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Broadcast Engineering

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(502) 0656

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by Howard W. Sams & Co., Inc.
BROADCAST ENGINEERING is published
monthly by Technical Publications, Inc., an
affiliate of Howard W. Sams & Co., Inc. Edi-
torial, Circulation, and Advertising head-
quarters: 4300 West 62nd Street, Indianapolis,
Indiana 46206. SUBSCRIPTION PRICES:
U.S.A. \$6.00, one year; \$10.00, two years;
\$13.00, three years. Outside the U.S.A., add
\$1.00 per year for postage. Single copies are
75 cents, back issues are \$1.00.

the technical journal of the broadcast-communications industry



Broadcast Engineering

Volume 8, No. 9

September, 1966

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Note the arrangement and variety of microphones employed in this "set-up" for a Capitol Records recording session. A thorough survey of professional microphones begins on page 18.
(Cover photo courtesy of Capitol Records)



“...CBS Volumax performs flawlessly. Please do not invent any more until we wear these out. At the present rate of deterioration, we will need to replace them by 2015 A.D.”

This is what station WRNC in Raleigh, North Carolina, said about our equipment. They own both the Audimax Automatic Level Control and the Volumax Automatic Peak Controller. Station WIGS in Gouverneur, New York, wrote, “Enclosed find check for Volumax 400. You couldn’t get it back from us for twice the price . . .” KLIN in Lincoln, Nebraska, purchased Audimax. They told us, “It is an engineer’s dream for absolute level control”. WAYB in Waynesboro, Virginia, tells us, “Purchased a Volumax and we are tickled to 99 and 44/100% modulation with it . . . Congratulations on a fine product”. Station KHOW in Denver, Colorado, said, “It was surprising to receive equipment that exceeded specifications”.

There isn’t enough space here to include all the letters we’ve received praising Audimax and Volumax. But judge for yourself. Like all CBS Laboratories equipment, they’re available for a 30-day free trial. Audimax \$665. Volumax \$665. FM Volumax \$695. Write to us, or better yet call The Professional Products Dept. directly — Collect. Telephone (203) 327-2000. Maybe you’ll be in our next ad.

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■ How can high frequencies, which normally contain less energy than mid or low frequencies, cause trouble when pre-emphasis is applied? Simple! High frequency information, such as the jingling of keys, the sharp "s", the muted trumpet, cymbals, or other high frequency sounds, often become high frequency "spikes" when pre-emphasized thereby exceeding the FCC 100% modulation limitation. By making high frequency information "spike-free" (through the use of inaudible super fast attack and release times) the FAIRCHILD CONAX now allows the use of the full high frequency pre-emphasis curve.

HERE'S A STEP-BY-STEP GRAPHIC ANALYSIS OF THE FAIRCHILD CONAX IN ACTION...

FIG A — Normal program material with program information distributed in mid range—500 to 5000 cycles.

FIG B — Same program material pre-emphasized. Still trouble-free.

FIG C — Program material with a high percentage of high frequency material in its content—such as found on today's records.

FIG D — Same high frequency program material (hot) after pre-emphasis. Note high frequency "spikes" now exceed 100% of modulation.

FIG E — Same program material now controlled by the FAIRCHILD CONAX action.

* Note even with pre-emphasis the lack of troublesome high frequency "spikes" that normally would cause over-modulation.

■ The FAIRCHILD CONAX has an exclusive patented preview circuit which applies a standard pre-emphasis curve to any entering signal. The patented FAIRCHILD CONAX frequency dividing and controlling network allows accurate and inaudible control only of the troublesome high frequency "spikes". This means you can transmit a signal with high average modulation level up to 3 db higher, utilizing the full apparent loudness possibilities of your rated power. In FM stereo and SCA transmission, the FAIRCHILD CONAX prevents slatter between the SCA channel and the stereo channel, allowing you to use both of these dollar producing signals to their fullest. Now full modulation capabilities can be realized without the danger of FCC citation or any change in the transmitted sound of your signal. Now FAIRCHILD CONAX gives your station that brighter and louder sound... the sound that sells. **AVAILABLE IN MONO OR STEREO COMPACT SIZE!**

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Circle Item 4 on Tech Data Card

LETTERS to the editor

DEAR EDITOR:

In the May 1966 issue of BROADCAST ENGINEERING, page 34, you describe the new term "Hertz" for cycles per second. The reason the "H" is capitalized in the abbreviation is not that it is the first letter as you state. The reason is that Hertz is a proper name. The same is true for other abbreviations derived from proper names. Examples are kV (kilovolts) for Mr. Volta, kW (kilowatts) for Mr. Watt, etc.

I think you are going to find stations saying "1230 on your dial" before they'll say "1230 Hertz." We will just have to wait and see.

JOHN J. DAVIS
Chief Engineer
KCBH
Beverly Hills, Calif.

But what about ma for milliamperes and mh for millihenries (or millihenrys)? Although there is some question about the reason, most authorities seem to agree that the abbreviation for Hertz should have a capital H.

Also, there has been some objection to the use of the small letter m for the prefix "mega-," since the same letter is used to represent "milli-." The purpose in adopting the new terms and abbreviations was to avoid confusion, so beginning next month, the term "mega-Hertz" will be abbreviated MHz instead of mHz.

For years, many stations have used phrases like "1230 on your dial" in preference to "1230 kilocycles" in promotional announcements, etc. However, at least one clear-channel station is already using "kiloHertz" in its station breaks.—Ed.

Errata

In the article "Servicing Solid-State Audio Equipment" (July 1966, page 18), the emitter and collector voltages in Fig. 1 are interchanged. The collector voltage should be 5.0 V, and the emitter voltage should be 0.5 V.

In the article "Small-Budget Audio-Proof Package" (June 1966, page 16), the two parts of Fig. 1 have been interchanged. The schematic on the right shows the circuit before modification, and the schematic on the left shows the modifications.



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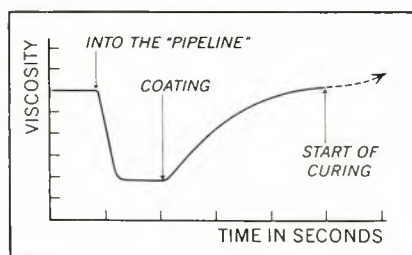
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Circle Item 5 on Tech Data Card

Some plain talk from Kodak about tape:

The binder that ties things together... and how to sound in the pink

"La sauce, c'est tout,"—the sauce is everything, say the French. An oversimplification perhaps. Still, as far as sound recording tape goes, the sauce—our "R-type" binder—counts for a lot. First off, there must be a mutual affinity between binder and oxide. It must be a good oxide mixer, while still keeping individual oxide particles at arm's length, you might say. Of course, fast drying, superior chemical stability, and a dozen other mechanical and chemical properties are a must. One very interesting point involves the "R-type" binder's extremely interesting viscosity characteristics . . .



"R-type" Binder Viscosity Graph

A Sticky Problem. Familiar with no-drip house paints? They're thick in the can . . . thin when you apply them (for low effort) . . . yet thicken again as soon as applied, so they won't drip. Somewhat the same thing has to happen when one applies the binder-oxide mix to the tape backing. It's got to go on smoothly—low viscosity . . . then it's got to stay put—high viscosity. To thicken the plot, once the coating is on, the tape is passed through a very strong magnetic field to physically align the oxide particles—low viscosity again. Once aligned, the particles have got to stay locked in "at attention!"—high viscosity. That's asking a lot of a binder. And ours delivers.

It's loaded. Our "R-type" binder not only gives you a more disciplined, smoother, more efficient oxide layer . . . but it allows us to incorporate a high oxide density in the magnetic dispersion. High output is the "proof" of this density. That's why KODAK Tapes give you from 1 to 3 db extra output compared to equivalent competitive tapes.

Pink noise testing . . . or how hi-fi is your room? Room acoustics certainly color the sound you hear . . . may even produce effects you have ascribed to electronics. Take test tapes, for example. They frequently make use of pure tones, even pure sine waves that easily go through your amplifier yet give a most confusing impression in your sound-level meter or ears. The culprit? Standing waves caused by hard parallel surfaces—like walls, floor and ceiling—which reflect the sound back and forth. At the point of reinforcement, the sound is loud; at the null point, it's low. What to do? Persian wall-hangings, bearskin rugs and soft rounded forms—if you're lucky enough—help keep standing waves down. But to develop the very best in KODAK Sound Recording Tapes, our engineers turn to "pink noise" testing.

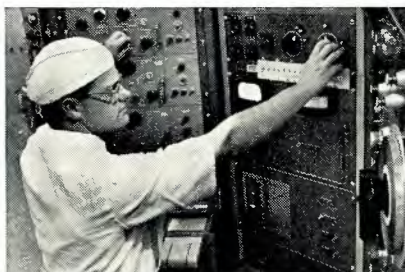
Why pink? Unlike pure tones that

make for easy instrumentation, musical sounds are complex—very similar to narrow bands of "white noise." But a white noise generator produces a mixture of all possible tones with equal energy-per-unit frequency. By breaking this white noise down into one-third octave bands of equal energy, we can study portions of the sound spectrum separately, yet have sound waves that are sufficiently complex so standing waves no longer confuse the issue. We call this type of white noise "pink." We're working on a practical simplification that will let you do something of this sort for your



own checkout. But meanwhile, relax to the music of KODAK Tape, secure in the knowledge that it is even "Pink Noise Tested!"

KODAK Tapes—on DUROL Base and polyester base—are available at most electronic, camera, and department stores. To get the most out of your tape system, send for free, 24-page "Plain Talk" booklet which covers the major aspects of tape performance. Write: Dept. 940, Eastman Kodak Company, Rochester, N. Y. 14650.



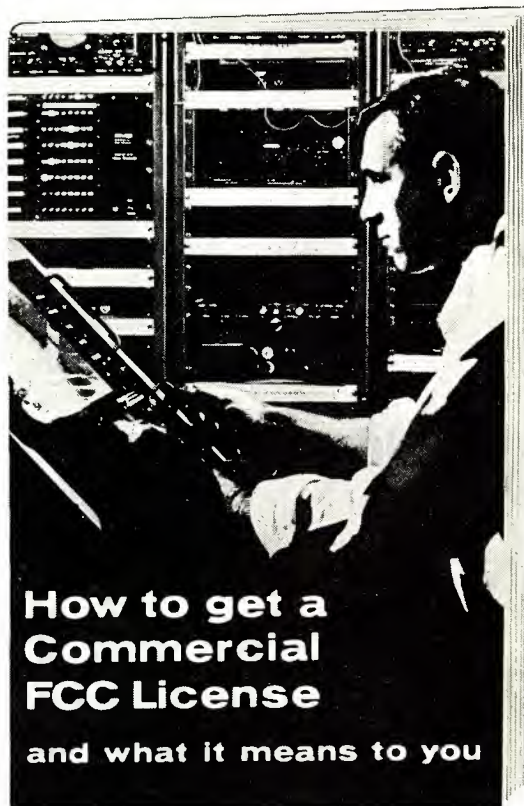
EASTMAN KODAK COMPANY, Rochester, N.Y.

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It takes the mystery out of
getting the FCC License you need
for security and success



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New job opportunities are opening up constantly for qualified license-holders. Many more will be needed to operate and maintain the countless new UHF-TV stations expected to begin operation, now that all new TV sets can receive UHF.

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says Matt Stuczynski, senior transmitter operator, Station WBOE. "Even though I had only six weeks of high school algebra, CIE's AUTO-PROGRAMMED™ lessons make electronics theory and fundamentals easy. After completing my CIE course, I took and passed the 1st Class FCC Exam. I now have a good job in studio operation, transmitting, proof of performance, equipment servicing. Believe me, CIE lives up to its promises. I really enjoy my work and I'm on my way up."

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2500-mHz ETV SYSTEMS

by John F. X. Browne, Jr.*

Part 1—Preliminary planning is essential before system design can begin.

Television is playing a role of ever-increasing importance as an effective tool for enhancing and improving the learning processes in schools and colleges across the country. Televised instructional programs are emanating from ETV broadcast stations and closed-circuit studios for classroom viewing at all levels. Much of the programming now in use at the elementary and secondary levels is being provided by the broadcast stations. While these stations have been performing a very worthwhile service, they have

been limited by the single-channel capability in the quantity of programming available and the ability to offer programs on schedules compatible with the various schools utilizing the service.

The need for multichannel ETV distribution systems is clearly indicated in situations where television is used as a regular adjunct to classroom instruction. While the FCC has honored requests for second ETV channels in several cities, it has recently indicated that it will not do so in the future when the primary use of the proposed station will be the extension of in-school instructional program services.

Closed-circuit cable systems have the capability for multi-channel distribution and are being used successfully in many areas of the country. These systems, however, generally tend to be very expensive to operate because of the high cost of leasing the cable facilities when large geographic areas and numbers of schools must be covered.

The ITFS

In recognition of the need for a practical multichannel system for instructional television and the apparent unsuitability and limited availability of broadcast channels, the FCC has authorized a new service specifically for use by educational institutions. A band of frequencies has been set aside in the microwave portion of the spectrum which will make 31 channels available to educators. The new service has been officially named the Instructional Television Fixed Service (ITFS) and is more commonly referred to as the "2500-mHz Service" because of the assigned frequencies which fall in the range of 2500-2686 mHz. The 31 channels are arranged in seven groups of four alternately-spaced six mHz channels and one group of three channels (Table 1).

The transmission standards are

*Browne Associates
Telecommunications Consultants
Birmingham, Mich.

Table 1. ITFS Channels

Group A		Group B		Group C		Group D	
Channel No.	Band limits MHz	Channel No.	Band limits MHz	Channel No.	Band limits MHz	Channel No.	Band limits MHz
A-1	2500-2506	B-1	2506-2512	C-1	2548-2554	D-1	2554-2560
A-2	2512-2518	B-2	2518-2524	C-2	2560-2566	D-2	2566-2572
A-3	2524-2530	B-3	2530-2536	C-3	2572-2578	D-3	2578-2584
A-4	2536-2542	B-4	2542-2548	C-4	2584-2590	D-4	2590-2596
Group E		Group F		Group G		Group H	
Channel No.	Band limits MHz	Channel No.	Band limits MHz	Channel No.	Band limits MHz	Channel No.	Band limits MHz
E-1	2596-2602	F-1	2602-2608	G-1	2644-2650	H-1	2650-2656
E-2	2608-2614	F-2	2614-2620	G-2	2656-2662	H-2	2662-2668
E-3	2620-2626	F-3	2626-2632	G-3	2668-2674	H-3	2674-2680
E-4	2632-2638	F-4	2638-2644	G-4	2680-2686		

essentially the same as those now used in television broadcasting; i.e., vestigial-sideband, amplitude-modulated visual carrier and an FM sound carrier 4.5mHz above the visual carrier. The transmitter power is generally limited to 10 watts (peak visual), but higher power may be authorized upon a demonstration of need. No limit is placed on the gain of transmitting antennas or effective radiated power.

System Operation

The microwave signals are converted to standard VHF channels (usually 7-13) at each school by a broadband converter capable of handling four or five alternately spaced channels. Signals are then fed to standard VHF distribution systems and receivers. A typical system is shown in Fig. 1. One of the outstanding features of the receiving

equipment is its capability for four- or five-channel reception. Thus, a system can be initially designed for the distribution of one or two channels and later expanded to the maximum number without additional receiving equipment, provided that the provision for expansion is made at the time the receiving and distribution equipment is installed. Only additional transmitting equipment is required for expansion.

A subsequent article in this series will discuss the technical planning aspects of a system in greater detail. It is important, however, to mention that system planning must be approached with all potential services and components in view, from the transmitter input to the classroom monitor, because low transmitter power at nearly superhigh frequencies leaves little room for guesswork.

The concept of "coverage area"

of an ITFS system differs from that normally associated with a broadcast facility. The FCC considers the service to be one of transmitting signals from one point to specified receiving locations and not "blanketing" an area as is customary for the usual broadcast facility. Thus, while omnidirectional radiation is permissible if required to cover all of the receiving locations, directional transmitting antennas are normally employed to limit the radiation to that necessary to provide signals to specific receiving locations.

Instead of coverage area, it is more meaningful to speak of range. The range of a system is determined by topographic factors, antenna heights, transmitting and receiving antenna gains, converter noise figures, and the minimum acceptable signal-to-noise ratio of the signal displayed on the classroom receiver.

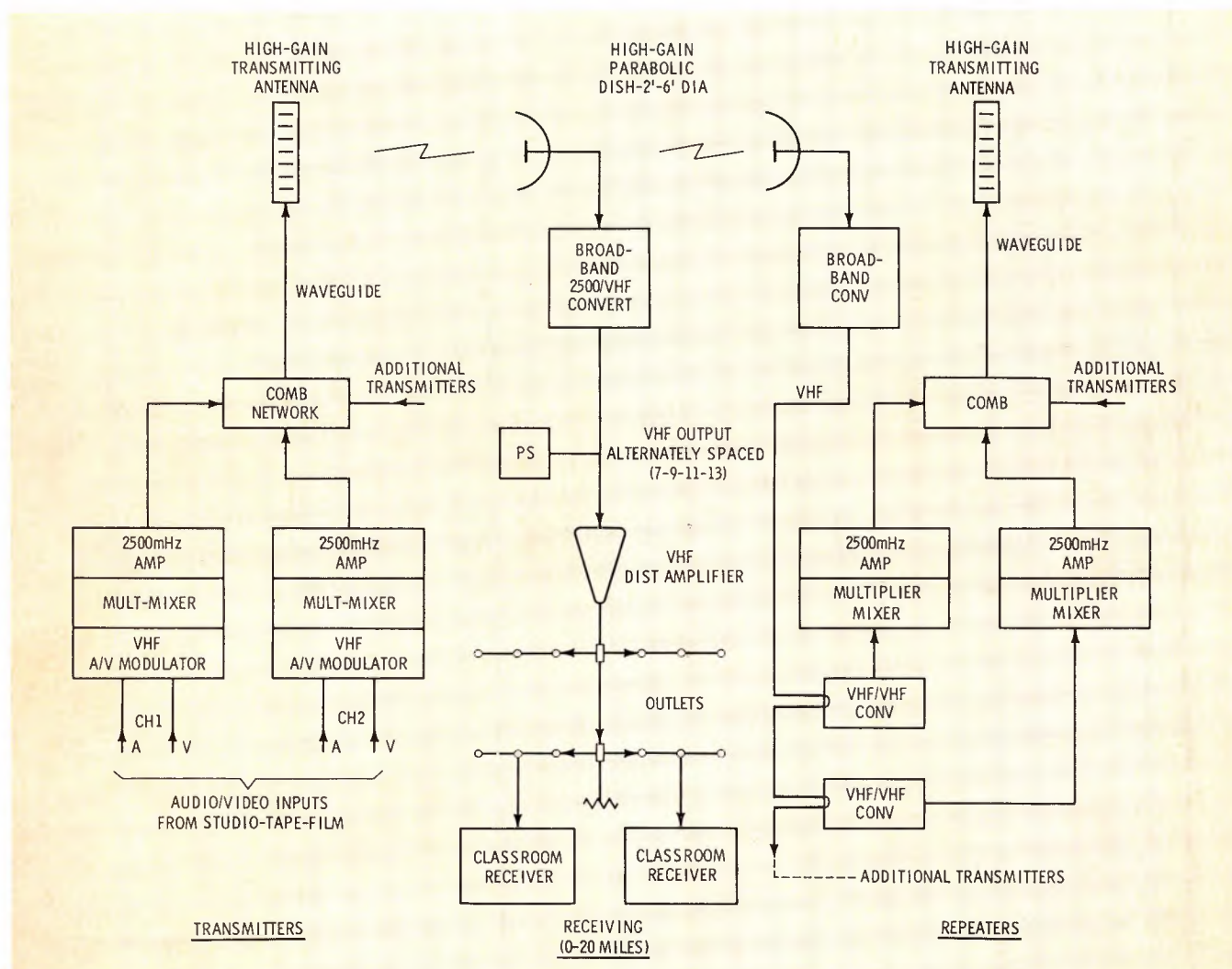


Fig. 1. Block diagram of complete 2500-mHz ETV system which provides long-range relay and allowance for system growth.

The most important single factor affecting range and performance is the presence of natural formations or manmade structures in the paths between the transmitter and receiving locations. Better than line-of-sight conditions must prevail over the path. In the absence of path obstructions, the range of a typical system will be 15-20 miles with standard equipment, although distances up to 30 miles may be considered if special equipment and techniques are employed. The range of a system may be further extended through use of repeaters. Repeaters may also be employed to provide interconnection between systems located in widely separated areas.

Channel Availability

Channels are assigned by the FCC upon application without reference

to area allocations. The individual applicant will probably be limited to the use of four channels for origination. The demand for channels has been so great in some areas that all of the available channels are already assigned. The FCC has recognized the problems associated with the assignment and use of the channels, and is now encouraging cooperation among interested parties in each area. This is to insure maximum utilization of the channels, and to prevent a few organizations from utilizing all of the channels, thus precluding future use by others. A national committee, sponsored by the FCC, has been formed to organize regional committees of interested parties, and to provide a vehicle for mutual assistance between the users and the Commission. Organizations interested in applying for channels

are invited to contact the local representative of the Committee for the Full Development of the Instructional Television Fixed Service. This will enable a potential user to ascertain the channels most suitable for its operations in view of other existing and proposed facilities. The name and address of local representatives can be obtained from the Educational Broadcasting Branch, Federal Communications Commission, Washington, D. C.

Channels will be assigned only to organizations who can meet the legal requirements for licensing and whose proposed use is within the limits set by the Commission. Any commercial use of the channels is prohibited. The basic qualification for meeting legal requirements is that the applicant be an accredited educational institution, or a nonprofit corporation specifically organized to provide ETV services. The service must be used for the primary purpose of providing instructional programming to enrolled students, but may be used incidentally for administrative purposes, data transmission, industrial training programs, and similar related functions.

System Costs

It is difficult to cite specific system costs for various reasons, including local conditions. The costs shown in Table 2 are given for reference only and should be used cautiously. Financing for these systems may be available under one or more of the federal educational programs including NDEA, Elementary and Secondary Educational Act, and the Vocational Education Act.

Obtaining Approval

Interested organizations should review Subpart I of Part 74 of the FCC Rules and Regulations (contained in Volume III and available from the Government Printing Office in Washington for \$4.50) to determine licensing requirements and permissible services. It is desirable that the advice of legal and engineering counsel be sought in the early stages of planning. Proper technical planning is essential, and the advice of legal counsel in the preparation of an application for a Construction

Table 2. Systems Cost

Transmitting

Transmitters	\$10,000-\$12,000	Each Channel
Ant System	1000- 15,000	Depending on Tower Height, Number of Channels, Length of Waveguide or Coax, type of Antenna

Receiving

2500mHz Conv, Ant, Tower	\$ 1100- \$1500	Depending upon Height of Tower and Size of Dish
Distribution System	300- 1000	Depending upon number of outlets
Receivers, Stands	150- 300	Each

Repeaters

Transmitters	\$ 8000-\$10,000	Per Channel
Receiving Equipment	1000- 2000	Depending upon number of Channels
Ant System	1000- 10,000	Depending upon Tower Height, Number of Channels, Type of Antenna

Other Costs not Included

Production/Origination Equipment
Test Equipment, Spares
Engineering Design, Specifications
Legal Fees
Building, Construction Permits
Land, Buildings, Modifications, Power Wiring

Maintenance Costs

5% - 10% of Total System Cost per year

A system now in operation with two channels to 60 schools cost \$125,000 not including production equipment, school distribution systems, or receivers.

Permit (CP) will prevent the costly delays that can be caused by a defective application.

As is true for most services under FCC jurisdiction, it is necessary to file an application for a CP, and construction may not begin until authority is received from the Commission. Application is made on Form 330-P, and processing ordinarily will consume two to four months. The form is divided into five sections covering legal and financial qualifications of the applicant, programming proposals, production facilities and staff, and a technical description of the system. The form and required data are similar to those used in broadcast services. Forms may be obtained from local FCC field offices or from the Washington office.

In addition to FCC approval of Form 330-P, it may be necessary to secure Federal Aviation Agency (FAA) approval for both transmitting and receiving tower structures. Approval is usually not required for structures that do not increase the height of existing structures by more than 20 feet (except when increasing the height of existing antenna structures). Structures in excess of 170 feet above ground will require approval and must be painted and lighted in accordance with Part 17 of FCC Rules. However, certain structures less than 170 feet in height which are deemed to be a hazard to air navigation will require a special aeronautical study and approval by a regional airspace committee. Applicants should refer to Part 77 of the FAA Rules and Regulations to determine if any proposed towers or antenna structures will require this special approval. If so, application is made to the FAA on Form 117. Local building codes should also be reviewed to determine the need for securing local permits and/or zoning board approval prior to erecting towers or antennas.

The next article in this series will be devoted to the design of a typical multichannel system (Fig. 2), including discussions of all the factors affecting system performance and the criteria for selection of components. Subsequent articles will deal with installation techniques and performance measurements. ▲

ITFS Committee Representatives

East—Dr. Bernarr Cooper
Bureau of Mass Communications
State Education Department
Albany, New York

South—William Kessler
Florida ETV Commission
Gainesville, Florida

Midwest—Robert M. Schultz
State Office of Public Instruction
Springfield, Illinois

West—Dr. Lawrence Frymire
TV Coordinator
State of California
Sacramento, California

ITFS Equipment Manufacturers

Electronics, Missiles &
Communications (EMCEE)
160 E Third Street
Mount Vernon, New York

Jerrold Electronics Corporation
15th and LeHigh
Philadelphia, Pennsylvania

Litton Educational Technology
Division
Litton Industries
580 Winters Avenue
Paramus, New Jersey

Micro-Link Division
Varian Associates
1375 Akron Street
Copiague, New York

Radio Corporation of America
Communications Products Division
Camden, New Jersey

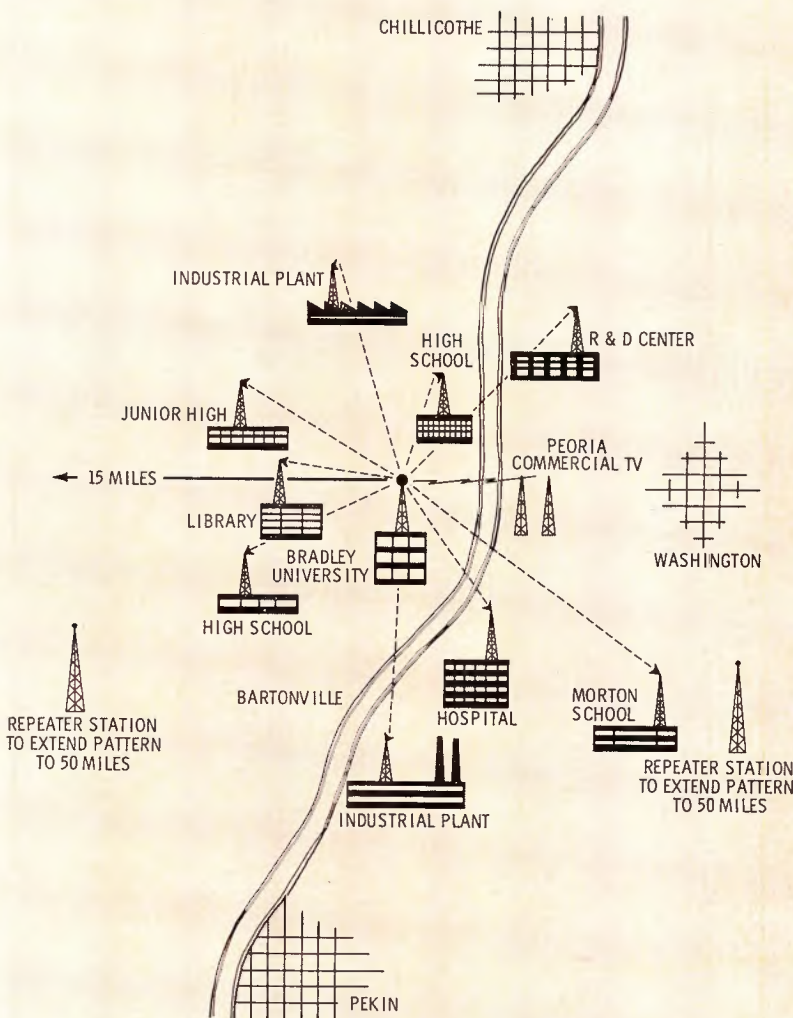


Fig. 2. Pattern of distribution for Bradley University 2500-mHz ETV system.

AUDIO COMBINING NETWORKS

by **Charles D. Sears**, Chief Engineer, WIAN, Indianapolis, Indiana—Properly designed combining and dividing networks provide optimum signal with minimum losses and distortion.

An item seldom included in impedance matching charts is the combining, or dividing, network. Typical networks of this type are shown in Fig. 1 (unbalanced) and Fig. 2 (balanced). Where all terminal impedances are equal, usually 500 or 600 ohms in professional audio applications, any terminal can be used as an input or output.

An example of a combining network is the mixing circuit of an audio console. A dividing network of this type occurs after a program amplifier with circuits going to output line, monitor amplifier, and tape-recorder input. These networks also occur in audio patch bays when "mult" circuits are employed.

It is not customary to consider these circuits as "pads," but insertion losses do occur, and it is possible to calculate matching elements so that these losses will be minimized and optimum signal transfer will occur. The number of lines which can be combined or divided is limited only by the amount of signal loss which the system can tolerate (either in signal amplification available, or undesirable noise or distortion which overamplification will produce).

In networks of this type it is necessary that all inputs and/or outputs be of matching impedances. If a circuit does not match the desired network impedance, it must be connected to the network through a matching transformer or resistive matching device.

Balanced or unbalanced systems can be used, but all elements of the network must be consistent.

To find the value of resistance required for each branch:

$$R = Z \left(\frac{n - 2}{n} \right) \quad (\text{eq 1})$$

Where

R = value of each resistor in ohms

Z = network impedance

n = total number of terminals

To find the loss of the network, from any terminal to any other terminal:

$$\text{Loss in db} = 20 \text{ Log } (n - 1) \quad (\text{eq 2})$$

Where

Log = Log to the base 10

n = total number of terminals

Fig. 1 is the basic unbalanced network. The isolation or matching resistor is inserted in the "hot" leg of each circuit. Normally the other leg is grounded. Fig. 2 shows the balanced configuration. In this network the branch resistance is divided equally between the circuit legs. Fig. 3 represents an unbalanced network with appropriate resistance values indicated, and Fig. 4 is the balanced network similarly represented. There are four terminals in each example (three branch terminals and one combined terminal). Therefore,

$$n = 4$$

and

$$Z = 600 \text{ ohms}$$

Branch resistances may be calculated by employing equation 1.

$$\begin{aligned} R &= Z \left(\frac{n - 2}{n} \right) \\ &= 600 \left(\frac{4 - 2}{4} \right) \\ &= 300 \text{ ohms} \end{aligned}$$

Use this value for each resistor in the unbalanced

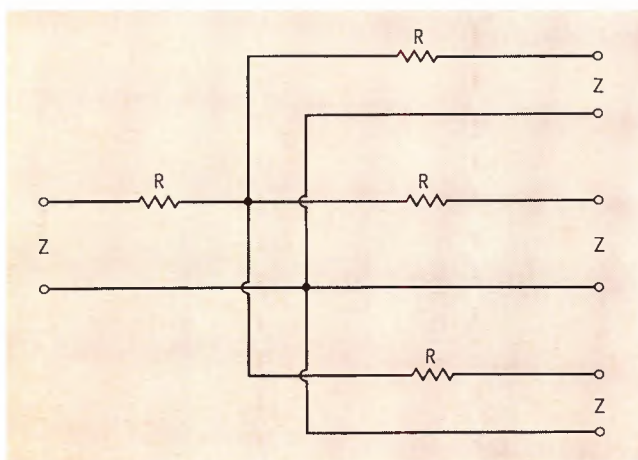


Fig. 1. Unbalanced combining network resistor placement.

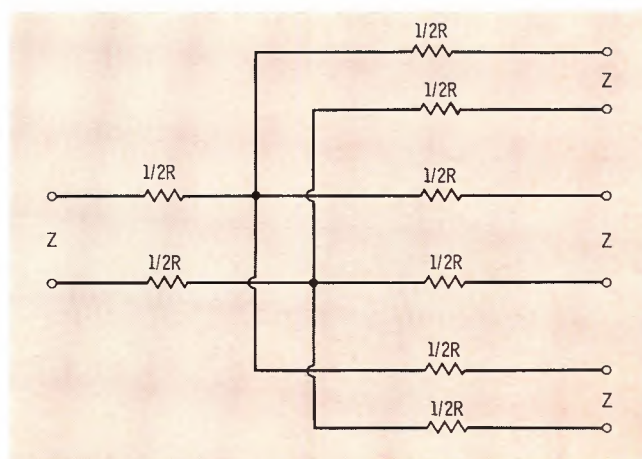


Fig. 2. Balanced configuration divides branch resistances.

Table 1. Resistances for splitting and combining networks.

Terminal Impedance	Number of Terminals							
	Unbalanced Networks				Balanced Networks			
	3	4	5	6	3	4	5	6
600Ω	200Ω	300Ω	360Ω	400Ω	100Ω	150Ω	180Ω	200Ω
200Ω	66.6Ω	100Ω	120Ω	133Ω	33.3Ω	50Ω	60Ω	67Ω
50Ω	16.6Ω	25Ω	30Ω	33.3Ω	8.3Ω	12.5Ω	15Ω	17Ω
Loss in db	6 db	9.5 db	12 db	14 db	6 db	9.5 db	12 db	14 db

network (Fig. 3). For the balanced configuration (Fig. 4), divide the branch resistance by two. Each resistor will be

$$R = \frac{300}{2} = 150 \text{ ohms}$$

To find insertion loss in the networks, use equation 2. The loss is the same for both the unbalanced and the balanced networks, and for any network impedance value, and will appear at each terminal. For the example shown

$$\begin{aligned} n &= 4 \\ \text{Loss in db} &= 20 \text{ Log } (n - 1) \\ &= 20 \text{ Log } (4 - 1) \\ &= 9.54 \text{ db} \end{aligned}$$

Table 1 has been calculated for typical professional audio values of network impedances such as microphones (50 and 200 ohms) and "high-level" sources such as tape recorders and cartridge machines (600 ohms). Losses are identical at any impedance and whether balanced or unbalanced. Values of resistance are specific values to be used in appropriate networks.

Fig. 5 is a typical combining network of unbalanced configuration frequently encountered in audio mixers. Standard 600-ohm attenuators are used, and in each

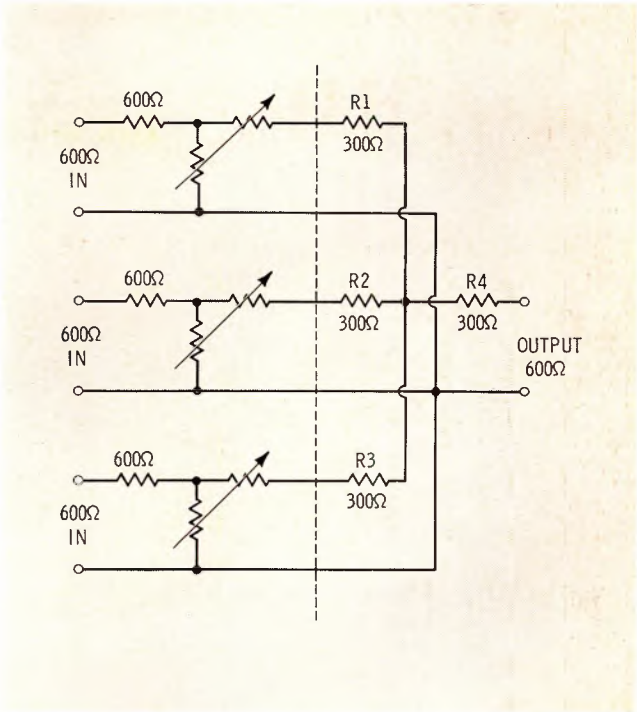


Fig. 5. Circuit of typical unbalanced audio mixer network.

instance are followed by the combining-network resistor calculated from equation 1. In this example all inputs and the output are unbalanced. If it is necessary to feed this network into balanced inputs, an isolating transformer would follow R_4 . Conversely, a balanced input would require an isolation transformer ahead of the corresponding unbalanced attenuator, or between a balanced attenuator and one of the combining resistors (R_1 , R_2 , or R_3). In the event one or more of the terminals were of a different impedance, insertion of an appropriate matching device would be required.

In all combining network design and application, it is customary and desirable that input levels match. Amplification or attenuation should take place ahead of the network resistances in the appropriate circuit. ▲

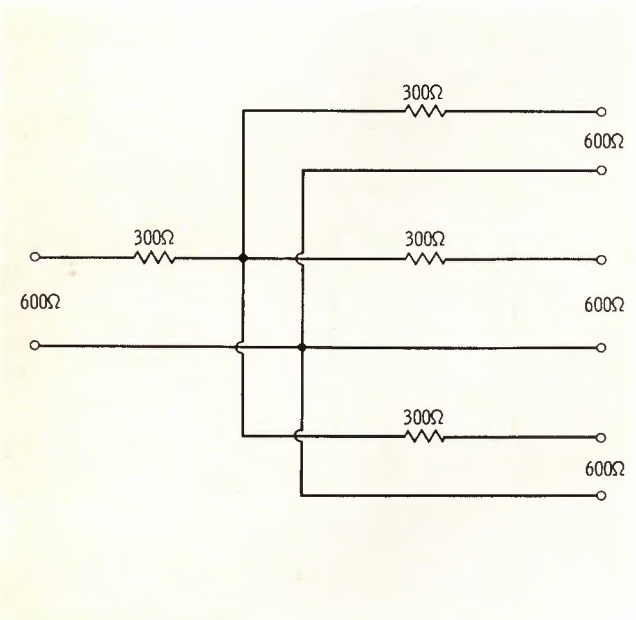


Fig. 3. Unbalanced network with resistance values given.

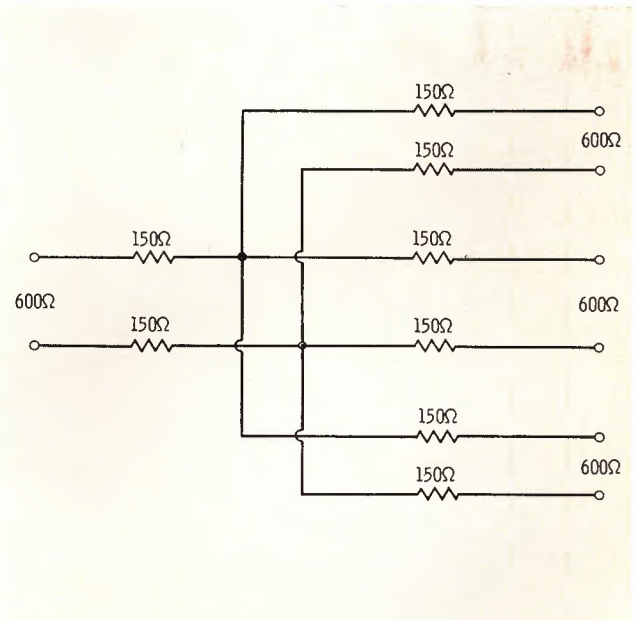


Fig. 4. Leg values in balanced system are 1/2 of branch R.

REVIEW OF PROFESSIONAL MICROPHONES

Part 1. The first half of a comprehensive survey of professional microphones being manufactured and available to the broadcast industry.

Not so long ago, a few microphones were considered professional, and the rest were something else. Developments of recent years, however, have changed the picture so dramatically that today an engineer is faced with a bewildering selection, any one of which does a number of jobs—and quite nicely.

The rules that once governed the selection of a particular microphone have largely disappeared. Dynamic microphones now have broad frequency response; velocity microphones are much lighter in weight; and condenser microphones do not always have huge power supplies and long power cables. In fact, it is often difficult to look at a microphone and tell what type it is. Still, each microphone has retained the properties for which the particular type has become famous: dynamic microphones are still rugged; velocity microphones have wide frequency response at moderate cost; and condenser microphones have retained good frequency response and sensitivity.

In the pages that follow, BROADCAST ENGINEERING has attempted to present comparative data on every microphone of professional calibre being manufactured and marketed today. Data include pictures, response curves, physical dimensions, weight, sensitivity, limitations, special properties, price, and — where of particular interest — directional characteristic curves. Generally, specifications, where available, follow industry standards. For output level, frequently called sensitivity, a reference standard of 10 dynes per cm² has been used. The term "hum level" refers to hum pickup and is usually referenced to 0.001 or 0.003 gauss at 60 Hz, depending on the manufacturer. Exceptions to either rule are generally noted. In this survey are the products of five nations. Since international standards are not universally employed by the manufacturers, it has not been possible to be uniform in the data presented.

The price indicated is usually a list price. It is an industry practice to extend a forty percent discount to the list price where a microphone is purchased for professional use but this is not always the case. The exact point-of-sale price, in the end, depends on the manufacturer and/or your professional audio products dealer.

Determining whether a microphone is of professional calibre is, of course, a matter of judgment. In this we have used the criteria of the purchasing habits of the broadcast and recording industries. Because each of the manufacturers listed is well known for the integrity of his products, we have relied upon published specifications for the data included. Although considerable variation in frequency response does exist, we have given special consideration for their intended use (i.e., lavaliers for voice frequencies only, etc.). A few microphones listed would not appear to satisfy professional requirements. Their inclusion in the survey is deliberate; each of them has specific application to unusual situations which, from time to time, are encountered by broadcast and recording services.

If a particular favorite does not appear in this listing, it will be for one or more of the following reasons: (1) it is no longer being manufactured, (2) it was not reported to us, or (3) it has not generally been accepted.

In this survey only the general properties of each microphone have been presented. A compilation of all the characteristics and measurements would entail publication of hundreds of pages of material. Obviously this could not be done in a monthly publication. The survey is, then, a guide. For complete information about a particular microphone, a list of manufacturers or their representatives with proper addresses follows.

Altec-Lansing

Altec-Lansing Corp.
1515 S. Manchester Ave.
Anaheim, California

AKG

North American Philips Co., Inc.
Professional Products Div.
100 East 42nd Street
New York, New York 10017
Visual Electronics Corp.
356 West 40th Street
New York, New York 10018

Electro-Voice

Electro-Voice, Inc.
Buchanan, Michigan 49107

Neumann

Gotham Audio Corp.
2 West 46th Street
New York, New York 10036

PML

Ercona Corp.
432 Park Ave., So.
New York 16, New York

RCA

Broadcast & Communications
Products Div.
Radio Corporation of America
Camden, New Jersey 08102

Sennheiser

Sennheiser Electronics
25 W. 43rd Street
New York 36, New York

Shure

Shure Bros. Inc.
2040 W. Washington
Chicago, Illinois

Sony

Sony Superscope, Inc.
8150 Vineland Avenue
Sun Valley, California 91353

Syncon

Syncon, Inc.
10 George Street
Wallingford, Connecticut

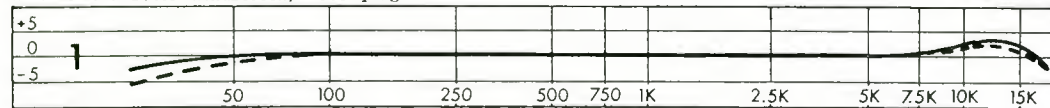
Turner

The Turner Co.
909 17th Street, NE
Cedar Rapids, Iowa

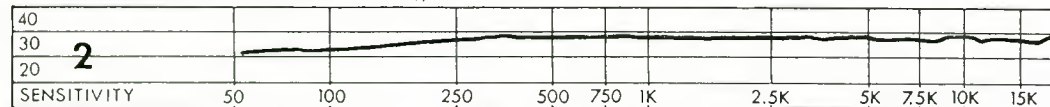
University

University Sound
9500 West Reno
P.O. Box 1056
Oklahoma City, Okla. 73101

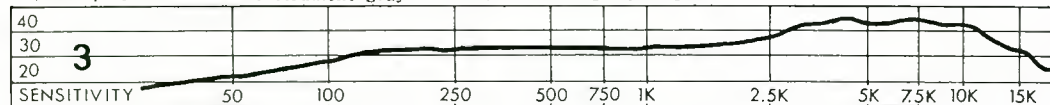
Altec-Lansing M-30
Condenser system—Shock mount (6/8"-27 thread)—Output level: -64 dbm to -35 db/1V—Hum: not susceptible—Impedance: 30/150/600/10,000—Dimensions: Microphone, 25/32" × 3/4" dia.; Base, 2-15/16" × 11/16" dia.; Power supply, 2-3/8", 8-5/8", 7-1/2"—Weight: not available—Finish: microphone, stainless steel; base, anodized gray; shock mount, gray; power supply, silver gray—Cable furnished: 15 ft. of abrasion resistant Fibreglas® microphone cable—Vital accessories: 175A base, 169A shock mount, 525A power supply (117V, 60 Hz, 15W)—Optional accessories: 170A windscreens, 4665 plug-in



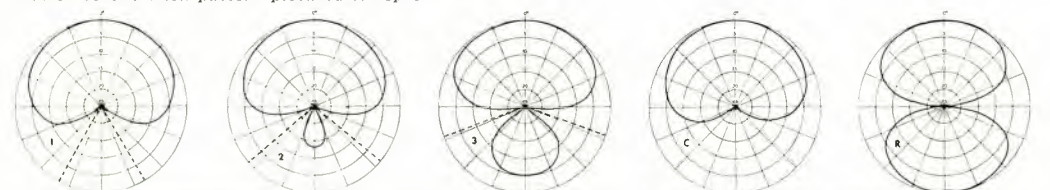
Altec-Lansing M49, M50, M51, M52
Condenser system—Slip-on holder for floor or desk stand—Output level: -53 dbm—Output Configuration: 2-wire shielded, balanced from 540A power supply—Impedance: 150/250—Dimensions: microphone and base 3-1/2" × 3/4" dia., power supply 1-5/16" × 3-1/8" × 3-15/16"—Weight: microphone and base, 2.2 oz; power supply, 23 oz—Finish: nonreflective electroless nickel and chrome—Accessory furnished: see comments—Connectors: Cannon XLR3-12 on base,



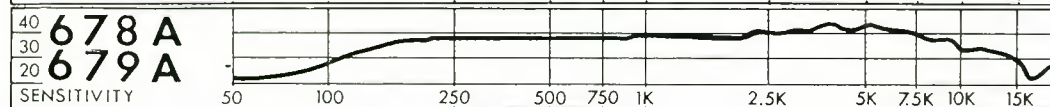
Altec-Lansing 632C, 633A, and 633C
Dynamic omnidirectional — Hand-held or stand-mounted—Output level: -55 dbm—Impedance: 632C, 30/50 ohms; 633A, 30/50; 633C, 30/50, 150/250 (selectable)—Dimensions: 632C, 2-1/8" × 2" dia; 633A/C, 3-1/2" × 2" dia—Weight: 632C, 8-1/4 oz; 633A, 10 oz; 633C, 13 oz—Finish: instrument gray—



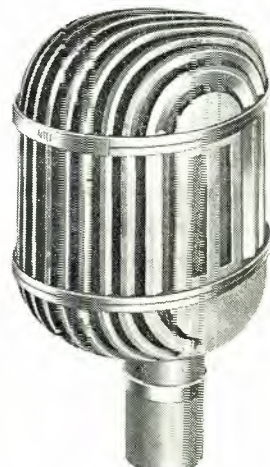
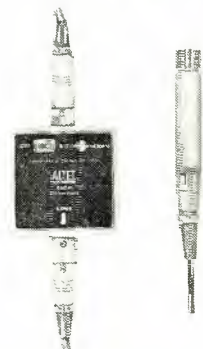
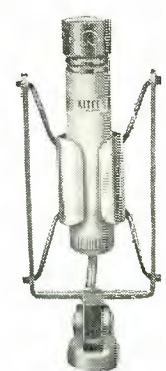
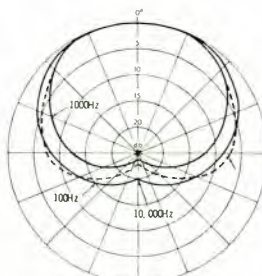
Altec-Lansing 639B
Dynamic, velocity selectable cardioid—Stand mounted—Output level: -52 dbm—Hum: -120 db—Impedance: 30/50 ohms—Dimensions: 7-1/2" H (incl plug) × 3-7/16" W × 4-7/16" D—Weight: 3.25 lb—Finish: dark gray on diecast aluminum—Price: \$302. Comments: The directional characteristic of this microphone is selectable by means of a slotted screw. Each pattern pictured is repre-



Altec-Lansing 674A, 675A, 678A, 679A
Dynamic omnidirectional or cardioid—slip-on swivel adapter with 5/8"-27 thread—Output level: -58 dbm—Hum: -120 db—Discrimination: front-to-back, 15 db—Impedance: 678A, 150/250 ohms; 679A, 20,000 ohms; 674A, 150/250 ohms; 675A, 20,000 ohms—Dimensions: 7-1/8" × 1-9/32" dia—Weight: 678A, 4.5 oz.; 679A, 4.7 oz; 674A, 4.1 oz;



transformer for balanced output line, 167A 25-ft extension cable, 1183H6 cable (fiber-glass), 11853 rack-mounting assembly — Price: \$252. Comments: This very small microphone (Model 29B) is attached to the 175A base which houses a subminiature impedance-matching tube and provides interconnection between the microphone and the 525A power supply. Sensitivity (output level) is a function of the impedance, which can be switched from balanced (30, 150, and 600 ohms @ -53dbm) to unbalanced (30 ohms/-64dbm) (150 ohms/-58 dbm) (600 ohms/-54 dbm) (10,000+ ohms/-35 db/1V).

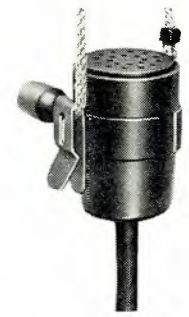
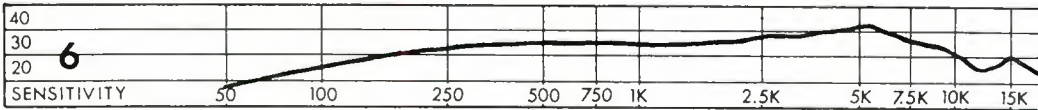


Altec-Lansing 677A

Dynamic omnidirectional—Lavalier or goose-neck mounting—Output level: -58 dbm—Hum: -120 db—Impedance: 150/250 ohms—Dimensions: 1-3/8" × 7/8" dia.—Weight: 0.91 oz—Finish: baked enamel, nonglare dark green on aluminum—Accessories furnished: 20 ft of 2-conductor, shielded cable; "slip-on" lavalier cord—Accessories available: 35A flexible microphone mount and mounting

flange—Price: \$65.

Comments: The flexible mounting for this extremely light-weight microphone is threaded 5/8"-27 and can be installed on any similarly threaded stand or boom; the mounting flange permits permanent installation on a lectern, desk, etc. The lavalier cord is permanently connected to the microphone but can be removed readily.

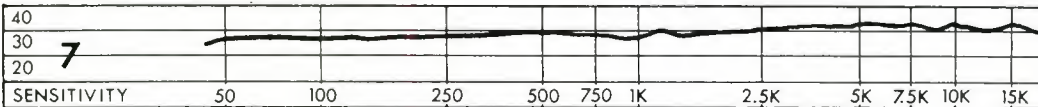


Altec-Lansing 684B

Dynamic omnidirectional—Slip-on adapter for stand mounting with 5/8"-27 thread—Output level: -55 dbm—Hum: -120 db—Impedance: 150/250 ohms—Dimensions: 7-1/2" × 1-1/8" dia.—Weight: 8 oz—Finish: two-tone baked enamel, black and dark green—Accessories furnished: 15-ft, 2-conductor, shielded cable with plug for connection to microphone.

Microphone is equipped with 3-pin connector for Cannon XLR-3-11C; No. 13798 slip-on adapter plug. Price: \$72.

Comments: The 684B is a microphone designed for universal application. The slip-on mount permits quick release for position changing from stand to stand or hand-held operation.

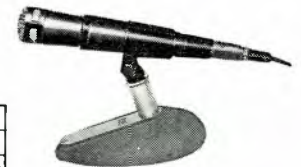
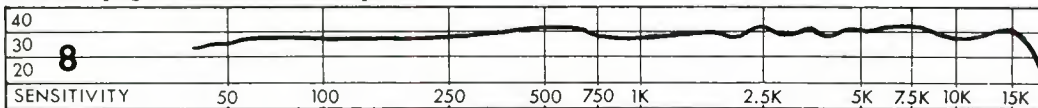


Altec-Lansing 685B

Dynamic cardioid—Slip-on adapter for desk or stand mount with 5/8"-27 thread—Output level: -54 dbm—Hum: -120 db—Discrimination: front to back, 20 db—Impedance: 150/250 ohms—Dimensions: 7-13/16" × 1-1/2" dia.—Weight: 11 oz—Finish: two-tone baked enamel, black and dark green—Accessories furnished: 15-ft, 2-conductor, shielded cable with plug for connection to microphone.

Microphone is equipped with 3-pin connector for Cannon XLR-3-11C; Slip-on swivel adapter—Price: \$84.

Comments: Incorporated is a pop-screen filter located at the sound entrance. This serves to protect the microphone from popping. A positive "lock-in" eliminates the possibility of the microphone's slipping out of the stand adapter.

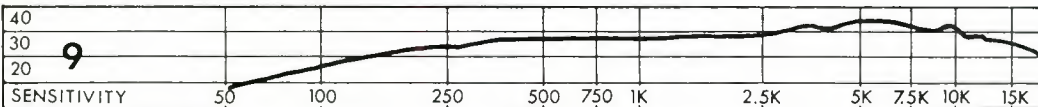


Altec-Lansing 686A

Miniature dynamic omnidirectional—Snap-on lavalier cord—Output level: -55 dbm—Hum: -120 db—Impedance: 30/50, 150/250 ohms (selectable)—Dimensions: 3-1/2" × 1-1/16" dia.—Weight: 3 oz—Finish: baked enamel, nonglare dark green—Accessories furnished: 20-ft, 3-conductor, shielded cable and plug;

snap-on lavalier neck cord No. 13356 including spring-type tie or lapel clip No. 13322—Price: \$45.

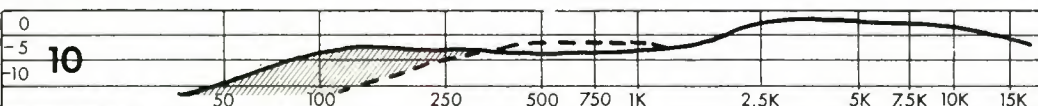
Comments: A sintered bronze filter provides protection to the acoustical element by prohibiting the entrance of any foreign particles or moisture into the microphone proper.



Altec-Lansing 687B

Dynamic omnidirectional—Cast housing including handle with 5/8"-27 thread—Output level: -58 dbm—Hum: -120 db—Impedance: 150/250 ohms—Dimensions: 7-1/2" H × 3" D × 1-5/8" dia.—Weight: 1 lb—Finish: satin chrome—Accessory furnished: 15-ft, 3-conductor, 80% shielded cable (permanently attached to microphone)—Accessories available: matching No. 34A shock-mount desk stand—Price: \$36.

Comments: The "on-off" microphone switch has available a nonshielded wire for actuating muting relays and/or indicating lights. Its two-position functions permit "hold" or "lock-in" operation. A movable shutter on the rear of the housing may be adjusted to reduce low-frequency response in the presence of machinery rumble, low-frequency feedback, and ambient noise.

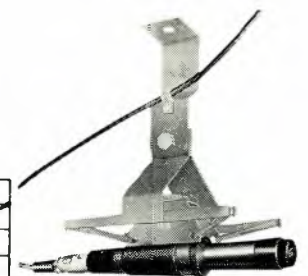
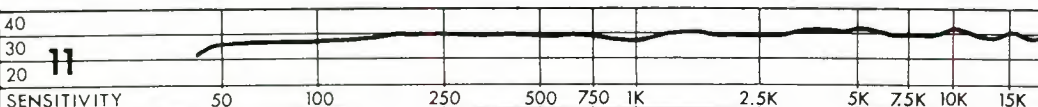


Altec-Lansing 688B

Dynamic omnidirectional—Hand-held, stand, or boom mount—Output level: -55 dbm—Hum: -120 db—Impedance: 150/250 ohms—Dimensions: 7-1/2" × 1-1/2" dia.—Weight: 8 oz—Finish: two-tone baked enamel, black and dark green—Accessories furnished: 15-ft, 2-conductor shielded cable and a plug

(Cannon XLR-3-11C) for insertion into microphone; slip-on adapter for stand mount with 5/8"-27 thread—Accessories available: 181B boom mount (pictured)—Price: \$81.

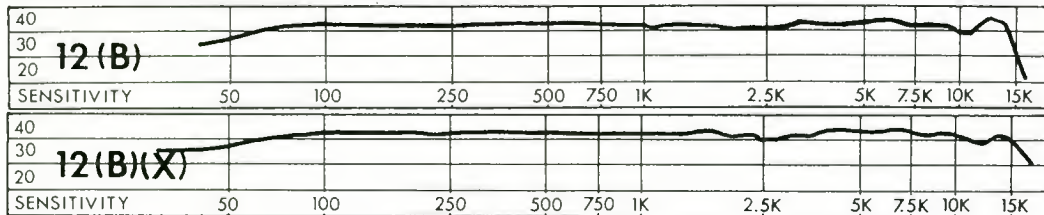
Comments: Contains a polyester-foam pop filter. Because of flat frequency response, the frequencies at which feedback normally occurs are not emphasized.



Altec-Lansing 689B, 689BX
Dynamic cardioid—Hand-held, stand, or boom mount—Output level: -54 dbm—Hum: -120 db—Discrimination: front to back, 20 db—Impedance: 150/250 ohms—Dimensions: 7-13/16" × 1-1/2" dia—Weight: 11 oz—Finish: two-tone baked enamel, black and dark green—Accessories furnished: 15-ft, 2-conductor shielded with a plug (XLR-3-11C) for connection to microphone, slip-on adapter

No. 13798 with swivel mount and 5/8"-27 thread—Accessories available: 181B boom mount (illustrated)—Price: 689B, \$96; 689BX, \$118.

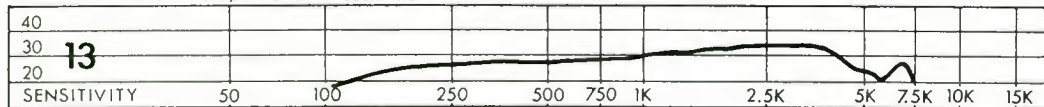
Comments: The 689BX microphone is a special version of the 689B for application in equalized sound systems utilizing the Borer Process or for stereo systems requiring matching microphones.



Altec-Lansing 697A
Noise-cancelling dynamic with built-in transistorized amplifier for replacement of carbon-type telephone transmitters—Output level: -37 db Re: 1 volt, -44 db Re: 1 dyne/cm² (high gain, 100-ohm load, 24 ma) -44 db Re: 1 volt, Re: 1 dyne/cm² (low gain, 100-ohm load, 24 ma)—Impedance: 100 ohms to infinity—Dimensions: 1" × 1-13/16" dia—Weight: 1.5 oz—Price: \$51.75.

Comments: This microphone has been designed to replace the telco-furnished carbon

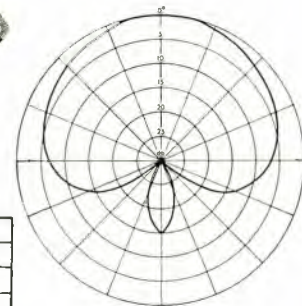
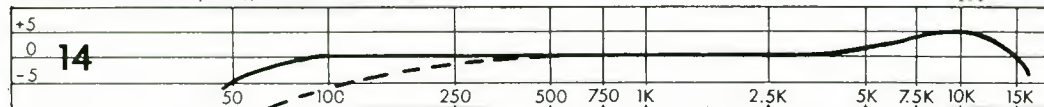
transmitter for high-grade telephone circuits, particularly in broadcast applications. The assembly operates from the current normally supplied to the carbon element, requiring less current for a given output and permitting greater loop length. A high and low sensitivity adjustment is available. The circuitry of the transistor operates free of earth ground, complying with telco requirements.



Electro-Voice KE-15
Dynamic cardioid—Slip on holder (clamp) for mounting on desk or floor stand, standard thread—Output level: -55 db—EIA sensitivity: -149 db—Impedance: 150 ohms—Dimensions: 6-7/16" × 1-3/8" dia—Weight: 8 oz (without cable)—Finish: non-reflecting matte satin nickel on steel case—Accessories furnished: 18-ft, 2-conductor, shielded, synthetic rubber cable with Cannon XLR3-11 connector at microphone, metal case and

Model 310 clamp—Optional accessories: Model 311 Snap-Out clamp—Price: \$255.

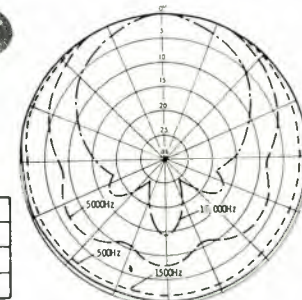
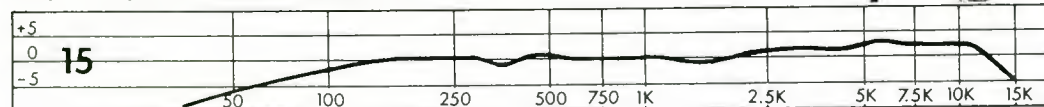
Comments: This microphone features frequency response virtually independent of angular source and greatest rejection at 150° off axis rather than the usual 180°. This pattern provides greatest horizontal rejection at 30° tilt. A "brass-tilt" switch corrects spectrum balance for boom and other long-reach use.



Electro-Voice 635A
Dynamic omnidirectional—Slip-on holder (clamp) for mounting on desk or floor stand. Can be hand-held or used as lavalier—Output level: -55 db—EIA sensitivity: -149 db—Impedance: 150 ohms—Dimensions: 5-15/16" × 1-13/32" dia—Weight: 6 oz (without cable)—Accessories furnished: 18-ft, 2-conductor, shielded, synthetic-rubber cable with Cannon XLR-3-11 connector at

microphone: 310 clamp and lavalier neck cord—Cable connector: Cannon XL3-12—Finish: nonreflecting matte satin nickel on steel case—Price: \$82.

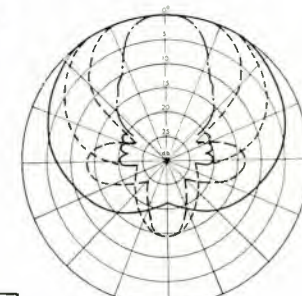
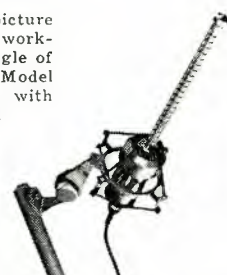
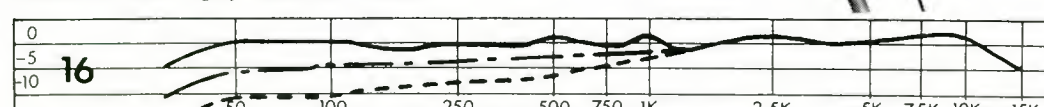
Comments: A special internal shock mount is designed to provide special durability, and a four-stage, pop-and-dust filter rejects wind and breath noises. The microphone is often used without a windscreen.



Electro-Voice 642
Dynamic directional—Shock or suspension mounting—Output level: -48 db—EIA sensitivity: -142 db—Impedance: 50/150/250 ohms—Dimensions: 17-7/8" × 3-3/16" dia—Weight: 3 lb, 4 oz—Accessories furnished: 20 ft, 3-conductor, shielded, broadcast type with Cannon UA-3-11 connector which mates with UA-3-14 on microphone: Deluxe carrying case—Finish: abrasion-proof, nonreflecting gray on cast aluminum—Optional accessories: Model 327 (\$100) or 356 (\$50) shock mounting—Price: \$390.

Comments: This highly directional micro-

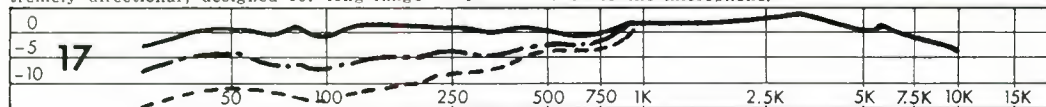
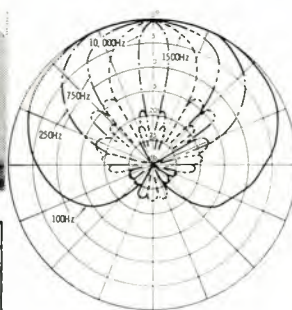
phone has been awarded a motion picture "Oscar." It has been designed for long working distances and has a nominal 80° angle of acceptance. It must be shock mounted. Model 356 is for indoor use, and Model 327 with windscreen is for exterior employment.



Electro-Voice 643

Dynamic directional—5/8"-27 or 1/2" pipe thread—Integral mount—Output level: -48 db—Impedance: 50/150/250 ohms—Dimensions: 86" × 14-3/4" H—Weight: 12 lb—Finish: gray on machined aluminum—Accessories furnished: 20-ft, 3-conductor broadcast type with Cannon UA-3-11 connector; carrying case—Price: \$1,560.
Comments: The stand-mounted 643 is extremely directional; designed for long-range

pickup. It is cardioid up to 100 Hz and distributed front opening above that frequency. Angle of acceptance is normally 40°, narrowing to approximately 15° at 10 kHz. Environmental conditions may be compensated for by means of a slot adjustment for three low-frequency response variations. An integral high-pass filter provides attenuation below 100 Hz at 40 db per octave. The filter has a switch by means of which filter impedance may be matched to the microphone.

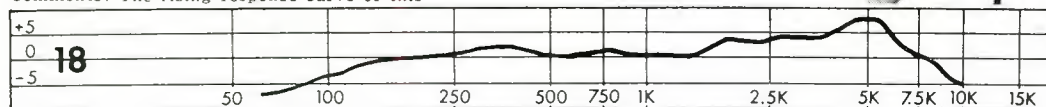
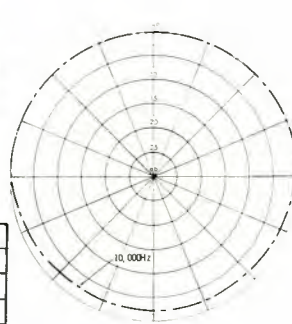


Electro-Voice 649B

Dynamic omnidirectional—Lavalier—Output level: -61—Impedance: 150 ohms—EIA sensitivity: -154 db—Dimensions: 2-1/4" × 3/4" dia—Weight: 31 grams—Finish: non-reflecting gray on aluminum—Accessories furnished: 30-ft, 2-conductor, shielded, synthetic-rubber cable; neck-cord assembly; belt clip; stand adapter; and suede pouch—Price: \$105.

Comments: The rising response curve of this

microphone compensates for conditions normally encountered in lavalier employment in order to achieve balance with stand-mounted units. The flexible cord retainer can be removed from the microphone; the belt clip provides cable placement control and helps to prevent mechanical noise from being transmitted up the cable. A magnetic shield provides protection from dust and magnetic particles.

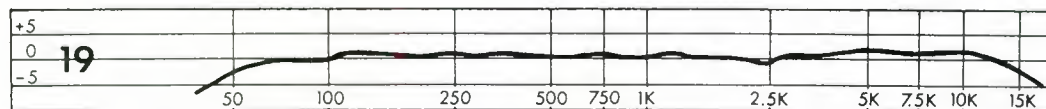
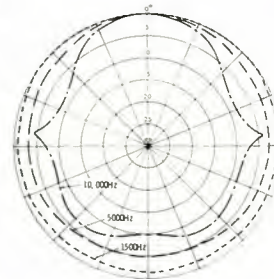


Electro-Voice 654A

Dynamic omnidirectional—Stand-mounted or hand-held—Output level: -57 db—EIA sensitivity: -151 db—Impedance: 150 ohms—Dimensions: 6-15/16" × 1-1/8" dia—Weight: 7 oz—Finish: nonreflecting gray on extruded aluminum—Accessories furnished: 18-ft, 3-conductor, shielded, synthetic rubber cable

with XLR-3-11 connector; Model 300 clamp; lavalier neck cord; and suede bag—Price: \$100.

Comments: Designed for close-lip applications when broadcasting or recording noisy sports events or other situations involving high ambient crowd noise.

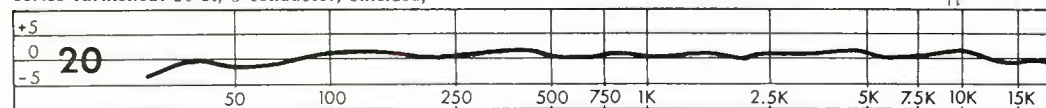
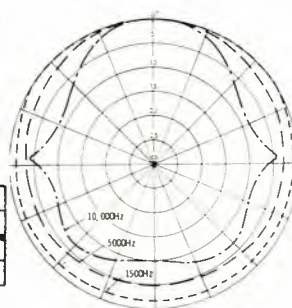


Electro-Voice 655C

Dynamic omnidirectional—hand-held, stand, or boom-mounted—Output level: -57 db—EIA sensitivity: -150, -151, -149 db—Impedance: 50, 150, 250 ohms (connection change: shipped 150 ohms)—Dimensions: 10-3/8" × 1-1/8" dia—Weight: 7 oz—Finish: nonreflecting gray on aluminum—Accessories furnished: 20-ft, 3-conductor, shielded,

neoprene cable with UA-3-11 connector; Model 300 clamp; and carrying bag—Price: \$200.

Comments: This microphone can be employed in both long-range and close-lip applications. The latter condition is particularly applicable to soloists because of the Acoustifoam wind and breath filter.

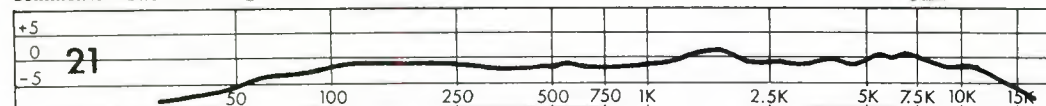
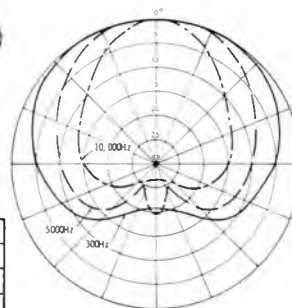


Electro-Voice 665

Dynamic cardioid—stand-mounted or hand-held—Output level: -58 db—EIA sensitivity: -151, -150 db—Impedance: 50, 250 ohms (switch)—Dimensions: 7-7/16" (not including stud) × 1-7/8" dia—Weight: 1 lb, 10 oz—Finish: nonreflecting gray on die-cast zinc—Accessory furnished: 18-ft, 3-conductor, shielded, neoprene cable with XLR-3-11 connector—Price: \$150.

Comments: The mounting stud is threaded

to the 5/8"-27 thread. A magnetic shield is provided to prevent dust and magnetic particles from reaching the element. Background noise rejection is accomplished by the use of three sound entrances located behind the diaphragm. Effectively the entrances form one entrance which varies inversely with the frequency, achieving optimum phase and amplitude conditions. Pop protection is furnished with a wire-mesh grille.

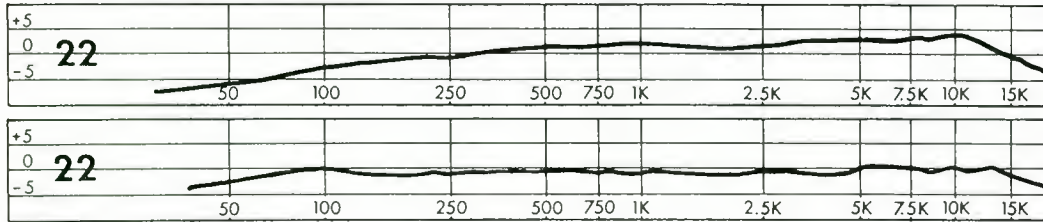
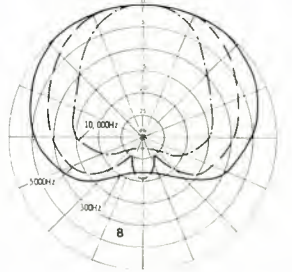
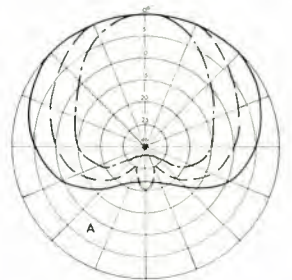


Electro-Voice 666/666R

Dynamic cardioid—stand-mounted or hand-held—Output level: 666, -58 db; 666R, -56 db—Hum: -125 dbm—EIA sensitivity: 666, -151, -152, -150 db; 666R, -149, -150, -148 db—Impedance: 50, 150, 250 ohms (connection change; shipped 150 ohms)—Dimensions: 7-11/16" × 1-11/16" dia—Weight: 11 oz—Finish: nonreflecting gray on die-cast aluminum—Accessories furnished: 20-ft, 3-conductor shielded, neoprene cable with UA-3-11 connector; Model 300 detachable stand clamp; and deluxe carrying case—Price: \$255.

Comments: This is an all-purpose microphone especially designed for locations where ambient noise and severe vibration exist.

These effects are reduced with the employment of three entrances behind the diaphragm which achieve effectively one entrance whose distance varies inversely with the frequency. The Model 666R differs from the Model 666 in low-frequency response. This is to effect a balance where bass and drum loudness is excessive or where it is desired to reduce room rumble.

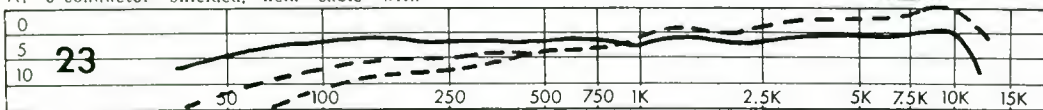
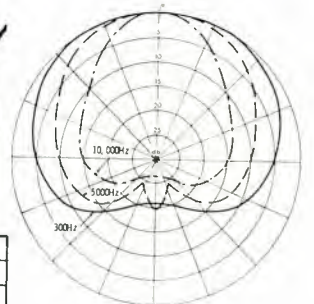
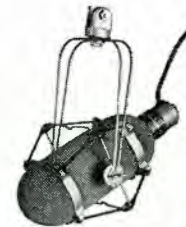


Electro-Voice 667A

Dynamic cardioid—Boom mount—Output level: 150/250 ohms, -51 db; 50 ohms, -52 db—EIA sensitivity: -150, -145, -149 db—Impedance: 50, 150, 250 ohms (selectable by moving one pin on rear of case)—Hum: -121 dbm—Dimensions: 9-5/8" L × 6-1/2" W × 9-1/4" D overall—Weight: 1 lb, 8 oz—Finish: nonreflecting gray on machined aluminum—Accessories furnished: 2-ft, 2-conductor, shielded, isolation cable; and 20-ft, 3-conductor shielded, field cable with

UA-3-11 connector—Price: \$345.

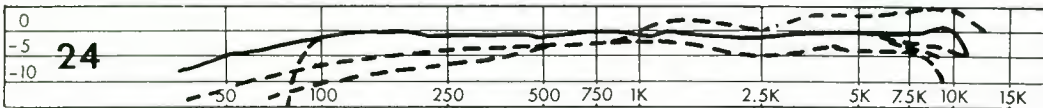
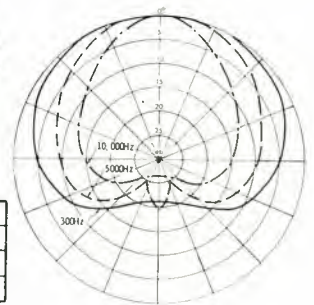
Comments: Integral is a passive equalizer network by means of which the choice of two variations of high-frequency response (A or B) and a choice of three variations of low-frequency response (1, 2, or 3) may be selected. Access to the selector panel is provided by removing a cap at the rear of the microphone. The boom mount illustrated is built onto the microphone as is the Acoustifoam windscreen.



Electro-Voice 668

This microphone is generally identical to Model 667A except: Passive filter networks for reduction of response above 8000 Hz and below 80 Hz (reduction of 50 db per octave in each case) is provided. Effectively, a choice of 36 response variations is available. This permits adapting the microphone to environmental conditions and response matching to other microphones. Also, as with the

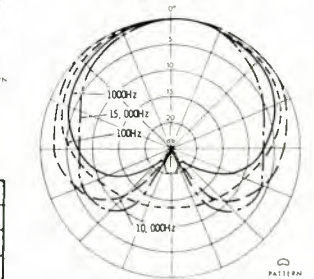
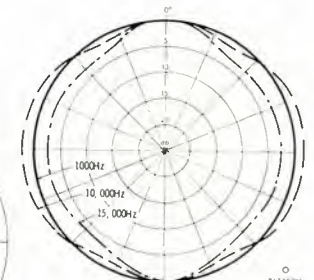
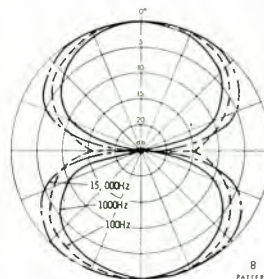
Model 667A, background noise rejection is accomplished with a matched pair of slotted tubes coupled to the back at the diaphragm.—Price: \$495.



Neumann KM 56

Variably cardioid miniature condenser system—Stand and boom mount—Output level: 0.9 mV—Channel separation: > 45 db—Impedance: 50, 200 ohms (changeable)—Dimensions: 6" × 7/8" dia—Weight: 4 oz—Accessories furnished: power supply, 25-ft interconnecting cable, swivel stand mount, mating audio output connector, AC power cable—Price: \$460.

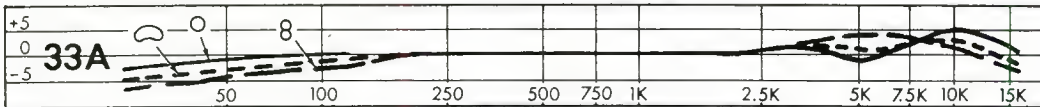
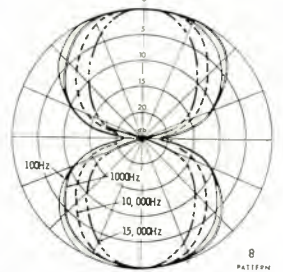
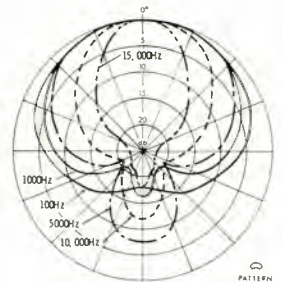
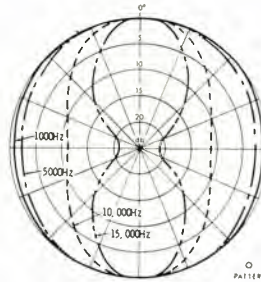
Comments: This miniature condenser system, consisting of two condenser elements, has a pickup pattern, variable from omnidirectional to figure-eight, which can be switched by turning a ring at the bottom of the microphone. The polar graph indicates that the pattern is relatively independent of frequency, not narrowing at the high-frequency end as is characteristic of many condenser systems. The impedance-matching amplifier is integral to the microphone case.



Neumann M 49

Two-condenser system with switchable cardioid pattern—Stand, boom, or suspension mounting—Output level: omni, 0.45 mV; cardioid, 0.6 mV; figure-eight, 0.8 mV—Impedance: 50, 200 ohms (changeable)—Dimensions: 6-3/8" x 3-1/8" dia—Weight: 1.8 lbs—Accessories furnished: power supply, 25-ft interconnecting cable, swivel stand mount, mating audio output connector, AC power cable—Accessories available: numerous—Price: \$495.

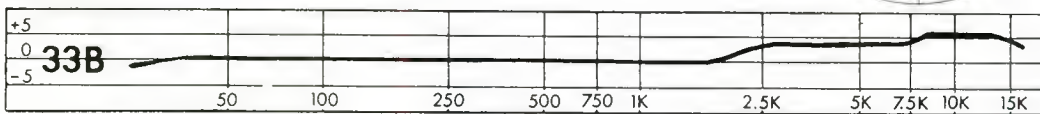
Comments: Two separate gold-sputtered diaphragm condensers are mounted back-to-back, and a fader on the power supply (which can be up to 250 ft from the microphone) permits change of pickup pattern to each of three separate patterns and intermediate points. The system is designed specifically for suspension in concert-hall applications. The impedance-matching amplifier, an integral part of the microphone, is internally shock mounted to eliminate shock noise.



Neumann M 50

Omnidirectional condenser system — Stand, boom, or suspension mounting—Output level: 1.5 mV—Impedance: 50, 200 ohms (changeable)—Price: \$485.

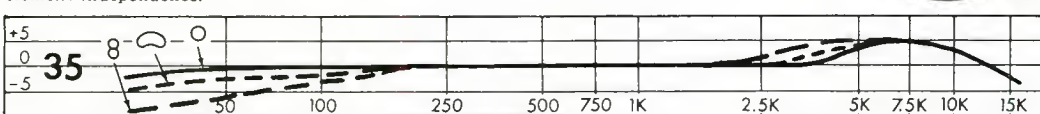
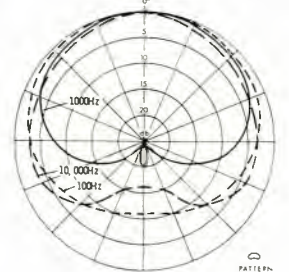
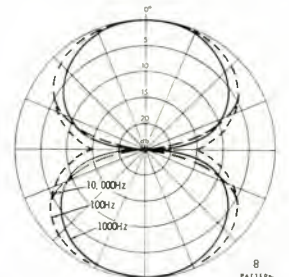
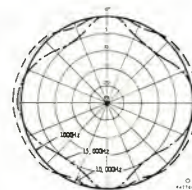
Comments: In appearance and accessories, the M50 is identical with the M49 except for a red or white dot above the nameplate. This microphone is specifically designed for suspension above an orchestra for single-microphone pickup. The omnidirectional characteristic becomes directional at high frequencies.



Neumann SM 2c/23c

Stereo, variably cardioid, two-element condenser system—Stand, boom, or suspension mounted—Output level: 1mV—Channel separation: ≥ 45 db—Impedance: 50, 200 ohms (changeable)—Dimensions: 8" x 1-1/8" dia—Weight: 1 lb—Accessories furnished: power supply, 25-ft interconnecting cable, swivel stand mount, mating audio output connector, AC power cable — Accessories available: numerous—Price: \$820.

Comments: These microphones consist of two separate and noninteracting double-condenser systems in the same miniature case. The systems are independent, allowing unequal directional characteristics for each system. Patterns are changed by means of two independent switches on the power-supply case. The upper element can be rotated 270°. The Model SM 23c varies from the SM 2c in that two separate power supplies are required. This enables achievement of even greater element independence.

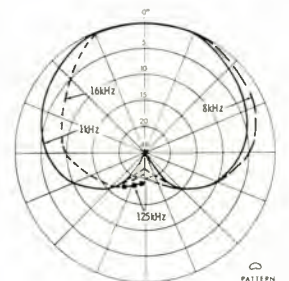


Neumann KM 64

(not illustrated) U 64

Linear admittance cardioid condenser system—Stand, boom, or suspension mounting—Output level: KM 64, 0.9 mV; U64, 1.1 mV—Impedance: 50, 200 ohm (changeable)—Dimensions: KM 64, 4-7/8" x 7/8" dia; U 64, 4-1/2" x 7/8" dia—Weight: 4.2 oz—Accessories furnished: power supply, 25-ft interconnecting cable, swivel stand mount, mating audio output connector, AC power cable—Accessories available: numerous—Price: \$435; KM 64B (with BB 12 battery power supply) \$405; U 64, \$360.

Comments: The feature of this microphone is relative independence of frequency response with a cardioid pattern, especially at the high end. The self-contained impedance matching amplifier employs the Telefunken triode AC701k. The U 64 differs in that a nuvistor replaces the triode. This results in higher sensitivity and a smaller case.

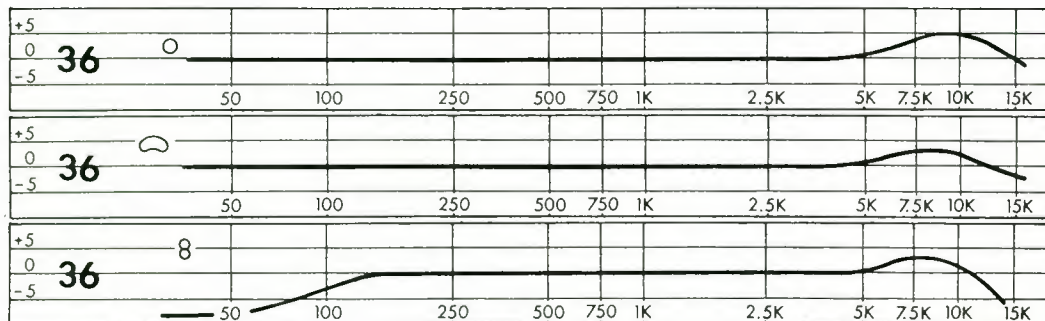
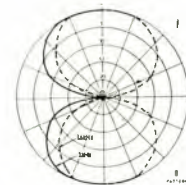
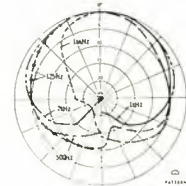


Neumann SM 69

Double condenser stereo, variable pattern—Stand, boom, or suspension mounting—Output level: 1.5mV—Impedance: 50, 200 ohms (changeable)—Dimensions: approx 10" × 2" dia—Weight: 1 lb—Accessories furnished: power supply, 25-ft interconnecting cable, swivel stand mount, mating audio output connector, AC power cable—Available accessories: numerous—Price: \$865.

Comments: This microphone system consists of two separate condenser elements with independent impedance-matching amplifiers in the same case. It is designed for stereo applications but, by using only one element, can be employed in monophonic situations. The directional characteristic can be changed by means of a potentiometer on the power supply, which can be as much as 125 ft

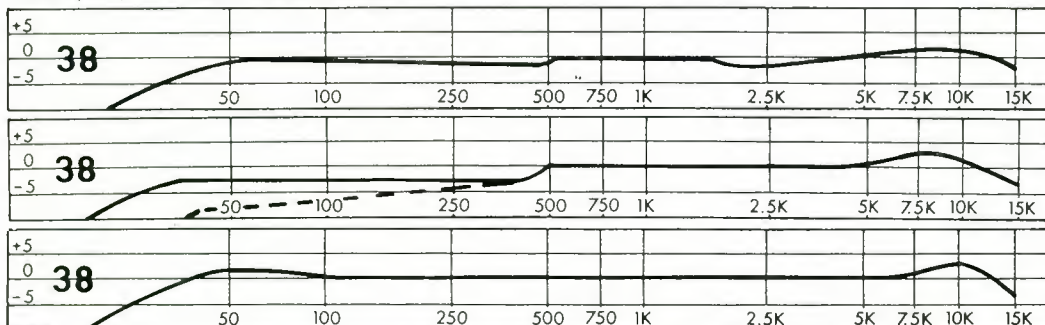
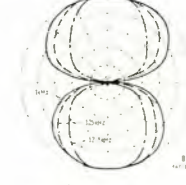
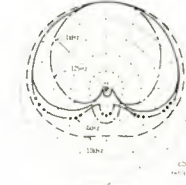
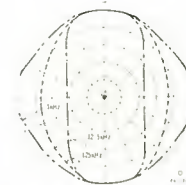
from the microphone. It is possible to use two separate power supplies (NN 48b). This requires the use of an adapter for the separate cables. Each half of either capsule system has a cardioid characteristic. By applying suitable polarizing voltages to each system, independent patterns can be established. The upper capsule can be rotated through an angle of 270° relative to the lower one.



Neumann U-67

Variable pattern condenser system—Stand, boom, or suspension mounted—Output level: omni- and figure-eight, -59 db: cardioid, -55 db—Impedance: 30/50, 150/250 ohms (switchable)—Dimensions: microphone: 7-7/8" × 2-1/4" dia; power supply: 4" × 4" × 8-1/2"—Weight: microphone, 1 lb, power supply, 4 lbs—Finish: matte satin chrome or gray hammertone—Accessories furnished: power supply, 25-ft microphone cable, suspension, XLR-3-11 connector, 6-ft AC power cord—Accessories available: numerous—Price: \$460; with elastic suspension, \$474.

Comments: This microphone features a novel internal construction with a universally available plug-in type amplifier tube. The entire microphone assembly, including the encapsulated condenser element, can be dismounted, without tools, for maintenance. Three slide switches (controlling directional characteristic, frequency response, and sensitivity) are located directly below the capsule housing. The sensitivity control permits close-proximity use by soloists or announcers. The system has been designed for all-purpose employment.

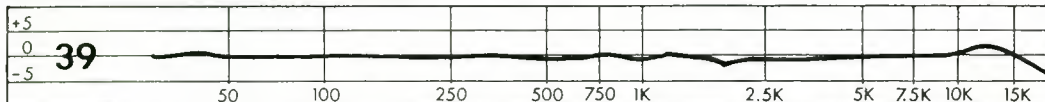
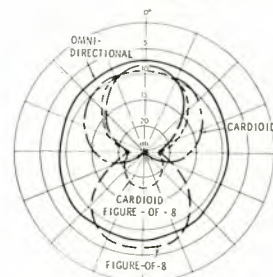


Norelco C-12A (AKG)

Variable pattern condenser system—Stand or boom mount—Output level: -44 db—Impedance: 200 ohms—Dimensions: microphone, 3-7/8" × 2-5/8" × 1-1/16"; power supply, 6-3/4" × 5" × 3-1/2"—Weight: System, 9 lbs.—Accessories available: numerous—Price: \$480.

Comments: In addition to the power-supply-

controlled three basic patterns, six intermediate positions may be selected. A special feature of the system is a bass attenuator which may be adjusted to 0, -7 db, or -12 db at 50 Hz. The self-contained, impedance-matching amplifier consists of a nuvistor and a printed circuit. Frequency-response curves are similar in each of the pickup patterns.

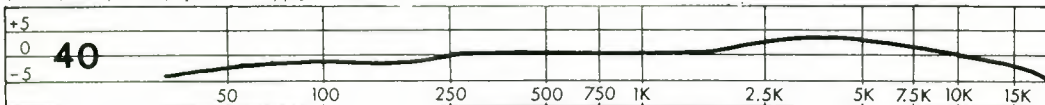
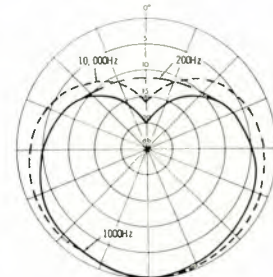


Norelco C-60 (AKG)

Cardioid or omnidirectional miniature condenser system—Hand-held or stand-mounted—Output level: -58 db—Impedance: 600 ohms unbalanced: 50, 200, 500 ohms with N-60 power supply—Dimensions: microphone, 3-15/16" × 23/32" dia; power supply, 6-1/4" × 4-9/16" × 2-3/4"—Weight: microphone, 2-1/8 oz; power supply, 46.9 oz—

Accessories furnished: power supply, microphone cable, stand adapter, and mating connector—Accessories available: numerous—Price: \$280; CK-26A element, \$75.

Comments: The microphone is normally supplied with the CK-28A cardioid condenser capsule, but this can be replaced easily with CK-26A omnidirectional capsule.

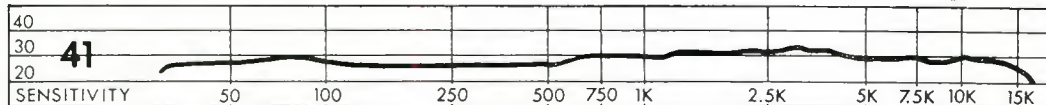
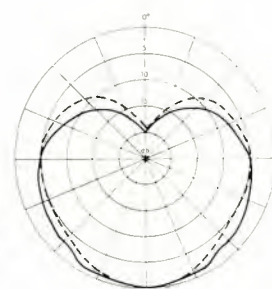


Norelco D-202ES (AKG)

Cardioid dynamic — Hand-held or stand-mounted—Output level: -53 db—Impedance: 200 ohms — Dimensions: 8-1/2" long — Weight: 9-1/2 oz—Accessories furnished: 15-ft cable—Accessories available: numerous —Price: \$130.

Comments: Two independent capsules are incorporated in the housing. These are connected by means of a dividing network which is free of phase distortion. One capsule is adjusted for low frequency and the other for

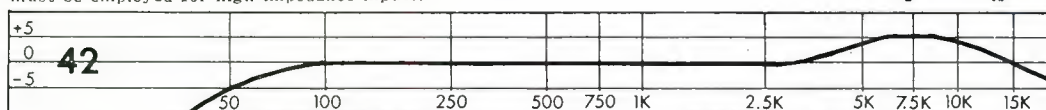
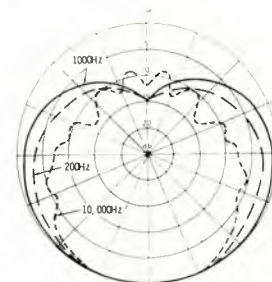
high. Crossover is 500 Hz, and the cardioid pattern is relatively independent of frequency. Effects of stray magnetic fields are eliminated by compensator windings attached to the high-frequency transducer. A newly developed sintered bronze cap acts as a windscreen and as a protection against ferrous dust. Other features include continuous bass roll-off of up to 20 db at 50 Hz and a recessed on-off switch.



Norelco D-24E (AKG)

Cardioid dynamic — Hand-held or stand-mounted—Output level: -75 db—Impedance: 200 ohms (60 ohms on request)—Dimensions: 6-1/2" x 1-9/16" dia—Weight: 6 oz—Accessories furnished: case — Accessories available: stand adapter SA 10/3—Price: \$160.

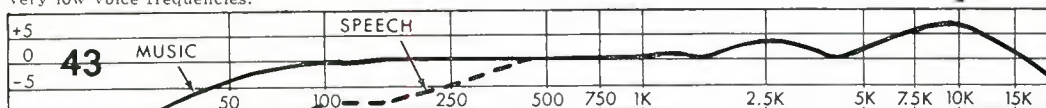
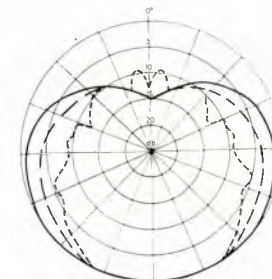
Comments: The D-24E incorporates a built-in, three-pole Cannon connector which mates with the XLR-type. A matching transformer must be employed for high-impedance inputs.



Norelco D-19E/200 (AKG)

Cardioid dynamic — Hand-held or stand-mounted—Output level: -75 db—Impedance: 200 ohms—Dimensions: 7-1/8" x 1-7/16" dia—Weight: 7 oz—Accessories furnished: stand adapter, matching microphone connector—Accessories available: numerous—Price: \$58.

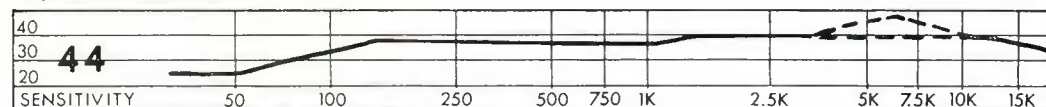
Comments: A self-contained base switch can be set to a "speech" position to provide clear response at close talking range, even for very low voice frequencies.



Norelco D-109 (AKG)

Omnidirectional dynamic—Lavalier—Output level: -56 db—Impedance: 200 ohms—Dimensions: 2-3/4" x 5/8" dia—Weight: 1-1/2 oz—Accessories furnished: thin 30-ft nondetachable microphone cable—Price: \$49.

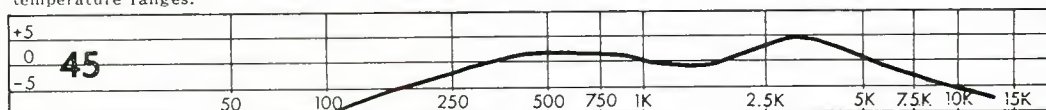
Comments: One of the considerations given to the design of this microphone is the resonance of the human chest cavity—for which corrections have been made to assure proper speech reproduction. The frequency-response curve may be attenuated to specific applications by raising or lowering the tunnel-shaped lavalier attachment.



Norelco D-58E (AKG)

Lobe-patterned miniature dynamic—Cannon-connector mounted—Output level: approx 0.5 mV at 2" distance—Impedance: 200 ohms (60 ohms, if specified)—Dimensions: 1-5/8" x 13/16" dia—Weight: 1.1 oz—Accessories furnished: case—Accessories available: flexible shaft and stand adapter—Price: \$43.

Comments: The D-58E antinoise microphone has been developed for close-range voice applications in noisy surroundings. A differential principle cancels sound originating inversely with the distance. A shield for dust and stray magnetic fields is provided, and the unit withstands high humidity and wide temperature ranges.



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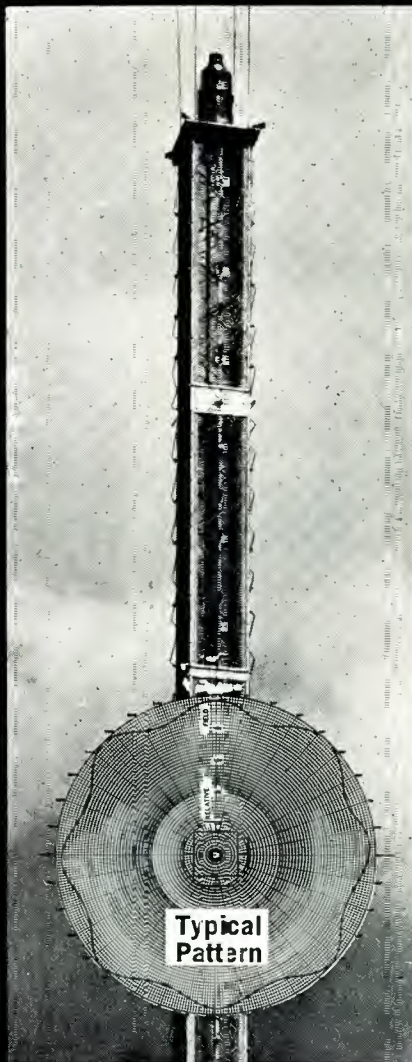
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Typical
Pattern

DESCRIPTION
Improved mechanical
construction
Wide variety of Gains
Power rating to 50 kw
Beam tilting and null fill avail-
able at no increase in cost

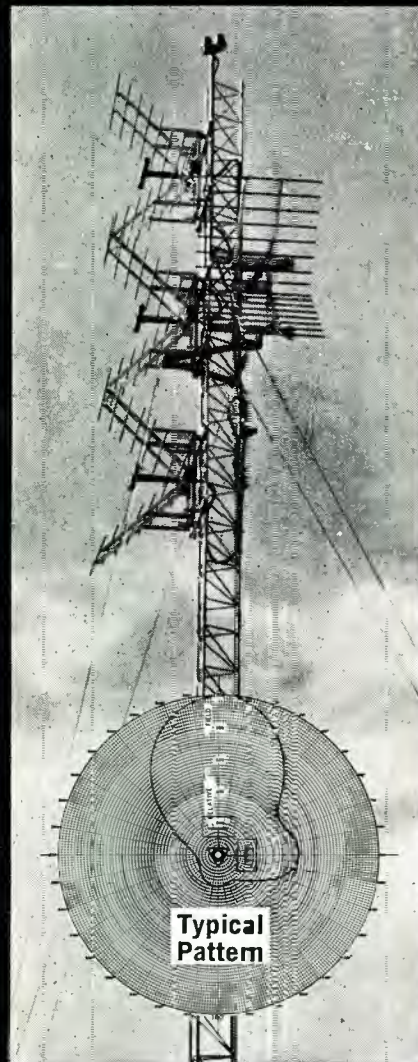
UHF ZIG ZAG



Typical
Pattern

DESCRIPTION
Simple panel construction
All copper elements
All Teflon insulated
Low VSWR
Inputs to 50 kw
Gain of about 30 per panel

CORNER REFLECTORS



Typical
Pattern

DESCRIPTION
Wide variety of frequencies from
Channel 2 through 83
Low VSWR
Versatile for fill in or directionals
Gains of generally around
10 per corner

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The 1966 NCTA Technical Sessions

Monday Morning

The morning session was opened by Mr. Edward P. Whitney with the comment, "Welcome to Show and Tell." The morning session was devoted to representatives of sixteen manufacturers who brought to the attention of those gathered in the east ballroom their companies' latest products.

Speaking first was Mr. John Pankie of Ameco, Inc. He introduced their new "Pacesetter" series. He emphasized the ease with which these units can be serviced, the fact that they are of modular construction, the fact that they pop out of the case with no loose hardware, and the fact the enclosure is all cast aluminum. He also explained that the power supply is of unitized construction and has a linear voltage-adjusting transformer.

Next speaker was Mr. Bob Brooks of Anaconda Astrodata Co. He introduced the new "XDR" series of trunk and distribution equipment. He pointed out that one can cascade up to 160 amplifiers of this type. A second item new at the show was the Model 990 analyzer. It stands just 50 inches high and weighs only 39 lbs.

Farrell Anderson of Cascade Electronics, Ltd., described their new line of boxes which are aluminum except for the test point and the hinge pin. The silicone seal fits directly into the lid. A total of four discretely separate amplifiers can be constructed from plug-in units to fit this housing.

Fourth speaker was R. G. Jones of the Collins Radio Company. Collins was new to the CATV show this year. Mr. Jones introduced the MW-109E Microwave system. This is a heterodyne system, and has been available for the past three years in the 4-gHz, 6-gHz, and 11-gHz bands. Power outputs are approximately 15 watts at 4 gHz, 10 watts at 6 gHz, and 5 watts at 11 gHz. Simplified maintenance results from the sub-system design concept.

Fifth to speak was Robert Vendeland of Dynair Electronics. He introduced their new solid-state head-end gear which features modular construction and built-in metering.

Next was Mr. Ed Whitney of Entron, Inc., the presiding officer at the morning session. He mentioned Entron's low-noise preamplifiers, their UHF-to-VHF converter, and new underground applications.

Danny Coulthurst described the new International Good Music, Inc. TELMAS program unit, which is similar to the unit they have used in the broadcast field for seven years. This unit incorporates a crystal clock; batteries are capable of operating it for 24 hours after loss of AC power. A new item is their solid-state switchable filter that provides 80-db picture filtering.

Eighth speaker was Preston Spradlin of CAS Manufacturing Co. He introduced a new double-conversion transistor head-end unit. It can be mounted in a 19-inch rack, is easy to repair, and is reduced in size. Two new units are available in four- and two-tap models. These are nick-

named the "Milk Cow" and "Nanny Goat," respectively. A new TRA-230 AGC amplifier is also available.

Next was Mr. Frank Rigone from Jerrold Electronics Corp. Innovations are (1) the starline equalizer, (2) a nonduplication programmer with B+ switching, (3) a new family of low/sub amplifiers, and (4) cast-iron amplifier housings for direct burial.

Tom D. Smith of Scientific Atlanta, Inc. noted the addition of two new products, a UHF parabolic antenna and a 110- to 130-mile multielement UHF array.

Billy O'Neil was spokesman for Spencer-Kennedy Laboratories, Inc. (SKL). Their new distributed-circuit transistor amplifier is capable of handling 12 channels with 50db of gain. In many applications, these new amplifiers can eliminate line extenders.

Ray Unrath from Telemation, Inc. introduced six new products, including a new Model 97 WEATHER CHANNEL®, and a Model 75 economy WEATHER CHANNEL®. He also described a synthesized color system and the SAVE-A-CHANNEL® program-logic device.

Next was Bill McNair of Times Wire & Cable Co. They have a new 1¼" low-loss transportation cable for long runs, the "Super drop JTL-250." Also new is a low-loss drop cable; a 150-foot length of this cable is 4.5db better than RG-59. A new line of connectors meeting military specifications also is available.

Fourteenth speaker was Jay Hubbell of Viking Industries. He introduced their new "Futura" line of Main, Bridge, and AGC amplifiers. The new Model 5667 switches with seven-day capability were also introduced.

Next to last was Danny Mezzalingua, representing Craftsman Electronic Products, Inc. The directional modular power tap was their number-one item.

And last was Fred Shulz of Blonder-Tongue System, Inc. A solid-state sweep generator with a 10-220 mHz and a 470-890 mHz range, and a marker generator were new additions to their line of test equipment.

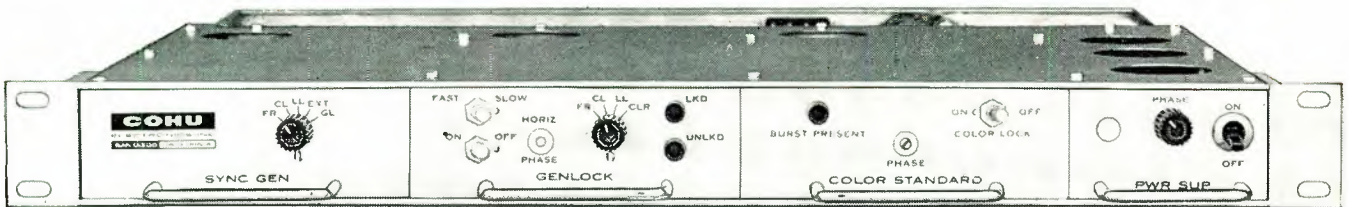
Monday Afternoon

Presiding over the session was Archer S. Taylor. The first speaker to be introduced was Mr. Hubert Schaffly of TelePromTer Corp. Mr. Schaffly talked about TelePromTer's new AML (Amplitude Modulated Link) microwave units. The system is capable of transmitting 12 channels with color-grade quality and is being used over ranges of up to six miles. It is now being operated with an FCC experimental license.

The system modulates only the lower sideband with signals from 54 to 216 mHz; the carrier is suppressed. By this means, a full complement of head-end signals can be delivered to one or more receiving points. In effect the system is like an invisible cable requiring no poles, no wires, and no real estate. At the receiving locations, antennas with 1° beam width are employed.

In addition to its applications in large cities, the system can be employed to hop over canyons or rivers. The speak-

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er pointed out that in the New York City test one receiving point for each city block is being used, and no streets need be crossed. The 18-gHz band is being used primarily because all lower microwave channels are in use or don't allow enough bandwidth.

While AML is meant only for limited distances on the order of six miles, it can probably work at distances up to 10 or 12 miles. While the present experimental units operate with a few milliwatts of power, 2.5 to 5 watts may be used eventually.

The second speaker of the afternoon was Mr. R. R. MacMillan, of Kaiser-Cox Corp., who gave a bread-and-butter talk on "Test Equipment Methods." He indicated that most test equipment now being used is inadequate for today's transistor gear.

A good sweep generator must be stable to one-tenth of a db during time of measurement and have an output impedance of 75 ohms. The detector should be the full-wave DC clamp type, and must be capable of a bandwidth greater than the amplifier under test. The oscilloscope must be a DC scope with DC stability, have a sensitivity equal to 10 mv/cm, and have a screen of ample size.

Measurement of noise can only be done on a relative basis. Also, noise measurements should cover the entire band transmitted (channel 2-13).

Cross-modulation, commonly known as "wiping," can also be measured on a relative basis. Equipment should be able to measure to within one-tenth of one db, and to at least -60db. Many manufacturers now make a cross-modulation meter. It works by feeding 85% modulation to eleven channels, then comparing this to the residual level of the twelfth channel.

It should be possible to check noise figure, output capability, and gain of any amplifier. Test instruments must have accurate calibration and adequate response in order to test today's equipment.

Third on the program was Mr. I. Switzer, a consulting engineer from Lethbridge, Alberta, Canada, who gave a talk entitled "Time Domain Reflectometry." Basically, this talk had to do with testing coaxial cable.

In the past all cable testing was done in the "frequency domain." However, a new type of oscilloscope now allows testing of cable in the time domain. This is referred to as TDR testing. Measuring reflections in the frequency domain will give envelope delay and frequency response. Measurements in the time domain will show up ghosts by reflections. In a sense, the operation is like a radar system. A pulse of very fast rise time is fed into the cable under test.

The TDR can show the location of a fault along the cable. From the type of echo received, the nature of the fault can often be determined as well. Even moisture in a cable will give an indication.

The accuracy of locating faults depends upon the accuracy of the instrument. In fact it is a good idea to calibrate your own by inserting a known discontinuity into the cable at a precisely known distance. For this purpose, a very accurate tape measure is a must.

One caution: The TDR pulse has frequency components as high as 2300 mHz, and can actually show faults outside the useable range of interest (54-216mHz). In such cases, a low-pass filter is helpful, since it restricts the pulse energy to appropriate frequencies.

Mr. Switzer's talk included a description of one commercially available scope made by Hewlett-Packard Co. With this particular unit one can measure 1000 feet of cable up to 500 mHz.

The fourth speaker was Mr. I. S. Blonder, president of Blonder-Tongue Systems, Inc. Mr. Blonder's talk was titled "Technical Training." The speaker categorized tech-

nical knowledge in four general divisions: scientist, engineer, technician, and craftsman. He defined the scientist as a pure researcher, the engineer as a creative planner, the technician as the person on whom falls the principal burden for day-to-day operation, and the craftsman as the installer and repairman. He described technical training as being accomplished at a number of levels ranging from self-study to university. However, he pointed out that standards for measuring the level of technical knowledge achieved are virtually nonexistent.

Available figures show that about 15,000 engineers and the same number of technicians are trained each year. A ratio of three technicians to one engineer is considered desirable, so a shortage of qualified technicians is indicated.

The speaker described the CATV industry as being "Faced with the never-ending shortage of electronic technicians, a school system incapable of producing them, and no immediate relief in sight . . ." He then suggested four approaches to solving the problem: (1) Set standards of training and knowledge; possibly an examination and certification system should be set up by NCTA. (2) Individual CATV companies could establish their own training programs. (3) Outside training help could be contracted. (4) Use could be made of training courses and material from industry.

Next speaker was Mr. George Bates of Dynair Electronics, Inc., whose talk concerned "Use of Sideband Analyses in Maintenance." The sideband analyzer, which is used strictly at the head-end for checking modulators, is really a spectrum analyzer and a video sweep oscillator combined. The sweep oscillator must be accurately synchronized with the spectrum analyzer.

The analyzer has three advantages over the old method: It is easier to operate; it reduces the time needed to test a modulator; and the test equipment involved is considerably cheaper.

Mr. Bates illustrated his talk with four slides comparing the old way of testing modulators and the new sideband-analyzer method.

The last speaker of the afternoon was Mr. Lyle Keys of TeleMation, Inc. Mr. Keys listed four areas into which the subject of nonduplication can be divided: (1) requirements for program deletion, (2) choice of substitute programming, (3) method of switching, and (4) method of switcher programming.

In the first area, he listed a number of enticements to offer the broadcaster in negotiating a simultaneous-only agreement. These included carriage of local station breaks before and after the deleted program, offering simultaneous nonduplication outside required hours, relaxing eight-day notifications rules, and providing on-channel carriage.

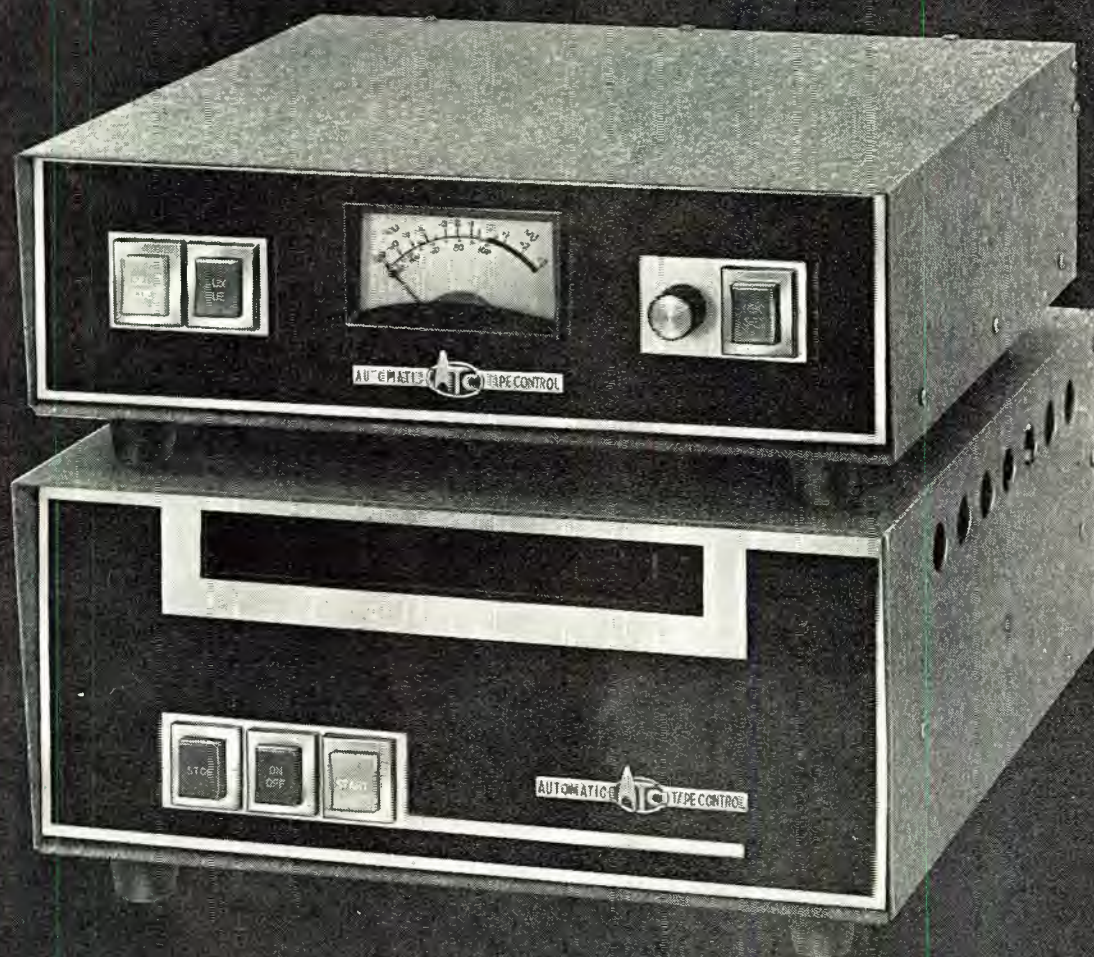
In the second area, the speaker feels the most desirable choice is to substitute the local station for deleted channels. Other choices are local live or taped programs, news or weather with background music, delayed or film programs, or a card explaining the absence of the regular program.

In the area of switching methods, possibilities are: (1) video with subcarrier audio, (2) separate video and audio, (3) switching of IF frequencies, (4) switching converter RF output or $B \pm$ voltage. TeleMation has had most success with direct video switching, but this is difficult to apply in off-the-air channels.

A number of criteria for switcher programming were listed. Basically, these dealt with ease of operation, the ability to make changes readily when needed, and sufficient flexibility to accommodate the schedules of various stations. Several approaches to the problem were illustrated with slides. Old and new TeleMation nonduplication switchers were compared.

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Mr. Matthews then made some specific proposals concerning the top-100 rule to the FCC staff. The first was that a basic re-examination is needed in light of the recent copyright decision. Second, the rule should be limited to only the top 50 markets, since it is only in these areas that applicants have been seeking new UHF stations. In addition, the scope of the grade A criterion should be studied, since most TV stations are interested only in their local cities. He suggested that the "City Grade" contour would be a more accurate limit. He proposed that the FCC re-examine its policy where a distant UHF station can't be carried, but a VHF station in the same market, because of superior coverage, is carried. And finally, he proposed that signals be carried even beyond their Grade B contour if the viewers in the area are already viewing the station.

The final speaker of the morning was Mr. E. Stratford Swith, special counsel to the NCTA. He opened his remarks by saying, "We must now talk about the 'Third Report and Order'." He stated the FCC should ignore the economic restrictions and concede that CATV is fair competition to broadcasting. He added a question: "If the broadcasters really want fair competition, why should CATV operators be restricted in local originations?"

Following the talks, the panel was open for questions from the floor and among the panelists.

Wednesday Morning

Presiding was Mr. Hubert J. Schlafly. Lead-off speaker was Mr. Gaylord Rogeness, director of engineering for Ameco Engineering Corp., whose talk was entitled "Transient Response Testing of CATV Systems."

Mr. Rogeness described how a transient-response test can be used to examine system envelope delay. The effects of delay distortion are particularly significant in the transmission of color. A $\sin^2$ pulse can be used to evaluate delay qualitatively as a supplement to other tests made on the system. This type of pulse was chosen because of its convenience for practical measurement and ease of reproducibility, and because a relatively simple mathematical function can be used in theoretical studies. The $\sin^2$ pulse has a close resemblance to the camera output pulse that results from scanning a white line.

There are two possible sources of signals for this test. One is the use of a $\sin^2$ generator and modulator for each channel to be tested. The other source is the Vertical Interval Test Signals (VITS) transmitted by the networks.

The second speaker of the morning was Mr. Jay Hubbell of Viking Industries. His talk was on "System Construction and Operation."

Mr. Hubbell said the most important job in building a system is to economize and satisfy the CATV operator; this will lead to less down time. Cable received on the job must be inspected for damage immediately after it arrives. One must always use extreme care when working with cable; for example, never make a bend sharper than a 20:1 radius. Cable should be jacketed if it is to be wrapped directly to a telephone cable.

Stainless-steel lashing wire should always be used. In long spans, river crossings, etc., double-lashing should be applied. Amplifiers should be placed as nearly in accordance with the manufacturer's layout as is possible.

Underground cable systems have advantages such as neatness, lack of poles and pole hardware, and immunity from vandalism. The type of housing for amplifiers depends entirely upon local codes and terrain. Disadvantages of this type of installation include higher cost and problems with moisture and rodents.

For any system, accurate maps and amplifier gain readings should be retained.

The third speaker was Mr. Brian L. Jones of C-Cor Electronics, Inc. Mr. Jones described "The Use of High-Gain Amplifiers in CATV Systems."

The speaker pointed out that any superior amplifier must have (1) low noise and (2) as low cross-modulation as possible or as high an output capability as possible. Most amplifiers in use today have 18-20-db gain, whereas the ideal theoretical amplifier has 8.7-db gain. The theoretical amplifier doesn't work in practice because costs are too high (more units are needed per system) and the noise level is not one-half that of a 20-db amplifier.

Dynamic range (Q, in db) is equal to output capability in dbmV less noise figure. As Q increases a better amplifier is achieved. Q's of 110 are about the state-of-the-art today. Mr. Jones was confident Q values of 120 will soon be realized. It follows that the higher the Q figure is, the higher the trunk-amplifier gain will be. Gains as high as 30, 40, or 50 are possible. By employing fewer amplifiers (each of high gain), construction expenses could be reduced.

The next speaker was Mr. Ken Simons from the Jerrold Electronics Corp. His talk was entitled "Reducing Reflections on CATV feeders."

Mr. Simons stated that modern trunk cables and amplifiers are quite good, especially on color signals; color problems usually occur in the head-end or the feeder. Reflections come principally from the taps. For many years the capacitive tap was the standard. This kind of tap, however, is not back-matched. A better kind of tap is the autotransformer.

Because of the small distances involved, reflections in feeders usually cause smears rather than ghosts. If taps were installed at periodic intervals, a buildup would occur at certain frequencies. The cheaper taps cause much worse reflections (in the order of 3db) than do the transformer type (about 1db). If all taps are located at 36-inch intervals, a self-cancelling of reflections is developed because 36 inches is about $\frac{1}{4}$ wavelength on the low band and $\frac{3}{4}$ wavelength on the high.

A directional coupler is the best kind of tap. It discriminates against any signals, or reflections, coming back up the cable feeder. This controls reflection to about 1/10 db.

The fifth speaker was Mr. Edward Wuernser, of Entron, Inc., whose subject was "UHF to VHF Converter for CATV."

As Mr. Wuernser pointed out, UHF signals must be converted. The cable losses at UHF are just too great for same-channel distribution; amplifiers with two and one-half times more amplification would be needed.

All UHF converters used in CATV are crystal controlled to about 0.005% stability. The tunable oscillators used in home-type TV tuners have a stability of only 0.1%.

The output of the local oscillator (L.O.) feeds into a mixer diode. Because different diodes have different noise figures, the power output of the L.O. varies. As the power output increases, so does the noise; thus a compromise must be achieved.

Mr. Wuernser's talk consisted mainly of design theory, values of gain, noise figures, etc., and the proper point to locate the amplifiers, mixers, and L.O.'s. He concluded by saying VHF post amplification should occur on the ground and not on the tower behind the UHF antenna.

Following Mr. Wuernser was Mr. Allen M. Kushner, of Times Wire & Cable Co. Mr. Kushner talked on "New Concepts in CATV Cable." He stressed the fact that with the copper shortage, scrap cable is quite valuable, and users must be selective in replacing cable. He added that a choice of cable should be made so that it is not necessary to move any amplifiers.



D-202ES—THE MOST NOTABLE ADVANCEMENT IN DYNAMIC MICROPHONE DEVELOPMENT

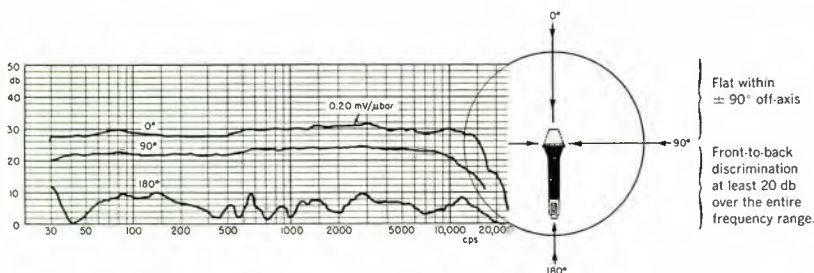
For Boom Operation—No frequency discriminating characteristics in off-axis pickup.



In the D-202ES, two independent microphone capsules are incorporated in a single microphone housing, connected by means of a cross-over network, free of phase distortion. Each of the capsules is optimally adjusted to a specific frequency pickup range; one for low frequencies, and the other for high frequencies. The cross-over is at 500 cps.

This unique arrangement achieves a wide, smooth frequency range (30-15,000 cps ± 2 db) and a cardioid pattern with a front-to-back discrimination of never less than 20 db over the entire frequency range. In addition, the microphone offers a 90° off-axis response which is completely parallel to the 0° (on-axis) curve.

These features offer several advantages in practical applications: The flat frequency response enables control of feedback at any frequency. The uniform front-to-back discrimination of at least 20 db virtually eliminates feedback and offers almost complete freedom in microphone and speaker placement.



The parallel 90° off-axis response is of particular importance in sound reinforcement and recording applications, to achieve a natural reproduction of all frequencies introduced to the microphone $\pm 90^\circ$ off-axis.

The D-202ES utilizes a sintered bronze screen which is extremely rugged and protects the microphone systems from iron particles and dust. It also acts as a windscreen and is waterproof.

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Mr. Kushner stated that a new 1¼-inch cable, so-called long-distance cable, has the lowest total cost. He felt that any larger size would not be practical. In this cable a saving is made by constructing the center conductor of copper-clad aluminum. This kind of cable is currently used in the military aircraft industry.

Also important in design are moisture tightness, vapor transmission, and mechanical tightness. A chart was made of present-day cable showing the maximum distances that can be used (including amplifiers):

CABLE DIAMETER	DISTANCE
½ inch	14 miles
¾ "	18 "
1¼ "	28 "

The cost of stringing 1¼-inch compared with ½-inch cable including amplifiers, etc., is 2.2 times.

It was pointed out that if 1¼-inch cable and the new low/sub-band amplifiers were used, the 28 miles could be increased to about 40 or 50 miles. It is interesting to note that fewer amplifiers per mile are required with 1¼-inch cable.

CABLE SIZE	AMPL/MILE
1¼ inch	1.6
¾ "	2.5
½ "	3.5

The speaker said that the new drop feeders with foam dielectric have only about 3.2-db loss per 100 feet; this type of cable is, therefore, more efficient than the standard RG-59U.

The seventh speaker was Clay Mahronic of Amphenol-Borg Electronics Corp. His subject was "The Effects of Cable Attenuators on Return Loss." Highlights of his talk are as follows:

The VSWR on any cable must be determined for each

desired frequency band. Variations in diameter cause changes in impedance. Such changes along the cable act collectively to increase the VSWR, yet each individual change in diameter may be too small to be found.

Each discontinuity attenuates slightly the reflection used to measure VSWR. Each succeeding discontinuity therefore, sees less of the incident wave. If a single dent, or discontinuity, were equal to one-quarter wavelength, a maximum reflection would occur.

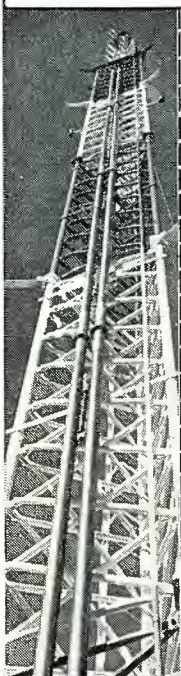
If sweep measurements are made from each end on a given length of cable, the VSWR's are not always equal. In one example, when a discontinuity in a 1000-foot cable was 900 feet away from the test point, a flat VSWR was found. Yet, when checked from the other end, with the discontinuity 100 feet from the test point, the cable showed an appreciable VSWR on channel 13.

The final speaker was Mr. Alan Ross of Nelson-Ross Electronics. His talk was about "Spectrum Analyzers."

Mr. Ross stated that the spectrum analyzer was unheard of in the CATV industry; to date it is used mostly in military applications. In a way, the SA is three instruments in one: a sweep generator, a receiver, and an oscilloscope. Since the sweep generator also drives the oscilloscope, a panoramic display is obtained. With the SA one can view visual and aural carriers of all channels at one time. These appear as pairs of pips on the scope display. The SA is useful in checking for spurious signals and for flatness or slope adjustment.

By using a bandwidth filter, the operator can observe even co-channel interference from 10-kHz offset carriers. This allows tuning out of interference. In addition, the SA is good for checking relative levels of picture and sound carriers and noise-to-carrier level.

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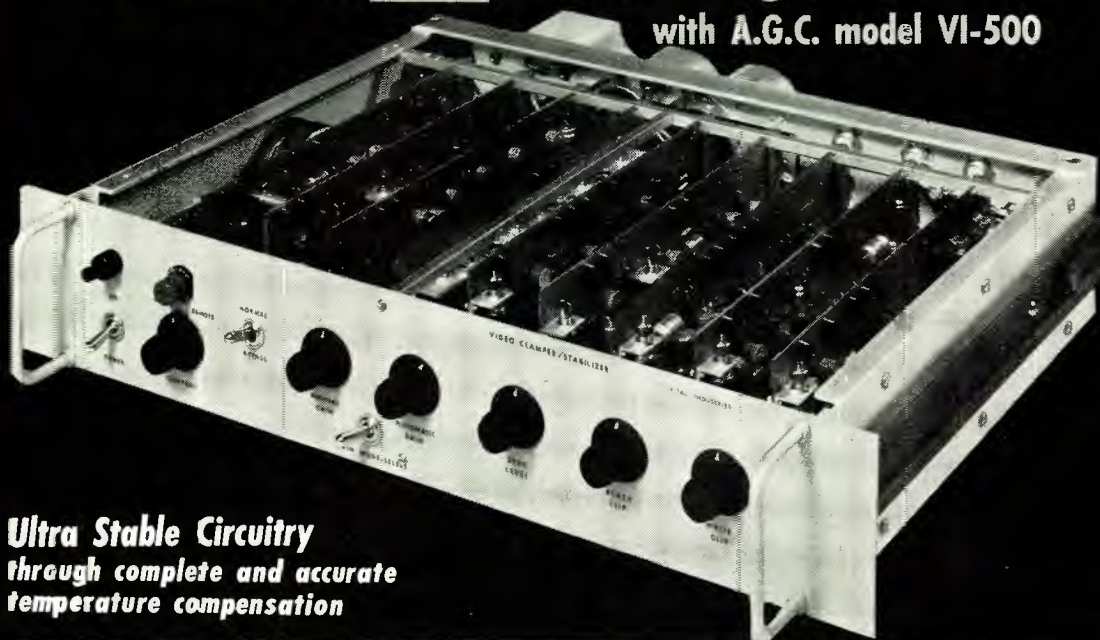
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Maintains video peaks constant to a preset level, with reference to blanking.

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Sync tip clamps remove hum, tilt and other low frequency disturbances.

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Sync level is maintained at a constant amplitude despite large variations in input.

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Accurately compensates for losses in up to 1000 feet of coaxial cable.

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Mono. or Color non composite output board in lieu of white stretch is available at additional cost.

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Wherever there is video and you want to assure:

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Circle Item 15 on Tech Data Card

New Products

at the NCTA Convention

Fifty equipment manufacturers were among the exhibitors at the Americana hotel. Literally hundreds of new kinds and models of equipment were on display for inspection

by interested convention-goers. In the following pages is a brief word tour of the exhibit hall with emphasis on what was new.

Aberdeen Company

Featured at this booth was the Model "A" cable clamp for drop-wire hookups. The stainless-steel clamp is made in a zig-zag configuration through which the cable is interwoven; this provides the gripping action. Also exhibited was stainless-steel cable-lashing wire.

Advance Industries

This company highlighted its line of preassembled aluminum buildings for head-end and other applications. These insulated buildings are designed to house electronic equipment in a dust-free, temperature-controlled environment. The buildings are wired at the factory, and a thermostatically controlled ventilation system is standard. Heating, air conditioning, special wiring, and other optional equipment are available. Other products included towers and a line of microwave passive repeaters.

Ameco, Inc.

Ameco announced that, effective with the NCTA show, it is exclusive CATV distributor of IGM television automation equipment. New from Ameco was the "Pacesetter" equipment line, which includes a heterodyne signal processor, a strip amplifier, and a group of several mainline amplifiers.

The solid-state signal processor has

specified sensitivity of 100 μ V input for 1V output into 75 ohms; AGC sensitivity is given as no more than ± 0.5 db for a 26-db input-level change. A squelch circuit prevents noise output in adjacent channels when a station goes off the air. The plug-in tuner and transmitter may be changed to change received and transmitted channels.

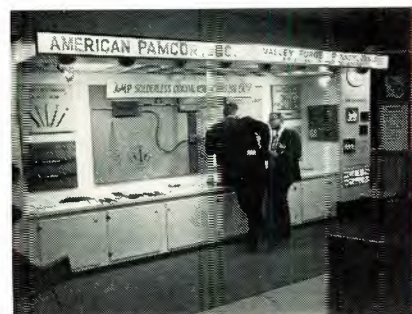
The strip amplifier is designed with color in mind. Specifications include maximum gain of 50 db, maximum output of +60 dbmv, 10 db maximum noise figure, and AGC giving ± 0.5 db output change for ± 8 db input change. Other features include a signal-sensing circuit that reduces gain when the input signal disappears, and selectable attenuation pads to prevent overdriving by high-level input signals.

The "Pacesetter" mainline amplifiers are designed with unitized plug-in circuit boards to facilitate replacement. Other features are symmetrical loading, transformer power supply, seized center conductors, built-in surge protection, and matched input/output. The group includes the Mainliner amplifier, Mainliner with AGC, Mainliner bridging amplifier, bridge, and line extender.

American Cable Electronics Div. of Jack Kent Cooke, Inc.

The center of attention at this booth was shared by the Model 106 Weather-Data display unit and the Model 600 Emerg-Alert emergency warning system.

The Weather-Data unit incorporates projection-type digital readout of time,



temperature, barometric pressure, wind speed and velocity, and relative humidity. All information is displayed simultaneously; space is also provided for interchangeable written messages. The display unit is combined with a solid-state vidicon camera.

The Model 600 Emerg-Alert is a self-contained origination system for both video and audio. Alert messages are lettered on cards which are inserted in a front-panel slot where they are scanned by a built-in vidicon camera. Audio messages may be inserted locally or by way of a remote line. Individual channels may be selected, or the message may be applied to all channels simultaneously. The Emerg-Alert is designed to permit operation from remote locations such as police stations and civil-defense headquarters.

American Electronic Laboratories, Inc.

AEL premiered its "Colorvue" line of solid-state trunk-line amplifiers and associated equipment. The units are enclosed in cast aluminum housings, and all make use of plug-in modules to minimize maintenance time. Basic modules are the DC power supply and the trunk amplifier, which has a rated maximum output of 48 dbmv, a gain of 24 db over 12 channels, an input/output VSWR of 1.38:1, and a full-gain noise figure of 8 db at channel 2 and 10 db at channel 13. Power supplies are the CVPN 10-ampere unregulated and the CVPR 12-ampere regulated models. Other modules include AGC, bridging amplifier, and off-trunk splitter units.

American Pamcor, Inc.

A line of new connectors for CATV was shown. Included in the exhibit were the Type U coaxial connectors for a variety of 75-ohm cables.

Amphenol Cable Div. Amphenol-Borg Electronics Corp.

This long-time manufacturer of cable and connectors was represented this year by a compact but varied assortment of these products for CATV applications.

Anaconda Astrodata Co.

This new company exhibited for the first time at the 1966 convention. The display featured the "XDR" line of amplifiers for CATV, including trunk, trunk AGC, bridger, intermediate bridger, AGC bridger, and distribution amplifiers. The name XDR is derived from the term "extended dynamic range." The solid-state XDR units

have been designed for greater dynamic range (stated as 87db for most units) to provide greater capabilities for cascading and to provide for bridgeability, the ability to serve many subscribers from a single bridging location. One bridging amplifier, used with six distribution amplifiers per output, is intended to provide service to as many as 1104 subscribers.

Benco Television Associates Div. of Redifon Canada Ltd.

Among the new products featured by this Canadian manufacturer was the universal multitap insert that provides 1 to 4 backmatched taps.

Glass epoxy printed circuit boards are used in Benpre solid-state preamplifiers, which have been designed specifically for low intermodulation. The housing is designed for mast or tower installation. The Benpre/L (low-band) has a specified gain ranging from 18db for channel 2 to 16db at channel 6 and 13db at 110 mHz; specified noise figure is 5db at +34 dbmv. Specified gain of the Benpre/H (high-band) is 21db at channel 7 and 19.5db at channel 13; noise figure is 6.6db maximum.

The Benfeed-26 is a solid-state line amplifier supplied in an in-line housing for use with .412-in aluminum-sheathed cable. It is rated for a maximum gain of 28db at channel 13; it is aligned for 22db of cable loss and 6db of flat loss to allow for splitters or taps.

The Benex-22 is a solid-state wide-band amplifier intended for use primarily as a line extender. Its gain at channel 13 is rated at 22db.

All the foregoing amplifiers are installed in housings using the Versacan design. The bracket on the can is detachable and can be arranged to provide six different methods of mounting.

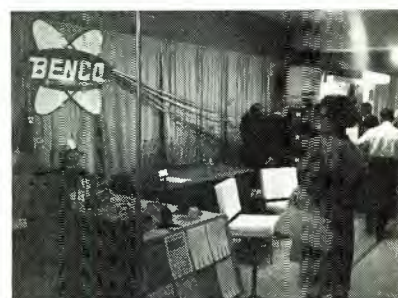
Other new Benco products included the TPS-6 power supply for mast-mounted preamplifiers and the KCFM one-channel FM Processor. The latter unit is designed to provide ½-volt output on any channel and AGC correction for a 40-50 db input-level variation.

Blonder-Tongue Systems, Inc.

On display were a number of new cable amplifiers and test instruments. The Transporter trunkline amplifier provides a specified operating gain of 22db and an output level of 51dbmv. The Courier pilot-carrier AGC-controlled amplifier has specified operating gain of 27db at 70°F; output variation is ±0.4db for a 4-db input change. The Dispatcher I bridging amplifier is for use at locations up to 6db from a trunkline amplifier, and the Dispatcher II is for use between

6 and 14db from a trunkline amplifier. Line extenders are the Trunkette (18-db gain at 216mHz) and the Trans-tender (10-db gain at 216 mHz). All units employ solid-state circuitry, and the Transporter, Courier, Dispatcher, and Trunkette all have adjustable tilt control.

Also new were the BPF bandpass filter and the Powerdrive single-channel AGC VHF amplifier offering a 60-db gain and 1-db output change for 40-db input change at 6 volts output. The XO-2 crystal-controlled converter provides conversion from low to high band, high to low band, VHF to subchannel, and subchannel to VHF in a single unit. High-to-high and low-to-low band conversion is possible for most desired channel combinations.



International Good Music, Inc.

The TELMAS (TELEvision Modular Automatic Switchers) are built by IGM to provide for nonduplication switching by CATV systems. Switching at 1/2-hour intervals during an 18-hour day can be preprogrammed for seven days by inserting pins in a cross-bar matrix. Programming modules are supplied for each channel that must be switched. The two-source module switches the distant channel off and substitutes an alternate source; the three-source module substitutes one of two alternate sources. The TELMAS system can also be used to start projectors, turn on cameras, etc., for local origination.

Also shown was the Model LB Channel Gate. This switchable trap provides approximately 80db of rejection. Applied voltage (12 volts at 4ma) switches the trap in or out.

Jerrold Electronics Corp.

A host of products made their debut in Jerrold's large exhibit.

The "Parabeam" series of UHF antennas are designed to give high gain with minimum wind loading. The antennas employ modular, parabolic grid-type dishes. They are available as quad arrays of 6-foot dishes, dual ar-

rays of 6- or 8-foot dishes, or single 6- or 8-foot dishes.

The "Color-Captain" series of VHF antennas are designed to offer high side and rear cochannel rejection together with high gain. They are available as "Diamond 4" arrays or as single antennas. An added design feature is relative immunity of performance from ice-loading effects.

The new Model CCX-2, CCX-3 . . . CCX-13, crystal-controlled, single-channel VHF converters are available for installation on new or existing "Channel Commanders." The output of the Channel Commander is crystal-controlled, and the new accessory adds similar control of the input.

The Model PC-6 Program Commander provides preselected, automatic program switching. The basic unit controls six different output events at half-hour intervals. It can be set up for a week, and the switching sequence is repeated each week until changed. The equipment is preset by insertion or removal of program pins.

Three new Starline Stations, Models SLA-610, SLA-611, and SLA-612 are solid-state, 12-channel units for transmission of low- and sub-channel signals in the 5 to 95 MHz band. They replace the previous tube and solid-state models used for long-haul systems. They feature a specified noise figure of 8 db at maximum gain and 9 db at operating gain. Model SLA-611 is similar to the SLA-610 but has AGC; Model SLA-612 is similar to the SLA-611 but has additional alarm circuitry.

The Starline Satellite line extender, Model SLE-1, features a regulated power supply, seized-center-conductor input and output connections, plug-in-module construction, and externally available input and output RF test points. Specified gain is 25 db minimum.

The Model TLE-2 T-line extender amplifier offers a maximum gain of 25db at channel 13 and an output capability of 37 dbmv for 12-channel operation. The solid-state unit mounts on the messenger.

The Matchmaker is a four-outlet, pedestal or surface-mounting directional-coupler tap. The design features vertical disposition of all fittings. Another new tap with directional-coupler circuitry is the Model DCM series. Up to four subscriber drops are possible from a single location. The DCM-series models are enclosed in messenger-mounting utility housings and are intended to be useful in congested areas along feeder lines.

Rounding out the list of new products are the 1465 and 1495 models of pressure taps designed to accommo-

date jacketed aluminum cable JT-1412J or equivalent. The taps have a large cable groove incorporating serrations that bite into the aluminum jacket to minimize lateral cable movement. Both models are available with A-type or B-type blocks.

Kaiser-Cox Corp.

Two new amplifiers were among the equipment on display. Model KCML is a solid-state low-band truck amplifier with manual gain control. The unit includes a Model KCMQ amplifier module; by replacing this with a Model KCAQ module, an amplifier with AGC can be made. Specifications of the KCML include: operational gain, 25 db; maximum output capability, ± 55 dbmv per channel for five channels; noise figure 11 db maximum at operational gain.

Model KGAA is an all-band trunk amplifier with AGC. Addition of a Model KCBO-2 or KCBO-4 bridging module permits conversion to a 2- or 4-output trunk/bridging amplifier with AGC. Substitution of a Model KCMG module for the standard Model KCAG converts the unit to manual gain control. Specifications of the KGAA include: operational gain, 22 db; maximum output ± 50 dbmv per channel for 12 channels; noise figure, 10 db maximum at channel 13 and 14 db maximum at channel 2; AGC range, less than 1 db output change for 6 db input change.

Lenkurt Electric Co., Inc.

Lenkurt showed two established systems from their line of microwave relay equipment.

Phelps Dodge Copper Products Corp.

New this year is the availability of Foamflex cable in lengths of 4000 feet. This polyethylene-jacketed coaxial cable is aluminum-sheathed and has a foam dielectric. It has a nominal impedance of 75 ohms and is available in .412-in, 1/2-in, and 3/4-in diameters.

Plastoid Corp.

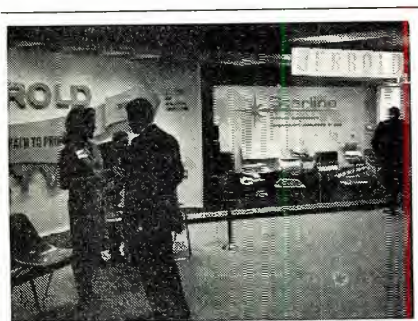
This company's exhibit featured its line of coaxial cable for use in CATV installations.

Preformed Line Products Co.

New in this manufacturer's line of cable accessories is the Teletap connector for attaching house-drop cable to the messenger strand. Opposite ends of the helical connector wrap around the messenger and the cable to provide a firm attachment without concentration of stress. The end of the connector for the drop cable has a protective neoprene coating.

Jack Pruzan Co.

As additions to their complete line



of tools and equipment for CATV installation and maintenance, Pruzan introduced the P-1592 Pole Clearance Extension Bracket providing 15-inch clearance; the P-1950-1 Cross-Arm Bracket for suspending Figure -8 cable or up to three feeder cables; and the TV S Wire Grip for pole, tap, or house connections.

Raytheon Co.

Two new microwave systems were featured. Model KTR 2A is a 1-watt baseband system operating in the 6 to 13 GHz band. It transmits a single wideband video channel with up to four subcarriers for 15-kHz audio. Model KTR 3A is a heterodyne system and has a transmitter power of 10 watts in the 5.9-7.6 GHz range and 5 watts in the 10.7-13.25 GHz range. Channel capacity is for color TV plus up to four 15-kHz program audio.

The units are serviceable from the front through the use of drawer-type pullouts. The rack enclosures have removable sides, and the doors have magnetic catches. Plug-in modules carry a 5-year warranty. Test points are provided for on-the-air system measurements.

RF Systems, Inc.

Featured in this display of antenna products was information on a 30-foot parabola.

Rohn Systems, Inc.

The Rohn exhibit showed highlights of the company's full line of towers and accessories of interest to CATV operators.

Scientific-Atlanta, Inc.

On display were pictures and models of parabolic and multielement master antenna systems.

Sigma Industries, Inc.

Sigma displayed their line of heat-shrinkable tubing, boots, and caps; the self-sealing, re-entry enclosures SSE-40 and SSE-41; and the Aperseal for use in sealing the aperture in a flat surface through which a cable passes.

Spencer-Kennedy Laboratories, Inc.

The SKL exhibit was centered around the new Colorburst 7000 line of CATV equipment. Leading off is the SKL/7220 cochannel filter. This instrument is said to make possible the adjustment of interference-cancelling antenna arrays to the point that both cochannel signals can be distributed over the system (one translated to another channel).

A series of trunk and bridging amplifiers is included in the Colorburst

7000 line. These units feature modular construction and the use of an integrated AGC circuit. One common housing accepts five different amplifiers and four line splitters. Connectorless cable fittings are used; the cable is inserted directly into the housing, and the center conductor is secured by a screw terminal.

Also part of the line is a line-extender amplifier, the SKL/7300. This unit features connectorless cable fittings and a regulated power supply. Specified gain is 24 db at channel 13.

Rounding out the line is the SKL/7500 series of Colortap directional taps. Smaller than previous models, these taps also feature connectorless cable fittings on the line and drop cables. The basic tap is available in 10- and 22-db models to serve a single drop. Insertion losses are 1.2 and .8 db, respectively. By installing a tap-adder circuit, the tap can be made to serve up to four drops. Depending on the Colortap and tap adder used, total loss at each tap is 13 to 40 db. Isolation between taps is 20-25 db.

Another member of the SKL family is the SKL/262 high-level distribution amplifier. Specifications for this unit include a minimum gain of 50 db at 216 mHz, a noise figure at full gain of 18 db maximum, and an output level at full gain of +58 dbmv, 12 channels.

Superior Cable Corp.

A new design configuration for coaxial cable was introduced. As the name implies, the insulating material between the conductors of "Balloon" cable resembles a line of small balloons placed end-to-end. The insulating material, a solid polyethylene called "Stabiline," is extruded around the No. 10 copper center conductor and is then crimped at intervals, giving the balloon appearance. The solid aluminum sheath is then drawn over the core to seal the finished cable. Nominal outside diameter of the cable is .412 in.

Systems Engineering, Inc.

New products on display were the Log Log Z Line antennas and the bulldog cable connector. The new antenna uses a modified logarithmic design and is intended to provide an essentially conical wave pattern and back lobes of low amplitude. This pattern permits the use of specialized feed arrangements for high gain and elimination of interference. The antenna boom may be grounded, and no external balun is required.

The bulldog connector is designed so that the cable attached to it can act as an accordion during temperature changes. In this way, the problem of

center-conductor pullout is minimized.

Tape-Athon Corp.

On display was the Model 900 professional tape recorder/reproducer. Features of this equipment include fast starts and stops, capacity for up to 7200 feet of 1/2-mil tape, slot thread-





ing, solid-state circuitry, and a standard NAB VU meter. Switches provide torque adjustments when reel size or tape speed is changed. Timing accuracy is stated as ± 2 sec for a 30-min span of tape. Tape speeds of 15-7 1/2 or 7 1/2-3 3/4 ips may be chosen; slower speeds are also available. Specifications include response within ± 1 db from 50 to 15000 Hz at 7 1/2

ips and 50 to 7500 Hz at 3 3/4 ips, wow and flutter 0.09% at 7 1/2 ips.

TCA Tower Co., Inc.

This company featured new uses and arrangements for its existing line of towers and accessories.

Telemation, Inc.

Local origination was the central theme of new equipment shown in this exhibit. Two new WEATHER CHANNEL® models were introduced. WEATHER CHANNEL 97 has nine panels and seven instruments; WEATHER CHANNEL 75 has seven panels and five instruments. Both models feature lighting designed to eliminate pointer shadows. Provision is made for pan and tilt of the camera to facilitate live pickup.

Also introduced were two accessories to operate with the weather-display units. The CHROMA-CHANNEL® equipment makes it possible to display weather information in the form of color stripes on the home receiver. A side feature is that viewers and service technicians can use the transmitted color information for receiver adjustment. SAV-A-CHANNEL® is a device which automatically intersperses news and weather information on one system channel.

Telemet Co.

Telemet's exhibit highlighted a full line of equipment including distribution amplifiers, color monitors, color encoders, color flying-spot scanners, special-effects generators, signal generators, and others.

Texas Electronics, Inc.

Equipment featured Series 300 & 600 weather instruments and the Mark IV Weatherminder.

Times Wire & Cable Co.

Three new products from Times were shown. Type JT 11250 Supertrunk 1 1/4-in seamless aluminum-sheath trunk cable has specified attenuation of 0.36 db/100 ft at channel 6 and 0.68 db/100 ft at channel 13. This cable was developed to permit the use of fewer amplifiers for a given length of cable.

Type JT 207DT Superdrop cable has a loss of about 3 db/100 ft. Among the advantages of low-loss drop cable are improved color reception and the need for fewer line extenders.

The company's new Timatch® connector was introduced. All parts of this connector are integral with the body. Heart of the assembly is a coil of

• Please turn to page 56

Full-fidelity sound with the new GATES PRODUCER Recording Mixer

The only professional-quality audio mixer designed to fill the void between commercial sound equipment and studio consoles. And linked to your audio chain, it will start a chain reaction of listener appreciation — at low investment. Ideal for quality recording of commercials, public-service features or news segments. Professional in every respect, weighs 30 pounds.

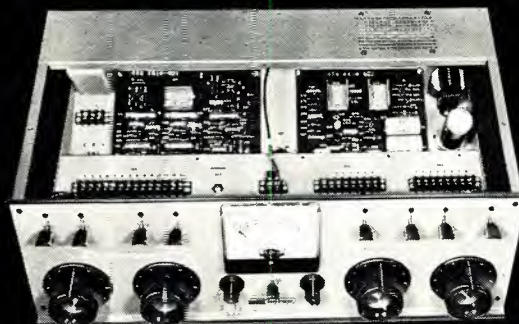
Production studios, advertising agencies, news rooms, mobile studios, educators — many others — have found the Producer ideally suited to their needs, and pocketbooks. Write for complete information and specifications — Brochure 141A.

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Will success spoil 75A?

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75A is our rugged, reliable, long-haul, heavy density microwave radio. And, although it's our newest system, 75A has already made its mark. For instance, the 75A heterodyne system is used in a heavy-density toll network in the province of Alberta, Canada. (Proving yourself there, home of some of the most stringent operating conditions on the continent, is hardly a cinch.)

75A has also been used in the AUTOVON system, for a major educational TV system in the mid-west, and for a long-haul telephone network on the West Coast. It has been selected for use with a COMSAT system and for CATV networks in New York and Pennsylvania.

Do we sound like we're bragging a little? Well, we are. But, why not? The 75A has quickly proved itself as the perfect radio for backbone applications. It offers many outstanding features including extremely low distortion, 5 watt output

power, and frequency diversity operation or one-for-three path protection.

Also available are a program channel for TV, IF auxiliary amplifiers, variable equalization for group delay and time delay, IF patching facilities, and baseband regulators. And provision is made for bridging off a video signal at any repeater making the 75A ideal for TV networks.

If you'd like to find out more about 75A and how it has succeeded in the communications business without even trying, write or give us a call.

Lenkurt Electric Co., Inc., San Carlos, California. Other offices in Atlanta, Chicago, Dallas, and New York City.

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1966 AES ANNUAL CONVENTION

The 31st Annual Convention of the Audio Engineering Society (AES) will be held at the Barbizon-Plaza Hotel in New York during the week of October 10 through 14, 1966. In all, 104 papers will be presented in thirteen technical sessions. A complete list of the papers and their authors is presented here.

The public is invited to attend the manufacturers' exhibits and presentation of the papers, but a four-dollar charge will be made to non-AES members. The fee is charged once only for the entire convention.

For those readers planning to attend the convention, or interested in receiving abstracts of the papers to be presented, the Society requests that inquiries be directed to:

Audio Engineering Society
Department 428
Lincoln Building
60 East 42nd Street
New York, New York 10017

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Richard R. Howard

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Semiconductor Microphone

M. E. Sikorski and C. K. Kuo

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Niels O. Young

Directional Microphones

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A Mobile Two-Frequency Acoustic Source for Underwater Studies at Great Depth

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Edmond A. May

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Saul J. White

The Use of the Complex Plane Impedance and Admittance Locus in Analyzing Electroacoustical Transducers

Abraham I. Dranetz

Miniature Audio Amplifiers

William H. Greenbaum

Linear Microelectronics and the Implementation of Audio Control Functions

Basil T. Barber

Inroads of Integrated Circuits in Audio

H. R. Camenzind

Thick Film Integrated Circuits

George C. Haas

Transistor Power Amplifier Design with High Speed Overload Protection Circuit

F. J. Krausser

FET's in Audio Circuits

Charles L. Farell

A VOX System for Operation at High and Variable Ambient Levels

Emil L. Torick and Richard G. Allen

An Improved Home Reverberation System

Arthur P. Davis

A Voltage Tuned Audio Wave Analyzer

David Smoler

Comprehensive Sound Measurement Console Design

Ervin E. Gross

All Electronic Audio Sweep Generator and Display for Response Measurements

Allen E. Byers

Electronic Dummy for Acoustical Testing

E. Torick, A. DiMattia, A. Rosenheck,

L. Abbagnaro, B. Bauer

A High-Speed Transient Analyzer

Gordon R. Partridge

Design of a Low-Cost AC/DC Volt Ohmmeter

James M. Colwell

A New Acoustical Reverberation Chamber

G. L. Fuchs

Tone-Burst Transient-Overload Testing

James K. Skilling

The Compact-Cassette System for Audio Tape Recorders

L. F. Ottens

Design Evolution of the 8-Track Stereo Tape Cartridge

Theodore Naimy

Design Considerations of a New Continuous Tape Cartridge System

B. A. Cousino and R. E. Cousino

Some Design Considerations of the 8-Track Endless Loop Magnetic Tape Cartridge and Player

H. E. Roys and L. C. Harlow

Adapting Stereo Tape to the Automotive Environment

John P. King

Automotive Tape Players

Robert Wolf and Alfred Dusey

Mastering Eight Tracks on 1/2-in Tape at 7-1/IPS with 62-dB+ S/N Ratio

Keith O. Johnson and D. P. Gregg

Design Considerations for Magnetic Tape used on Continuous Loop Cartridges

R. C. Smith and P. J. Vogelgesang

Higher Speed Duplication of Eight-Track Tapes with Enhanced Dynamic Range

Keith O. Johnson and Carl S. Nelson

A Hybrid Encoding Scheme for Vocoders

Lawrence E. Cassel

Word Recognition

Bernard Gold

Some Generalized Bandwidth Compression Methods Applied to Vocorder Data

Charlton M. Walter

A Comparison of Two Types of Digitalized Autocorrelation Vocoders

C. R. Howard, H. J. Manley,

J. C. Stoddard

Techniques for the Modification of the Speech Spectrum

Roger M. Golden

Some Problems in Subjective Testing

E. H. Rothaus and G. Urbanek

Conferencing Techniques for Channel Vocoders

Stanley W. Helms

Survey of Methods for Measuring Speech Quality

Michael H. L. Hecker

The Dilemma Facing the Record Mastering Engineer

Sidney Feldman

Design Considerations for a Depth Control Unit for Stereo Disc Mastering

Daniel Cronin

A New Vertical-Storage Automatic Disc Playback System

W. E. Olliges and J. S. Shragal

Rumble and Rumble Measurement

Benjamin B. Bauer

High-Frequency Intermodulation Testing of Stereo Phonograph Pickups

J. G. Woodward and R. E. Werner

An Analysis of Phonograph Cartridge Mistracking

Ronald A. Knuebel

Optical 8 mm Motion Picture Sound

Marvin I. Mindell

Multiple Speed Tape Duplicating

J. L. Ooms

Integrated Circuits for Audio Applications

John T. Heizer

Versatile High Performance Tape Recorder

John T. Mullin

A Convenient Magnetic Tape Degausser

Edward M. Long

Distortion Reduction in Tape Recording

John Curtis

Audibility of Tape Dropouts

B. B. Bauer, E. J. Foster,

A. J. Rosenheck

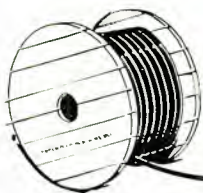
Absolute Level and Frequency Response Characteristics in Magnetic Sound Recording—Definitions and Standardization

John G. McKnight

Adjustment of Magnetic Recorder/Reproducers with Various Test Tapes

F. K. Harvey and D. J. MacLean

• Please turn to page 48



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SUPERIOR L-O-N-G L-I-N-E LOW-LOSS COAXIAL TRUNK CABLE

"6 AWG bare soft drawn
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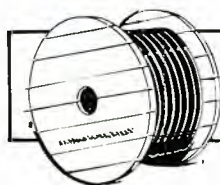
Maximum Attenuation db/100 ft. at 68°F

Channel 6		Channel 13	
Nominal	0.52	Nominal	0.85
Maximum*	0.55	Maximum*	0.89

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Circle Item 20 on Tech Data Card

AES Convention

(Continued from page 46)

Tape Reprodncer Response Measurements With a Reprodncer Test Tape

John G. McKnight

Reprodncer Test Tapes, Their Evolution and Manufacture

Robert K. Morrison

A New Concert Violin

Carleen M. Hutchins

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Instruments

Robert A. Moog

Transient Analysis of Musical Tones with Digital Filters

James W. Beauchamp

A Computer Sound-Generation Program

Allowing User-Defined Signal Production Algorithms

Gary R. Grossman

A Graphical Language for Composing and Playing Sounds and Music

M. V. Mathews

"New Sounds" vs Musical Articulation

J. K. Randall

Audio Facilities at AES Conventions—Their Development to the Present

I. Joel, H. Russell, and K. Morris

An Audio Console for AES Conventions—Its Design and Functions

K. Morris, I. Joel, and H. Russell

Sound Reinforcement Systems for Broadway Shows

Saki Oura

Sound Amplification Systems and the Performing Arts

David L. Klepper

Sound Reinforcement for Stage Performances

R. T. Bozak and Christopher Jaffe

A Distributed System for Church

Sound Reinforcement

N. E. Rudback

A Consideration of the Fundamentals of Passive and Active Acoustics

Harry F. Olson

Some Examples of Sound-System Correction of Acoustically Difficult Rooms

C. R. Bomer

Modern Electronics in Colonial Williamsburg

Charles C. Squires

Civil Defense and Disaster Outdoor Warning Systems

William R. Truitt and Edward Burquez

Improving the Reliability of Sound Systems

Edward S. Seeley

Language Laboratory Without Earphones

David H. Kaye

A New Concept in Language

Laboratory Equipment

William R. Lewis

Reverberation Reinforcement by Delayed

Electroacoustic Feedback—Ambiophony

G. F. Dutton

Hall Acoustics and Recordings

Leo L. Beranek

Recording Practices and Studios for

Pops Recordings

Al Weintraub

The Relay of Stereophonic Programs by a Space Satellite

Harold L. Kassens

FM Stereo Monitoring

Arno M. Meyer

Measurements of the Phase of the Stereophonic Subcarrier in FM Stereophonic Transmission

Lawrence G. Middlekamp

The Effects of Antenna System VSWR on Stereo

Peter Onnigian

Recent Developments in FM Receiving Antennas and Multiplex Receivers

William S. Halstead and

Richard W. Burden

The Germanium Planar FET—A New Device for Radio Applications

David N. Leonard, Steve T. Ou,

and Jack H. Abernathy

Audio in a Video World

Oliver Berliner

Amplitude Limiting in Systems with Frequency-Dependent Overload

Characteristics

E. Torick and R. Allen

A Portable Audio Control Console

William G. Dille

Automatic Audio Level Control

Dale C. Connor

Studio Facilities with Remote Control

Bruce H. Ratts

Film Mixing with Conventional Tapes

Robert Landers

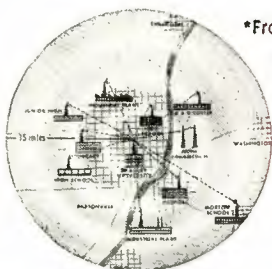
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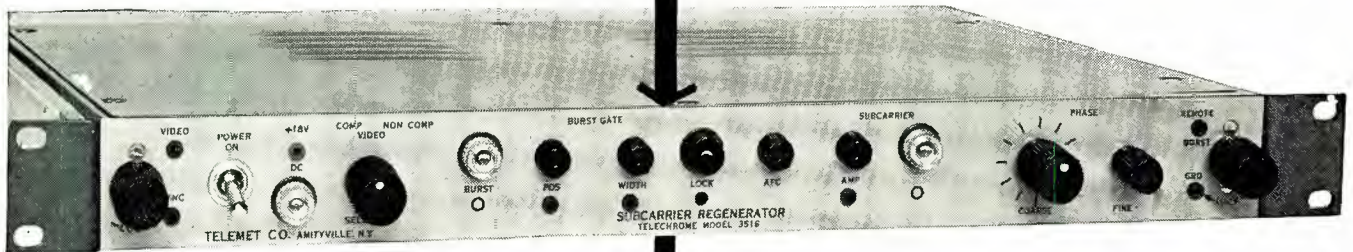
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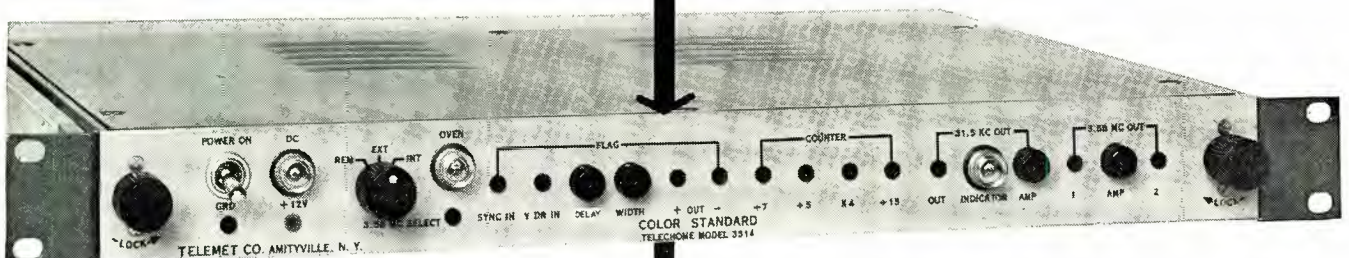
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LOOK TO VISUAL FOR NEW CONCEPTS IN BROADCAST EQUIPMENT

Circle Item 23 on Tech Data Card

BOOK REVIEW

Oscilloscope Measuring Technique: J. Czech; Springer-Verlag New York Inc., New York, N. Y.; 620 pages, 659 illustrations 6" x 9", cloth; \$15.80.

A much expanded revision of "Cathode Ray Oscilloscope" by the same author, this is one of the most comprehensive works about oscilloscopes ever published.

Part I is a 252-page section covering the theory of scopes in great detail. There is considerable use of math in this section, but by careful writing on the author's part, it is quite understandable by technicians as well as engineers. Some of the subjects covered here are: Multi-beam tubes; storage tubes; power supplies; time-base circuits including triggering, blanking, etc.; deflection amplifiers, and probes.

Part II is titled General Measuring Technique. This section consists of 111 pages of display set-ups. Here are found the initial adjustments and accessory set-ups needed to produce meaningful displays on the scope. Subjects covered include: Choice of the most suitable relationship between input frequency and time-base frequency; resistance, power, and capacitance measurements; null indication; electronic switches; Z-axis modulation; and phase and frequency measurements.

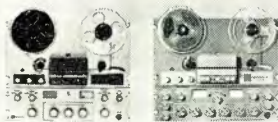
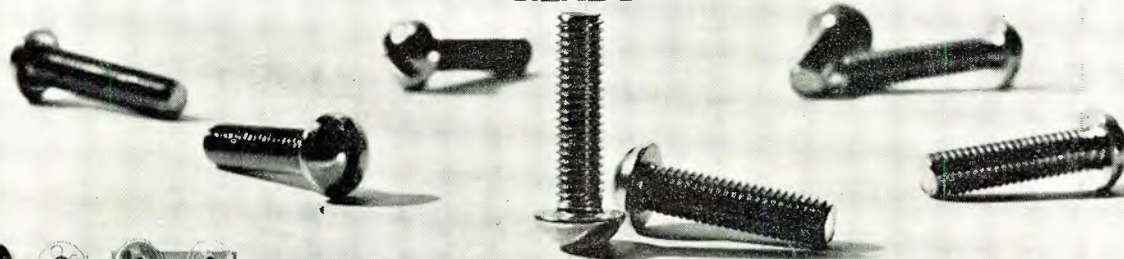
Part III, titled Practical Examples, is a 180-page section, dealing with such subjects as: The display of hysteresis loops; Recording the characteristics of diodes, transistors, and tubes; Measuring pass-band curves, transit times, and impedance; and numerous other practical measurement applications.

Part IV is a 40-page section dealing with photographing and large-screen projection of scope traces.

Though this book deals mostly with high-performance scopes, there are examples throughout which show how the more inexpensive scopes can be applied to complex tests.

The book is illustrated with hundreds of exceptional quality photos of scope traces, and should serve as a handbook for advanced technicians and engineers in every field of electronics. ▲

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ACCESSORIES
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MAGNECORD
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Here's that new Collins Speech Console you've been hearing about



We've stepped up production to give OFF-THE-SHELF Delivery

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- ☐ Noiseless photoconductive cells (no pops, clicks or hums).
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Acceptance of the 212S-1 has been rapid and widespread. With each installation, demand has increased. To meet this demand, we've gone to an off-the-shelf production schedule.

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Circle Item 25 on Tech Data Card

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September 1966

We interrupt this magazine to bring you...

Late Bulletin from Washington

by Howard T. Head

San Diego TV Stations Granted Temporary CATV Importation Limit

In response to petitions from the San Diego, California, television stations, the Federal Communications Commission has ordered CATV systems in the San Diego area to refrain from extending CATV carriage of television signals from Los Angeles, 110 miles away. Portions of the area served by the CATV systems prior to February 15, 1966, are not affected. This order is to be only temporary, pending a hearing to determine whether the interim relief requested by the television stations should be made permanent. This is the first such hearing ordered under the Commission's new CATV rules.

Despite the very considerable distance from Los Angeles to San Diego, the Los Angeles television transmitters, located on Mount Wilson at an elevation near 6000 feet, have calculated Grade B service extending to substantial distances, in some instances including portions of San Diego. In view of these circumstances, the Commission felt that a hearing was in order to determine the impact which any further CATV expansion would have on television broadcast service.

Land Mobile Television Channel-Sharing Discussions Scheduled

The Commission has established an advisory committee to assist in determining the feasibility of sharing television broadcast channels with stations in the land mobile radio services (see August, 1966 Bulletin). The initial meeting, under the chairmanship of FCC Chief Engineer Ralph Renton, is scheduled for September 29.

The advisory committee will prepare for and conduct any field tests that may be deemed appropriate. Industry members on this committee will be drawn from broadcast associations, land mobile manufacturing and using organizations, and JTAC, the Joint Technical Advisory Committee of IEEE and EIA. The committee will study technical information now available which is related to the feasibility of channel sharing, and will determine what additional information may be needed for the Commission to reach a proper decision in the matter.

Conflicting technical opinions were previously submitted to the Commission: land mobile interests concluded channel sharing to be technically feasible, while television broadcasters concluded that severe interference to television reception would result. This disagreement convinced the Commission that field tests of shared operation are necessary to resolve these conflicting judgments. It appears likely that tests will be conducted in a large city such as New York

or Chicago, with several land mobile base stations operating on frequencies within an unused television channel.

Relaxation of AM and FM Transmitter Remote Control Rules Sought

The National Association of Broadcasters (NAB) has petitioned the Commission for relaxation of the rules governing remote-control operation of AM and FM transmitters with power greater than 10 kw. At present, an application for such operation must be accompanied by an analysis of the transmitter operating logs, maintenance logs, and records for the 12-month period immediately preceding filing of the application. Under the NAB proposal, this 12-month waiting period would not be required, bringing the regulations into line with those now in effect for powers of 10 kw or less.

The effect of the present rules is to require a licensed operator in attendance at the transmitter during the 12-month period during which the required experience data are accumulated. NAB points out the burden imposed by this requirement, particularly since it applies even in instances where no change is made other than the replacement of an old transmitter with a new one. NAB cites the reliability of modern transmitting equipment in support of its requests.

Way Opened for Earth-Satellite TV Relay

The Commission has ruled that the Communications Satellite Corporation (COMSAT) has the legal authority to provide service to organizations other than communications common carriers, such as AT&T. This ruling opens the way for the establishment of a system of earth satellites which could provide program service directly to individual television broadcast stations and CATV systems, without requiring intermediary service through AT&T. The Commission has emphasized, however, that COMSAT is intended primarily to provide service to common carriers, and that direct service of this sort is to be provided only "in unique and exceptional circumstances."

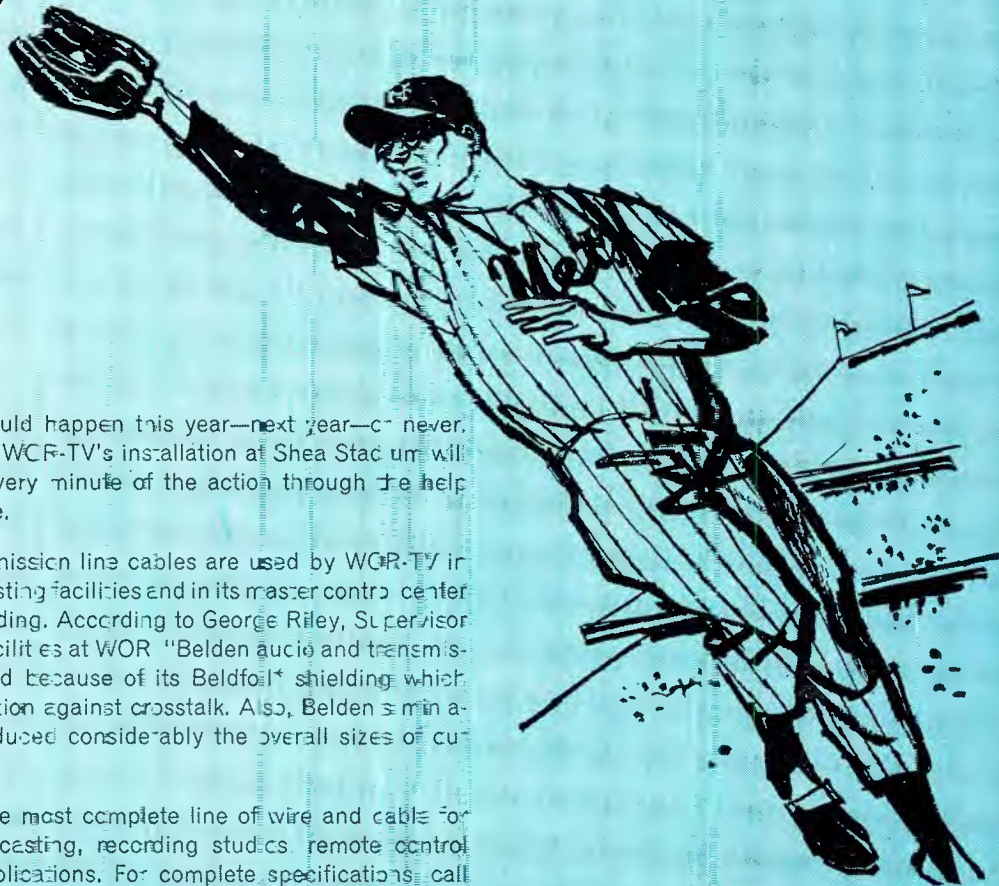
Hard on the heels of this ruling came a proposal by the Ford Foundation that the Foundation be permitted to operate such a system, with expected rates which would cut, perhaps in half, present intercity television transmission charges. An additional feature of the proposal is that the profits from the operation would be used for the support of educational television. It appears from the Foundation's proposal that even after providing intercity channels for ETV relaying, sufficient profits would remain to provide several million dollars annually for ETV programming.

Short Circuits

The Commission has modified the requirements for notifying stations within 35 miles of a station requesting new or changed call signs; notification may be made by copies of a single notice, rather than by individual notices as previously required. Copies must be sent to construction-permit holders as well as licensees. . . An FM station at Oklahoma City on 100.5 MHz has been ordered off the air; its third harmonic was interfering with reception on 301.5 MHz at Tinker Air Force Base. . . Negotiations with Mexican authorities to arrive at a new standard broadcast treaty are to begin on September 6; next meetings are scheduled in Mexico City in November. . . RACES plans must be submitted to regional OCD Directors by October 1. . . The Commission has refused to apply the proposed new directional antenna MEOV rule (not yet adopted) to pending AM applications. . . The Commission is studying the establishment of a separate CATV Bureau. . . The annual Symposium of the IEEE Group on Broadcasting will open in Washington on September 22, at the Mayflower Hotel.

Howard T. Head. . . in Washington

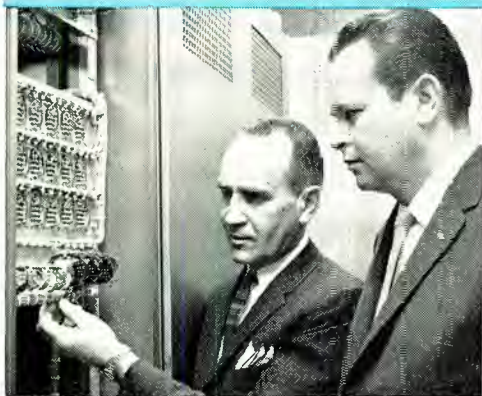
When the "Mets" capture the pennant... Belden will be there



Such a phenomenon could happen this year—next year—~~or never~~. But if and when it does, WOR-TV's installation at Shea Stadium will record and broadcast every minute of the action through the help of Belden wire and cable.

Belden audio and transmission line cables are used by WOR-TV in both its stadium broadcasting facilities and in its master control center in the Empire State Building. According to George Riley, Supervisor of TV Operations and Facilities at WOR: "Belden audio and transmission line cable was used because of its Beldfoil® shielding which provides superior insulation against crosstalk. Also, Belden's miniaturized audio cables reduced considerably the overall sizes of cupboards and consoles."

Belden manufactures the most complete line of wire and cable for all TV and radio broadcasting, recording studios, remote control circuits, and similar applications. For complete specifications call your Belden electronics distributor.



The control center of WOR-AM-FM is wired with Belden 8451 and 8700 miniature broadcast and audio cables. Explaining the complexity of the installation to George Kyros is Orville J. Sather, Director of Engineering for WOR-AM-FM.



In the control room, six monitor screens help the engineers transmit the play-by-play action. Looking over part of this installation are George Kyros, Belden Territory Salesman, and Earl Neely, Maintenance Supervisor of WOR-TV. The monitors are wired with Belden 8451, 8241, and 8281.

Belden

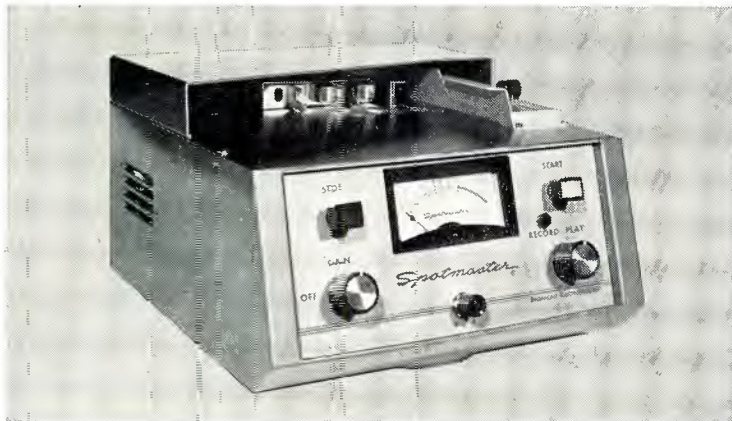
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Spotmaster

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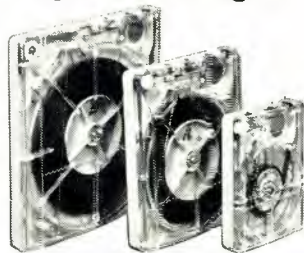


And Here's the New
Economy King
COMPACT 400-A



Don't let their low price fool you. New, solid state SPOTMASTER Compact 400's are second only to the Super B series in performance and features. Available in both playback and record-playback versions, these Compact models share the traditional SPOTMASTER emphasis on rugged dependability.

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Tape Cartridges



Superior SPOTMASTER tape cartridges are available in standard timings from 20 seconds to 31 minutes, with special lengths loaded on request. In addition, Broadcast Electronics offers a complete selection of blank cartridges, cartridges for delayed programming and heavy duty lubricated bulk tape. Prices are modest, with no minimum order required.

Introducing the Super B, today's truly superior cartridge tape equipment.

New Super B series has models to match every programming need—record-playback and playback-only, compact and rack-mount. Completely solid state, handsome Super B equipment features functional new styling and ease of operation, modular design, choice of 1, 2 or 3 automatic electronic cueing tones, separate record and play heads. A-B monitoring, biased cue recording, triple zener controlled power supply, transformer output . . . all adding up to pushbutton broadcasting at its finest.

Super B specs and performance equal or exceed NAB standards. Our ironclad one-year guarantee shows you how much we think of these great new machines.

Write, wire or call for complete details on these and other cartridge tape units (stereo, too) and accessories . . . from industry's largest, most comprehensive line, already serving more than 1,500 stations on six continents.



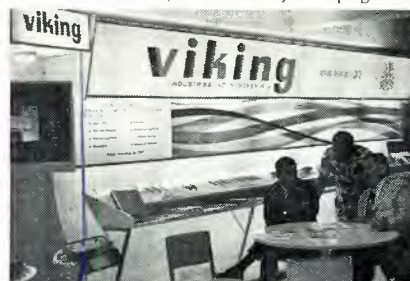
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Area Code 301 • JU 8-4983

Circle Item 27 on Tech Data Card

Products at NCTA

(Continued from page 44)



square wire. Tightening the back nut draws the coil tightly around the cable, holding it in place. After the assembly is tightened, the combined action of left- and right-hand threads in the assembly prevents any loosening. The connector is available in series N, F, UHF, and VSF.

Viking Industries, Inc.

A variety of new products was introduced by this manufacturer. A new, special, double-shielded RG 59/U cable was introduced for use in head-end jumpers. The cable meets requirements of areas of high radiation and is available with solid or foam dielectric; it accepts standard fittings.

The "Futura" series of modular, plug-in amplifiers is intended for use in all-band, 12-channel systems. The amplifiers feature specified noise ratio in excess of 40 db, built-in lightning protection, weather and radiation proofing, and the ability to cascade 50 or more amplifiers. The series includes Model FT/25 mainline amplifier, Model FT/26 mainline amplifier with AGC, Model FT/27 mainline amplifier with bridge, and Model FT/28, AGC mainline amplifier with bridge.

Also introduced was "Precision" test equipment for practical CATV applications. Included were a variable attenuator, an RF detector, and head-end filters.

Model 5967 is a seven-day nonduplication switcher. This prewired, rack-mounted unit switches programs by the minute and can store up to 60,486 commands.

A modular, flat directional tap was introduced. From one to four outputs can be inserted with no change in insertion loss or line match. Feed-through of up to 8 amperes of AC or DC power is possible with the taps isolated.

Weather-Scan®

On display at the R.H. Tyler Co. booth were the Weather-Scan® and Roto-Scan time/weather/message-display units. Basically the same design shown at the 1965 NCTA Convention, this year's Roto-Scan incorporates new and improved indicating instruments.

Not so hot.



Harvey Radio Co. stocks the complete line of Melcor professional solid-state audio amplifying equipment.

SPECIFICATIONS (basic amplifier)

- ☐ Sensitivity: 70 mv to produce rated output
- ☐ Power output: Continuous sine wave, + 47 dbm (50 watts). Music power rating 75 watts
- ☐ Signal input impedance: 60K ohms
- ☐ Load impedance: 8 ohms
- ☐ Damping factor: Greater than 20:1 from 50 cps to 15 Kc.
- ☐ Frequency response: ± 0.5 db, 20 cps to 60 Kc.
- ☐ Power bandwidth: 20 cps to 15 Kc.
- ☐ Total harmonic distortion: Less than 1.0%, 20 cps to 15 Kc at 50 watts.
- ☐ Noise, unweighted: 75 db below rated output
- ☐ Power requirements: 117 VAC, 50/60 cps, 100 watts for 50 watt sine wave output. Line switch for 105-117V or 117-130V.
- ☐ Temperature range: 0 to 65° C.
- ☐ Weight: 26 lbs.
- ☐ Dimensions: 3 1/2" high x 19" wide x 13 1/2" deep.
- ☐ Mounting: Standard 19" relay rack
- ☐ Controls: Gain; power ON-OFF; Line voltage, Hi-Low
- ☐ Price: \$243.00

Until recently, heat-producing tube equipment was something the professional studio had to live with. There was no choice.

Then the transistor. Cool operation, but not quite as reliable as the tube in terms of stability and performance. Initially.

Now, the Melcor AB-47 solid-state 50 watt monitor amplifier for professional studio use. Realizing the full potential of the transistor and unmatched in performance and stability. A very cool amplifier. So cool, in fact, you can stack AB-47's in a rack *without* spacer panels.

The all-silicon transistors of the AB-47 are completely protected by a unique dissipation limiting circuit. In the event of a short, this circuit is activated immediately. At the same time, an overload indicator on the panel glows. Turn the amplifier off for 20 seconds. Turn it back on. Operation is fully restored. Changing a tube was never that easy.

In terms of performance, the AB-47 is one of the finest monitor amplifiers available. Tube or transistor. The specifications on the left will tell you that right away.

It's a hot one.

Harvey Radio Co., Inc.

Cool it.

If the heat's on in your studio, we'll send the Melcor AB-47 to you for a 15-day trial period. No cost or obligation. You can play it cool. Send coupon to: Harvey Radio Co., Inc., 60 Crossways Park West, Woodbury, L.I., N.Y. 11797.

Name _____

Company _____

Address _____

City _____ State _____ Zip _____

NEWS OF THE INDUSTRY

INTERNATIONAL

International News Broadcasts for New York

New Yorkers can now hear the same international news as radio listeners in Europe, Africa, and Latin America. News programs of **Radio New York Worldwide Inc.** international radio station WNYW are being simulcast in the New York area over WRFM (FM).

Produced at Radio New York Worldwide's new studios, the news will be simultaneously beamed by WRFM's transmitter in Woodside, Long Island, to the New York area, and by four of WNYW's 50,000-watt transmitters in Scituate, Mass., to Europe, Africa, and Latin America.

Plant to Serve Europe And United Kingdom

The Andrew European office at Copenhagen (Hellerup) closed June

24 and reopened on an expanded scale August 1 at Lochgelly, Fife, near Edinburgh, Scotland. Mr. Douglas E. Proctor, marketing manager, Europe, is moving to the new location.

Andrew Antenna Systems has been formed to manufacture Andrew products in Scotland, serving the United Kingdom and Europe. The organization is under the direction of W. Clifford Morgan, general manager.

From the new location, sales and technical services will be provided on the full line of Andrew products. First production at the Lochgelly plant will emphasize microwave antennas, waveguide, and transmission line components with other items to follow. Standard HELIAX coaxial cable, waveguide, and antenna products will be stocked.

CCBA Convention

The 1966 convention of the **Central Canada Broadcasters' Association** will

be held on October 16, 17, and 18 at the Inn on the Park, Toronto, Ontario. The convention is a joint meeting of the Engineering and Management Sections, with separate lectures and conferences for each section. There will also be a combined manufacturers' equipment display.

NATIONAL

NAB Activities

The **National Association of Broadcasters** has asked the Federal Communications Commission to postpone for six months its proposed rules requiring frequency-monitoring devices for FM stations engaged in stereophonic programming or subcarrier operations.

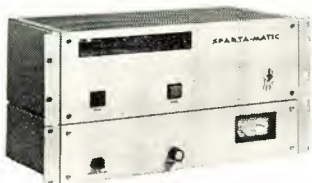
In requesting postponement to January 5, 1967, of the rules scheduled to

NOW INCLUDED IN ALL SPARTA-MATIC TAPE CARTRIDGE SYSTEMS



800C SERIES

Space saving, compact, table-top convenience • Transistorized modular electronics • Super-silent operation • Hinged lid for easy internal access • 800C-RP - \$650 — 800C-P - \$475



300C SERIES

Rack, table-top or cabinet mounting • Transistorized plug-in modules • 2nd and 3rd tone cue option • Separate record amplifier • Full remote operation • 300C-P - \$520 — 300C-R \$240

NEW SPARTA ENGINEERED CH-5 TAPE TRANSPORT



This completely new design eliminates belt-driven fly-wheel assembly with a direct motor/capstan drive system. Super-silent solenoid action gives smoother and faster cartridge handling performance with no operator effort. Regulation of pinch roller to capstan pressure is made by movement of the capstan shaft rather than angular variation of pinch roller, thereby eliminating the possibility of tape "skew". Cartridge is guided on all sides making it impossible to hit, move or damage heads.



**MC-104 MULTI-TAPE
CARTRIDGE SYSTEM**

Provides four independent plug-in CH-5 tape cartridge transports • Compact design for table-top (illustrated) or rack mount installation • Individual transistorized electronics • Manual or sequential operation • Multi-tone and audio switcher options

SPARTA ELECTRONIC CORPORATION

5851 FLORIN-PERKINS ROAD • SACRAMENTO, CALIFORNIA
(916) 452-5353



ANDREW

Lower attenuation...
new HELIAX®

**1/4", 3/8", 1/2" flexible
coaxial cables for**

- Military
- Broadcast
- CATV
- Mobile Radio
- Data Processing and
Instrumentation Systems

These new air and foam cables offer lower attenuation in small physical sizes. Type FH1, 1/4" Foam HELIAX Cable has 30% lower attenuation, 60% smaller size and 50% less weight than RG8/U. The copper inner and outer conductors assure optimum electrical performance with long life reliability. Available in long splice free lengths with or without polyethylene jacket.

For additional information on HELIAX Cable, contact your regional Andrew sales engineer or write P.O. Box 807, Chicago, Illinois 60642.

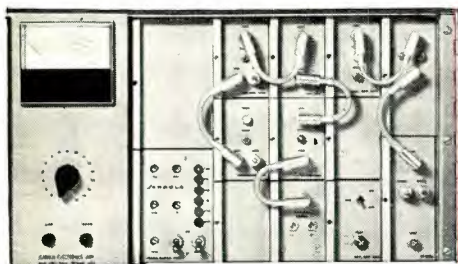
6-65A

Circle Item 30 on Tech Data Card

Andrew
CORPORATION

29 YEARS OF ENGINEERING INTEGRITY

not just color... COLOR



with new Jerrold 440 solid-state microwave

For your STL and other microwave applications, color transmission demands excellent differential phase and gain characteristics. New Jerrold 440 Solid-State Microwave, with differential phase of ± 0.25 degree and differential gain of ± 0.25 db, is the equipment to specify.

Compact, ultra-stable, with solid-state design and high-output klystron—the 440 Series by Jerrold is without a doubt the finest microwave gear available from any manufacturer at any price. We'll prove it—write today for complete technical data.

Features of Jerrold 440 (6-8 GHz)

1-watt (min.) transmitter output • Vapor-stabilized transmitter klystron • Frequency stability $\pm 0.005\%$ • Solid-state receiver and local oscillator • 12 MHz baseband, flat within ± 0.25 db • Individually self-contained power supplies • Modular construction throughout • Compact—only $10\frac{1}{2}$ in. high.



**JERROLD
ELECTRONICS
CORPORATION**

Communications Systems Division
401 Walnut Street, Phila., Pa. 19106

Circle Item 33 on Tech Data Card

be effective July 5, NAB told the FCC that equipment is not readily available for measuring SCA and pilot sub-carrier frequencies. Delivery of frequency-measuring equipment is "back-ordered several months," according to Douglas A. Anello, the Association's general counsel.

Also, in Washington, NAB's Board of Directors has voted to seek the counsel of three nationally known architectural authorities on NAB's proposed new headquarters building. After architectural drawings of the proposed building and a model were viewed and discussed by the Board, it asked the combined NAB Building and Executive Committees to select the authorities who will be asked to review present building plans.

The Board also asked the Executive Committee to decide whether the winter Board meeting should be held in Mexico City, since the Mexican Association of Broadcasters had extended the invitation. It was pointed out that holding the meeting in Mexico City would cost no more than holding it in California.

In other actions, the Board (1) authorized the expenditure of up to \$10,000 to join Red Lion Broadcasting Corp., Red Lion, Pa., in testing the constitutionality of the FCC's "fairness doctrine." NAB is joining in the appeal because of the constitutional issues involved. (2) Heard a status report from Donald H. McGannon, president of Westinghouse Broadcasting Co. (Group W) and chairman of the NAB Research Committee and the Rating Council on research and ratings activities. (3) Approved an NAB sales management seminar to be held in the summer of 1967. (4) Voted to ask broadcasters who attend the General Assembly of the Inter-American Association of Broadcasters in Buenos Aires in November to serve as official NAB representatives. Board members and former Board members will be given priority in making up the delegation. All representatives will pay their own expenses.

NAB has asked the FCC for permission to intervene in its study of telephone rates and to present "expert testimony on a proper rate base" for program transmission services used almost exclusively by radio and TV.

A petition submitted by Mr. Anello noted that filings by the American Telephone and Telegraph Co. on May 31 stated that a rate increase might be necessary for program transmission services for which broadcasters now pay "upwards of \$40 million a year."

"Preliminary indications are," the petition stated, "that no other individ-

31st AUDIO ENGINEERING SOCIETY

Convention

OCTOBER 10 THROUGH 14

**Exhibition of
Professional Audio Equipment
for
Studio and Laboratory**

For listing of more than 100 important papers see page 46

TECHNICAL SESSIONS: Monday through Friday, morning, afternoon, and evening at 9:30, 1:30, and 7:30. ANNUAL AWARD BANQUET: Thursday evening at 7:00. EQUIPMENT EXHIBITION: Monday through Thursday; Monday and Tuesday, Noon to 6:45 P.M.; Wednesday, Noon to 9:00 P.M.; and Thursday, Noon to 5:00 P.M.

**Banquet Tickets and
Program available:
Telephone (212) 661-8528
or write**

**AUDIO ENGINEERING
SOCIETY, INC.**



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60 East 42nd Street
New York, N. Y.
10017

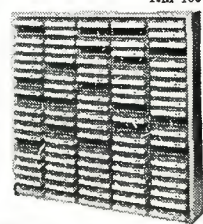
SPOTMASTER

RS-25



**Tape
Cartridge
Racks**

RM-100



... from
industry's
most comprehensive
line of cartridge tape equipment.

Enjoy finger-tip convenience with RM-100 wall-mount wood racks. Store 100 cartridges in minimum space (modular construction permits table-top mounting as well); \$40.00 per rack. SPOTMASTER Lazy Susan revolving cartridge wire rack holds 200 cartridges. Price \$145.50. Extra rack sections available at \$12.90.

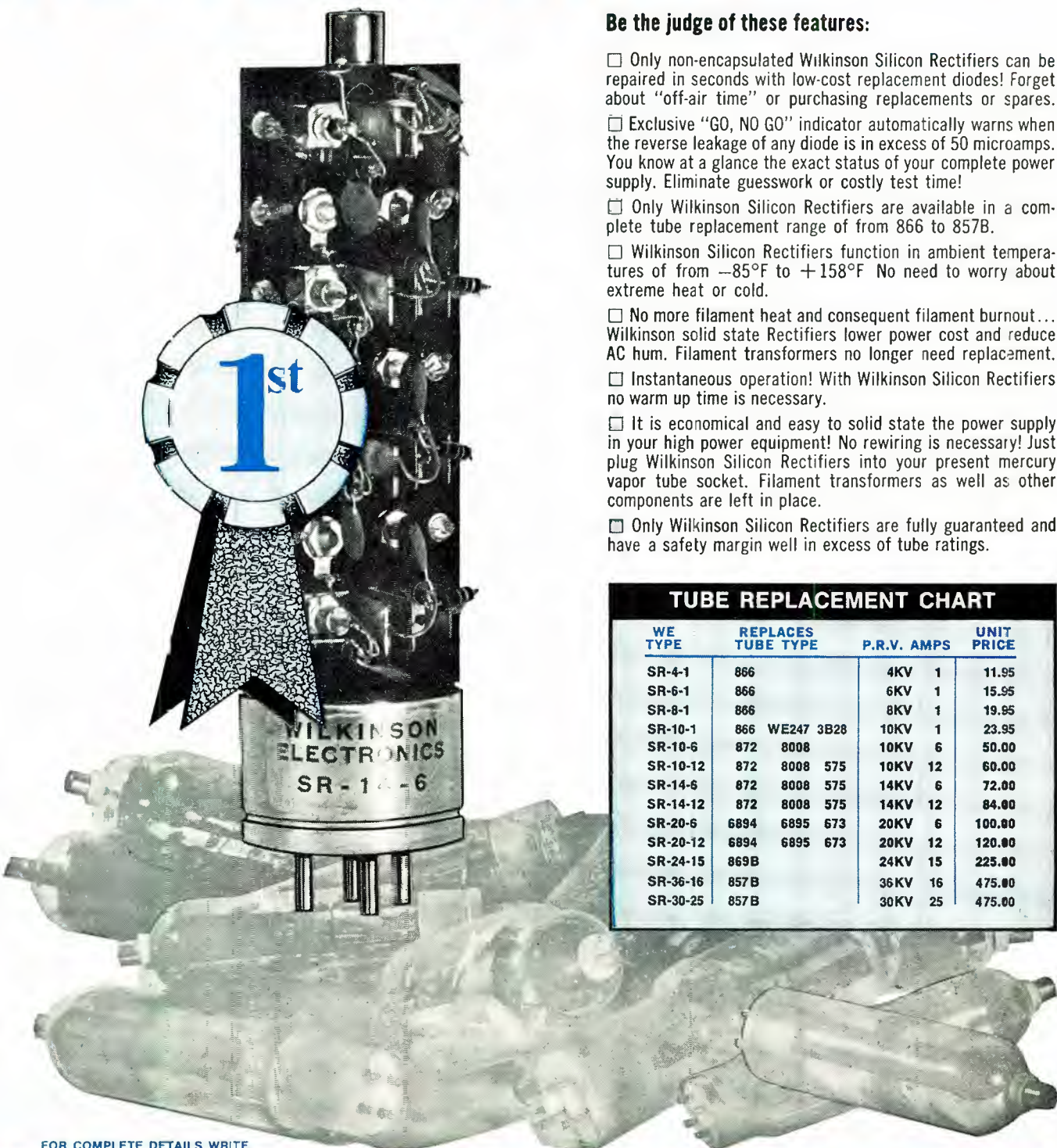
Write or wire for complete details.

Spotmaster
BROADCAST ELECTRONICS, INC.
8800 Brookville Road
Silver Spring, Maryland

Circle Item 31 on Tech Data Card

BROADCAST ENGINEERING

Wilkinson Direct Replacement Silicon Rectifiers... Stand Out In A Crowd ...and Stand Up Forever!



Be the judge of these features:

- ☐ Only non-encapsulated Wilkinson Silicon Rectifiers can be repaired in seconds with low-cost replacement diodes! Forget about "off-air time" or purchasing replacements or spares.
- ☐ Exclusive "GO, NO GO" indicator automatically warns when the reverse leakage of any diode is in excess of 50 microamps. You know at a glance the exact status of your complete power supply. Eliminate guesswork or costly test time!
- ☐ Only Wilkinson Silicon Rectifiers are available in a complete tube replacement range of from 866 to 857B.
- ☐ Wilkinson Silicon Rectifiers function in ambient temperatures of from -85°F to $+158^{\circ}\text{F}$. No need to worry about extreme heat or cold.
- ☐ No more filament heat and consequent filament burnout... Wilkinson solid state Rectifiers lower power cost and reduce AC hum. Filament transformers no longer need replacement.
- ☐ Instantaneous operation! With Wilkinson Silicon Rectifiers no warm up time is necessary.
- ☐ It is economical and easy to solid state the power supply in your high power equipment! No rewiring is necessary! Just plug Wilkinson Silicon Rectifiers into your present mercury vapor tube socket. Filament transformers as well as other components are left in place.
- ☐ Only Wilkinson Silicon Rectifiers are fully guaranteed and have a safety margin well in excess of tube ratings.

TUBE REPLACEMENT CHART

WE TYPE	REPLACES TUBE TYPE	P.R.V. AMPS	UNIT PRICE
SR-4-1	866	4KV 1	11.95
SR-6-1	866	6KV 1	15.95
SR-8-1	866	8KV 1	19.95
SR-10-1	866 WE247 3B28	10KV 1	23.95
SR-10-6	872 8008	10KV 6	50.00
SR-10-12	872 8008 575	10KV 12	60.00
SR-14-6	872 8008 575	14KV 6	72.00
SR-14-12	872 8008 575	14KV 12	84.00
SR-20-6	6894 6895 673	20KV 6	100.00
SR-20-12	6894 6895 673	20KV 12	120.00
SR-24-15	869B	24KV 15	225.00
SR-36-16	857B	36KV 16	475.00
SR-30-25	857B	30KV 25	475.00

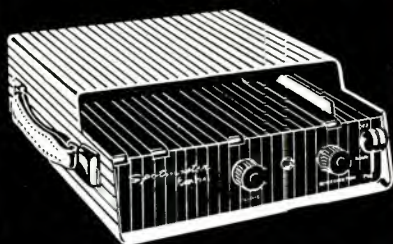
FOR COMPLETE DETAILS WRITE

WILKINSON ELECTRONICS, INC.

1937 MACDADE BLVD. • WOODLYN, PA. 19094
TELEPHONE (AREA CODE 215) 874-5236 874-5237

Circle Item 34 on Tech Data Card

SPOTMASTER



PortaPak I Cartridge Playback Unit

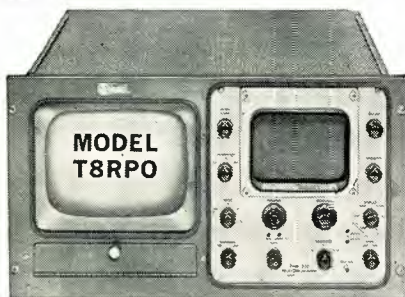
Your time salesmen will wonder how they ever got along without it! Completely self-contained and self-powered, PortaPak I offers wide-range response, low distortion, plays all sized cartridges anywhere and anytime. It's solid state for rugged dependability and low battery drain, and recharges overnight from standard 115v ac line. Packaged in handsome stainless steel with a hinged lid for easy maintenance, PortaPak I weighs just 11½ lbs. Vinyl carrying case optional.

Write or wire for full information.

Spotmaster
BROADCAST ELECTRONICS, INC.

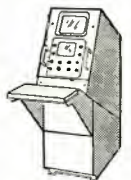
8800 Brookville Road
Silver Spring, Maryland

Circle Item 37 on Tech Data Card



PROFESSIONAL TRANSISTORIZED MONITORS BY MIRATEL

Here's reliable solid state performance in monitors made to the broadcaster's high standard of quality. 800 line center screen resolution. Minimum maintenance. 8, 14 and 17 inch sizes. 13 custom, rack, cabinet and console models. Write to Miratel Electronics, Inc., 3600 Richardson Street, New Brighton, St. Paul, Minn. 55112.



MODEL TP88ROC



MODEL TP88M



MODEL TP88RT



Standard line of video monitors available in all types and sizes . . . custom designs available.

Circle Item 38 on Tech Data Card

ual service will be viewed in such a manner by AT & T."

The petition said an increase "could have an important effect on the ability of broadcasters to receive and disseminate important public affairs programming."

The NAB said, "Since the American public relies on broadcasting to an unprecedented degree for its news and similar types of programs, it is important that the entire industry be represented."

On July 18, the NAB asked the FCC to permit all radio stations of more than 10kw power to operate by remote control without waiting 12 months to demonstrate the reliability of their transmitters. There is no such proof-of-performance requirement for remote control of those FM stations or nondirectional AM stations which operate on 10-kw power or less.

In its petition, NAB said that the 12-month trial period for higher-power stations is outmoded by technological advances in transmitting equipment and imposes an unnecessary burden on licensees by requiring them to hire additional manpower to keep the performance log.

Emphasizing that it shares the FCC's concern over transmitter reliability, NAB said the same objective could be achieved simply by requiring "reliability test" data from manufacturers and a simple block diagram from licensees. It said, "Transmitter reliability is not taken lightly by the licensee," and manufacturers over the years have made "a continuing substantial effort . . . to increase the reliability of all transmitters."

"For practical economic reasons," the petition said, "broadcasters seek the most reliable equipment available because no one in the industry could long survive if faulty equipment caused continuing interruptions in service.

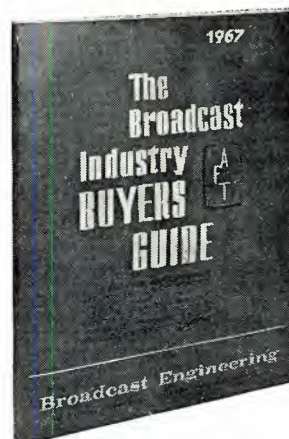
"Transmitters which are unreliable are quickly modified to increase this all-important factor, or are replaced with more up-to-date equipment."

SMPTE Celebrates 50th Anniversary

The Society of Motion Picture and Television Engineers (SMPTE) celebrates its 50th Anniversary this year with the 100th Semiannual SMPTE Technical Conference and Equipment Exhibit. The conference will be held in Los Angeles at the Ambassador Hotel on October 2-7, 1966.

Topics for the Conference Papers Program were announced recently by LeRoy M. Dearing, L.M. Dearing Associates, chairman of the Confer-

Coming in JANUARY!



Most Complete Reference Available

THE BROADCAST INDUSTRY BUYERS GUIDE is the most comprehensive listing of products and manufacturers available to the broadcast-communications industry. The complete cross-referencing gives the buying decision-maker complete on-the-spot information when it's needed most.

PUBLISHED ANNUALLY

This much-needed reference source on products and their manufacturers for the AM, FM, TV, CATV industry will now be available on an annual basis starting with the 1st Edition in January, 1967. THE BROADCAST INDUSTRY BUYERS GUIDE will be the one complete source equipment buyers can rely on for day-to-day information—year after year.

THE BROADCAST INDUSTRY BUYERS GUIDE will be divided into three main sections to provide quick, accurate reference for the buying decision-makers in all radio and television stations.

• **ALPHABETICAL PRODUCT LISTINGS:** The first section will list about 500 product classifications used by the broadcast industry. Under each product listing are the names of the companies that manufacture the product.

• **MANUFACTURERS' PRODUCT LISTING:** The second section lists in alphabetical order the names of broadcast equipment manufacturers. Under the name of each company is a list of all their broadcast equipment products.

• **COMPANY REPRESENTATIVES ADDRESS LISTINGS:** The third section contains the names, addresses, and phone numbers of the manufacturers' representatives according to states.

MANUFACTURERS — are you listed?

A FREE LISTING in the 1967 edition of THE BROADCAST INDUSTRY BUYERS GUIDE places the names of your firm, products and reps before virtually all the buying decision-makers in the radio and TV broadcast industry. This comprehensive Guide is the ONE guide broadcast equipment buyers can rely upon for day-to-day information.

If your firm has not received a Manufacturer's FREE Listing Form . . . phone or write Hugh (Scotty) Wallace, Advertising Sales Manager at Area Code 317-291 3100

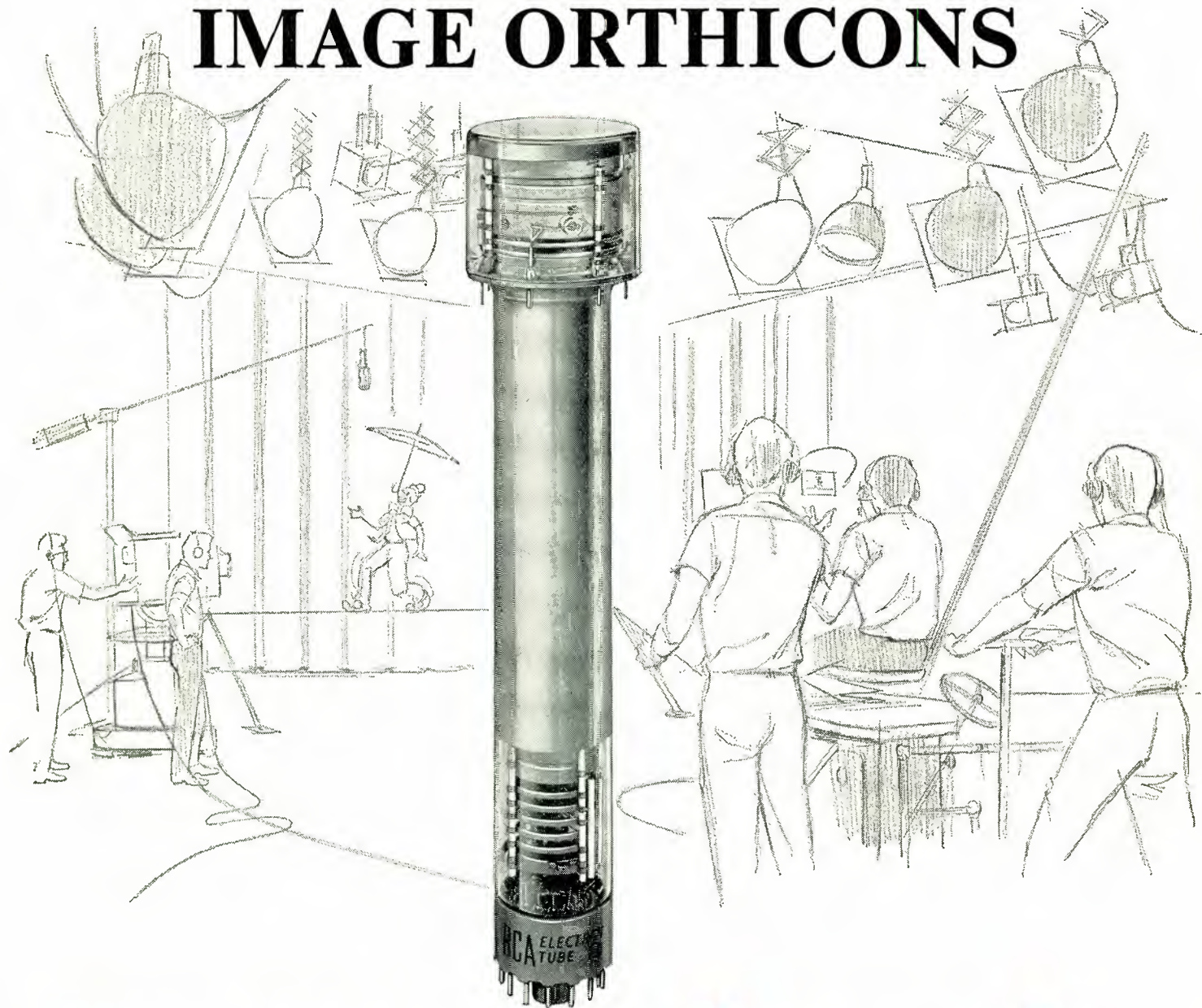
Broadcast Engineering

4300 W. 62nd St.—Indianapolis, Indiana 46206

BROADCAST ENGINEERING

RCA **color** capability

IMAGE ORTHICONS



7513/S-4513/S For Superior Quality Studio Color

**4415/S-4416/S For Uniform Color
at Black-and-White Lighting Levels**

8092A/S For Unequalled Remote Color Pickup

AVAILABLE FROM YOUR RCA BROADCAST TUBE DISTRIBUTOR

For complete technical information, ask for RCA's new Camera Tube catalog, CAM-600B. RCA Electronic Components and Devices, Harrison, N.J.



The Most Trusted Name in Electronics

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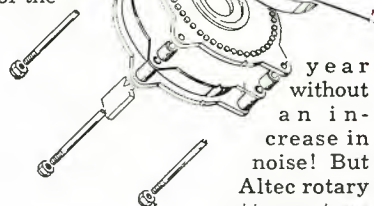
www.americanradiohistory.com

No noise after 500,000 operations with Altec rotary attenuators. Here's proof.

No need to get involved in the old-fashioned daily cleaning of contacts when you use Altec rotary attenuators. That's because Altec attenuators *stay* clean, as proved in recent tests. We applied a 15,000-Hz tone at -90-db to the attenuator input and 90-db gain to the output. This test firmly establishes stability, both physically and relative to noise, after repeated long-term operations.

Running the units for 500,000 operations showed no increase over the insignificant residual noise. In a second test, we ran units for 4000 operations, let them idle for four weeks, then repeated the operations to a total of 50,000. Still no noise.

If you think about it, 500,000 operations come out to more than 125 operations every day of the



are even better than that, because they were still going strong and noise-free after 500,000 operations!

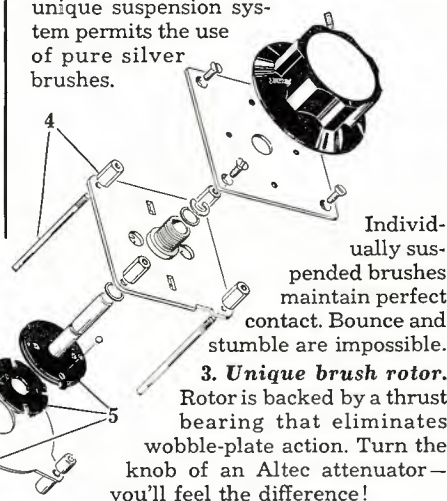
So, just for old times' sake, go ahead and clean your Altec attenuators once a year—even if they *don't* need it!

Here's why Altec rotary attenuators are best:

1. Pure silver precision-lapped brushes & contacts. By using fine (pure) silver instead of copper alloy (coin silver), we eliminate the major cause of noise-causing contaminants. Coin silver oxidizes, reducing conductivity and increasing noise level. Altec's pure silver sulphides, actually forming a wear-reducing lubricant. Pure silver is one reason for Altec's lowest contact resistance, less than 1.0 milliohm! Altec's solid silver contacts are cold-forged, giving them as much density

as silver can have. Compare this to ordinary silver plating of competitive units, which is spongy and easily wears off.

2. Unique double-nested brushes. Altec's unique suspension system permits the use of pure silver brushes.



Individually suspended brushes maintain perfect contact. Bounce and stumble are impossible.

3. Unique brush rotor. Rotor is backed by a thrust bearing that eliminates wobble-plate action. Turn the knob of an Altec attenuator—you'll feel the difference!

4. Cadmium iridite finish protects steel parts from corrosion.

5. Black dulite prevents corrosion on cold rolled steel parts.

6. Thrust bearing is made of spring brass.

7. Brush tension springs are of beryllium copper.

The most commonly needed Altec rotary attenuators are available off the shelf for prompt delivery. Custom configurations made to your requirements. Write for our new precision attenuator literature.

New gain set now available



The new Altec gain set is a precision test instrument for measuring the gain, loss, frequency response, and signal level of audio devices. Simultaneous input and output and two VU meters permit simultaneous readings, and the unit can be used for balanced or unbalanced circuits. Write for complete data.



A Division of LSPV Ling Altec, Inc., Anaheim, California

Circle Item 39 on Tech Data Card

ence Program. Papers will be presented in Education, History, Laboratory Practices, Photographic and Allied Sciences, Sound, Studio Practices, Television, Theater Presentation and Projection, Instrumentation and High-speed Photography, and Aerospace Cinematography.

The conference will also feature an equipment exhibit in which more than 80 booths of equipment will be displayed. Exhibit chairman is Warren Strang, Hollywood Film Co.

The exhibit opens officially at 5 p.m., Monday, Oct. 3. At that time, there will be a traditional ribbon-cutting ceremony, followed by an exhibitors' open house. Refreshments will be served.

Booth holders are invited to present descriptions or demonstrations of new products at a special session Wednesday morning, October 5.

During the conference, the SMPTE Exhibit Award Committee will choose a display which they feel is the most imaginative, effective, and best presented, regardless of size. The winner will receive a plaque in appropriate ceremonies at the conference closing.

New Warehouse

Jerrold Electronics Corp. has announced the establishment of warehouse and shipping facilities at Kansas City, Mo., to serve the midwestern part of the United States. The complete line of Jerrold products will be handled at the warehouse.

Kenneth W. Lloyd, Jerrold's mid-west regional manager, is in charge of the new operation, built to supplement existing warehouse facilities in Philadelphia and Redwood City, Calif.

Purchase of Transistor Radios Urged

Two college students, representing Mallory Battery Company have made a tour of major cities across the country to urge a transistor radio in every home as a security measure in time of emergency.

The students, Whit Holden of John Hopkins University, and Bob McNaughton of Villanova, started the tour June 20 with their first call at Harford, Conn. They presented Mayor George Kinsella with a transistor radio. The students visited 32 cities in the United States from coast-to-coast to meet with leading city and community officials.

The idea of having a transistor radio available as stand-by equipment has been strongly endorsed by Civil Defense, FCC, and other government and community agencies.

NEW PRODUCTS

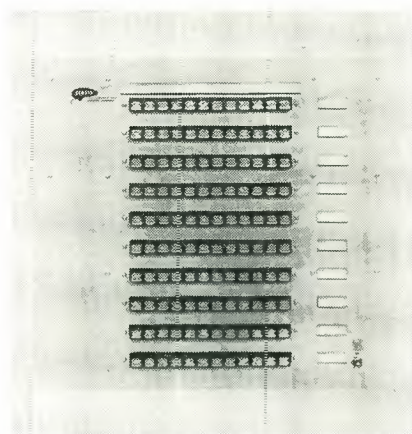


Stereo Monitor

(130)

To be added to its line of FM monitors by **Belar Electronics Laboratory** is the FMS-1 Stereo Monitor, which contains a 19-kHz pilot-frequency meter by means of which a broadcaster is enabled to make the daily reading as required by the FCC. The unit monitors "L" and "R" audio and pilot injection, and, with internal filters, measures $L + R$, $L - R$, subcarrier suppression, crosstalk ($L + R$, $L - R$, and SCA), and S/N ratio. The specified demodulated separation capability is better than 45 db; crosstalk is better

than 60 db. Remote metering is provided with 5000 ohms external loop resistance. The unit is designed to operate in conjunction with the Belar Frequency and Modulation Monitor FMM-1 and, if applicable, the SCA monitor SCM-1.



Pushbutton Video/Audio Patch Panel

(131)

Dynair Electronics, Inc., has devel-

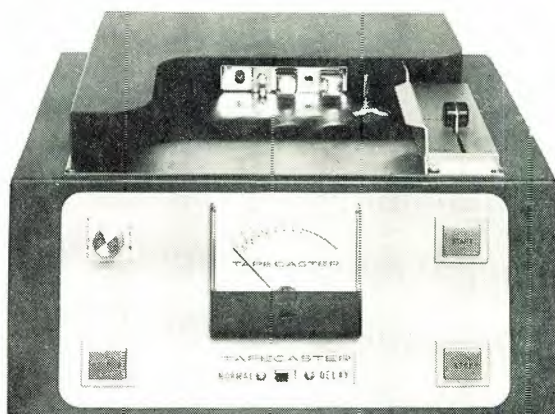
oped a pushbutton switcher designed to replace patch panels in television systems. The Series-X switcher has built-in solid-state isolation amplifiers and regulated power supply. All electronic components are mounted on plug-in modular etched circuit boards. The equipment is available for switching video only, or, if desired, for simultaneous switching of both video and audio.

Instead of plugging and unplugging patch cables to effect a change in the signal routing, a group of labeled pushbuttons are depressed, providing the same results. Using this device, repatching can be performed quickly. Another feature of the switcher is a reduced space requirement.

Series-X switchers are available with six or twelve inputs and from one to twelve outputs. Any or all of the outputs may be switched to a single input with negligible signal degradation. Options include sync-mixing provisions, audio switching facilities, bridging inputs, and illuminated push-buttons.

SERIES 700 BY TAPECASTER

Delayed Programmer
for telephone
interview shows



Model 700-RPD

Broadcaster Net Price \$500.00

Signal-to-Noise Ratio
10 DB better than
competitive delay unit

The only all silicon solid state cartridge machine that can be used both as a delayed programmer and a combination record-playback unit.

TAPECASTER ELECTRONICS

Box 662, 12326 Wilkins Avenue
Rockville, Maryland 20851, Area Code 301 942-6666



Presenting Metrotech's Two-Direction Slow Speed Logger

12-16 Operating Days of Continuous, Unattended Logging Time for any Broadcast or Communications Requirement.

Tape cost less than 4¢ per hour — or \$1.00 for a 24-hour day.

Heavy duty Transport with latest solid state electronics is fully automatic and provides exceptional fidelity — 3 db from 200-2700 cps with adjustable equalization.



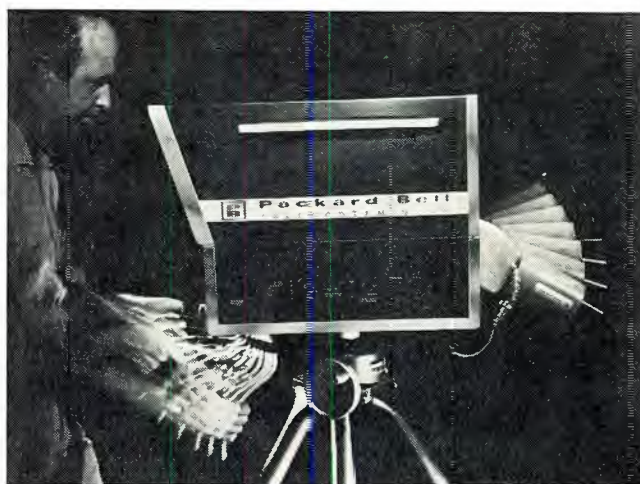
A complete line of Professional Recorders/Reproducers, operating at standard speeds, is also available and surpasses all N.A.B. specifications.

Write today for six-page illustrated brochure and price information.

SERIES 500

METROTECH INC. 670 NATIONAL AVENUE
MOUNTAIN VIEW, CALIF.

Circle Item 41 on Tech Data Card



Viewfinder TV Camera

(132)

A completely self-contained, transistorized viewfinder TV camera with built-in pan-and-tilt and electric zoom lens has been announced by Packard Bell's Space & Systems Division.

Designed for educational studios, the Telecaster 9200 keeps the viewfinder kinescope continuously at eye level through all tilt positions within the 60-degree range. The positioning handle is moved up and down to control tilt and is swung for operation through the full 360-degree pan range. The handle also contains fingertip zoom and focus controls for the motorized zoom lens.

All operating controls are at the rear of the camera. Front and rear tally lights, intercom-audio jack, and EIA sync-insertion jacks are provided.



CUSTOM 12"
also available in
STANDARD 12" or 16"

Long time no trouble!

"We've been using QRK Turntables for 14 years and it just occurred to us — we've forgotten what turntable trouble is. It's like our engineer says, 'the only reason to change a QRK is if you get tired of its color.'* Of course our DJ's wouldn't trade, because QRK spins any disk with no need for pop-up gadgets — starts fast for accurate cueing — runs true and quiet."

*And, we can do that for you, too!
Ask about our custom color service.



See your dealer today or call or write us for complete information.

QRK ELECTRONIC PRODUCTS
2125 N. Barton — Fresno, California

Circle Item 42 on Tech Data Card

BROADCAST ENGINEERING

The integral electrical zoom lens has 4 to 1 focal length (25 to 100 mm or optional 3.5 to 150 mm). Circuit boards are glass-fiber/epoxy, with all circuit functions labeled. Components are used at 60% of rating, and plug-in transistors provide easy replacement. Price is \$3500.



Portable Dimmers
(133)

A series of ColorTran portable, individual electronic dimmers for photographic lighting control has been introduced by **Berkey Technical Corp.**

The dimmers incorporate an integral dimming control potentiometer, and have provision for remote control up to 1000 feet from the unit. Remote units are available for controlling one dimmer or six dimmers. All standard remote-control units have rotary controllers.

The dimmers are available in 1000-,

2000-, 3000-, and 6000-watt capacities for use with 120-volt lamps and 1000-, 2000-, 5000-, and 10,000-watt capacities for use with 230-volt lamps.

Solid-state circuitry, designed for continuous duty at full rated load, utilizes silicon symmetrical switching devices. Rated efficiency factor is in excess of 95%. Protection against short circuits and line transients is provided, and units may be hot patched to full rated capacity. All dimmers are filtered (900 microseconds rise time) to suppress filament sing, as well as any interference to FM and video.

The units are available in 105/135-volt and 220/250-volt models, single-phase 60-Hz AC. Units for 50-Hz AC are also available on special order. All models have carrying handles, and the 2000-watt and larger models can be mounted in specially designed portable racks.

CORRECTION!

The Sparta BP-211 advertised in August **BROADCAST ENGINEERING** should have been priced at \$225.

The correct address for Sparta is 5851 Florin-Perkins Road, Sacramento, Calif..

Get 3 Seconds to 1 Hour TIME DELAY

with the new **SPARTA-MATIC CD-15**
TAPE CARTRIDGE UNIT

- ★ Separate record, playback and erase heads allow time delays for "on the air" **TELEPHONE CONVERSATIONS!**
- ★ Can be used as a "special effects" generator to create **ECHO CHAMBER** and **REVERBERATION** effects.



SPARTA ELECTRONIC CORPORATION

5851 Florin-Perkins Rd.
Sacramento, California 95828
Phone (916) 452-5353

Circle Item 44 on Tech Data Card

TELEVISION ENGINEERS

We are interested in contacting 10 Station Engineers capable of design or field engineering. Excellent opportunities in TV Development Engineering and Systems Engineering with Sarkes Tarzian, Inc., Broadcast Equipment Division.

TV station engineering experience required, BSEE or equivalent desirable. Send resume of experience, or call, Mr. Biagio Presti, Broadcast Equipment Division, Sarkes Tarzian, Inc., Bloomington, Indiana, Area Code 812, 332-7251.



Symbol of Excellence
in Electronics



CCA - AM - 5000 D

The CCA AM-5000D, 5KW AM broadcast transmitter incorporates features that are standard in all CCA AM transmitters. These include:

Silicon rectifiers with minimum of 200% safety factor; 300% reserve in air cooling; minimum tube costs; low distortion high level plate modulation; automatic overload recycling; minimum floor space; full accessibility with hinged meter panels.



CCA ELECTRONICS CORPORATION
GLOUCESTER CITY, NEW JERSEY
(609)-456-1716

YOUR
INQUIRY
INVITED

AM & FM TRANSMITTERS AT REALISTIC PRICES

Quality AM BROADCAST TRANSMITTERS

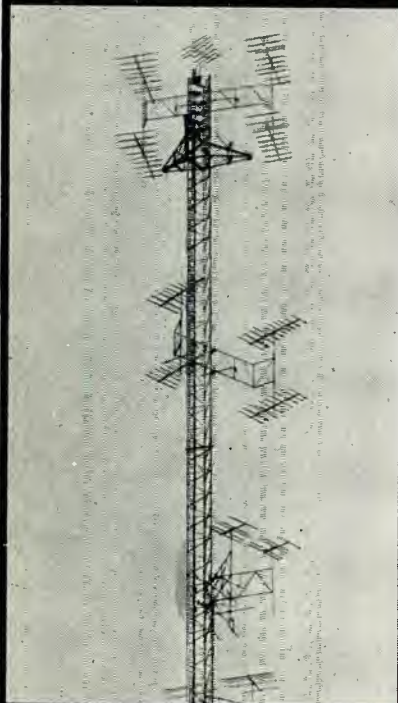
EXCEED FCC SPECS.

at *Realistic*
Prices

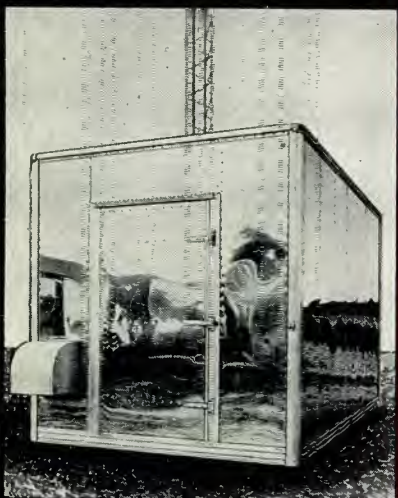
250W	\$ 3,495.00
500W	\$ 4,545.00
1KW	\$ 4,850.00
5KW	\$13,900.00
10KW	\$16,600.00
50KW	\$89,500.00

Circle Item 43 on Tech Data Card

THE PACESETTERS



**CATV-UHF-AM-FM
MICROWAVE
TOWERS**



**PRE-ASSEMBLED
ALUMINUM BUILDINGS**

Self-contained with wiring and ventilation installed prior to shipment.

IMMEDIATE DELIVERY

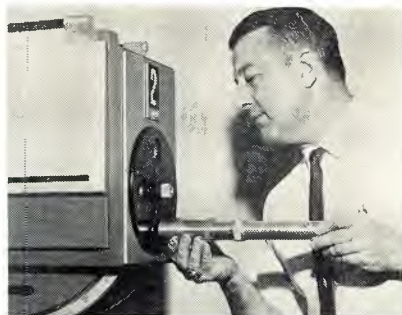
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705 Douglas St.—Sioux City, Iowa 51101
Phone (712) 252-4475—TWX 712-991-1893

Circle Item 46 on Tech Data Card



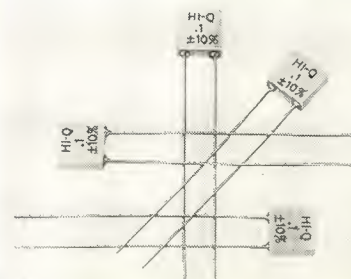
**Vidicon Camera
Alignment Gauge**

(1134)

The **Zolomatics Diascope 252** provides the service engineer with an instrument to align any vidicon television camera rapidly.

The Diascope has a built-in resolution chart, which is projected on the vidicon tube giving an image on the monitor. Blurring or distortion of the image is an indication that the vidicon tube needs aligning, and the engineer can make the necessary adjustments immediately.

Once the camera tube has been correctly positioned, all the lenses used will focus correctly.



**Hermetically-Sealed
Ceramic Capacitor**

(1135)

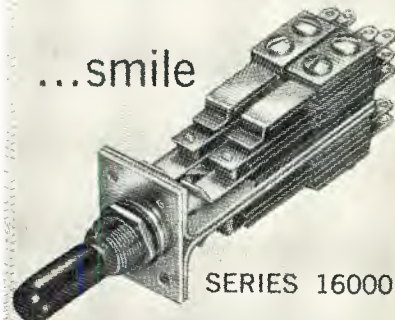
Aerovox Corp. has introduced the "Ceraseal," an all-ceramic monolithic capacitor that is hermetically sealed. The hermetic sealing of the unit has been demonstrated by its ability to pass long-term polarized moisture tests, including those detailed in MIL-C-23269.

This construction eliminates the organic encapsulation formerly employed on all ceramic capacitors. The design is intended to minimize degradation of encapsulation as well as the degradation of the capacitor as a unit by solvents, high-temperature exposures, shelf life, flammability tests, and effects of radiation.

Ceraseal is initially being offered in the CKR06 and CKR12 case sizes and ratings. The CKR06 style is available at 200 V DC in the capacitance

when you specify
**SWITCHCRAFT
"TELEVER"**
TELEPHONE TYPE
SWITCHES

...smile



SERIES 16000

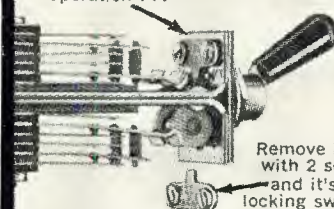
...you've done
your station
a favor

1. OUTSTANDING QUALITY

Virtually indestructible "T-Beam" frame. Proved and preferred Leaf-type switch stacks go on-and-on after other types wear out. Materials and finishes meet Mil specs . . . overall design meets rigid telephone company standards (but with lots more uses).

2. CHANGEABLE FUNCTIONS

Insert for non-locking operation . . .



Now it locks—now it doesn't. Exclusive removable inserts converts it either way—even in the field. Can be locked in any one or all positions.

3. TOPS IN VERSATILITY

Incomparable flexibility in contact arrangements (up to 8-pole, double throw). Two and three position. Palladium or fine silver contacts. Unsurpassed for any critical switching function—telephone companies, communications and test equipment, computers, ground support equipment, etc.

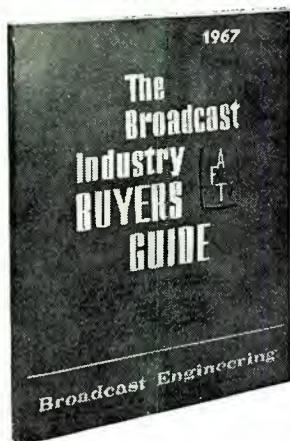
Write for bulletin S-302, or see your authorized Switchcraft distributor for immediate delivery at factory prices.

SWITCHCRAFT[®]
INC.

5535 Elston Avenue, Chicago 30, Illinois

Circle Item 45 on Tech Data Card
BROADCAST ENGINEERING

Coming in JANUARY!



Most Complete Reference Available

THE BROADCAST INDUSTRY BUYERS GUIDE is the most comprehensive listing of products and manufacturers available to the broadcast-communications industry. The complete cross-referencing gives the buying decision-maker complete on-the-spot information when it's needed most.

PUBLISHED ANNUALLY

This much-needed reference source on products and their manufacturers for the AM, FM, TV, CATV industry will now be available on an annual basis starting with the 1st Edition in January, 1967. THE BROADCAST INDUSTRY BUYERS GUIDE will be the one complete source equipment buyers can rely on for day-to-day information—year after year.

THE BROADCAST INDUSTRY BUYERS GUIDE will be divided into three main sections to provide quick, accurate reference for the buying decision-makers in all radio and television stations.

- **ALPHABETICAL PRODUCT LISTINGS:** The first section will list about 500 product classifications used by the broadcast industry. Under each product listing are the name of the companies that manufacture the product.
- **MANUFACTURERS PRODUCT LISTING:** The second section lists in alphabetical order the names of broadcast equipment manufacturers. Under the name of each company is a list of all their broadcast equipment products.
- **COMPANY REPRESENTATIVES ADDRESS LISTINGS:** The third section contains the names, addresses, and phone numbers of the manufacturers representatives according to states.

MANUFACTURERS — are you listed?

A FREE LISTING in the 1967 edition of THE BROADCAST INDUSTRY BUYERS GUIDE places the names of your firm, products and reps before virtually all the buying decision-makers in the radio and TV broadcast industry.

This comprehensive Guide is the ONE guide broadcast equipment buyers can rely upon for day-to-day information.

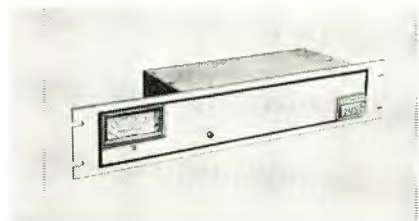
If your firm has not received a Manufacturer's FREE Listing Form . . . phone or write Hugh (Scotty) Wallace, Advertising Sales Manager at Area Code 317-291 3100

Broadcast Engineering

4300 W. 62nd St.—Indianapolis, Indiana 46206

range of 1200 through 10,000 pf and at 100 V DC in the range of .012 through 0.1 mfd. The .250-in. long by .100-in. square CKR12 style is available at 100 V DC in the capacitance range of 10 through 10,000 pf.

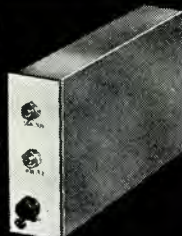
Both units meet the MIL "BX" voltage-temperature characteristic ($\pm 15\%$ 0 V DC, +15, -25 rated V DC) over the entire capacitance range. Other materials, including NPO with a power factor of 0.1% or less, are available with minimum capacitance tolerances of 5% in ratings of 25, 50, 100, and 200 V DC.



Frequency Monitor
(136)

Rust Corporation has made available a 19-kHz frequency monitor especially designed to comply with the recent FCC requirement for daily checks of the stereo pilot signal. The \$290, 19-kHz frequency monitor oc-

CONVERTING TO SEPARATE FM STEREO PROGRAMMING?



The remarkable new LANG Tape Playback Amplifier provides the low budget approach to converting your Ampex tape machines for unsurpassed performance. The new LANG LTP is a completely transistorized low noise, equalized tape head playback amplifier which raises the head signal to line level.

The LTP features separate high and low frequency equalization controls to permit the tape head output to be accurately adjusted to the NAB playback curve. The LANG LTP also contains a five-stage silicon transistor amplifier capable of delivering +24 dbm output with less than 1% total harmonic distortion. A built-in output transformer provides balanced output connections. Radio frequency and switching interference is eliminated by a shielded connector compartment and feed-thru capacitors.

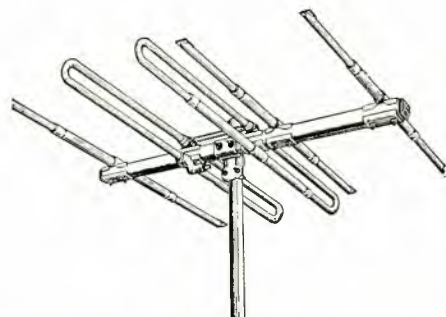
Each LANG LTP is contained in a completely enclosed 5 x 12 x 1 1/4" heavy gauge aluminum chassis with adjustment controls located on the front panel. Standard input, output and power connectors are mounted on the rear apron.

Units may be ganged for up to 10-channel operation.

For complete details and
new Lang Catalog write:

LANG ELECTRONICS INC.
507 FIFTH AVE., N.Y. 17
For all your audio needs — look to Lang!

Circle Item 47 on Tech Data Card



if THIS Yagi design doesn't
solve your problem . . .

choose from over **100** other
Taco ruggedized Yagi antennas



There is simply no compromise when you specify a TACO Yagi antenna or antenna system. As a pioneer manufacturer and prime supplier of Yagi antennas, TACO has developed models for every communications need—point-to-point, rebroadcast TV, Translator, CATV, MATV, ETV, or sophisticated tracking arrays.

TACO Yagi antennas are available in 5, 8, and 10 element designs in single or multiple arrays for vertical or horizontal polarization. These are cut and tuned for specific broad or narrow bands in the frequency range from 30 MHz to 500MHz.

TACO catalogs almost one hundred and fifty different types of Ruggedized Yagis—each suited to do a particular job best. TACO's tremendous backlog of experience in special-function design is matched by no other antenna manufacturer.

Send for complete catalog data today.

TACO antennas and
antenna systems

JERROLD ELECTRONICS CORPORATION

Government and Industrial Division
Philadelphia, Pa. 19106

Circle Item 48 on Tech Data Card

CATV CABLE & CONNECTORS

Times CATV seamless aluminum sheath cable—in continuous lengths up to ½ mile—requires fewer splices, costs less to install and maintain. Weathertight. Offers 30 db minimum return loss for minimum ghosting. Outlasts and outperforms so-called "economy" cable (which costs still more to replace) and lives up to your system's planned potential.

Matching, instantly-installed Timatch® connector fits Times and other semiflexible CATV cables. One piece. Reusable. Matches the life of the cable itself. Has exclusive CoilGrip® clamp.

Timatch® perfect
match connectors

Cable: Available in
seamless lengths up to ½ mile



For full data, contact
Times at your local
Jerrold Sales Engineer

**TIMES
WIRE & CABLE** Dept. 69
Wallingford, Conn.

- ☐ Please send complete data
on connectors and CATV cable.
☐ Please have a field representative call.

Name _____

Company _____

Address _____

City _____ State _____



cupies 3½ inches of panel space and contains a direct-reading meter calibrated in cycles of deviation from 19 kHz. Provisions are also included for deviation reading at a remote location through most remote control systems.

The equipment is all solid state and is designed to bridge a 19-kHz source with negligible effect to the source.



Remote Amplifier
(137)

Broadcast Electronics is offering a 4-channel remote amplifier designed for AC or battery operation. The solid-state unit will accept 50/150/250-ohm transformer-coupled inputs (XL connectors); output impedance is 600/150 ohms at +4 dbm (switchable to 0). Frequency response is 40 to 20,000 Hz within 1½ db; gain is 75 db within 2 db. Model RA-4CA has two head-set jacks and high-impedance PA feed. The amplifier weighs 11 lbs with batteries. Price is \$385. ▲

Erratum

In the Engineers' Exchange item "Chopper Modification" (January 1966, page 48), reference is made to the July 1964 issue. The reference should have been to the article "Solid-State Chopper for Modulation Checks" (June 1964, page 26).

MOVING?

Write: **BROADCAST ENGINEERING**

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**YOU
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THIS
MUCH
PANEL
SPACE
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TECH
LAB'S
NEW 1"
VERTICAL
ATTENUATOR**

(actual size)

Here's the smallest vertical attenuator made in the U.S.A. . . . another first from Tech Labs, pioneers in vertical attenuators since 1937.

It uses little panel space . . . only 1" wide x 6" long. It provides quick change of levels on multiple mixers and assures long, noise-free life. Units are available in 20 or 30 steps with balanced or unbalanced ladder or "T", or potentiometer circuits. Standard Db per step is 1.5, others on order. Impedance ranges are 30 to 600 ohms on ladders or "T's" and up to 1 megohm on pots.

Don't wait, send for complete data today!
Need Video or Audio Rotary Attenuators?

All Tech rotary attenuators are precision made for extended noise-free service. Many standard designs available and specials made to your specs. Send for literature today.



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Tel: 201-944-2221 • TWX: 510-230-9780

Circle Item 51 on Tech Data Card
BROADCAST ENGINEERING

AUDIO & RECORDING EQUIPMENT

60. ATLAS SOUND—Catalog 566-67 shows new models of PA speakers, microphone stands, and accessories for commercial sound applications.
61. KRS — Technical Bulletins SB1 and SB6A describe 1-Stact® and 6-Stact® tape-cartridge equipment.
62. MAGNE-TRONICS—Literature contains information about motivational background-music service for FM-multiplex and/or telephone-line transmission under franchise arrangement.
63. MICHIGAN MAGNETICS—Catalog offered includes complete line of magnetic record, play, and erase heads.
64. QUAM-NICHOLS — General Catalog 66 lists public-address, sound-system, high-fidelity, automotive, musical-instrument, and replacement speakers.
65. SHURE BROS. — Specification sheet furnishes graphs and other data on new unidirectional microphone SM58, which has a self-windscreen.
66. SPARTA—Product guide covers newly developed magnetic tape cartridge and tape reel eraser, Model CE-2.
67. SWITCHCRAFT—New Product Bulletin 162 describes No. 378 "Tini-Tee" output adapter for two separate ear-phones, and No. 3843 personal ear-phone kit.

68. VIKING OF MINNEAPOLIS—Brochure concerns Series 235 tape duplicating system.

CATV EQUIPMENT

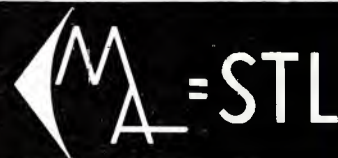
69. AMECO—Available are two new brochures on solid-state CATV amplifiers—the 65- and the 70-series. Also available is a brochure on related services.
70. BLONDER-TONGUE — 12-page catalog has complete specifications on the entire line of CATV equipment, including head-end, distribution, and subscriber items. Featured is a new line of solid-state distribution gear, including high-output broadband amplifiers, distribution amplifiers, and line extenders.

COMPONENTS & MATERIALS

71. TEXWIPE—Literature concerns Freon® TF solvent cleaner for tape heads, drives, and capstans.
72. TROMPETER — New catalog T-6 includes complete line of connectors, cable assemblies, patching systems, and twinax and triax cable used in video, RF, telemetry, and data-handling systems.

MICROWAVE DEVICES

74. MICROWAVE Associates—Data sheets are available for MA 2A, MA 7A, and MA-2T microwave relays.



THE MOSELEY FORMULA

Don't accept our prejudiced view. Ask owners of Studio-Transmitter Links for a recommendation.* They will come up with a formula too . . . OURS.

*Write us for the call letters of stations near you that own Moseley aural STL equipment.

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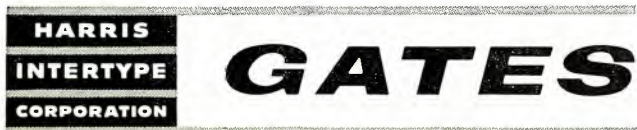
Circle Item 53 on Tech Data Card

New Gates "Top Level" positively prevents FM overmodulation

Strong statement? Read what one FM broadcaster has to say: "We can run our total modulation up to 98% and hold it without overmodulating, balance change or distortion." And another: "Truly it gives a new sound . . . crystal-clear beauty . . . rich and vibrant program definition, and it makes the station sound louder and fuller."

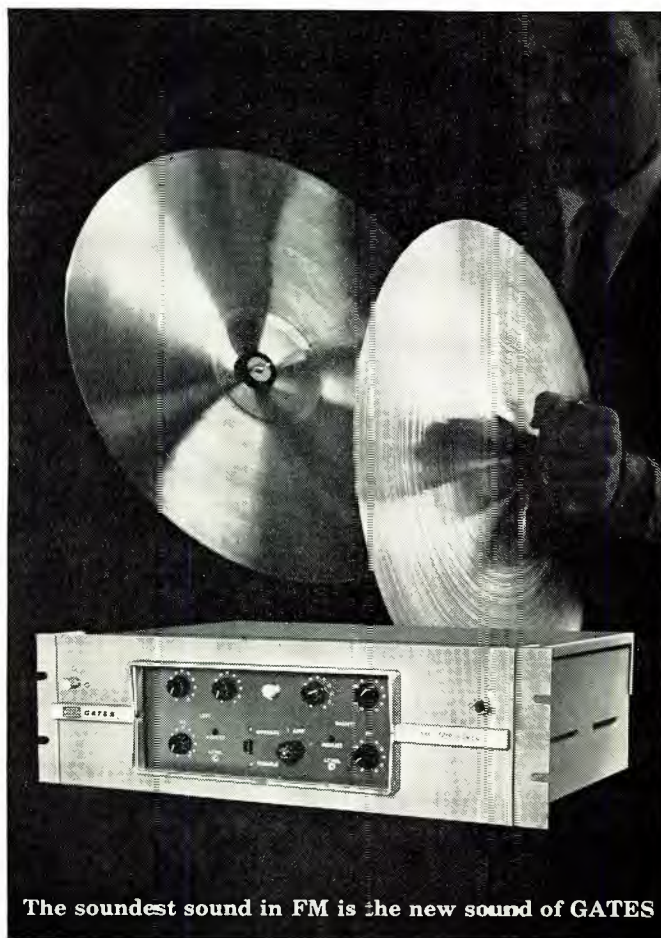
The Top Level is for use between your limiting amplifier and FM transmitter — designed for stereo or monaural use. It is fully transistorized. Gives instantaneous action. Extremely low distortion.

Write for brochure 168 and NAB engineering paper.



GATES RADIO COMPANY • QUINCY, ILLINOIS 62302 U.S.A.

A subsidiary of Harris-Intertype Corporation



The soundest sound in FM is the new sound of GATES

Circle Item 52 on Tech Data Card

**ANOTHER
LITTLE
BLACK
BOX
FROM**



**FOR COLOR
A NEW
LAP AMPLIFIER**

FEATURES:

- * VELVETY-SMOOTH TRANSITIONS
- * GUARANTEED INHERENT TRACKING
- * HI-PERFORMANCE DA SPECS
- * ELIMINATION OF CLAMPING
- * FAULTLESS COLOR RENDITION
- * IDEAL UNIT FOR COLOR SWITCHING SYSTEMS
- * DUAL OUTPUTS
- * BRIDGING INPUTS
- * LOCAL AND REMOTE CONTROL
- * ALL SILICON SEMICONDUCTORS
- * UNUSUAL PRICING—\$555.00

**FEATURE FOR FEATURE, THERE IS NOTHING COMPARABLE
ON TODAY'S MARKET.**

FOR MORE INFORMATION
CALL OR WRITE

APPLIED ELECTRO MECHANICS, INC.
2350 Duke Street
Alexandria, Va. 22314
703-548-2166

Circle Item 54 on Tech Data Card

MOBILE RADIO & COMMUNICATIONS

75. MOSLEY ELECTRONICS — Literature and '66 commercial catalog give details on new Business Band ground-plane antenna, the Dispatcher DP-275.
76. MOTOROLA — Brochure explains how a communications control console improves operation of a network.

POWER DEVICES

77. HEVI-DUTY — Bulletin 7-22 supplies data on line-voltage regulator using saturable-core reactor.
78. ONAN — Offer is reprint of *American Legion Magazine* article entitled, "No Escape From Power Failure Disaster?"
79. TOPAZ — Data sheet is for all-transistor, fully automatic battery selector applicable to two-battery installations.

RADIO & CONTROL ROOM EQUIPMENT

80. BAUER — Brochure tells about new stereo consoles and high-power FM transmitters.
81. CBS LABORATORIES — Literature is on a new FM limiter guaranteed to prevent FM overmodulation and SCA cross-talk without distortion. The unit is available in stereo or mono versions.
82. MOSELY ASSOCIATES — Data sheet outlines properties of SCG-4T Direct FM subcarrier generator, which is of all-solid-state construction.

REFERENCE MATERIALS & SCHOOLS

83. CLEVELAND INSTITUTE OF ELECTRONICS — New pocket-size plastic "Electronics Data Guide" includes formulas and tables for: frequency vs. wave-length, db, length of antennas, and color code.
84. GATES — "The Shape of Broadcasting to Come—1984," by L. J. Cervone, and "New Network Audio Systems Amplifiers," by Wallace Kabrick, are offered.
85. HAYDEN — 64-page catalog lists Hayden and Rider books for engineers, technicians, and management.
86. METRO-TEL — Newsletter analyzes the reliability, economy, and varied uses of tone multiplex communications equipment.

STUDIO & CAMERA EQUIPMENT

87. CLEVELAND ELECTRONICS — A 52-page quick-reference, step-down diecut catalog covers complete information on Vidicon, Plumbicon®, and image-orthicon deflection components. Included are photographs, specifications, technical data, and dimensional drawings.

TELEVISION EQUIPMENT

88. COHU — Specification and data sheets describe 2470 Series miniaturized rack-mounting sync generators, 9000 Series video switching systems, and Model 9830-071 color video encoder.
89. COLORADO VIDEO — Data sheet gives description of Model 302 Video Analyzer, which allows chart recordings to be made of "line-selected" video waveforms.
90. INTERNATIONAL NUCLEAR — Technical data on Model TVM2 video modulator (to convert color receiver to a color monitor) is available.
91. MICRO-LINK SYSTEMS — "Two Channel 2500 Mc Instructional TV Comes to Houston" is the title of literature offered.
92. TELEMATION — Brochure gives information concerning CHROMA-CHANNEL® color-band synthesizer.
93. TV ZOOMAR — Literature describes Model 10X4DC 10-to-1 zoom lens for image-orthicon cameras.
94. VITAL — Data sheets give specifications of Model VI-500 stabilizing amplifier, Model VI-10A video distribution amplifier, and Model VI-20 pulse-distribution amplifier.

TEST EQUIPMENT & INSTRUMENTS

95. BALLANTINE LABORATORIES — A 2-page data sheet is for Model 323 True-rms voltmeter, which is battery- or line-operated, is of all-solid-state construction, and operates over the frequency range 10 Hz to 20 mHz.
96. BARKER & WILLIAMSON — Specifications are detailed in sheet for the Model 210 audio oscillator and the Model 410 distortion meter.
97. SECO ELECTRONICS — Catalog sheet No. 200SS on Model 260 transistor analyzer and Model 240 SCR analyzer is offered. ▲

**KEEP TOMORROW'S
NEEDS IN MIND
TODAY WITH BELAR**



**ADD-ON
MONITOR
SYSTEM**



The Belar ADD-ON MONITORING SYSTEM allows the broadcaster to fulfill his monitoring requirements as the needs arise. The basic unit is the FMM-1 Frequency and Modulation Monitor for monaural use, and when requirements call for SCA, add the plug in SCAM-1 SCA unit. For stereo the FMS-1 Stereo unit completes the system.

Today's monitoring requirements make this system a must.

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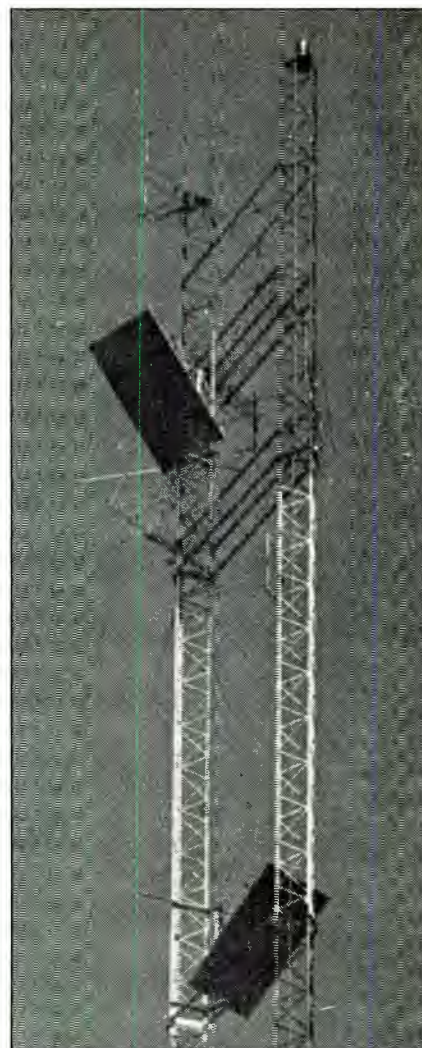
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The classified columns are not open to the advertising of any broadcast equipment or supplies regularly produced by manufacturers unless the equipment is used and no longer owned by the manufacturer. Display advertising must be purchased in such cases.

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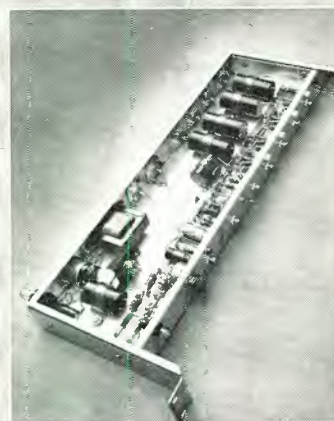
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