April, 1972/75 cents

BROADCAST ENGINEERING

the technical journal of the broadcast-communications industry

A HOWARD W. SAMS PUBLICATION

The New Cable Rules, page 19

First US FM Translator
Wow and Flutter Report
Cable Engineering Inside

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When it comes to cardioid dynamic microphone developments **AKG** is purposely creating a generation gap.

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Imitation is the sincerest form of flattery and while others attempted to equal the acoustical properties and duplicate the design appearance of the D-19 and D-24, **AKG** continued in setting the pace by developing a new family of transducers with superior performance characteristics.

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April, 1972 • Volume 14, No. 4

BROADCAST engineering

The technical journal of the broadcast-communications industry

in this issue...

ABOUT THE COVER

There are great expectations for CATV. Originations will play an increasing role. For up-to-date cable rules interpretations, see pages 19 and CE-2 in the Cable Engineering section.

DEPARTMENTS

BROADCAST ENGINEERING is published monthly by Intertec Publishing Corp., 1014 Wyandotte Street, Kansas City, Missouri 64105. Telephone: 913/888-4664.

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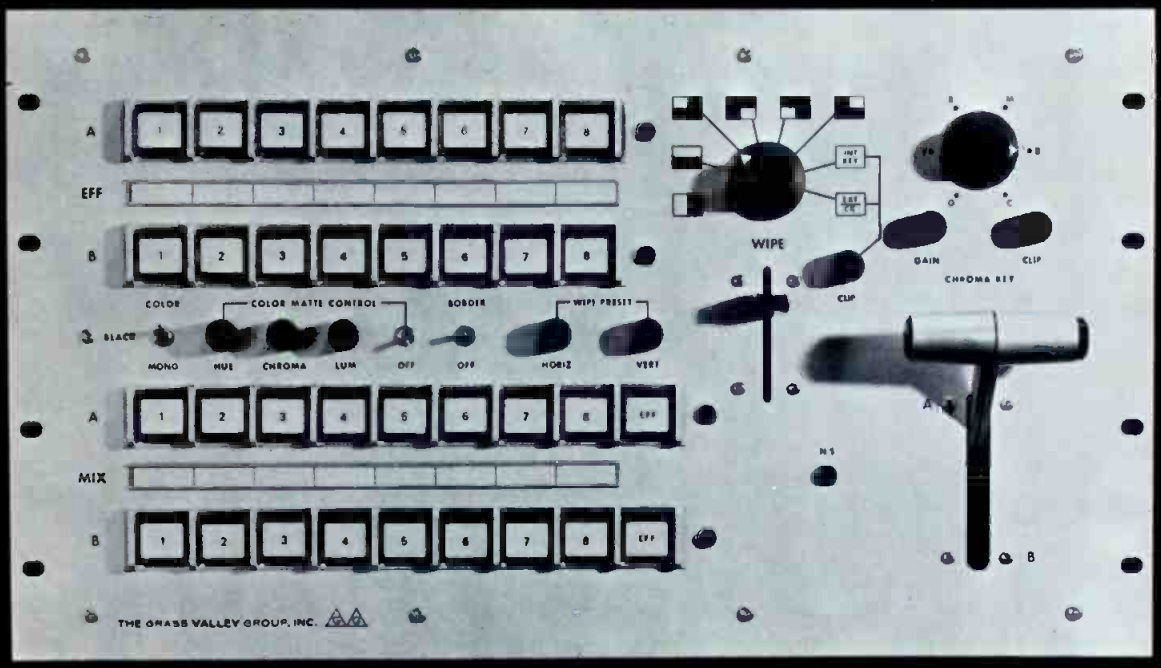

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DIRECT CURRENT FROM D. C.

April, 1972

By Howard T. Head

Broadcast Rules Revision Under Study

At the urging of Broadcast Bureau Chief Wally Johnson, an industry committee is being set up to consider a general revision of the Rules governing radio broadcast and auxiliary stations (See Jan. 1972 D.C.). Such a revision, which has been proposed from time to time, would be the first general revision of the present broadcast rules since they were originally written in the late 1930's. FCC staff members would participate in the Committee's work as observers. The Commission has been interested in bringing the broadcast rules, especially the Technical Standards, up to date but has found it impossible to make any real progress on a task of this magnitude because of staff limitations. A NAB proposal for the revision of Part 74 of the rules (broadcast auxiliary services) has been before the Commission for some time (See Jan. 1971 D.C.) but has received little attention because of the staff shortage. It is expected that the Part 74 revisions will be incorporated as part of the overall work of the Committee.

Part 73 of the rules relates to the regulation of both the technical and non-technical aspects of broadcasting. The Committee intends, however, to make a study of the technical regulations its first order of business since it is in this area that revision is most urgently needed.

Sauce for the Goose?

An FM broadcast station in the West has asked that the rules governing the operation of AM and FM transmitters by remote control be modified along the lines of the recently adopted television remote control regulations. The new television rules require a five-day-a-week inspection of transmitters when operated by remote control, but lower the requirement to once weekly where an auxiliary transmitter is licensed capable of providing 20 percent or more of the authorized power. The Commission's order establishing this requirement pointed out that one of the Commission's concerns was that of assuring continuity of service where remote control operation was employed.

The required daily AM inspections imposed a substantial burden on many AM licensees, particularly where the station employs different directional antenna systems for day and night operation. The problem is further compounded by the need for making the inspection within two hours after the pattern change, which varies over periods of several hours because of the seasonal changes in sunrise and sunset times.

In the meantime, the Commission has disposed of the last of several petitions for relaxation of the new television remote control rules, which are now expected to go into effect on schedule.

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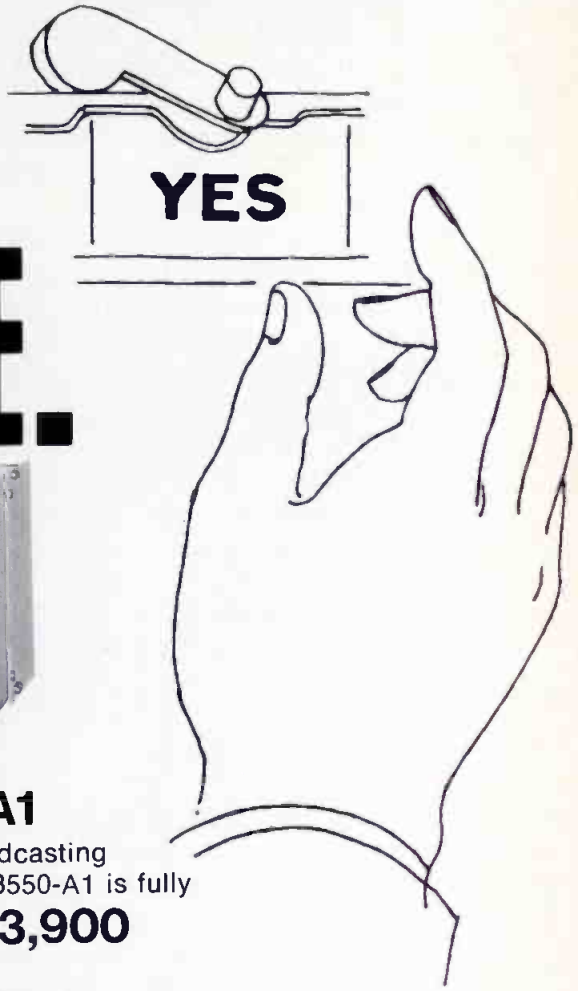

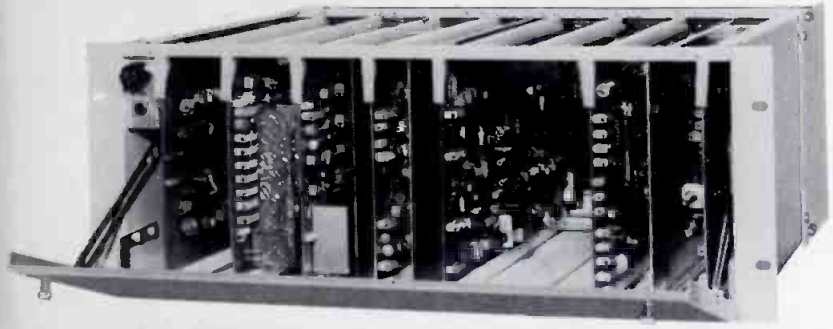

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Circle Number 6 on Reader Reply Card

(Continued from page 4)

Caption System Tested for TV for the Deaf

Recent demonstrations have established the technical feasibility of a system for providing captions on special receivers intended to be watched by persons who are either deaf or hard of hearing. The system tested employs a digital code on the first few microseconds of line 1, which is converted to a character display by special circuits in the receiver.

Although the demonstrations were successful, subsequent tests on standard receivers have raised questions as to whether the use of line 1 might create problems with some models of standard television receivers. Since line 1 is in the vertical retrace interval, complete blanking must be assured to avoid any visibility during retrace, and the energy content must be controlled to avoid any pairing of the interlace. The visibility problem has arisen in tests of other experimental signals in the vertical interval.

Proposals for the use of the "real estate" in both the vertical and horizontal intervals appear to be limited only by human ingenuity (See Oct. 1971 D.C.). Uses and proposals include VIT signals, VIR signals, time signals, frequency synchronizing signals, facsimile signals, auxiliary sound signals, and others. Many of these proposals have undoubted value, but if all were adopted we would soon wind up with 483 lines of test signals and 42 lines of picture—instead of the other way around.

Licensees Reminded Unauthorized Rebroadcast of FAA Transmissions Illegal

The Commission has sharply reminded radio and television licensees that unauthorized rebroadcast of FAA transmissions is a violation of the Communications Act. Some broadcasters have monitored FAA communications, and in some instances have broadcast this material either live or from tape. The FAA has not authorized such monitoring, and has pointed out that this practice may hinder law-enforcement activities during aircraft hijacking, possibly jeopardizing the lives of aircraft passengers and crew. Licensees are reminded that only FAA officials are authorized to grant authority for such monitoring and rebroadcast, and that due consideration must be given to any conditions imposed on this activity by the FAA.

Short Circuits

The FCC has beefed up its license renewal staff in an attempt to reduce the backlog of pending applications . . . The Commission is temporarily suspending monitoring of television transmission with IDC coded material not meeting the requirements of the standards (See Nov. 1971 D.C.) . . . The Commission has adopted proposed rules requiring FM stations to operate at least twelve hours a day (See Dec. 1971 D.C.) . . . The Commission's Chicago Regional Spectrum Management Task Force (See Jan. 1972 D.C.) has set up offices at 176 W. Adams Street . . . Continued experimentation with "road-side radio" along the roads to Los Angeles International Airport has been authorized; however, interference problems forced a shift in frequency to 830 kHz from the 550 kHz originally contemplated (See Aug. 1971 D.C.).

This is the signal for better performance at a lower price*

DEM 911 Demodulator in metal cabinet

DEM 911 RT Demodulator in dual rackmount configuration

The Setchell Carlson Model DEM 911 UHF/VHF television demodulator is a modestly priced, all solid-state unit with many features and capabilities usually found in much more expensive models, and is the only one in its price range with Automatic Fine Tuning (AFT). It produces outstanding monochrome and color picture quality due to the excellence of its bandwidth characteristics. Internal switching for an external video/audio signal is standard and makes it an ideal source for broadcasting, CATV, and CCTV systems.

Every feature of the DEM 911 is engineered in the Setchell Carlson tradition of quality: Four IF stages • High RF sensitivity • Low noise • Low chrominance/luminance delay difference • Full chrominance signal level • Regulated power supply • Exclusive Setchell Carlson UNITIZED® construction for easy maintenance. Available in several rackmount configurations or attractive metal cabinet.

BEST OF ALL...the DEM 911 is priced under $280.00*.

Write or call today. We will send you complete information.

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Circle Number 7 on Reader Reply Card

LETTERS TO THE EDITOR

A Suggestion For Warning System Receivers

Dear Editor:

After reading "The Status of Radio Warning Systems in The United States" in the February issue of **BE** it seems there are quite a few drawbacks to the system. It didn't mention who would pay for the billion dollars worth of receivers required, but I don't think the public would take it upon themselves to buy a receiver just for that purpose. Also, I think the warning should come through an AM or FM receiver because of its mobility versus the suggested use of a TV set.

An idea occurred to me that could incorporate the use of the proposed warning transmitters and cover the general public without as much of an outlay for the receivers and would be more acceptable to the public because of the dual use.

The system would use the IF frequency of the AM and FM receivers for the alerting frequency. Receivers could then be built (or converted) using an extra RF amplifier tuned to 455 KHz or 10.7 MHz for FM. This stage would also furnish a cut off voltage or relay for the receiver local oscillator, RF amp or mixer to cut off the station that was previously being listened to. This clamping circuit should have a time delay filter so static wouldn't cut off main signal during a storm. If necessary, could add another stage that would be cut off with a no-alert signal condition for noise purposes. This amplifier would be coupled to the receivers first IF stage input.

A good feature of this method of reception, which others lack is that no matter which station the receiver was tuned to, the alert signal would be heard. This frequency would also make it adaptable to amateur construction because of availability of IF coils, etc. Also broadcasting stations using AM or FM receivers for the house monitor could have a practical alarm receiver with a little circuit addition.

If the alerting transmitters were strong enough and located near population centers, existing receivers there would probably hear the signal through the inter-electrode capacity of the mixer stage.

Clifford Graff, CE
Station WSGW
Saginaw, Mich.

Service Literature Needed For TK-21

Dear Editor:

We have a model ASE-1B auto-target unit and a video AGC unit for the RCA TK-21 camera manufactured by TEK-TRON Industries. We badly need service literature for these units but can find no address listing for them. The closest we can come is Charleston, S.C., which is all the name plate says.

If anyone knows the address or how we could get in touch with them, it would be greatly appreciated.

Jerry Keith
Engineering Supervisor
Loma Linda Univ.
Loma Linda, Calif. 92354

Further Suggestions For Mic Modification

Dear Editor:

I think it needs to be pointed out that there is a weakness in the diagram for the "Relay controlled mic" in Engineer's Exchange, February **BE**.

The diagram as shown leaves the mic input lines to the console floating when the relay is de-energized, thus open to picking up noise from

(Continued on page 10

The Pick-Up Pros.

Artie Altro makes the WOR-FM sound, while Eric Small, Sebastian Stone and Promotion Director, Kim Olian look over a new album.

WOR-FM, the country's leading FM/Stereo rock station, has been using Stanton cartridges since its inception.

Program Director Sebastian Stone likes the smooth, clean sound the Stanton delivers; the way it is able to pick up everything on the record so that the station can assure high quality transmission of every recording.

Eric Small, Chief Engineer for WOR-FM, likes the way that Stanton cartridges stand up under the wear and tear of continuous use. "We standardized on Stanton a couple of years back," Small said, "and we haven't had a cartridge failure since. Studio Supervisor Artie Altro concurs.

Whether you're a professional or simply a sincere music lover, the integrity of a Stanton cartridge delivers the quality of performance you want.

There are two Stanton professional cartridge series. The Stanton 681 Series is engineered for stereo channel calibration in record studios, as well as extremely critical listening. The 500 AL Series features design modifications which make it ideally suited for the rough handling encountered in heavy on-the-air use. In fact, among the nation's disc jockeys it has become known as the "industry workhorse."

All Stanton cartridges afford excellent frequency response, channel separation, compliance and low mass and tracking pressure. And every Stanton cartridge is fitted with the exclusive "longhair" brush to keep grooves clean and protect the stylus. They belong in every quality reproduction system—broadcast or high fidelity.

For complete information and specifications on Stanton cartridges, write Stanton Magnetics, Inc., Terminal Drive, Plainview, L.I., N.Y. 11803.

STANTON

All Stanton cartridges are designed for use with *all* two and four-channel matrix derived compatible systems.

Circle Number 9 on Reader Reply Card

(Continued from page 8)

adjacent contacts and circuit components. The addition of a resistor of the proper value across the normally closed contacts of the bottom two SPDT sets on K2 will present the normal load to the preamp input, and greatly reduce noise at that point. If you're cheap, just short the contacts...it's better than nothing!

Grady Moates, CE
Station WKOR
Starkville, Miss.

"NEVER SEE A TAPE DECK BEFORE?"

Tracking Improves With New Turntables

Dear Editor:

I agree with Randall Sturm that increasing tracking force is a poor solution to the disc playback problems that he describes in the February issue of BE. Replacement of his archaic arm with one of more recent design would provide a real solution to this problem, while actually reducing record wear.

Good arms of current design are not viscous damped and can track flawlessly in broadcast station operation at forces on the order of one gram. They are (1) balanced in all directions and (2) anti-skating compensated. They will track under the most adverse conditions: for example, the turntable can be turned upside down or on its side (provided the record and platter are made to stay in place) and the arm will continue to track unimpeded.

We have used the Shure/SME arm with the Shure V-15 11 cartridge at KPEN for five years and at KZAP for almost as long. Both are 24 hour-a-day operations, programming mostly music, which justifies (to us) the expenditure for each arm and cartridge installation. Undoubtedly a lower priced arm would suffice in solving the tracking problems described by Mr. Sturm as long as it meets the requirements above.

Lawrence Gahagan
Peninsula Bcstg. Corp.
Mountain View, Calif.

A Profession Requires Title

Dear Editor:

I feel it is time to add my thoughts to the issue regarding the title "broadcast engineer", and the alleged use or misuse of the word.

History teaches us that the term "engineer" originally denoted the operator or "engineer" of engines

(Continued on page 12)

Tape-Athon THE INDEX OF PROFESSIONAL STUDIO EQUIPMENT

lodel 900

LOGGER

Tape-Athon's broadcast LOGGER is ideal for radio sta- ons and communications centers, combining performance, dependability and ow investment in a field-proven unit. Speeds down to 15/32 ips permit 409 ecording hours per channel with up to 8 channels / 8 tracks available.

LOGGER

Circle Number 150 on Reader Reply Card

lodel 900

RECORDER

A truly professional recording system, the 900 ill perform virtually any audio assignment in the studio. Mechanically and elec- onically the 900 has proven itself in hundreds of installations. Uses all reel sizes o 10½", has dual capstans for smoother tape movement, 30 to 15,000 Hz esponse, sensitive to 25 Hz cue tone and speed combinations of 3¾-7½ or 7½- 5 ips. It operates so smoothly it can handle ½ mil tape.

lectronics are solid state, of course, with automatic reversing and reel torque ompensation.

RECORDER

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MULTIPLEXING

Here's a pair of easy ways to broad- ast background music for fun and profit. Tape-Athon's PROGRAMMER and CHANNEL CASTER both have 4 tape transports with a capacity of over 800 dif- erent musical selections. With the PROGRAMMER, you have built-in timing ircuits that permit an infinite variety of mixing for specialty music during the roadcast day. It's complete with 7-day ON-OFF clock, VU meter, monitor speaker, nd 40 watt amplifier. The CHANNEL CASTER is equipped with six inputs and an ntersperser to mix music and ads or other spot announcements. Both are available vith Tape-Athon's extensive music library on a sale or lease basis.

MULTIPLEXING

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AUTOMATION

This low-cost Tape-Athon CHANNEL ASTER CAROUSEL allows any station to automate for a modest investment. The CC is a two-tape transport system (expandable) with a cartridge Carousel unit hat can be interspersed with the music. This allows local ads to be aired with ews, weather, ID, or any other promo material. This complete program package s priced at only $4285.00 in mono, and $5285.00 in stereo.

AUTOMATION

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Tape-Athon Corp. 502 S. Isis Ave., Inglewood, Calif. 90301 • (213) 776-6933

Letters

(Continued from page 10)

or machinery. To this day, "operating engineers" operate compressors, bulldozers, cranes and other machinery with engines. The individual in charge of the powerplant on board a ship is the "Chief Engineer" and has "Engineers" under him doing the actual work on the ship's engines.

Initially, broadcasting was tied to the radio transmitters in service by the maritime industry. The licenses that all broadcast engineers hold are a throwback to the time when the safety of life on the high seas mandated licensed personnel in charge of the ship-to-shore facility.

Perhaps the usage of the word "engineer" should be disallowed for all but those personnel operating engines or machinery. The PE's, EE's, ChE's or whatever are in fact misusing the term. However, through the evolutionary processes in the English language, the word has been re-defined.

What is occurring now is the result of "ruffled feathers" on the part of graduate engineers at the "misuse" of the title, engineer. We are all witness to this fact. However, the Labor Departments of most of the fifty states list the occupation "broadcast engineer" as a valid term in common use throughout the state in question.

A true broadcast engineer is a professional; he is knowledgeable in Management, Business Administration, Programming as well as the technical skills that he excels in, in the day-to-day operation of his station or stations. He is much more than the operator that just satisfies the Commission.

The danger in allowing the disuse of the title engineer, comes in not recognizing the professionalism and ideals that attracted the rare creature to this business in the first place. There are station managers and owners that think of the broadcast engineer in the same vein as the gardener or plumber; additionally, he is an albatross placed on his property by the Commission. It is that type of station that attracts the six-week wonders to his station and the consequential shoddy technical operation th must follow. The broadcast e gineer has long left for green pastures.

A danger in allowing the ter broadcast engineer to end is th our profession will become a trad further promoting shoddy tec nical performance. While this ma seem to be a trivial thing to man we all have worked many years i the broadcasting industry to g to the point that we could ca ourselves broadcast engineers an professionals, and to allow som individual or individual's feelin to be placated at our expense wi be a tremendous disservice to th professionals in the industry.

The Society of Broadcast En gineers is a professional societ that has long been trying to promot the recognition of the professiona achievements of its members. Pe haps those members of our profe sion that feel as I do, and man other broadcast engineers d should get behind the SBE an promote these ideals.

Edwin T. Karl
VP, Engineering
Beck-Ross Comm., In
Babylon, N.Y.

Humbug History

Dear Editor:

I have been following the tit controversy in *BE* with intere and would like to add one mo opinion to the growing pile.

An operator holds an FCC l cense: an engineering technicia (as distinguished from a medic technician) holds a certificate fro the Institute for the Certification Engineering Technicians, 2029 Street, N.W., Washington, D.C 20006 and an engineer, by law most states, must have obtaine state registration as a Profession Engineer.

To call a broadcast operator engineering technician an engine is as incorrect as calling a nur a doctor.

W. S. Campbell, I
Ballston Lake, N.

Letters begin on page 8

INDUSTRY NEWS

FM Hours Increased

On April 7 the new FCC rule ncreasing the minimum operating ours for FM stations will go into ffect. The new minimum will be 2 hours daily. This is a jump of 7 ours over the old Rules.

The 12 hours need not be con-ecutive. Eight hours of operation ill be required between 6 AM and PM, and not less than four hours etween 6 PM and midnight local ime.

The Commission feeling on the natter is that there are too many eeds for aural service, especially t night, to allow FM stations to ontinue to broadcast at the old inimum. Noting that waivers ften are granted for FCC Rules, ie Commission said that a rule to t every unusual and/or meritori-us situation would be difficult o mold.

In a rule making notice adopted November 3, 1971, the Commission said that despite the increased viability of FM economically, some FM stations were still operating at or near the minimum despite the inconsistency with the needs for more aural service in many places and the need to insure the availability of aural broadcast service in the evening. It noted that FM and AM are parts of a single broadcast service.

The Commission said the proposal drew little comment. Michigan City Broadcasting, licensee of WMCB-FM, Michigan City, Ind., agreed with the change but argued that the broadcaster should be allowed to determine the hours of operation Monday through Saturday based on local public interest needs.

EIAJ Offers VT Machine Report

The National Industrial Tele-ision Association is offering free f charge single copies of a 6 page rofessional report on the EIAJ-ype I half-inch intermanufacturer ideotape machine standard.

Titled, EIAJ-TYPE I OPEN EEL HELICAL SCAN VIDEO APE MACHINE MANUFAC-URER AND MODEL LIST, is report identifies 25 different IAJ-Type I models made avail-ble under 10 different manufac-rer brand names. The history nd the various technical and oper-tional concerns of the EIAJ-ype I standard are reviewed. A eries of explanatory notes ac-ompanies the list of manufacturer rand names and model numbers.

A single copy of the report may e obtained without charge by writ-ten request accompanied by a self-addressed 4 x 9 envelope affixed with 16c postage addressed to the National Industrial Television Association, P.O. Box 262, Maplewood, New Jersey 07040.

The National Industrial Television Association is a professional organization of persons concerned with the use of television and related techniques for communications, training, and instruction in business & industry, government and similar applications. Edward W. Palmer, CCTV Supervisor, New England Telephone Company, Boston is the Association President. Regional directors and area coordinators hold meetings, seminars and workshops for members at locations throughout the country. The national office is located at the Maplewood, New Jersey address.

Class Time...

Seminar Schedules

Cable Pressurization

The Systems Equipment Plant of Superior Con nental Corporation's Cable and Equipment Divisio in Hickory, North Carolina has scheduled its 19 cable pressurization school, which will consist of tw training courses.

The first session takes nine class days, with th first seven class days covering cable pressurizatio systems in use today, as well as future concepts cable pressurization, and the last two class days cove ing air dryer installation and application and dryer maintenance.

The second session is made up of the last two cla days of the complete courses, and although the tw subjects are offered in the complete course, th separate session is offered for those interested in dryer training only.

Dates of the nine-day courses are: September 11-2 and October 9-20.

The two-day sessions will be held on: September 2 22; and October 19-20.

Charges for the complete cable pressurizati course are $50 while the air dryer installation a maintenance course is offered at no charge.

All sessions will be held in the corporate traini facility of the Systems Equipment Plant in Hicko North Carolina.

For further information on the courses, conta Wallace E. Jones, Jr., Product Manager–Equipme Products, Superior Cable and Equipment Divisio 1928 Main Avenue, S.E., P.O. Box 489, Hicko North Carolina 28601, Telephone 704/328-2171.

Film Production and Processing

Eastman Kodak Company's Marketing Educatio Center has announced its 1972 schedule of progra in film production and processing for people worki with film in television, education, business and dustry, government, and motion pictures.

Specific courses, workshops and seminars sch uled for 1972 include the Basic Newsfilm Worksh the Videofilm Seminar, two summer workshops film production, Advanced Film Production Wo shop, ME-4/ECO-3 Basic Process and Contr Seminar, and Double Application Sound Worksh

Courses will be held at the Kodak Marketing Ed cation Center in Rochester, N.Y., as well as at regio marketing education centers in San Francisco, Dall Atlanta, and Oak Brook, Ill.

Kodak's recently opened training complex Rochester is designed to train professional users Kodak products and services in obtaining high quali improving efficiency, and reducing costs in their u of Kodak films and equipment.

A free copy of the 1972 program schedule and additional information on courses being offered are available from any Motion Picture & Education Markets Division sales and engineering representative; from any regional office of Motion Picture & Education Markets Division in Dallas, Atlanta, Hollywood, San Francisco, New York City, Honolulu or Oak Brook, Ill.; or by writing Eastman Kodak Company Marketing Education Center, 343 State Street, Rochester, New York 14650.

Closed Circuit Production Seminars

Comprehensive two- and three-day television production seminars are being scheduled this spring by TeleMation, Inc. TeleMation's Training Manager, Richard L. Williams, experienced in commercial broadcasting, ETV, industrial TV and education, will conduct beginning and advanced seminars.

The two-day beginning course covers camera operation, production switching, lighting, audio, graphics and directing. Students attending advanced seminars learn to coordinate equipment and props, produce timed and untimed programs of their choice and participate in a final project using paid, professional talent. The remainder of the seminar is spent discussing special effects, videotape editing and other topics of the students' choice. Instruction in both courses consist of discussion and hands-on workshop sessions, supplemented by special reference materials.

Chicago	Beginning Seminar	April 3-4
(Glenview, Illinois)	Advanced Seminar	April 5-7
Toronto, Ontario	Beginning Seminar	April 19-20
Burlingame (San	Beginning Seminar	April 24-25
Francisco area)	Advanced Seminar	April 26-28
San Juan,	Beginning Seminar	June 13-14
Puerto Rico		

Further information and registration forms can be obtained by writing Training Department, TeleMation, Inc. P.O. Box 15068, Salt Lake City, Utah 84115.

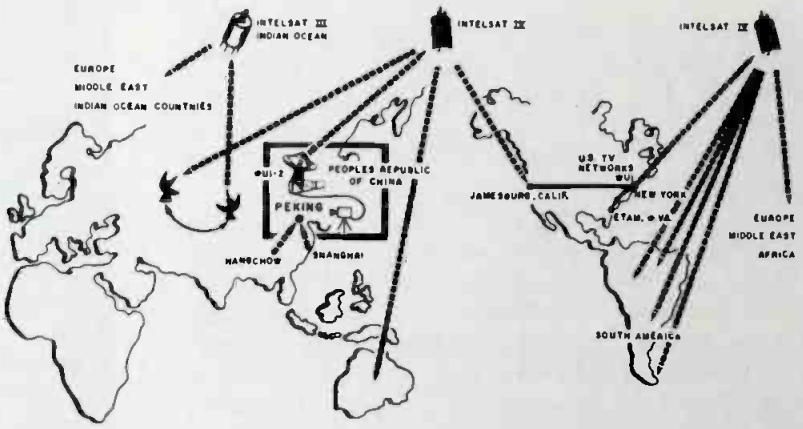
See Page 50 For Information On Tech Data And Tech Papers

Broadcast Engineering Offers Subscriptions On Reader Service Card. For Change of Address Write To: 1014 Wyandotte Kansas City, Mo. 64105

China Relay Was Extensive

One of the most comprehensive international communications systems ever devised was made available by the People's Republic of China during President Nixon's visit to Peking. A total of 60 voice channels, 22 telegraph channels, a video channel, and 2 facsimile photo channels was at the disposal of both news media and the President's official party.

A site had already been prepared at Peking Airport for the installation of a transportable earth station WUI-2 leased by the People's Republic of China from Western Union International, Inc. Adjacent to the earth station, the Chinese constructed a large building that housed press and photographic facilities, and a television studio.



WUI-2 is the second generation of portable earth stations to be used by WUI in the transmission of events of international interest. Its predecessor, WUI-1, designed under the guidance of Roy K. Andres, Vice President—Planning and chief technical director for WUI, was the ocean-going station that relayed from the decks of the recovery carriers the splashdown of Apollo moon missions dating back to Apollo 7 and on through the most recent Apollo 15 mission.

Lighting Symposium

The Illuminating Engineering Society has announced that it will sponsor the eighth annual theater, television and film lighting symposium. The meetings will be held in the Pick Congress Hotel in Chicago, May 21 through 24.

Further information on the symposium may be obtained by writing to the Illuminating Engineering Society, 345 East 47th Street, New York, N.Y. 10017.

APRIL, 1972

CABLE ENGINEERING

in this issue...

'The Spirit of Part 76'

THE NEW FCC RULES FOR CABLE TELEVISION

By Archer S. Taylor

About The Author

For those of you new to the Cable TV industry, an Introduction to Archer Taylor is in order.

Mr. Taylor is vice president of Malarkey, Taylor & Associates. For 27 years he has been practicing as a consulting engineer for broadcast and CATV. What's more, he built the first CATV system in Montana, and he owned and operated four systems until 1968.

In addition, Archer Taylor has served on the Board of Directors and on engineering committees of the NCTA, and this includes being a former chairman of an ad hoc committee on technical standards which assembled and presented data extensively utilized and incorporated by the FCC in the Commission's First Report and Order for CATV.

Mr. Taylor also has served on IEEE Coordinating and Standards committees.

Malarkey, Taylor & Associates is a full-time cable television and broadband communications network consulting firm located in Washington, D.C.

Regulation of CATV has been on the calendar for consideration by the Federal Communications Commission for just about every one of the more than twenty years CATV has existed. Simple proposals have been in plentiful supply; effective solutions have been scarce. For example, it has been suggested that CATV should:

- be regulated as a common carrier
- be licensed as a radio station
- be subject to Sec 325 of the Communications Act requiring permission to "rebroadcast"
- pay copyright fees
- pay a "public dividend" to the Corporation for Public Broadcasting
- switch local broadcast commercials into distant signals
- drop dead

In March, 1966, the Federal Communications Commission adopted Rules and Regulations sharply restricting the development of Community Antenna Television Systems. Since that time, this highly complex subject has been under massive study, not only by FCC, but also by a host of "think tanks": Stanford Research Institute, Stanford University, Rand, Mitre, Sloan Foundation, Markle Foundation, Ford Foundation, Kettering Foundation, and many others.

On Friday, December 13, 1968, the Commission issued Proposed Rulemaking intended to dispose of the unbearable burden of proliferating evidentiary hearings it had brought upon itself by the provisions of the 1966 rules. The Proposed 1968 Rules were referred to by then Chairman Rosel Hyde as "a constructive step toward opening the way for new CATV service in many areas". In fact, however, the Interim Procedures in effect during the consideration of the 1968 Rules, were so structured as to result in a **defacto** freeze. Chairman Hyde's optimistic hopes to the contrary notwithstanding, the number of new CATV starts declined sharply; several CATV equipment suppliers ceased to exist to any practical extent (though none went through formal bankruptcy) and the survivors operated in an atmosphere of stark austerity. Although franchise activity proceeded with considerable vigor, new system construction was rare.

Finally, "after more than three years of exhaustive inquiry" on February 3, 1972, the FCC issued its long heralded Report and Order effective March 31, 1972 (unless stayed by FCC on reconsideration or by Court order). These new Rules, adopted as Part 76 of Rules and Regulations of the FCC, are both thoroughly comprehensive and intensely complex. We have attempted to summarize the essential features in a series of Tables reproduced herein.

A significant court challenge is expected by some attorneys on the issue of whether proper administrative procedures were followed in adopting the Consensus Agreement negotiated (perhaps "hammered out" would better express it) by the White House Office of Telecommunications Policy (OTP) among the conflicting adversary commercial interests of cable, broadcast, and copyright industries. FCC Chairman Dean Burch has expressed satisfaction as an attorney that the public interest as well as all commercial interests were more than adequately represented and protected. Time, and the Courts, will tell.

Part 76, the new cable television rules, covers every conceivable area of cable television regulation in a specific, detailed, and complex manner which can hardly be called

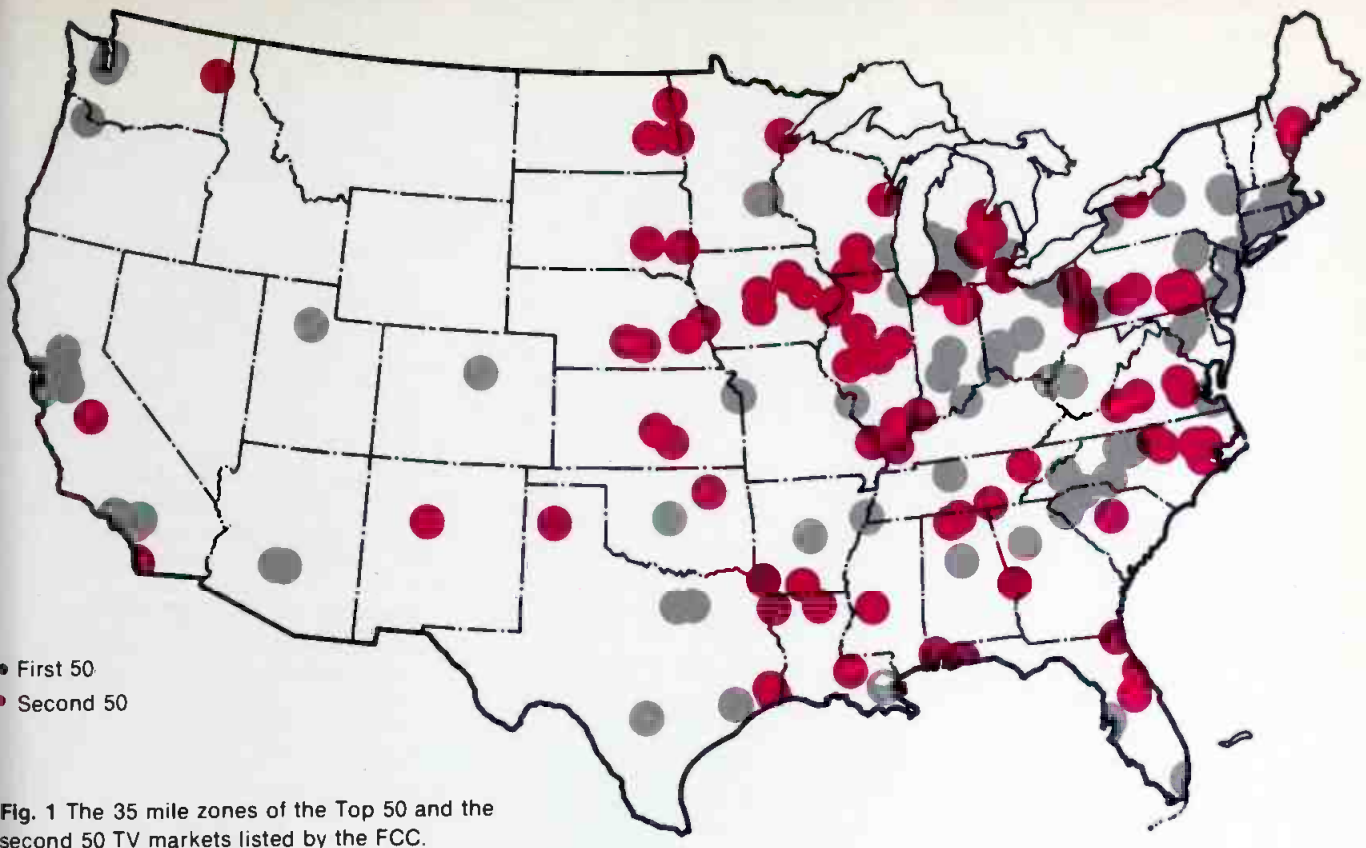


Fig. 1 The 35 mile zones of the Top 50 and the second 50 TV markets listed by the FCC.

superficial. Subject areas covered in Subparts A through K are:

- Definitions
- Applications for Certificates of Compliance
- Carriage of local and distant signals
- Protection of program exclusivity
- Cablecasting
- Access to cable facilities
- Federal-State-Local regulatory relationships
- Technical Standards
- Grandfather provisions
- Forms and Reports
- Payment of Annual Fees to FCC
- Logs and Records
- Diversification of Control

Of particular interest are the new definitions of four classes of Cable Television Channels, paraphrased as follows:

Class I. A downstream signalling path for broadcast TV signals.

Class II. A downstream signalling path for cablecast TV signals.

Class III. A downstream signalling path for non-TV signals.

Class IV. An upstream signalling path for TV or non-TV signals.

The term "signalling path" was invented by FCC for Part 76 to include channels other than 6 MHz, whether or not signals are actually being transmitted.

Under Part 76, both new and existing cable TV systems must make application to the FCC for a **Certificate of Compliance** with the new Rules, supported by full disclosure of ownership, proposed services, franchise agreements, and an affidavit certifying that all stations within whose Grade B contours the system will operate have been notified of the proposed services. New Certificates are required for any changes in ownership or operating plans, but do not expire until the franchise itself expires. In general, cable television systems existing (or authorized) by March 31, 1972, will be allowed to continue present operations under several "grandfather" rules; though they must obtain Certificates covering such operations, and any changes will be subject to the Rules.

Rules governing carriage and exclusivity, as seen from the accompanying charts, depend largely on the size of the market. Part 76 includes a list of the 100 largest TV markets and their designated communities, based essentially on the 1970 American Research Bureau (ARB) ranking of prime-time household viewing. FCC does not expect to change this listing according to subsequent ARB ranking.

For most purposes, a specified zone of 35-mile radius centered on the main post office or other reference point (geographic coordinates are included in the Rules) replaces former concepts of "local service area". Figure 1 shows the 35-mile zones of the Top 50 and second 50 TV markets listed by FCC.

To resolve the problem of carriage or protection in overlapping markets (the so-called Footnote 69 situation), Part 76 provides that stations may be treated as local stations when they are "significantly (viewed" in any community, even though they may be located in another, usually overlapping market. After much travail, the FCC has defined "significantly) viewed" as follows, based on the 1971 ARB survey of non-CATV share of viewing hours:

- Full or Partial Network Stations:
  - at least 3% share of total viewing hours
  - at least 25% net weekly circulation
- Independent Stations:
  - at least 2% share of total viewing hours

at least 5% net weekly circulation

(Net weekly circulation is the percentage of the total TV households that watched the station for at least 5 minutes during an entire week.) A list is included in Part 76 showing the stations which are "significantly viewed" in each of the more than 3000 counties in the United States. No changes are contemplated in this showing for at least a year.

The new Rules require only si

TABLE I—CARRIAGE

MARKET SIZE	LOCAL SIGNALS MUST CARRY ON REQUEST	DISTANT SIGNALS MAY CARRY—SUBJECT TO "LEAPFROG" RULES
TOP 100 MARKETS For systems located wholly or in part within the 35-mile zone of any commercial TV station in one of the 100 largest markets.	A. All station—35-mile zone (including hyphenated communities). B. ETV Stations—Grade B. C. 100 watt translators—in licensed community. D. Stations with significant viewing.	A. Missing; to provide full complement of: **Top 50 Markets**: 3 full networks, 3 independents **Second 50 Markets**: 3 full networks, 2 independents B. "Wild Cards" 2 additional independents Less: the number of distant signals carried to make up the full complement. C. Additional ETV stations. D. Stations programming predominantly non-English language. E. Programs from any station (without regard to leapfrog rules) may be substituted for "blackouts" or strictly local programs on distant independents regularly carried.
MARKETS SMALLER THAN TOP 100 For systems located wholly or in part within the 35-mile zone of any commercial TV station in a market below the Top 100.	A. Stations in the same, or other market smaller than Top 100—Grade B. B. ETV Stations—Grade B. C. 100 watt translators—in licensed community. D. Stations with significant viewing.	A. Missing; to provide full complement of: 3 full networks—1 independent. B. No "Wild Cards". C. Additional ETV stations. D. Stations programming non-English language.
OUTSIDE ANY MARKET For systems located wholly outside the 35-mile zone of any commercial TV station.	A. All stations—Grade B (regardless of market size). B. ETV Stations—35-mile zone. C. 100 watt translators—in licensed community. D. Stations with significant viewing.	A. Any distant signals may be carried. B. No leapfrog rules apply.

LEAPFROG RULES

A. Distant network signals must come from either:
1. The nearest full network station; or
2. The nearest in-state full network station.

B. Distant Independent Signals (other than ETV or foreign language)
1. If any distant signals come from the Top 25 markets: the **first two distant independents** must come from one or both of the nearest two Top 25 markets: otherwise, they may come from any market.
First: UHF within 200 miles; or
Second: VHF within 200 miles, or any UHF

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multaneous non-duplication of network programs (with certain limited exceptions), according to priorities based primarily on predicted Grade Contours, rather than the same-day non-duplication required since 1966.

Protection of exclusive contract rights to exhibit syndicated programs, on the other hand, is excruciatingly complex. In general, the responsibility for providing the necessary information on duplicated showings has been placed on the party supposedly benefitting. It is not at all clear, however, that some of these responsibilities could even conceivably be met without a carefully programmed computer to examine the myriads of contracts, release dates, broadcast date terms of protection, and ownershi of rights. A Special Proposed Rul making on Sports Blackouts wa released at the same time as Pa 76, with a March 16 deadline fo comments. A curious loophole wa left in Part 76, probably by ove sight: network syndicated program are given only simultaneous pro

TABLE II—EXCLUSIVITY PROTECTION

SYNDICATED PROGRAMS	PROTECTION COMMENCES	PROTECTION EXPIRES
Pre-clearance protection in the Top 50 markets for programs first released for syndication.	Date the program is first sold or licensed to a U. S. TV station for broadcast.	One year later.
Programs covered by exclusive contracts with TV stations:		
A. In Top 50 Markets	Date of acquisition of exclusive broadcast rights.	Run-of-contract; date of expiration of exclusive rights.
B. In Second 50 Markets		
1. Off-network series.	Date of first non-network showing of an episode in the market.	One year later; or after the full series has been shown, whichever comes first.
2. First-run series.	Date of first showing of an episode in the market.	Two years later.
3. First-run non-series and feature films.	Date the program is *available* under contract for showing in the market.	Two years later.
4. All others, including: Non-series; Non-network series re-runs; Off-network non-series.	Date of acquisition of exclusive broadcast rights.	One year later; or one day after the first non-network showing in the market, whichever comes first.
NETWORK PROGRAMS	**PRIORITY**	**EXCEPTIONS**
Simultaneous Non-Duplication.	Protection against lower priority but not against equal priority: 1. Principal Community 2. Grade A 3. Grade B 4. 100 watt translator community Significantly viewed signals are entitled to protection, as if they were local. Color has priority over monochrome.	Special exceptions in time-zone situations. Programs released by networks for prime time are not protected in non-prime time. Non-simultaneous protection may be required for network programs released in Canada prior to U.S. broadcast. Program deletion not required if subscribers would have less than two networks at any time. Private agreement will be honored.

tection while non-network programs are carefully protected for extended periods. This will surely be changed.

Part 76 is predicated on the assumption that the emergence of

TABLE III – RESPONSIBILITY ASSIGNMENTS

CABLE SYSTEM LOCATION AND TYPE OF PROTECTION	CABLE OPERATOR'S RESPONSIBILITY	LOCAL TV STATION'S RESPONSIBILITY	COPYRIGHT OWNER'S RESPONSIBILITY
IN TOP 50 MARKETS Pre-clearance protection of first releases for syndication.	To search Newspapers, and other schedules to determine when the listed programs must be deleted from distant stations carried.	None	Notify cable operators giving name of program and date of first sale or license to a U.S. TV station for broadcast.
IN TOP 100 MARKETS Protection of exclusive broadcast rights of TV stations to syndicated program exhibition.	To black out distant signals as specified by local TV station. To verify station notifications in case of doubt or controversy concerning eligibility for protection, by examining station's public files. To identify programming which is free of exclusivity protection, in order to fill "blackouts" on regularly carried distant stations.	To notify the cable operators within 35-mile zone by Monday of the week before blackout is required. Notification must include: • call letters of station to be blacked out • date, time, and duration of the blackout To notify cable operators of schedule changes 36 hours in advance. To monitor for violations.	None
IN GRADE B OF ANY STATION (Or in community to which 100 watt translator is licensed). Protection of network programs.	To black out network programs duplicated by stations of lower priority subject to proper notification by station of highest priority. To request notice by Monday of the week before the required blackout, if desired; otherwise notice is 48 hours in advance.	To notify the cable operators of the required network blackout at least 48 hours in advance, or by Monday of the preceding week, if so requested. Notice must include: • date and time of the protected broadcast • date and time and station to be blacked out	None
ALL SYSTEMS AND ALL STATIONS	To obtain certification from FCC for all TV broadcast signals carried, after notification to all stations within Grade B. To keep a log of distant stations carried, including call letters, date, time carriage commenced and terminated, and the program schedules of each. Retain for two years.	To maintain in a public file exact signed copies of relevant portions of exclusivity contracts establishing eligibility for protection of syndicated programs.	None

a broad-band communication network with exciting future potential, depends on the economic viability of a cable television reception service during development of technology and markets. So, having provided for at least two otherwise unavailable distant signals in all major markets (provided they are not blacked-out most of the time to protect exclusivity), Part 76 seeks to assure that systems in major markets will be available for new, non-broadcast services by specifying additional channel capacity, two-way capability, and capability of expansion when demand fo channels approaches existing avail ability, as outlined in the Table

Probably of most significanc however, is that Part 76 affirm tively encourages advertising an subscription television on lease

TABLE IV—CABLECASTING

Purpose	Charges Permitted	Specific Regulations	Regulations Applicable to all Cablecasting (except Local Government Access Channels)
Origination Calbecasting One or more dedicated channels on all systems with more than 3500 subscribers.	Commercial/Political advertising permitted, subject to non-disruptive advertising and political broadcasting regulations. Subscription TV permitted.	Local origination channels not to be used for any other purpose. Used as local outlet "to a significant extent". No agreements outside any TV market which inhibit use of prime time for controversial local issues. Subject to fairness/equal time. Sponsorship identification required.	No Censorship No Lotteries No Obscene or Indecent material Records of names and addresses of persons requesting access shall be available for public inspection for 2 years.
Access Cablecasting **Public Access**—at least one dedicated channel. **Education Access**—at least one dedicated channel. **Leased Access**—dedicated channels optional; unused time on any non-broadcast channel must be available for leased access (except origination cablecasting channels).	No charge except for use of production facilities for more than 5 minutes. Subscription TV not prohibited.	No commercial/Political candidate advertising. Not subject to fairness/equal time. Non-discriminatory—First come basis.	
	No charge for first 5 years Subscription TV not prohibited.	No Commercial/Political candidate advertising. Not subject to fairness/equal time.	
	Rates for leased access to be filed with FCC. Subscription TV not prohibited.	Paid Commercial/Political advertising permitted, with sponsor identification. Not subject to non-disruptive advertising rules. Not subject to fairness/equal times, or political broadcasting restrictions.	
Local Government Access—at least one dedicated channel.	No charges for first 5 years. Subscription TV not prohibited.	No Restrictions of any kind are placed on Local Government Access Channels.	No restrictions, except as provided elsewhere in State or Federal Law.

channels, subject to restrictive regulations similar to those governing broadcast advertising and over-the-air subscription television.

While municipal and state authorities are assigned responsibility for choosing the best qualified applicants for the franchise, they are advised by FCC to restrict franchise terms to a maximum of 15 years, with "reasonable" renewals; and to establish franchise fees in the range of 3-5%. The franchising authority is assigned responsibility for dealing with complaints and for supervising rate structures.

Technical standards are included in Part 76, limited to Class I signalling paths. (These are covered in an article by Howard Head.) A technical advisory committee is to be appointed to augment the technical standards with respect to:

Cable TV receiver standards
Frequency allocations on cable
Standards for Class II, III and IV signalling paths
Standards on envelope delay, differential gain and phase
Standards on cross-modulation and "ghosting"
Carriage of radio signals

Cable television systems must submit annual reports, including financial data; and must pay FCC an annual fee of 30 cents per subscriber, in addition to filing fees for Certification and other petitions or applications. They must keep a log of stations carried and program schedules, and must keep records on persons requesting the use of access or leased channels.

Rules proposed or adopted in 1970 are incorporated in Part 76, prohibiting national TV networks from owning cable TV facilities anywhere, and prohibiting TV stations from owning within their Grade B Contour. No action is yet taken on newspaper ownership or radio station ownership.

A Proposed Rulemaking regulating the importation of FM and AM radio signals by cable systems was released at the same time as Part 76. This would, if adopted, require cable systems to carry all AM and FM radio stations licensed to communities within 35 miles. In the interim, the Commission will prohibit carrying radio stations more than 75 miles away in communities of less than 50,000 population which have one or more radio stations. Furthermore, no distant radio stations can be carried unless all local stations are carried.

The "Spirit of Part 76" seems to be "A Great Leap Forward" for cable television, into the mostly unfamiliar land of exclusivity protection.

Who won? Who knows? Perhaps Part 76 may effectively have tossed the whole situation into the market place. Does the public want television as it has been? Or will the public demonstrate enough interest in the advantages of a cable television reception service to bring on the dawn of the New Era of the Broadband Communication Network (BCN)? Maybe the market place is where the judgment properly belongs.

TABLE V—CAPABILITY REQUIREMENTS

Systems within 35-mile zones of Top 100 market TV stations. (No requirements for smaller markets.)	
Channel Capacity	120 MHz minimum bandwidth available for immediate or potential use.
Equivalent Bandwidth	For each Class I Cable channel utilized, an additional 6 MHz suitable for Class II or Class III signals is required.
Bi-directional	"Technical capacity for non-voice return" is required. "Each cable system shall be constructed with the potential of eventually providing return communications without... time consuming and costly rebuilding".

TABLE VI—SUBSCRIPTION TV

Feature films:	Any films which have had first-run showing on non-reserved seat basis anywhere in the U.S. within the last 2 years. One film, whose last first-run showing on non-reserved seat basis was more than 10 years ago, may be shown for one week in each calendar month. Films whose last first-run showing was between 2 and 10 years ago may be used if the owner of the rights has been unable to sell them for television broadcast or is withholding them to protect future box-office.
Sports:	Events may be used which have not been broadcast during the past 2 years by any commercial TV station within whose Grade A Contour the system is located. (Except non-annual events such as Olympic Games, America's Cup, etc.)
Series programs, with interconnected plot or the same cast of principal characters:	Prohibited from subscription TV at all times.
Other Programs:	At least 10% of the total subscription TV hours must be other than feature films and sports.
Advertising:	No advertising except to promote subscription TV programs, and only before or after complete programs.

Microwave Alternatives For CATV

By Leo G. Sands

It is the coaxial cable trunk line that limits the overall length of a CATV system and the maximum distance at which the head end can be located from the communities served. The present state of the art limits the number of cable amplifiers that can be cascaded.

In the distant future, it is likely that PCM multiplexing systems will enable simultaneous transmission of many color television channels over almost unlimited distances through waveguide. Although such equipment is not yet available, there is an alternative that can be utilized now.

This alternative is "microwave radio transmission." The use of microwave in CATV systems is not new. Nor is FDM multiplexing. However, their combination for simultaneous transmission of several television channels over a single microwave carrier is new. Multiplexed television microwave systems capable of simultaneous transmission of several television channels are now being offered.

One of these systems, known as the Airlink, which was developed by Laser Link Corporation, can also transmit simultaneously from a master head end to as many as 21 distribution centers (sub-head ends) at different locations, as shown in Figure 1.

Utilizing such a system, one head end could serve several communities, each having its own cable network. For example, a head end on top of Garrett Mountain, in the heart of the Northern New Jersey metropolitan area, could serve CATV systems in Ridgewood, Paterson, Newark, Montclair and many other cities and towns within microwave range of the mountaintop LDS (Local Distribution Service) microwave transmitter.

To cite another example, such a system with its head end on Mt. Diablo could serve numerous communities in the San Francisco Bay Area and the valleys north, east and south of the mountain. There are many other similar possibilities throughout the United States and Canada. Such a system could also make nationwide television possible in such island nations as Jamaica where no individual TV station could cover all of the mountainous island.

Multiple Channels

The earliest television microwave systems were capable of transmitting only one television channel. The video signal directly modulates the FM microwave transmitter. The audio signal is fed to an FM modulator which in turn modulates the microwave carrier at a subcarrier frequency. To transmit more than one TV channel, it is customary to "stack" microwave transmitters, as shown in Figure 2, each transmitting one TV channel and all sharing the same antenna through an antenna multiplexer.

To transmit to two or more receiving stations, the signals of all of the head end microwave transmitters can be intercepted at a junction repeater station, as shown in Figure 3, and then transmitted

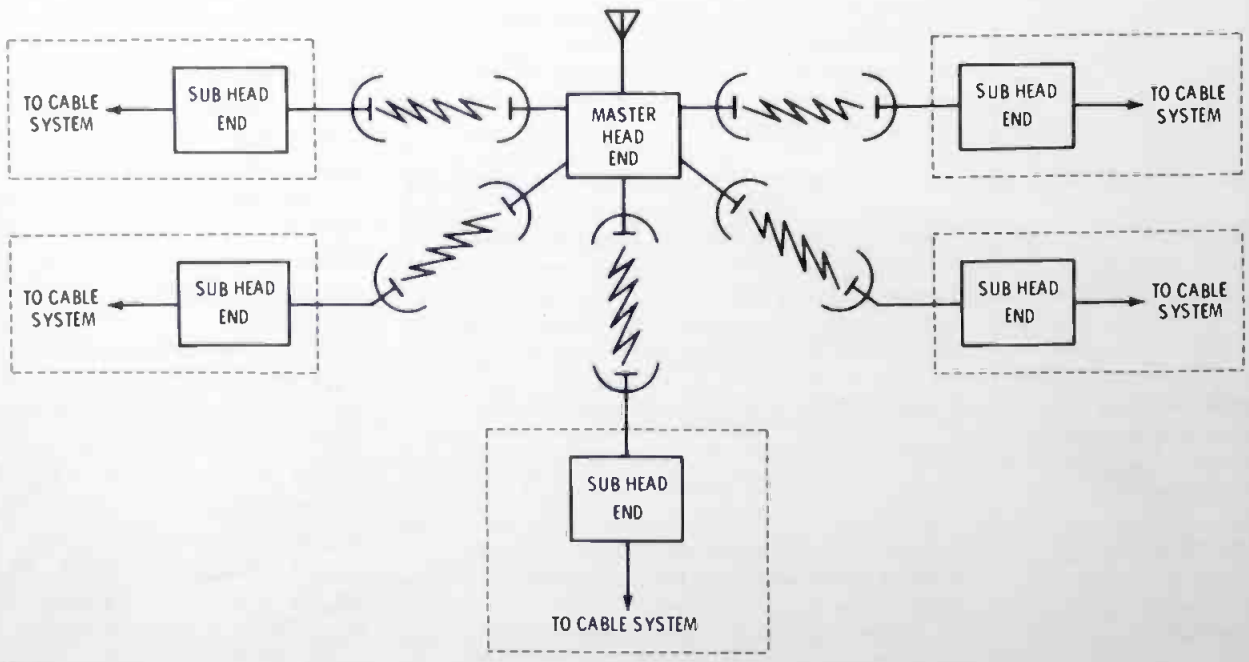

Figure 1

) receiving stations at differ-nt locations.

To transmit three programs, six nicrowave frequencies are re-uired, three to transmit from A to , and three to transmit from B to and from B to D. It is necessary) use separate receiving and trans-nitting frequencies at the repeater tation to avoid desensitization of ne receivers.

Figure 2

It is not necessary to transpose requencies when utilizing a "pas-ive repeater". The group of micro-vave signals radiated by antenna A re intercepted by antenna B. An-enna B is connected to antennas C nd D which reradiate the signals t their original frequencies in dif-erent directions. This technique, tilized in communications micro-vave systems designed by Budel-nan Electronics Corporation, re-uires the use of antennas of ufficient gain to offset antenna ranching losses.

Hundreds of telephone channels an be transmitted over a micro-vave system by employing FDM frequency division modulation) nultiplexing. Telephone channels A, B and C are applied as subcar-iers at three different frequencies e.g. 12, 24 and 36 kHz) to the mi-rowave baseband.

The same basic technique is used n the Airlink system. The head end mplifier and channel translators eliver signals at the visual and ural carrier signal frequencies of V channels 2, 3, 4, 5 and 6 di-ectly to the baseband of the FM nicrowave transmitter. (Additional hannels can be transmitted in the ame way at translated frequencies elow 54 MHz and above 88 MHz).

Modulating Frequencies

The basic technique is the same s used in FDM communications nicrowave systems. The differ-ences are that special multiplex equipment is not required and that the modulating frequencies are much higher. In the Airlink system, both AM (video) and FM (audio) signals modulate the FM microwave transmitter.

At a receiving station, the frequency-modulated microwave carrier is demodulated to extract the visual and aural subcarrier signals which are then fed to the cable distribution network through head end type amplifiers and/or translators.

To make it practical to transmit the multiplexed microwave signals simultaneously to several receiving stations in different directions, the microwave transmitter utilizes a TWT (traveling wave tube) RF amplifier at the output of the solid state FM exciter. The transmitter employs a 3-GHz solid state modulator, a solid state upconverter, a 20-Watt 12.7-12.95 GHz TWT power amplifier and a harmonic filter.

The output of the transmitter is fed to two or more microwave antennas through an antenna multiplexing system. Three TWT amplifiers can be paralleled to permit feeding microwave signals to as many as 21 antennas.

At each cable distribution center, a microwave receiver is required. The receiver downconverts the microwave signal to a 1.5-GHz IF signal which is demodulated by a discriminator. The IF amplifier employs 25 dB of AGC to offset fading and delivers a 14-dBm signal to the limiter which saturates at 10 dBm. At locations where a greater fade margin is required, a tunnel diode preamplifier with 15 dB of AGC can be provided.

Instructional Uses

Although the Airlink system is currently FCC type accepted for licensing in the Cable Antenna Radio Service (CARS), its applications are not limited to CATV. Such a system could be used, for example, for transmitting a number of live, filmed and taped instructional TV programs from a central location to numerous schools. Another application, the FCC permitting, could be transmission of several special-interest programs to the business community.

What is significant about this system is the application of FDM techniques, which date back to the 1920's and FM techniques which were originally developed by Major Edwin H. Armstrong. Much has been learned about multiplexing and FM techniques since then and new developments are being applied to solve television transmission problems.

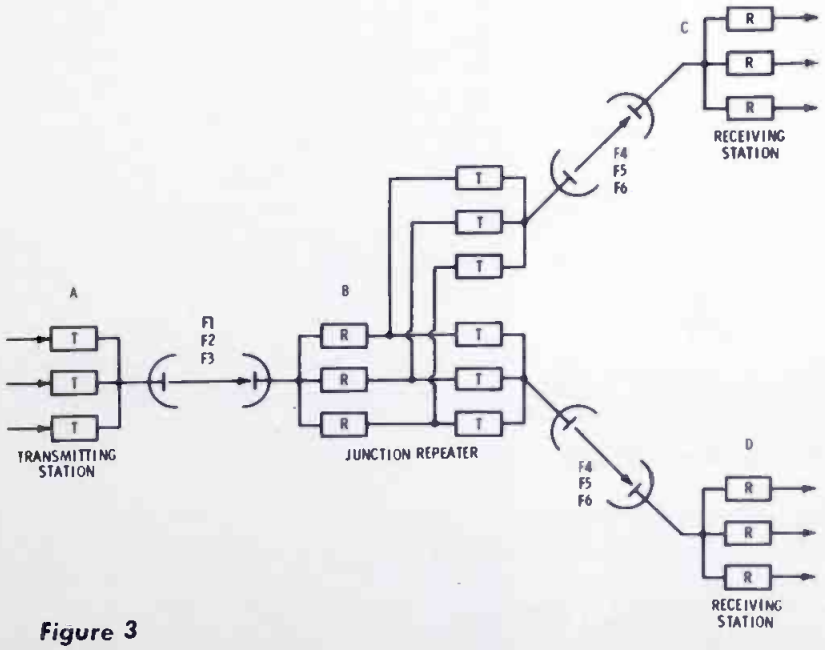

Figure 3

Theta-Com Petitions With Microwave Assignment Plan

Theta-Com of California has petitioned the Federal Communications Commission to modify the channel frequency assignment plan for multi-channel microwave local distribution service (LDS) contained in the commission's rules for CATV systems.

The requested rule modification would not supplant the existing channel assignment plan, but would supplement it with an alternate set of frequency assignments specifically designed to carry mid-band and super-band channels in their normal spectral relationship with respect to the standard VHF channels. The petition explained that being in the existing Community Antenna Relay Service (CARS) band, the requested alternate frequency assignments would facilitate the use of LDS by the growing number of cable system operators who now or will soon need to carry more than 20 channels because of FCC regulations or franchise obligations.

Multi-channel microwave local distribution service is used in CATV systems for crossing natural or man-made barriers, reaching pockets of population, and other problem solving applications where a span of coaxial cable is not practical. To date, Theta-Com's AML is the only LDS equipment in actual CATV system operation. According to R. W. Behringer, president of Theta-Com, the proposed alternate frequency assignment plan will improve the performance and reduce the cost of the CATV system by eliminating unnecessary frequency conversions.

Cable Report, Order Is Now Available

The FCC Cable Television Report and Order, announced February, was reprinted in the Federal Register of Saturday, February 12 and is available for sale by the Superintendent of Documents at the Government Printing Office. The price of the document is 20 cents.

The following title should be used when ordering: **Federal Register of February 12, 1972, Volume 37, number 30, Part II only.**

Mail requests should be addressed to the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. Do not address requests to the Federal Communications Commission. Documents will also be available for over the counter sale at the Superintendent of Documents Bookstore, North Capitol and H Streets, N.W.

The Federal Register reprint will include the report and order, the rules, the list of significantly viewed television stations, and the consensus agreement.

New Products

New Carrier Fill Telecom Cable

A new telecommunications cable for T-1 Carrier systems has been developed by the **Anaconda Wire and Cable Company** Communication Products Engineering Center, Sycamore, Illinois. The cable features two compartments for electrical separation of pair groups plus two extra pairs, one for repeater interrogation and one for voice order wire.

All pair counts of the new cable, known as Plus 2,™ are said to allow 100 percent of the pairs to be used for T-1 Carrier systems, with transmission in both directions, at maximum repeater spacing. In addition, all repeater housing spaces can be utilized regardless of whose equipment is installed because cable pairs from the nominal pair count need not be allocated for repeater interrogation and voice order wire functions. Maximum repeater spacing is possible due to improved near-end crosstalk coupling loss characteristics.

Separation of the core into two compartments by means of a polyolefin-coated metallic shield enables simultaneous transmission of T-1 line signals in opposite directions without interference between channels.

Cables with nominal pair counts of 50 pairs or more will include two interrogation pairs and two voice order wire pairs to accommodate larger systems where the number of repeater sections in tandem may be greater than 12, or where two or more repeater housings are required at each location.

Anaconda plans to offer the new separator shield and extra pair features with filled and non-filled versions of all of its standard communications cable construction.

Circle Number 66 on Reader Reply Card

Improved Boom Mic

Shure Brothers Inc., Evanston, Illinois, introduced an improved version of its Model SM5A unidirectional dynamic microphone that includes features designed to minimize subsonic low frequency transients resulting from rapid boom movement or wind.

Called the SM5C, the new model incorporates a 100 HZ hi-pass filter in the cartridge assembly that significantly reduces subsonic transients. Although these transients often occur at frequencies below audible levels, they can overload the input stage of some recording channels and result in momentary blocking or distortion.

The SM5C Model also includes a hum-bucking coil that improves the signal-to-noise ratio when used in high-magnetic fields, such as power transformers or lighting dimmers.

Like other models in the SM series, the SM5C offers wide range smooth response and a near perfect cardioid pattern. It is ideal for boom applications involving narration, vocals, dialog, and orchestration pickup.

Circle Number 67 on Reader Reply Card

Further Rules Information On Page 19 Also See Page 46 For New Products

SEVEN YEARS AGO AMPEREX GAVE THE TELEVISION INDUSTRY ITS FIRST PLUMBICON® TV CAMERA TUBE...

...LAST MONTH THE TELEVISION INDUSTRY GAVE AMPEREX ITS 20,000th ORDER* FOR THIS STILL UNIQUE, UNDUPLICATED DEVICE.

In the comparatively short span of time between its introduction and the total conversion of the broadcast industry to its use, the Plumbicon has enjoyed continuing professional acclaim and industry wide endorsement as attested to by its receipt in 1967 of the coveted Emmy from the National Academy of Television Arts and Sciences, by the award of the David Sarnoff Gold Medal by the Society of Motion Picture and Television Engineers, Inc. to Dr. E. F. deHaan, the tube's developer and by the very practical and meaningful award to Amperex of purchase orders for twenty thousand Plumbicon tubes.

How do you say 'Thank You' for such support and such recognition? We feel that the most sincere way to show gratitude to an industry for its support of one's efforts is to rededicate those efforts for the further advancement of that industry.

We therefore pledge that we will continue to devote the greatest part of our energies to the task of keeping ahead of the uncompromising requirements of the television industry and to keep the industry ever supplied with better and better TV camera tubes. Electro-Optical Devices Division, Amperex Electronic Corporation, Slatersville, Rhode Island 02876.

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Sold through
North American Philips Electronic Component Corporation

Early this year, Amperex delivered its 20,000th Plumbicon tube, through its distributor Satterfield Electronics, to WHA, educational TV station affiliated with the University of Wisconsin.

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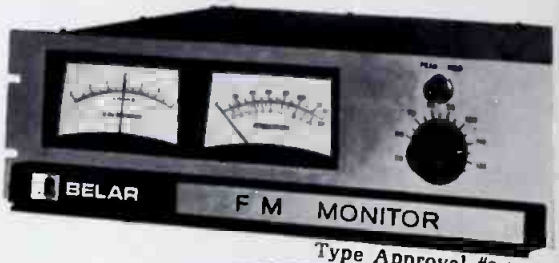

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Type Approval #3-146

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Type Approval #3-181

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Circle Number 18 on Reader Reply Card

The FCC's New Technical Standards

By Howard T. Head*

The matter of Technical Standards governing the esign, installation and operation of cable systems egan to assume increasing importance as cable sys-:ms expanded into television broadcast markets. 'elevision broadcasters, anxious to assure that cable ystems delivered their signals to subscribers with iinimum degradation, urged the FCC to adopt strin-ent technical requirements. On the other hand, the arly cable systems, many of which were marginally esigned and marginally profitable, preferred little r no technical regulation.

The first formal proposals to the Commission for ie adoption of Technical Standards were made in 965, and included proposals and counter-proposals

\. D. Ring & Associates, Washington, D. C.

from broadcasters, cable operators, and others. These and additional subsequent filings with the Commission ultimately led to a Commission proposal in 1970, reflecting the Commission's own judgment as to the desirable level of technical regulation consistent with the state of the cable technical art. The Commission's 1970 proposal, only slightly modified as a result of still further comments, was adopted by the Commission along with the new rules dealing with signal carriage, exclusivity, program protection and other non-technical matters.

The new Technical Standards leave a number of important areas for future consideration, the Commission stating that the newly adopted standards "are minimal and should be augmented as soon as possible with Standards covering other technical areas..." These other areas include the color quality parameters

TABLE I—COMPARISON OF CABLE TECHNICAL STANDARDS PROPOSALS

	Original Proposals				
Performance Factor	TV Broadcasters	Cable Operators	FCC	New FCC Rules	Canadian CATV Regulations
Proof of Performance	Annual		Annual	Annual	Not Specified
Visual Carrier Tolerance	±.005%		±25 kHz	±25 kHz[1]	±50 kHz
Aural Carrier Tolerance Receiver			±1 kHz	±1 kHz	±2 kHz[3]
Minimum/Visual Signal Level Across 75 ohms	1 mv	500 μv	1 mv	1 mv	500 μv
Permissible Variation in Visual Signal Level		Overall:	6 dB	12 dB	20 dB
		Rel. to Adj. Ch.	6 dB	3 dB	3 dB
		Rel. to Any Ch.	10 dB	12 dB	
Aural Signal Level Below Visual	15 dB		13-17 dB	13-17 dB	7-17 dB
Hum & Low Freq. Effects	5%		5%	5%[5]	1%[4]
Signal-to-Noise	40 dB	34 dB	36 dB	36 dB	40 dB[4]
Channel Freq. Response	±2 dB[2]		±2 dB	±2 dB	±2 dB[2]
Intermodulation	48 dB	46 dB	46 dB	46 dB[5]	46 dB[4]
Terminal Isolation			30 dB	18 dB	18 dB
Signal at Head End Ch. 2-6	−93 dBW	−95.3 dBW			
7-13	−91	−95.3			
14-83	−87	−89.3			
Head-End Noise Ch. 2-6	4 dB				
Figure 7-13	6 dB				
14-83	10 dB				
Return Loss	30 dB			[5]	
Ghosting	40 dB			[5]	
Color Subcarrier Differential Gain	±1 dB			[5]	2 dB[4]
Color Subcarrier Differential Phase	±4°			[5]	±5°[4]
Envelope Delay	0.1 μsec			[5]	0.1 μsec[4]
Systems Radiation			See Table II		

[1]± 250 kHz with converters
[2]± 0.5 dB at head-end
[3]For color; ±5 kHz for monochrome
[4]Provisional standards
[5]Subject to further rule-making

—envelope delay, differential gain and differential phase at the color subcarrier—and standards for "ghosting", which has been the subject of much controversy, particularly where television broadcasters have insisted on on-channel carriage in areas of high ambient RF fields.

To cope with these problems the Commission, in adopting the new Technical Standards, announced its intention to initiate a new proceeding to deal with these matters, and at the same time establish a Task Force of technical experts to provide advice in formulating further proposals.

Canada in the meanwhile found itself confronted with similar problems. Cable systems in Canada assumed particular importance for a number of reasons, including the limited availability of U.S. network and color programs. Cable penetration in Canada near the U.S. border has reached considerably greater proportions than in the U.S. Canada's Department of Communications (DOC), charged with the technical regulation of broadcasting, issued in 1970 its Broadcast Procedure 23 establishing technical standards for Canadian cable systems. As with the FCC, DOC acknowledged the need for further study in some areas, designating certain of the new standards as "provisional".

Standards Perspective

An interesting comparison of the principal features of the various standards, both as proposed and adopted, is given in Table I, which lists highlights of the original proposals as advanced by both broadcast and cable interests, along with the FCC proposals and those adopted in Canada by DOC.

The Commission's new technical regulations go considerably beyond the adoption of the Technical Standards and include other aspects of cable system specification. To begin with, the Commission's new Rules require that any new systems built in the top 100 markets have a capacity equivalent to at least 20 television channels (120 MHz). No minimum capacity is specified for markets below the top 100. In the top 100 markets, the cable system is required to devote at least half of the available channel capacity to material other than television broadcast signals. No such requirement is established outside of the top 100 markets.

The new rules establish four classes of CATV channels as follows:

Class I: Television broadcast station carriage
Class II: Local originations not requiring special decoders
Class III: Local originations requiring decoder (Pay-TV) or intended for special receiver
Class IV: "Return" or "response" channels from subscriber terminals to other points

The new CATV Technical Standards are applicable to Class I cable channels only, although the Commission states its intention of specifying Technical Standards for the other classes of channel in the future. With the adoption of the new CATV rules, the Commission created a high-level Cable Television Technical Advisory Committee to deal with the problems of Technical Standards which will include in its

membership, representatives of the interested segments of the cable industry. In addition to this newly established FCC Committee, other groups are active in CATV Technical Standards, including NCTA and special Cable Coordinating Committee of IEEE.

Class I Standards

The Technical Standards established for Class I cable channels deal with frequency stability, subscriber signal levels, signal-to-noise ratios, subscriber terminal isolation, and system radiation. The requirements of each of these general areas are described in the following paragraphs.

A. Frequency Relationships: Channeling on the cable is required to be the same as that established for television broadcasting. However, the Commission will entertain applications for different arrangments if a showing of need can be made. The visual carrier frequency is to be 1.25 MHz above the lower edge of the television channel. The specified frequency tolerance is ±25 KHz (compared with ±1 KHz for television broadcast stations). The aural carrier must be 4.5 MHz higher in frequency than the visual carrier with a tolerance of ±1 KHz (the same as television broadcasting).

B. Signals Delivered to Subscriber Terminals: The minimum peak visual signal level at the subscriber's terminal is 1 mv/ across a 75-Ohm impedance, or 2 mv/ across a 300-Ohm impedance. The visual signal level on any channel must not vary over a range of more than 12 dB (4:1 voltage ratio). The visual signal level on any given channel may not vary by more than 3 dB from that on either adjacent channel, or by more than 12 dB from that on any other channel. Maximum signal levels are required to be held to values which will not overload a subscriber's receiver.

The aural signal on any given channel must be maintained within 13 to 17 dB below the associated visual signal level. The amplitude vs. frequency response within any given channel must be held within ±2 dB for all frequencies within −1 MHz and +4 MHz of the visual carrier frequency.

C. Signal-To-Noise Ratios: A minimum ratio of 36 dB is specified for visual signal level to system noise, and with respect to offset co-channel interference. This requirement applies to cable subscribers within the predicted Grade B contour of the television station being carried, as well as to signals picked up within the predicted Grade B contour of the television station. The visual signal level variation caused by hum or other low frequency disturbances is not permitted to exceed 5 percent of the visual signal level. Intermodulation products or discrete frequency interfering signals not offset from the television carrier must be at least 46 dB below the visual signal level.

D. Subscriber Terminal Isolation: The isolation between subscribers' terminals must be sufficient to prevent any visible picture impairment for either open-circuited or short-circuited terminals, and in no events less than 18 dB.

Effective Date of Regulations

The new Technical Standards were scheduled to go into effect for new systems on March 31, 1972, and

for existing systems on March 31, 1977. An exception is made in the case of the system radiation requirement above, which was to go into effect March 31, 1972 for all systems. Cable systems are now required to make adequate performance tests to insure that each system is designed, installed and operated in full compliance with the foregoing requirements.

Complete performance tests must be made at least once each calendar year at intervals not to exceed fourteen months. The test data must be kept on file by the system for at least five years, and must be made available for the Commission inspection on request. The new Technical Standards require each cable system to make measurements that demonstrate compliance with the foregoing requirements. The required tests must include measurements made at at least three widely-separated points in the cable system, at least one of which is representative of a terminal at the end of the longest cable run. The new Technical Standards do not require specific measuring techniques, but do suggest some generally accepted techniques for measuring such items as frequency response, noise, and terminal isolation.

In other areas, the Commission, while not establishing Technical Standards at this time, has set the topic for further study. The areas of study include sources of color picture degradation such as envelope delay, differential gain and differential phase, frequency allocations within the cable network, standards for special cable television receivers, standards for Class II, III, and IV cable channel, and standards for cable carriage with aural broadcast programs.

One of the Commission's principal aims in permitting increased importation of distant signals into the top 100 markets was to provide services not being realized from the present system of over-the-air television broadcasting. The non-broadcast channel capacity being required under the new regulations is intended to provide channels for public access, educational access, and leased access, that is, channels to be made available to others either free or at a reasonable charge, carrying material whose content is not under the control of the cable system operator.

The Commission recognized that access to channel space is of little value in the absence of suitable program production facilities, and the new rules require that all systems having 3500 or more subscribers have acceptable facilities for local production and presentation other than automated services. These production facilities are required to be made available for public use for the production of programming for the public access channel.

No Technical Standards are established governing the performance of the equipment and the facilities used for program origination. The Commission notes, however, the increasing reliance on inexpensive production equipment, noting that while such equipment may not produce signals of the same quality as those employed for broadcast, there appears to be promise of improvement and refinement.

The final new engineering requirement imposed by the new regulations is that all cable systems in the top

TABLE II
A. U.S. Cable System Radiation Standards

Frequency Band	Former		New	
	Field Strength μv/m	Distance feet	Field Strength μv/m	Dist. feet
Below 54 MHz	15	100	15	100
54-132 MHz	20	10	20	10
132-216 MHz	50	10	20	10
Above 216 MHz	15	100	15	100

[1]400 μv/m in sparsely inhabited areas
[2]1000 μv/m in sparsely inhabited areas

B. Canadian Cable System Radiation Standards

Frequency Band	Field Strength μv/m	Distance feet
50-54 MHz	9	30
54-88	3	30
88-216	9	30

00 markets be built so as to be capable of two-way ommunication. No details are included, but the return ommunication capacity is required to be at least on non-voice basis. No bandwidth is specified. The Commission states that it is premature at this time to equire systems to provide actual two-way service, ut new systems must be built in such a way as to have capacity for return communication which can be added without costly system rebuilding.

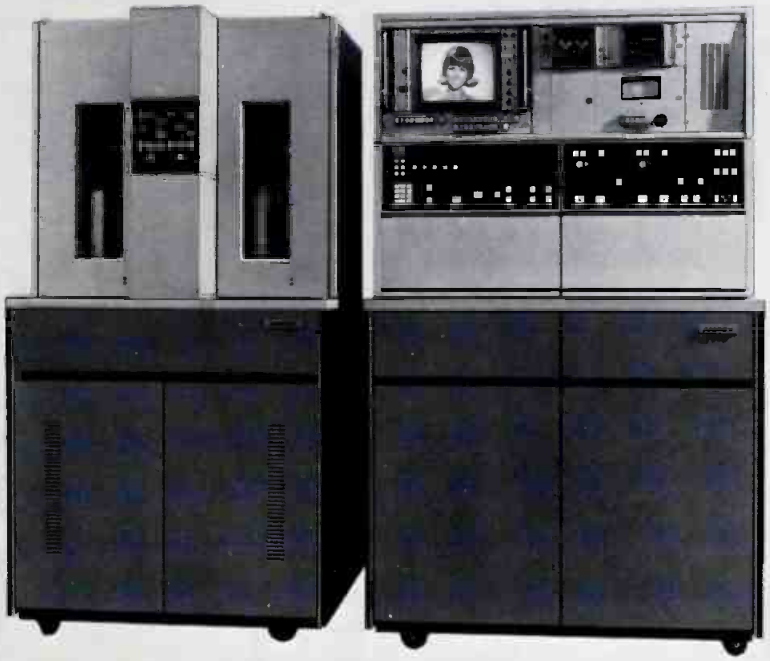
Petitions have already been filed asking the Commission to reconsider various aspects of the new cable regulations. As of this writing, however, no serious challenges have been made against the intentions of the new Technical Standards. With the final resolution of the pending petitions, the cable technical standards will become the law of the land.

Now make every second pay off, back-to-back, at random or in sequence

XX-TV
Program Log

TIME	LENGTH	PROGRAM	LOCATION	CASSETTE NO.	VIDE
7:48:00	:30	FOOD COMM.	Bin 12	522	AC
7:48:30	:10	MOVIE PROMO	Bin 13	684	AC
7:48:40	:60	FLOOR CLEANER COMM.	Bin 14	102	A
7:49:40	:10	JUICE COMM.	Bin 15	723	A
7:49:50	:10	COMM. I.D.	Bin 1	468	
7:50:00	8:00	LOCAL MORNING SHOW			
7:58:00	:60	AUTO COMM.	Bin 16	890	
7:59:00	:10	MOVIE PROMO	Bin 24	212	
7:59:10	:20	COFFEE COMM.	Bin 17	170	
7:59:30	:30	COSMETIC COMM.	Bin 18	650	
8:00:00	28:45	NETWORK			
8:28:45	:15	PUBLIC SERVICE	Bin 19	380	
8:29:00	:60	CEREAL COMM.	Bin 20	140	
8:30:00	:15	LOCAL NEWS OPEN	Bin 22	525	
:30:15	2:30	LOCAL LIVE NEWS			
:32:45	:20	MILK COMM.	Bin 3	925	
33:05	:10	EVENING NEWS PROMO	Bin 4	365	
3:15	:30	WEATHER	Bin 5	720	
:45	:15	LOCAL NEWS CLOSE	Bin 23	374	
00	:30	DEODORANT COMM.	Bin 6	676	
0	:10	I.D.	Bin 7	428	
	5:00	"THE MANAGER SPEAKS"	Bin 8	97	
	:10	EVENING NEWS PROMO	Bin 4	36	
	:10	MOVIE PROMO	Bin 24	2	

...with the amazing Ampex ACR-25 Video Cassette Recorder/Reproducer



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Now, free your reel-to-reel recorders for more profitable enterprises. Avoid make-goods caused by cuing errors. Accommodate last minute changes dictated by market conditions. Make your on-the-air continuity as smooth as your programming. All with the ACR-25.

Created from Ampex third generation video technology, the ACR-25 combines automatic features of the AVR-1 and cassette handling capability that makes it the best short segment recorder available. Completely flexible access and a 10 sec. recycle time that allows back-to-back short segment playback. Reloadable cassettes to eliminate dubbing and the resultant degradation of picture quality. Front accessible transports for easier, quicker maintenance. And all the automatic error correction capabilities of the AVR-1.

Try to imagine doing any of the breaks at the left on any other single machine. Then call your Ampex representative to learn how easy it is with the ACR-25. Or write: *National Sales Manager, Audio-Video Systems Division, Ampex Corporation, 401 Broadway, Redwood City, CA 94063*

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Circle Number 23 on Reader Reply Card

A New Broadcast Service:

The first US FM translator

By Robert A. Jones*

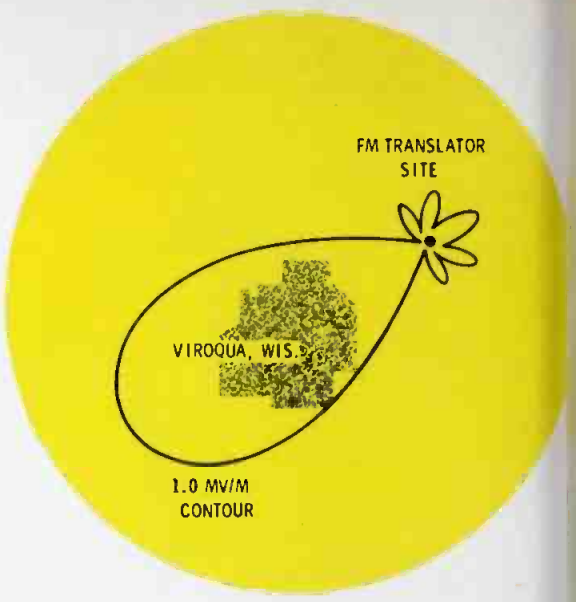

Fig. 1. Lobe from the FM translator signal covers this Wisconsin city.

It has now been over a year since the Federal Communications Commission finalized Rule Making that permitted FM translators and FM boosters to be legally operated. Up to now there have been some controlled experiments, but no legally authorized stations.

The first application to be filed and accepted by the FCC, was that of Wisconsin Christian Broadcasters, Inc., who requested authority to construct a 1.0 Watt FM translator at Viroqua, Wisconsin. This is FCC file Number BPHT-1. However, trouble was quick in coming. For example, in order to be granted a license, one has to specify a "type accepted" translator. There was no such equipment available last year. It has only been now, one year later, that equipment is available.

But let's first, review the difference and advantages of both boosters and translators, for those who are not yet acquainted with them.

In some circles these are referred to as FM satellites. And, in a sense, they are. They do not normally generate nor originate any programs, but repeat a retransmitted program originated by some regular FM stations. The FCC Rules provide for two types of satellites; boosters and translators.

*BE Facilities Editor and head of a consulting firm, LaGrange, Ill.

An FM Translator has three important points that set it apart from an FM Booster. These are **First**, the power level is restricted to either 1.0 or 10 Watts. By power I am referring to the power output of the translator. Now, why the difference in power outputs? This is because the FCC Rules say that those people lucky enough to locate their translators west of the Mississippi can operate with 10 Watts. The rest of us are stuck with 1.0 Watt. Keep in mind that these power levels are regardless of where the primary FM station is located. For example if you were to pick up WHA-FM and translate it from a point at Dubuque, Iowa you could operate with 10 Watts. If, however, you translated it from East Dubuque, Illinois you could employ only 1.0 Watts.

Input-Output Frequencies

The Second point deals with the fact that the input and the output frequencies must be different. Actually this is where the name Translator comes from, since in effect we are changing or "translating" the incoming signal to a new frequency.

The last point to recognize about translators is that their output frequency must be on one of the twenty Class "A" channels. Please note that the "input" can be on a Class "A", a Class "B", a Class "C", or even on educational channels.

There are four major points that distinguish an FM Booster. First, the power can be 10 Watts regardless of which side of the Mississippi you locate. Second, the input and output frequencies are the same. No "translating". Next, they have to operate on the same channel as the primary station they are repeating. Possibly the choice of the word repeater would have been more descriptive than the word booster to represent this type of FM satellite. And lastly, these Boosters must be located geographically within the theoretical 1.0 MV/M contour of the primary station.

The drawing shows a hypothetical allocation of two FM translators and one FM Booster used to extend the coverage of a given FM station. As you can see, the two translators are located well beyond the 1.0 MV/M contour of the primary station. While the booster is within this same contour.

Site Location

The reason that the coverage of each of these three satellites is drawn as a tear-drop shaped con-

tour, instead of a circle, is that all FM satellites will employ highly directional antennas. In fact such antennas will be used both for receiving and for transmitting.

At this point some engineers may question why anyone would want to, or even have to, locate a booster within his 1.0 MV/M countour. Fig. 3 is a possible situation where a booster would be helpful. Just to the north of Madison, Wisconsin lie the Baraboo Hills. They effectively block off all FM reception from the Madison area FM stations. A "line-of-sight" signal from WRVB-FM (a typical Madison station) would completely miss covering the city of Baraboo. If however an FM Booster were installed on top of one of these hills, it could easily "fill-in" this city, insofar as service from WRVB-FM is concerned. I'm sure many other possible cases of holes in other existing FM stations' service areas will come to mind.

I think by now you can appreciate the difference between FM boosters and FM satellites, and how each can be used by any FM station to improve or extend its signal.

Our efforts at Viroqua were delayed as we searched for a manufacturer to construct an FM translator to apply for type-acceptance. After many months of getting the standard answer, "We are working on one; but it may be a few weeks until we complete it"; I realized the only way to get one licenseable, was to build it myself. Had I known the problems I was in for, I doubt if I would have done it.

The photo and the block design show the Model J-316 translator, the first licensed translator in the United States. The input signal comes in at the top left. The first box is the MOS FET RF preamp. The following box is the down con-

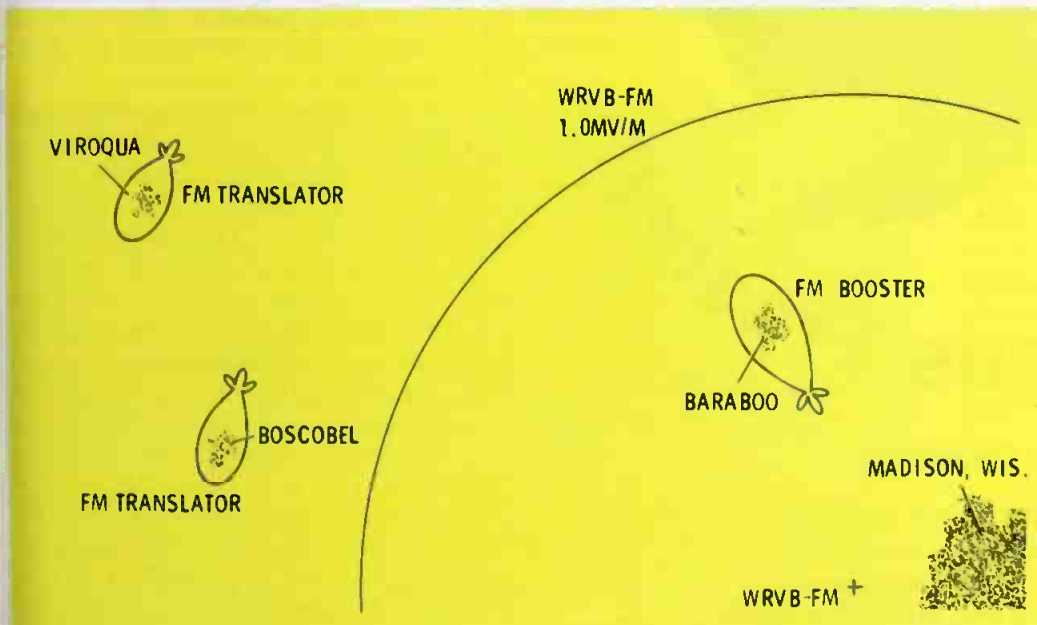

Fig. 2. Hypothetical allocation of two translators and one booster. The teardrop shape of their coverage is the result of using highly directional antennas.

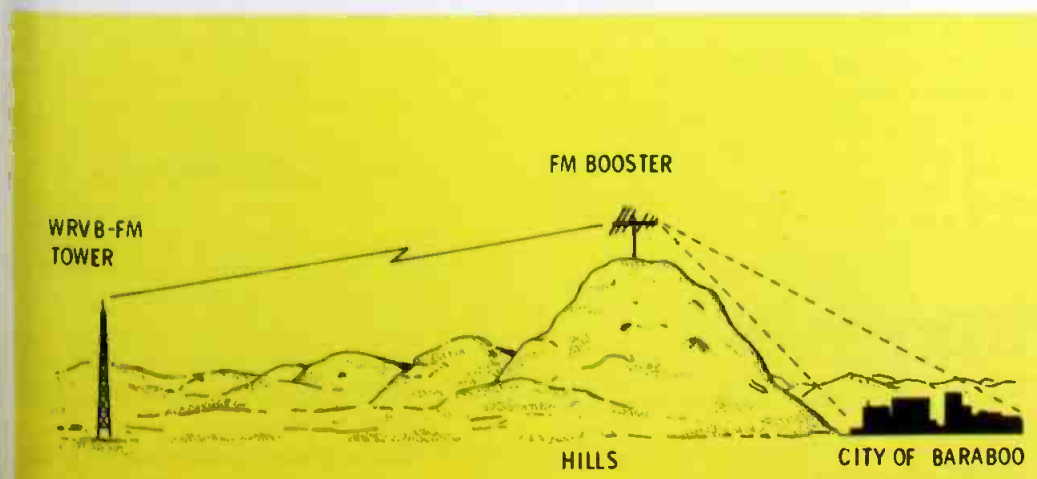

Fig 3. An example of how FM service can be brought into a previously inaccessible area.

vertor from the FM band to 10.7 MHz. This is followed by five stages at 10.7 MHz of the IF strip. This is where the selectivity is achieved as well as any unwanted parasites are removed.

The second convertor box represents the Up Convertor. At this point the frequency of the FM signal is brought back up to the FM band, (88-108 MHz). The three boxes below this up convertor represent the RF amplifiers and power output stages of the translator. There are two oscillators. These represent the down convertor oscillator, and the up convertor oscillator. The other boxes are for various controls, power supplies and FCC required functions. Not shown but part of the IF strip is a lump constant filter used to achieve the high degree of selectivity we found necessary.

The Model J-316 was intentionally designed in two self contained units. These, for lack of a better choice of names, I call Unit "A" and Unit "B". The reason for this is to be able to physically separate the receiving unit ("A") from the transmitting unit ("B") in the event there is interference or in the event we wish to operate this as an FM Booster. Later designs with better shielding permitted the complete unit to be in one housing.

Speaking of FM Translators, the first country to license the use of such devices, was not the U.S.! As far as I have been able to learn it was Haiti. A missionary group, Radio Lumiere, installed seven mountain top units as long ago as 1962. Their most powerful unit is only 1.0 Watt, with some units achieving only 60 milliwatts.

Antenna Requirements

In most cases antennas will be the same regardless of whether it is to be used with a booster or a translator. I used a ten element YAGI for this first licensed station at Viroqua, Wisconsin. Identical types for receiving and transmitting will be employed.

To properly receive an FM sig-

nal, some distance from the primary station, one needs as much gain amplification as well as directivity at the receiving end of the path as one can readably obtain. In most cases the receiving antenna will be mounted one at the top of the tower. In addition to the gain characteristics, it will also be helpful to utilize the high degree of suppression off the sides and the back of the YAGI antenna to eliminate co-channel or first adjacent channel interference. After all, you want to repeat only one FM station, not all those in the area. There are several good manufacturers of single channel FM antennas, or they can be constructed out of aluminum tubing using simple formulas such as one finds in the American Radio Relay League handbook.

Fig. 4. The FM translator built by the author. See Figure 5.

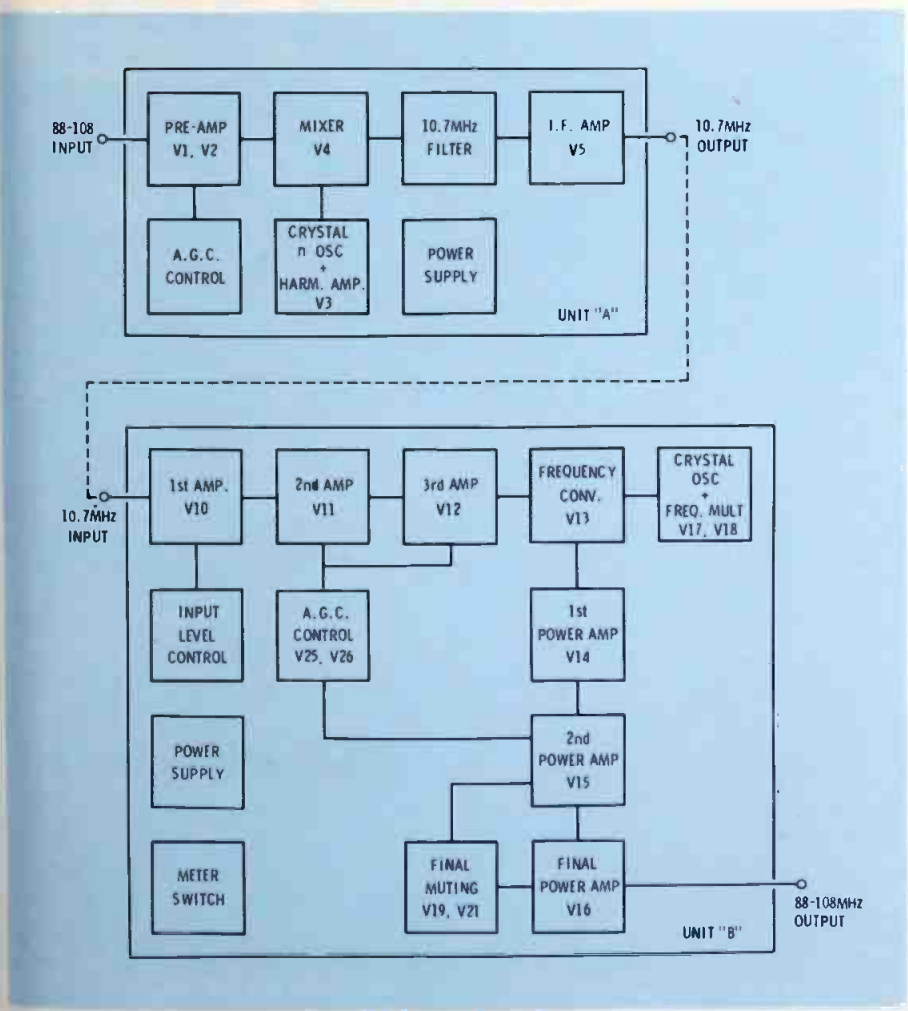

Fig. 5. Block diagram of the translator—model J-316—described in the text.

My work to date has shown that we can install our receiving and our transmitting antenna on the same tower, in the case of an FM translator, provided that they are not closer than 50 feet. Also, it is desirable to have the direction of each at about right angles so as to minimize interaction. If you plan to use an on-channel booster, then it is necessary that they be physically separated by as much distance as possible. One of the best methods is to locate the receiving antenna and transmitting antenna on opposite sides of a hill or mountain peak. In any event I recommend at least 300 feet separation.

The map represents the coverage of the Viroqua translator. Keep in mind this is the FCC predicted coverage using the 50:50 curves of Section 73.333 of the Rules. Listeners with good FM receivers or outside antennas may copy this one Watt device at two or three times the distance predicted.

Commercials on Translators

A final thought should be considered. First, locally originated spot announcements and commercials can be programmed over translators. The FCC reasoning behind this, I am told, is to provide a means for local support of FM translators. Keep in mind that such announcements are limited to 20 seconds in length. The Model J316 described above does have the capability of making local cut-in's by adding one small sub-chassis. No other FM translator, as yet approved by the FCC is so equipped.

Obviously, if enough translators are built, and the need for local announcements to provide financial support is great enough, manufacturers will develop such a device.

Redesigning for low studio noise

By Dana P. Doiron*

The elimination of noise (unwanted sound) has always been part of the design criteria of radio and television stations and recording studios. Until recently, however, such a construction specification was costly and, in many cases, without promise of satisfaction.

Before installing $380,000 worth of new equipment and spending $120,000 renovating its headquarters, Eastern Sound Co., a North American producer of professional sound recordings, wanted assurance that the finished job would provide studios and control facilities which met exacting standards in elimination of background noise.

Murray A. Shields, Eastern's Vice President and General Manager, describes their specifications as almost impossible. "We have two control rooms and one sound studio, separated from each other by 38-inch-thick walls. For these installations to operate simultaneously, the leakage of sound from each to the others had to be reduced to a minimum.

"Cominco's Sheald reduced sound leakage by 90 decibels. That's an extremely high degree of isolation." (To give some idea of what this means: The normal background in

*Vancouver, BC, Canada

Fig. 1 Exterior of Eastern Sound's studio in Toronto. Renovation did not disturb old building exterior.

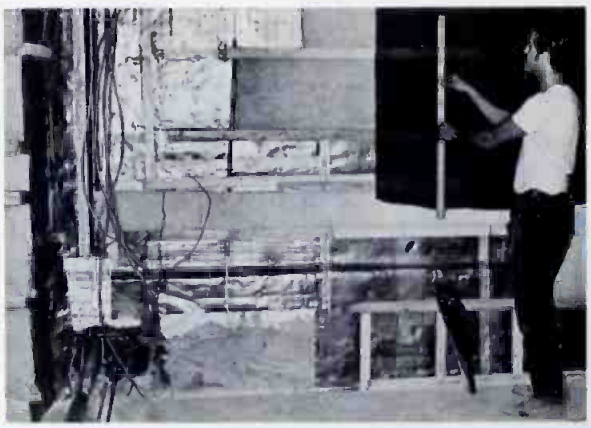

Fig. 2 This construction shows the various layers of materials used in sound proofing and decoration. (Photo by *Heavy Construction News.*)

Fig. 3 Murray Shields, VP and general manager of Eastern Sound, at the control console in the new studio. Note black scrim and dowelling in background. Worker in Fig. 2 demonstrates details.

a room is about 40 decibels. The human pain threshold for sound intensity begins at about 125 decibels. Eastern Sound's working level is about 115 decibels, so 25 decibels or less penetrate into other rooms—far less than normal background sound.)

But they were met. And Sheald*, a continuously cast thin lead sheet product is largely the reason.

The noise barrier qualities of lead have long been recognized as ideal but the high cost of rolling sheet lead has been a prohibiting factor even in many of the most critical areas.

Cominco Ltd. developed Sheald at its Product Research Centre at Sheridan Park, Ontario. The continuous casting process produces thin (1/64 in. to 3/64 in.) lead sheet that is uniform, malleable, dense and an economical alternative to rolled lead. It can be cut with a knife or scissors and can be installed by construction or maintenance personnel without special training.

The acoustical contractor employed by Eastern had previously worked with Sheald. However, for this critical application he approached Cominco for technical assistance on the project. On Cominco's recommendation, the walls and ceilings of the rooms were lined with Sheald (3 lb./sq. ft., 3/64 in. thick). Joints were sealed with lead tape.

Over this, 1 inch x 2 inch wooden slats were placed vertically at 18 inch centers. Fiberglass insulation was laid between the slats and a finish of coarse-weave fiberglass cloth, dyed black, covered the walls and ceiling. As a result, environmental control was effectively accomplished through absorption (fiberglass) and isolation by the barrier metal—Sheald.

For decorative purposes, natural finished 1¾ inch diameter oak dowelling was placed vertically at three inch centers and offset from the wall ½ inch. The result—a clean, modern and soundproof studio system.

Other features incorporated in the renovation include a 4 ft. x 14 ft. window (between the studios and control room) made up of two panes of ⅜ in. plate glass with an average 6 in. air space between. All floors are independent of the wall structures to prevent possible transmission of sound from floor to wall.

Each room has a separate air-conditioning unit with silencers. The supply and return duct work is insulated on the inside and where ducts pass through the ceiling it is sealed with acoustic caulking and with Sheald interlocked around the duct.

Entrances to studios and control room each have two doors which incorporate Sheald in their construction.

The shell of the old building is much the same as it was more than a hundred years ago. But, the interior, altered many times over the years, now houses one of the most modern sound recording installations in North America.

*Trademark of Cominco Ltd.

Wow and flutter in disc recordings

Measurement techniques and check list for turntable maintenance.

By Mahlon C. Stacy*

Most people in this country come into contact with music which is reproduced from disc equipment. There are many factors which influence a signal being stored on the disc. But wow, flutter, and noise are the only factors which inject undesirable effects. In this article I will discuss the causes and effects of wow and flutter in the reproduction system.

Wow and Flutter are, effectively, the same measurement. In fact, it is difficult to separate them when making instrument measurements. They are caused by periodic irregularities in the velocity of the medium, in this case the rotational speed of the record. Rotational speed that is the culprit, and this means that the frequency and amplitude of the actual wow and flutter will not change at any radius on the disc.

Wow is now seen as speed changes which occur once for each revolution of the record. Flutter frequencies are higher than once per revolution from about 5 Hz to 200 Hz. They were originally recognized separately due to their separate effects on the reproduction of the sound.

The effect of wow to the listener is a slowly changing reproduced frequency, when the wow frequencies are from zero to about 7 Hz. Flutter will be noticed as sidebands which add to and subtract from the recorded sound, when the flutter frequencies are between 50 and 200 Hz. Between 7 and 50 Hz, the flutter can be noticed as a change in the tonal quality of the recorded sound.

Wow, Flutter Standards

Frequency modulation is most noticeable in a single-frequency sine wave. Wow and flutter in turntables is usually characterized by a complex wave form, and thus is not so directly noticeable. However, for a simple listening test of wow and flutter, a single frequency test record may be played, to bring out the audible effects.

Wow and flutter standards are many, most of them relating to magnetic tape reproduction. There is only one sure disc standard used in this country, and that is the NAB disc standard, stated as follows:*

"It shall be standard that the instantaneous peak deviation from the mean speed of the reproducing turntable when reproducing shall not exceed ±0.2 percent of the mean speed."

The other flutter standards in use today were all designed for tape reproducing. They are the NAB tape standards, the DIN tape standard, and other less recognized standards, such as CCIR, and the Japanese standard. These tape standards may be applied to disc reproduction, as long as it is realized that the numerical results do not directly correspond to each other, due to differences in the methods by which the measurements are made.

Specifically, the NAB tape standard refers to an RMS reading of the flutter, which may or may not be weighted toward an aural response curve. The DIN measurement requires a peak reading of the flutter, which corresponds to the NAB Disc standard, however, the DIN measurement is usually weighted. Thus, there can be a great deal of confusion between the different readings obtained from the same piece of equipment.

Measurement Techniques

The measurement technique for wow and flutter in disc systems is uniform in two respects. It starts on the turntable with a test record and a cartridge, and passed through a FM discriminator. The material on the record is a single frequency, usually 1000 or 3000 Hz. After the discriminator, various circuits are employed to derive the results in the proper form for one or another of the various standards. If a flutter meter designed for tape measurements is used, it may be passed through a weighting network, then amplified, and rectified, and usually presented as a meter reading.

Another method of measurement involves the use of a strip chart recorder, usually an oscillograph type, to follow the instantaneous velocity of the disc. This will yield a peak to peak record of the velocity of the turntable, which must be interpreted into one of the accepted standards.

The basic problem with all of these methods of measurement is

CHART 1

Comparison of readings for the same value of Flutter at various frequencie

Frequency, Hz.	Peak-peak	DIN, weighted	DIN (peak)	NAB, weighted	NAB (R.M.S
.55	.200%	.027%	.100%	.019%	.071%
.75	.200	.047	.100	.034	.071
4.00	.200	.100	.100	.071	.071
50.00	.200	.025	.100	.018	.071
200.00	.200	.007	.100	.005	.071
Composite Sum of all of the above	1.000	.206	.500	.147	.353

NAB weighted measurement shows smallest numerical value of the differe measurement procedures. DIN (peak) corresponds to measurement calle for by NAB disc reproducing specs.

*Gray Research, East Hartford, Conn.

that it relies upon a test record which, since it must be produced on a turntable, contains wow and flutter of its own. It cannot be separated from the wow and flutter of the system under test. Manufacturers of disc recording lathes have spent considerable time and effort to keep the wow and flutter in their lathes at a low level, and it is considerably lower in the final record than in the average reproducing turntable. However, for close measurements, this inherent flutter must be considered.

Check List For Wow And Flutter

The causes of wow and flutter in turntables can usually be separated into wow factors and flutter factors. **Wow can be caused by any or all of the following:**

1. Lack of balance in the platter or flywheel of the turntable.
2. Dimensional irregularities in the flywheel and/or platter. These include concentricities of the drive point and the record spindle, and flatness and perpendicularity of the playing surface.

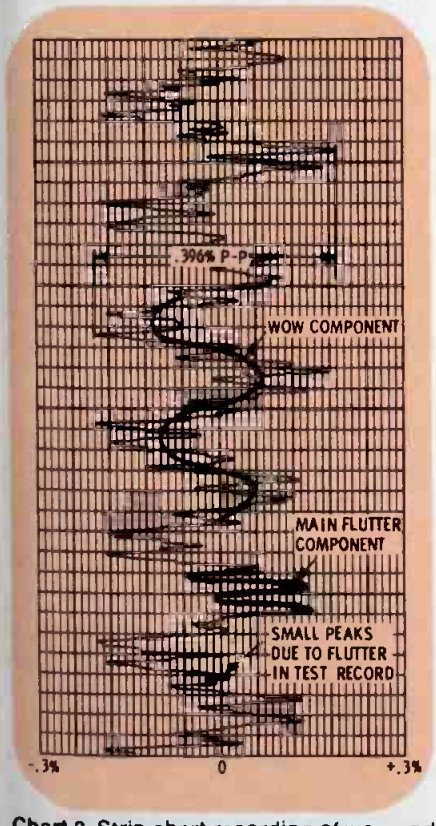

Chart 2. Strip chart recording of wow and flutter from typical turntable. Peak to peak is .396%. NAB weighted measurement was about .06%. This unit was within manufacturer's rated specification, which called for .075% DIN weighted wow and flutter.

3. Deficiencies in the bearing structure, lubrication, wear, alignment, and surface finish of the bearings and shaft can influence the wow reading.

Flutter can be caused by:

1. Surface irregularities of the flywheel, idler, or motor shaft.
2. Dimensional irregularities, such as roundness, concentricity, and perpendicularity of running surfaces.
3. Condition of bearings, pulley and motor.
4. Balance of rotating parts.
5. Slippage of friction drive points.

Basic wow and flutter characteristics are usually designed into a turntable. The numbers will be affected by the weight of the platter, size of the idler, torque of the motor, and other parameters which cannot be changed when the turntable is in use. However, certain causes of wow and flutter can create problems and be corrected with simple maintenance. This would include proper lubrication at the intervals prescribed by the manufacturer, to retain ideal bearing qualities and replacement of worn or slipping idlers or belts. Naturally, it is a good idea to discover and correct any problems before they are pointed out by your listeners.

How much wow and flutter is acceptable depends upon the application to which the turntable will be subjected. Top 40 format radio stations can tolerate more wow and flutter than classical FM stations, due to the types of music played. The normal range of wow and flutter in modern broadcast turntables is from .12 percent to .35 percent, Peak, unweighted.

Published specifications do not usually indicate the method of measurement used to derive the result, and as such can be deceiving. A summary of the correspondence between various readings is shown in the chart.

In conclusion, wow and flutter are real quantities which can plague an engineering staff if not fully understood. Some causes of wow and flutter can be eliminated in the studio as a part of normal maintenance, but the basic characteristics require quality design and manufacturing.

*NAB Engineering Handbook 5th Ed. McGraw & Hill, New York, 1960, PP. 1-374.

Telephone interface basics

Part 1 of a series explaining considerations and details for patching in communications systems.

By Clint Tinsley*

I am always amazed at the lack of information available on basic telephony. It will be my purpose to 'expose' the telephone in terms of how one might connect to the telephone in a very practical sense and use that connection in broadcasting.

Every radio station in which I have been employed has had some phone 'patch' problem which has really pointed up the lack of information in this field. The station at which I am presently employed had nothing more than a 2 mfd capacitor between the telephone and the console and a 5 kW AM transmitter sitting downstairs. I have spent many hours devising a means and improving that means of access in to the telephone.

Basic Telephony

The average DC resistance of the standard WE 500D set is 100 Ohms, with the older 302 set being slightly higher and of fixed value. The WE 500D set, as well as most modern telephone sets, has some voltage/current dependent variable resistive elements which compensate for loop losses and vary the resistance of the telephone over a measured range of 80 to 120 Ohms.

The telephone could be reduced to a simple on/off switch, a dial or pulsing arrangement noting that the dial is a normally closed item, an earphone and a carbon microphone all connected in series.

The heart of any telephone is a induction coil which is contained in the "network" of the modern telephone. The WE designation for the network in the modern 500 series set is 425E. It has a multiple winding transformer 'induction' coil, three varisistors, a few ordinary resistors and capacitors, and a terminal area on top. It is the terminal area we'll consider first.

Figure 1 is an illustration showing the terminal area pictorially and a schematic presentation of the connection made there on. For privacy, you should make your broadcast loop connections at F and C on the 425E. Do not attempt to mute the handset at R by switching the common lead because all that will happen is that the sidetone balance of the set will be destroyed and the handset will still be hot; break the microphone lead at B to mute the microphone.

Figure 2 is the usual method of bridging the broadcast connection. Figure 3 shows the so-called 'hybrid' arrangement with the nulling feature. I have tried several different nulling arrangements, resistive bridge and the like in transistor equivalent, and have almost consistently been plagued with two problems: return echo distortion (which seemed to take the edge of the moderator's voice) and loss which almost certainly required microphone level reamplification.

The receive level from the phone line coupling circuit of Figure 2 will be approximately a -20 dBm when the line is terminated in the 425E network. This is just about right for the medium level inputs of most broadcast consoles. I recommend the terminating of the phone line in what ever type of load that might be present in your telephone set for proper "match" to the phone circuits in your area and thus usually recover maximum audio.

Terminate It Yourself

You should anticipate a 10 to 20 dB range between transmit and receive levels through your audio coupler. Good audio practice dictates some type of isolation to break up the effects of stray grounds and accompanying noise problems. The impedance of the phone line is generally in the area of 900 Ohms and good audio recovery will result from a transformer input impedance of 200 to 1000 Ohms bridging the telephone circuit.

In the KATN system I use a Stancor A-4350 transformer tapped 500/500 which has a DC resistance of approximately 10 Ohms. In previous systems I have used telephone repeater coils with good success but with telephone repeater coils you have to watch phasing as most coils have 4 windings and they also have different values of impedance.

A comment on the size of coupling capacitor in the audio coupler. The phone circuit established in a cross town call is not of the elementary circuit conceived as a system of two sets with a battery in series but instead consists of a local battery in series with a supervisory/signaling relay and your particular receiving set and then coupled through the switching equipment to the called party with a 1 to 2 mfd capacitor. Due to this coupling capacitor, there is not much value in exceeding a 2 mfd capacitance since your coupling reactance at the low end is not going to be any better than that established by the coupling capacitor in the phone company central office.

*KATN AM-FM, Boise, Idaho

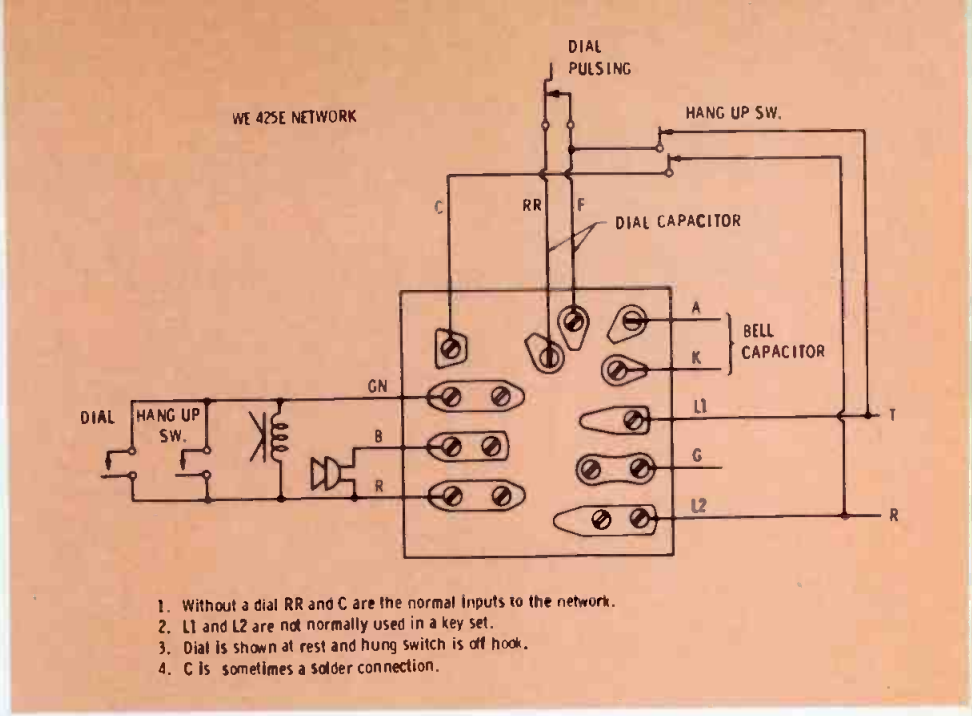

Fig. 1 The WE 425E network. Without a dial, RR and C are the normal inputs to the network. L1 and L2 are not normally used in a key set. Dial is shown at rest and hang switch is off hook. C is sometimes a solder connection.

DC loop resistances are very important and should be considered when designing your audio coupler. The following concerns this fact and the current required for the supervisory/signaling function which prevents unintentional disconnect. Relating to central office equipment:

"For Step-By-Step and Panel Offices: Maximum loop resistance of 850 and 1200 Ohms respectively, limited by supervisory signaling and dial pulsing requirements.

For No. 5 Crossbar and ESS offices: Maximum loop resistance of 1300 Ohms, based primarily on transmission considerations."[1] As stated previously, the DC resistance of the modern telephone is approximately 100 Ohms and your audio coupler DC value should approach that of the telephone set.

Key Control Systems

Figure 4 gives you the basic key control designations. When you seize the phone circuit, you tie all three lines into their respective circuits. To release the circuit, you must break all three lines at once. To produce a hold, you break the A1 control circuit first, then the other two lines. Once a circuit is on hold, you cannot recover the circuit inside your plant by terminating across T and R until the A1 circuit has been re-established. If the circuit has not been placed on hold, you can seize the circuit with T and R, but the light indicators on the key set will not show the circuit to be in use.

You will have to examine your own plant in knowledge of Figure 4 and its functional analysis. There are many different key sets in the field and within the KATN plant, I found three key sets with different terminal layouts and designations in similar 500 series key telephones.

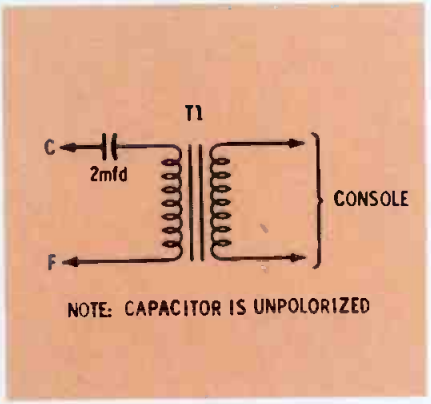

Fig. 2 The usual method of bridging the broadcast connection.

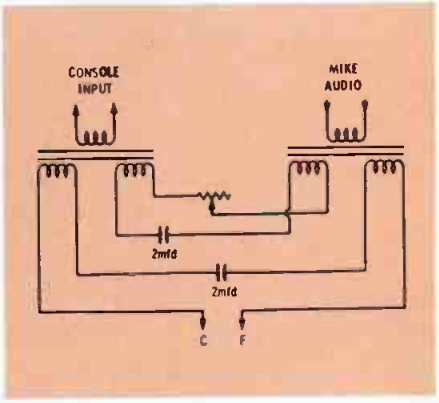

Fig. 3 Hybrid arrangement with nulling feature.

One approach I would recommend is that you get the telephone company to provide you with a key "pad" and extend the proper control functions from that into your system.

KATN Auto-Patch

The KATN system was designed for maximum talk show flexibility and operator ease of control. We do not use a beeper unit or a talk delay system. We work into a key system and thus must perform all the functions of Figure 4 plus proper line termination. Line selection is made in two ways. The KATN system is tandem, with a conference tie facility such that the operator can have two phone lines on the air at the same time. The two line selection methods are (a) the key set on the phone in the studio and (b) the conference tie unit which has a rotary switch for line selection and performs all the functions of the key set. This conference tie unit can serve as the primary means of line selection if the key set breaks, which has happened in the middle of a program.

A third backup is provided by line selection in the usual manner and coupled into the console through a circuit similar to Figure 2. The operator never touches the phone except to select the line on the key set in normal operation, but may in a given situation, pick up the phone and talk to the party in full privacy.

Located directly in front of the

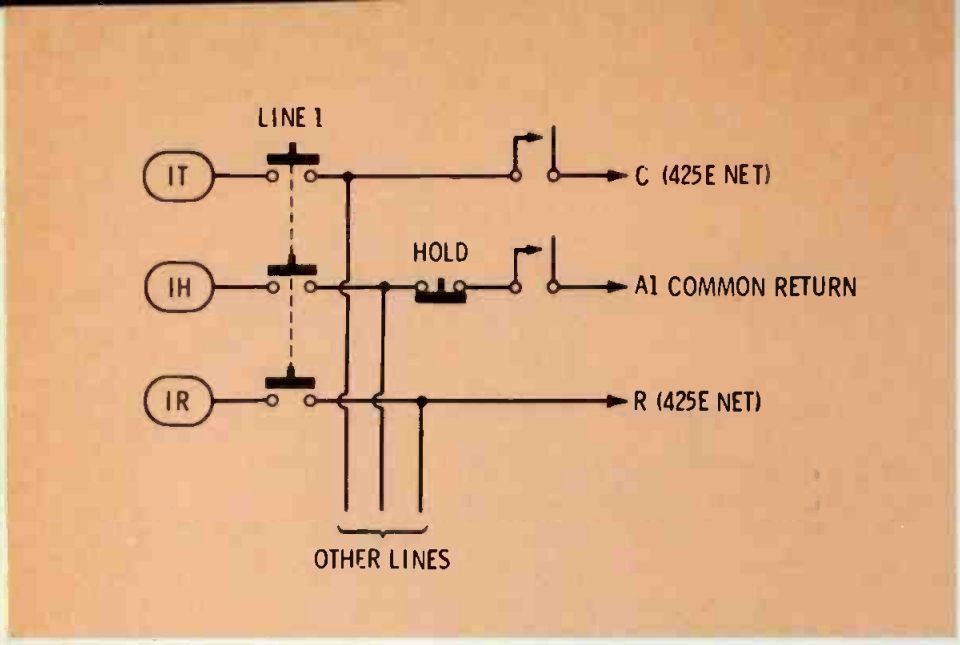

Fig. 4 Basic key control designations.

operator on the console are three push buttons which control access to both systems and full release. Individual release buttons are provided on the conference tie unit along with a hold button, system status switch and conference mode switch along with line indicating lights and selection switch. Figure 5 is the schematic of the KATN Auto-Patch. P1 and P2 controls phone line access by energizing K3 or K4 respectively thus terminating the phone line in a Stancor A-4350 500/500 transformer and

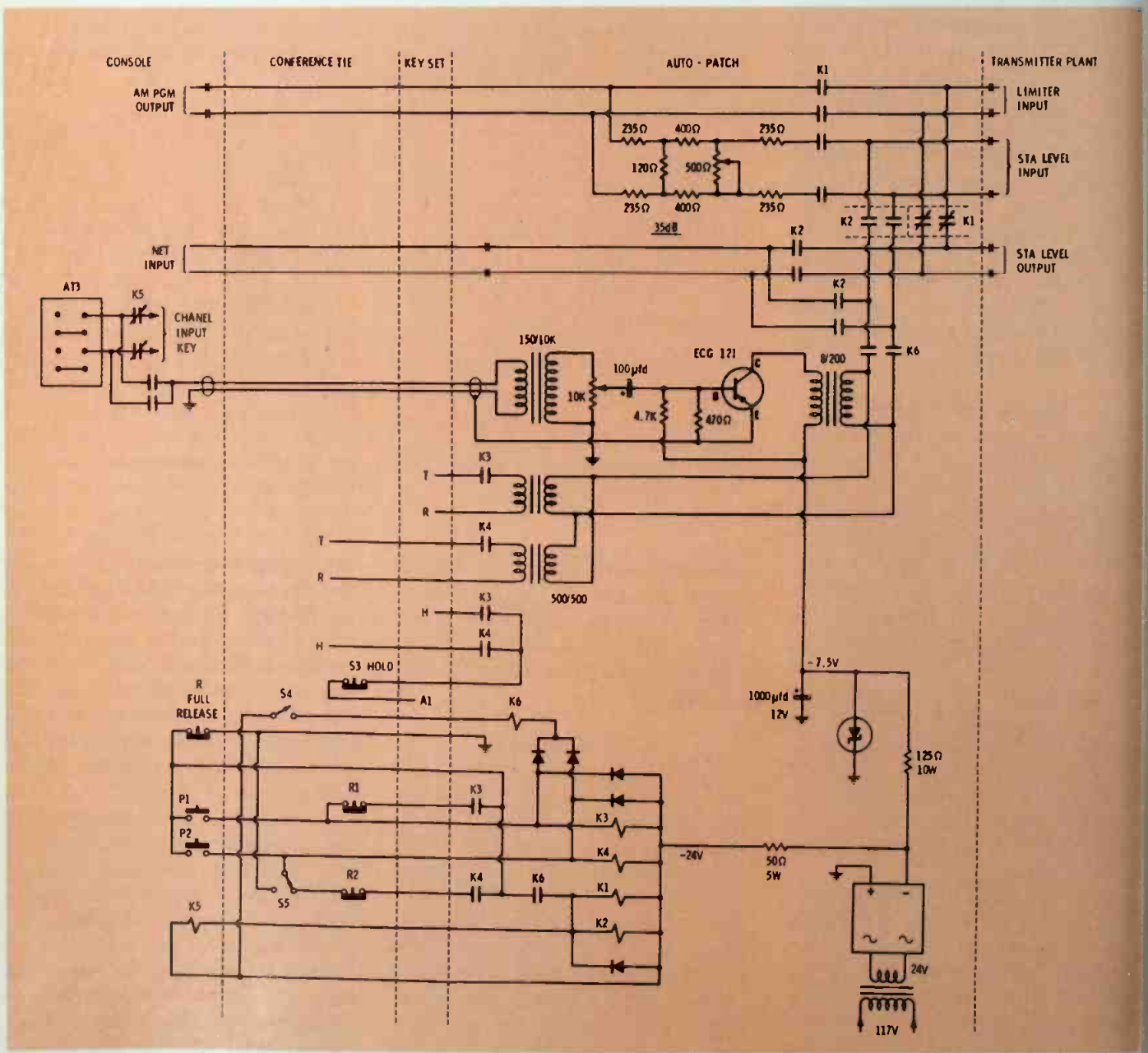

Fig. 5 schematic of the KATN auto-patch unit.

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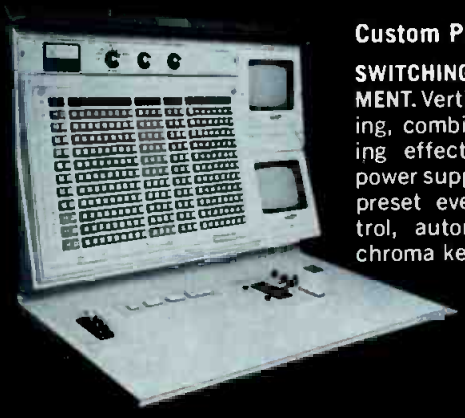

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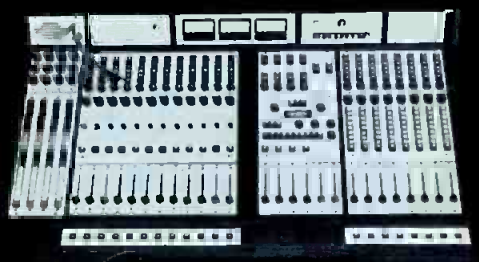

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completing the A1 control circuit. K3 or K4 hold through their own contacts, R1 or R2 respectively and ground return system of R, designated as full release. K6 is the System Status control relay which finds its holding circuit through one of two gating diodes and the respective holding circuit of K3 or K4. K6 is switched to -24V through S4 which is the System Status control switch.

There are two positions on the system status switch which are air and hold which allows the moderator to leave the phone lines briefly to read a commercial and then return to the same party(s) with a simple flip of a switch. K6 controls K1, K2 and K5. K1 and K2 control the switching of the AGC amplifier out of the program circuit and into the phone system thereby stabilizing the output of the Auto-Patch into the console utilizing an effective compression range of approximately 30 dB.

The output of the console is switched directly into the limiter during this time. K5 switches the outputs of the stereo microphone preamps from the console mixing busses and into the booster amplifier giving adequate transmission level into the phone lines. The 8/200 transformer is a 25 V constant voltage line transformer tapped at 2 Watts. Diodes are GE-504 and relays are P&B KHP17D11 24 Volt.

Figure 6 provides some additional insight into the control theory of the Auto-Patch. The **Conf. Mode** switch was a late addition to the Auto-Patch. This switch locks up K4, thus preventing accidental release of the phone interview party and removes the normal holding circuit of K4. The moderator may still use the system status switch to break away briefly, if desired.

RF Fields and the Phone Patch

Your problems here can be three fold. Detected transmitter audio is usually one of the first ones noted and if present before work starts on your phone connector, have the telephone company come out and put their RFI filter units on the stations' lines or you will have problems all the way.

The second problem is that of detected transmitter audio after connection of your phone patch, which will cause your transmitter to chirp and just generally have a good case of the birdies. Check your grounding of the patch: (A faraday shield in your coupling transformer might help). Following this is good RF isolation the telephone lines from the phone patch.

The third problem is that of sideband splatter and hum, which are both related to having a good quiet mike circuit. Note on Figure 5 that I have 1000 mfd/12V filter capacitor following the zener. A buzz on the sidebands can usually be eliminated by the addition of a 5 kHz low-pass filter on the output of phone patch provided you don't get some harmonic addition and shouldn't if your equipment is up to proof.

Telco Relations

Talk to the phone company first, work with them and remember that they are in the business of working for you. If they can provide the equipment that you need, lease from them; and if they don't, then build your own, usually with their blessings. It's a two way wire...

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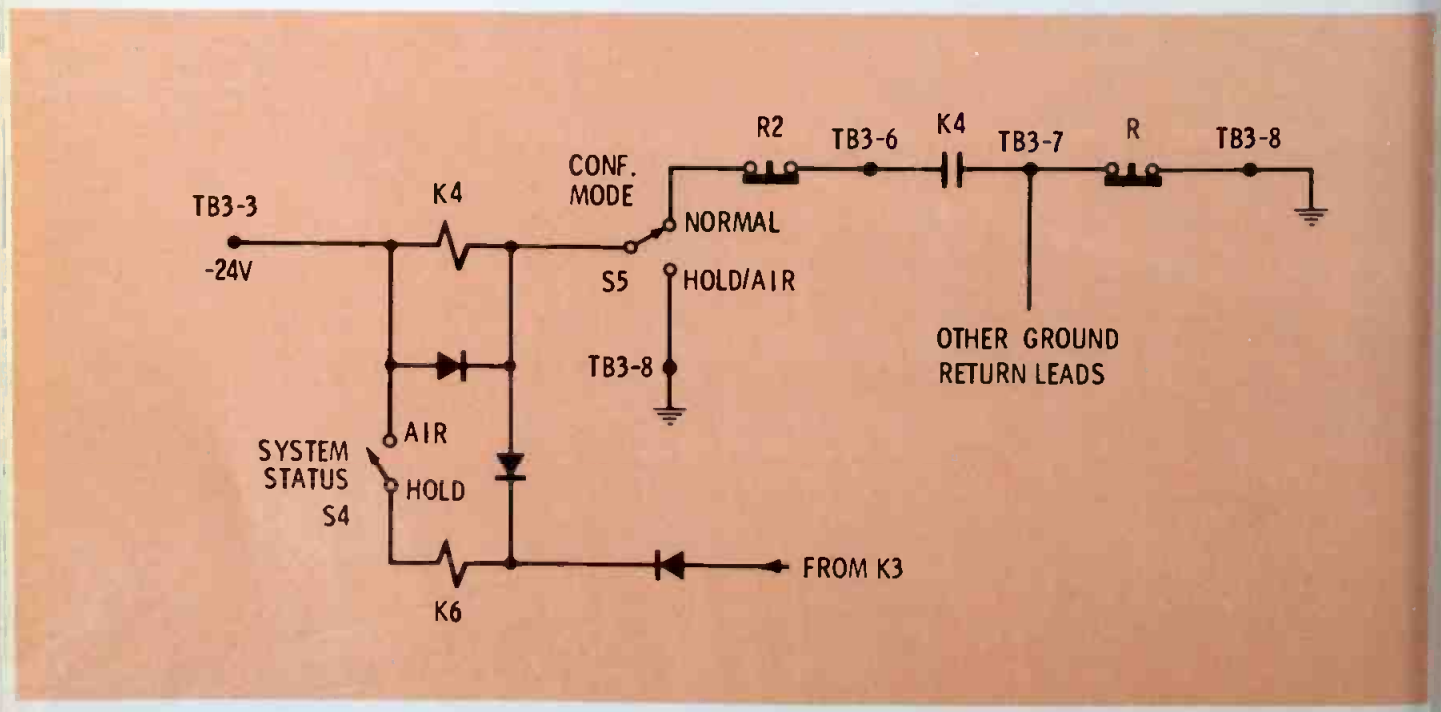


Fig. 6

Recording Equipment Maintenance Manual Is Now Available

Nortronics Company, Inc., manufacturer of magnetic heads, has announced the availability of a new, 16-page manual which provides comprehensive information about recording equipment maintenance.

Entitled "Recording Equipment Maintenance Manual", the new publication is industry's first complete treatment of the need for preventive maintenance and the simple techniques that will keep recorders functioning to original specifications. It includes detailed data on magnetic heads in terms of the way accumulated dirt and oxide can degrade performance; information on demagnetization, splicing and splicing tapes, lubrication and liquid and spray cleaners.

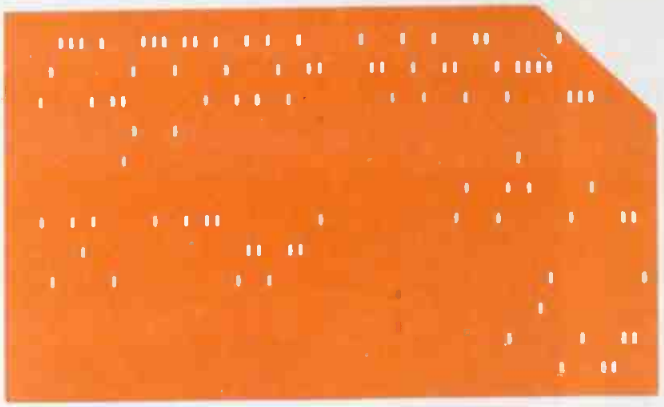
A typical maintenance program is presented in chart form, along with Nortronics' LOOK-TOUCH-LISTEN approach to head examination and evaluation. Finally, the manual provides five pages which detail Nortronics new QM-SERIES of maintenance accessories.

Copies of the Nortronics "Recording Equipment Maintenance Manual" may be obtained from Nortronics distributors, or by writing to Nortronics Company, Inc., 8140 Wayzata Boulevard, Minneapolis, Minnesota 55416.

Anderson Laboratories Forms CATV Subsidiary

Anderson Laboratories has a new subsidiary—Optical Communications—that will surely bring some innovations to the cable industry.

The new company, to be located in Orlando, Florida, will be developing short-haul communications systems. This will include video links designed for broadcast and CATV uses. The initial objective of the company will be to take part in the evolution of data links for common carriers and to participate in the growth of CATV and other cable systems through multichannel video transmission links.



Computer Assisted Engineering

By Morris Courtright*

Much has been written about the wonders of a broadcast automation system or computer and the great help it can be to the station operating staff. Very little has been said, however, about how a computer can help the engineer.

With the aid of a friendly computer and an acquaintance with at least one computer language called FORTRAN, much of the sweat and toil can be taken out of many engineering calculations. It is not even required that you become a computer expert, just be able to write your problems in words the computer can understand.

First, what is this language called FORTRAN? The letters are an acronym for Formula Translation, and that is exactly what it was intended for: to translate your everyday formulas into something the computer can solve. One of the oldest symbolic languages, FORTRAN is also one of the most common in engineering and scientific circles. And, for good reason. It is easy for engineers to work with.

Language Translation

For example, the well known equation for resonant frequency $1/2\pi\sqrt{LC}$ becomes 1/(2*3.1416*SQRT(L*C)) in FORTRAN, R1R2/R1+R2 becomes (R(1)*R(2))/(R(1)+R(2)), and E=IR becomes E=I*R. Simply, you use the +, —, / symbols as usual for arithmetic operations, while multiplication becomes * and exponentiation is **. Included are built-in subroutines to calculate the Sine (SIN), Square Root (SQRT), natural logarith (ALOG), and many others.

There are, of course, some rigid rules about the use of parentheses, variable names and the methods of getting the data into and out of the machine. You will also discover those very handy things called DO Loops, IF statements, GO TO's and so on, but you will find that all can be easily learned with relatively little effort. At least enough to solve your problems.

An example of how the computer can be of great help is that basic broadcast engineering problem of coverage prediction. Whether for a new station or changes to an existing one, the problem usually entails much calculation and head scratching.

Figuring Pattern Coverage

Long familiar to most engineers, figuring out the coverage of an AM pattern to fit into the existing coverage of some 4351 stations can be a tedious, time consuming task. Predictions of FM or TV coverage, usually by use of appropriate charts in the Rules, many times requires supplemental calculations when th antenna height is less than 100 f above average terrain.

As in most cases in engineerin when all else fails, go back to bas theory. In this case, the old wa propagation equations. With the a propriate formula in hand, the ne step is to sit down with slide rul desk calculator, pencil, paper an copius amounts of coffee and figu out the coverage. At least that h been the traditional approach. No however, relief is at hand. Much the tedious hand calculation c be done quite effortlessly by computer.

First though, a quick look at t method of array calculation. As d veloped over the years, the fie strength equation is:

$$F(\emptyset,O) = E_1F_1(O)\sqrt{2F\sqrt{1+2F}}$$

$$+\text{Cos}(S\text{Cos}\emptyset\text{Cos}O+Y)$$

Perhaps not so well known is t basic far field equation:

$$F(\emptyset,O = 1 + \Sigma K_i\text{Cos}(S\text{Co}$$

$$\text{Cos}O+Y) + j\,\Sigma\, K_i\text{Sin}(S\text{Cos}\emptyset\text{Co}$$

$$+ Y)$$

Either can be used depending your inclination, but in this partic lar case the latter was employe Results were checked against t traditional method and formula, a in every case the results were wit 1 percent of each other.

Figure 1 shows the pattern a typical array hand calculated the traditional manner. Most of y

*Consulting Engineer, Flagstaff, Ariz., and BE Automation Editor.

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3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163	171	179	187	195	203
4	12	20	28	36	44	52	60	68	76	84	92	100	108	116	124	132	140	148	156	164	172	180	188	196	204
5	13	21	29	37	45	53	61	69	77	85	93	101	109	117	125	133	141	149	157	165	173	181	189	197	205
6	14	22	30	38	46	54	62	70	78	86	94	102	110	118	126	134	142	150	158	166	174	182	190	198	206
7	15	23	31	39	47	55	63	71	79	87	95	103	111	119	127	135	143	151	159	167	175	183	191	199	207
8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168	176	184	192	200	208

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1	9	17	25	33	41	49	57	65	73	81	89	97	105	113	121	129	137	145	153	161	169	177	185	193	201
2	10	18	26	34	42	50	58	66	74	82	90	98	106	114	122	130	138	146	154	162	170	178	186	194	202
3	11	19	27	35	43	51	59	67	75	83	91	99	107	115	123	131	139	147	155	163	171	179	187	195	203
4	12	20	28	36	44	52	60	68	76	84	92	100	108	116	124	132	140	148	156	164	172	180	188	196	204
5	13	21	29	37	45	53	61	69	77	85	93	101	109	117	125	133	141	149	157	165	173	181	189	197	205
6	14	22	30	38	46	54	62	70	78	86	94	102	110	118	126	134	142	150	158	166	174	182	190	198	206
7	15	23	31	39	47	55	63	71	79	87	95	103	111	119	127	135	143	151	159	167	175	183	191	199	207
8	16	24	32	40	48	56	64	72	80	88	96	104	112	120	128	136	144	152	160	168	176	184	192	200	208

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well know this plot represents quite a few man hours of effort. However, with the aid of our friendly computer the same pattern can be generated in about 1½ minutes, including program compilation time. The actual calculation takes about 20 seconds. Not only is the pattern generated, but also a table of field strengths in one degree increments rather than the traditional 10 degree increments. The computer generated pattern and data are shown in Figures 2 and 3.

Question Of Accuracy

The question of accuracy usually arises whenever a computer is used. The answer to that question is obtained by running a batch of problems with known answers and comparing results. In the case of the program for the AM directional pattern, tests show accuracies on the order of 1 percent in most cases and seldom above 3 percent. Considering the limitations of slide rule accuracy, the question of whether the computer results or the manual results are most accurate is left to your discretion.

Another example of using a computer to do the tedious work is that of FM coverage prediction for negative antenna heights. This time,

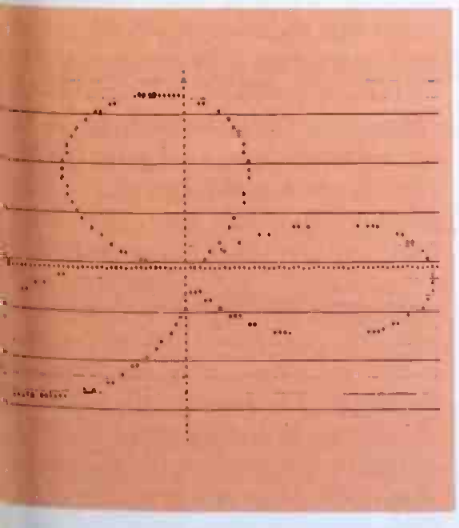


Fig. 2 Computer generated plot for the typical array.

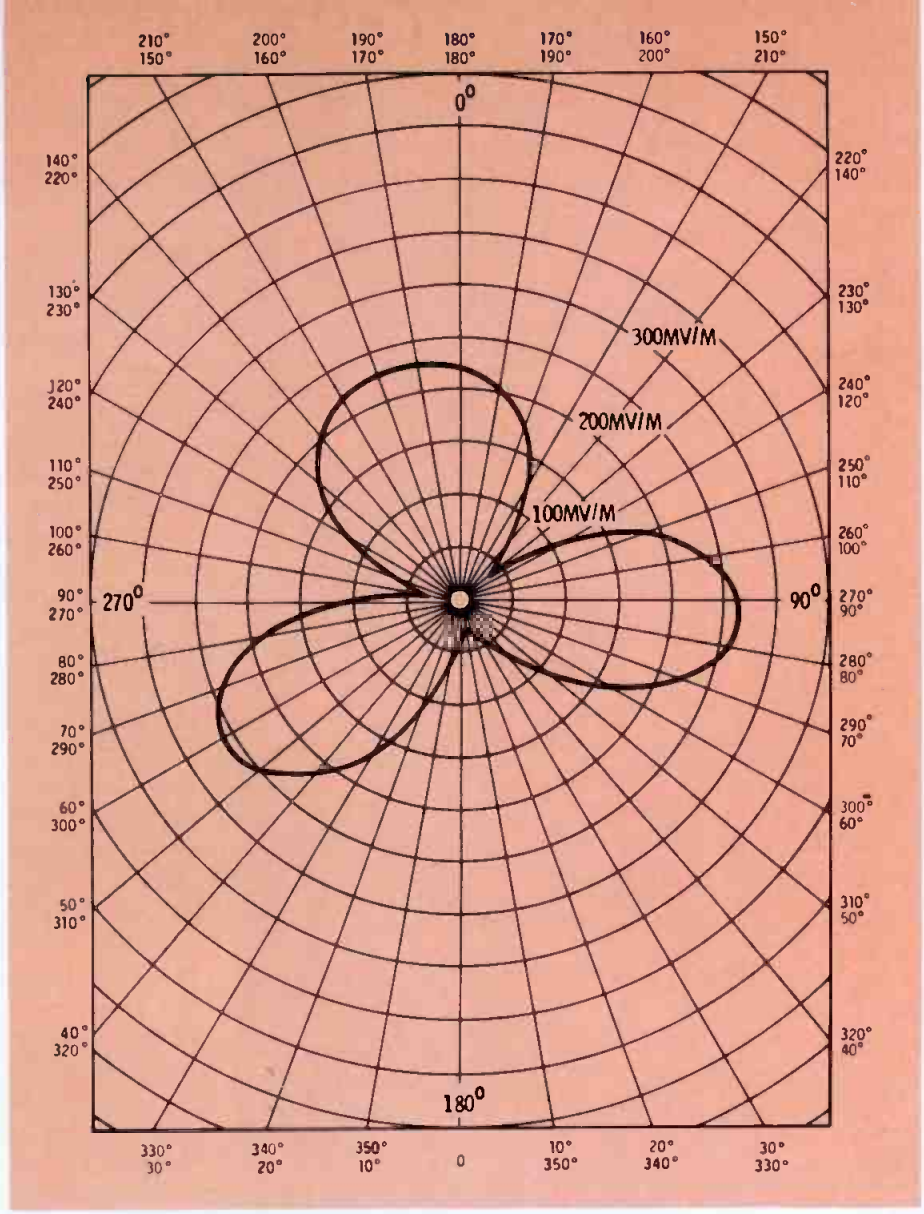


Fig. 1 Typical AM array pattern.

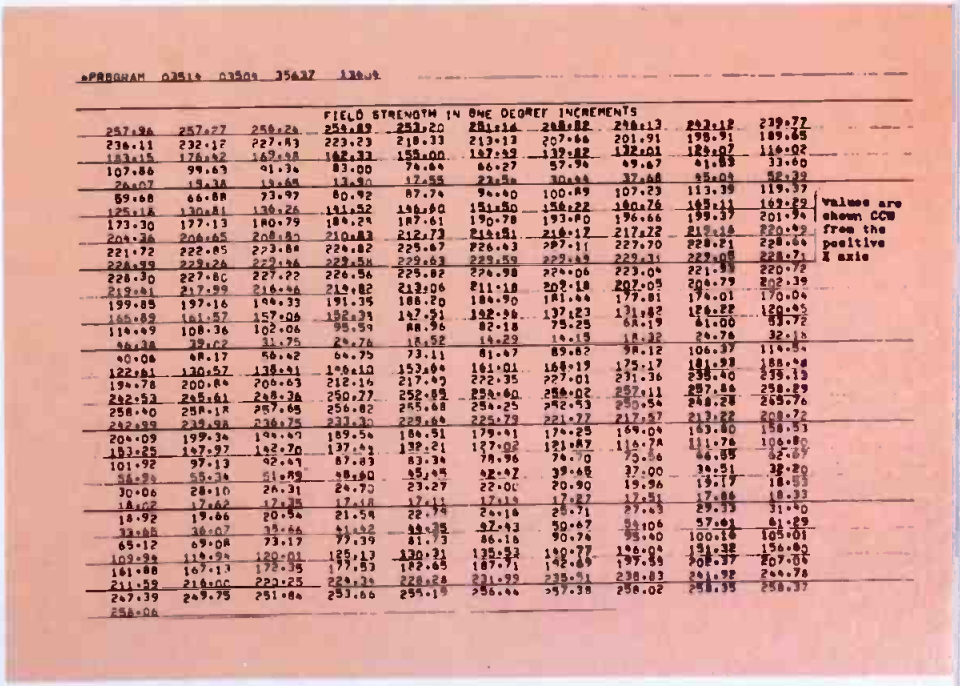


Fig. 3 Computer calculated pattern data.

```
NAME        ENTRY ORIGIN   LAST SIZE/10 COMMON   BASE

.PROGRAM  03514  03504  05217      8+4

PREDICTED FM COVERAGE CONTOURS

RADIALS          3.16MV/M          1.0MV/M
DEG              MI                MI

  0               10.5              18.8

 45               10.6              18.9

 90                4.8               7.8

135                3.1               5.8

180                5.5               9.8

225               12.9              21.8

270               11.4              20.3

315                3.6               6.5
```

Fig. 4 Computer calculated FM contours.

```
NAME        ENTRY ORIGIN   LAST SIZE/10 COMMON   BASE

.PROGRAM  03514  03504  13273      3960

.ENDJOB.
. ASSIGN S.MTO.SI.CR.BB.MT1.BI.MT1.LB.LP.
.RE.IND MT1.
.FORTRAN BB.LB.
.     1  .      COURTRIGHT/FM CONTOURS.
.     2         DIMENSION ALPHA(8),A(8),B(8),DISB(8),NRAD(8),DISA(8)
.     3         READ 5,((ALPHA(I),I=1,8),FREQ,ERP,HANT)
.     4       5 FORMAT (8F5.3,F5.1,E6.2,F5.1)
.     5         E0=137.6*(SQRT(ERP))
.     6         AVL=984/FREQ
.     7         DO 10,K=1,8
.     8         A(K)=(ALPHA(K)*E0**4.)*3.14159*HANT*30.0)/(.AVL*3.16)
.     9         B(K)=A(K)*3.16
.    10         DISA(K)=SQRT(A(K)/5280)
.    11         DISB(K)=SQRT(B(K)/5280)
.    12        10 CONTINUE
.    13         NRAD(1)=0
.    14         DO 20,J=2,8
.    15         NRAD(J)=NRAD(J-1)+45
.    16        20 CONTINUE
.    17         PRINT 25
.    18        25 FORMAT(.PREDICTED FM COVERAGE CONTOURS.)
.    19         PRINT 35
.    20        35 FORMAT(///,.RADIALS.,10X,.3.16MV/M.,10X,.1.0MV/M.)
.    21         PRINT45
.    22        45 FORMAT (1X,.DEG.,16X,.MI.,16X,.MI.)
.    23         PRINT 55,(NRAD(K),DISA(K),DISB(K),K=1,8)
.    24        55 FORMAT (//,1X,I3,13X,F6.1,12X,F6.1)
.    25         END

PROGRAM ALLOCATION

  00003 ALPHA     00023 A         00043 B         00063 DISB
  00103 NRAD      00113 DISA      00133 I         00134 K
  00135 J         00136 FREQ      00140 ERP       00142 HANT
  00144 E0        00146 AVL

SUBPROGRAMS REQUIRED

  SQRT
```

Fig. 5 Typical FORTRAN program (FM contours).

theory is combined with empirical data to achieve the desired results. The basic plane earth propagation formula is adjusted by a factor to account for terrain shadowing:

$$E = \frac{2E_o}{D} (\text{Sin}\frac{2\pi H_t H_r}{\lambda D}$$

Figure 4 is the print out of results from the solution of this equation and Figure 5 is the actual computer program used. Accuracy in this case is only about 4 percent as compared to FCC figure 73.333. The major problem in improving accuracy is determining the exact effect of terrain shadowing upon the theoretical plane earth propagation. The same problem exists, though, whether hand calculated or computed calculated and does not at all detract from the value of using the computer to perform the calculations. In fact, with a computer, many runs can be made in a short time to determine the exact fit for experimental data; something that would take many hours if done by manual methods.

Solving Other Problems

There are many other problems encountered in engineering that readily lend themselves to solution by computer, with the saving of many man hours in the engineer's harried day. Filter networks, impedance matching pads, transmitter operating parameters, circuit design and even job scheduling are examples of problems that are solved by a computer in seconds. Some of the equations may even seem trivial, but if you are involved in solving them many times over, the computer will be of great assistance.

In general, there are three reasons for considering use of a computer to solve your engineering problems: 1) involved or complex equations, 2) equations with many repetitive calculations, or 3) equations with large amounts of input data. In any of these cases, the time saved is well worth the time and effort spent in writing the program

Commission Proposes Land Mobile Changes

The FCC has proposed a rule making that would permit non-government fixed and land mobile operations in the 1427-1435 MHz band.

Proposed ammendments would affect Parts 2, 89, 91 and 93 of the Rules, and the changes would allow telemetering operations on a secondary basis to existing services.

The frequencies (1427-1429) involve presently shared space for telecommand services and (1429-1435) exclusive government radio services.

The proposed land mobile telemetering service would be limited to the local area, industrial, public safety and land transportation applications to be coordinated with Government users on a case-by-case basis. The Commission said that extensive fixed and land mobile telemetering operations requiring wide area frequency clearance would not be authorized. Systems which could not tolerate interference from the primary users of the band because of public safety or other factors, would not be authorized, the Commission said, and base stations would be limited to telecommand.

Considerable use can be made of the proposed allocation, despite the limitations imposed in order to minimize the potential of harmful interference to the primary services. (Among the potential uses—home meter reading, railroad crossing warning, and environmental telemetry systems.) Comments received in Docket 18924 (deletion of aeronautical telemetering to provide for land mobile telemetering in Industrial Radio Services) indicate a growing need for land telemetering in industrial, public safety and land transportation applications which might be accommodated in this higher range of the spectrum, the Commission said.

Comments may be submitted by May 9, 1972, and reply comments by May 23, 1972.

Acoustics Book Available

Acoustics Of Studios And Auditoria was written by V. S. Mankovsky. Dr. Mankovsky has succeeded in presenting the whole of acoustics, sound insulation, and noise control as a neat and logical sequence, with sufficient basic theory to give the reader a thorough understanding of the subject and enable him to apply his knowledge to new situations. At the same time there is a mass of design information which makes it a useful work of reference.

The book is unique in that it is a statement of the modern approach to studio acoustics in the USSR, and the differences in outlook and methods between the USSR and the West are of unusual interest; for instance, the author's treatment of stereophony is strikingly different, and the methods of analysis of

(Continued on page 53)

ENGINEER'S EXCHANGE

Saving Time On Pulse Failures

After a failure of one of the driving pulses that was not discovered until a camera was turned on causing the loss of a production, it became apparent that we needed a pulse failure alarm.

The pulse system used at the University of Michigan Medical Television facility consists of dual Grass Valley Group 950, 955 sync generators with automatic change over feeding Telemet 3202 pulse distribution amplifiers. The time our problem occurred was when one of the DA's failed.

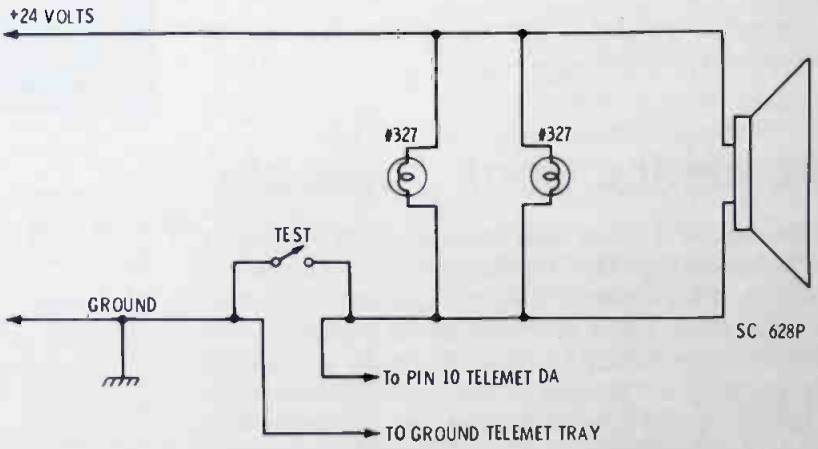
This particular type of DA has a relay that controls a light on the front panel to show the presence of a driving pulse. When failure occurs, the relay closes a contact on the mounting frame. Looking at the design, it was decided to make use of this contact. If a DA fails, the contact closes on that DA. If the sync generator fails, all DA's close the contact.

The construction is straightforward. I built the unit on a rack panel. It could even be built to fit in one space of the Telemet DA tray. The alarm used was a Mallory SC 628 P Sonalert. This one has a pulsating output so that it would not be confused with those on the cameras. A pair of lights and a test switch were included to check the alarm system if a light burns out on a DA and to satisfy those who wanted to play with it at installation time. After several months of operation it is felt that the test switch could have been left out of the design and replaced with a light.

The alarm system can be mounted at the same location as the sync generator and DA's. If desired, a second Sonalert can be remoted to give notice in several locations at the same time.

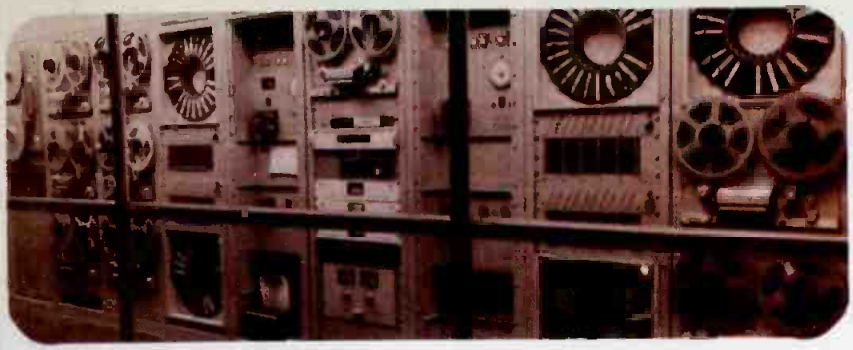
If different pulse DA's are used that do not have a relay in them, one could be installed. Sample the pulse just before the output stage and drive a transistor to conduction that is in series with a relay. The pulse could even be sampled in the sync generator if desired.

H. C. Hill
University of Michigan
Medical Television
Ann Arbor, Michigan 48104



PARTS LIST

	ITEM	NEWARK #
One	Sonalert Mallory SC628P	68F304
One	Dialco Switch 513-0101-604	60F1000
One	Dialco Light 188-9730-14-602	60F1006
Two	Dialco Red Len Caps 188-1471	60F1138



Photos of Radio Comerciales S.A., Guadalajara, Jal., Mexico

How to get your share of the Latin American broadcast market.

Right now, there are close to 6,000 radio and television stations in Spanish-speaking areas of the world. Competition among stations is keen. To remain competitive - and keep pace with Latin America's rapidly growing economy - their equipment must be kept in top condition. Clearly, a substantial market exists for all kinds of broadcast equipment and components. New and used.

One publication — RADIO y TELEVISION — serves this vast purchasing potential. It provides saturation coverage among buyers and those who influence purchasing at broadcast facilities throughout Latin America and Spain. Owners, managers, engineers and technicians at commercial and educational radio and TV stations, recording studios, electronic equipment manufacturers and related businesses.

As the Spanish-language counterpart of Broadcast Engineering, RADIO y TELEVISION delivers technically-oriented editorial aimed at helping readers to select, operate and maintain equipment and components for maximum signal quality. This unique content provides the precise environment that induces buyer receptivity. It enables advertisers to "sell the broadcaster when his mind is on signal quality."

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Number 88 in a series of discussions by Electro-Voice engineers

LOOK! UP IN THE SKY!

WALTER FRAEDRICK
Project Engineer

Skylab is NASA's most ambitious project to date, with a program of 3 separate crews planning to spend tours of from 28 to 56 days in the orbiting space laboratory. And the special microphones and speakers required have been one of the more interesting E-V projects of late.

Several limitations proved challenging. One is the need to perform despite wide variation in atmospheric pressure. In addition, flammable and out-gassing materials were prohibited, and lightness and extreme reliability were obvious design goals. In addition the transducers had to be unaffected by extended exposure to vacuum.

Both design and production testing was rigorous and extensive, with X-ray techniques employed for all castings, and E-V's altitude chamber used to duplicate the near-vacuum conditions specified.

While the microphone design finally selected bears many similarities to military models supplied regularly by Electro-Voice, the speaker required extensive development. Traditional cone materials were all ruled out by the rigors of the ambient conditions. The solution was found in a new plastic not presently used for this purpose.

To make the 4" speaker cone, dust dome, and supporting spider required development of new molding techniques involving unusual temperature and pressure to convert the sheet plastic into the desired parts. The result is a cone assembly that is unusually strong, chemically inert, and unaffected by the atmospheric environment or by abrupt pressure variations from 15 p.s.i. down to a virtual vacuum.

A total of 9 sets of microphones and speakers are located in communications stations at each of the work positions and section of the Skylab, providing instant communications to all three astronauts. In addition other similar speakers are used as an electronic Klaxon to warn of changes in the life support system. The system was produced for McDonnell Aircraft, the prime contractor, and continues the Electro-Voice participation in the space program that began with the early Mercury and later Gemini flights.

For reprints of other discussions in this series, or technical data on any E-V product, write:
ELECTRO-VOICE, INC., Dept. 423V
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Circle Number 48 on Reader Reply Card

NEW PRODUCTS

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

The new products featured this month are mostly those on exhibit in Chicago at the NAB convention last month. Also, you'll note that beginning with this issue, we are including two Reader Service Cards and a separate free subscription card.

Election Coverage Character Generator

Television stations can broadcast tabular election returns and can quickly identify candidates and politicians being interviewed by adding a **Datavision** Character Generator.

From the New Hampshire Primary in March on through the General Election in November, broadcasters will be faced with the problem of providing their viewers with instant information as returns pour in on election night.

The Datavision Model D-2400 Character Generator has a unique dual-channel output that allows preview of a second election slate display while the first is being transmitted. The device also has a self-contained memory in which up to four pages of display material can be stored. The keyboard entry allows the device to respond to real-time changes very quickly. The fact that the unit is self-contained and truly portable makes possible its use in broadcast vans for remote coverage as well as in the studio.

The Model D-2400 also contains several editing features which are very useful in election coverage. Election slate up-dating can be performed very quickly via keyboard data insertion as returns come in. The names of apparent winners can be caused to blink, if this is desired. The four-page memory capacity can be used to store four different horizontal crawl messages for superimposition on network shows in progress.

The election slates can be set up in advance and stored on regular studio audio cartridges. From one to four pages of data can be stored on a 30-second cartridge for display through the D-2400's four-page memory recall. Continuous election coverage can be maintained, because it takes slightly over four seconds to transfer data stored on an audio cartridge onto one of the four internal memories of the D-2400. As the announcer discusses one page of returns, the next is being read in.

In addition, control code editing allows display commands to be placed between pages of data to automate the sequencing of election slate displays.

With the addition of a modem as interface, the D-2400 can be used in conjunction with time-sharing access to election data stored in a computer to generate election slates, or to display projections of results.

Circle Number 60 on Reader Reply Card

Transistor VHF Field Strength Meter

Rohde & Schwarz have developed the new compact, fully transistorized VHF Field-strength Meter HFV for propagation, radio monitoring and interference measurements. This battery- or AC-operated instrument together with a plug-in halfwave dipole permits measurements of wanted- and interfering-signal field strength of

AM and FM transmitters over a continuously tunable frequency range of 25 to 300MHz (without band switching).

The HFV is also suitable as a selective microvoltmeter (input impedance 50 Ohm) and for RF-Current measurements in conjunction with the R&S Current Transformer.

Special features are: Direct voltage calibration in dB (uV) measurement range 130dB, linear (20dB) and logarithmic (60dB) indication, average and peak value modes, measuring accuracy ± 2dB (voltage) and ±4dB (field strength) built-in pulse generator for gain calibration, tunable input circuit which improves the IF rejection to value better than 75dB and the suppression of spurious frequencies to better than 80dB, also reduces oscillator reradiation.

At the IF bandwidth and with peak-value rectification, the rms value of TV-picture carriers can be determined at the sync-peak level, independent of the picture content. Pulse modulated transmitters and interfering signals can also be measured. A second version of the instrument with built-in pulse-weighting unit enables evaluation according to VDE 0876 and CISPR, i.e., measurements of noise voltage, interference field strength and – with absorbing clamp MDS 20 – interfering-signal power.

Circle Number 61 on Reader Reply Card

Color Closed Circuit Recorder-Player

A new ½-inch reel-type color closed circuit videotape recorder/player with simple assemble edit capability and improved picture stability has been placed on the market by **Ampex Corporation.**

The Model VR-420 videotape recorder uses two motors, which

(Continued on page 48)

(Continued from page 47)

result in improved picture stability for closed circuit television use in education, business, industry, government and medicine. The use of two motors eliminates the scanner belt which is a common source of trouble in low cost videotape recorders.

The new recorder also permits simple assemble editing for limited production work and stereo audio recording and playback.

Typically, the VR-420 video recorder will be used in schools, colleges and universities by teachers and students, for "instant replay" applications such as role playing and training in business and industry, and as a distribution device for playing back educational or instructional tapes in many locations by a variety of closed circuit television users.

Steinberg said that the VR-420 recorder is not a substitute for the company's Instavideo cartridge system, which also uses ½-inch wide tape.

The VR-420 recorder is compatible with the EIAJ Type I monochrome standard and the recommended EIAJ color standard adopted by most manufacturers of ½-inch videotape recorders. Tapes recorded on VR-420 recorders can be played back on all recorders meeting EIAJ standards and tapes recorded on EIAJ standard machines can be played back on VR-420 recorders.

Circle Number 62 on Reader Reply Card

Election Reporting System

TeleMation Inc. unveiled the TED-1 Television Election Display System. Company officials said that the system was developed to offer broadcast television stations a flexible, easy-to-use and relatively inexpensive system for coverage of elections and other major events. The TED-1 uses electronic character generators, minicomputers, teletypewriters and other associated equipment to automatically display alphanumeric information on a television screen. A major advantage of the system from a broadcaster's point of view, Russ Ide, Director of Broadcast Operations said, is that it can save a TV station the cost and inconvenience of building and rebuilding tote boards and sets for elections. The cost of the TED-1 can be amortized over several elections, he added.

An important part of the system is a simplified computer which receives, processes and stores voting information, and displays selected election races on command. Anyone can use the computer since it is set up to use conversational language. A significant feature of the system is the simultaneous entry and display from different positions in a station. After elections are over, the various equipment components can be used for sports coverage, automatic news and weather reporting or other events.

Circle Number 63 on Reader Reply Card

System Audio Console

Ward-Beck Systems consoles, distributed by **Central Dynamics** in the U.S., incorporate the latest technology in the audio "world".

A wide range of standard modules, using the latest IC operational amplifier technology, permits economical customization and easy servicing.

The entire console system is balanced, including the mixing attenuator, switching, jacks, talkback, reverb circuits, etc. This approach offers predictably superior performance with respect to switching transients, crosstalk and immunity to audio degradation due to R. F. interference.

Actively balanced summing modules are incorporated to process multiple switching configurations with 100dB isolation between circuits.

Conductive plastic attenuators,

endar pushbuttons, teflon wire, lammond transformers, tantalum nd computer grade capacitors are standard". Logical power supply istribution for reliable operation also a "standard".

Circle Number 64 on Reader Reply Card

Automatic Tape Sequencer

Broadcast Automation has unveiled its automatic tape sequencer. Designed for radio stations using imited or part time automation. Available in 3 to 12 channel configuration. Each source has its own elector switch, permitting it to be perated manually, in the Automatic Mode which will cause a tape nachine to stop on a 25 Hz tone, or in the sequencer mode which vill cause one machine to switch o the next and stop the previous nachine. There is one position for ach input in the sequencer mode, permitting any combination of nputs.

Highest quality switches and workmanship including baked enamel, filled engraving, and heavy steel construction.

Circle Number 65 on Reader Reply Card

Noise Elimination

Burwen Laboratories, a company specializing in amplifiers and noise elimination devices, has developed a dynamic noise filter designed to reduce noise when playing master tapes, pre-recorded tapes, records, cassettes, or FM. It's called the Model 1000.

By varying it bandwidth automatically in response to the music, it is able to reduce noise with negligible audible effect on the program content.

For low levels, attenuation is 25 dB at 30 cps and 22 dB at 10 kHz. The chassis accommodates from one to four channels ganged in pairs for stereo. The number of channels can be varied by plugging in epoxy encapsulated modules.

Circle Number 66 on Reader Reply Card

TV Remote Monitoring Generator

Obviously, there was considerable interest at the NAB convention concerning equipment needed for TV remote monitoring. **Tektronix** announced their 149 Generator—a single unit that is a source of all three necessary signals, including color bars.

The 149 is quite similar to the 147 generator which requires an external source of color bars. (See the remote control VIT signal article in Dec., 1971 BE.)

The 149 also includes all signals commonly used in transmission testing and can be easily reprogrammed by simple internal strap changes. VIRS and STOC II are included at no extra charge. The 149 will be available in May.

Circle Number 67 on Reader Reply Card

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

TECHNICAL DATA

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

99. JAMES G. BIDDLE CO.—Digs truly are reserved for Archaeologists, because cable faults must be found fast. Today's skyrocketing costs put a premium on good, reliable equipment that helps you locate faulted cable fast and accurately, and this new Bulletin 65 describes the most complete line. You'll find Terminal and Impulse tracer equipment covered, also detectors including their new Acoustic type. Bridges are included, also small handheld equipment, even truck-mounted equipment.

100. CANON—A new brochure on the Canon Sound Scoopic 200 is now available. The Canon Sound Scoopic 200 is a newly developed 16mm motion picture sound camera capable of simultaneously shooting and recording 20 rolls of 200-foot-film at a time. The brochure includes photographs, illustrations, features and specifications.

101. CERRO WIRE & CABLE CO.—A new four-page brochure describing Cerro CATV seamless aluminum sheathed cables is now available. The brochure gives types of cables available, description, properties and attenuation.

102. CHRONO-LOG CORP.—A new six-page application note en titled "Time Correlation for Instru mentation" describes serial tim codes used for data correlation. A description is given of all the pres ently used serial time codes and th various code formats. Explanation of how time code generators, tim code readers and tape search sys tems operate are also included.

103. ELECTRONIC ENGINEER ING CO. OF CALIF.—Seventy eight different types of panels, in cluding socket boards, connecto boards and special boards ar shown in a new 28-page EEC Dual-In-Line Socket Board an Packaging Hardware Catalog. Th catalog also includes 49 standar drawers and frame assemblies in cluding fixed, swing-out, doubl level and front panel models. Whil emphasis is on standard parts, th possibility of special packages de veloped around the modular socke boards is also illustrated. Com patible power supplies, cryst oscillators, 11 input/output con nectors and three breadboard kit are included.

104. DU PONT COMPANY—Physical, thermal and chemic property data on "Teflon" FE fluorocarbon film is contained i two new information bulletins. FE film is used in chemical, electric and electronics industries, as we as in molding and materials han dling processes. Properties includ anti-stick, low friction, chemic inertness, non-flammability, no wetting and retention of physic and electrical characteristics over wide range of temperature. Ge erally processed like a thermopla tic, it is bondable and can be he sealed, welded, thermoformed an metallized.

105. GENERAL ELECTRIC—A ultiple application color camera hich can be set up and operated / non-technical personnel is the bject of a six-page brochure EZ-4992A) from the Visual omm. Products Operation of the eneral Electric Co. The TE-201A a live color camera designed for e in specialized broadcast, closed rcuit and community antenna perations. The compact, light-eight camera with long term op-ational stability, operating sim-icity, and complete broadcast erformance fills the bill for pro-ssional quality pictures.

106. G-V CONTROLS DIVISION -Sola Basic Industries. A new roduct bulletin describing a solid-ate call re-director designed to utomatically transfer at a given me all incoming calls to an easily re-programmed number is now vailable. The data sheet provides pecifications, line drawings, a hotograph and application and rdering information for the call e-director module. Typical appli-ations of the unit include auto-natically re-routing repair calls to centrally located facility, trans-erring calls from unattended offices o private homes, dialing around a PABX with restricted assignments nd correcting directory listing rrors.

107. INTERNATL. ELEC-'RONIC RESEARCH CORP.—'he new 1972 IERC General Cat-log of heat sinks and dissipators or electronic components and cir-uits is now available. Always con-idered the most extensive array f such devices in any publication nd noted for its comprehensive ngineering data, the new edition includes many new dissipators including versions of the company's exclusive staggered finger design for DIP packages, GEL-246 packages, 1.0"-square sealed metal packages, plus models specially configured for potting IC substrates directly to the dissipator.

110. NORTRONICS CO., INC.—A revised brochure describing their Model 5800 head for replacement use in more than 90% of all auto and home 8-track stereo cartridge players is now available. The new publication contains a comprehensive listing of players offered by more than 70 different manufacturers in terms of model number or head part number. It also includes a brief description of Nortronics' new QM-SERIES Quality Maintenance Accessories for 8-track machines such as Cartridge Head Cleaner, Cartridge Life Extender, Head/Capstan Cleaner and Head Cleaner/Demagnetizer. The Model 5800 replacement head features parallel deep gaps for maximum wear life, laminated core for improved high-frequency performance, deposited quartz gap spacers for better gap definition, polished hyperbolic head face, hi-mu shield case for optimum rejection of external noise and complete interchangeability with existing mounts.

111. PHELPS DODGE COMM. CO.—Coaxial cable installation procedures and accessories includ-

(Continued on page 52)

Tech Data Begins On Page 50

(Continued from page 51)

ing pressurization equipment, are covered in a new brochure. The new eight-page folder covers, in detail, the installation of Phelps Dodge coaxial cable including preparation and installation under a variety of conditions. A diagram on a typical tower installation is included as a guide. Two pages are devoted to a variety of accessories and hardware. Two pages cover transmission line pressurization techniques along with descriptions of different models of air dryers offered.

112. RAYTHEON CO.—A new 104-page handbook and catalog of Sorensen power supplies and controlled power products is now available. Included in the handbook is a glossary of terms used to describe power supplies and their operation, a section on the theory of operation of regulated power supplies, and an analysis of operating characteristics and specifying criteria. The catalog portion of the new publication lists electrical and mechanical specifications for Sorensen's extensive line of DC power supplies, high voltage DC power supplies, AC line voltage regulators special purpose power supplies and custom design capabilities.

113. RCA ELECTRONIC COMPONENTS—A new enlarged and revised catalog covering RCA's current line of photomultipliers gas and vacuum photodiodes, electron multipliers, and the new integrated photodetection assemblies (IPA) is now available. This new 86-page catalog, PIT-700B, describes some of the developments in photodetector design and manufacture that has resulted in the performance improvements on these RCA products.

114. REVOX CORP.—A new eight-page brochure on microphones is now available. The brochure gives photos, descriptions and prices on each microphone. Two pages are devoted to the microphone stands.

(ontinued from page 43)

iblic address systems in large enclosures are in ad-ince of Western practice.

An attractive feature is the fact that all the essen-l theory is dealt with by the use of College level athematical methods.

The whole subject is dealt with systematically aking this an interesting and stimulating work. It ill be helpful to Acoustic Designers, Sound En-neers, and specialists working on sound transmission the cinema and in broadcasting.

This book is available through Communications rts Books, Hastings House, Publishers, New York, ew York.

NAB Picks Goals Group

Eight radio and television executives active in fairs of the National Association of Broadcasters ere named as members of an Ad Hoc Committee study the association's future goals and direction. They were selected by NAB President Vincent T. /asilewski and NAB Board Chairman Richard W. hapin in accordance with a resolution adopted by e 44-member Board of Directors at its recent winter eeting in Marco Island, Fla.

Richard D. Dudley, president of Forward Com-unications, Wausau, Wis., a member of the NAB adio Board, was designated chairman of the special udy committee.

Five of the other committee members are NAB oard members – Radio Board Chairman Andrew M. ckershausen, assistant general manager of the Even-g Star Broadcasting Co., Washington; William D. haw, president of KSFO, San Francisco, Calif., and hilip Spencer, president and general manager of VCSS, Amsterdam, N.Y., of the Radio Board, and arl W. Hickerson, vice president and general man-ger of WCEE-TV, Rockford, Ill., and Peter Storer, xecutive vice president of the Storer Broadcasting o., Miami Beach, Fla., of the Television Board.

(Continued from page 52)

115. RHG ELECTRONICS LABORATORY, INC.—A new two-page bulletin describing their frequency agile, C-band links used in reconnaissance, surveillance, and high speed data transmission systems is now available. The bulletin contains photos, tables of received signal strength and video signal-to-noise ratio, and a comprehensive block diagram. System specifications and mechanical and environmental details are also given.

116. RUSTRAK INST. DIV.—A data sheet on a new low-cost recorder that measures both AC voltage and current is now available. The new model 230 recorder is furnished with a clamp-on transducer and leather carrying case with handle. The single instrument records three voltage ranges (0-15 V, 0-300 V, and 0-600 V—60 Hz) and three current ranges (0-25 Amps, 0-100 Amps, and 0-300 Amps—60 Hz). Accuracy is within 3 percent for voltage and 4 percent for current, full scale. Featuring clean, inkless writing, th strip chart paper has straight-lin grids (rectilinear) for easy readin The clamp-on transducer has built-in dial to permit easy chang ing of the range or function bein monitored. The jaws accept cor ductors up to 1-in. diameter. Cli leads for voltage tests are als furnished.

117. SHELLY ASSOCIATES—new full color, four-page brochu featuring a detailed description an ordering information for a comple line of micro-miniature indicator is now available. The brochu provides complete electrical an mechanical data on the incadescen BRITE-EYE, transistorize TRANS-EYE and neon GL EYE indicators that are availab in standard or heat resistant hou ings of black or white. In additio the 70 optional lens caps are d scribed by style and color.

118. SHURE BROTHERS, IN—A new comprehensive catal describing the company's full li of microphone and circuitry pro ucts for broadcasting, recordin motion pictures, and profession sound reinforcement is now ava able. Included in the catalog a illustrations and technical specific tions, extensive discussions microphone types and microphon selection, and a variety of applic tions in which Shure Professio Products have been used.

119. SINGER COMPANY—T company's 33 products are d scribed briefly in this 16-page br chure. They include EMI/fie intensity meters, RF curre probes, antennas, microwave co ponents, FM/AM/SSB commu cations test instrumentation, fr quency meters, signal generato synchro/resolver test instrumen tion, angle-to-digital converte phase-angle voltmeters, ratio tra formers and electrostatic voltmete

123. TUCKER ELECTRONI CO.—A new 81-page catalog gi information and photographs ab Tucker, its new facilities, and modern calibration laboratory a services. Tucker sells new a reconditioned electronic t equipment.

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Moseley model ADP-120 Digital Automatic Transmitter Logger. Used only for demonstration purposes—like new. Gates Radio Division of Harris Intertype Corporation, 123 Hampshire Street, Quincy, Illinois 62301. 4-72-1t

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BROADCAST TAPE CARTRIDGES. New empties; load yourself and save. Sold in lots of 25 only. 25/$1.20 each; 50 or 75/$1.10 each; 100/$1.00 each. Enclose payment with order, shipping collect. Redding Radio, Box 344, Fairfield, Connecticut 06430. 3-72-4t

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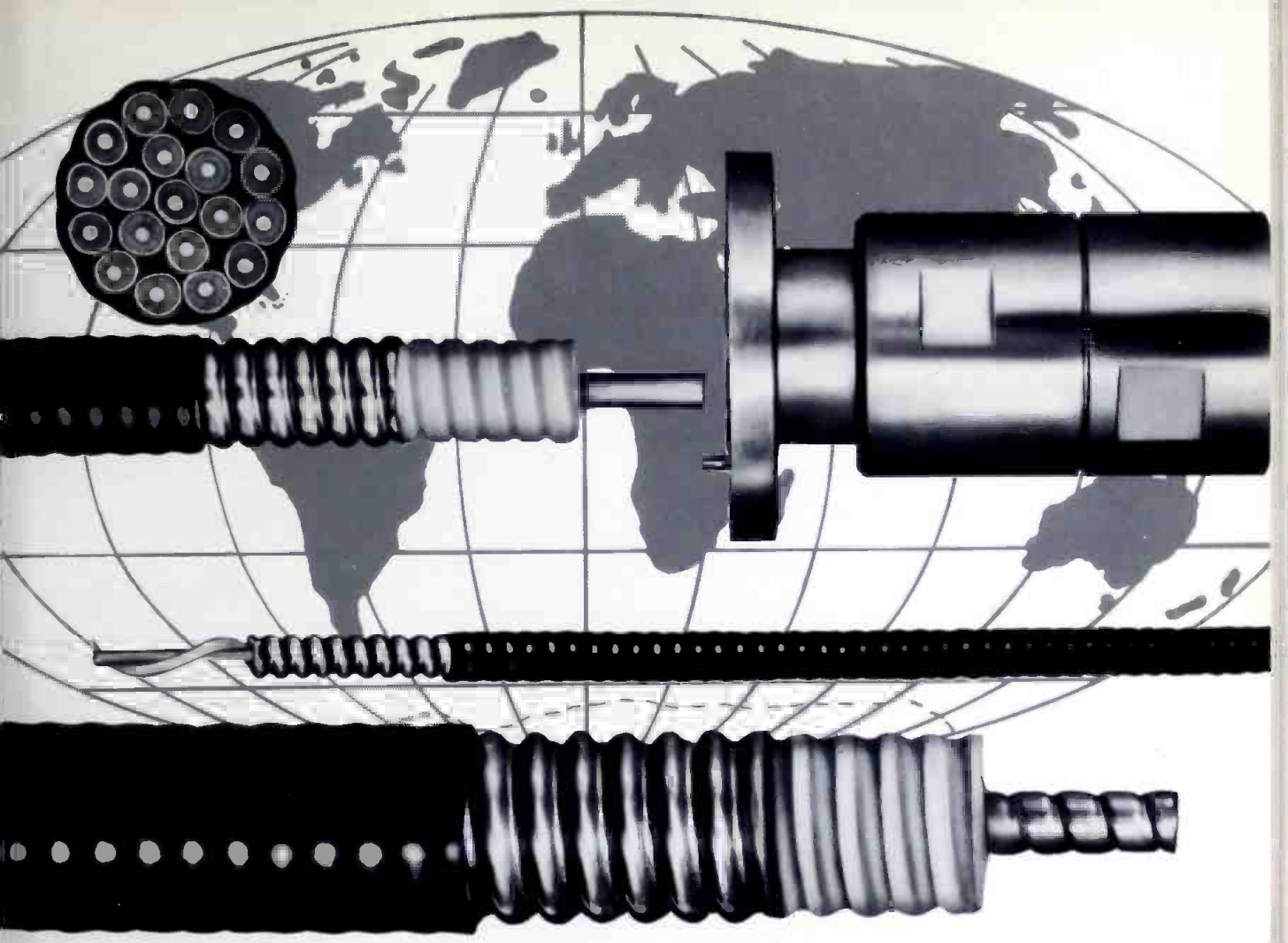

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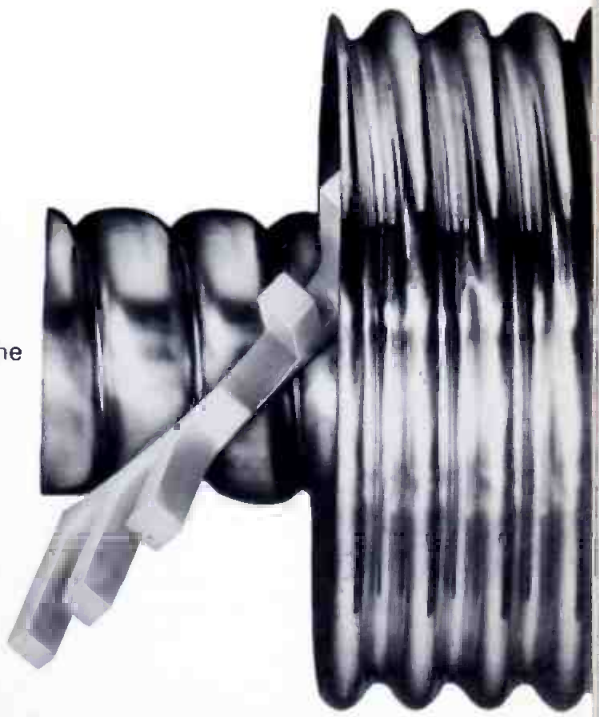

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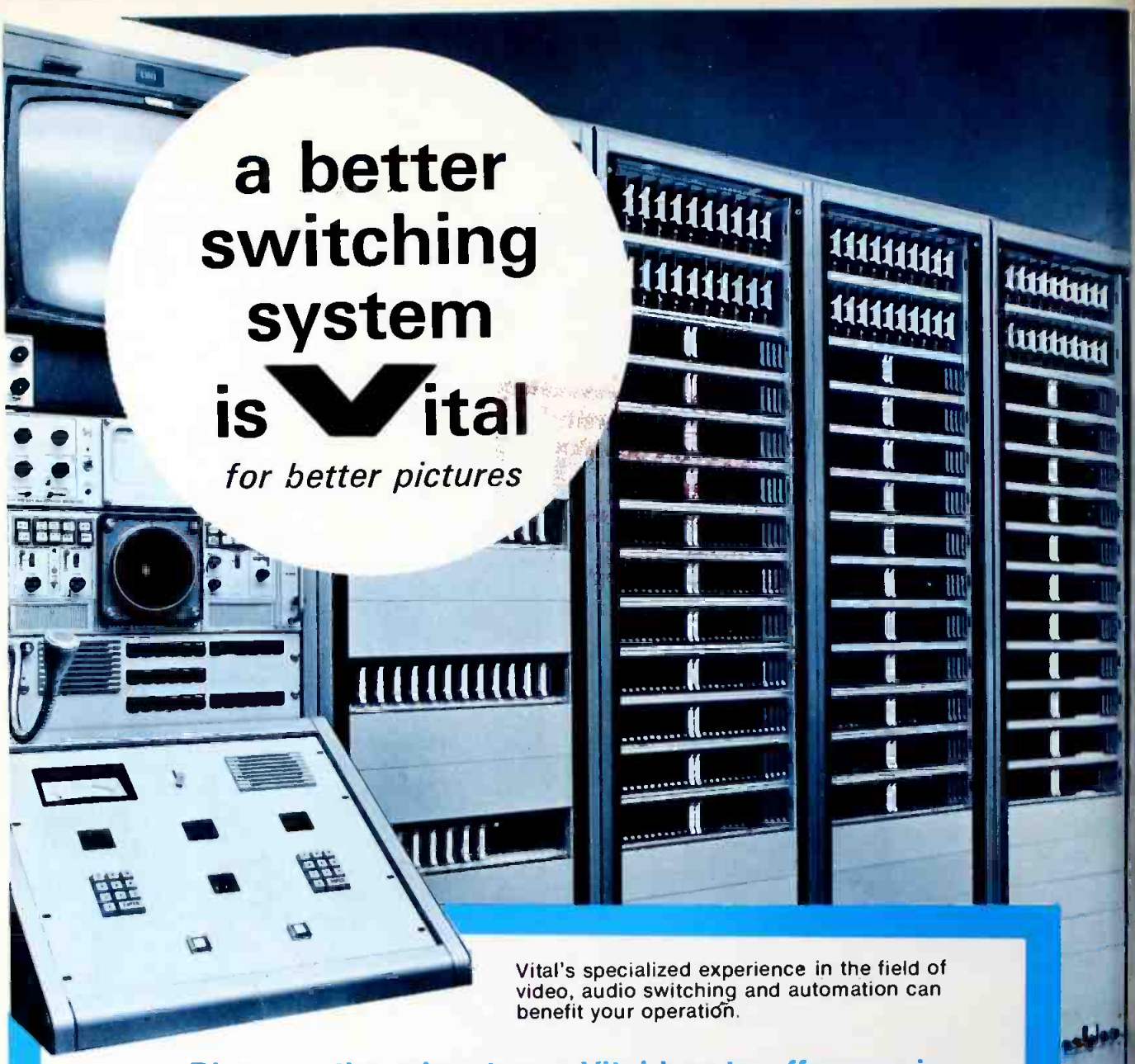

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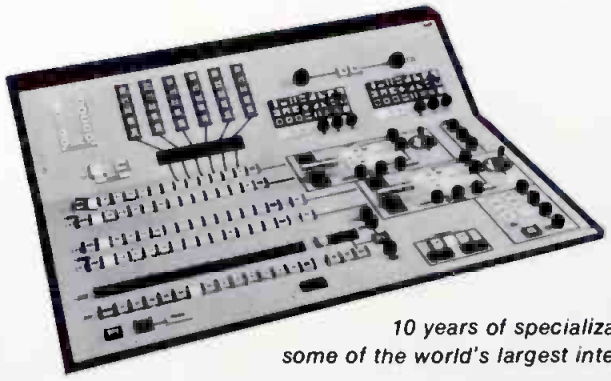

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