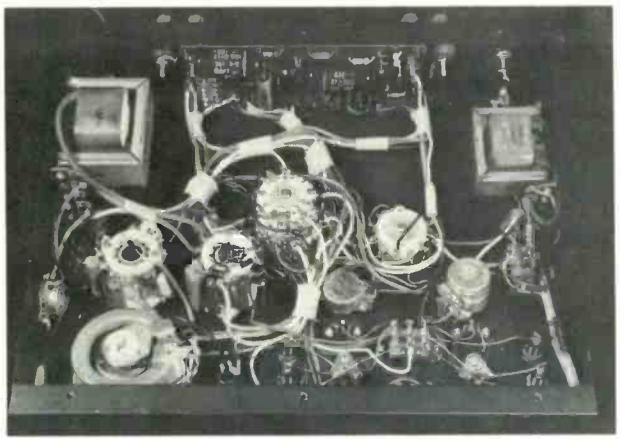
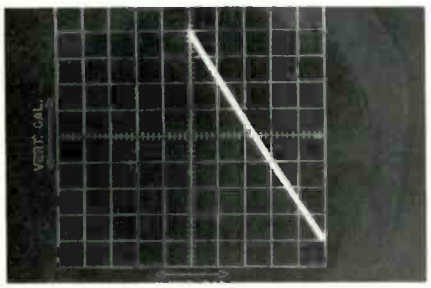
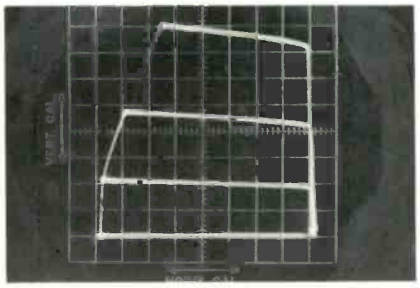


Fig. 4 Front panel layout and the internal wiring of the Eico 443 Semiconductor Curve Tracer.

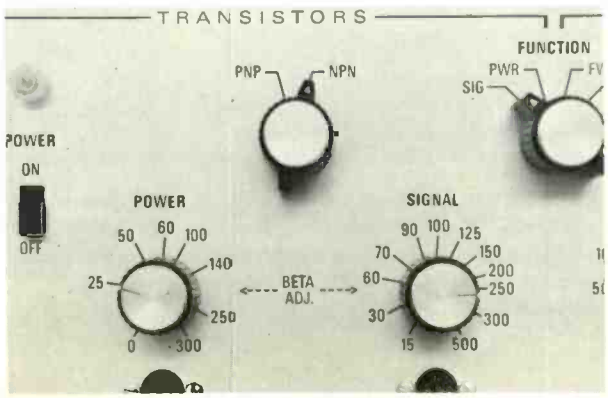


5A Calibrate the scope for transistor beta tests with the Eico 443 by adjusting the horizontal gain, vertical gain and the centering controls on the scope for a 5-by-8 division diagonal line.



5B Typical of curves obtained using the Eico 443 are these curves of a non-defective PNP transistor which measures a beta of 60. Adjust the beta knob until the total height of the waveform is 8 divisions, then read the beta from the dial calibration.

5C Power and signal beta calibrations on the transistor-testing side of the curve tracer.



Testing Other Solid-State Components

Go/no-go tests of solid-state components, such as diodes, zener diodes, SCR's and FET's, also can be made with the Williams curve tracer, although the instrument was primarily designed for transistor testing. Typical waveforms obtained when these other solid-state devices were tested out-of-circuit are shown in Figure 3.

The base-emitter junction of silicon transistors exhibit zener action when tested as a diode. This is a positive way of identifying silicon alloy type transistors, since germanium types do not exhibit zener action.

Using The Eico 443 Transistor-Diode Curve Tracer

Another solid-state curve tracer suitable for use in electronic servicing is the Eico 443; both the front panel and the internal wiring are shown in Figure 4. The design of this tracer is somewhat different from that of the Jud Williams tracer, and so is the resultant pattern.

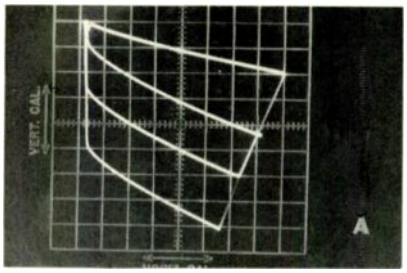
One strong feature of the Eico 443 is the accurate series of tests for diodes, including reverse leakage, maximum PIV and voltage drop in the forward direction.

Four combination binding post/banana plug jacks are provided on the rear of the cabinet, for connection to a scope. It appears, from the function and spacing of the posts, that the tracer can be plugged directly into the binding posts of the Eico 465 DC scope by the use of four male-to-male banana plug adapters. A 10-by-10 division graticule for use on any scope is included.

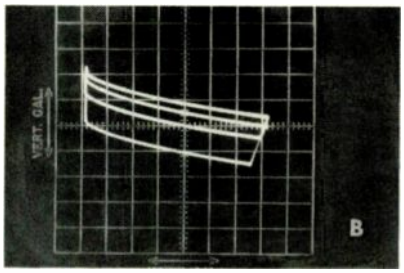
The Eico 443 is available in either kit or wired form. We built the kit version and encountered no problem; the tracer worked on the first try.

Testing Transistors With The Eico 443

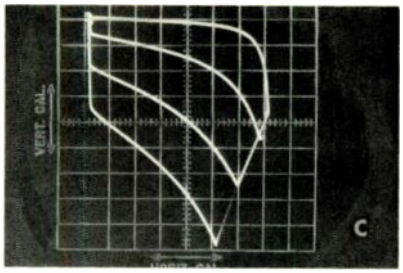
A zero base current line and three steps of base current are supplied by the Eico unit, giving four curves. All small, or "signal", transistors are tested with 10 volts applied to their collectors with a maximum current of 12 milliamps.



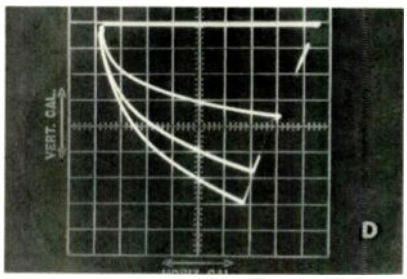
(A) A NPN silicon transistor with excessive leakage that causes the curves to be tilted.



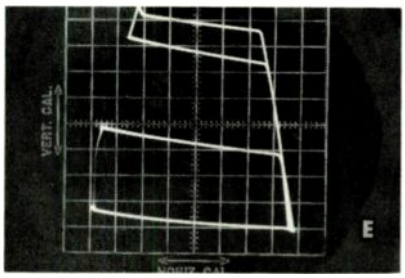
(B) These curves of a NPN small-signal transistor show excessive leakage, and a beta below 15 (because the curves cannot be adjusted to 8 divisions high).



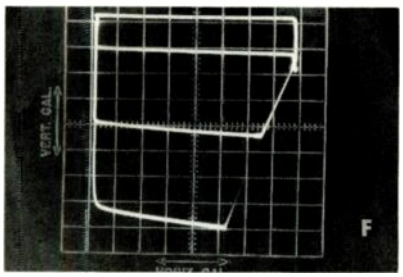
(C) Another NPN small-signal trantor with a beta measuring over 500, but with avalanche at a low collector voltage and excessive leakage.



(D) The forward resistance of the base-emitter junction measured on an ohmmeter a normal 110 ohms, but the base-collector resistance was an abnormal 1.2K ohms. Notice the sloping zero-collector-voltage side of the curves. Beta measured less than 15 on the Eico curve tracer.



(E) Excessive leakage is indicated in these tilted curves of a NPN power transistor, and the beta tested only 25.



(F) A high beta of over 500 was measured on this NPN silicon small-signal transistor. However, the avalanche at only 10 volts would prevent satisfactory operation in many circuits.

Fig. 6 Typical curves obtained from defective transistors.

Power transistors are tested separately, using another beta-calibrated scale at 10 volts of collector voltage and a maximum of 1 ampere.

Pre-setting of the vertical and horizontal gain controls of the scope by means of standard voltages from the curve tracer is necessary if calibrated readings are needed.

Calibrate the scope which is to be used with the curve tracer as shown in Figure 5A. A typical curve of a non-defective transistor is shown in Figure 5B. Notice there are four curves, including the zero base current line. Figure 5C shows the separate panel markings for "power" and "signal" transistors.

Several typical curves of abnormal transistors are shown in Figure 6. Leakage, if any, is indicated by the tilt of the zero base current line.

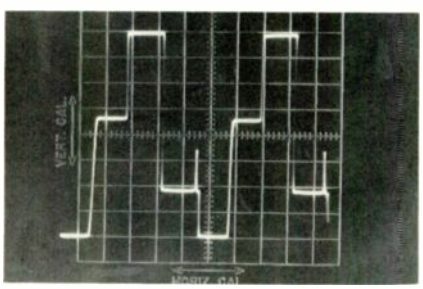


Fig. 7 Base-to-emitter voltage (without a transistor) in the Eico 443 curve tracer shows zero and three steps of base voltage.

Testing Diodes

A different scope calibration is needed for diode tests. Rectifier diodes can be tested for reverse leakage at any voltage between zero and 1400 volts of peak-inverse-voltage (PIV) at 1, 10 or 100 microamps per scale division. Forward voltage drop can be measured at either 10 or 100 milliamps per scale division.

Zener diodes also can be measured for the exact zener voltage at any desired current.

How The Eico 443 Works

The voltage applied between base and emitter during beta tests is shown in Figure 7. There are zero and three different steps of voltage, but they are not in sequence. This accounts for the faint lines across the ends of the curves.

Both the Jud Williams and Eico curve tracers tested the beta of transistors accurately enough for any practical use. The Williams machine is slightly faster to operate than the Eico, and can be used to check transistors in-circuit; however, the Eico gives higher accuracy on diode tests.

Aside from in-circuit tests, both units can give valuable assistance in the selection and matching of components after troubleshooting or before construction of assistance circuits. ▲

bookreview

The Techniques of Special Effects in Television gives details on all that the title implies. Written by a senior designer with BBC, the author spells out the details on how to achieve most any visual effect possible in TV (and film as well).

From bullet and bomb effects to animated captions, this one book covers it all. Includes nearly 400 pages of large and small budget scene effects and optical effects that can be achieved when only small studios and a limited number of cameras are available.

This book should be especially helpful to those working up local ads, producing locally originated shows and special programs. A standard for educational broadcasters.

This book is available through Hastings House, Publishers, Inc., 10 East 40th Street, New York, N.Y. 10016.

Circuit Problems and Solutions is now available in three separate volumes. Volume 1: Elementary Methods covers Ohm's Law, Resistive Circuits, Series—Parallel Resistive Circuits, Meters, Resistance, Magnetisim and Electromagnetism and other topics.

Volume 2: Network Theorems extends the problem-solving coverage begun in Volume 1. The detailed, step-by-step solutions clearly demonstrate how to apply such methods as: delta to wye and wye to delta transformation, Thevenin's Theorem, Norton' Theorem. Without the aid of an instructor, the student equips himself to solve problems in AC and DC circuitry.

Volume 3: Transistor and Tube Circuits gives solutions to transistor and tube circuit problems. This volume completes the coverage of circuit problems begun with Volume 1 and Volume 2, and reviews transistor and tube constants, decibels, and tuned circuits and covers such topics as transistor and tube audio amplifiers, power amplifiers, and RF and IF amplifiers.

These books are available through Hayden Book Company, Inc., New York.

Basic Motion Picture Technology is a comprehensive survey of the technology of film and its application in television. It is concerned with fundamentals and does not assume that the reader has a sophisticated technical background.

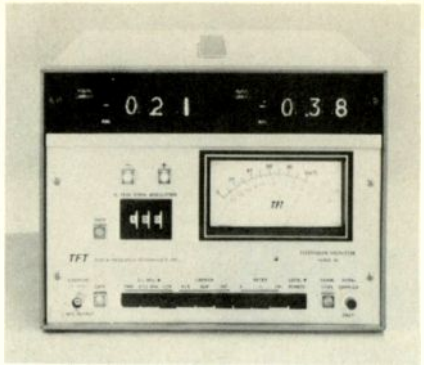
Treatment is based on professional practice for picture and sound, but both mathematical and electronic engineering detail have been kept to a minimum. Makes extensive use of clear and simple diagrams to illustrate both general principles and operational practice. Special effects and film processing and duplication receive special attention. Overall, must be rated as a necessary guide for film in TV.

The book is written by Bernard Happe, Technicial manager of Technicolor Ltd., author of several books and technical papers on film.

Available through Communication Arts Books, Hastings House, Publishers Inc., 10 East 40th Street, New York, N.Y. 10016.

NEW PRODUCTS

(Use circle number on reader service card for further information)



Besides its use as a monitor, the Model 701 can be used as a six-digit general purpose frequency counter. Conversion is made by depressing a single front panel pushbutton.

The Model 701 can be supplied for portable or rack mount operation. It is 11″ wide, 8″ high, and 15″ deep. Weight is 22 pounds and operating temperature is 0° C. to 50° C. Power requirement is 115/230 V.

Circle Number 60 on Reader Reply Card

Frequency And Modulation Monitor

A new frequency and modulation monitor that measures aural and visual frequency, and per cent aural modulation, up to 30 miles away and operates up to 18 months between calibrations has been introduced by **Time & Frequency Technology, Inc.**

Called the Model 701, the new monitor covers all UHF and VHF channels and provides digital readout of frequency errors. It requires frequency calibration only every 18 months in VHF applications and only every 6 months in UHF applications, to meet FCC requirements.

The Model 701 also has a built-in aural modulation calibrator and digitally settable peak flashers which display plus and minus peaks simultaneously.

Optional accessories include a super-stable oscillator that keeps the monitor in frequency for 12 years in VHF use and for four years in UHF use; a WWVB receiver, for direct calibration of the internal frequency standard; and an off-frequency and over-modulation alarm.

Six Channel Time Tone Receiver

With the recent changes in the WWV time signal format (including a voice announcement of the exact time each minute) the interest in time code receivers is increasing. With that in mind, let's take a look at the Simex Time Standard built by the **Coast Navigation School.**

Originally designed for use aboard ships, the Simex model 003 can be used in almost any location. The frequency is switch selected across the five WWV channels and CHU (the Canadian counterpart of WWV). With six frequencies available, it is possible to receive time signals, regardless of band conditions.

Unlike most other time signal and

communications receivers, the Simex unit is completely solid state. It uses two CA3028 IC's, nine transistors, and eight diodes. And since the unit uses a low drain design, it will operate for lengthy periods on batteries. An outboard 12 VDC supply can be used to power the unit when portable operation is not necessary.

In comparative tests against two general coverage communications receivers, the crystal controlled Simex on all bands during most hours of the night and day outperformed the other two in BE's lab.

Circle Number 61 on Reader Reply Card

Solid State Video Monitor

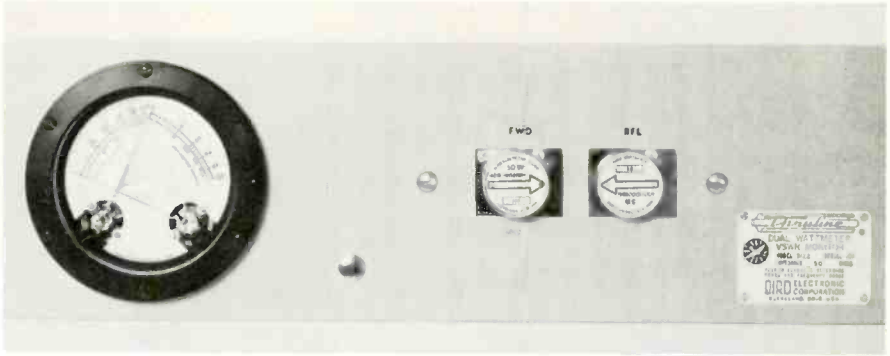
A new all solid state video monitor for use in business, industrial and educational surveillance systems has been introduced by **Magnavox.**

Called the model T-5905, the unit is compatible with any standard video monitor camera. It has a solid state chassis with an isolated transformer for maximum safety and reliability. It also features a 12" screen with 71 square inch face plate area, center resolution with 600 lines and front mounted on-off, contrast and brightness controls. The secondary controls for height, vertical linearity, vertical and horizontal hold are mounted on the rear.

Constructed of sturdy, high-impact plastic, it has an eight foot long power cord and concealed handle for easy portability. Dimensions of the unit are: 13½" L x 10¼" D x 13¼" H.

Circle Number 62 on Reader Reply Card

(Products continued on page 60)



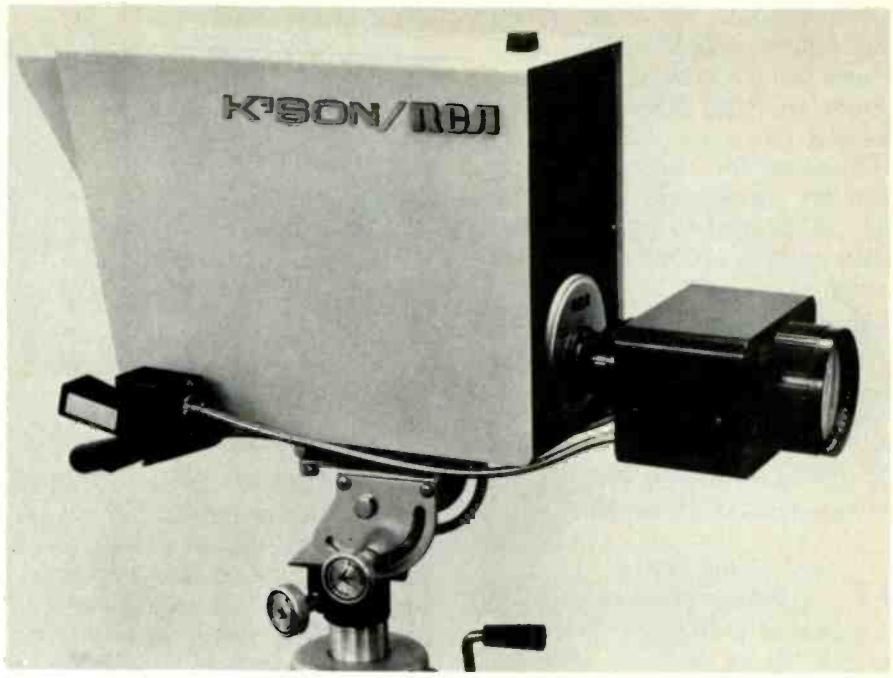
Wattmeter/VSWR Monitor

The new **Bird Electronics** THRULINE model 3122 Dual Wattmeter-VSWR Monitor displays three measurements at once on a single meter face: forward and reflected power are indicated by individual pointers and VSWR is monitored on a third scale from the intersection of the two power pointers.

Unlike most VSWR meters, the model 3122 does not require any adjustments to full scale deflection, or any switching before VSWR readings can be taken. The entire set of three transmission parameters is read out simultaneously during normal RF operations or during maintenance adjustment procedures.

Power and frequency range of the new Bird Dual Wattmeter-VSWR Monitor depend on two plug-in elements selected from more than 90 choices available with the company's THRULINE Model 43. Full scale power levels at ±5% accuracy range from 10 to 10,000 watts for forward indication and 1 to 1000 watts for reflected, in discrete frequency bands from 0.45-2300 MHz. (For increased resolution, the reverse power Element is ten times more sensitive than the forward power Element). Model 3122 Insertion VSWR in 50-ohm systems is a low 1.035 to the point of measurement.

Circle Number 63 on Reader Reply Card



CATV Camera

A new television camera has been developed by K'SON Corporation of Placentia, California. K'SON is the RCA Technical Distributor for Professional Television in Southern California. The new camera, a K'SON engineered adaptation of an RCA camera, has been named "The Moonlighter" because of the low light levels required for satisfactory operation.

According to a K'SON spokesman, The Moonlighter can operate at the low power of one foot candle, making it applicable for a wide range of remote location live, filmed and taped programs such as school sporting events, parades, graduation ceremonies or any events that have insufficient lighting to allow the use of standard cameras.

Designed for CATV, educational and industrial use, the K'SON/RCA PK530LL Moonlighter with viewfinder (to give its full title) offers good picture quality, operational simplicity and flexibility, all at low cost. Basic price for the Moonlighter is under $1900.00.

A selection of standard "C" mount lenses is available, including 5:1 and 10:1 zooms. The Moonlighter's controls have been located to provide ease of operation. With the exception of the full complement of viewfinder controls, the only external operating control is the on/off switch. Also available on the rear of the camera is a mechanical focus control to compensate for different-sized lenses. The Moonlighter is designed to be mountable on any tripod/dolly/pan-tilt assembly able to support a minimum of 25 pounds.

Circle Number 64 on Reader Reply Card

Closed Circuit TV Camera

Cohu Electronics, Inc. has announced introduction of a new high-resolution, closed-circuit television camera in the continuing Cohu Design 6000 Series.

Designed primarily to meet the exacting demands of data storage and retrieval systems, the new Model 6120 camera's corner detail and flatness of field make it practical for any application involving transmission of detail.

With a bandwidth of 32 MHz, the Model 6120 offers resolutions up to 1500 lines horizontal center, 775 lines vertical center and 900 lines in the corners. A larger vidicon—1½ inch—and 35mm lens mean surface can be viewed with greater detail. Superior picture fidelity is provided by a uniquely designed low-noise preamplifier and a wide range automatic sensitivity circuit.

Measuring only 15½ inches in length, 7½ inches in width and 5 inches in height, the 6120 housing is made of high strength cast aluminum. Opening the two-piece housing reveals total silicon solid state active circuitry, mounted on easily

accessible plug-in boards with convenient test points and adjustments.

The 6900 Series camera control in an aluminum alloy housing is available in a dual compartment rackmount enclosure that occupies only 5½ inches of vertical rack space or as a single unit portable cabinet.

Rapid on-line maintenance of the 6900 is facilitated by the modular design incorporating plug-in circuit boards for each control function: video amplifier, deflection, power supply and optional synchronizing generator.

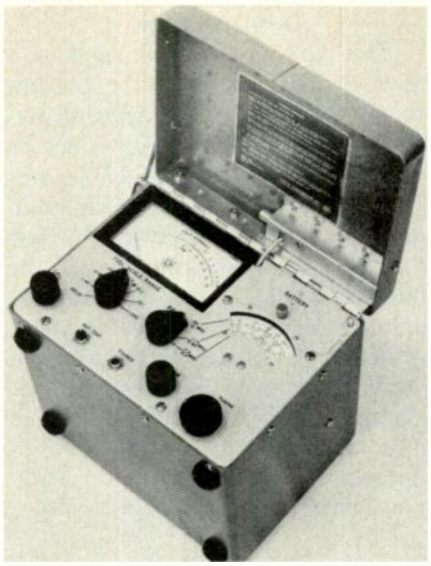
Circle Number 65 on Reader Reply Card

AM Field Intensity Meter

Solar Electronics Company has added an AM field strength meter to their product line.

The new unit covers fundamental, second and third harmonics of AM broadcast stations—540 kHz to 5.0 MHz. Sensitivity is 10 microvolts-per-meter. Bandwidth is 5 kHz.

The meter is solid state, and especially designed for use in adverse weather. Features include a simple means for calibrating in lieu of a known RF field, simplified operational sequence, and a 50 ohm input circuit so the unit can be used as a tuned voltmeter or null indicator. It also is shielded for operation in RF fields up to 10 volts-per-meter.



Circle Number 66 on Reader Reply Card

Color TV Source

Sylvania Electric Products Inc. is offering a color slide studio which feeds closed circuit RF or video television systems with program material derived from 35 mm slides and audio tape. Sylvania is a subsidiary of General Telephone & Electronics Corporation.

Model CSS-1 is a color television signal source which utilizes a Sylvania SC4679 flying-spot scanner tube with specially formulated phosphor for full spectral response. All electronic circuits in the studio feature complete solid-state construction.

The basic unit contains slide changer; flying-spot scanner with deflection yoke; all optics, splitters, and filters; deflection and high voltage module; photo-multipliers, pre-amplifiers and encoder. It mounts in a standard 19-inch rack and occupies 24.5 inches of vertical space.

The studio transmits over cable television, closed-circuit systems, and standard television broadcast facilities. It is specially suitable for advertising, local interest messages, information displays, and classroom use.

Color slides may be changed manually by a tone-cueing signal on the track of the audio tape. An

(Continued on page 62)

(Continued from page 61)

optional timer module also is available. It includes an interval timer which advances the slide tray to the next position at pre-selectable intervals from two to 20 seconds, and a 24-hour clock timer which cycles the equipment on and off for any pre-set period. The timer module also contains circuitry to accept 150 Hz tones from a pre-recorded tape and indexes slides in conjunction with prepared audio.

A tape transport, consisting of a continuous loop, two-track cartridge system, also is offered as an option with the CSS-1. It accepts NAB standard cartridges. Pre-recorded audio may be carried on one track while the other contains 150 Hz tone-cueing signals to change slides.

A sync generator also may be added to the studio. This option is equipped with integrated circuits to perform timing and processing functions and a crystal controlled subcarrier oscillator. It uses horizontal and vertical pulse rates, derived from color subcarrier, to provide proper color frequency interleaving.

Circle Number 67 on Reader Reply Card

Dolly System

This new unit brings together a television camera, monitor, camera mount, video tape unit, lighting and sound system. The unit provides its own lighting system, which is preset to remain on camera axis, even during panning and tilting. A few minutes' familiarization with the integral control panel permits any amateur operator to achieve near-professional results. No equipment need be removed for movement or storage. The **TV Dolly-Lite** will pass through any standard 32" doorway.

Circle Number 68 on Reader Reply Card

Digital Clock

A solid state digital clock capable of operating on either AC or DC power has been announced by **W. F. Sprengnether Instrument Co., Inc.** Designed for precision measurement of real or elapsed time, the instrument displays seconds, minutes, hours, and as an option, days. Other options include BCD, 1.0PPS, IRIG "C" Time Code Format and 50VA, 115VAC-50/60 Hz outputs. For performing various recording and control functions, hard contact closures at seconds, minutes, hours and days are provided.

Timing pulses can be advanced or retarded at the rate of 10 milliseconds per second for precise real time synchronization. The clock also provides for electronic synchronization with WWV. All controls are located on the front panel, including a switch with which the display can be turned off to reduce power consumption to a minimum during portable 12VDC operation.

Designated as the Model TS-200, the clock measures approximately 4 x 10 x 8 inches and weighs 7.5 pounds. The basic unit price is $1170.00.

Circle Number 69 on Reader Reply Card

Professional Tape & Head Cleaner

A brand new cleaner formulated for VTR, audio heads, magnetic tape and photo film is now available from **Nortronics.** The new cleaner, designed especially for professional recording equipment, is available as both liquid and spray. In either form, its use contributes to improved performance and extended life for magnetic heads and tapes.

The new cleaner can be used on cassette and cartridge tape recorders as well as conventional reel-to-reel equipment. Nortronics Tape/Head Cleaner preserves tapes and improves fidelity by eliminating accumulated dirt, film, and oxides. Since it is silicone free, it can also be used to clean guide parts, capstans, and pinch rollers. Most other available cleaners contain silicone, and therefore cannot be used for these applications.

Nortronics Tape/Head Cleaner is now available from Nortronics distributors in a 16 oz. aerosol spray can, with a 5 inch extender tube that directs the spray into crevices and hard-to-reach areas, and in liquid form in 8 oz. and 32 oz. cans.

Circle Number 70 on Reader Reply Card

Send your Engineer's Exchange Ideas To:
BE, 1014 Wyandotte
Kansas City, Mo. 64105

ENGINEER'S EXCHANGE

Four For One Remote Mike Adapter Box

On many occasions when called upon to do a special remote broadcast, requiring more than four microphones, we here at radio station WHEB have found our four channel remote amplifier was too small to do the job.

The first few times this happened we simply connected two four-channel remote amplifiers back to back. This worked fine except that it would require two men to transport all the equipment and to ride gain on two amplifiers. Another setback was that it took up more space than was set aside for the station, since usually there would be two or three stations doing the same broadcast.

Generally, when two amplifiers were used back to back, the announcer would simply open all mike pots. This would have worked fine except for the fact that with all the mike pots open, all kinds of unwanted background noises and echoes were picked up.

Only three of the mikes were used continuously (in this case, a City Council Meeting weekly) and one mike was used occasionally by the announcer to interject comments, another occasionally by the mayor and the other for the moderator. It was decided to somehow feed all the extra mikes into one spare pot on the remote amplifier, with the announcer selecting only that mike which would be used only occasionally. Since all the extra mikes, three in this case, would feed into the same pot, it was required that mikes not used, be killed to avoid cross pickup and noise pickup.

The unit that evolved is shown schematically and is known here as the "Four for One Mike Adapter Box."

The entire unit is built into one of the Bud type mini-boxes, with the four XLR-3-35 Cannon, single receptacles, with socket insert, mounted on the left end panel of the box. The five push button switches are interlocked and mounted on the front panel. The four switches used for mike control are all double-pole, double-throw, make before break types and the fifth switch can be of any combination. It is used only as an all OFF switch.

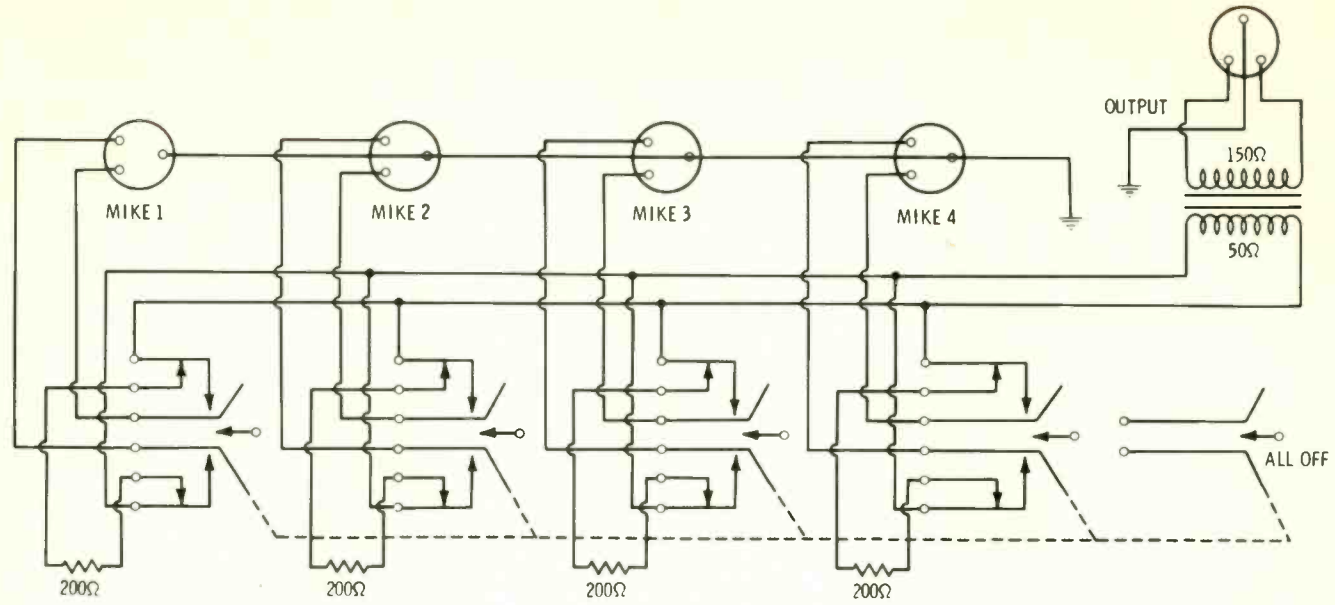
Since all switches are interlocked, depressing any one button will automatically disconnect all other buttons and place a dummy load across the output bus going to the output socket. In this manner, the load as seen by the remote amplifier, will always remain constant, regardless of the number of mikes in use.

The load resistors are 200 ohms each, giving an overall impedance of 50 ohms. In order to get a good match into the mike input channel of the remote amplifier, which in our case was 150 ohms, I used a 50/150 ohm matching transformer, of the UTC ouncer type, to feed output bus into the output socket of the adapter box.

The output socket used is Cannon XLR-3-36, single receptacle, pin (male) insert. There are no dangling wires on this box, so that in order to connect the output into the mike input socket on the remote amplifier, any of the station's mike extension cords can be used.

This unit has proved very effective. The announcer can now select any one of four additional mikes, as quick as it takes for him to depress a button.

When in use, the auxiliary pot on the remote amplifier into which the adapter is fed, is left open at all times, and all the announcer on duty need do is depress buttons when needed. All mikes can be used if needed simply by depressing all four buttons at the same time.



An improvement on this adaptor would be to use the newer illuminated push-button switches as this would make it easier to spot at a glance which mike was in use.

Antonio Vaccaro, CE
WHEB-WPFM
Portsmouth, N.H.

Quality Control For Religious Tape

With reference to your letter "What Do You Do With Poor Quality Religious Tapes" in February's issues, there is a simple two-part solution to this situation:

First, in setting up the arrangements for the program (i.e., with respect to broadcast contracts and agreements) have it understood that the client is to provide the tape, and it must be of acceptable quality. Specification of a newer "indestructable" type (eg. Scotch #175) is most helpful to the client, who, generally, knows very little about choosing a tape.

Second, adopt a "standard procedure" in the control room for locally produced tapes, whereby the announcer/engineer who is responsible for airing the tape, bulk-erases it after its last use before it is returned to the client. This insures a clean erasure for the next recording.

This system costs nothing and gives excellent results! If the tape supplied by your clients causes any problems, the station can supply the tapes, thereby controlling the quality, and pass on the cost to the client/sponsor. In the event of "no-charge" programs, the tapes' cost is tax deductable as a donation if the client keeps it at the end of its use!

I have had excellent results with this system at several stations. However, some folks like perfection and settle for nothing but the best. In this case, I have achieved an additional 100 percent increase in quality by going to 4-place head assemblies on the reproduce deck(s), whereby all studio cuts are played with a standard full track head, while "homebrews" are played by switching to the second playback

head which can be either a ½ or a ¼ track head, depending upon your preference.

This system gives the optimum s/n ratio for playback; however, some amount of bass boost will result from using a ¼ track head on a ½ tape, as also happens with a ½ track head on a full track recording. This is a normal occurance, and is generally not objectionable. Don't try to equalize it out, as degradation will result when the head is used for its proper width recording. No appreciable degradation or frequency response problems crop up if a ½ track head is used for a ¼ track tape!

For the fellas with the Sparta boards that put the mic on cue when the pot is turned fully counterclockwise, resulting in unnerving feedback: simply open the board and cut out the resistor (two resistors on stereo boards) which is connected to the switch on the mic pot. This takes about a half a minute, solves the problem nicely, and does no harm to the operation of the board!)

John B. Crutchley, Mgr.
JB Custom Audio Services
Div.—Brennan Electronics
P.O. Box 307
Defiance, Ohio 43512

How To Prevent Styli Damage

Damage to turntable styli is one of the hottest trouble spots in the broadcast control room. It is so easy to chip one of the fragile diamond tips and sometimes the damage stays hidden until the high's are sliced from a good number of records. This can be a disaster to a station who's prime selling point is the quality of it's sound.

Unless an operator is very conscientious and double-checks each possible case of damage before using the stylus again, the first warning of trouble is usually a sharp rise in the noise level from records that have been 'sliced.'

At WMCF, we took the following steps to reduce the chances of this kind of damage. First, we set the stops on our Shure pickup arms so they could not move outboard past the arm rest. Second, I glued a small piece of foam padding, (the pad from the stylus container) to the base of the turntable under the head arc between the rest and the platter.

Now, if an arm is dropped, the stylus will hit (1) Not at all as the arm slips into the arm rest, (2) the foam pad, (3) the felt turntable mat, or (4) the record surface. Needless to say, none of these will chip the diamond.

If I can only figure a way to stop operators from moving the platter after a stylus has dropped onto the felt mat and ripping the stylus assembly right out . . . we'll have it made.

Fred Chapman, CE
Station WMCF-FM
Stuart, Florida

Send Your Exchange Ideas to Broadcast Engineering Yes—We Pay

TECHNICAL DATA

For further information, circle data identification number on reader service card.

105. COMPUTER SCIENCES CORP.—A new technical bulletin, "Small Computer Automated Testing Facilities", is now available. The bulletin describes how automation can aid in testing of concepts as well as devices in a number of areas. By automating the experimental data-gathering function, it becomes possible to amass large amounts of data and to process it in real time as opposed to customary techniques of costly real-life installations and tests.

106. EASTMAN KODAK COMPANY—A new publication outlining procedures for recovering silver from photographic processing solutions which employs the entirely new Kodak chemical recovery cartridges and companion Kodak circulating unit is now available. Entitled "Silver Recovery with the Kodak Chemical Recovery Cartridge P," the new publication pinpoints how to install and use this recently introduced equipment. Details about the equipment, installation, how to change cartridges, and details of adapter kits and Kodak silver estimating test books are included. A handy table outlines the type of cartridge recommended for particular types of solutions from which silver recovery is made. Specific cartridge capacities (in gal.) and maximum flow rate (in ml/min.) for maximum efficiency are contained in this same table. A check list of what to do and what not to do is presented on the closing page.

107. GENERAL MICROWAVE CORP.—Bulletin M189 describes General Microwave's new 70-dB Absorptive PIN Diode Modulator/Attenuator. It operates from 200 MHz through 18 GHz. Switching speed is less than 200 nanoseconds for a step function input; less than 20 nanoseconds with a shaped circuit driver. The attenuation is flat to within ±1.0 dB over most of the frequency range. Low VSWR and insertion loss are featured.

108. LYNCH COMMUNICATIONS SYSTEMS—A new two-page brochure covering their E75 "Portable" Speech Scrambler is now available. The Lynch E75 Speech Scrambler offers total speech privacy on land, sea or air with operation from either telephone or radio communication circuits. Complete privacy of voice conversation transmitted over telephone circuits or radio is assured by the selection of any one of 1408 different code card combinations. The illegal tapping of telephone circuits or monitoring of radio transmissions will be heard