

# Broadcast Engineering

the technical journal of the broadcast-communication's industry



A HOWARD W. SAMS PUBLICATION

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***A new day in  
cablecasting***

page 26

Cablecasting guidelines  
Cablecasting equipment  
Broadcast buyers guide

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# Broadcast Engineering

The technical journal of the broadcast-communications industry

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### ABOUT THE COVER

The cover for this CATV origination issue was taken in the studio at Midway Cable Television Company in Kansas City, Kansas. They may have one of the only women camera operators. See page 26 for origination introduction.

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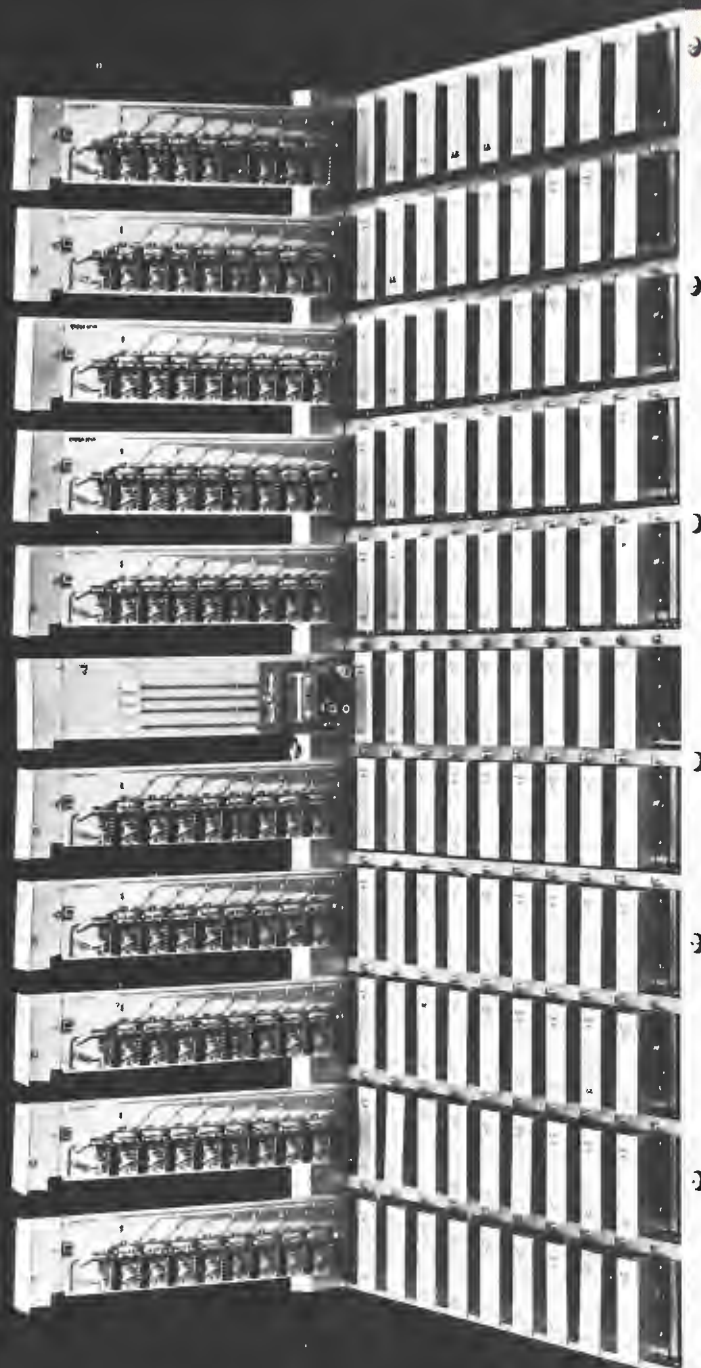
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# DIRECT CURRENT FROM D. C.

June, 1970

By Howard T. Head

## Commission to Crack Down on AM Overmodulation

The Commission's engineers are becoming increasingly disturbed by recent instances where AM stations have installed new transmitters rated at 5 kW RF power output but having 10 kW modulation capability. These transmitters are being sold by at least two of the major AM transmitter manufacturers.

The principal selling point of these transmitters is that they permit positive modulation levels will in excess of 100 percent, with one manufacturer claiming the capability of achieving 170 percent positive modulation. The present AM Technical Standards place no limit on positive modulation peaks, although modulation may not exceed 100 percent in the negative direction.

The Commission's engineers are concerned with the audio distortion and carrier shift, as well as interference to other stations, which occur under overmodulation conditions. The transmitter manufacturers insist, however, that these can be held within limits for very high modulation percentages, a nice trick if it can be done without repealing some fundamental physical laws.

The Commission is convinced that the only way to solve the problem is to reimpose an upper limit on positive modulation peaks, and a proposal to this effect is expected from the Commission shortly. Such a requirement was in effect until 1953 when it was eliminated to permit small amounts of overmodulation, but the present trend to excessive modulation levels has brought about the current re-examination of the problem.

## Requirements Relaxed for AM Changes

As predicted (April '70 D.C.), the Commission has relaxed the requirements of the AM "freeze" to expedite the processing of applications for improvement and relocation of existing AM transmitting facilities. Under the new Rules, the Commission is treating as a "minor" change any application, such as a request for a new transmitter site, which does not involve changes in frequency, power, station location, or an increase in hours of operation. Under the new ruling, "minor" changes will also include such things as changes in directional antenna patterns and changes from directional to non-directional operation.

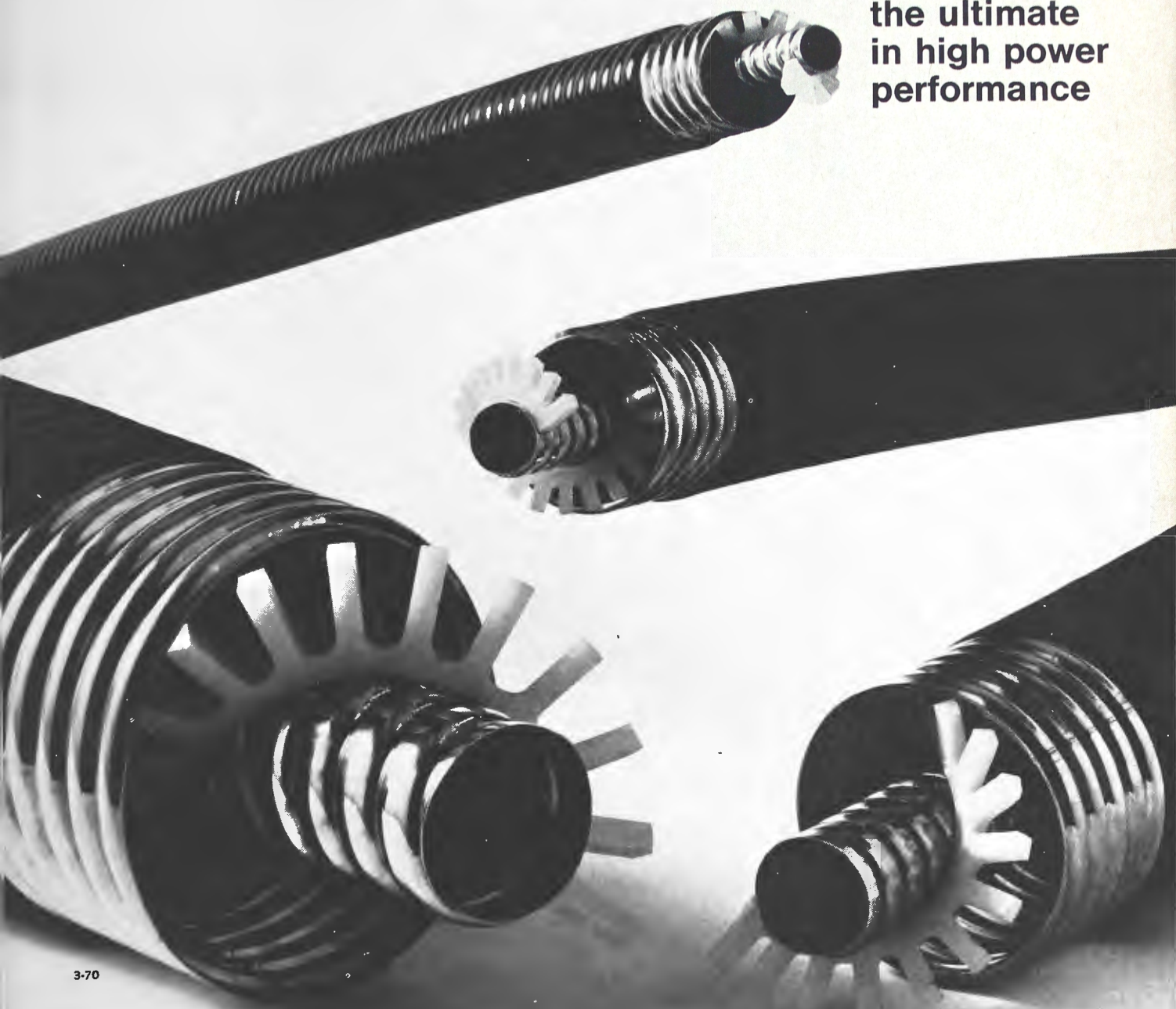
In addition to providing for the processing of applications for these changes, the new ruling also provides for expedited consideration of receipt, ordinarily avoiding the long delays which for many years have been associated with applications for "major" changes.

In other respects, the AM "freeze" continues to be solid. The Commission is returning without acceptance large numbers of applications

(Continued on page 6)

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for new stations, power increases, and frequency changes which request a waiver of the current freeze rules.

#### EIA to Test New Color Reference Signal

A Subcommittee of the Electronic Industries Association (EIA) is planning field tests of a new color vertical interval reference (VIR) signal to aid in maintaining color uniformity in network signal transmissions, and in determining sources of color distortion between the network feedpoint and the individual stations' transmitter outputs. The proposed new signal, which will appear in line 20, will contain chrominance, luminance, black, and blanking reference levels, together with 24 usec of the 3.58 MHz color subcarrier at zero phase.

The signal is to be first tested on the New York City stations, including tests to determine the relative utility of including the reference signal in both fields of the picture or in Field 1 alone. If the New York tests are successful, the signal will then be supplied to all network affiliates with instructions for its use. A special article in the July issue of BROADCAST ENGINEERING will supply full details for our readers.

Because line 20 is technically in the vertical blanking interval, the blanking interval, the test signal would not be passed by some makes of processing amplifiers. However, tests of a wide variety of processing amplifiers have shown that they may be readily modified to pass the reference signal in line 20 as part of the picture signal, which does not begin until line 22.

#### Short Circuits

The Commission has once again criticized a CATV system in the San Diego, California area for inadequate efforts to eliminate signal degradation . . . ITFS stations have been authorized to use data transmission on response stations for such purposes as testing and scoring of tests . . . CATV systems in Frankfort, Kentucky have been denied requests for program exclusivity waivers, provided the television stations install 100 watt translators to fill in areas of inadequate service from the main stations . . . As predicted last month, the Commission has refused to grant further waivers of the local oscillator radiation requirement for UHF television tuners--deadline date for the new 350 uv/m requirement remains July 31, 1970 . . . The Commission's Field Engineering Bureau is stepping up efforts to minimize cheating among candidates for first-class operator examinations . . . Annual directional proofs of performance for AM remote-control renewal applications must now include non-directional as well as directional measurements--five points minimum per radial.

The Commission has authorized two one-watt VHF translators to operate from the same site on adjacent channels (10 and 11), multiplexing into a common antenna . . . The Commission has declined to permit renewals of provisional third-class operator certificates, now valid for a period of twelve months only . . . The Commission has confirmed its establishment of a Local Distribution Service (LDS) for CATV systems and has proposed to expand both the LDS and the CARS to include a new modulation technique known as Filtered Pulse Width Modulation (FPWM).

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| Cable Capacitance   | 275 pF                                      |
| DC Resistance       | 800 ohms approx.                            |
| Inductance          | 550 mH approx.                              |
| Channel Balance     | within 2 dB                                 |
| Stylus Tip          | 0.7 mil Spherical                           |
| Tracking Force      | 3-7 grams                                   |
| Cartridge Weight    | 5 grams                                     |
| Mounting Dimensions | $\frac{1}{16}$ " to $\frac{1}{2}$ " centers |

For complete information and specifications write Stanton Magnetics, Inc., Terminal Drive, Plainview, L.I., New York 11803



Scott Muni  
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## LETTERS TO THE EDITOR

### NAB Gives Citation To Gulf Coast Broadcasters

Our thanks must go to the NAB committee that chose to honor WLOX and a host of other Gulf Coast broadcasters for their service in the public interest before, during and after hurricane Camille hurried itself inland last fall.

After his speech on emergency broadcasting, Ray Butterfield of WLOX was presented a special citation of recognition for the broadcasters of the Gulf Coast. The citation reads:

**For their outstanding service in a time of great tragedy to the citizens of their states . . .**

**For their operation of the emer-**

**gency broadcast system during the hurricane Camille at the risk of their lives . . .**

**These dedicated broadcasters served the public by sounding the alarm, broadcasting emergency messages, and they helped bring order out of chaos.**

**This citation is presented with admiration and respect by the members of the National Association of Broadcasters.**

In the July issue of Broadcast Engineering, we will bring to our readers the suggestions that Ray Butterfield has presented on emergency broadcasting.

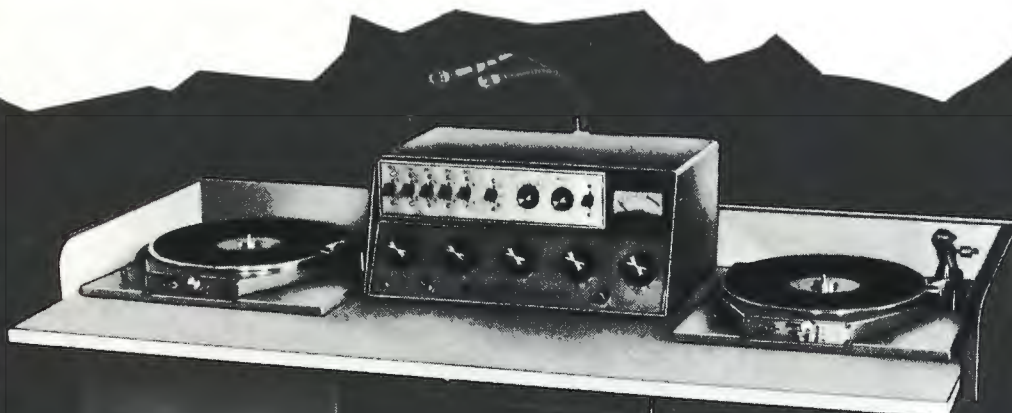


Vince Wasilewski (left) presents citation to Ray Butterfield.



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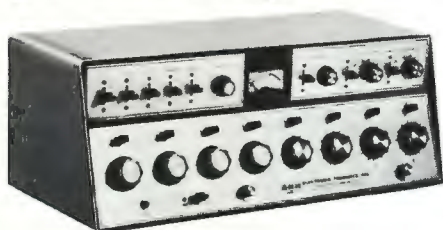
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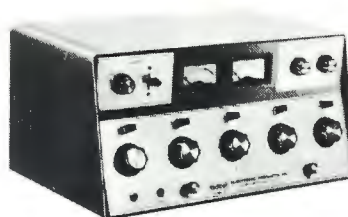
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## LETTERS TO THE EDITOR

### Engineer Steamed Over FCC Exam

Dear Editor:

In recent months (BE February 1970) there have been some discussion on preparation of new exams for the FCC first class radio-telephone operators license. Having recently passed the exams now existing, I'd like to offer a comment or two on their quality.

The present system does not adequately test an applicant for the qualifications necessary in day-to-day operations in a modern broadcast plant, particularly TV. This is quite obvious since very few of the questions I answered on the exam pertain to my everyday duties as a TV engineer. There was a total of only 5 or 6 questions on TV, and not one on color, the most technically complicated requirement! To cite further, the transistor theory questions are hopelessly inadequate, since they do not reflect modern design practice. Of course, there are no questions on IC's as IC's were not even conceived when these tests were written. The circuits which do predominate are tube circuits, nowadays found only in transmitters. It's nice to understand these circuits, but they're really not that hard, and the level of the design concepts can hardly hold a candle to a state of the art video-proc-amp or color encoder.

There have been numerous complaints against the "90-day-wonder" schools and courses geared to rote memorization of test questions. I won't argue the pro's and con's of these schools. Their products speak for themselves. The real truth is that these practices will never be curbed and 90-day wonders will not disappear until some appropriate taxpayer's employees in DC get with it and put some real teeth into these tests. And while they're at it, why not require periodic re-examination for our older license holders who

have fallen behind the times. Times change, and awareness must follow to stave off obsolescence. Proficiency must be maintained and should be able to be demonstrated. There are many problems in today's world, and it may be said by some that the above gripes are relatively minor. But that doesn't make them unimportant, or justify their continuing existence. The American citizen has to tolerate too much mediocrity these days, and it's about time someone set out to eliminate it. Cleaning up this "soft" license joke will be one step in that direction.

**Walter Jung**  
Station WMPB  
Owings Mills, Md.

### KULE Keeps It Clean

Dear Editor:

In your March, 1970 issue, I think Roy Carter points out some very wise facts to take into consideration.

If I may, I would like to add this suggestion to those announcers who don't like to get their hands full of ink when changing the teletype ribbon: Invest in a pair of rubber gloves. They are flexible enough to allow the ribbon to be changed without the mess. One thing to keep in mind, though, we rely heavily upon our sense of touch while performing this task, so it may take a little practice to get good at it.

**Terry DeLeo**  
Chief Engineer  
KULE Radio  
Ephrata, Wash.

### To Fine Or Criticize— Who Needs It?

Dear Editor:

In response to your recent editorial on fines for engineers I would like to make a few statements in behalf of the chief engineer or engineers.

In the first place most engineers work at least a 50-hour—6 day week. Not counted is the 18-hour a day—7 days a week standby time and field measurements, etc. on his day off.

After 22 years in Broadcasting, of which 12 years as chief AM-FM-

(Continued on page 12)

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As you know, it generally takes two people to run a proof, unless the person running the proof has four arms and four eyes. Management will not supply the extra help necessary to run proofs or anything else. The paper hangers they hire are not generally used in a technical sense.

So, fine the people who are responsible not the poor chief engineer.

**Name Withheld  
By Request**

**Dear Engineer:**

I think **Broadcast Engineering** has made it clear in its editorial columns during recent months that: (1) the Rules do not allow engineering fines; (2) that engineers and technicians will make honest mistakes (especially when engineering is understaffed and overworked); (3) that

indiscriminate fining is insupportable in any case; and (4) that station fines indicate a lack of communications and an understanding of the Rules.

As recently as an editorial item added to the end of the NAB convention roundup (May issue), **Broadcast Engineering** made this statement; "But the best (50 years of broadcasting. The best is yet to come.) might mean that we offer more association sponsored seminars, listen to their (engineers) problems, and actively work to attract new blood and provide whatever it takes to keep them."

The fact that you did not choose to have your name printed indicates the condition of communications within your station. Others, for various reasons, have made similar comments and signed their names.

Most of the engineers I know continually seek to raise the technical standards of their staff. But there are those who detract from the general excellence of the broadcast engineering ranks. And it is for this negligent minority that such suggestions as fines are made.

Doubtless, there are managers and owners who have been stung by fines through engineering negligence when there was no good reason for it. You can imagine their reaction toward subsequent chief engineers at their stations.

The ominous shadow that always follows the loaded fining question is made up of (1) who would levy the fine, (2) under what engineering categories would it apply, and (3) how could "fairness" and implied assurances be employed?

Most people would rather avoid the subject because a satisfactory system might never be developed. The questions that keep coming to mind are, why aren't more associations dealing with this is the open at convention time? Is the subject really too explosive? Are communications people failing at their own art?

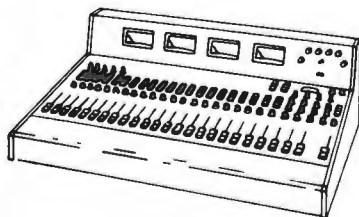
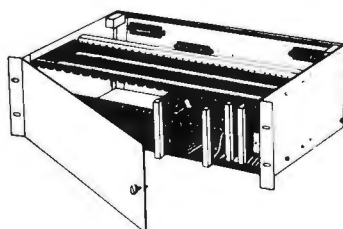
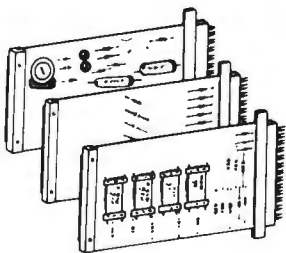
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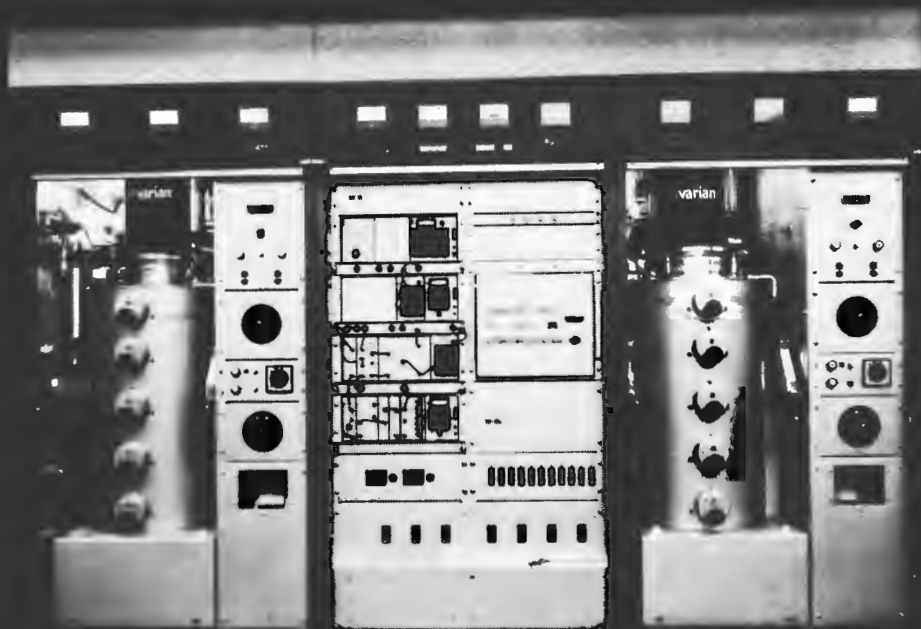
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The extra reliability essential for unattended transmitter operation. That's what the Independent Television Authority (London) saw in Varian's high gain 5-cavity klystrons.

That's why our integral cavity tubes were selected to power ITA's twenty-four transmitters directly from solid state drivers. (Since launching its pioneer UHF color telecasting throughout the UK last November, ITA's network has grown to twelve stations.)

Not that Varian was any stranger to the business. Since building the first UHF TV klystron in 1955, Varian has made more of them—over 1500 in all—than anybody else, anywhere. In doing so, our product has provided more than 1½ million operating hours for over 90% of all UHF TV

stations in the United States. We've backed it with an exclusive 24-hour service capability anywhere in the U.S., and service availability throughout the free world.

And with the strongest, longest guarantee in the business.

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palo alto tube  
division

weren't for the cooperation of equipment manufacturers. While most of the articles appearing in **Broadcast Engineering** are written by station engineers and consulting engineers, we do accept articles from design engineers. In some cases, they are the best source for information.

In the April, 1970 issue of **BE**, we ran an article "Vertical Interval Signal Applications" without giving credit to Telemation for supplying much of the information we needed to put this one together. We appreciate their help and take this time to say "Thanks, Telemation".

If there are problems plaguing your operation, drop us a line and we'll pass it along to the manufacturers or on to our readers through this column. Write to: The Editor, **Broadcast Engineering**, 1014 Wyandotte, Kansas City, Mo. 64105.

### Help Needed

The following is a letter received by **Broadcast Engineering** just prior to press time. We think there are a great many suggestions our readers will want to pass along to Mr. Morales. Send your replies to Nuvue Cablevision, Inc., Room 24, Lopez

**Bldg. No. 1, Session Road, Baguio City B-202, Philippines; or you can send them to The Editor, Broadcast Engineering, 1014 Wyandotte, Kansas City, Mo. 64105.**

#### Dear Editor:

This letter intends to inform you as well as to acquire some ideas or comments you may give to help CATV industry in the Philippines. Being the very first company to start this system in our country, there are still policies which we have initiated temporarily subject to change. We have encountered and still encountering problems in some aspects from our subscribers. Below are the outlines of terms and conditions re CATV installation and also some inquiries related to it:

1. Prior to the installation of our facilities, the one time initial connection charge of \$6.50 shall be paid.
2. A monthly service charge of \$3.25 will be paid in advance within the first seven days of every month.
3. Duly authorized representatives of the company shall be permitted to enter the premises for inspection purposed during

reasonable hours on business days.

4. The company shall not be responsible for the interruption of service due to causes beyond its control.
5. The company reserves the right to discontinue service due to arrears (2 months) in the payment of charges or for failure to comply with these terms and conditions.

Lately we issued additional policies covering the following:

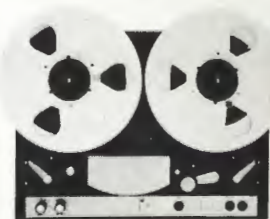
1. Subscribers requesting disconnection for some reasons and wishes to be re-connected after such time of absence are being charged with another installation fee of \$6.50. In this particular case, the subscriber refuses to accept the terms. Could we get your comments about this?
2. Subscribers transferring to another location are being charged with a transfer fee of \$2.17, corresponding to 1/3 of the initial installation charge covering the cost of labor and extra materials used.
3. For stolen TV sets, we are



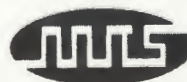
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The Conrac CYA17 and CYB17 models, by far the most widely used color monitors in the field, will still out perform anything except the new RHA. But the kinescopes don't match the new ones. You could junk them and buy our new models. Maybe you should. But that might not necessarily serve you best. Conrac has a practical answer. Modernization. Now you can return your CYA17 or CYB17 to Conrac for a complete overhaul. Not only do you get a new 90-degree kinescope but it uses the same controlled color-matched phosphor as our RHA and KHA models. For only \$800 total, you also get extensive mechanical and electronic modifications and a full one year warranty. Ask for a return authorization today.

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# can a "teetotaler" be loaded?

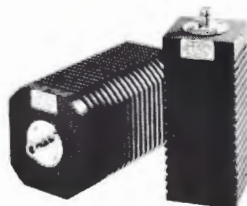


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giving a subscriber 15 days to purchase a new one and start billing them again at the time of reconnection. Some subscribers refused to pay the months not consumed by him at the time when his/her TV set was stolen. Please give your honest suggestion and solution to this problem.

4. Some demanding subscribers asked for rebates on times when the system is undertaking minor repairs or even during city power failure. Last time a big fire hit the main commercial center of the city and damaged practically 1/2 of our subscribers by not receiving any signal. Is it advisable to deduct the unused days from customers upon demand?
5. Per individual connection we have appropriated 200 feet of cable. What are your normal charges if exceeding 200 feet of RG-59 cable is used? At present, we are charging \$3.30 per 100 feet additional cable.
6. For an additional TV set a connection fee of \$2.17 plus the monthly rate of \$0.66 per TV set is charged to the customer. This privilege is extended only to immediate families of a certain subscriber. Can we extend the same benefit to others requesting the same?

We forgot to mention that we have printed a coupon book in 12 monthly subscriptions given to customers upon installation. This is to enable them to make their monthly payments direct to the office, so as not to utilize the services of collectors. Arrears of two months is subject for disconnection.

At present these are the running procedures observed in the company and so far we received good results except for the problems stated herein. We would appreciate your comments and solutions you may suggest to improve the CATV system in our city.

**Fernando C. Morales**  
Resident Manager  
Philippines

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# Gute kamera



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## NAB Convention Report On Automation

**Broadcast Engineering's automation editor, Morris Courtright, made the rounds of the exhibit booths of the NAB convention in April. This is his report on the state of broadcast automation for the convention and the first half of 1970.**

Flying into Chicago for the NAB conference was not only a highly speculative experience for many, but also provided an apt demonstration of automation. The airlines automated reservation systems and computer generated flight schedule displays were functioning flawlessly, but actual air service was a bit uncertain. It seems that smoothly functioning computers can not, by themselves, keep aircraft flying. People are still needed! Similarly in broadcast automation, no matter how sophisticated or efficient the equipment, people "keep the program on the air". Automation may change the type of people needed, but it will not replace them.

The exhibit halls contained many examples of automation's growth and the proliferation of automation equipment. Ranging from a small \$6,000 program automation system through the "total" station automation equipment with tags of many thousands of dollars to a time share computer network for automating a multitude of stations simultaneously, the paths to station automation are rapidly becoming more diverse and complex. They all promise wondrous improvement and the station that installs any one of the systems will note a tremendous change in their operation. Whether the change is for the good, or otherwise, depends on adequate planning, realistic expectations of system capability, and proper training of people to operate the system.

Among the many systems shown, perhaps the newest concept for general broadcast use were the time-

sharing systems of Sarkes-Tarzian and General Electric. Both use a small process control computer, Honeywell 516 and GE PAC-30 respectively, at the station for local control while communicating with a remotely located large scale computer. The large central computer, which may be in a different city, handles the data processing tasks for a number of stations simultaneously.

Security is provided so that data files are confidential and can be accessed only by the proper station. In use, buy information is entered into a terminal device such as a CRT or teletype and the computer checks availabilities, adjacencies, rates, etc. and confirms the order. If acceptable, the station file is updated to produce a new log and customer transaction records.

Periodically the local computer is updated with current log information to control the engineering switching. These systems provide a wide variety of reports such as availability listings, costs, ratings, demographics and sponsor adjacency. Both produce "verified" program logs, but, as in almost all automation systems, the only thing verified is what should have been aired, not what was actually aired if the wrong tape or film had been loaded. Systems of this size, complexity and cost are primarily aimed at, and considered only by, television stations.

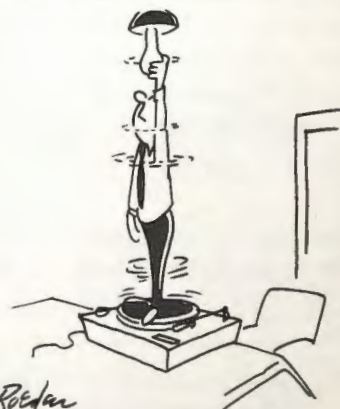
Not to be overlooked on the automation scene is the video switchers and associated gear of Central Dynamics. While not directly in the "computer" business, Central Dynamics is a forerunner in television automation and their equipment is designed with complete automation in mind and will interface with most standard data processing equipment.

Gates Radio showed a relatively

complete automation system for radio. This is one that uses codes on the cue track to actually verify what was aired and produce an accurate, verified program log automatically. The Moseley automatic transmitter logging system is part of the Gates system, and once programmed and started the system will handle all engineering switching, program logging and transmitter logging untouched by human hands. One apparent drawback is the use of cartridges so that a cue track is available for the coded information. Until a three track tape machine is available, many, many cartridges will be needed. ASCII code is used by Gates, which allows for direct data interchange with commercial data processing equipment for traffic and accounting purposes.

IGM came on strong with their punch card controlled system and the new Instacart and Random Select Memory. Forty-eight cartridges may be randomly programmed and four options of single spot, double spot, or spots with breakers assigned to each, also randomly. IGM is also in the process of breaking a software controlled automation system using a standard PDP-12 computer.

Schafer has changed the physical appearance of their broadcast computer by doing away with the desk-like console and placing the processing and memory units in a standard 19 inch rack. The CLEAR language used in the system uses terms more familiar to the broadcaster than the data processor. Use of software for information input and control creates a very flexible system. For example, the 48 event, 48 format capacity of the system



"They won't replace me with Automation!"

would require 2,304 thumbwheel switches to duplicate with hardware programming.

Less sophisticated systems (and priced accordingly) aimed only at the task of program automation are those of MaCarTa, AutoGram (Collins) and Broadcast Products. MaCarTa uses color coded metal plates for program control, Broadcast Products retains the thumbwheel switches and AutoGram uses a combination of pin matrix and rotating disk. Relatively simple, the program automation system makes no attempt to process data. They are designed to produce a consistent on-air sound while minimizing the dependency on air people and freeing them for more creative effort. These systems appeal strongly to the local market radio station.

The question faced by the individual station contemplating automation is not just a matter of which systems to buy, but primarily which concept of operations to pursue. The first decision is what to automate; the traffic and accounting functions, engineering switching, program logging, transmitter logging, or some combination of functions. Automating all of these functions may be quite desirable, but it can also be quite expensive.

Automating the engineering switching is a task for process control computer or simple program automation system. The data processing tasks of traffic and accounting can be performed by most standard commercial computer equipment. When the functions are combined, interface problems arise which rapidly escalate the complexity of the system, and its attendant cost.

The choice of method to accomplish the desired automation may or may not be compatible with automation of other functions at some later date, unless a wise choice is made at the beginning. Most of all, be realistic. Is it necessary to automate your entire operation, or just certain portions of it? The equipment is available, and the proper choice can be the best thing that ever happened to your station.

**Broadcast  
Buyer's Guide  
Begins On Page 52**

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(Continued from page 19)

## Commission Sets New Policy For AM Major, Minor Changes

The Commission has issued a new policy statement on the classification of standard broadcast applications for major and minor changes. These classifications appear in the Rules and in Section 309 of the Communications Act.

According to Section 309, a 30-day holding period is required for major change applications and for petitions against these applications. Moreover, major change applicants must submit proof of publication and, in some cases, are responsible for completing the programming portions of the application forms. These requirements generally do not apply to minor change applicants.

Section 1.571(a)(1) of the Rules defines major change applications as those involving changes in frequen-

cy, power, hours of operation, and station location. This section further provides that applications for other types of changes may, upon notification to the applicant, be treated as major change applications. Most applications treated as major under this proviso, have been proposals to change the radiation pattern. Changes in transmitter site, antenna height, and MEOV's have been consistently classified as minor.

Pattern change applications have been classified as major or minor on an ad hoc basis. With the advent of the AM application "freeze", these rulings became crucial. Because of interference and city coverage constraints in the AM band, the magnitude of change resulting from applications of this type is

small, irrespective of how they are classified.

The position of the Commission is that, "After careful review of this matter, we have concluded that henceforth applications for changes in AM radiation patterns, including those for change from directional to non-directional operation and vice versa, will usually be considered as minor change proposals, unless associated with changes in frequency, power, hours of operation, or station location. In addition, and in keeping with the original intent of Section 1.571 of the rules, applications for changes in hours of operation not involving new nighttime propagation studies will also be considered as minor change proposals.

"It is recognized that proposed changes in site or radiation pattern might, in rare instances, involve a combination of factors which would prompt us to treat them as major change applications rather than minor change applications. We feel that the public interest requires that our present discretion be preserved in this regard. For this reason, the proviso language appearing in Section 1.571(a)(1) has been retained.

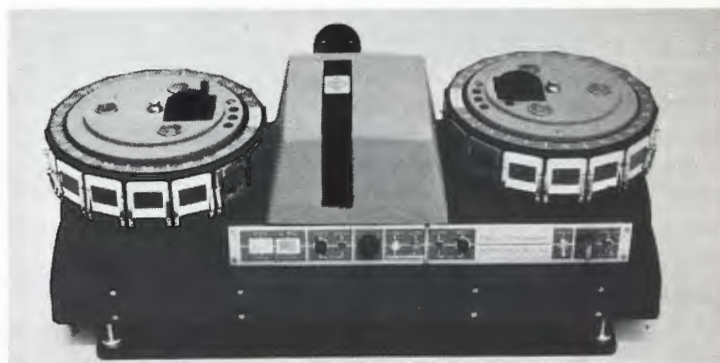
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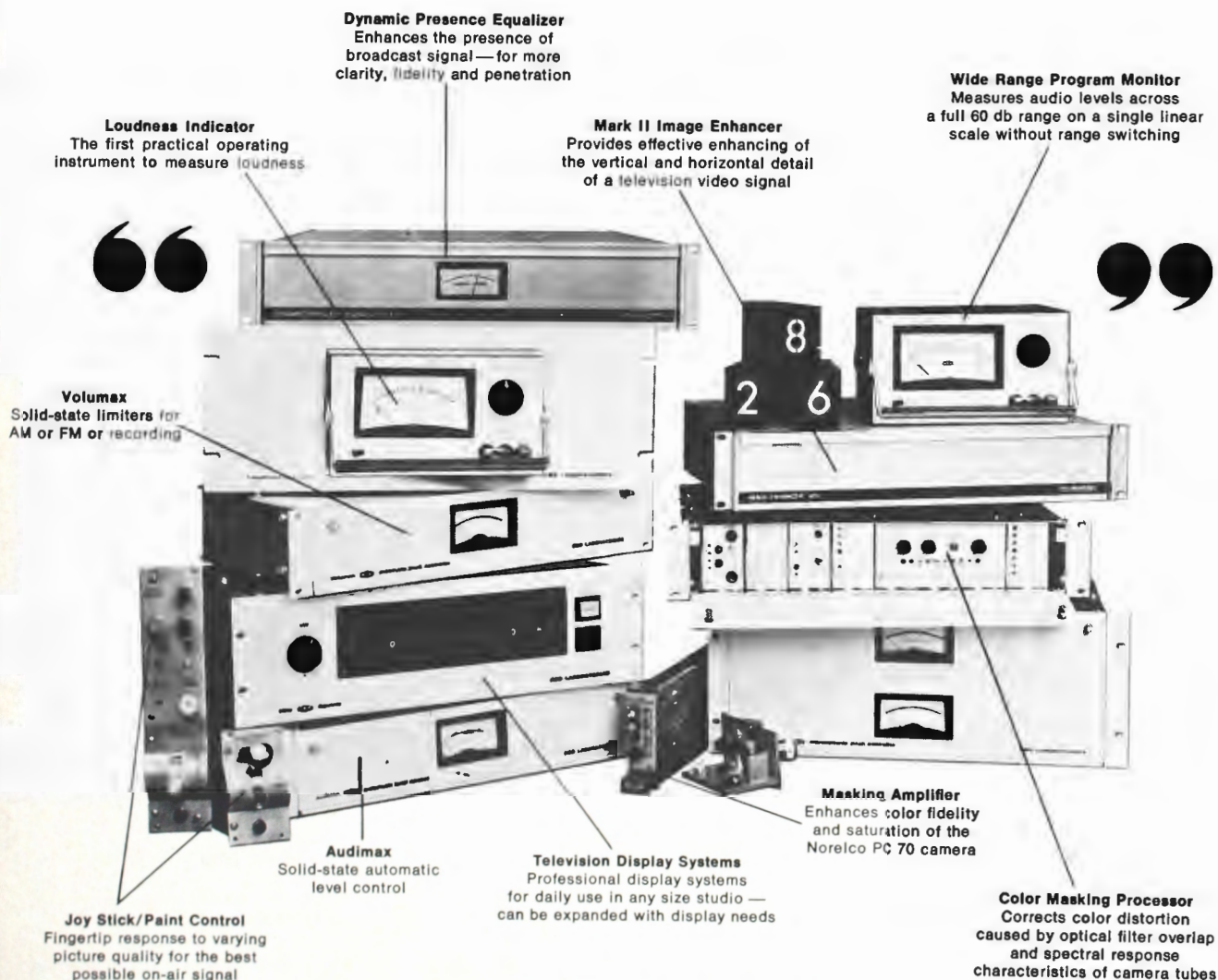
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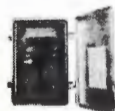


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## Network Coded Transmissions Approved By Commission

Late in April the Commission adopted a Report and Order in Docket 18605, which amended Part 73 of its rules and regulations to permit the inclusion in television picture transmissions of patterns containing coded information which, when intercepted and decoded by suitable apparatus, can be used for the electronic identification of a program segment including the code. They found that such a system would benefit many entries involved in television broadcasting, and that transmission of the coded patterns would not result in television picture degradation.

The comments in this proceeding have pointed up a matter that has been of concern to the Commission for some time—the use by networks of certain methods of signalling and cueing which, although intended for use only by networks and their affiliates, nevertheless affect to some extent the quality of broadcast service.

Thus, the Columbia Broadcasting System employs audio tones for signalling purposes, with no attempt to prevent their reception by the general public from its affiliated stations. The National Broadcasting Company momentarily displays a blank square or similar marker in the upper right hand corner of certain television programs to advise affiliates of upcoming intervals during which local announcements may be made. This device is clearly visible to the viewing audience.

While the American Broadcasting Company makes extensive use of signals in the audible range of frequencies, its technique is such that they are not heard by the public. However, the suppression of the tones is achieved by means which restrict, to some degree, the frequency range of aural program material.

Such signals have been employed without permission from the Commission, apparently on the assumption that no specific authorization is required, since the signals, even though they may be received by the general public, are not intended for its use, and their transmission

is only incident to their internal employment by the network.

However, all of these signalling systems cause some degree of degradation of the broadcast signal. Their use is subject to regulation by the Commission under Section 303(e) of the Communications Act of 1934, as amended, which directs the Commission to "Regulate the kind of apparatus to be used with respect to its external effects and the purity and sharpness of emissions from each station and from the apparatus therein". Therefore, signals of the nature described cannot be employed without specific authorization by the Commission.

While the Commission recognizes that the use of signalling within a network is essential to its efficient operation, they are unconvinced at this time that the function cannot be performed practicably by means which will leave broadcast service to the public unimpaired. Accordingly, they expect that any request for an authorization to use such special signals will include a showing that it is infeasible to transmit signals within the network by means which have no detrimental effect on the broadcast service.

## Commission Amends Rule Section 1.955

To reflect certain amendments in the Technical Annex of the Agreement Between the United States and Canada on the "Coordination and Use of Radio Frequencies Above 30 Megacycles per Second", the Commission has amended Section 1.955 of its rules. These amendments indicated the bands in which frequency assignment information and engineering comments on proposed assignments are exchanged.

Because the rule changes involve conformance with a bilateral international agreement and reflect agency procedure and practice, the Commission said Section 552 of the Administrative Procedure Act of 1946 relating to public notice is not applicable.

BROADCAST ENGINEERING

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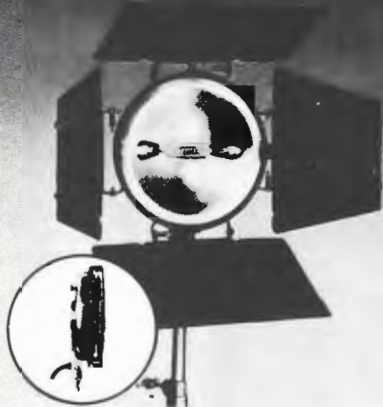
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Circle Number 69 on Reader Reply Card

# Commission Puts Engineering Record Retention At 3 Years

Licensees must now retain applications and other material in their public files for a period of seven years under terms of an amendment to Section 1.526 adopted by the FCC.

The Commission said the 7-year period will eliminate the public retention of unnecessary material, ease the task of broadcasters, while at the same time provide sufficient records available to the general public on which sound presentations can be made.

Provision was made for the disposal, after 3 years, of engineering material of a former mode of operation such as frequency, power, different directional pattern or transmitter location. This permits elimination of sometimes bulky material, the Commission noted. It also specified that "material having a substantial bearing" on claims against the licensee, or Commission investigation or complaints is to be retained until the licensee is notified in writing that it may be discarded, or in private matters, until the issue has been resolved. With regard to material voluntarily retained after required retention period, the rule requires that it be "kept in a form and place convenient to the licensee, and shall be made available to the inquiring party, in good faith and after written request, at a time and place convenient to both the party and the licensee." The changes were adopted in part as requested by CBS.

Section 1.526 was adopted by the Commission on March 31, 1965. It requires broadcast stations and applicants for new stations to keep "local inspection" files containing copies of applications and other material filed with the Commission, and to provide opportunity for public inspection in the local files to the extent it is available for inspection at the Commission's offices in Washington. There was no limitation on time the material should be kept.

Following a request by the National Association of Broadcasters

for reassessment of the local file rule and a suggestion by the NAB for a 3-year retention period, the Commission on July 9, 1969, adopted a rule making notice proposing a 7-year retention period.

Doubleday said the files might well be eliminated and referred to "minimal use" of them. Most of the other parties urged that the retention period be reduced to cover only one license term—three years. RKO supported the 7-year period as a needed improvement over the present unlimited time. It said the public would have an opportunity to examine station activity over a reasonable period of time which is necessary for correct evaluation of trends in licensee's policies and practices. Time-Life said that while the 3-year period would be adequate, the 7-year period would cause no undue burden. CBS regarded a 7-year period as too long and suggested that a shorter period—3 years—be further considered.

A number of parties relying primarily on an NAB survey which showed that in 1967 only 50 of 1,286 stations reported requests for inspection of their public files, contended that the public does not have an interest in the public files.

Palmer said that there have been no requests to see the local files of its TV and radio stations in Des Moines and Cedar Rapids, Iowa, and only requests to see political advertising file (1968 election period) at its Naples, Florida, stations.

ABC and a number of commenting parties asserted the files are voluminous and burdensome. Each of the commenting parties, except from RKO, said the time for material to be kept in public files should be geared to one license renewal period, 3 years, since older material is irrelevant. NAB suggested a 39-month period in place of a 3-year period stating that the most public interest in local file material occurs during the 3-months between the filing of a given renewal application and expiration.

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From an increasingly selective audience there will be a strong demand for talent on both ends of the camera. The challenge for cablecasters will be to meet that demand.

## A New Day in Cablecasting

By Ron Merrell

Black Friday and the CATV freeze came as a hard blow to cable operators and CATV equipment manufacturers on December 13, 1968. There were too many loose ends. The CATV industry had been snowballing and the Commission couldn't quite bring it into focus. Caught in the middle of angry broadcasters and demanding cable operators, the Commission side-tracked the industry until October, 1969.

It was on October 24th that CATV Task Force Chief Sol Schildhouse sent a heatwave of excitement throughout the industry with his announcement of a rulemaking that would end the freeze and bring new meaning to local origination.

This rulemaking called for a new day in cablecasting. It officially begins on January 1, 1971 with an FCC command performance by system operators serving 3,500 or more subscribers, and it may end up as the first real step toward a national CATV network. What does this mean to operators now and in the years to come?

In the beginning, this decision will bring a higher dollars and cents commitment to the operator. In this issue of **Broadcast Engineering** there are articles that describe three levels of commitment to cablecasting through the choice of minimal to medium and sophisticated equipment.

While operators are experimenting with origination systems, the FCC will surely be looking over their shoulder in an effort to clarify

the boundaries of the new requirement for originations "to a significant extent". Actions and reactions by the Commission to programming will be slow in coming. Even with logging requirements, how can they check what is on the line?

But the immediate impact of the program policy is that local municipalities cannot control program content. This means that program content, generally, is open to the imagination of the operators. However, the Commission has not left the door completely open.

Portents of the future are implied in the requirements that equal-time, sponsorship-identification, and the fairness doctrine apply to local originations.

Of course you can't talk about expansion without hitting on the common rough spot in the com-

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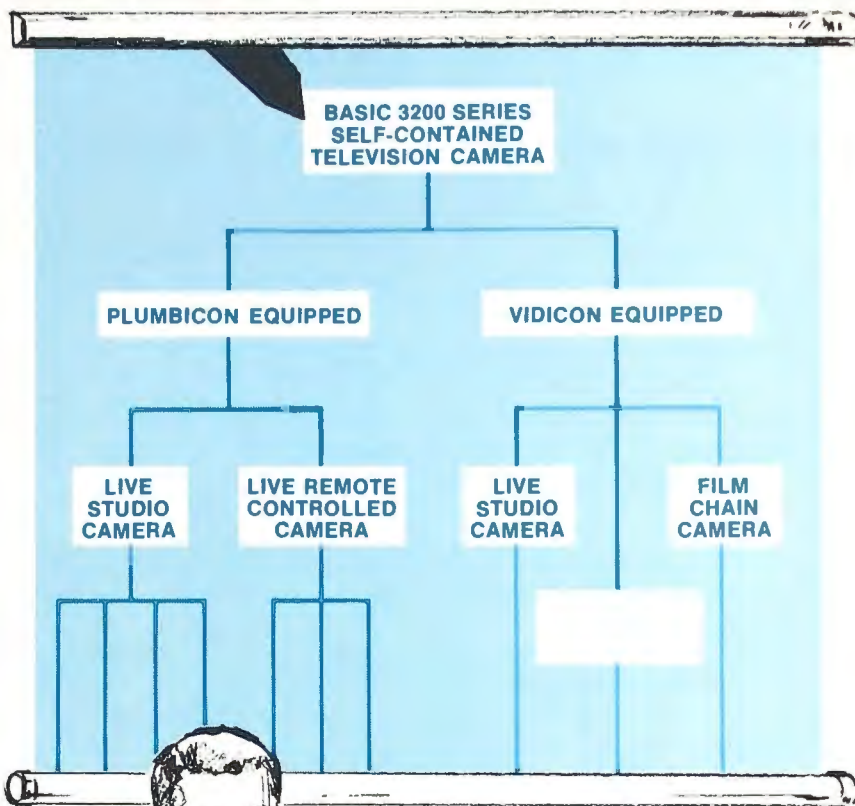
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A plug-in sync generator is available as an option. Or you can select a drive generator (for use from an external sync source) to provide common sync to multiple cameras. It's easier when you start at the top. For complete details contact your nearest Cohu representative or the TV product line manager direct at 714-277-6700, Box 623, San Diego, California 92112, TWX 910-335-1244.

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munications industry — technical manpower. The “rob from Peter to pay Paul” theory of putting properly trained people in key positions will not work for very long. Caught in the middle of this tug-of-war, the engineers and technicians in some areas can expect pay increases as cablecasters and commercial licensees bargain for their talents. This would be to the advantage of no owner or operator.

What is needed by both interest groups is a more concerted effort to affect additions of engineering courses, to include seminars on operation and maintenance, and respect for engineers and technicians as something more than panic depressants or legal guardians.

### Commercials

The new day in cablecasting will include commercials at “natural breaks”. As operators advance from ad cards to slides plus audio and on to film and videotape, these natural breaks will be stretched to the limits of their definitions.

There will be a host of technical areas for the systems to substantially improve. The local merchant who gets a poor initiation to cable advertising due to timing, visuals, down time, roll-overs between slides, tearing, may decide to wait for the system to add the equipment and technicians capable of presenting his (image) message. After all, he may see network and local commercial station ads as a standard.

It was fair for the Commission to permit advertising on the origination channel, but advertising in any medium has always involved additional investments. It would be unrealistic for system operators to assume that only studio equipment purchases are needed.

The cable system can offer new possibilities to a number of sources of untapped would-be advertisers. In this sense, some commercials may even be more effective on a cable system, because the advertiser is seeking to speak directly to people in the immediate vicinity.

### Subscriber Rates

At a time when increasing the gross income to pay for origination and support equipment, it seems likely that subscriber rates will get



Two small viewfinder cameras in use here offer flexibility, but don't expect them to compete with the big cameras and heavy dollies in the studio or on remotes.

the “twice-over”. After all, original cable advertising time rates are substantially lower than commercial rates. In other words, it would take a long time to pay off the equipment needed for a truly comprehensive origination setup if commercials were the only answer.

For the larger systems, an additional 50 cents per month would be a great help. The danger is that as the subscriber rate goes up, the service may be more difficult to sell. Cable signal quality and programming techniques can be the keys to success or the sour notes of failure.

### System Links

Following up on its determination to encourage and even require local organizations, the Commission has moved to make microwave frequencies more freely available to cable systems.

The Commission has authorized the use of Community Antenna Relay Systems (CARS) for the purpose of carrying all types of program originations. These include links between studio and headend, remote pickup, and service from mobile units.

The service permitted by cable systems parallels that now authorized for television station broadcast use. CARS channels in the frequency band from 12.7 to 12.95 GHz are to be employed. Operators are limited to a maximum of three channels.

In addition to this type of operation, the Commission has established a local distribution service

(LDS) operating in the same band as a substitute for trunk cable in underground conduits and on surface poles.

Systems proposing to substitute microwave service for existing cable links will be required to explain their reasons for changing to microwave before the change can be made.

### Looking Ahead

During the 1969 NCTA national convention there was considerable time devoted to initiating the idea of a six channel national hookup. In fact, industry spokesmen proposed a satellite system, thereby offering operators the ultimate challenge.

With CATV multiplex and two-way communications looming on the horizon, the possibilities become even greater.

Off in the wings there are a great many interested parties waiting to see how the NCTA and cable operators act on their commitments in the early 1970's. Among those looking on are the manufacturers. The prospects are healthy, but there are many who are not yet willing to declare themselves.

Meanwhile, if the FCC at any speed responds to control complaints, we may see actions that cut into multiple ownership and a division of interests. The history of the FCC reveals time and again that as they assume regulatory responsibility they weigh everything against the public interest. Sometimes the measures are amazing. The result could be a fourth network.

Despite the bitter arguments, the lobby groups, and the casual pro and con arguments of cross-ownership representatives, despite the prognostications of the industry and equipment manufacturers, the future falls mostly into the hands of the receiving public. There was a time when economists said that supply is based on demand. But there came an awareness in the 1960's that, in fact, supply often preceded demand. The market of the 1970's will make their own demands, and these must be interpreted as public interest.

Over-the-air broadcasters and cablecasters will move on to new and better days so long as public interest prevails over dollar signs.

# What does AEL know about CATV?

# A lot!

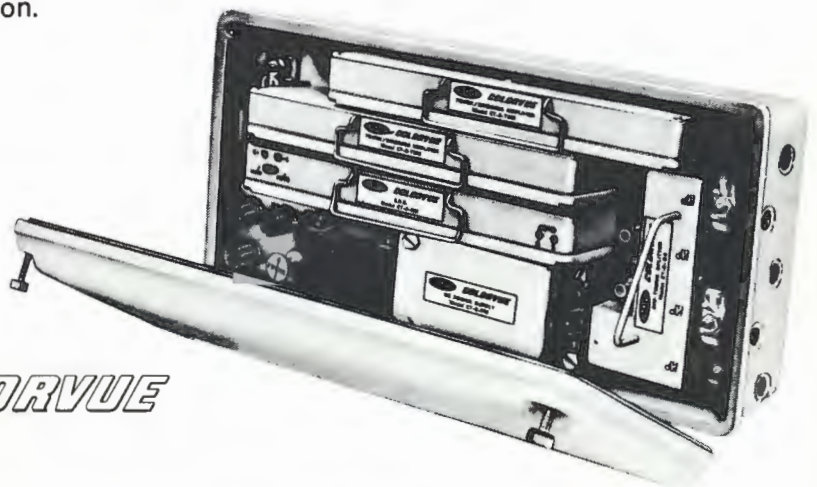
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# Cameras, Switchers, and Monitors for Local Origination

By Charles S. Harris

The author, Charles S. Harris, is technical editor of a group of consumer-oriented electronics magazines. He is also a consulting member of the engineering staff of Leo G. Sands Associates, Inc., where he participated in the design of a large-scale, bidirectional CATV-telecommunications system for serving a city with a population of almost one million. Previously, he held executive posts with Tele-Signal Corp., Metro-Tel Corp., Hammarlund Manufacturing Company and RCA. He is a specialist in the design and application of switching systems and tone signaling and control.

Except for a single viewfinder camera operation, means must be provided in the CATV local program origination studio for switching and monitoring video signals. Such facilities need not be anywhere nearly as elaborate as at network TV studios.

The video signal sources in a CATV local program origination studio can include two or more cameras and videotape recorders, a

flying spot scanner, two or more film camera chains, the output of a microwave link, video pair or coaxial cable which feeds in remotes. pickups.

The studio may be at the head end where the selected or mixed video and audio signals are fed into the cablework through a TV modulator. Here, switching is handled manually when televising or taping a live program. When all programs are films, playbacks of tapes, views of weather instruments, programmed commercials, etc., switching can be automated or controlled from a remote location.

When the head end site is not at a convenient location for a studio, it is possible to locate the studio in town or at or near the point on the trunk line cable ahead of the first bridging amplifier. (See Figure 1). In the former case, the signals from the studio can be transmitted to the head end through a microwave link, or an independent coaxial cable run along the cable route back to the head end. A video pair and an audio program circuit can be leased from the telephone company, or installed by the CATV operator.

The switching and monitoring facilities are located at the studio in either event (Figure 2.) The need

for a transmission path from the studio to the head end, when both are at different locations, is not needed if all programming is recorded on videotape and transmitted later from the head end.

## Cameras

Whereas TV network studios employ expensive image orthicon monochrome cameras and even more expensive color cameras, most CATV operators use vidicon cameras, for monochrome viewing and the new, lower cost color cameras. (Figure 3.)

The standard vidicon camera, designed initially for use in closed circuit TV systems, is also satisfactory for feeding monochrome local-origination programs over a CATV system. It is not necessary to have a professional cameraman to get good quality pictures. The vidicon camera has been developed to a high degree of efficiency by employing solid state components and integrated circuits and is compact and needs little power. It is relatively low in initial cost, requires a minimum of auxiliary equipment and is simple to operate.

One of the outstanding features of the vidicon camera is that its wide latitude of light sensitivity makes it possible to use it under normal room lighting conditions, even as low as 5 foot-candles, for passable picture quality. The 4000 to 1 ratio of the automatic light compensation circuit of some vidicon cameras permits rapid shifting of the camera (e.g. panning) from brightly lighted to dimly lighted scenes without loss of detail, with good grey scale balance, and without causing temporary or permanent damage to the vidicon tube.

The video output can be combined with any audio sources for modulation into any TV channel. In addition to the composite video

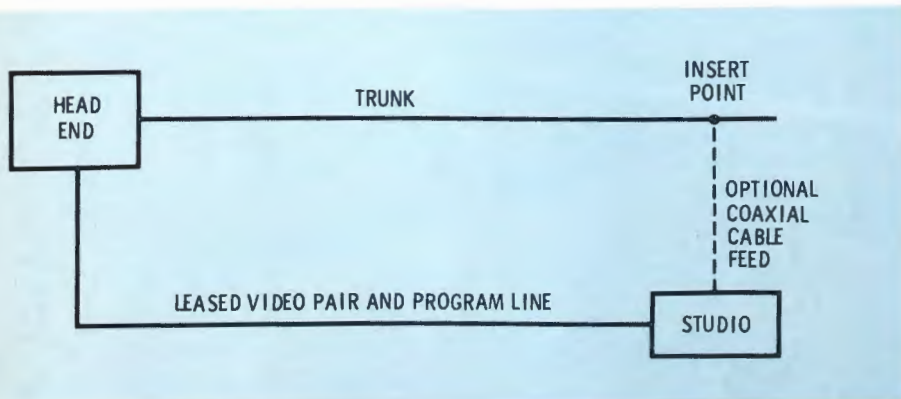
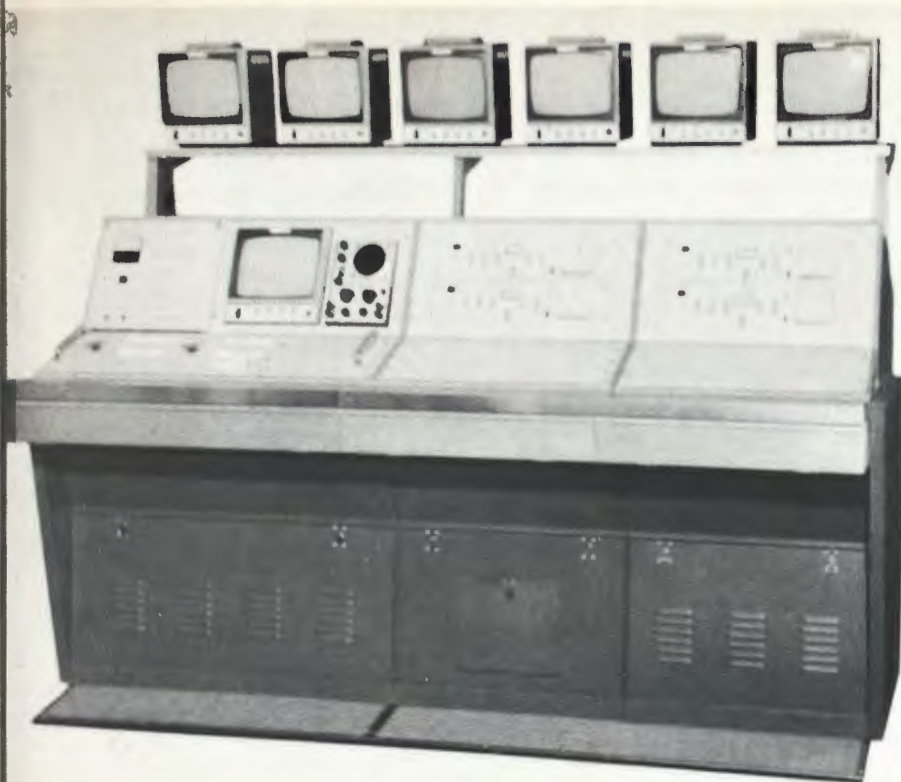


Fig. 1 Tie-in of head end and local program studio.



**Fig. 2** Example of studio control center.

signal output of 1 to 1.5 volts (p-p), an RF signal output of over 30 mV (rms) usually is also available from these cameras. This RF signal can be tuned to any frequency from 54 to 88 MHz (channels 2 to 6) and can be fed directly on to the coax cable without requiring a separate TV modulator, when the next adjacent lower frequency channel is not occupied. However, in most CATV installations, the camera's video output and the audio system output are fed to a TV modulator whose output is the same as that of a TV transmitter.

The scanning system is random interlace, with vertical frequency of 50/60 Hz, locked to the power line, and horizontal frequency of 15.75 KHz, or, at the flick of a switch, the camera can be operated in conjunction with an external sync generator. This is necessary for multi-camera operation where switching must be effected without roll-overs following the switch.

Some vidicon cameras have a built-in viewfinder/monitor mounted directly above the control panel at the rear of the camera, employing a 5-inch picture tube that is protected by safety glass against mechanical damage or shock.

Comparable, simple to operate,

vidicon color cameras are now available to the CATV system operator. They normally employ three vidicons, one each for red, blue, and green components of a scene. Some employ a fourth vidicon for better monochrome quality. Though not quite as sensitive as monochrome cameras, they still give good color rendition with low level lighting (40 to 50 foot candles). Another difference of color cameras is that the output is strictly video, and they



**Fig. 3** Here is an example of one of the many new light weight cameras now available to the cablecaster.

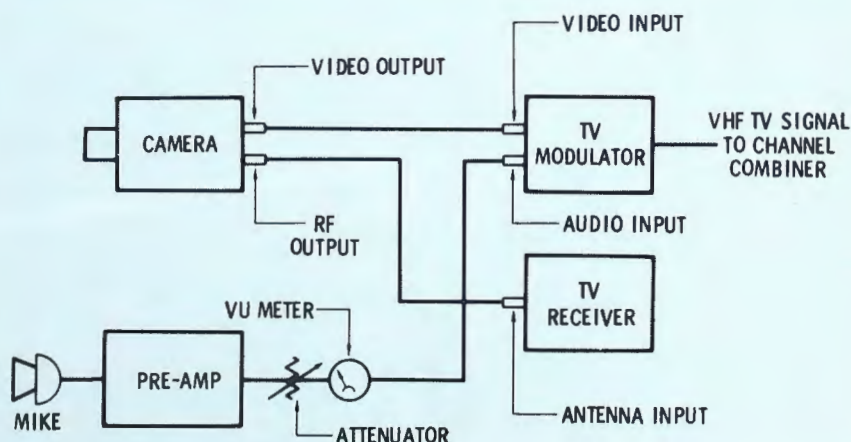


**Fig. 4** Example of color TV modulator with audio and video level controls.

require an audio/video (TV) modulator to feed the CATV system. Modulators are now available which are designed to handle color most effectively (Figure 4.)

### Video Monitors

Many types of video monitors are now available which are designed to accept the video output of a TV camera and other video signal sources. As the block diagram Figure 6 shows, a video moni-



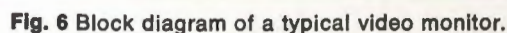
**Fig. 5** Minimal non-switch program origination system.

Nevertheless, for CATV purposes conventional TV receivers with AFC make excellent monitors. A color TV receiver can be used for monitoring both monochrome and color programs.

for each camera and other video sources. When the camera has both video and RF outputs, the video output is fed to the TV modulator, as shown in Figure 5, and the RF output can be fed to a conventional TV receiver type of monitor.

a more elaborate set-up, all monitors can be of the video-only type.

There are various techniques used for switching video circuits. A switcher may run the gamut from simply on-off switches to solid state switching systems with complex timing, blanking and other capabilities. Switching of video signals can be divided into two basic groups: (1) where one or more camera outputs



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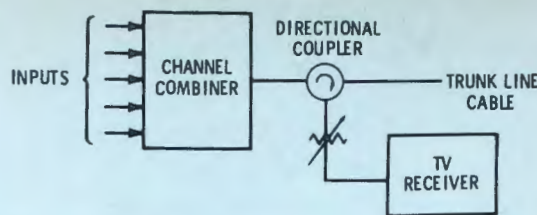
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**Fig. 7** Program monitor off a directional coupler.



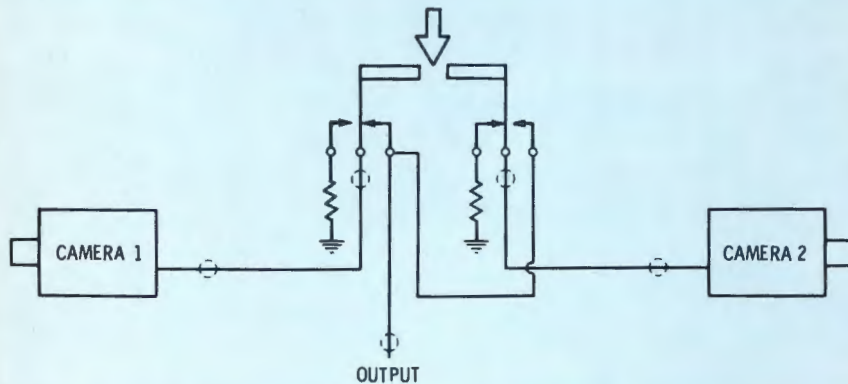
are switched to a single output buss; and (2) where one or more camera outputs are switched to one or more output busses. Each of these groups can be broken down further into several categories, depending on the quality of switching required, and where the switcher is located with respect to the actual control point.

Major factors are whether or not the video signals to be switched are synchronous or non-synchronous as well as the mode of switching and the time it takes to switch from one to another output. The switch non-synchronous signals requires, inherently, a break of the timing pulses, which cannot be corrected or blanked out by special switching techniques. On the other hand, it's possible to switch synchronous signals where a reasonable degree of continuity is maintained during the switch over from one to another signal.

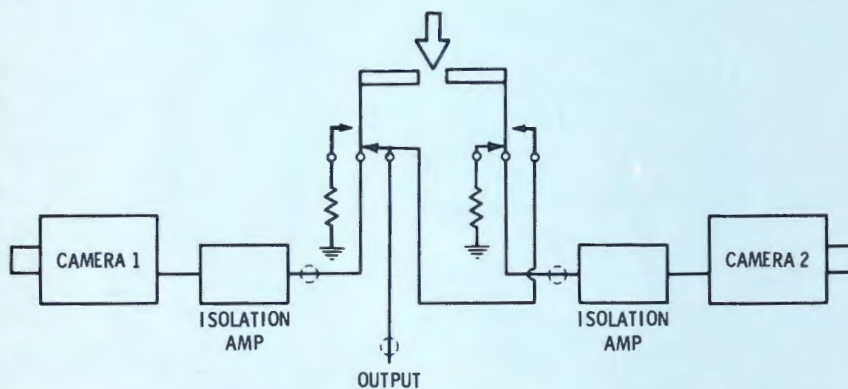
Momentary loss of picture, roll-over streaking, or other picture deformities are the direct result of timing. It is possible to lose sync completely, which will produce a tear or rolling of the newly switched scene. There are three different types of switching available to overcome the timing aspect. These are often referred to as break-before-make, which is the simplest form of switching (also called gap switching), or make-before-break switching (also called lap switching) and vertical interval switching, which is by far the most complex.

Any DPDT, break-before-make switch, preferably of the push-button variety, will perform the simple switching task of satisfactorily transferring non-synchronous signals, since there are no problems of continuity of picture involved. The only consideration is: how much time can be allowed for the transfer to be made before deterioration of the picture destroys the effectiveness of the transfer during the switching operation? In many cases the low cost of the simple switcher, versus the high cost of more sophisticated switching, may seem to offset the advantage gained by the more costly, quality switching (see Figure 8).

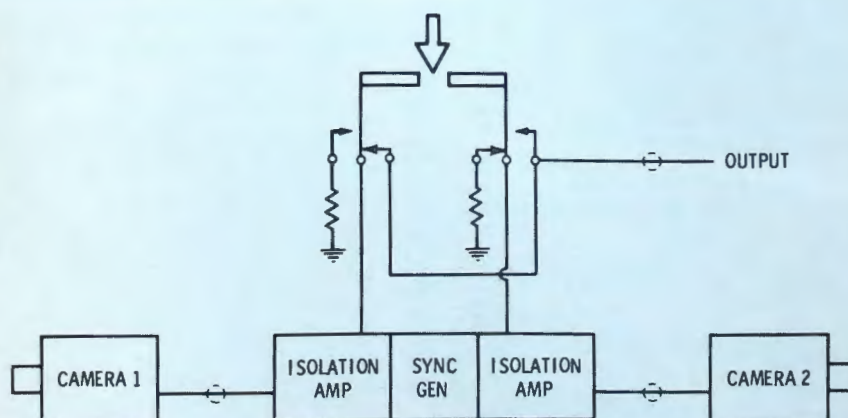
Another switching technique is to have both pictures feed the output buss for a very short period of time before dropping out the orig-



**Fig. 8** Gap switching using make-before-break switch. Camera 1 disconnects before camera 2 connects.



**Fig. 9** Lap switching using break-before-make switch. Camera 2 is connected before camera 1 is disconnected.



**Fig. 10** Vertical interval switching of synchronized cameras.

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inal scene. To do this, essentially the only change that is needed to convert the switcher from the simplest system to this more adaptable one is to change the DPDT switch from break-before-make to just the opposite operation, make-before-break. With this type of operation both signals are present on the output leads or the switch until the break occurs. This is sometimes referred to as lap switching. Two specific advantages are achieved with this type of switching: (a) because there is always a signal on the output buss there is much less possibility of losing sync, and, (b) the transfer is not nearly as noticeable in the monitor. However, to prevent one signal from feeding back into the other, it is necessary to provide isolation between contacts.

The third, and most sophisticated switching system, is one in which the switching circuitry is turned on by the vertical sync component to effect the actual switching during the vertical interval. (Figures 9 and 10). This produces what appears on the monitor as an instantaneous change from one scene to another without an apparent lap or gap or other deterioration of the picture. This is the most costly and sophisticated system because it requires accurate timing. Since this sophistication is a must for distribution type switching, and is more expensive, for the reasons previously mentioned, it is used almost exclusively by broadcasters (see Figure 5).

One of the other conditions affecting the selection of the switcher is the switcher location. This was mentioned before in the introductory remarks. The location of

the switcher complicates the selection of a switcher further and can be divided into two sub-categories: (1) the switcher is part of the local control unit, or: (2) the switcher is located remote from the controls, normally near the monitor, and is controlled remotely. The switches that control the direction of the path the picture is to take in a locally controlled switcher are often mechanically interlocked push-button switches (Figure 13).

To remotely control the switcher, relays, stepping switches, solid state switching or a combination of any of the three may be used to direct the path the picture(s) will take. Normally they are actuated by a simple normally open switch that closes a circuit to permit a control voltage to operate the remote switcher. Remote switchers are quite flexible and are usually adjacent to a monitor point that could be miles away from the switcher. It is possible also to use tone signals in lieu of voltages to effect the remote control of a switcher. Either a single tone for each remote function, or multiple tones in a coding arrangement can be used in remote control tone systems.

Up to this point we have discussed only the picture switching function and have purposely delayed mention of the possible need for simultaneously switching audio as well as the possibility of switching cueing lights and studio lights. Where different cameras are being switched as a common scene with just a single commentary or audio portion, it is not necessary to switch the audio. However, if the switching is to a completely different program, then audio switching is of equal importance to the video.

It is a relatively simple matter to handle audio switching simultaneously. Just double the number of circuits each switch controls. For example, in a simple system utilizing one or two cameras, feeding a single output buss type, the local switcher, instead of using a DPDT push-button switch, can use a 4PDT switch. One of the two pairs of contacts would be used as previously outlined to switch the video and the second pair of contacts would be used to switch the audio. To control a cueing lamp would, of course, require at least one additional SPDT pair of contacts ganged with the others to effect simultaneous switching of picture, audio and cueing. It may be preferable, if available, to use another set of DPDT contacts for the cueing operation.

So far the discussion has been limited to a single local-origin program switching system. Obviously, some CATV system operators will provide more than one local-origin program at the same time (Figure 13). For example, there could be a film on one channel, a weather display on another, a taped show on another, etc.

Separate switching systems could be used for each channel. However, maximum utilization of cameras and other equipment can be made by using a multiple-output switcher. An example is shown in block diagram form in Figure 13.

Many techniques are used besides those discussed here, but the basic principles are the same. It can be expected that CATV switching systems will become more sophisticated and will include faders (Figure 14) and video effect devices, which already are available. ▲



Fig. 11 Example of compact sync generator.



Fig. 12 Simple, compact 4-input switcher.

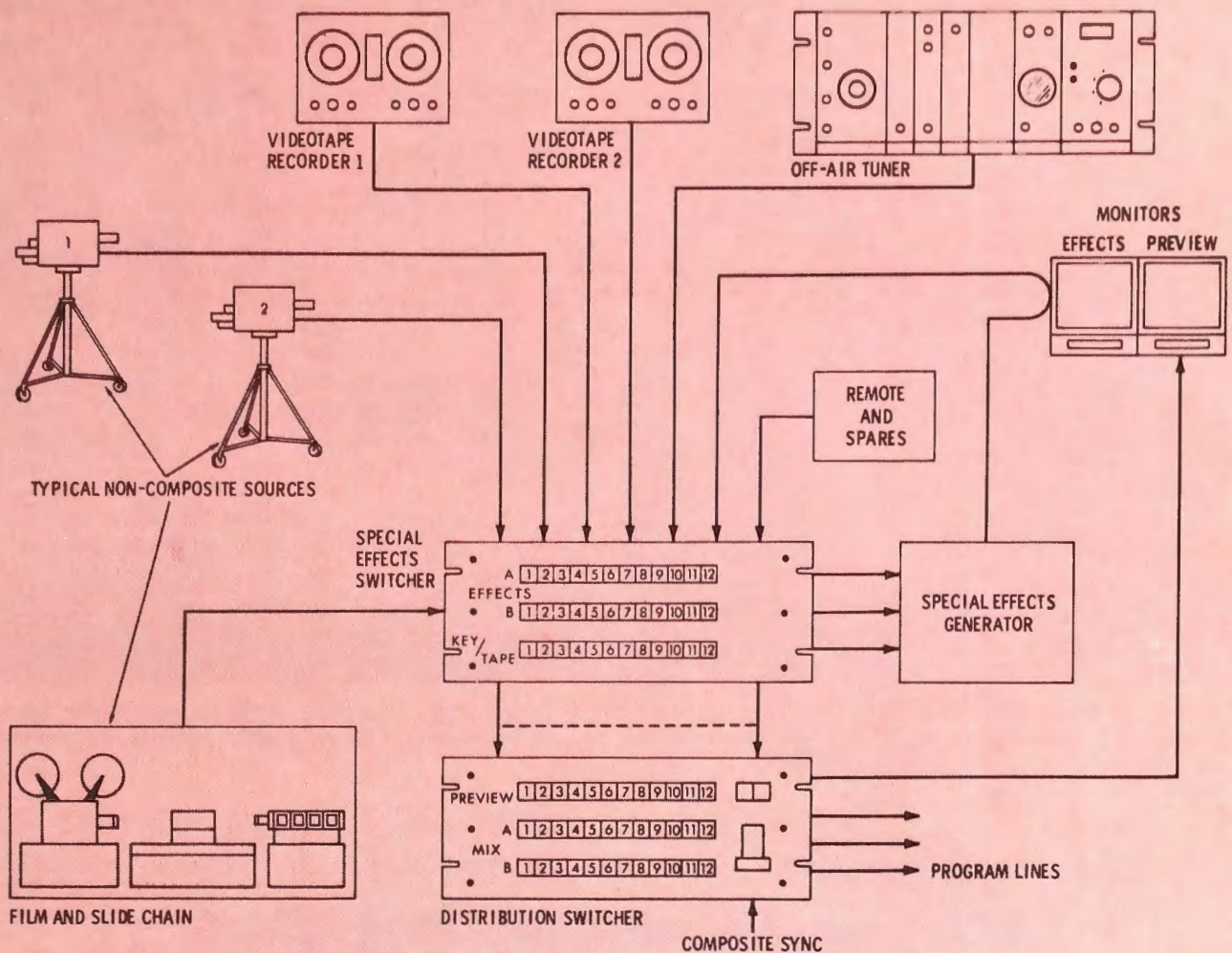


Fig. 13 Six-input, triple-output switching system.

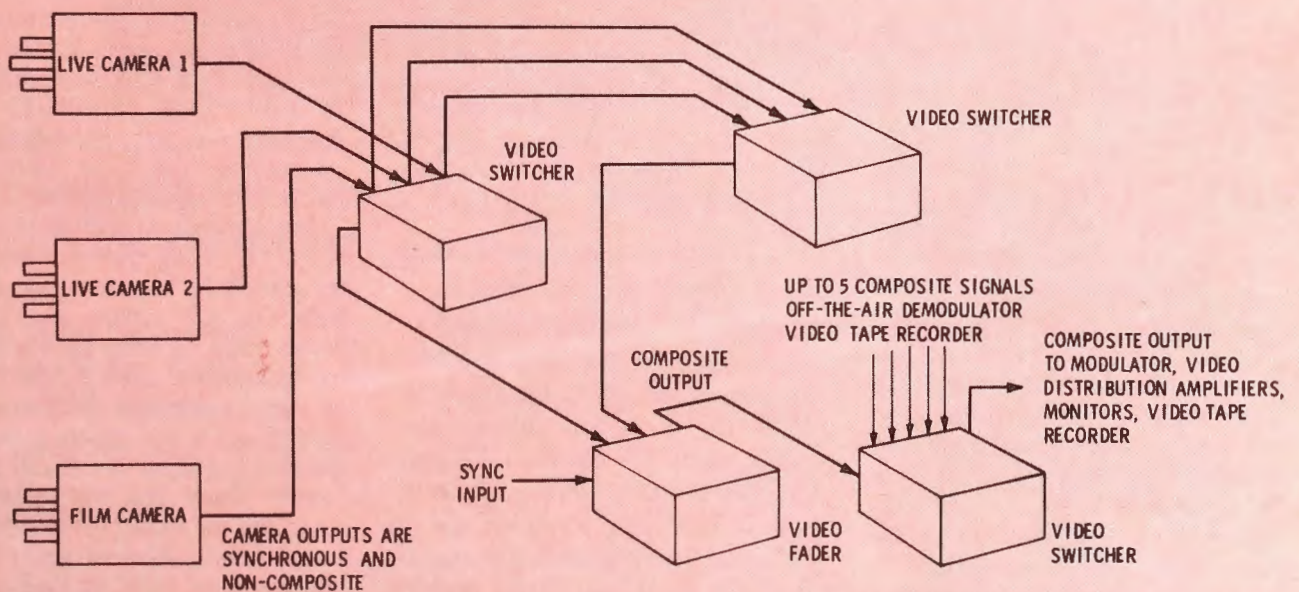
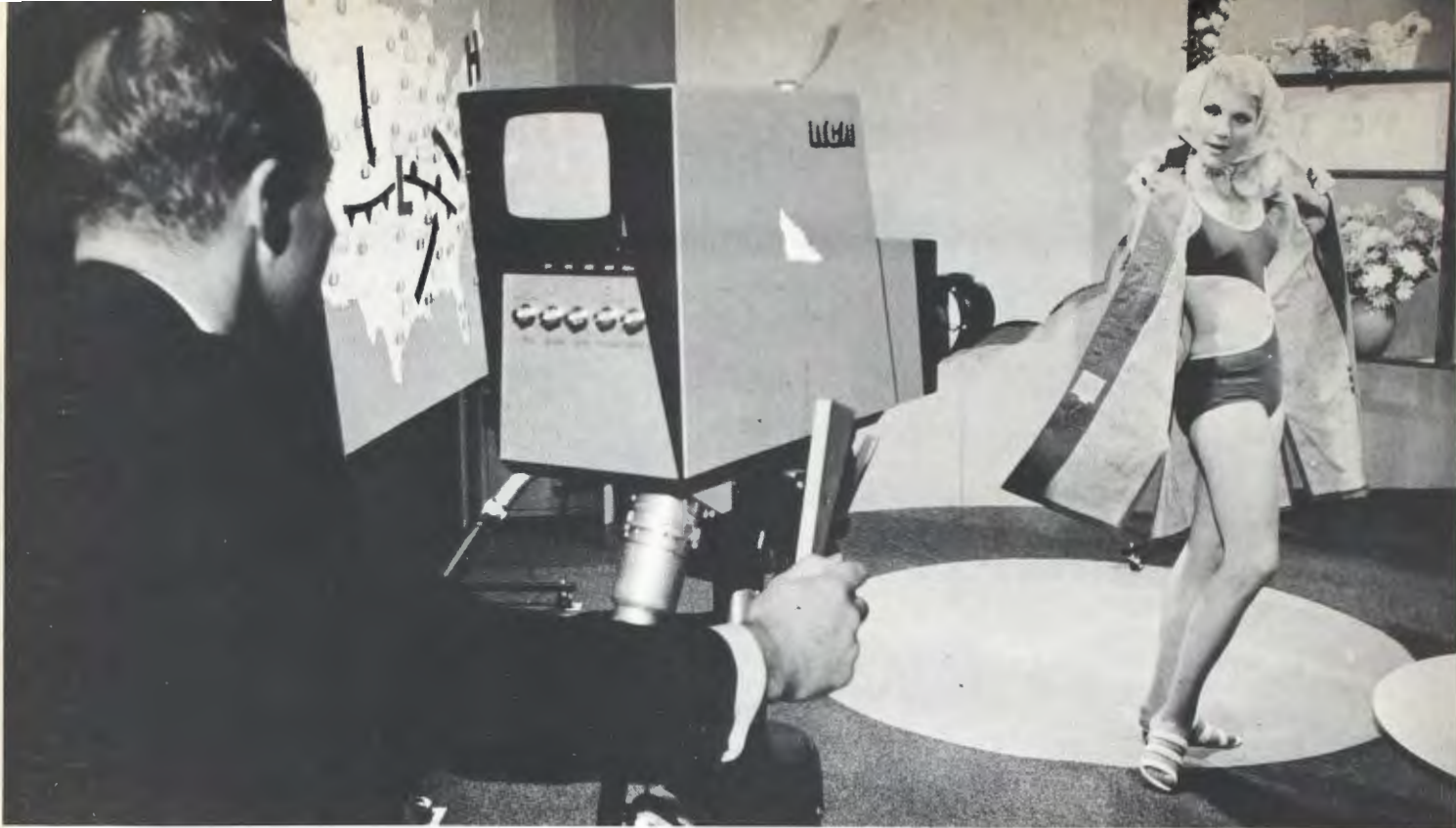


Fig. 14 Eight-input switching-fading system.



Even in a small studio setup, more than one backdrop can be used daily. Convention booth arrangements are good examples of maximum use of small studio space. In this one, note the simple central backdrop and the weather map at the left.

## Visuals for CATV

By Leo G. Sands

Extensive use of visuals—graphic art, photographs, slides and other still illustrations—can make programs much more interesting to the viewer. Show card paint, charcoal, India ink, felt-tip pens, vinyl tape and/or press-on type and symbols can be used to prepare graphs, charts and other graphic art in black

or gray on off-white (non-shiny) art board for monochrome transmission. Pure white and pure black cannot be transmitted successfully when covering large areas. Instead, various shades of gray from off-white to near-black should be used. Acetate overlays (transparent or opaque) and pasted-on cut-outs can be used for special effects.

For viewing on a close-up stand, 8" x 11" cards can be used. The art should be prepared to conform with the TV screen and camera aspect ratio (4 units by 3). With a tripod-mounted camera, 11" x 14" or larger cards can be viewed and flipped easily by inserting them in the correct sequence in a ring binder. Each can be allowed to drop into the camera's view on cue. Large cards, of course, can be placed on an easel or they can be placed one at a time on a flannel board.

A flannel board can be made by

The author, Leo G. Sands, is president of both Leo G. Sands Associates, Inc., and Telecommunications Training Corp., both headquartered in New York City. Before founding Sands Associates in 1954, he held executive and engineering posts with Bendix, Philco-Ford, RCA and Curtiss-Wright. In addition to electronics engineering, he has had show business exper-

ience as a motion picture projectionist, lighting director and producer of stage shows. He is the author of 45 books, more than 1000 magazine articles. He has been a senior member of the IEEE for 20 years, and is executive secretary and a Fellow of The Radio Club of America, and a member of the Society of Broadcast Engineers.

# This Broadcast Quality Equipment is Ridiculously Easy to Operate!

## VF-7001 3 Vidicon, full NTSC Color TV Studio Camera

- FAST WARMUP
- ONLY ONE OPERATING CONTROL

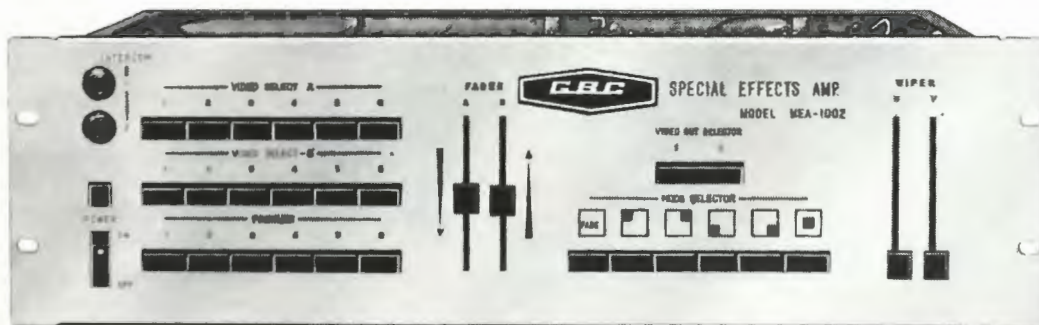
This completely self-contained solid state color camera is a real breakthrough in quality, economy and ease of operation. Unlike ordinary color cameras it can be set up in just ten minutes. Electrostatic focus eliminates warm-up time and readjustment.

What's more, the VF-7001 uses only one operating control, the rear controlled 6 times zoom lens. Everything else is automatic.

Finally, this camera can easily be used with any color film projector for late shows. To convert it to film chain use, just flip the sweep reverse switch and zoom into the right size on the projector.

The VF-7001 includes a built-in sync generator, but it will accept external sync. Also includes built-in intercom and two tally lights.

**CATV operator's price** *only* **\$5850**  
COMPLETE WITH REAR CONTROLLED 6X ZOOM LENS



### Monochrome Studio Equipment MEA-1002 Switcher-Fader/ Special Effects Generator

**Includes:**  
EIA Sync Generator,  
Preview Buss, Tally  
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Provide switching, fading, sync and special effects. Select any of six camera inputs, fade in and out, laps, dissolves, superimposes, provides 11 different wipes.

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**Includes:**  
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And Three 5" Monitors,  
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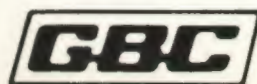
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### TVS-6M Complete CATV Console

**Includes:**  
MEA-1002 Switcher-Fader/  
Special Effects Generator,  
Six 5" Monitors,  
Audio Mixer

Everything you need except cameras and microphones. Mounted in convenient console and pre-wired, ready to go.

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Circle Number 28 on Reader Reply Card



Automated filmstrip projector with disc sound source.  
Beep tones on the record trigger the projector.



Setup for viewing films and slides.

applying flannel cloth to a sheet of plywood attached to a wall or supported by a stand. Rubber cement can be used to apply the unsanded side of a sheet of sandpaper to the back of each card. The sanded side will cling to the flannel board. Or, a small Alnico magnet can be affixed to the back of each card so it will adhere to a sheet of steel covered with a thin coat of paint or contact wall paper.

The size of the cards depends upon the camera technique. If a Teleopticon or Balopticon machine is to be installed, 4" x 5" cards or photostats of art reduced to that size from art originally prepared on larger cards can be used. If a Minicaster is used, 3" x 5" cards must be used. This machine is furnished with a vidicon camera in place.

Uniform lighting should be applied to vertically-mounted cards and the camera should be aimed head-on at the object in order to avoid geometric distortion. When using a blackboard, white chalk should be applied as heavily as practical to obtain adequate contrast. Off-white or gray pressure-sensitive tape or showcard paint, can be used and easily removed. Chalk can be used for material that is to be added or erased during the program.

To view photographs, it is preferable to use a close-up stand. Photo prints should be 8" x 10" or

larger, although 4" x 5" prints are acceptable when a Balopticon or similar machine is used. To prevent curling, photographs should be mounted on cardboard using rubber cement or mounting tissue. When there is a choice, matte finish photographs should be used instead of glossy prints which have a highly reflective surface.

When using a tripod-mounted or suspended camera, matte finish 16" x 20" or larger photo prints are easier to televise. Enlargements up to 30" x 40" can be made from a 4" x 5" or larger negative or an 8" x 10" glossy print, by any of several photo-finishing firms in New York City, and other large cities, at a cost of about \$5 each plus \$1.50 for a copy negative, if the original negative is not available.

### Lettering

In the television broadcasting industry, all lettering and printed captions are referred to as titles. An ordinary typewriter can be used for preparing titles on clay coated or other smooth surfaced paper using a silk, nylon or carbon-paper ribbon. The typewritten copy can be enlarged photographically for viewing on a close-up stand. Balopticon or with a tripod-mounted or suspended camera. A typewriter with extra large letters, such as used for making convention badges can be

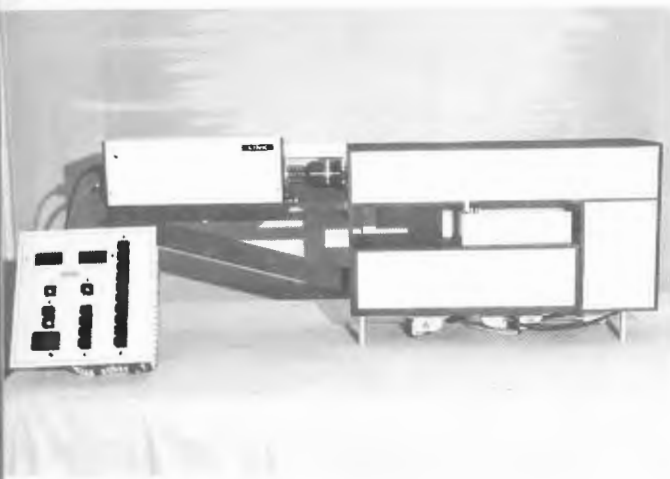
used for preparing titles which do not have to be enlarged. For example, an Orator element can be installed in an IBM Selectric typewriter to produce titles which do not have to be enlarged.

For better quality titles, a local printer or typographer can set type and furnish reproduction proofs on non-coated paper. Type size should be 14-point or larger. (The text you are reading is 10-point type.) If the proofs are saved, words and letters can be re-used when making new paste-ups. When cost is an important factor, press-on type (art type) can be used, which is available in sheets and is transferred to paper by rubbing on the back of the selected character.

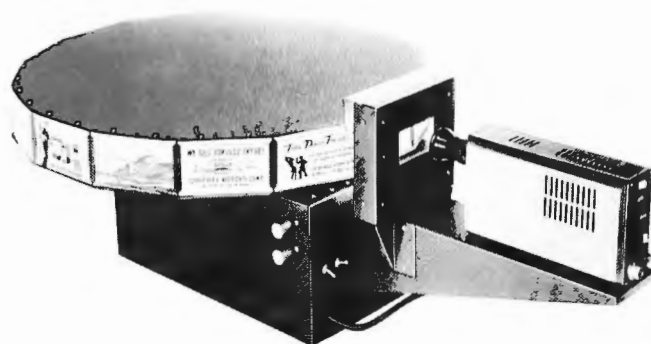
Titles can be prepared most quickly and at lowest cost by using home movie title boards and stick-on letters, which are available at camera stores. Since these title boards are small, they can be most effectively viewed on a close-up stand. By having several title boards available, new titles can be made up while one is being shown.

### Using Slides

When specially-taken photographic slides are not required, stock 35-mm slides which are available from camera stores, can be used to illustrate newscasts, lectures,



EDS random access slide projector with digital control.



Programmed viewer for 3 x 5 opaques, including camera.

etc., and for effects. Although they are in color, they will usually reproduce well in monochrome on a television screen.

To make your own slides, you can use a high quality 35-millimeter still camera and reversible black and white film. The exposed film can be sent to a professional photo processing laboratory for development into positive transparencies mounted in glass. Of course, color film such as Kodachrome, Ektachrome, etc., can be used. Slides mounted in glass will be better preserved and can be easily cleaned without damaging the film's emulsion.

In addition to photographing views and live scenes, pictures of graphic materials can be taken for televising through a slide projector. Slides can be stored more easily than original graphic material. To photograph small, flat graphic materials, a copying stand should be used to hold the camera securely above the subject.

Slides can be stored in metal or plastic slide files. Each slide should be numbered and a slide index should be prepared to make it easy to select slides for future use.

To eliminate the need for a slide projector operator, a magazine loading type projector, which can be programmed or operated by remote control, can be used. The slides can be loaded into the magazine in the

correct sequence well in advance of the time the program is televised.

An automated program can be produced by using a remotely-controlled projector and an audio tape recorder. The narration is recorded on tape and, by means of a push button, a tone pulse can also be recorded on the tape as a cue to change slides. When the tape is played back, the tone pulse actuates the slide projector. But, the tone pulse is prevented from being transmitted by a band-stop filter which passes voice and music, but blocks passage of the tone.

In lieu of 35-mm slides, 2" x 2" color or black and white slides can be shown using a projector capable of handling slides of this size. If a lantern slide projector for showing 3½" x 4" lantern slides is available, it can be used in the same manner as a 35-mm slide projector but must be operated manually. You can make your own lantern slides for use as titles and illustrations. Use a 3¼" x 4¼" or 4" x 5" view camera or press camera. If you use 4" x 5" reversible film, crop the positive transparency to fit within the 3½" x 4" area and mount it between two glass plates to form a slide. If you use conventional film, send the negatives to a professional photo processing laboratory and have the positive images impressed directly on the glass, cropped or reduced

photographically to fit.

Both 16-mm and 35-mm film strips can be viewed through a film strip projector. As in the case of slides, a remotely-controlled film strip projector can be controlled by tone pulses recorded on audio tape.

### Film Camera Chain

One of the important components of a CATV local program origination system is a 16-mm (millimeter) film camera chain which is used for viewing films originally produced on 16-mm film, kinescope recordings of TV programs and 16-mm prints of motion pictures originally photographed on 35-mm film. There are thousands of educational and documentary 16-mm films available on a loan or rental basis.

Motion picture film clips and taped sequences, used to illustrate lessons, are known as inserts and can be used when an appropriate film projector or videotape player is available. They are used extensively in TV broadcasting and can be easily utilized in CATV locally-originated programming.

For future use, a library of film clips can be built up by a photo processing laboratory. You can produce your film clips and even complete filmed programs. A high-grade 16-mm movie camera and black and white or color film can be used.



# Altogether now. The best color camera is...

**“The TK-44A makes very sharp pictures. Reaction to a recent live ball game was ‘It’s the finest video ever seen.’”**

—LeRoy Bellwood, Director of Engineering  
KOGO-TV, San Diego, California  
Time-Life Broadcast, Inc.

**“The camera has met with excellent reaction from viewers and sponsors...No question whatsoever—it beats the day-lights out of other cameras. Sharpness of picture, by the enhancer...means another generation of quality tapes.”**

—Wayne Barrington, Chief Engineer  
WISN-TV, Milwaukee, Wisconsin

**“...picture quality is outstanding... Quality pictures one minute after turn on.”**

—Eugene R. Hill, Vice-President, Engineering  
Kaiser Broadcasting Corp.  
Oakland, California

**“Many people have remarked how much better our pictures look. Not simply the color, but how much sharper. It’s a better picture.”**

—C. E. Miller,  
V.P., Engineering  
Fisher’s Blend Station,  
Inc.  
KOMO-TV, Seattle,  
Washington

**“Our folks like the way the picture looks and the way the camera handles...We get requests to go on location...agencies from out of town come to us...We are doing a lot of this work.”**

—Rupert Bogan, Director of Engineering  
Carter Publications, Inc.  
WBAP-TV, Fort Worth, Texas

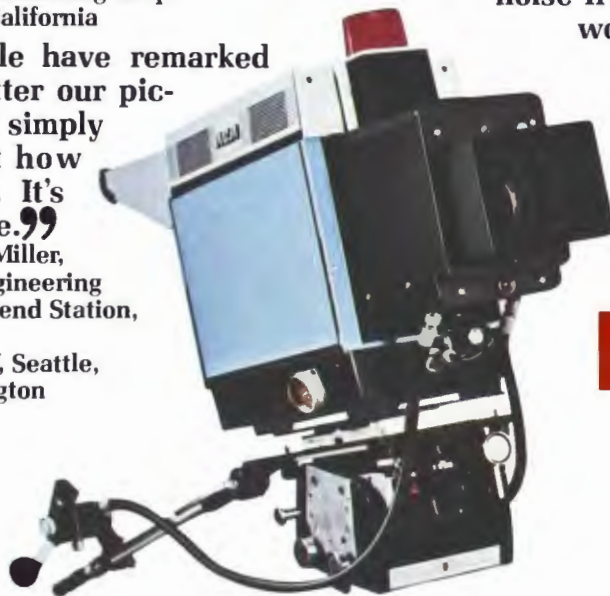
**“We have been impressed with the construction, the dependability and the quality of pictures...The pictures are great and the lack of noise in the black is beyond belief.”**

—Vincent E. Clayton, Director of Engineering  
Bonneville International Corporation  
KSL-TV, Salt Lake City, Utah

**“They have been used with as little as 25 foot candles of light...and give us noise free color pictures...We have worked with all other makes and models of cameras, but none compare to the TK-44A.”**

—Larry R. Eskridge, Chief Engineer  
WTOG-TV, St. Petersburg,  
Florida

Thank you, gentlemen.



# RCA



Three-way optical multiplexer.

For most purposes, synchronized sound is not required and a "silent" movie camera can be used. However, motion pictures with synchronized sound can be used, but a fairly expensive sound camera is required.

The 8-mm movie camera is extremely popular for taking amateur movies, but is not yet widely used on TV because of its past limitations. However, a new technique has recently been developed, using low-cost 8-mm film, which provides a larger picture and an improved magnetic sound track. This makes it possible to produce your own sound movies and film clips, at low cost for showing on CATV.

Inserts, including animated titles, as well as complete programs can be recorded on videotape in the studio. If a portable videotape recorder is available, it can be taken, along with a viewfinder camera to record events in areas away from the studio.

Drapes, photomurals, cycloramas, wall paper, curtains, backdrops, or flats can be used as backgrounds in a studio which the existing wall is

not suitable for the occasion. The size of the background depends upon its distance from the camera and the lens. Photomurals can be prepared by firms that produce large photographic blow-ups. To prepare a wallpaper background, fasten plywood or wall board sheets to a frame to provide a flat surface for the wallpaper. To prepare a flat, stretch cloth over a wooden frame and paint it to depict a scene or design. A theater flat is usually 5'9" wide and 10' or 12' tall, but for CATV purposes, a flat can be any convenient size. The desired width is obtained by joining two or more flats with hinges which also permits storing flats in a minimum of space.

A drape is non-movable cloth that covers a wall or an object, whereas a curtain is movable. Drapery material or a curtain can be attached to an overhead traverse rod to form a traveler. To form a backdrop, a scene can be painted on the curtain.

When the existing background is a wall, drape or traveler, without a pattern, a slide or opaque projector can be used to project an illuminated pattern on the background surface. The projected background may be a photograph or a pattern. For example, a venetian blind pattern will produce the effect of sunshining through a window and casting shadows. Slides bearing various patterns can be purchased or readily made.

A method of providing background pictures without the necessity of the added space required for rear projection is a system that utilizes a highly reflective screen behind the performer. By projecting a 35-mm slide onto this screen the image is reflected back to the camera. Because of the high light level reflected the portions of the image which appear on the performer are not seen by the camera because the person does not reflect as much as the screen and therefore the camera is set to the brightest light which is the screen image. The only equipment needed for this is the camera, a 35-mm projector and the reflective screen.

Lack of showmanship in presentation can be blamed for less-than-expected interest in locally-originated programs. As the late Thomas Jaski stated in his guest editorial in the August 1965 issue of **Radio-Electronics**, "It takes the little factors in interpersonal interchange, humor, picturesque use of language, amusing and colorful illustrations and a bit of whimsy to make programs digestible to human minds."

What the audience sees on the television screen must have pleasing esthetic qualities which induce the viewers to like what they see. Composition is determined by the cameraman who must compose the picture quickly upon the instruction of the director or as stipulated in the script.

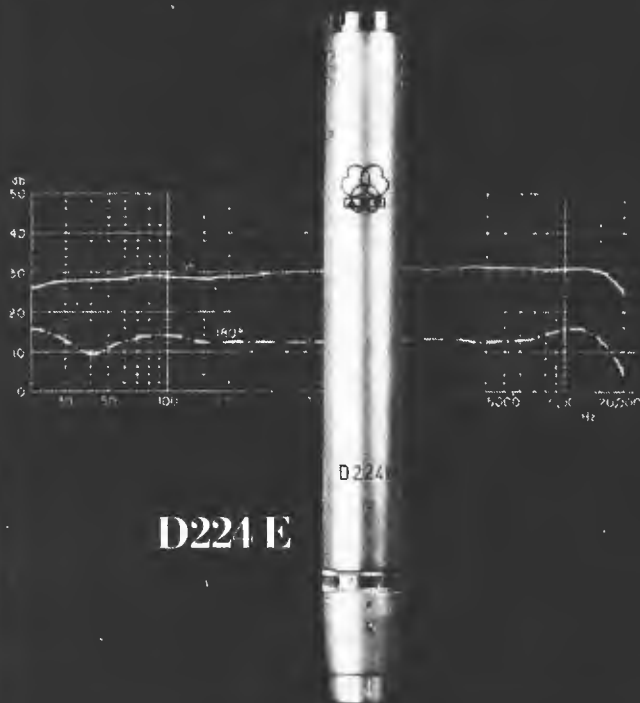
For good composition, the viewer's attention should be attracted only to the essential element, action or interaction. The scene should be uncluttered. When elements other than the intended center of attraction must be in the scene and viewed at a distance, they should be arranged so they will not attract attention away from the principal elements when viewed close up. For example, a pointer should be viewed at such an angle that it will draw the eye to the object at which it is pointing.

When more than one camera is employed, each should be positioned and set for a different view so switching from one camera to another can be made without delay. For example, while viewing a moderator with one camera, have the other one focused and positioned for a shot of a guest. Switch from one camera to the other immediately (cut) or gradually dissolve (fade out, fade in), depending upon the effect desired. Use either transition technique for changing from a camera viewing a live scene to one on a close-up stand or viewing a slide, film or title card, or to videotape recorder or film chain.

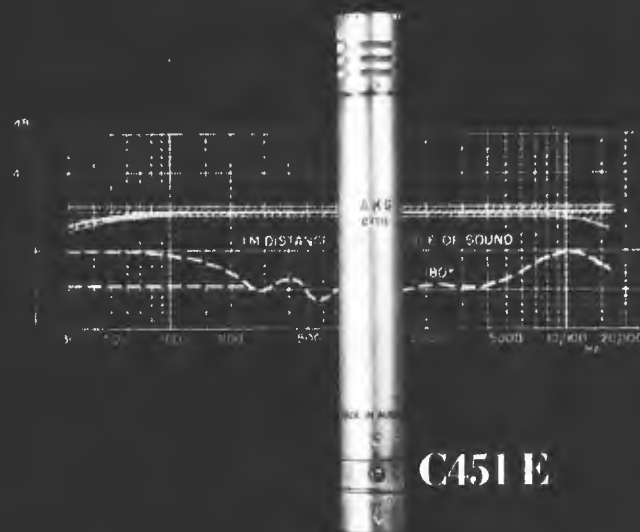
When only one camera is used, and it is necessary to pan or tilt to switch from a live scene to graphic art, it should be done slowly to avoid streaking and interference with the train of thoughts. ▲

When your  
dynamics are  
this good...

you have to  
make the best  
condensers



D224 E



C451 E

With the invention of two-way microphones **AKG** improved the quality of cardioid dynamic microphones drastically in many areas: *Flat frequency response* over the entire audible range. *Linear off-axis response*: 90° off-axis is reproduced as natural as 0° on-axis response. *Uniform front-to-back discrimination* of 20 db, even in the critical low frequency response and upper mid-range area. And in addition: *No proximity effect*.

In fact, the two-way microphones are out-performing some condenser microphones.

The next **AKG** step was the development of a new condenser microphone capsule. It consists of a gold-vaporized ceramic electrode and a permanently mounted

metallic alloy diaphragm. Both materials have the same expansion coefficient, thereby increasing the longevity of the capsule. In addition it is impervious to a wide range of temperature and humidity fluctuations, and it is free of deterioration and hysteresis.

The preamplifier of the C-451E requires 7.5v operating voltage, which is supplied via phantom circuit. It permits central feeding via a two-conductor plus shield cable and eliminates the use of power supplies.

Of course, we also have AC and DC power supplies to operate the C-451E. Most important of all, it permits *interchanging of pick-up capsules* to CK-2 omni-directional, CK-6 variable pattern, and CK-9 shot gun (interference tube) attachment.

AKG-39



# MICROPHONES • HEADPHONES

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AKG CANADA • DIVISION OF DOUBLE DIAMOND ELECTRONICS • SCARBOROUGH, ONTARIO  
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approximately doubled when voltage is cut 4 percent and halved when voltage is raised 4 percent.

The color temperature of lamps differs among types of lamps. Some lamps are designed specifically to

meet the requirements of TV and photographic studios, motion picture studios for color or black and white film, and amateur photographic use.

Quartz lamps are highly recommended, because they are more ef-

ficient than incandescent lamps, smaller, and their color temperature does not change with intensity. By installing quartz lamps initially, transition from monochrome to color will not require changing over to quartz lights.

Before taping or transmitting a live program, use a light meter to measure the illumination reflected from the face of the performer or point of interest.

### Point Of Interest

When overhead incandescent or fluorescent lighting in a studio is adequate (100 foot candles or more) for illumination of the total scene, "key" lighting can be added by an overhead spot light aimed at the performer or other point of interest. The spot light should be suspended so that, when aimed at the subject, it will be pointed at a 20° to 40° vertical angle with respect to an imaginary horizontal line at the subject's eye level or point of interest.

When excessive contrast results, "fill" lighting can be provided by a Sun Gun or by scoops, mounted lower than the key lights so that they will be pointed downward at approximately a 15° angle with respect to an imaginary horizontal line at the subject's eye level.

When ambient lighting is inadequate, "back" lighting from spot lights suspended high enough behind the subject to allow the lamps to be pointed at a 45° vertical angle, when aimed at the head and shoulders of the subject, can be used.

To produce shadows to heighten interest, "modeling" light can be directed at the subject from the side, but in front of the subject, generally at a lower level than the fill light. To brighten the subject's eye and to provide additional illumination for close-ups, a small spot light, mounted on the camera, aimed at the subject, can be used.

When the background is important, it can be illuminated independently with "set" lights from the sides or overhead. When using a projected pattern as a background, it should not be much brighter than the fill light.

### Illumination

Using a light meter, the lighting



Key lighting is shown in use while shooting a live scene.



Dark background with fill lighting provides appropriate contrast and emphasis on talent.

# Measure Vital Characteristics of Broadcasting Systems\*

## VIDEO NOISE

### UPSF VIDEO NOISE METER

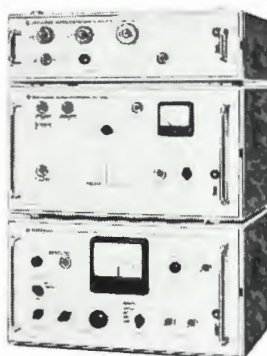


Designed for noise voltage measurements on TV cameras, film scanners, video tape recorders, radio links, coaxial lines, TV transmitters, receivers and transposer, with synch. Signals.

- 40 Hz to 10 MHz
- 7 Measurement Ranges: 1/3/10/30/100/300/1000 mVpp
- True RMS or Peak-to-Peak Indications

## GROUP DELAY

### LFM TEST ASSEMBLY



Determine group (envelope) delay of video and TV transmission systems.

- 0.1 - 10 MHz and 25-250 MHz (ext. to 1 GHz)
- $\pm 10$  to  $\pm 1000$  nsec.
- Using Type SWOF sweep system group delay is instantaneously displayed on CRT.

## PHASE & GAIN

### PVF PHASE & GAIN METER



Simultaneously measure differential phase & gain; sensitivity heretofore unavailable; measures direct or via transmission link; self calibrating.

- Measure:  $\Delta$  Phase:  $0.1^\circ$  -  $60^\circ$   
 $\Delta$  Gain: 0.5% - 50%
- Calibrating Signals:  $1^\circ$ ,  $10^\circ$ , 1%, 10% f.s.d.
- Switch permits simultaneous display of  $\Delta$  Phase-Gain
- Takes Low Frequency Oscilloscope (250 KHz) as readout device
- AFC provides 500 Hz locking range to ext. color subcarrier

## VESTIGIAL SIDEBAND ANALYSIS

In the presence of synch. signals

### SWEEP GENERATOR/RECEIVER

### HIGH QUALITY $\frac{1}{2}$ W. X-MITTER

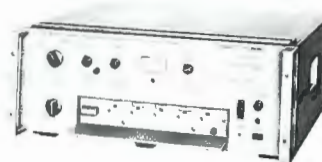
### TV-DEMODULATOR



**SWOF VIDEOSKOP** A video sweep generator tracking selective (3 kHz) receiver, and display unit. Range: Frequency, 20 kHz to 20 MHz, (1 GHz with sideband adapter); Sweep Width: 1 to 16 MHz, continuously variable; sweep duration 50 ms to 5.5 s.



**SBTF VESTIGIAL SIDEBAND SIGNAL GENERATOR** Modulation of vision and sound signals is accomplished in the IF, thereby permitting use of plug-in heads for VHF & UHF. SBTF generates exceptionally high quality NTS signal for development and production testing of receivers, and as low power Xmitter.



**AMF TV DEMODULATOR** A Nyquist demodulator as a ref. standard for TV Xmitter performance (B&W, color and sound). Video and audio frequency response, phase and group delay, intercarrier signal-to-noise ratio, etc. Models available for VHF and UHF.

\* MEETS REQUIREMENTS OF ALL U.S.A. BLACK AND WHITE AND NTS COLOR SYSTEMS

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Greater Reliability, and  
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Circle Number 31 on Reader Reply Card

should be adjusted for a 10:1 to 20:1 contrast ratio. For a 10:1 contrast ratio, the brightest areas will reflect ten times as much light as the darkest areas. Excessive contrast should be avoided. Also, inadequate contrasts should be avoided, so that the televised scene will not be too flat and lacking in detail.

As a general rule, provide 100 foot-candles of lighting on cards, titles and contrasty graphic material, and from 200 to 300 foot-candles on scenes where movement takes place.

Strong illumination permits use of smaller lens openings which means that more of the scene (in terms of depth) will be in focus. This will allow greater front-to-back freedom of movement of performers without requiring refocusing of the camera. On the other hand, with less illumination the lens must operate at a wider opening, resulting in a reduction in the depth-of-field. For some purposes, reduced depth-

of-field is used advantageously, when there is little movement, to concentrate attention on a subject in sharp focus with the rest of the scene intentionally blurred. The effect of more light on the performer's face can be achieved by simply reducing the intensity of the back lights.

The use of make-up is not essential. However, because of lighting, skin can look a little shiny on a TV screen, and the use of pancake make-up, available at drug stores, will reduce glare. Pancake make-up can also be used to subdue blemishes that might be accentuated by studio lights. Women should wear lipstick and eye make-up to avoid the chance of having their features washed out. The basic purpose of make-up is to make a performer look presentable.

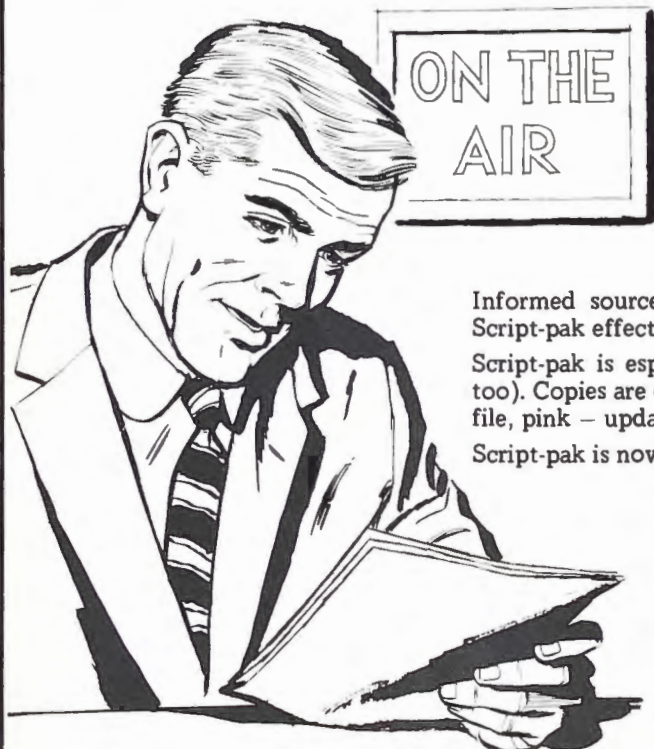
White and pastel colored clothing should be avoided. White is especially objectionable because it has a tendency to "glare" on the TV

screen. Men should wear light blue or gray shirts and women should wear dark-colored dresses. When a man wears a dark jacket over a white shirt, or a woman wears a white blouse and a dark skirt, a blurred line may appear where the dark and light fabrics meet. Because of the brightness of the lights, bright buttons and shiny jewelry should be avoided since they may cause reflections and distractions. Buttons and other shiny objects can be covered with liquid soap to reduce reflections.

Since studio lights can consume considerable electric power, an adequate electric service and numerous outlets should be provided. Also, since studio lights can generate considerable heat, it will be necessary to provide enough ventilation to carry away the heat or to air condition the studio.

Obviously, means should be provided for remote switching and dimming of studio lights. ▲

## News For Newscasters:



# TV Script-pak

## ELIMINATES CAMERA-FLARE

Informed sources in TV broadcasting and engineering report that new TV Script-pak effectively stops camera-flare and reduces audio noise as well.

Script-pak is especially formulated for color (excellent for black and white too). Copies are color coded for filing and updating. (Gray - studio, yellow - file, pink - update).

Script-pak is now in use at major stations throughout the country.

Script-pak is a must for all script readers.

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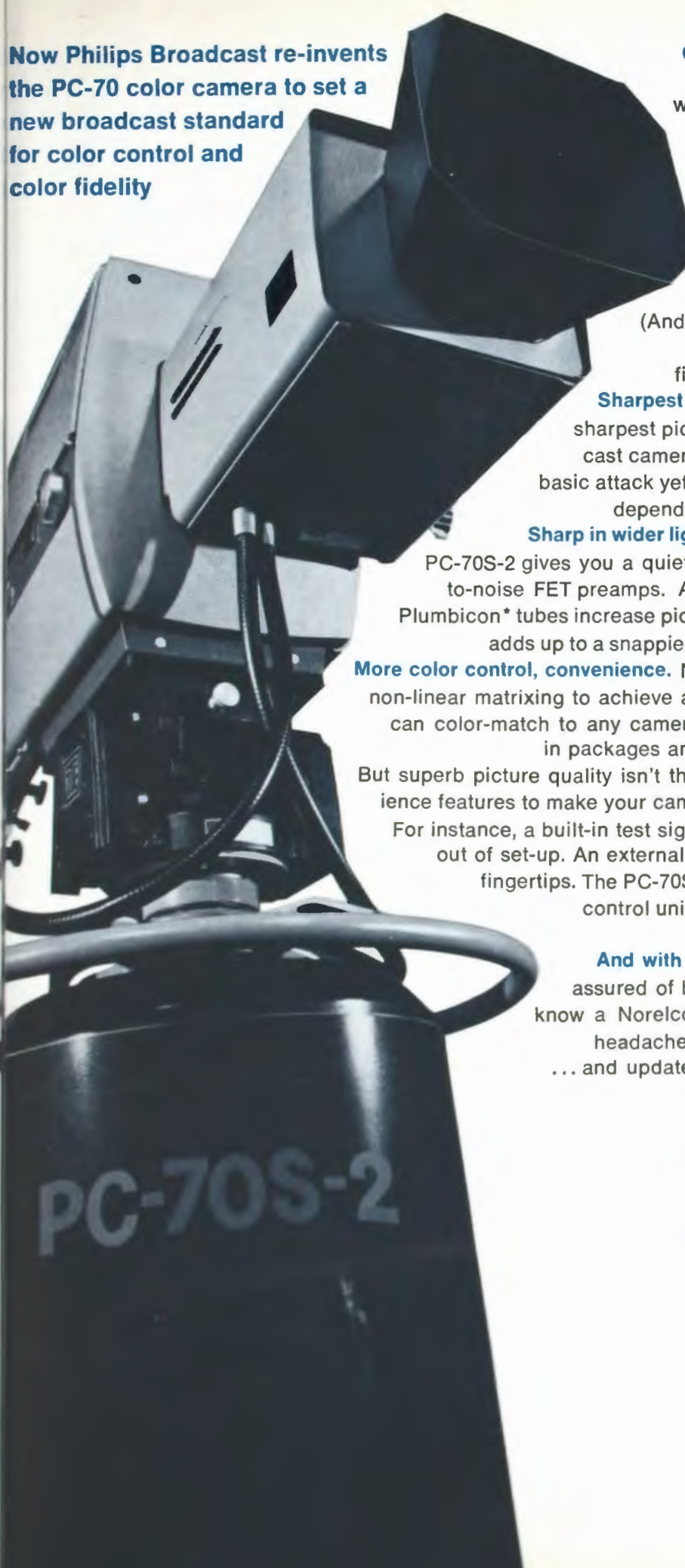
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The Innovators Introduce:

# “Son of PC-70”

The Norelco PC-70S-2

Circle Number 34 on Reader Reply Card



**Now Philips Broadcast re-invents  
the PC-70 color camera to set a  
new broadcast standard  
for color control and  
color fidelity**

**Over 1,000 3-Plumbicon\* cameras** have been delivered throughout the world, with more than 600 serving broadcasters and production companies in the United States. It is the standard other cameras try to match.

That was tough before. Now it's tougher. Because today the Innovators are introducing the PC-70S-2, with an important list of new features. (And to prove you are always state-of-the-art with Norelco, they're available as field update kits for older PC-70 models.)

**Sharpest picture yet.** Our key innovation is the sharpest picture detail you have seen from a broadcast camera. A new technique introduces the most basic attack yet on picture-degrading "noise" . . . level-dependent comb-filtered contour enhancement.

**Sharp in wider light range.** In low-light situations, too, the PC-70S-2 gives you a quieter picture. We've added 48-db signal-to-noise FET preamps. And at all light levels, separate-mesh Plumbicon\* tubes increase picture resolution and dynamic range. It all adds up to a snappier picture in every area from light to dark.

**More color control, convenience.** Now the PC-70S-2 is also available with non-linear matrixing to achieve an infinite range of tints and hues. You can color-match to any camera you own. Even those problem colors in packages and costumes snap into true-to-life color. But superb picture quality isn't the whole story. There are many convenience features to make your cameraman more expert, more productive.

For instance, a built-in test signal generator that takes the guesswork out of set-up. An external filter wheel control at the cameraman's fingertips. The PC-70S-2 ranges far and free from the camera control unit . . . up to 3,000 feet with standard cable, or 1,000 feet with mini-cable.

**And with over 1,000 cameras delivered,** you are assured of broadcaster-proved dependability. You know a Norelco camera will deliver performance, not headaches. You know Norelco delivers service . . . and updates to keep you abreast of innovations.

Ask us about details and prices now.



One Philips Parkway  
Montvale, New Jersey 07645 (201) 391-1000



\*Reg. T.M. N.V. Philips of Holland

# ORINATION SYSTEMS

## *for three budget ranges*

By Robert F. Burns

The author, Robert F. Burns, is vice president of Leo G. Sands Associates, Inc., a telecommunications systems engineering and market research firm, headquartered in New York City. He previously was president of Artic Communications and an engineering executive at Link Radio Corp., Budelman Electronics Corp., and Cardion Communications Corp. At Sands Associates he is responsible for the planning and design of facilities for CATV local program origination, cable television transmission and distribution systems, conversion of cable systems for bidirectional transmission, CCTV systems for hospitals and other large institutions, and microwave and mobile radio systems. His staff includes specialists in TV studio lighting and program production.

For less than \$2000, a CATV operator can purchase the equipment required for minimal local program origination capabilities. One vidicon camera with both RF and video outputs, a conventional TV receiver for use as a monitor, a TV modulator and a photoflood lamp are all that would be required.

However, CATV originated programs must compete for viewers with network programs, particularly in regard to picture quality and so they must be almost as good as, or better than the network shows. Furthermore, they must sustain viewer interest. Local news and weather are community services that usually draw a large number of viewers.

One of the foremost TV studio facility experts, Jack R. Poppele, president of Tele-Measurements, Incorporated, advises CATV operators to buy the best available pro-

gram origination equipment. He points out that on a long-term basis, good equipment costs less than the manpower required to operate and maintain cheap equipment. If the initial cost of equipment cost is only \$70 per week, or \$0.64 per hour if used 16 hours per day, 7 days a week, its cost could quickly be recovered by modest effort applied to selling commercial time.

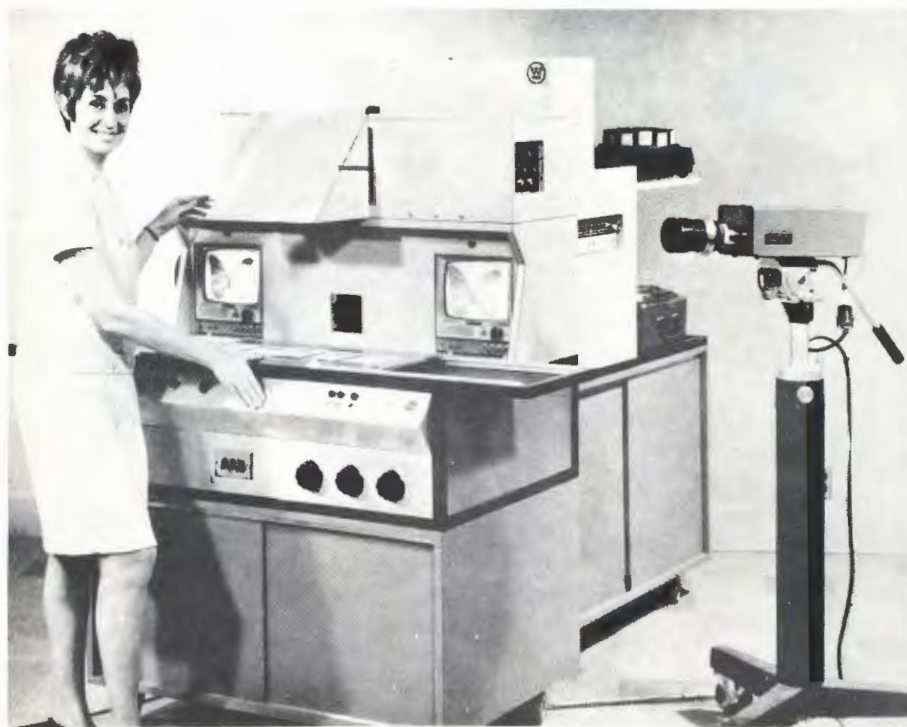
### **Low Budget Systems**

A one-man television studio, which was designed for classroom and industrial training, can also be used for CATV local program origination. Using the new audio-visual equipment, one person can combine a live presentation with videotaped materials, films, slides, photographs, charts, and other graphic materials. The resulting program can be transmitted "live" or recorded on videotape for later use.

This unit, for example, combines two television cameras and standard audio-visual aids with up front controls. With a brief period practice, one person can operate the system proficiently and can concentrate on the program rather than operation of the equipment.

A companion audio-visual recorder, capable of recording video and as many as five different audio tracks, is also available for storing programs for later playback. In addition to feeding its output into a CATV system, the studio can be adapted to microwave transmission of programs to a distant head end.

Two caster-mounted cabinets and a tripod-mounted television camera comprise the system. It can accommodate 8-mm or 16-mm motion picture film, filmstrips, slides, overhead projection transparencies and audio or videotape. A fixed camera with a zoom lens is used for opaque materials such as writings, drawings, photographs, maps, and solid objects such as shells, specimens, and books. The tripod-mounted



**Fig. 1** Single operator studio set-up including a camera for live scenes and a means for viewing opaques and slides. A videotape recorder can be added.



## Sony professional at work.

You're looking at Sony's new ECM-50 Tie-Tac/Lapel Electret Condenser Microphone. It's one of the new line of Sony Professionals—products specifically designed for special applications.

For example, TV announcers long burdened by the cumbersome lavalier version of the standard dynamic microphone, will welcome the miniaturized Sony ECM-50 Tie-Tac/Lapel condenser microphone. Employing the electret principle, it is so small it literally cannot be seen on camera. Yet its condenser performance with tailored frequency response and high sensitivity is vastly superior to any dynamic lavalier microphone.

The Sony ECM-50 is an excellent example of the new line of Sony/Superscope special application products that have a unique ability to solve difficult problems in modern communications.

The ECM-50 is available at select Sony/Superscope dealers. For their names, as well as complete details and specifications, please write Special Application Products Division, Sony/Superscope, 8150 Vineland Ave., Sun Valley, CA 91352.

**SONY SUPERSCOPE**

Circle Number 35 on Reader Reply Card

© 1979 Superscope, Inc.



**Fig. 2** Packaged system with the console as the key unit. Emphasis is on live originations in the studio.



**Fig. 3** This basic system includes a camera, videotape recorder, and monitor. Many major manufacturers are now offering origination packages to fit the needs of the low, medium and large budget system.

camera, also with zoom lens, is used for live pickup. The system operates effectively with normal room lighting and occupies less than 15 square feet of floor space.

Another one-man system package consists of a console providing complete control of two studio camera chains, a film chain camera, and a videotape recorder. The console contains all necessary equipment for professional programming, including: switcher/fader, special effects generator, wave form monitor, film projector control, and a seven input audio mixer. Five transistorized displays monitor the output of two cameras, film camera, preview bus, and the program line.

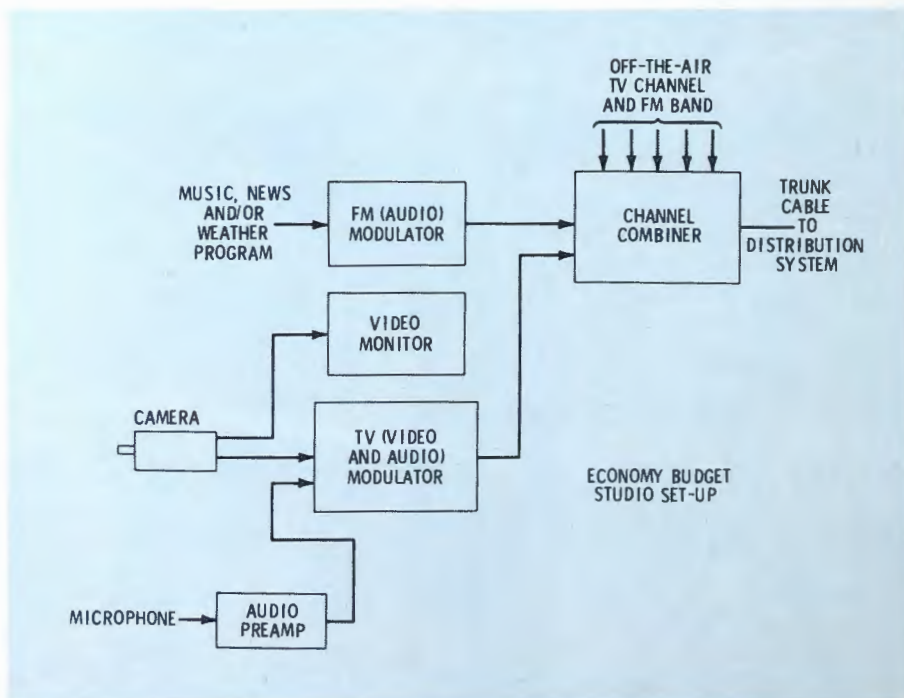
Local news and weather are community services that usually draw a large number of viewers. One of the greatest attractions is the live telecasting of local sports events. This can be accomplished with a minimum of equipment (monochrome) in small cities or as in the case of New York City with complete color coverage of the sports events in Madison Square Garden. A minimum unattended set-up for local origination of weather reports could be on an FM audio channel. This can be tied in with a VHF monitor receiver for the local ESSA weather broadcast. To this can be added a vidicon camera and a small instrument package showing wind

speed and direction, time and temperature. A more elaborate display would utilize a weather radar in combination with the instruments on a split screen or through the use of a sequencer.

#### Medium Budget Systems

For local news an audio tape recorder-player and modulator can be added. A microphone should also be available for "live" bullet-

ins. A simple way of providing local news and weather plus other items of local interest for slightly more than \$1000 is to use a rotary card holder that is programmed to keep each card in position in front of the camera for 15 seconds. To add live news coverage, a 16-mm movie projector and camera can be utilized as well as a 35-mm slide projector for still pictures. A sync generator should be used when two or more



**Fig. 4** Economy budget studio set-up.

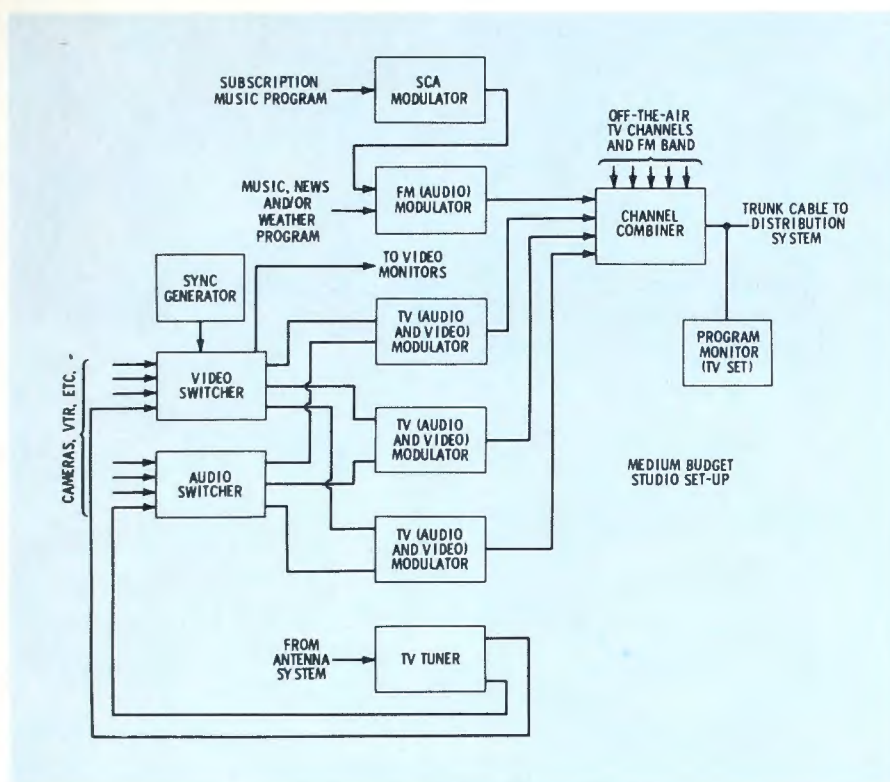


Fig. 5 Medium budget studio set-up.

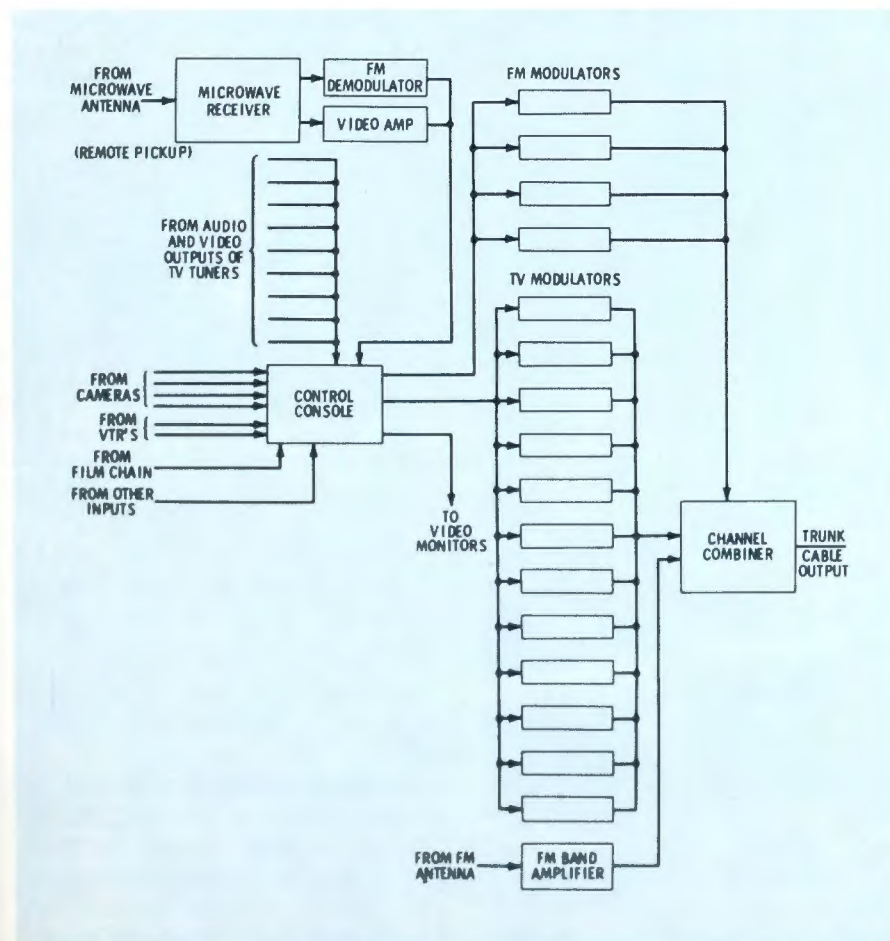


Fig. 6 High budget system. Control console permits selection of any TV channel for locally originated programs.

cameras are used to prevent picture "roll-over" when switching from one source to another.

If live coverage is desired, a panel truck should be outfitted with a camera and platform, an audio system microwave link, switching panel and portable lighting units. The microwave should have an order wire circuit to enable the remote crew to communicate directly with the studio. If a direct link is not employed, a videotape recorder can be used and the tape quickly returned to the studio for broadcast.

The use of a single studio camera with several different film projectors in a film chain can be accomplished by using an optical multiplexer. This permits smooth transition from one source of programming to another without any unnecessary mechanical switching.

### Large Budget Systems

The optimum in local program origination is the full-color operation. At least one of the cable systems now offers full programming in color. This provides film programs of the same color quality as provided by the networks. The film system employs a four-tube color film camera, motion picture and slide projectors and an optical multiplexer. For stock ticker quotations, weather, news headlines and other printed material a system is used to convert the information directly into a TV signal without using a camera.

To give adequate coverage of major sporting events at least four cameras should be used. Two at playing level and two elevated for general coverage. The color coverage is seen on the cable system and can also be sent to the visiting teams home city over Bell System leased circuits. Nearly all cameras have zoom lenses for added versatility. To have a more complete sports facility, a VTR (videotape recorder) for instant replay and "stop-action" could be added.

In planning local origination programming, the educational system should be considered. Most communities request a certain amount of time devoted to lectures and educational material. This requires a minimum amount of added equipment: usually only one or two mono-



**Fig. 7** This system arrangement allows the color camera to be removed from the film chain pedestal. With the addition of a standard zoom lens, it can be used for studio work.

chrome cameras, a sync generator and an audio system. This same set-up can be used to interview people of local interest such as officials or visiting celebrities.

#### **Studio Location**

Since the head end is usually at an isolated site and may not be a convenient location for a studio, it might be worth considering establishment of the studio elsewhere. The problem is one of feeding its signals into the cable system. There are the following options:

1. Installation of a studio-to-head end microwave link.

2. Leasing of a video pair and an audio program circuit from the studio to the head end; or running your own video pair and a twisted pair for audio.

3. Running of a separate coaxial cable from the studio to the head end.

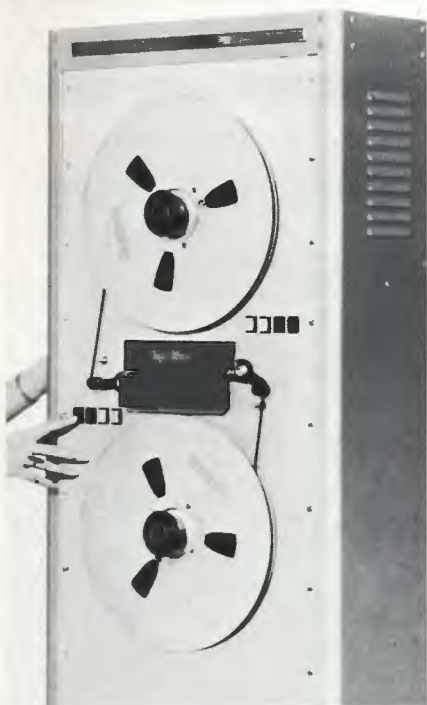
4. Running of a coaxial cable from the studio to a coupler on the trunk cable, just ahead of the first feeder cable tap-off point.

5. Conversion of the cable plant

from unidirectional operation to bi-directional capability between the studio and the head end.

6. Producing all programs at the studio, recording them on tape, and then playing them back at the head end.

If the sixth option is adopted, all programming can be taped at the studio, including inserts, views of opaques, slides, etc. The tapes can then be delivered to the head end for play-back as scheduled. To provide program continuity, at least two videotape machines should be



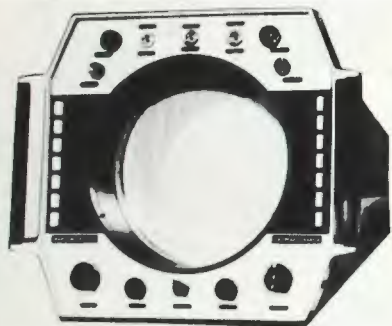
**Fig. 8** Sixteen hours of pre-recorded audio programming can be played on this machine. The 14-inch reels will hold 9600 feet of tape.



**Fig. 10** Local nightclubs are good sources for live remote or taped entertainment programs.



**Fig. 11** Visiting celebrities are good subjects for interview and news programs. Robert Culp is shown here being interviewed by Eddie O'Day of Teleprompter CATV. But ambitious programming will make added demands on equipment and technical personnel.



**Fig. 9** Relatively low cost marine radar can be modified for use as a weather radar unit.

installed at the head end. It is even possible to control the videotape machines remotely through a leased telephone circuit.

#### **Audio Facilities**

Audio facilities for live programs and for taping of programs for delayed transmission must, of course, be provided and studio acoustics must be considered. It is essential that the studio be sound-proofed to prevent or at least minimize pickup of outside noises.



**Fig. 12** Viewfinder cameras keep the cameraman from shooting blind.

Reverberation and pickup of outside noises can be minimized by carpeting the studio walls, floor and ceiling. Or, the walls and ceiling can be covered with sound absorbent tiles. It might be better not to cover all surfaces with sound absorbent material to avoid an overly-dead room which would result in lack of realistic sound.

A minimum single-camera set-up could use only a single microphone, suspended by a boom, plus a pre-amplifier to boost the level high enough to drive the audio channel of the TV modulator. (Some vidicon cameras contain an audio pre-amplifier.) Also essential are means for controlling and monitoring (VU Meter) audio level.

When more than one microphone and other sound sources (record player, audiotape player) are involved, an audio control unit (mixer) is usually provided for blending and controlling the levels of the various sound sources.

For providing musical backgrounds and sound effects from disc recordings, a record turntable and a

phonograph pick-up are required. A turntable, operable only at 33 rpm, enables playback of LP (long playing) recordings up to 12 inches in diameter. A multi-speed turntable, operable at 33, 45 and 78 rpm, enables playback of all types of discs. The pick-up should be of the monophonic (not stereo), magnetic type, equipped with a diamond stylus, to provide optimum fidelity and to minimize record wear. For more flexibility, two record players can be provided so that one can be readied while the other is in use.

An audiotape recorder-player is one of the most versatile sound instruments since it can be used for both recording and playback. In the studio, it can be used for playing back pre-recorded tapes and for recording and playing back lectures, narrations and music. Only a professional quality tape recorder should be considered. Either a monophonic or stereophonic (operated in its monophonic mode) tape recorder can be used.

The audiotape recorder can be of the reel-to-reel type or one that

utilizes tape cassettes. The advantage of cassettes is compact, easy storage. Furthermore, it is not necessary to actually touch the tape. But editing is more difficult, particularly if it requires cutting out or inserting sections of tape.

For audio-only programs, tape decks are now available which permit recording and playing back up to 16 hours of programming on a single 14 inch reel of tape.

While there are many types of microphones, only a few are used in CATV applications. Omidirectional microphones can be used in studios to pick up sounds from all directions. Cardioid microphones, which are more sensitive to sounds from the front than to sounds from the rear, are excellent for general use. Recently developed snorkel microphones are unidirectional and very sensitive to sounds directly in front of them, making them particularly suitable for picking up distant voices without picking up unwanted sounds.

In the television studio, the microphones can be mounted on floor

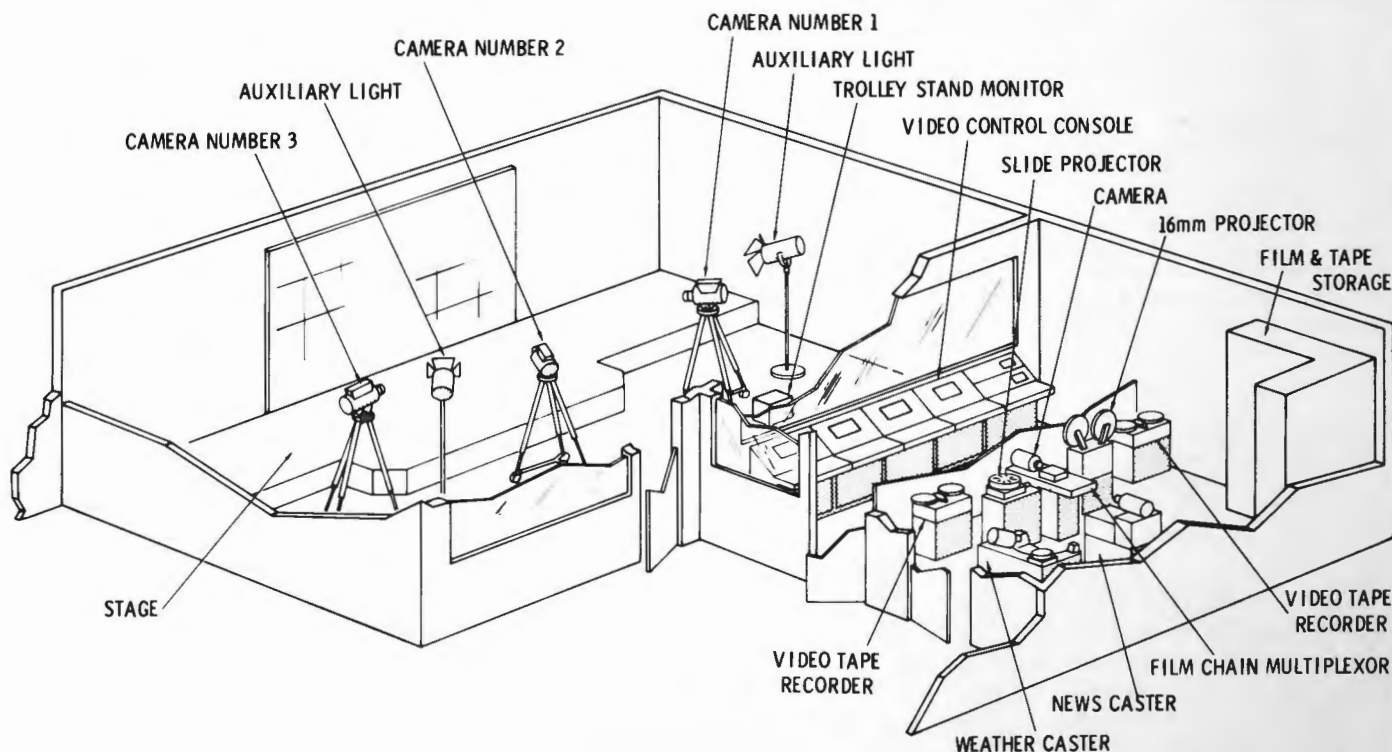


Fig. 13 Layout of a typical local origination facility.



### It loses nothing in the translation.

Film and television have always talked different languages. The subtle colors you see through the camera viewfinder can often become harsh and contrasty on the TV screen.

That's why Agfa-Gevaert designed two low-contrast reversal films specifically for TV transmission.

Gevachrome T 6.00 combines extremely fine grain with the low contrast required for television. In both interior and exterior scenes its true color rendition retains all the brilliance and sharpness you want, without losing important middle tones in transmission. Its ASA 50 speed can be doubled in the laboratory.

And, when you're shooting in available light, you should be using Gevachrome T 6.05. Its

exposure index, too, can be doubled—to an ultra-fast ASA 250—without the graininess you expect from high-speed films. A low contrast film, T 6.05 lets you take in all the action without taking along the extra lights.

With the Gevachrome prepackaged chemicals, you can process both films anywhere in the world. Make it the star of your next show.



Agfa-Gevaert, Inc., 275 North St., Teterboro, N.J. 07608  
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6901 North Hamlin Ave., Chicago, Ill. 60645

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## AGFA-GEVAERT

stands or suspended from adjustable overhead booms. For newscasts, a desk-stand microphone can be used by the announcer, but a lavalier microphone, suspended from the announcer's neck, allows freedom of movement and keeps his voice within the desired range of the microphone.

### Videotape Recorders

A videotape recorder is an essential part of a program origination set-up since it records still and moving pictures and sound on reels of magnetic tape much as a conventional audio tape recorder records sound alone, and like an audio recorder, it permits instant replay of recorded material. Videotape recorders recorded television pictures from a television camera, from a television receiver or by duplication from another recording. Sound tracks on the video tape permit au-

dio recording from microphones or other audio sources, resulting in sound motion pictures.

In audio tape recording, where frequency response up to 18,000 Hz allows high fidelity recording of music, the tape moves past the recorder's stationary heads. Tape speed of 7½-inches-per-second is the accepted standard speed for high quality performance. Since much higher frequencies are required to record TV pictures, the tape is moved past rotating heads, increasing the frequency response to permit the recording of picture information.

Two kinds of video tape recorders are commonly used today—transverse and helical. In 1956, the rotary recording head and a technique called transverse recording was introduced and still is the standard in the broadcast industry. Two-inch-wide video tape is moved past recording heads at 7½-inches-per-

second. Four record/playback heads are mounted on a disc which is rotated rapidly across the tape at virtually a 90 degree angle to the path of the tape, increasing the relative tape-to-head speed to 1,500 inches-per-second and achieving frequencies of more than 5,000,000 Hz per second.

In 1963, a new generation of smaller recorders was introduced, utilizing a helical recording technique. One or two record/playback heads are mounted on a moving drum and record across the moving tape in a diagonal curve known as a helix. In the one-inch-wide format, the tape travels across the moving head at 9.6 inches-per-second to produce a relative tape speed of 1,000 inches-per-second and frequencies of 3.2 MHz.

Minimum equipment needed to produce a video tape program is a camera, a tripod for securing the camera, a microphone for picking up sound, a videotape recorder for recording the signals, a reel of magnetic tape for providing the recording surface, and a television set for first previewing and then monitoring the picture during transmission. A simple professional videotape recording system may be purchased for approximately \$2,000.

More complex systems—incorporating electronic editing, color recording and playback, multi-recorder and multi-camera installations—are necessarily more expensive.

In addition to conventional videotape recorders which provide one video and one audio channel, an audio-visual recorder, capable of recording video and as many as five different audio tracks, is now available.

Since the recorder is capable of video recording or playback combined with any or all of five different audio channels, multi-lingual audio can be transmitted simultaneously with the picture. The picture and the English-language audio can be transmitted over a TV channel, and audio in other languages can be transmitted over separate FM channels. Foreign language viewers would watch the picture with a TV receiver and listen to the audio with an FM receiver. ▲

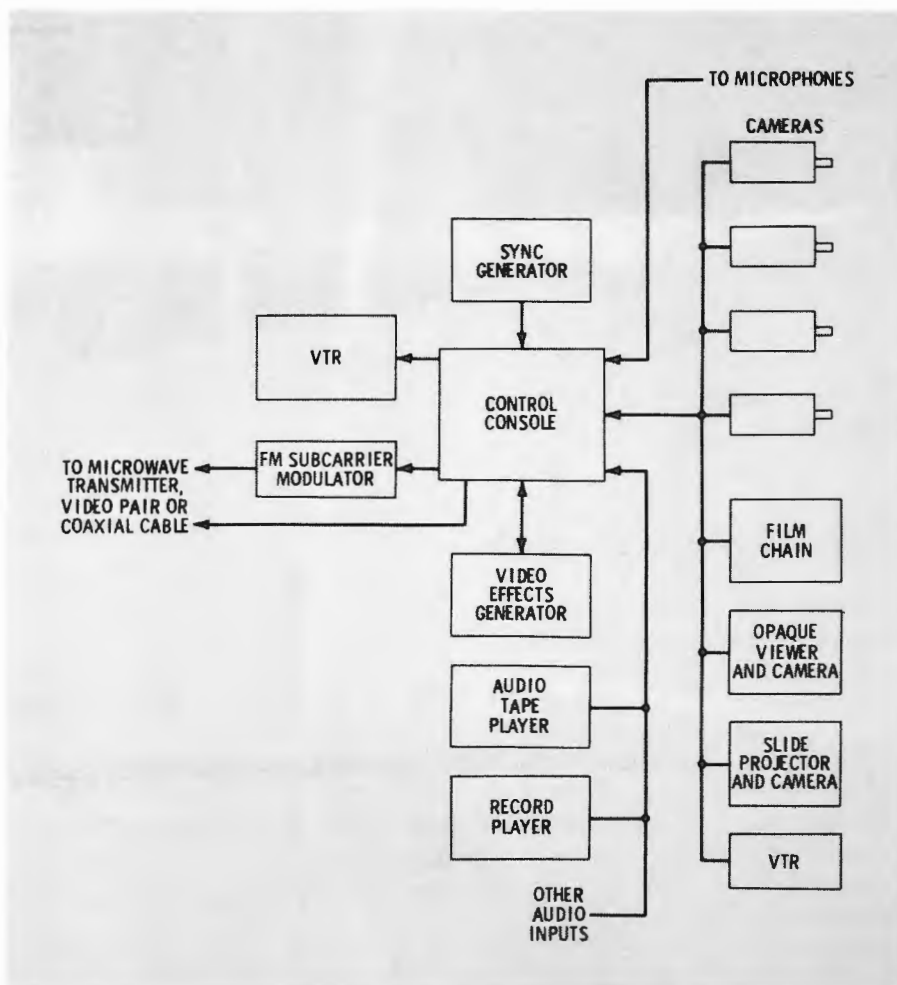


Fig. 14 Example of facilities for a remote studio.

# Origination Directory

This directory of local program origination equipment was compiled by the staff of Leo G. Sands Associates, Inc. The firm has 16 years of experience in market research and maintains files of data on all types of equipment used in telecommunications, CATV, and broadcasting applications.

No directory can include everyone in the field covered. This is so because some manufacturers and marketers have not adequately made their products known or because they do not answer directory questionnaires. For these reasons, we suggest you check additional

type equipment categories in the Broadcast Directory section of this special issue. This will be especially helpful when looking for equipment not directly related to Cable origination components.

During the time that this directory section was being compiled, U.S. Postal Service letter carriers were on strike. Doubtless, some mail never did reach its destination. Suppliers whose listings were not included are urged to send the appropriate information to **Broadcast Engineering** so that they may be included in future directories.

## Cameras Program Origination Equipment

Ameco Inc.  
Ampex Corp.  
Blonder-Tongue Labs Inc.  
Brown Engineering Co., Inc.  
Brush Instruments Div., Gould Inc.  
Canadian Marconi Co.  
Catal  
CBS Labs  
Chester Electronic Labs.  
Cohu Electronics Inc.  
Concord Electronics Corp.  
Commercial Elect.  
Diamond Power Specialty Corp.  
Fairchild  
GBC Closed Circuit TV  
General Electric Co.  
Karl Heitz, Inc.  
International Video Corp.  
Kalart Co., Inc.  
Listec TV Equipment Corp.  
Marconi Div., English  
Electronic Corp.  
Midland International Corp.  
Motorola Inc., Communications Div.  
Norelco, Philips Broadcast Equip.  
Parkard Bell  
Panasonic, VTR/CCTV Dept.  
Raytheon Learning Systems Co.  
RCA Corporation  
Riker Information Systems Inc.  
Roberts Div. of Rheem Mfg. Co.  
Sarkes Tarzian, Broadcast  
Equip. Div.  
Shibadan Corp. of America  
Siemens America, Inc.  
Singer Co., GPL-TV Link Div.  
Sonocraft Corp., CCTV Div.  
Sylvania Electric Products Inc.  
Telemation  
Tele Measurements Inc.  
Television Utilities Co.  
Tyler R. H. Co., CATV Div.  
Vikoa, Inc.  
Visual Electronics Corp.  
Westinghouse Electric Corp.

## Film Projectors

ATV Engineering Specialties  
Chester Electronics Labs.  
Christie Electric Corp.  
Karl Heitz, Inc.  
Listec TV Equipment Corp.  
L-W Photo Inc.  
Magna-Tech Electronic Co., Inc.  
RCA Corporation  
Sarkes Tarzian Inc., Broadcast  
Equip. Div.  
Singer Co., GPL-TV Link Div.  
Sonocraft Corp., CCTV Div.  
Telepro Industries  
Triad Corp.  
Tyler R. H. Co., CATV Div.  
Vikoa, Inc.

## Lighting Systems

Bardwell McAllister Inc.  
Berkey-Colortran Inc.

Century-Strand  
FB Ceko Inc.  
Houston Electronics  
Janson Industries  
Kliegl Brothers  
Lighting Unlimited  
Mole Richardson Co.  
RCA Corporation  
Singer Prod. Co.  
Skirpan Electronics  
Sonocraft Corp.  
Sylvania  
Tele Measurements Inc.  
Telequip Corp.  
Visual Electronics

## Long Play Audio Tape Equipment

International Good Music  
Magnecord  
Sarkes Tarzian Inc., Broadcast  
Equip. Div.  
Scully Recording Instruments Co.  
Stancil-Hoffman  
Tape-Athon Corp.  
VIF International

## Monitors

Ameco, Inc.  
Ball Bros. Research Corp.,  
Comm. Div.  
Chester Electronic Labs  
Cohu Electronics, San Diego Div.  
Conrac Div.  
Diamond Power Specialty Corp.  
Hewlett-Packard  
Listec TV Equipment Corp.  
Miratel Electronics  
Motorola Inc., Communications Div.  
Panasonic, VTR/CCTV Dept.  
Rank Precision Ind., Broadcast Div.  
RCA Corporation  
Riker Information Systems Inc.  
Roberts Div. of Rheem Mfg. Co.  
Sarkes Tarzian Inc., Broadcast  
Equip. Div.  
Shibadan Corp. of America  
Singer Co., GPL-TV Link Div.  
Sonocraft, CCTV Div.  
Telemation, Inc.  
Television Equip. Assoc.  
Television Utilities, Co.  
Tyler R. H. Co., CATV Div.

## Video Effects Machines

Alma Engineering Inc.  
Ball Bros. Research Corp.,  
Comm. Div.  
Chester Electronic Labs.  
Colorado Video Inc.  
Cohu Electronics, San Diego Div.  
Dynair Electronics Inc., Factory Div.  
Grass Valley Group Inc.  
Kliegl Brothers  
Panasonic, VTR/CCTV Dept.  
Richmond Hill Labs, Ltd.  
Riker Information Systems Inc.  
Sarkes Tarzian Inc., Broadcast  
Equip. Div.

Shibadan Corp. of America  
Shintron Co., Inc., Video Div.  
Singer Co., GPL-TV Link Div.  
Spindler & Sauppe, Inc.  
Telemation, Inc.  
Telemet, Div. of Geotel

## TV Modulators

Catal Corp.  
Dynair Electronics, Factory Div.  
Jerrold Electronics Corp., CATV Div.  
Sarkes Tarzian Inc., Broadcast  
Equip. Div.  
Shibadan Corp. of America  
Sonocraft Corp., CCTV Div.  
Telemet, Div. of Geotel  
Tyler R. H. Co., CATV Div.

## Videotape Recorders

Ampex Corp.  
Chester Electronic Labs.  
Concord Electronics Corp.  
Craig Panorama, Inc.  
Diamond Power Specialty Corp.  
General Electric Co.  
Karl Heitz, Inc.  
International Video Corp.  
Listec TV Equip. Corp.  
Norelco, Philips Broadcast  
Equip. Corp.  
Panasonic, VTR/CCTV Dept.  
RCA Corporation  
Riker Information Systems Inc.  
Roberts Div. of Rheem Mfg. Co.  
Shibadan Corp. of America  
Singer Co., GPL-TV Link Div.  
Sonocraft, CCTV Div.  
Sony Corp. of America  
Telemation, Inc.  
Tyler R. H. Co., CATV Div.

## Video Switchers

Alma Engineering, Inc.  
Ampex Corp.  
Ball Bros. Research Corp.,  
Comm. Div.  
Catal Corp.  
Central Dynamics  
Chester Electronic Labs.  
Cohu Electronics Inc., San Diego Div.  
Computer Image Corp.  
Dynair Electronics Inc., Factory Div.  
Grass Valley Group Inc.  
Karl Heitz, Inc.  
Richmond Hill Labs., Ltd.  
International Good Music  
Kliegl Bros.  
3M Co., Mincom Div.  
Panasonic, VTR/CCTV Dept.  
Philips Broadcast Equip.  
RCA Corporation  
Riker Information Systems Inc.  
Sarkes Tarzian Inc., Broadcast  
Equip. Div.  
Shibadan Corp. of America  
Shintron Co. Inc., Video Div.  
Singer Co., GPL-TV Link Div.  
Sonocraft, CCTV Div.

Telemation, Inc.  
Telemet Div. of Geotel  
Television Utilities Co.  
Trompeter Electronics, Inc.  
Tyler R. H. Co., CATV Div.  
Vital Industries, Inc.

## Sync Generators

Ball Bros. Research Corp.,  
Comm. Div.  
Chester Electronic Labs.  
Colorado Video Inc.  
Cohu Electronics, San Diego Div.  
Dynair Electronics Inc., Factory Div.  
Grass Valley Group Inc.  
Karl Heitz, Inc.  
Kliegl Bros.  
Listec TV Equipment Corp.  
Panasonic, VTR/CCTV Dept.  
RCA Corporation  
Sarkes Tarzian Inc., Broadcast  
Equip. Div.  
Shibadan Corp. of America  
Singer Co., GPL-TV Link Div.  
Sonocraft, CCTV Div.  
Tektronix, Inc.  
Telemation, Inc.  
Telemet, Div. of Geotel  
Tyler R. H. Co., CATV Div.

## Auxiliary Equipment

Cleaners - Ultrasonic - Film, Tape  
Lipsner-Smith Corp.  
Compensators - Color  
3M Co., Mincom Div.  
Consoles, Video  
Electrodyne Corp.  
RCA Corporation  
Shibadan Corp. of America  
Controls - Audio  
Collins Radio Co., Broadcast Div.  
Electrodyne Corp.  
Gates Radio Co.  
International Good Music  
Langevin  
Riker Information Systems Inc.  
Switchcraft, Inc.  
Ultrasonic Products  
Controls - Camera  
O'Connor Engineering Labs Inc.,  
Photographic Div.  
Controls - Zoom Lens  
Power-Optics Inc.  
Vicon Industries Inc.  
Film - Inspection Equipment  
Harwald Co.  
Film - Processing Equipment  
Grass Valley Group Inc.  
Kliegl Bros.  
Trelse Engineering Inc.  
Film - Systems  
RCA Corporation  
Telepro  
Lenses  
Bausch & Lomb Inc.  
Motorola Inc., Comm. Div.  
Rank Broadcast Div.  
Vikoa, Inc.

**Rollers - Caption**  
Listec TV Equipment Corp.  
**Tripods - Stands - Dollies**  
Davis & Sanford  
Listec TV Equipment Corp.  
Quick-Set Inc.  
Riker Information Systems Inc.

#### Auxiliary Equipment—General

Alma Engineering Inc.  
Anaconda Electronics  
Asteroid Corp.  
Ball Bros. Research Corp.,  
Comm. Div.

Behrends, Inc.  
Benco Television Corp.  
Brush Instruments Div.,  
Gould Inc.  
Chester Electronic Labs.  
Cohu Electronics, San Diego Div.  
Davis & Sanford  
Diamond Power Specialty Corp.  
Electrodyn Corp.  
Electro-Voice, Inc.  
GBC Closed Circuit Television Corp.  
Grass Valley Group, Inc.  
Harwald Co.  
Karl Heitz, Inc.

HTV Systems Inc.  
International Good Music  
Kaiser-Cox Corp.  
Kliegl Bros.  
Listec TV Equipment Corp.  
Magna-Tech Electronic Co., Inc.  
3M Co., Mincom Div.  
O'Connor Eng. Labs Inc.,  
Photographic Div.  
Philips Broadcast Equip.  
Photo Research Corp.  
Quick-Set Inc.  
Rank Precision Ind., Broadcast Div.  
RCA Corporation  
Riker Information Systems Inc.

Shibadan Corp. of America  
Shure Bros., Inc.  
Spinaier-Sauppe  
Taco  
Tektronix, Inc.  
Telemation, Inc.  
Telepro Industries  
Telesync Corp.  
Television Equipment Assoc.  
Television Presentations  
Total Technology  
Vicon Industries  
Visual Dynamics  
Visual Electronics  
Woodward Assoc.

## Guide To Manufacturers

### A

**Alma Engineering Inc.**  
7990 Dagget St.  
San Diego, Cal. 92111

**Ameco Inc.**  
2949 W. Osborn Rd.  
Phoenix, Ariz. 85017

**Ampex Corp.**  
401 Broadway  
Redwood City, Cal. 95063

**Anaconda Electronics**  
1430 S. Anaheim Blvd.  
Anaheim, Cal. 92803

**Asteroid Corp.**  
5665 Kearny Villa Rd.  
San Diego, Cal. 92123

**ATV Engineering**  
4202 36th Ave. West  
Seattle, Wash. 98199

### B

**Ball Bros. Research Corp.,  
Commercial Div.**  
1050 33rd St.  
Boulder, Colo. 90038

**Bardwell McAlister**  
1117 N. McCadden Pl.  
Hollywood, Cal. 90038

**Behrends, Inc.**  
161 East Grand Ave.  
Chicago, Ill. 60611

**Benco Television Corp.**  
724 Bugbee St.  
Jacksonville, Fla. 32207

**Berkey-Colortran**  
1015 Chesnut St.  
Burbank, Cal. 91502

**Blonder-Tongue Labs Inc.**  
9 Alling St.  
Newark, N.J. 07102

**Broadcast Electronics**  
8810 Brookville Rd.  
Silver Springs, Md. 20910

**Broadcast Products Inc.**  
12330 Wilkins Ave.  
Rockville, Md. 20851

**Brown Engineering Co., Inc.**  
300 Sparkman Dr.  
Huntsville, Ala. 35805

**Brush Instruments Div.  
Gould Inc.**  
3631 Perkins Ave.  
Cleveland, Ohio 44114

### C

**Canadian Marconi Co.**  
2442 Trenton Ave.  
Montreal 16, Quebec

**Catel Corp.**  
517 Marine View Ave.  
Belmont, Cal. 94002

**Central Dynamics**  
903 Main St.  
Cambridge, Mass. 02139

**Century-Strand**  
3 Entin Road  
Clifton, N.J. 07014

**CBS Labs Div., Columbia  
Broadcasting System Inc.**  
227 High Ridge Rd.  
Stanford, Conn. 06905

**C-Cor Electronics, Inc.**  
State College, Pa. 16801

**Chester Electronic Labs.  
Div. Sylvania Information  
Systems Group**  
Winthrop Road  
Chester, Conn. 06412

**Christie Electric Corp.**  
3410 W. 67th Street  
Los Angeles, Cal. 90060

**Cohu Electronics Inc.,  
San Diego Div.**  
P.O. Box 623  
San Diego, Cal. 92112

**Collins Radio Co., Broadcast Div.**  
Mail Stop 407023  
Dallas, Texas 75207

**Colorado Video Inc.**  
P.O. Box 928  
Boulder, Colo. 90302

**Commercial Elect.**  
1271 Terra Bella Ave.  
Mountain View, Calif. 94040

**Computer Image Corp.**  
2685 Beverly Dr.  
Beverly Hills, Cal. 90212

**Concord Electronics Corp.**  
1935 Armacost Ave.  
Los Angeles, Cal. 90025

**Conrac**  
600 N. Rimsdale Ave.  
Covina, Cal. 91722

**Craig Panorma, Inc.**  
2302 E. 15th St.  
Los Angeles, Cal. 90021

### D

**Davis & Sanford**  
24 Pleasant St.  
New Rochelle, N.Y. 10802

**Diamond Power Specialty Corp.**  
P.O. Box 415  
Lancaster, Ohio 43130

**Dynair Electronics Inc., Factory Div.**  
6360 Federal Blvd.  
San Diego, Cal. 92114

### E

**Electrodyn Corp.**  
7315 Greenbush Ave.  
North Hollywood, Cal. 91605

**Electro-Voice, Inc.**  
Buchanan, Mich. 49107

### F

**Fairchild**  
30 Park Place  
Paramus, N.J. 07652

**F. B. Ceko Inc.**  
315 W. 43rd St.  
New York, N.Y. 10036

### G

**Gates Radio Co.**  
123 Hampshire St.  
Quincy, Ill. 62301

**GBC Closed Circuit Television Corp.**  
74 Fifth Ave.  
New York, N.Y. 10011

**General Electric Co.**  
2200 N. 22nd St.  
Decatur, Ill. 62526

**Grass Valley Group Inc.**  
P.O. Box 114  
Grass Valley, Cal. 95945

### H

**Harwald Co.**  
1245 Chicago Ave.  
Evanston, Ill. 60202

**Karl Heitz, Inc.**  
979 Third Avenue  
New York, N.Y. 10022

**Hewlett-Packard**  
100 Locust Ave.  
Berkeley Heights, N.J. 07922

**Richmond Hill Labs., Ltd.**  
1240 Ellesmere Rd.  
Scarborough, Ont.

**HTV Systems, Inc.**  
10 Monroe St.  
East Rochester, N.Y. 14445

**Houston Electronics**  
11801 W. Olympic Blvd.  
Los Angeles, Cal. 90064

### I

**International Good Music**  
3950 Home Road  
Bellingham, Wash. 98225

**International Video Corp.**  
675 Alamo Ave.  
Sunnyvale, Cal. 94086

### J

**Janson Industries**  
Box 985  
Canton, Ohio 44701

**Jerrold Electronics Corp.,  
CATV Div.**  
401 Walnut St.  
Philadelphia, Pa. 19105

### K

**Kaiser-Cox Corp.**  
Box 9728  
Phoenix, Ariz. 85020

**Kalart Co., Inc.**  
Hultenius St.  
Plainville, Conn. 06062

**Kliegl Bros.**  
32-32 48th Ave.  
L.I.C., N.Y. 11101

### L

**Langevin**  
1801 E. Carnegie Ave.  
Santa Anna, Cal. 92705

**Lighting Unlimited**  
560 W. Beech St.  
Long Beach, N.Y. 11561

**Lipsner-Smith Corp.**  
7334 N. Clark St.  
Chicago, Ill. 60626

**Listec TV Equipment Corp.**  
35 Cain Drive  
Plainview, N.Y. 11803

L-W Photo Inc.  
1541 Cabrito Rd.  
Van Nuys, Cal. 91406

## M

**Magnecord**  
9600 Aldrich Ave. South  
Minneapolis, Minn. 55420

**Magna-Tech Electronic Co., Inc.**  
630 Ninth Ave.  
New York, N.Y. 10036

**Marconi Div., English Electric Corp.**  
1 Park Ave.  
New York, N.Y. 10016

**Midland International Corp.**  
1909 Vernon St.  
N. Kansas City, Mo. 64116

**Mincom Div., 3M Co.**  
300 S. Lewis Rd.  
Camarillo, Cal. 93010

**Miratel Electronics**  
3600 Richardson St.  
St. Paul, Minn. 55112

**Mole Richardson**  
937 N. Sycamore Ave.  
Hollywood, Cal. 90038

**Motorola Inc., Communications Div.**  
1301 Algonquin Rd.  
Schaumburg, Ill. 60172

## N

**Norelco, Philips Broadcast Equip. Corp.**  
100 E. 42nd St.  
New York, N.Y. 10017

## O

**O'Connor Eng. Labs Inc., Photographic Div.**  
3490 E. Foothill  
Pasadena, Cal. 91107

## P

**Panasonic, VTR/CCTV Dept., Matsushita Electric Corp. of America**  
23-05 44th Road  
L.I.C., N.Y. 11101

**Philips Broadcast Equip. Corp.**  
299 Rt. 17  
Paramus, N.J. 07652

**Photo Research Corp.**  
3000 N. Hollywood Way  
Burbank, Cal. 91502

**Power-Optics Inc.**  
P.O. Box 266  
Fairview Village, Pa. 19409

## Q

**Quick-Set Inc.**  
8121 Central Park Ave.  
Skokie, Ill. 60076

## R

**Rank Precision Ind., Broadcast Div.**  
260 North Rt. 303  
West Nyack, N.Y. 10956  
**Raytheon Learning Systems Co.**  
475 S. Dean St.  
Englewood, N.J. 07631

**RCA Corporation**  
Front & Cooper Sts.  
Camden, N.J. 08102

**Riker Information Systems Inc.**  
101 Industrial East  
Clifton, N.J. 07012

**Roberts Div. of Rheem Mfg. Co.**  
Los Angeles, Cal. 90016

## S

**Sarkes Tarzian Inc., Broadcast Equip. Div.**  
E. Hillside Dr.  
Bloomington, Ind. 47401

**Scully Recording Instruments Co.**  
400 Bunnell St.  
Bridgeport, Conn. 06607

**Shibadan Corp. of America**  
58-25 Brooklyn-Queens Expwy.  
Woodside, N.Y. 11377

**Shintron Co. Inc., Video Div.**  
144 Rogers St.  
Cambridge, Mass. 02142

**Shure Bros., Inc.**  
222 Hartrey Ave.  
Evanston, Ill. 60204

**Siemens America, Inc.**  
350 Fifth Ave.  
New York, N.Y. 10001

**Singer Co., GPL-TV Link Div.**  
Binghamton, N.Y.

**Skirpan Electronics**  
4143 24th St.  
Long Island, N.Y. 11101

**Sonocraft Corp., CCTV Div.**  
29 W. 36th St.  
New York, N.Y. 10018

**Sony Corp. of America**  
47-47 Van Dam St.  
L.I.C., N.Y. 11101

**Spectra Sonics**  
770 Wall Ave.  
Ogden, Utah 84404

**Spindler-Sauppe, Inc.**  
1329 Grand Central Ave.  
Glendale, Cal. 91201

**Stancil-Hoffman Corp.**  
921 North Highland  
Hollywood, Cal. 90038

**Switchcraft, Inc.**  
5555 N. Elston Ave.  
Chicago, Ill. 60630

**Sylvania Electric Products Inc., Comm. Elect. Div.**  
Burlington Road  
Bedford, Mass. 01730

## T

**Taco**  
Sherburne, New York 13460

**Tape-Athon Corp.**  
502 S. Isis  
Inglewood, Cal. 90301

**Tektronix, Inc.**  
P.O. Box 500  
Beaverton, Oregon 97005

**Telemation, Inc.**  
2275 S. West Temple  
Salt Lake City, Utah 84115

**Tele Measurements Inc.**  
145 Main Ave.  
Clifton, N.J. 07014

**Telemet, Div. of Geotel**  
185 Dixon Ave.  
Amityville, N.Y. 11701

**Telepro Industries**  
3 Olney Road  
Cherry Hill, N.J.

**Telequip Corp.**  
224 Glen Cove Ave.  
Glen Cove, N.Y. 11524

**Telesync Corp.**  
20 Insley St.  
Demarest, N.J. 07627

**Television Equipment Assoc.**  
P.O. Box 1391  
Bayville, N.Y. 11709

**Television Presentations**  
375 Park Ave.  
New York, N.Y. 10017

**Television Utilities Co.**  
10-11 50th Avenue  
Long Island City, N.Y.

**Total Technology**  
180 Constitution Drive  
Menlo Park, Cal. 94025

**Treise Engineering Inc.**  
1941 First St.  
San Fernando, Cal. 91340

**Triad Corporation**  
777 Flower St.  
Glendale, Cal. 91201

**Trompeter Electronics, Inc.**  
8936 Comanche Ave.  
Chatsworth, Cal. 91311

**Tyler R. H. Co., CATV Div.**  
1404 15th St.  
Wellington, Texas 79095

## U

**Ultraaudio Products**  
P.O. Box 921  
Beverly Hills, Cal. 90213

## V

**Vicon Industries Inc.**  
13 Stepar Place  
Huntington Station, N.Y. 11746

**VIF International**  
P.O. Box 1555  
Mountain View, Cal. 94040

**Vikoa, Inc.**  
400 Ninth St.  
Hoboken, N.J. 07030

**Visual Dynamics**  
8530 Wilshire Blvd.  
Beverly Hills, Cal. 90211

**Visual Electronics Corp.**  
356 W. 40th St.  
New York, N.Y. 10036

**Vital Industries, Inc.**  
3614 SW Archer Rd.  
Gainesville, Fla. 32601

## W

**Westinghouse Electric Corp.**  
E. Pittsburgh, Pa. 15112

**Woodward Assoc., Inc.**  
P.O. Box 22  
Fayetteville, N.Y. 13066



**Norelco EL3401A/54 VIDEO RECORDER**  
#29,503 \$585.00

## EXTRA SPECIAL COMBINATION

### Complete V.T.R. Recording System

ALL BRAND NEW

- 1—Norelco VTR EL3401A/54 \$585.00;
- 1—TV Camera TK-204 VD-4 \$169.95 and
- 1—Canon TV-16 1" F1.4 Lens \$39.95.

Total Value \$794.90

**SPECIAL PACKAGE PRICE . . . \$749.95**

Stock #5000-BE. Shipped via REA or truck, charges collect. Details in flyer 970J-2—no charge. The items available separately at prices shown. More bargains available from free flyers 970J-1 and 970M-1.

**DENSON ELECTRONIC CORP.**

**PO Box 85, Longview St. • (203) 875-5198 • Rockville, Conn. 06066**



\$169.95

**CCTV CAMERA**  
#18361

Circle Number 37 on Reader Reply Card

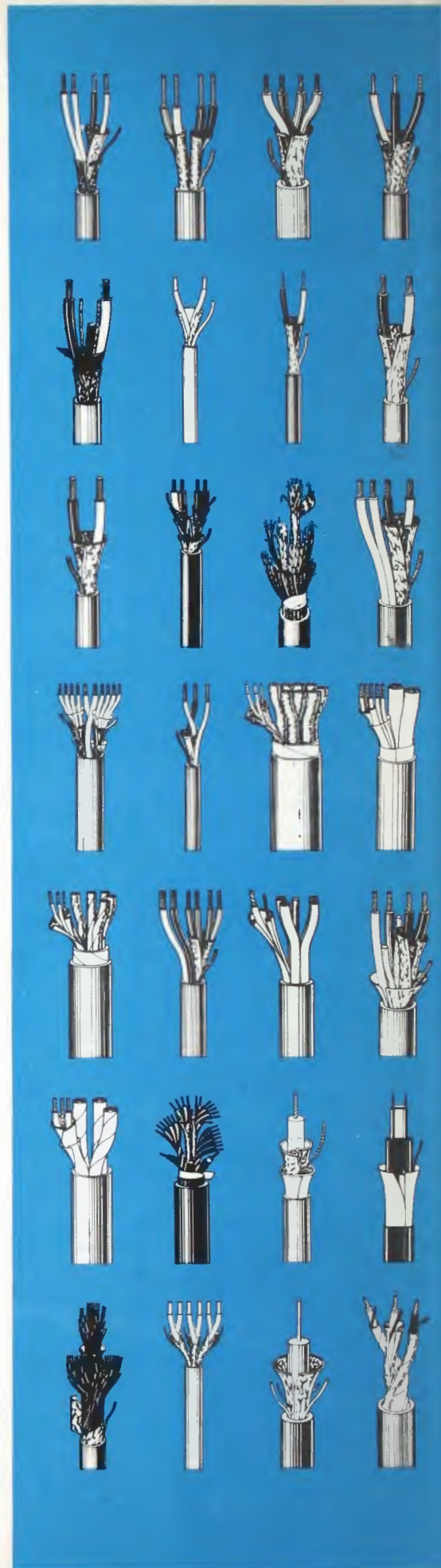
# end your signal pollution problems

## Beldfoil® ISO-Shielded™ Cable

It's the cable with virtually perfect shielding. It's a Belden exclusive. Beldfoil ISO-Shield is like a continuous metal tube enclosing each pair of conductors in a cable. It locks out crosstalk or interference . . . whether from outside sources or between shielded elements in the cable.

Beldfoil is a layer of aluminum foil bonded to a tough polyester film (for insulation and added strength.) To form an ISO-Shield, we apply it in any one of several unique ways to meet the requirements of different applications. (See Figures 1 and 2, for example). Each gives more physical shield coverage than braided wire or spiral wrapped (served) shields. And greater shield effectiveness . . . even after repeated flexing.

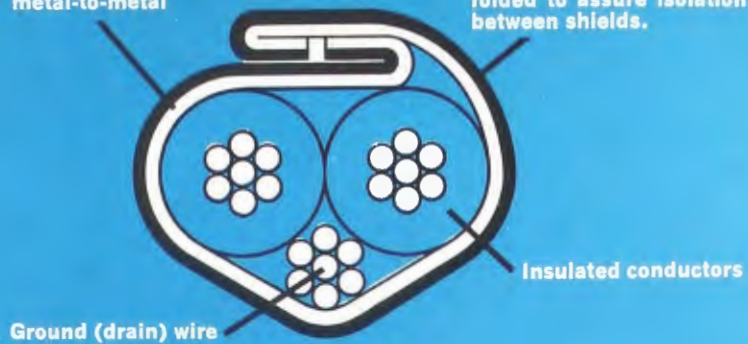
Beldfoil ISO-Shielded Cables are small, lightweight. They terminate easily. They're modest in price. Your Belden Distributor stocks a wide variety of standard Beldfoil shielded cables as listed in the "Belden Electronic Wire and Cable Catalog" (ask him for the latest edition). And, should you have specifications no standard product can meet, ask him to quote on a specially engineered design. Or, if you choose, contact: Belden Corporation, P. O. Box 5070-A, Chicago, Ill. 60680. Phone (312) 378-1000.



Metal (shield) foil, folded to assure metal-to-metal contact.

FIGURE 1

Polyester insulating layer folded to assure isolation between shields.



### Beldfoil Multiple Pair Individually Shielded Cable

The Figure 1 cross-section shows Belden's exclusive Z-folded Beldfoil ISO-Shield. Note the metal-to-metal contact between the two edges of the aluminum foil. In essence, you have a continuous aluminum tube. And the polyester layer on the outside of the fold assures the isolation between shields so necessary for best performance in the field.

#### Technical Data

Nominal values for multiple pair individually shielded cables containing 3 to 27 pairs (including 8769 and 8773 through 8778 Series cables)

Suggested working voltage: 300 volts rms max.

Working voltage between adjacent shields: 50 volts rms max.

Capacitance between conductors in a pair: 30 pf per ft. nom.

Capacitance between one conductor and other conductor connected to shield: 55 pf per ft. nom.

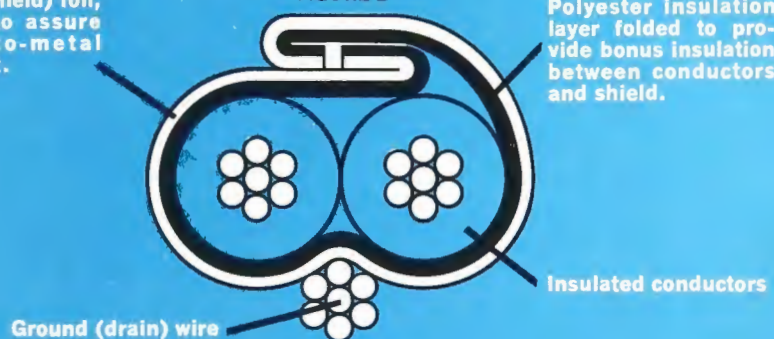
Capacitance between shields on adjacent pairs: 115 pf per ft. nom.

Insulation resistance between shields on adjacent pairs:  
100 megohms per 1000 ft. nom.

Metal (shield) foil, folded to assure metal-to-metal contact.

FIGURE 2

Polyester insulation layer folded to provide bonus insulation between conductors and shield.



### Beldfoil Shielded Single Pair Cable

The Figure 2 cross-section shows the exclusive Belden Z-fold with the polyester insulating layer inward. This makes use of the high dielectric strength of the polyester film as bonus insulation between the conductors and the shield. (The cable jacket provides the primary insulation of the shield from outside objects or adjacent cables.)

#### Technical Data

Nominal values for 8451 Shielded Pair Cable

Suggested working voltage: 200 volts rms max.

Capacitance between conductors: 34 pf per ft. nom.

Capacitance between one conductor and other conductor connected to shield: 67 pf per ft. nom.

**BELDEN**

*new ideas for moving electrical energy*

Circle Number 38 on Reader Reply Card

# Broadcast Product Directory

A listing of over 300 products and services compiled from questionnaires completed by the manufacturers.

## A

### Alarm, Fault

Bird Electronic Corp.  
Diversified Consultants  
Gotham Audio Corp.  
Houston Electronics  
Mallory  
Moseley Electronics  
Noller Control Systems  
Rust Corp.  
Singer Prod. Co., Inc.

### Alarm, Signal

Diversified Consultants  
Electronic Designers, Inc.  
Engineering Assoc.  
RFE Labs  
Rust Corp.  
Trepac Corp. America  
Videometrics, Inc.

### Amplifier, AF, AGC

Altec Lansing  
AMFCO, Inc.  
Ball Brothers  
Bauer/Sparta Trans. Prod.  
CCA Electronics  
C Cor Electronics  
Collins Radio Co.  
Fairchild Recording Eqpt.  
GE Visual Comm. Prod.  
Gates Radio Co.  
Grass Valley Group  
Marti Electronics  
Melcor Electronics Corp.  
Tape-Athon Corp.  
Visual Electronics Corp.  
Ward Electronic Indus.  
Wilkinson Elect. Inc.

### Amplifier, AF, Compressing

Altec Lansing  
Bauer/Sparta Trans. Prod.  
Bogen Communications  
CBS Labs  
CCA Electronics  
Collins Radio Co.  
Electrodyne Corp.  
Fairchild Recording Eqpt.  
Gately Electronics  
Gates Radio Co.  
Marti Electronics  
McMartin Industries, Inc.  
Melcor Electronics Corp.  
Multronics, Inc.  
Philips Broadcast Equipment  
Precision Elect., Inc.  
Ultra Audio Products  
Universal Audio, Inc.  
Ward Electronic Indus.  
Wilkinson Elect. Inc.

### Amplifier, AF, General Purpose

Allied Electronic Corp.  
Altec Lansing  
Amer. Geloso Electronics  
Ampex Corp.  
Arbor Systems, Inc.  
B&K Instruments Inc.  
Bauer/Sparta Trans. Prod.  
Bell P/A Prod. Corp.  
Bogen Communications  
Bradford Information Sys.

### Broadcast Prod. Co., Inc.

Calbest Electronics  
C Cor Electronics  
Collins Radio Co.  
Crown International  
Custom Craft Designs  
Denrad Mfg. Co., Inc.  
Dynair Electronics  
Electrodyne Corp.  
Electronic Designers, Inc.  
Electro-Voice, Inc.  
GE Electronic Components  
GF Visual Comm. Prod.  
Gately Electronics  
Gates Radio Co.  
Grass Valley Group  
Gray Research Div.  
Hewlett Packard Co.  
Intern'l. Nuclear Corp.  
Marti Electronics  
McMartin Industries, Inc.  
Melcor Electronics Corp.  
North Amer. Philips AKG  
Philips Broadcast Equipment  
Precision Elect., Inc.  
Precision Lab.  
Rangertone Electronics  
Round Hill Assoc.  
Singer Prod. Co., Inc.  
Television & Computer Corp.  
Ultra Audio Products  
Universal Audio, Inc.  
Visual Electronics Corp.  
Ward Electronic Indus.

### Amplifier, AF, Peak Limiting, AM

Altec Lansing  
Bauer Electronics Corp.  
Bogen Communications  
CBS Labs  
CCA Electronics  
Collins Radio Co.  
Electrodyne Corp.  
Electronic System Eng.  
Fairchild Recording Eqpt.  
Gately Electronics  
Gates Radio Co.  
Melcor Electronics Corp.  
Multronics, Inc.  
Singer Prod. Co., Inc.  
Tartan Electronics Corp.  
Universal Audio, Inc.  
Ward Electronic Indus.  
Wilkinson Elect., Inc.

### Amplifier, AF, Peak Limiting, FM

Bauer Electronics Corp.  
Bogen Communications  
CBS Labs  
CCA Electronics  
Collins Radio Co.  
Electrodyne Corp.  
Electronic System Eng.  
Fairchild Recording Eqpt.  
Gately Electronics  
Gates Radio Co.  
Singer Prod. Co., Inc.  
Universal Audio Inc.  
Visual Electronics Corp.  
Wilkinson Elect., Inc.

### Amplifier, AF, Remote

Altec Lansing  
Arbor Systems, Inc.

### Bogen Communications

Broadcast Electronics  
Collins Radio Co.  
Fairchild Recording Eqpt.  
Gately Electronics  
Gates Radio Co.  
Lang Elect. Inc.  
Round Hill Assoc.  
Shure Brothers, Inc.  
Singer Prod. Co., Inc.  
Tapecaster  
Ultra Audio Products  
Universal Audio, Inc.  
Visual Electronics Corp.  
Ward Electronic Indus.

### Amplifier, AF, Reverberation

Altec Lansing  
Bauer Electronics Corp.  
Electronic Designers, Inc.  
Gately Electronics  
Gotham Audio Corp.  
North Amer. Philips AKG  
Philips Broadcast Equipment  
Singer Prod. Co., Inc.  
Ultra Audio Products  
Visual Electronics Corp.

### Amplifier, AF, Stereo

Allied Electronic Corp.  
Altec Lansing  
Bauer/Sparta Trans. Prod.  
Bogen Communications  
Calbest Electronics  
Collins Radio Co.  
Crown International  
Electronic Designers, Inc.  
Electro-Voice, Inc.  
Gately Electronics  
Gates Radio Co.  
Heath Co.  
Koss Electronics, Inc.  
Magnecord  
Melcor Electronics Corp.  
Precision Elect., Inc.  
Albert Schultz, Inc.  
Shure Brothers, Inc.  
Singer Prod. Co., Inc.  
Standard Radio Corp.  
Superscope, Inc.  
Tartan Electronics Corp.  
Telecommunications Div.  
Visual Electronics Corp.

### Amplifier, Bridging

AMFCO, Inc.  
Anaconda Electronics  
Arbor Systems, Inc.  
Atlantic Research  
Bauer/Sparta Trans. Prod.  
C Cor Electronics  
Collins Radio Co.  
Comrex Corp.  
Delta Electronics, Inc.  
Denrad Mfg. Co., Inc.  
Dynair Electronics  
Gately Electronics  
Gates Radio Co.  
Intern'l. Nuclear Corp.  
JFD Electronics Co.  
Katona Electronics Co.  
McMartin Industries, Inc.  
Rust Corp.  
Singer Prod. Co., Inc.

### Spencer Kennedy Lab.

Ultra Audio Products  
Universal Audio, Inc.  
Vikoa, Inc.  
Visual Electronics Corp.  
Ward Electronic Indus.

### Amplifier, Clamping

Alma Engineering  
Bell & Howell Tape Div.  
Dynair Electronics  
Grass Valley Group  
Intern'l. Nuclear Corp.  
Presearch, Inc.  
Raytheon Co.  
Riker Video Industries  
Tartan Electronics Corp.  
Telemet Co.  
Videon Corp.  
Visual Electronics Corp.  
Vital Industries

### Amplifier, DC

American Data Corp.  
Bauer/Sparta Trans. Prod.  
Crown International  
GE Electronic Components  
Hewlett Packard Co.  
Honeywell, Inc.  
Melcor Electronics Corp.  
Moseley Electronics  
Presearch, Inc.  
Rust Corp.  
Rustrak Instrument Div.  
Videon Corp.

### Amplifier, Distribution

Alma Engineering  
Ameco, Inc.  
American Data Corp.  
Anaconda Electronics  
Applied Elect. Mechanics  
B&K Instruments Inc.  
Bell P/A Prod. Corp.  
Blonder Tongue Lab., Inc.  
Bogen Communications  
Bradford Information Sys.  
Broadcast Electronics  
Broadcast Prod. Co., Inc.  
C Cor Electronics  
Canoga Elect. Co.  
Central Dynamics Corp.  
Cohu  
Collins Radio Co.  
Delta Electronics, Inc.  
Dynair Electronics  
Electrodyne Corp.  
GBC CCTV  
Gately Electronics  
Grass Valley Group  
Intern'l. Nuclear Corp.  
Katona Electronics Co.  
Low Power Broadcast Co.  
Melcor Electronics Corp.  
North Amer. Philips AKG  
Philips Broadcast Equipment  
Presearch, Inc.  
RCA Broadcast Comm. Prod.  
Riker Video Industries  
Sarkes Tarzian, Inc.  
Shibaden Corp. of Amer.  
Shintron Co., Inc.  
Spencer Kennedy Lab

Spotmaster  
Tartan Electronics Corp.  
Telemation, Inc.  
Telemet Co.  
**TelComp**  
Videon Corp.  
Visual Electronics Corp.  
Vital Industries  
Ward Electronic Indus.

**Amplifier, Keying**  
Presearch, Inc.  
Riker Video Industries  
Videon Corp.

**Amplifier, Masking**  
CBS Labs  
Presearch, Inc.  
Riker Video Industries  
Videon Corp.

**Amplifier, Pulse**  
Alma Engineering  
American Data Corp.  
Applied Elect. Mechanics  
Bogen Communications  
C Cor Electronics  
Central Dynamics Corp.  
Cohu Electronics, Inc.  
Du Val I Fit Corp.  
Dynair Electronics  
G E Electronic Components  
General Radio Co.  
Grass Valley Group  
Hewlett Packard Co.  
Presearch, Inc.  
RCA Broadcast Comm. Prd.  
Richmond Hill  
Riker Video Industries  
Sarkes Tarzian, Inc.  
Tartan Electronics Corp.  
Telemation, Inc.  
Telemet Co.  
Videon Corp.  
Visual Electronics Corp.  
Ward Electronic Indus.

**Amplifier, RF, General Purpose**  
Ameco, Inc.  
Blonder Tongue Lab., Inc.  
Bogen Communications  
CCA Electronics  
C Cor Electronics  
Calbest Electronics  
Collins Radio Co.  
G E Electronic Components  
Hewlett Packard Co.  
Katona Electronics Co.  
Kay Electric Co.  
Microwave Assoc., Inc.  
Rodelco  
Rust Corp.  
Vikoa, Inc.  
Visual Electronics Corp.  
Wilkinson Elect., Inc.

**Amplifier, RF, Peak Limiting**  
Belar Electronics Lab.  
Gates Radio  
Microwave Assoc., Inc.

**Amplifier, RF, Power**  
Amer. Electronic Lab.  
Bauer Electronics Corp.  
CCA Electronics  
C Cor Electronics  
Collins Radio Co.  
Continental Electronics  
Eimac Div.  
GE Visual Comm. Prod.  
Gates Radio Co.  
Hammarlund Mfg.  
Hewlett Packard Co.  
Kay Electric Co.  
Microwave Assoc., Inc.  
Visual Electronics Corp.  
Wilkinson Elect., Inc.

**Amplifier, Sensing**  
Applied Elect. Mechanics  
Broadcast Prod. Co., Inc.  
Houston Electronics  
RFE Labs  
Riker Video Industries  
Ward Electronic Indus.

**Amplifier, Stabilizing**  
Central Dynamics Corp.  
Grass Valley Group

Intern'l. Nuclear Corp.  
Presearch, Inc.  
RCA Broadcast Comm. Prd.  
Riker Video Industries  
Telemet Co.  
Videon Corp.  
Ward Electronic Indus.  
Vital Industries

**Amplifier, TV, Video**  
Alma Engineering  
Ball Brothers  
Blonder Tongue Lab., Inc.  
C Cor Electronics  
The Catel Corp.  
Central Dynamics Corp.  
Cohu Electronics, Inc.  
Dage Bell Div.  
Dynair Electronics  
Fairlane Electronics  
GBC CCTV  
GE Visual Comm. Prod.  
Grass Valley Group  
Ikegami Co., Ltd.  
Intern'l. Nuclear Corp.  
Jerrold Electronics Co.  
JFD Electronics Co.  
Kay Electric Co.  
Miratel Div., Ball Bros.  
Multronics, Inc.  
Philips Broadcast Equipment  
Presearch, Inc.  
RCA Broadcast Comm. Prd.  
Raytheon Co.  
Richmond Hill  
Riker Video Industries  
Sarkes Tarzian, Inc.  
Shintron Co., Inc.  
Singer Prod. Co., Inc.  
Tartan Electronics Corp.  
Tele Cine, Inc.  
Videon Corp.  
Ward Electronic Indus.  
Applied Elect. Mechanics  
Vital Industries

**Amplifier, Video, Sweep**  
C Cor Electronics  
Kay Electric Co.  
Leader Instruments Corp.

**Analyzers, Distortion**  
B&K Instruments, Inc.  
Collins Radio Co.  
General Radio Co.  
Heath Co.  
Hewlett Packard Co.  
Shibaden Corp. of Amer.

**Analyzers, Harmonic**  
General Radio Co.  
Hewlett Packard Co.  
Micom, Inc.  
Rohde Schwarz Sales

**Analyzers, Intermodulation**  
Heath Co.  
Rohde Schwarz Sales

**Analyzers, Noise**  
B&K Instruments, Inc.  
Collins Radio Co.  
General Microwave Corp.  
General Radio Co.  
Hewlett Packard Co.  
Shibaden Corp. of Amer.

**Analyzers, Sideband**  
Collins Radio Co.  
Dynair Electronics  
Metrics Div.  
Rohde Schwarz Sales  
Singer Prod. Co., Inc.  
Ward Electronic Indus.

**Analyzers, Spectrum**  
B&K Instruments, Inc.  
Collins Radio Co.  
Dynair Electronics  
Heath Co.  
Hewlett Packard Co.  
Kay Electric Co.  
Metrics Div.  
Rohde Schwarz Sales  
Singer Prod. Co., Inc.  
Tektronix, Inc.

**Analyzers, Video**  
B&K Instruments, Inc.  
Colorado Video, Inc.  
Shibaden Corp. of Amer.

**Antennas, AM**  
Advance Industries  
Antenna Prod. Div.  
Collins Radio Co.  
Continental Electronics  
Gates Radio Co.  
Marconi Div.  
Rohn Mfg.  
RCA Broadcast Comm. Prd.  
Scala Radio Corp.  
Singer Prod. Co., Inc.  
Visual Electronics Corp.

**Antennas, FM**  
Alford Mfg. Co.  
Ameco, Inc.  
Ampex  
CCA Electronics  
Collins Radio Co.  
Finney Co.  
G C Electronics  
Gates Radio Co.  
Jampro Antenna Co.  
Jerrold Electronics Co.  
JFD Electronics Co.  
Marconi Div.  
Marti Electronics  
McMartin Industries, Inc.  
RCA Broadcast Comm. Prd.  
R F Systems  
Saxton Prod., Inc.  
Scala Radio Corp.  
Singer Prod. Co., Inc.  
Sitco Antenna Co.  
Taco  
Visual Electronics Corp.  
Waber Electronics, Inc.  
Zenith Sales Corp.

**Antennas, LF**  
Collins Radio Co.  
Continental Electronics  
Multronics, Inc.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.

**Antennas, MF**  
Antenna Prod. Div.  
Collins Radio Co.  
Continental Electronics  
Marconi Div.  
Multronics, Inc.  
Singer Prod. Co., Inc.

**Antennas, Microwave**  
Advance Industries  
Ameco, Inc.  
Amer. Electronic Lab.  
Andrew Corp.  
Andrews Towers, Inc.  
Collins Radio Co.  
Du Val I Fit Corp.  
Jerrold Electronics Co.  
Electronic Res. Labs, Inc.  
Metrics Div.  
Micro Link Div.  
Microwave Assoc., Inc.  
Narda Microwave Corp.  
Prodelin, Inc.  
RCA Broadcast Comm. Prd.  
R F Systems  
Raytheon Co.  
Singer Prod. Co. Inc.

**Antennas, Mobile**  
Andrew Corp.  
Andrews Towers, Inc.  
Collins Radio Co.  
Communication Prod. Div.  
G C Electronics  
Marti Electronics  
Microwave Assoc., Inc.  
Prodelin, Inc.  
RCA Broadcast Comm. Prd.  
R F Systems  
Singer Prod. Co., Inc.  
Utica Electronics  
Waters Mfg., Inc.

**Antennas, Remote Pickup**  
Communication Prod. Div.  
Gates Radio Co.  
Microwave Assoc., Inc.  
Prodelin, Inc.  
Scala Radio Corp.  
Singer Prod. Co., Inc.

**Antennas, TV**  
Alford Mfg. Co.  
Allied Electronic Corp.

Ameco, Inc.  
Ampex  
Blonder Tongue Lab., Inc.  
Cush Craft  
Du Val I Fit Corp.  
Finney Co.  
G C Electronics  
GE Visual Comm. Prod.  
Gates Radio Co.  
Jampro Antenna Co.  
Jerrold Electronics Co.  
Marconi Div.  
Multronics, Inc.  
RCA Broadcast Comm. Prd.  
R F Systems  
Scala Radio Corp.  
Singer Prod. Co., Inc.  
Taco  
Vikoa, Inc.  
Zenith Sales Corp.

**Antennas, 2500 MHz**  
Alford Mfg. Co.  
Amer. Electronic Lab.  
Andrew Corp.  
Andrews Towers, Inc.  
Jerrold Electronics Co.  
Micro Link Div.  
Microwave Assoc. Inc.  
Narda Microwave Corp.  
Prodelin, Inc.  
RCA Broadcast Comm. Prd.  
Raytheon Co.  
Scala Radio Corp.  
Singer Prod. Co., Inc.

**Antennas, Systems, HF**  
Andrew Corp.  
Antenna Prod. Div.  
Collins Radio Co.  
Continental Electronics  
Marconi Div.  
Multronics, Inc.  
RCA Broadcast Comm. Prd.  
Scala Radio Corp.  
JFD Electronics Co.

**Arms, Phonograph (see Arms, Tone)**  
Broadcast Electronics  
Gates Radio Co.  
Gray Research Div.  
Albert Schultz, Inc.  
Shure Brothers, Inc.  
Singer Prod. Co., Inc.

**Arms, Tone**  
Broadcast Electronics  
Gates Radio Co.  
Gotham Audio Corp.  
Gray Research Div.  
Russ Electronics, Inc.  
Albert Schultz, Inc.  
Shure Brothers, Inc.

**Attenuators, Audio**  
Altec Lansing  
Ameco, Inc.  
Centralab  
Collins Radio Co.  
Fairchild Recording Eqpt.  
Gotham Audio Corp.  
Holland Electronics  
Jensen Mfg. Div.  
Kay Electric Co.  
Lang Electronics, Inc.  
Mallory  
Omite Mfg. Co.  
Painton, Inc.  
Tech Laboratories, Inc.  
Telonic Instruments  
Texscan Corp.  
Universal Audio, Inc.  
Weinschel Engineering Co.

**Attenuators, Fixed**  
AVA Elect. & Machine Corp.  
Collins Radio Co.  
Davco Electronics Corp.  
General Microwave Corp.  
Holland Electronics  
Kay Electric Co.  
Microlab  
Microwave Assoc., Inc.  
Narda Microwave Corp.  
TV Cable Supply Co.  
Tech Laboratories, Inc.  
Texscan Corp.  
Weinschel Engineering Co.

## Attenuators, Impedance Matching

Ameco, Inc.  
AVA Elect. & Machine Corp.  
Collins Radio Co.  
Holland Electronics  
Metrologie Compagnie Gen.  
Microlab  
Narda Microwave Corp.  
Omite Mfg. Co.  
Rohde Schwarz Sales  
Tech Laboratories, Inc.  
Texscan Corp.  
Trompeter Electronics  
United Recording  
Weinschel Engineering Co.

## Attenuators, Microwave

Ameco, Inc.  
Bell P/A Prod. Corp.  
Collins Radio Co.  
General Microwave Corp.  
Kay Electric Co.  
Electronic Res. Labs., Inc.  
Metrics Div.  
Microlab  
Microwave Assoc., Inc.  
Narda Microwave Corp.  
Rohde Schwarz Sales  
Telonic Instruments  
Weinschel Engineering Co.

## Attenuators, RF

Ameco, Inc.  
AVA Elect. & Machine Corp.  
Bell P/A Prod. Corp.  
Bird Electronic Corp.  
Blonder Tongue Lab., Inc.  
Collins Radio Co.  
Davco Electronics Corp.  
General Microwave Corp.  
Hewlett Packard Co.  
Holland Electronics  
Jerrold Electronics Co.  
Katona Electronics Co.  
Kay Electric Co.  
Electronic Res. Labs., Inc.  
Metrics Div.  
Microwave Assoc., Inc.  
Narda Microwave Corp.  
Rohde Schwarz Sales  
Tech Laboratories, Inc.  
Telonic Instruments  
Texscan Corp.  
Vikoa, Inc.  
Waters Mfg. Inc.  
Weinschel Engineering Co.

## Attenuators, Video

Ameco, Inc.  
Fairlane Electronics  
Holland Electronics  
Kay Electric Co.  
Microlab  
Narda Microwave Corp.  
Painton, Inc.  
Sarkes Tarzian, Inc.  
Telonic Instruments  
Texscan Corp.  
Trompeter Electronics  
Videon Corp.  
Weinschel Engineering Co.

## Automation, Equipment, Program Control

Aitken  
Ameco, Inc.  
American Data Corp.  
Ampex  
Arbor Systems, Inc.  
Bauer/Sparta Trans. Prod.  
B&K Instruments, Inc.  
Broadcast Prod. Co., Inc.  
Chrono Log Corp.  
Collins Radio Co.  
Datatron, Inc.  
Gates Radio Co.  
General Elect.  
Industrial Instrument  
Internatl. Good Music, Inc.  
MaCarta  
Marconi Div.  
Moseley Assoc.  
Orbit Radio and Video  
Presearch, Inc.  
RCA Broadcast Comm. Prd.  
RFE Labs  
Riker Video Industries  
Rust Corp.  
Sarkes Tarzian, Inc.  
Sono-Mag Corp.  
Sparta Elect. Corp.

Tape-Athon Corp.  
Tech Laboratories, Inc.  
Telemation  
Tracor Ind. Inst. Div.  
Ultimation Systems  
Visual Electronics Corp.  
Ward Electronic Indust.  
Zoomar Inc.

## B

### Blowers and Fans

Ameco, Inc.  
Bud Radio, Inc.  
Dynacool Mfg. Co., Inc.  
GE Electronic Components  
Lectionic Res. Labs., Inc.

## C

### Cable, Coaxial, Flexible

Alpha Wire  
Ameco, Inc.  
Amphenol Corp.  
Anaconda Electronics  
Andrew Corp.  
Andrews Towers, Inc.  
Belden Corp.  
Birnbach Co., Inc.  
Boston Insulated  
Brand Rex  
CATV Equipment Co.  
Columbia Electronic CBL  
Communication Prod. Div.  
Comm-Scope Corp.  
Gates Radio Co.  
General Cable Corp.  
Gotham Audio Corp.  
Gulf Electro Sales, Inc.  
IRC Div. TRW, Inc.  
Jampro Antenna Co.  
Jerrold Electronics Co.  
Katona Electronics Co.  
Listec TV Equip. Corp.  
Phelps Dodge Electronics  
Prodelin, Inc.  
Pruzan Co.  
Rome Cable Div.  
Saxton Prod., Inc.  
Singer Prod. Co., Inc.  
Superior Continental Co.  
Terminal Hudson Elect.  
Times Wire And Cable  
Vikoa, Inc.  
Weinschel Engineering Co.

### Cable, Coaxial, Rigid

Alpha Wire  
Amphenol Corp.  
Andrew Corp.  
Andrews Towers, Inc.  
Columbia Electronic CBL  
Communication Prod. Div.  
Gates Radio Co.  
General Cable Corp.  
IRC Div. TRW Inc.  
Jampro Antenna Co.  
Phelps Dodge Electronic  
Prodelin, Inc.  
Rome Cable Div.  
Saxton Prod., Inc.  
Singer Prod. Co., Inc.  
Times Wire And Cable  
Weinschel Engineering Co.

### Cable, Direct-Burial

Alpha Wire  
Amphenol Corp.  
Anaconda Electronics  
Andrews Towers, Inc.  
Belden Corp.  
Birnbach Co., Inc.  
Boston Insulated  
Brand Rex  
Columbia Electronic CBL  
Comm-Scope Corp.  
General Cable Corp.  
Katona Electronics Co.  
Listec TV Equip. Corp.  
Phelps Dodge Electronic  
Prodelin, Inc.  
Rome Cable Div.  
Saxton Prod., Inc.  
Singer Prod. Co., Inc.  
Superior Continental Co.  
TV Cable Supply Co.  
Times Wire And Cable  
Vikoa, Inc.

### Cable, Shielded, Audio

Alpha Wire  
Amphenol Corp.

Belden Corp.  
Birnbach Co., Inc.  
Boston Insulated  
Brand Rex  
Columbia Electronic CBL  
D & B Electronics Co.  
G C Electronics  
Gates Radio Co.  
General Cable Corp.  
Gotham Audio Corp.  
IRC Div. TRW, Inc.  
Nortronics Co., Inc.  
Saxton Prod., Inc.  
Singer Prod. Co., Inc.  
Vikoa, Inc.

## Calibration Service, Instrument

B&K Instruments, Inc.  
Comm. Radio Monitoring  
Edison Electronic Co.  
Hewlett Packard Co.  
Honeywell, Inc.  
Instrument Lab. Corp.  
Potomac Instruments, Inc.  
Simpson Electric Co.  
Weinschel Engineering Co.

## Camera, Mounting Equipment

Ameco, Inc.  
Burke & James  
Du Val I Fit Corp.  
FB Ceco, Inc.  
GBC CCTV  
Hewlett Packard Co.  
Houston Fearless Corp.  
Innovative Television Equip.  
Listec TV Equip. Corp.  
Philips Broadcast Equipment  
Power Optics, Inc.  
Precision Lab.  
Quick-Set  
RCA Broadcast Comm. Prd.  
Shibaden Corp. of Amer.  
Singer Prod. Co., Inc.  
Sylvania Comm. Electronic  
Teledyne Co.  
Telemation, Inc.  
Telequip Corp.  
Television Prod., Inc.  
Vikoa, Inc.  
Visual Electronics Corp.  
Zoomar, Inc.

## Camera, Remote (Control Equipment)

Ameco, Inc.  
Du Val I Fit Corp.  
FB Ceco, Inc.  
GBC CCTV  
Ikegami Co. Ltd.  
Industrial Instrument  
Listec TV Equip. Corp.  
Philips Broadcast Equipment  
Power Optics, Inc.  
RCA Broadcast Comm. Prd.  
Shibaden Corp. Of Amer.  
Sonocraft Corp.  
Sylvania Comm. Electronics  
Tele Cine, Inc.  
Telemation, Inc.  
Trepac Corp. of America  
Tracor Ind. Inst. Div.

## Cameras, Film, Cine

Ameco, Inc.  
Arriflex Corp. of Amer.  
Cohu Electronics, Inc.  
Eastman Kodak Co.  
FB Ceco, Inc.  
Fairchild Industrial  
GAF Corp.  
North American Philips AKG  
Philips Broadcast Equipment  
Precision Lab.  
Teledyne Co.  
Telemation, Inc.

## Cameras, Film, Still

Burke, James  
Cohu Electronics, Inc.  
Eastman Kodak Co.  
GAF Corp.  
North Amer. Philips AKG  
Philips Broadcast Equipment  
Traid Corp.

## Cameras, Image Motion Compensation

Dynasciences Corp.

## Cameras, Oscilloscope

Ameco, Inc.  
Fairchild Industrial  
Hewlett Packard Co.  
Metrics Div.  
Tektronix, Inc.  
Tele Cine, Inc.  
Telemation, Inc.

## Cameras, TV, Color

Ampex  
Ameco, Inc.  
Bell & Howell Tape Div.  
CATV Equipment Co.  
Cohu Electronics, Inc.  
Commercial Elect.  
Du Val I Fit Corp.  
Fernseh  
GBC CCTV  
GE Visual Comm. Prod.  
Ikegami Co. Ltd.  
International Video Corp.  
The Janson Industries  
Lerro Electrical Corp.  
Marconi Div.  
North American Philips AKG  
Philips Broadcast Equipment  
Packard Bell Electronics  
RCA Broadcast Comm. Prd.  
Sarkes Tarzian, Inc.  
Shibaden Corp. of Amer.  
Telemation  
Tele Measurements, Inc.  
Visual Electronics

## Cameras, TV, Monochrome

ATV Research  
Ameco, Inc.  
Bell & Howell Tape Div.  
Bendix Corp.  
Bradford Information Sys.  
CATV Equipment Co.  
Canoga Elect. Co.  
Cohu Electronics, Inc.  
Colorado Video, Inc.  
Concord Elect. Corp.  
Dage Bell Div.  
Diamond Electronics  
Du Val I Fit Corp.  
GBC CCTV  
GE Visual Comm. Prod.  
GPL Div. Singer General  
Gen. Electrodynamics  
General Television Ntwk.  
Ikegami Co. Ltd.  
The Janson Industries  
Jerrold Electronics Co.  
Lerro Electrical Corp.  
Marconi Div.  
Motorola  
MTI Div., KMS Industries  
Nemo Recording Labs  
North American Philips AKG  
Philips Broadcast Equipment  
Packard Bell Electronics  
RCA Broadcast Comm. Prd.  
Sarkes Tarzian, Inc.  
Shibaden Corp. of Amer.  
Shintron Co., Inc.  
Sonocraft Corp.  
Sony Corp. of America  
Sylvania Comm. Electronic  
Telemation, Inc.  
Tele Measurements, Inc.  
Vikoa, Inc.

## Cartridges, Magnetic Tape

Amerline Corp.  
Ampro  
Audio Devices  
Broadcast Electronics  
Channel Marketing, Inc.  
Cine Sonic Sound, Inc.  
Gates Radio Co.  
Internatl. Good Music, Inc.  
MaCarta, Inc.  
Magna Tech. Corp.  
Magna Tech. Corp.  
Magnetic Prod. Div.  
Marathon Broadcast Equip.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co. Inc.  
Tapecaster  
Telecommunications Div.  
Sparta Elect. Corp.  
Stanton Magnetics, Inc.

## Cartridges, Photo

Bourns  
Broadcast Electronics  
Electro-Voice, Inc.

If spec sheets are among your favorite reading, we don't blame you for getting confused at times. Columns of figures aren't always too eloquent on their own, only in context or comparison with other specs. And statistics can be used to support anything — especially statisticians.

So it's nice to know how to read between the lines of a spec sheet. To know, for instance, that not all makers use the same measuring standards. Take overall frequency response: ours is measured at a  $-10\text{dB}$  level, the accepted broadcast standard. Yet certain other brands measure from as low as  $-24\text{ dB}$ .

Unfair to us? Yes. But more important, it's unfair to you.

Of course, there are other ways to play the numbers game. We say go ahead and compare specs till your head spins. But do it right: consider your own overall needs and objectives. Consider specs in relation to other specs on the same component. Compare that unit spec for spec, *standard for standard*, with competing models. Then go give a listen.

True, you can't be a computer.

But you shouldn't have to be a speculator, either.



# TEAC

TEAC Corporation of America • 2000 Colorado Avenue • Santa Monica, CA

# NUMBERS



G E Distributor Sales Op.  
G E Electronic Components  
Gates Radio Co.  
Gotham Audio Corp.  
Shure Brothers, Inc.  
Singer Prod. Co., Inc.  
Sparta Elect. Corp.  
Stanton Magnetics, Inc.

#### Cartridge, Tape (Recording Service)

Broadcast Electronics  
Cine Sonic Sound, Inc.  
Magna Tech Corp.  
Singer Prod. Co. Inc.  
Stanton Magnetics, Inc.

#### Clocks & Chronographs

American Data Corp.  
Bradford Information Sys.  
Broadcast Prod. Co., Inc.  
Chrono Log Corp.  
Electrodyne Corp.  
Gibbs Mfg. Research Co.  
Interntl. Good Music, Inc.  
Listec TV Equip. Corp.  
Parabam, Inc.  
Riker Video Industries  
Standard Elect. Time  
Telecomp Mfg.  
Television & Computer Corp.  
Visual Electronics Corp.

#### Communications Systems, Land, Mobile

Canoga Elect. Co.  
Collins Radio Co.  
Comrex Corp.  
Hammarlund Mfg.  
Marti Electronics  
Moseley Assoc., Inc.  
Moseley Electronics  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.  
Surface Construction

#### Communications Systems, Microwave

Amer. Electronic Lab.  
Andrew Corp.  
Canoga Elect. Co.  
Collins Radio Co.  
Jerrold Electronics Co.  
Lenkurt Electric Co., Inc.  
Marti Electronics  
Micro Link Div.  
Microwave Assoc., Inc.  
Moseley Assoc., Inc.  
Moseley Electronics  
Prodelin, Inc.  
RCA Broadcast Comm. Prd.  
Sarkes Tarzian, Inc.  
Singer Prod. Co., Inc.  
Surface Construction  
Telefunken Sales Corp.

#### Communications Systems, Multiplex

Belar Electronics Lab.  
Calbest Electronics  
Canoga Elect. Co.  
Collins Radio Co.  
Lenkurt Electric Co., Inc.  
Moseley Assoc., Inc.  
Noller Control Systems  
RCA Broadcast Comm. Prd.  
RFE Labs  
Scantlin Electronics  
Singer Prod. Co., Inc.  
Surface Construction  
Telefunken Sales Corp.

#### Communications Systems, Teleprinter

Collins Radio Co.  
Marconi Div.  
Scantlin Electronics  
Singer Prod. Co., Inc.  
Trepac Corp. America

#### Computer Equipment

Collins Radio Co.  
Colorado Video, Inc.  
G E Electronic Components  
Harvey Radio Co., Inc.  
Heath Co.  
Interntl. Good Music, Inc.  
Sarkes Tarzian, Inc.  
Scantlin Electronics

#### Console, Audio, AM

Accurate Sound Co.  
Alma Engineering  
Ancha Electronics, Inc.  
Arbor Systems, Inc.  
Bauer/Sparta Trans. Prod.  
CCA  
Collins Radio Co.  
Electrodyne Corp.  
Fairchild Recording Eqpt.  
GE Visual Comm. Prod.  
Gately Electronics  
Gates Radio Co.  
Gotham Audio Corp.  
Granger Assoc.  
Harvey Radio Co., Inc.  
Houston Electronics  
Ikegami Co. Ltd.  
Interntl. Good Music, Inc.  
Little Joe Enterprises  
Low Power Broadcast Co.  
Orbit Radio and Video  
Sarkes Tarzian, Inc.  
Singer Prod. Co., Inc.  
Tartan Electronics Corp.  
Telectro Systems Corp.  
Ultra Audio Products  
United Radio Supply, Inc.  
Universal Audio, Inc.  
Visual Electronics Corp.  
Ward Electronic Indus.  
Wilkinson Elect., Inc.

#### Console, Audio, FM

Accurate Sound Co.  
Alma Engineering  
Ancha Electronics, Inc.  
Arbor Systems, Inc.  
Bauer/Sparta Trans. Prod.  
CCA Elect.  
Collins Radio Co.  
Du Val I Fit Corp.  
Electrodyne Corp.  
Fairchild Recording Eqpt.  
GE Visual Comm. Prod.  
Gately Electronics  
Gates Radio Co.  
Gotham Audio Corp.  
Harvey Radio Co., Inc.  
Houston Electronics  
Ikegami Co. Ltd.  
Little Joe Enterprises  
Orbit Radio and Video  
Rupert-Neve  
Singer Prod. Co., Inc.  
Tartan Electronics Corp.  
Telectro Systems Corp.  
Ultra Audio Products  
United Radio Supply, Inc.  
Visual Electronics Corp.  
Ward Electronic Indus.  
Wilkinson Elect., Inc.

#### Console, Audio, Portable

Accurate Sound Co.  
Bauer/Sparta Trans. Prod.  
Broadcast Prod. Co., Inc.  
Collins Radio Co.  
Delta Electronics, Inc.  
Electrodyne Corp.  
Fairchild Recording Eqpt.  
Gately Electronics  
Gates Radio Co.  
Gotham Audio Corp.  
Harvey Radio Co., Inc.  
Houston Electronics  
Little Joe Enterprises  
Low Power Broadcast Co.  
McCurdy Radio  
McMartin Industries, Inc.  
Nemo Recording Labs.  
North American Philips AKG  
Orbit Radio and Video  
Philips Broadcast Eqpt.  
Shure Brothers, Inc.  
Singer Prod. Co., Inc.  
Telectro Systems Corp.  
Ultra Audio Products  
United Radio Supply, Inc.  
Visual Electronics Corp.  
Ward Electronic Indus.  
Wilkinson Elect., Inc.

#### Console, Audio, Recording

Altec Lansing  
Accurate Sound Co.  
Ancha Electronics, Inc.  
Arbor Systems, Inc.

Bauer Electronics Corp.  
Broadcast Prod. Co., Inc.  
Collins Radio Co.  
Electrodyne Corp.  
Fairchild Recording Eqpt.  
Gately Electronics  
Gates Radio Co.  
Gotham Audio Corp.  
Harvey Radio Co., Inc.  
Houston Electronics  
Lang Electronics, Inc.  
Little Joe Enterprises  
McCurdy Radio  
McMartin Industries, Inc.  
Nemo Recording Labs  
North American Philips AKG  
Orbit Radio and Video  
Philips Broadcast Equip.  
Rupert-Neve  
Singer Prod. Co., Inc.  
Sonocraft Corp.  
Sparta Elect. Corp.  
Tartan Electronics Corp.  
Telectro Systems Corp.  
Ultra Audio Products  
United Radio Supply, Inc.  
Visual Electronics Corp.  
Ward Electronic Indus.

#### Console, Audio, TV

Alcor, Inc.  
Alma Engineering  
Ancha Electronics, Inc.  
Bauer/Sparta Trans. Prod.  
Bradford Information Sys.  
Collins Radio Co.  
Delta Electronics, Inc.  
Electrodyne Corp.  
Fairchild Recording Eqpt.  
GBC CCTV  
GPL Div. Singer General  
Gately Electronics  
Gates Radio Co.  
Gotham Audio Corp.  
Houston Electronics  
Ikegami Co., Ltd.  
Interntl. Good Music, Inc.  
Interntl. Nuclear Corp.  
Lang Electronics, Inc.  
Orbit Radio and Video  
RCA Broadcast Comm. Prd.  
Sarkes Tarzian, Inc.  
Shibaden Corp. of Amer.  
Singer Prod. Co., Inc.  
Tartan Electronics Corp.  
Tele Measurements, Inc.  
Ultra Audio Products  
Visual Electronics Corp.  
Ward Electronic Indus.

#### Console, Video, Portable

Alcor, Inc.  
GBC CCTV  
Interntl. Nuclear Corp.  
Riker Video Industries  
Sarkes Tarzian, Inc.  
Shibaden Corp. of Amer.  
Shintron Co., Inc.  
Tartan Electronics Corp.  
Ward Electronic Indus.

#### Console, Video, Studio

Alma Engineering  
GBC CCTV  
GE Visual Comm. Prod.  
GPL Div. Singer General  
Interntl. Nuclear Corp.  
RCA Broadcast Comm. Prd.  
Riker Video Industries  
Sarkes Tarzian Inc.  
Shibaden Corp. of Amer.  
Sonocraft Corp.  
Sylvania Comm. Electronic  
Tartan Electronics Corp.  
Universal Audio, Inc.  
Ward Electronic Indus.

#### Converters

American Data Corp.  
CATV Equipment Co.  
Canoga Elect. Co.  
Catel Corp.  
G E Electronic Components  
Honeywell, Inc.  
Kato Engineering Co.  
Micro Link Div.  
RHG Electronics  
Singer Prod. Co., Inc.

Counters, Frequency  
Collins Radio Co.  
Engineering Assoc.  
G E Electronic Components  
General Radio Co.  
Hewlett Packard Co.  
Hickok Elect. Instrument  
Honeywell, Inc.  
Kay Electric Co.  
McMartin Industries, Inc.  
N E Electronics Corp.  
Simpson Electric Co.

#### D

#### Delay Lines

Allen Avionics  
Anderson Labs.  
Andrews Towers, Inc.  
Cook Electric Co.  
General Radio Co.  
Kappa Networks  
Phelps Dodge Electronics  
Presearch, Inc.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.  
Times Wire and Cable

#### Demagnetizers, Bulk Tape

Aerovox Corp.  
Bauer/Sparta Trans. Prod.  
G C Electronics  
Hewlett Packard Co.  
Lang Electronics, Inc.  
Minneapolis Magnetics  
Orbit Radio and Video

#### Demodulators

Ameco, Inc.  
Belar Electronics Lab.  
The Catel Corp.  
Collins Radio Co.  
Dynair Electronics  
Fairlane Electronics  
Hewlett Packard Co.  
Kahn Research Lab. Inc.  
Rohde Schwartz Sales  
Ward Electronic Indus.

#### Detectors, RF

Bird Electronic Corp.  
Blonder Tongue Lab., Inc.  
Microwave Assoc., Inc.  
Solitron Devices, Inc.  
Spencer Kennedy Lab.  
Telonic Instruments  
Weinschel Engineering Co.

#### Detectors, Microwave

Collins Radio Co.  
G E Electronic Components  
Microlab  
Microwave Assoc., Inc.  
Narda Microwave Corp.  
Solitron Devices, Inc.  
Sylvania Semiconductor  
Weinschel Engineering Co.

#### Detectors, Standing Wave

Bird Electronic Corp.  
Collins Radio Co.  
Narda Microwave Corp.  
Rohde Schwartz Sales  
Singer Prod. Co., Inc.  
Texscan Corp.  
Weinschel Engineering Co.

#### Duplexers

Alford Mfg. Co.  
Collins Radio Co.  
Jampo Antenna Co.  
Ikegami Co. Ltd.  
Microlab  
Microwave Assoc., Inc.  
Phelps Dodge Electronic  
Singer Prod. Co., Inc.

#### Display Equipment—TV

CBS Labs  
Central Dynamics Corp.  
Colorado Video, Inc.  
GPL Div. Singer General  
General Television Ntwk.  
Marconi Div.  
Parabam, Inc.  
Photo Research Corp.  
RCA Broadcast Comm. Prd.  
Sarkes Tarzian, Inc.



# mobile color on the move.

Mobile Color Inc. offers the most complete spectrum of remote color television services available — equipment permanently based in Houston, Omaha, Austin and San Juan, P.R.

We now have five complete units, with a total of 23 cameras, to handle any assignment throughout the United States, Canada, Mexico and Puerto Rico.

Units of 2, 3, 4, 5, or 6 cameras are available for lease and production work on local, regional, and national live and tape production, sports and special events, commercials, etc.

If you are a network, an agency, a local station, a production company, an ETV or CATV, contact MCI.



## Facilities

Five complete mobile vans — with 3 to 6 PC70's and PCP Norelco cameras; Ampex VTR's including HS200; Central Dynamics and Visual switching; Philips and Sparta audio; and more.

For additional information, call collect MOBILE COLOR, INC.

(Austin-San Juan)  
512-477-5611  
P.O. Box 490  
Austin, Texas 78767

(Omaha)  
402-733-7166  
P.O. Box 7171  
Omaha, Nebraska 68107

Circle Number 46 on Reader Reply Card

Scantlin Electronics  
Shintron Co., Inc.  
Sylvania Comm. Electronics  
Television Presentations

#### Dividers, Frequency

Collins Radio Co.  
G E Electronic Components  
Hartley Prod. Corp.  
Hewlett Packard Co.  
Jensen Mfg. Div.  
Microlab  
Presearch, Inc.

#### Dividers, Power

Alford Mfg. Co.  
Collins Radio Co.  
Microlab  
Microwave Assoc., Inc.  
Narda Microwave Corp.  
Trompeter Electronics  
Weinschel Engineering Co.

#### Dividers, Voltage

Collins Radio Co.  
G E Electronic Components  
General Radio Co.  
ITT Jennings  
Omite Mfg. Co.

### E

#### Editors, Audio Tape

Nemo Recording Labs.  
Rangertone Electronics

#### Editors, Film

Burke, James  
FB Ceko, Inc.  
The Kalart Co., Inc.  
Neumade Prod. Corp.

#### Editors, Video Tape

Central Dynamics Corp.  
GBC CCTV  
Gotham Audio Corp.  
RCA Broadcast Comm. Prd.  
Shibaden Corp. of Amer.  
Visual Electronics Corp.

#### Enhancers, TV Image

CBS Labs  
Colorado Video, Inc.  
Dynasciences Corp.  
Gen. Electrodynamics  
Grass Valley Group  
Philips Broadcast Equipment  
Sarkes Tarzian, Inc.  
Visual Electronics Corp.

#### Equalizers, Audio Emphasis

B&K Instruments, Inc.  
Electrodyn Corp.  
Fairchild Recording Eqpt.  
Gately Electronics  
Gotham Audio Corp.  
Gray Research Div.  
Lang Electronics, Inc.  
Melcor Electronics Corp.  
Painton, Inc.  
Pulse Techniques, Inc.  
Ultra Audio Products

#### Equalizers, Vertical Aperture

Dynasciences

#### Erasers, Magnetic (See Heads and Demagnetizers)

Channel Marketing, Inc.  
Duotone Co., Inc.  
Gates Radio Co.  
Lang Electronics, Inc.  
Minneapolis Magnetics  
Nortronics Co., Inc.  
Albert Schultz, Inc.

#### Exciters, FM

Amer. Electronic Lab.  
Belar Electronics Lab.  
CCA Electronics  
Collins Radio Co.  
Gates Radio Co.  
Granger Assoc.  
Marti Electronics  
Moseley Electronics  
Singer Prod. Co., Inc.  
Wilkinson Elect., Inc.

### F

#### Film, Photographic

Afg. Gevaert  
Eastman Kodak Co.  
FB Ceko, Inc.  
GAF Corp.

#### Film, Processing Service

Eastman Kodak Co.  
Houston Photo Prod., Inc.  
Jamieson Film Co.  
Lipsner Smith  
Photo Lab., Inc.  
Russell Film Lab.  
Tech. Film Labs., Inc.  
Treise Engineering  
WTTW Recording Serv.

#### Filters, Antenna

Bird Electronic Corp.  
Collins Radio Co.  
G C Electronics  
McMartin Industries, Inc.

#### Film Chain

Ampex  
Blonder-Tongue  
Cohu Electronics  
Diamond Power  
General Elect.  
Kalart  
MacKenzie Labs.  
Magna Tech  
Packard Bell  
Philips Broadcast Equipment  
RCA  
Raytheon  
Russco  
Sarkes Tarzian  
Shiba Elect.  
Sylvania  
Tele-Cine  
Telemation  
Tele Measurements  
Visual

### G

#### Generators, FM, Subcarrier

Amer. Electronic Lab.  
CCA Electronics  
Collins Radio Co.  
Gates Radio Co.  
Hickok Elect. Instrument  
Marti Electronics  
McMartin Industries, Inc.  
Moseley Assoc., Inc.  
Singer Prod. Co., Inc.  
Wilkinson Elect., Inc.

#### Generators, Power, Electric Motor

Columbia Electric Mfg. Co.  
G E Electronic Components  
Kato Engineering Co.

#### Generators, Power, Gasoline Engine

FB Ceko, Inc.  
Gates Radio Co.  
Kato Engineering Co.  
Mole Richardson Co.  
Singer Prod. Co., Inc.  
TV Cable Supply Co.

#### Generators, Signal, AF

B&K Instruments, Inc.  
Barker Williamson Div.  
Delta Electronics, Inc.  
General Radio Co.  
Gibbs Mfg. Research Co.  
Heath Co.  
Hewlett Packard Co.  
Hickok Elect. Instrument  
Kay Electric Co.  
Leader Instruments Corp.  
Metrologie Compagnie Gen.  
N E Electronics Corp.  
RCA Electronic Comp. Div.  
Rohde Schwarz Sales  
Texscan Corp.

#### Generators, Color Bar

Allied Electronic Corp.  
American Data Corp.  
Applied Electro Mech.  
Cohu

#### Engineering Assoc.

Heath Co.  
Hickok Elect. Instrument  
International Nuclear Corp.  
Leader Instruments Corp.  
Marconi Div.  
Metrologie Compagnie Gen.  
Philips Broadcast Equipment  
RCA Broadcast Comm. Prd.  
RCA Electronic Comp. Div.  
Richmond Hill  
Riker Video Industries  
Shibaden Corp. of Amer.  
Telemation, Inc.  
Tele Measurements, Inc.  
Telemet Co.  
Videometrics, Inc.  
Videon Corp.  
Visual Electronics Corp.  
Ward Electronics

#### Generators, Signal, Dot Bar

American Data Corp.  
Colorado Video, Inc.  
Heath Co.  
Hickok Elect. Instrument  
Leader Instruments Corp.  
Marconi Div.  
Philips Broadcast Equipment  
RCA Electronic Comp. Div.  
Richmond Hill  
Riker Video Industries  
Sencore, Inc.  
Shibaden Corp. of Amer.  
Tektronix, Inc.  
Telemation, Inc.  
Tele Measurements, Inc.  
Videometrics, Inc.  
Videon Corp.  
Visual Electronics Corp.  
Ward Electronics

#### Generators, Signal Marker

Blonder Tongue Lab., Inc.  
Hewlett Packard Co.  
Kay Electric Co.  
Leader Instruments Corp.  
Metrologie Compagnie Gen.  
RCA Electronic Comp. Div.  
Shibaden Corp. of Amer.  
Tektronix, Inc.

#### Generators, Signal Pulse

Canoga Elect. Co.  
Data Pulse  
FB Ceko, Inc.  
General Radio Co.  
Hewlett Packard Co.  
Hickok Elect. Instrument  
Honeywell, Inc.  
Marconi Instruments  
Narda Microwave Corp.  
Richmond Hill  
Tektronix, Inc.  
Videometrics, Inc.  
Visual Electronics, Corp.  
Ward Electronics

#### Generators, Signal, RF

Allied Electronic Corp.  
Blonder Tongue Lab., Inc.  
Canoga Elect. Co.  
Delta Electronics, Inc.  
Engineering Assoc.  
General Radio Co.  
Gibbs Mfg., Research Co.  
Heath Co.  
Hewlett Packard Co.  
Hickok Elect. Instrument  
Kay Electric Co.  
Leader Instruments Corp.  
Narda Microwave Corp.  
RCA Electronic Comp. Div.  
Richmond Hill  
Rohde Schwarz Sales  
Shibaden Corp. of Amer.  
Spencer Kennedy Lab.  
Texscan Corp.  
Triplett Elect. Instrument  
Weinschel Engineering Co.

#### Generators, Special Effect

American Data Corp.  
Applied Elect. Mechanics  
B&K Instruments, Inc.  
Central Dynamics Corp.  
Colorado Video, Inc.  
Concord Elect. Corp.  
Dynair Electronics

Grass Valley Group  
International Nuclear  
Marconi Div.  
Philips Broadcast Equip.  
Richmond Hill  
Riker Video Industries  
Shibaden Corp. of Amer.  
Shintron Co., Inc.  
Telemation, Inc.  
Tele Measurements, Inc.  
Telemet Co.  
Videon Corp.

#### Generators, Signal, Square Wave

General Radio Co.  
Heath Co.  
Hewlett Packard Co.  
Hickok Elect. Instrument  
Leader Instruments Corp.  
Marconi Instruments  
Parabam, Inc.  
Shibaden Corp. of Amer.  
Tektronix, Inc.  
Telemation, Inc.  
Tele Measurements, Inc.  
Telemet Co.  
Universal Audio, Inc.  
Videometrics, Inc.  
Weinschel Engineering Co.

#### Generators, Signal, TV Synchronizing

American Data Corp.  
Central Dynamics Corp.  
Chrono Log Corp.  
Cohu Electronics, Inc.  
Colorado Video, Inc.  
Concord Elect. Corp.  
Dage Bell Div.  
Du Val I Fit Corp.  
Dynair Electronics  
Electronic Designers, Inc.  
GE Visual Comm. Prod.  
GPL Div. Singer General  
Gen. Electrodynamics  
Grass Valley Group  
Ikegami Co. Ltd.  
Industrial Instrument  
International Nuclear  
Marconi Div.  
MTI Div., KMS Industries  
Philips Broadcast Equipment  
Presearch, Inc.  
RCA Broadcast Comm. Prd.  
Richmond Hill  
Riker Video Industries  
Rohde Schwarz Sales  
Sarkes Tarzian, Inc.  
Shibaden Corp. of Amer.  
Shintron Co., Inc.  
Sylvania Comm. Electronics  
Tektronix, Inc.  
Telemation, Inc.  
Tele Measurements, Inc.  
Telemet Co.  
Texscan Corp.  
Tracor Ind. Inst. Div.  
Videometrics, Inc.  
Videon Corp.

#### Generators, Signal, VITS

Electronic Designers, Inc.  
Richmond Hill  
Riker Video Industries  
Rohde Schwarz Sales  
Tektronix, Inc.  
Tele Measurements, Inc.  
Telemet Co.  
Videometrics, Inc.  
Videon Corp.

### H

#### Heads, Erase, Magnetic

Lipps, Inc.  
Magna Tech. Corp.  
Magnusonic Devices, Inc.  
Michigan Magnetics  
Minneapolis Magnetics  
Nortronics Co., Inc.  
Recordex Corp.  
Singer Prod. Co., Inc.  
Taber Mfg. Engr. Co.  
Tapecaster

#### Heads, Recording, Magnetic

Lipps, Inc.  
Magnusonic Devices, Inc.  
Michigan Magnetics  
Minneapolis Magnetics



## Buy a rainbow with black & white money.

Here is a complete color TV program origination system sporting a very easy to take monochrome price tag. Your first question might be "Where did they do the cutting?" But read what's in the system and you'll find that the only cut was in the price. The Visual Basic Color TV Origination System comes complete with 5 color sources: 2 film, 1 slide, 2 video tape. It has a fully pre-wired remote control console/equipment rack; full remote control for the film island; output switching; an audio mixer — even a lavalier microphone. It is set-up for NTSC-type color, and can be had with full NTSC color if you wish. And, of course, you



can expand to whatever degree of sophistication you want with concepts like Visual's titling systems.

The Visual Basic Color TV Origination System. It's from the people who bring you a full line of quality broadcast equipment including advanced monochrome and color cameras, Rapid-Q cartridge tape equipment, audio consoles, and a great deal more.

But mostly it's the basic color TV origination system you need now. At a price you can pay now — without turning colors.

Write **Visual Electronics Corporation**,  
356 W. 40th St., New York, N.Y. 10018.

Nortronics Co., Inc.  
Rangertone Electronics  
Recordex Corp.  
Singer Prod. Co., Inc.  
Taber Mfg. Engr. Co.  
Tapecaster

**Heaters, Station, Van**  
Valad Elect.

Jensen Mfg. Div.  
Mole Richardson Co.  
P K Neuses, Inc.  
Singer Prod. Co., Inc.  
Upson Tools, Inc.  
Vaco Products Co.  
Weber Electronics, Inc.

**Lights, Tower, Obstruction**  
Electronic Lights, Inc.  
Gates Radio Co.  
Harwood Mfg. Co.  
Hughey Phillips, Inc.  
Little Joe Enterprises  
RCA Broadcast Comm. Prd.  
Rohn Mfg. Co.  
Singer Prod. Co., Inc.

Singer Prod. Co. Inc.  
Waters Mfg. Inc.

**Meters, Frequency Calibrating**  
Hewlett Packard Co.  
Hickok Elect. Instrument  
Microlab  
Micro Link Div.  
Narda Microwave Corp.  
Singer Prod. Co., Inc.

## **I** **Integrated Circuits (Also See Semiconductors)**

Centralab  
Collins Radio Co.  
G E Distributor Sales Op.  
Microlab  
Motorola Semiconductor  
RCA Electronic Comp. Div.  
Texas Instrument  
Thor Electronics Corp.

## **Industrial TV (Also See TV, Closed Circuit)**

ATV Research  
Alcor, Inc.  
Alma Engineering  
Anaconda Electronics  
Blonder Tongue Lab., Inc.  
Bradford Information Sys.  
Canoga Elect. Co.  
Cohu Electronics, Inc.  
Colorado Video, Inc.  
Concord Elect. Corp.  
Dage Bell Div.  
Diamond Electronics  
Du Val I Fit Corp.  
Dynair Electronics  
GBC CCTV  
G E Electronic Components  
GF Visual Comm. Prod.  
Gen. Electrodynamics  
Ikegami Co. Ltd.  
The Janson Industries  
Katona Electronics Co.  
Lerro Electrical Corp.  
Marconi Div.  
Orbit Radio and Video  
Philips Broadcast Equipment  
RCA Broadcast Comm. Prd.  
Riker Video Industries  
Rust Corp.  
Setchell Carlson, Inc.  
Shibaden Corp. of Amer.  
Shintron Co., Inc.  
Singer Prod. Co. Inc.  
Sonocraft Corp.  
Sylvania Comm. Electronics  
Tektronix, Inc.  
Telemation, Inc.  
Tele Measurements, Inc.  
Television Presentations  
Vikoa, Inc.  
Visual Electronics Corp.  
Zoomar, Inc.

## **Lenses, Optical, Fixed**

Angenieux Corp.  
Arriflex Corp.  
Burke & James  
Canon  
Concord Elect. Corp.  
Dage Bell Div.  
Dynamic Optics, Inc.  
FB Ceco, Inc.  
GBC CCTV  
Gen. Electrodynamics  
Rank Precision  
RCA Broadcast Comm. Prd.  
Shibaden Corp. of Amer.  
Tele Cine, Inc.  
Teledyne Co.  
Visual Electronics Corp.  
Zoomar, Inc.

## **Lenses, Optical, Zoom**

Ampex  
Angenieux Corp.  
Arriflex Corp.  
Burke & James  
Canon  
Concord Elect. Corp.  
Dage Bell Div.  
Dynamic Optics, Inc.  
FB Ceco, Inc.  
GBC CCTV  
Power Optics  
Rank Precision  
RCA Broadcast Comm. Prd.  
Shibaden Corp. of Amer.  
Sonocraft Corp.  
Tele Cine, Inc.  
Teledyne Co.  
Visual Electronics Corp.  
Zoomar, Inc.

## **Lighting, TV Controls**

Berkey Colortran, Inc.  
Burke & James  
Century-Strand  
FB Ceco, Inc.  
Houston Electronics  
The Janson Industries  
Kliegl Bros. Lighting  
Lighting Unlimited  
Metropolitan Elect. Mfg. Co.  
Mole Richardson Co.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.  
Tele Measurements, Inc.  
Ultra Audio Products  
Visual Electronics Corp.  
Skirpan Electronics, Inc.

## **Lighting, TV, Systems**

Bardwell & McAllister, Inc.  
Berkey Colortran, Inc.  
Burke & James  
Century-Strand  
Du Val I Fit Corp.  
FB Ceco, Inc.  
The Janson Industries  
Kliegl Bros. Lighting  
Lighting Unlimited  
Metropolitan Elect. Mfg. Co.  
Mole Richardson Co.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.  
Skirpan Electronics Inc.  
Sonocraft Corp.  
Tele Measurements, Inc.  
Telequip Corp.  
Visual Electronics Corp.

## **Lightning Arresters**

Collins Radio Co.  
G C Electronics  
G E Electronic Components  
Joslyn Electronic Sys.  
Singer Prod. Co., Inc.  
Skirpan Electronics, Inc.  
Vikoa, Inc.

## **M**

### **Maintenance Services, Cartridge Tape**

Broadcast Prod. Co., Inc.  
Collins Radio Co.  
JOA Cartridge Service  
RCA Service Co.  
Paul Shepard, Inc.  
Singer Prod. Co., Inc.

### **Maintenance Services, FM**

Amer. Electronic Lab.  
Collins Radio Co.  
Little Joe Enterprises  
RCA Service Co.  
Paul Shepard, Inc.  
Taber Mfg. Engr. Co.

### **Maintenance Services, Microwave**

Amer. Electronic Lab.  
Collins Radio Co.  
Micro Link Div.  
RCA Service Co.  
Paul Shepard, Inc.

### **Maintenance Services, TV**

Alcor Inc.  
GBC CCTV  
GE Visual Comm. Prod.  
Sarkes Tarzian, Inc.  
Paul Shepard, Inc.  
Taber Mfg. Engr. Co.  
Tele Measurements, Inc.

### **Meters, Field Strength, AM & FM**

Anaconda Electronics  
Defense Electronics  
Engineering Assoc.  
Leader Instruments Corp.  
McMartin Industries, Inc.  
Metrics Div.  
Potomac Instruments, Inc.  
Simpson Electric Co.  
Singer Prod. Co., Inc.  
Wilkinson Elect. Inc.

### **Meters, Field Strength, TV, UHF**

Blonder Tongue Lab, Inc.  
CATV Equipment Co.  
Defense Electronics  
Engineering Assoc.  
Jerrold Electronics Co.  
JFD Electronics Co.  
Katona Electronics Co.  
Leader Instruments Corp.  
Measurements  
Potomac Instruments, Inc.  
Rohde & Schwarz Sales  
Sencore, Inc.  
Simpson Electric Co.  
TV Cable Supply Co.  
Vikoa, Inc.  
Video Instrument Corp.

### **Meters, Flutter & WOW**

Gotham Audio Corp.  
Kay Electric Co.  
Leader Instruments Corp.  
Micom, Inc.  
Sentinel, Inc.

### **Meters, Frequency**

Belar Electronics Lab.  
Collins Radio Co.  
Engineering Assoc.  
G E Electronic Components  
General Radio Co.  
Hewlett Packard Co.  
Hickok Elec. Instrument  
Lampkin Lab. Inc.  
Metrologie Compagnie Gen.  
Microlab  
Narda Microwave Corp.  
Simpson Electric Co.

## **Meters, Phase Angle**

G E Electronic Components  
Metrics Div.  
Potomac Instruments, Inc.  
Rohde & Schwarz Sales

## **Meters, Power**

Bird Electronic Corp.  
Engineering Assoc.  
General Microwave Corp.  
Hewlett Packard Co.  
Micro Link Div.  
Narda Microwave Corp.  
Rohde & Schwarz Sales  
Simpson Electric Co.

## **Meters, Standing Wave**

Bird Electronic Corp.  
General Microwave Corp.  
Hewlett Packard Co.  
Metrologie Compagnie Gen.  
Narda Microwave Corp.  
Rohde & Schwarz Sales  
Singer Prod. Co., Inc.  
Weinschel Engineering Co.

## **Microphone Stand & Boom**

Altec Lansing  
Amer. Geloso Electronics  
Atlas Sound Div.  
Century-Strand  
Custom Craft Designs  
FB Ceco, Inc.  
Gates Radio Co.  
Gotham Audio Corp.  
Houston Fearless Corp.  
Lang Electronics Inc.  
Mole Richardson Co.  
North Amer. Philips AGK  
Philips Broadcast Equipment  
Primo Co. Ltd.  
RCA Electronic Comp. Div.  
RCA Service Co.  
Sennheiser Electronics  
Singer Prod. Co., Inc.  
Television Products Inc.  
Turner Microphone Co.  
Zoomar, Inc.

## **Microphones, Condenser**

Altec Lansing  
B&K Instruments Inc.  
FB Ceco, Inc.  
Gates Radio Co.  
Gotham Audio Corp.  
Lang Electronics, Inc.  
North Amer. Philips AGK  
Orbit Radio and Video  
Philips Broadcast Equipment  
RCA Electronic Comp. Div.  
RCA Service Co.  
Sennheiser Electronics  
Singer Prod. Co., Inc.  
Sonocraft Corp.  
Superscope, Inc.  
Trusonic  
Primo Co., Ltd.  
Sparta Elect. Corp.

## **Microphones, Dynamic**

Altec Lansing  
Amer. Geloso Electronics  
Bauer/Sparta Trans. Prod.  
Collins Radio Co.  
Electro-Voice, Inc.  
FB Ceco, Inc.  
G C Electronics  
Gates Radio Co.  
Lang Electronics, Inc.  
Magnatech Co.  
Miles Reproducer Co.  
North Amer. Philips AGK  
Philips Broadcast Equipment  
Primo Co., Ltd.  
RCA Electronic Comp. Div.  
RCA Service Co.

## **J** **Jack Panel Assemblies**

Altec Lansing  
Audio Accessories, Inc.  
CEI  
Collins Radio Co.  
Cooke Engineering Co.  
Gates Radio Co.  
Gulf Electro Sales, Inc.  
Holland Electronics  
Phelps Dodge Electronic  
Potomac Instruments, Inc.  
RCA Broadcast Comm. Prd.  
Sarkes Tarzian, Inc.  
Singer Prod. Co., Inc.  
Switchcraft, Inc.  
Terminal Hudson Elect.  
Trompeter Electronics

## **K**

### **Kits**

Allied Electronic Corp.  
Bardwell & McAllister, Inc.  
Eico  
Engineering Assoc.  
G C Electronics  
Heath Co.

Attention TV Stations:

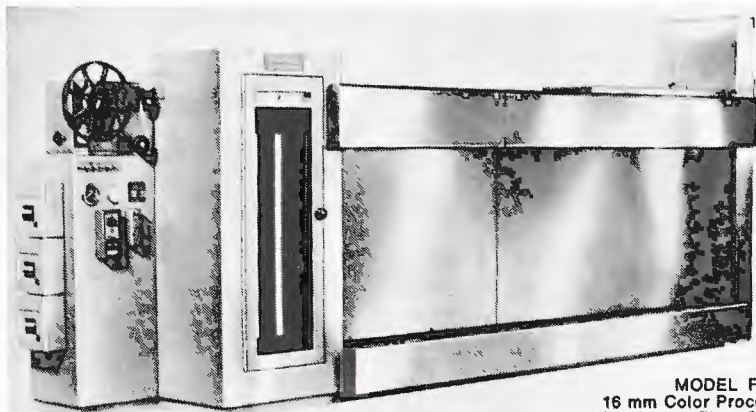
# We've got news for you!

## FILMLINE'S professional color film processors now available for TV NEWS

The FILMLINE Models FE-30 and FE-50 are exciting new color film processors designed specifically for use in television station news departments. The design is backed by Filmline's reputation as the world's leading manufacturer of professional film processors for the commercial motion picture laboratory industry.

Now for the first time the television industry can enjoy the benefits of professional caliber equipment incorporating exclusive FILMLINE features that have paced the state-of-the-art in commercial laboratories, at a cost lower than processors offering less.

*After you check these exclusive Filmline features you'll want to install a Filmline processor in your news department NOW!*



MODEL FE-50:  
16 mm Color Processor  
for Ektachrome Film. Speed  
50 FPM. **\$22,500**



MODEL FE-30:  
16mm Color Processor for  
Ektachrome film. Speed 30  
FPM. **\$16,400**

### ● "FILMLINE OVERDRIVE FILM TRANSPORT SYSTEM"

This marvel of engineering completely eliminates film breakage, pulled perforations, scratches and operator error. The film can be deliberately stalled in the machine without film breakage or significant change of film footage in solutions. The heart of any film processor is the drive system. No other film drive system such as sprocket drive, bottom drive or simple clutch drives with floating lower assemblies can give you the performance capability of the unique Filmline Overdrive Film Transport System.

● "TORQUE MOTOR TAKE-UP" gives you constant film take-up and does not impose any stress or strain on the film itself. Completely independent of the film transport system. This FILMLINE feature is usually found in professional commercial processors but is incorporated on the FE-30 and

FE-50 models as standard equipment. Don't settle for less!

● "TEMP-GUARD" positive temperature control system. Completely transistorized circuitry insures temperature control to well within processing tolerances. Temp-Guard controls temperatures accurately and without the problems of other systems of lesser sophistication.

● "TURBO-FLOW" impingement dryer. Shortens dry-to-dry time, improves film results, and carefully controls humidity content of your valuable (and sometimes rare) originals. Immediate projection capability is assured because the film dries flat without the usual curl associated with other film processors.

● "ZERO DOWN TIME" The reputation of any film processor is only as good as its reliability. The

combination of the exclusive and special added Filmline features guarantees trouble-free operation with absolute minimum down-time and without continual operator adjustments. Recapture your original investment in 2 years on maintenance savings alone. Filmline's "Push the button and walk-away processing" allows inexperienced operators to turn out highest quality film.

● "MATERIALS, CONSTRUCTION AND DESIGN" All Filmline machines are constructed entirely of metal and tanks are type 316 stainless steel, heliarc welded to government specifications. The finest components available are used and rigid quality control standards are maintained.

Compare Filmline features to other processors costing more money. Feature-by-feature, a careful evaluation will convince you that Filmline offers you more for your investment.

## Additional Features included in price of machine (Not as extras).

Magazine load, daylight operation ■ Feed-in time delay elevator (completely accessible) ■ Take-up time delay elevator (completely accessible) ■ Red brass bleach tank, shafts, etc. Prehardener solution filter ■ Precision Filmline Venturi air squeegee prior to drybox entry ■ Air vent on prehardener ■ Solid state variable speed D.C. drive main motor ■ Bottom drains and valves on all tanks ■ Extended development time up to two additional camera stops at 50 FPM ■ Pump recirculation of all eight solutions thru spray bars ■ Temperature is sensed in the recirculation line ■ All solutions temperature controlled, no chilled water required ■ Built-in air compressor ■ Captive bottom assemblies assure you constant footage in each solution ■ Change over from standard developing to extended developing can be accomplished in a matter of seconds ■ Impingement dryer allows shorter put through time.

Partial listing of Filmline Color Installations: — NBC- New York, NBC- Washington, NBC- Cleveland, NBC- Chicago, CBS & ABC Networks, Eastman Kodak, Rochester.

Laboratories: De Luxe Labs, General Film Labs (Hollywood), Pathe-Labs, Precision Labs, Mecca Labs, Color Service Co., Capital Film Labs, Byron Film Labs, MGM, Movie Lab, Lab-TV, Technical Film Labs, Telecolor Film Labs, Guffanti Film Labs, A-One Labs, All-service Labs, NASA Cape Kennedy, Ford Motion Picture Labs.

TV Stations: WAPI-TV, KTVI-TV, WXYZ-TV, WTPA-TV, WBT-TV, WEAT-TV, WMAL-TV, WSYR-TV, WDSU-TV, WVUE-TV, WJXT-TV, WTOP-TV, WAVY-TV, KTVI-TV, WTVR-TV, WFBC-TV, WMAR-TV, WCKT-TV, WAVE-TV, WCPQ-TV, WAPA-TV, WCIV-TV, WJIM-TV, WWL-TV, KYW-TV, KETV-TV, WNBQ-TV, KSLA-TV, WSAZ-TV, WHP-TV, WHCT-TV, WTOV-TV.

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Sonocraft Corp.  
Sony  
Sparta Elect. Corp.  
Superscope, Inc.  
Turner Microphone Co.

### Microphones, Velocity

Altec Lansing  
FB Ceko, Inc.  
Gates Radio Co.  
Philips Broadcast Equipment  
Primo Co., Ltd.  
RCA Electronic Comp. Div.  
RCA Service Co.  
Shure Brothers, Inc.  
Sony

### Microphones, Wireless

Amer. Geloso Electronics  
Bauer/Sparta Trans. Prod.  
Comrex Corp.  
FB Ceko, Inc.  
Gates Radio Co.  
Lang Electronics, Inc.  
Magnatech Co.  
Microwave Assoc. Inc.  
Miles Reproducer Co.  
Orbit Radio and Video  
Primo Co., Ltd.  
RCA Service Co.  
Albert Schultz, Inc.  
Sennheiser Electronics  
Singer Prod. Co., Inc.  
Sonocraft Corp.  
Superscope, Inc.  
Trusonic

### Microwave Components

Alford Mfg. Co.  
Amperex Corp.  
Andrew Corp.  
Andrews Towers, Inc.  
Bird Electronic Corp.  
Calvert Electronics, Inc.  
Collins Radio Co.  
Eimco Div.  
Fort Worth Tower Co.  
G E Electronic Components  
Lectronic Res. Labs, Inc.  
Lenkurt Elect.  
Microlab  
Microwave Assoc. Inc.  
Motorola Semiconductor  
Narda Microwave Corp.  
Phelps Dodge Electronics  
Prodelin, Inc.  
RCA Service Co.  
Raytheon Co.  
RHG Electronics  
Singer Prod. Co., Inc.  
Solitron Devices, Inc.  
Sylvania Semiconductor  
Telequip Corp.  
Texas Instrument  
Texscan Corp.  
Weinschel Engineering Co.

### Microwave Systems, STL

Andrew Corp.  
Collins Radio Co.  
Du Val I Fit Corp.  
GE Visual Comm. Prod.  
Lenkurt Electric Co., Inc.  
Marti Electronics  
Micro Link Div.  
Microwave Assoc., Inc.  
Moseley Assoc., Inc.  
RCA Broadcast Comm. Prd.  
RCA Service Co.  
Raytheon Co.  
RHG Electronics  
Sarkes Tarzian, Inc.  
Shibaden Corp. of Amer.  
Singer Prod. Co., Inc.  
Surface Construction

### Microwave Systems, 2500 MHz

Andrew Corp.  
Chester Electronic Lab.  
Collins Radio Co.

Lerro Electrical Corp.  
Micro Link Div.  
Microwave Assoc., Inc.  
RCA Broadcast Comm. Prd.  
RCA Service Co.  
Raytheon Co.  
RHG Electronics  
Shibaden Corp. of Amer.  
Singer Prod. Co., Inc.  
Surface Construction

### Mixers (Also See Consoles)

Altec Lansing  
Bauer Electronics Corp.  
Bradford Information System  
Collins Radio Co.  
Delta Electronics, Inc.  
FB Ceko, Inc.  
Gately Electronics  
Gates Radio Co.  
Harvey Radio Co., Inc.  
Houston Electronics  
Lang Electronics, Inc.  
McMartin Industries, Inc.  
Metrologie Compagnie Gen.  
Microwave Assoc., Inc.  
North American Philips AKG  
Philips Broadcast Equipment  
Orbit Radio and Video  
RCA Service Co.  
Shure Brothers, Inc.  
Sparta Elect. Corp.  
Tartan Electronics Corp.  
Visual Electronics Corp.  
Weinschel Engineering Co.

### Mobile Equipment

American Data Corp.  
Andrews Towers, Inc.  
Comrex Corp.  
Delta Electronics, Inc.  
Commercial Prod. Div.  
Hammarlund Mfg.  
Marti Electronics  
Microwave Assoc., Inc.  
Mobile Color, Inc.  
Philips Broadcast Equipment  
RCA Broadcast Comm. Prd.  
RCA Service Co.  
Singer Prod. Co., Inc.  
Sparta Elect. Corp.  
Superior Continental Co.  
Surface Construction  
Utica Electronics  
Visual Electronics Corp.  
H. Wilson Corp.

### Mobile Equipment, TV

Dage Bell Div.  
Electronic Mobile Units  
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Ikegami Co., Ltd.  
The Janson Industries  
Listec TV Equip. Corp.  
Micro Link Div.  
Microwave Assoc., Inc.  
Philips Broadcast Equipment  
RCA Broadcast Comm. Prd.  
RCA Service Co.  
Riker Video Industries  
Surface Construction  
Sylvania Comm. Electronic  
Tele Measurements, Inc.  
Visual Electronics Corp.  
H. Wilson Corp.

### Modulators, TV

Ampex  
Anaconda  
Blonder Tongue Lab., Inc.  
The Catel Corp.  
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Gates Radio Co.  
Katona Electronics Co.  
Micro Link Div.  
Orbit Radio and Video  
Philips Broadcast Equipment  
Packard Bell Electronics  
RCA Service Co.  
Tele Measurements, Inc.

### Monitors, AM Systems

Arbor Systems, Inc.  
Belar Electronics Lab  
CBS Labs

CCA Electronics  
Collins Radio Co.  
Electro-Voice Inc.  
Gates Radio Co.  
Gotham Audio  
Melcor Electronics Corp.  
Potomac Instruments, Inc.  
RCA Service Co.  
Singer Prod. Co., Inc.  
Wilkinson Elect. Inc.

### Monitors, FM Systems, Mono

Belar Electronics Lab  
Collins Radio Co.  
Electro-Voice Inc.  
Gates Radio Co.  
Gotham Audio  
Karg Lab, Inc.  
McMartin Industries, Inc.  
RCA Service Co.  
Singer Prod. Co., Inc.  
Utica Electronics

### Monitors, FM Systems, SCA

Belar Electronics Lab.  
Collins Radio Co.  
Gates Radio Co.  
Hammarlund Mfg.  
Karg Lab., Inc.  
McMartin Industries, Inc.  
RCA  
Singer Prod. Co., Inc.

### Monitors, FM Systems, Stereo

Ameco, Inc.  
Belar Electronics Lab.  
Collins Radio Co.  
Electro-Voice Inc.  
Gates Radio Co.  
Karg Lab, Inc.  
McMartin Industries, Inc.  
Singer Prod. Co., Inc.  
Telemeasurements

### Monitors, Frequency

Ameco, Inc.  
Belar Electronics Lab  
CCA Electronics  
Collins Radio Co.  
Edison Electronic Co.  
Gates Radio Co.  
Hewlett Packard Co.  
Lampkin Lab, Inc.  
McMartin Industries, Inc.  
Microlab  
Singer Prod. Co., Inc.  
Wilkinson Elect., Inc.

### Monitors, Modulation

American Data Corp.  
Belar Electronics  
CBS Labs.  
CCA Electronics  
Collins Radio Co.  
Gates Radio Co.  
Lampkin Lab., Inc.  
McMartin Industries, Inc.  
Metron Instruments  
Micro Link Div.  
Singer Prod. Co., Inc.  
Telemeasurements  
Wilkinson Elect., Inc.

### Monitors, Phase

Defense Electronics, Inc.  
Delta Elect.  
Gates Radio Co.  
Potomac Instruments, Inc.  
Singer Prod. Co., Inc.

### Monitors, Power

Bird Electronic Corp.  
Delta Elect.  
Hewlett Packard Co.

### Monitors, Video

Ameco, Inc.  
America Data Corp.  
Bell & Howell Tape Div.  
Concord Elect. Corp.  
Conrac  
Du Val I Fit Corp.

GE Visual Comm. Prod.  
GPL Div. Singer General  
Gates Radio Co.  
General Television Ntwk.  
Hewlett Packard Co.  
Ikegami Co., Ltd.  
Lerro Electrical Corp.  
Miratel Div. Ball Bros.  
Nemo Recording Labs  
North Amer. Electronics  
Packard Bell Electronics  
Philips Broadcast Equipment  
RCA Broadcast Comm. Prd.  
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Setchell Carlson, Inc.  
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Sony Corp. of America  
Sylvania Comm. Electronics  
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Tele Measurements, Inc.  
Telequip Corp.  
Vikoa, Inc.  
Visual Electronics Corp.

### Monitors, Waveform

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RCA Broadcast Comm. Prd.  
Sony Corp. of America  
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Tele Measurements, Inc.

### Multiplexers

The Catel Corp.  
Collins Radio Co.  
GE Visual Comm. Prod.  
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Singer Prod. Co., Inc.  
Sonocraft Corp.  
Telemation, Inc.  
Tele Measurements, Inc.

## N

### Narrow Band FM Equipment

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Comrex Corp.  
Hammarlund Mfg.  
Marti Electronics  
Singer Prod. Co., Inc.

### Networks, Matching, Audio

Collins Radio Co.  
Electrodyn Corp.  
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Kappa Networks  
Singer Prod. Co., Inc.  
TT Electronics, Inc.  
Universal Audio, Inc.

### Networks, Matching, RF

Alford Mfg. Co.  
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Collins Radio Co.  
Continental Electronics  
Gates Radio Co.  
Kappa Networks  
Multronics, Inc.  
Narda Microwave Corp.  
Singer Prod. Co., Inc.  
TT Electronics, Inc.

### Networks, Phasing

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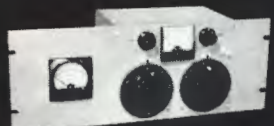
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June, 1970





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Tektronix, Inc.

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Eico  
Heath Co.  
Hewlett Packard Co.  
Hickok Elect. Instruments  
Leader Instruments Corp.  
Measurements  
Metrologie Compagnie Gen.  
RCA Electronic Comp. Div.  
Sencore, Inc.  
Singer Prod. Co., Inc.  
Tektronix, Inc.  
Texscan Corp.

### P

### Phasing Units (See Networks Phasing)

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Multronics, Inc.  
Presearch, Inc.  
Videon Corp.

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Sonocraft Corp.  
Superscope, Inc.  
QRK

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Ameco, Inc.  
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Delta Electronics, Inc.  
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G E Electronic Components  
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Ikegami Co., Ltd.  
Mole Richardson Co.  
Singer Prod. Co., Inc.  
Terminal Hudson Elect.  
Topaz, Inc.

### Power Supplies, Precision

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Altec Lansing

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Engineering Assoc.  
Fairlane Electronics  
Heath Co.  
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Multimetrix, Inc.  
Precision Lab.  
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Altec Lansing  
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American Data Corp.  
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B&K Instruments, Inc.  
Bauer/Sparta Trans. Prod.  
Bell P/A Prod. Corp.  
Bogen Communications  
Bradford Information Sys.  
CCA Electronics  
Collins Radio Co.  
Crown International  
Delta Electronics, Inc.  
Denrad Mfg. Co., Inc.  
Dynair Electronics  
Electrodyne Corp.  
Electronic Designers, Inc.  
Fairchild Recording Eqp.  
GE Visual Comm. Prod.  
Gately Electronics  
Gates Radio Co.  
Grass Valley Group  
Interntl. Nuclear Corp.  
Koss Electronics, Inc.  
Lang Electronics, Inc.  
Leader Instruments Corp.  
Marti Electronics  
McMartin Industries, Inc.  
Melcor Electronics Corp.  
North Amer. Philips AGK  
Philips Broadcast Equipment  
Orbit Radio and Video  
QRK Electronic Prod.  
Russco Electronics Mfg.  
Shure Brothers, Inc.  
Singer Prod. Co., Inc.  
Standard Radio Corp.  
Superscope, Inc.  
Tape-Athon Corp.  
Telecommunications Div.  
Universal Audio, Inc.  
VIF International  
Visual Electronics Corp.  
Ward Electronic Indus.

### Preamplifiers, Video

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AMF Alexandria  
Fairlane Electronics  
Interntl. Nuclear Corp.  
Philips Broadcast Equipment  
Presearch, Inc.  
Shintron Co., Inc.  
TV Cable Supply Co.  
Tele Measurements, Inc.  
Visual Electronics Corp.  
Ward Electronic Indus.

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Andrews Towers, Inc.  
Collins Radio Co.  
Superior Continental Co.

### Probes, Oscilloscopes

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Hewlett Packard Co.  
Hickok Elect. Instrument  
Leader Instruments Corp.  
Metrologie Compagnie Gen.  
RCA Electronic Comp. Div.  
Sencore, Inc.  
Tektronix, Inc.  
Texscan Corp.

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Filmline Corp.  
Houston Fearless Corp.

Houston Photo Prod.  
Tech Film Labs, Inc.  
Treise

#### Processors, Film, Color

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FB Ceko, Inc.  
Filmline Corp.  
Houston Fearless Corp.  
Houston Photo Prod.  
Jamieson Film Co.  
Mincon Div., 3M Co.  
Tech Film Labs, Inc.  
Triese

#### Projectors, Film

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Du Val I Fit Corp.  
Eastman Kodak Co.  
FB Ceko, Inc.  
GAF Corp.  
The Kalart Co., Inc.  
L W Photo, Inc.  
Lipsner-Smith  
Listec TV Equip. Corp.  
Philips Broadcast Equipment  
RCA Broadcast Comm. Prd.  
Tele Cine, Inc.  
Traid Corp.  
Visual Electronics Corp.

#### Projectors, Film, Rear

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Fairchild Industrial  
The Kalart Co., Inc.  
Telepro Industries  
H. Wilson Corp.

#### Projectors, Slide

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GAF Corp.  
Gray Research Div.  
The Kalart Co., Inc.  
RCA Broadcast Comm. Prd.  
Visual Electronics Corp.

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GBC CCTV  
GPL Div. Singer General  
General Television Ntwk.  
Hokushin Elect. Co.  
The Janson Industries  
The Kalart Co., Inc.  
Philips Broadcast Equipment  
RCA Broadcast Comm. Prd.  
Tele Measurements, Inc.

#### R

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Canoga Elect. Co.  
Collins Radio Co.  
Gen. Electrodynamics  
Kaer Engr. Co.

#### Radomes

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Collins Radio Co.  
Jampro Antenna Co.  
Parabam, Inc.

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Electro-Voice  
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Hallicrafters  
Hammarlund Mfg.  
Heath Co.  
IRC Div. TRW, Inc.  
Kahn Research Lab., Inc.  
North Amer. Philips AKG  
Philips Broadcast Equip.  
Singer Prod. Co., Inc.  
Utica Electronics

#### Receivers, FM

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Belar Electronics Lab  
Bogen Communications  
Comrex Corp.

Electro-Voice  
Delco Radio  
Gates Radio Co.  
Hammarlund Mfg.  
Heath Co.  
IRC Div. TRW, Inc.  
Marti Electronics  
North Amer. Philips AKG  
Philips Broadcast Equip.  
Singer Prod. Co., Inc.  
Utica Electronics  
Wilkinson Elect. Inc.

#### Receivers, HF

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Collins Radio Co.  
Comrex  
Engineering Assoc.  
Hammarlund Mfg.  
Karg Lab., Inc.  
Multronics, Inc.  
Narda Microwave Corp.  
Singer Prod. Co., Inc.

#### Receivers, Multiplex

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Bogen Communications  
Calbest Electronics  
Electro-Voice, Inc.  
Gotham Audio Corp.  
Heath Co.  
Johnson Electronics  
Karg Lab, Inc.  
Albert Schultz, Inc.  
Singer Prod. Co., Inc.  
Standard Radio Corp.  
Superscope, Inc.

#### Receivers, SCA

Belar Electronics Lab  
Calbest Electronics  
Karg Lab, Inc.  
Marti Electronics  
McMartin Industries, Inc.  
Singer Prod. Co., Inc.

#### Receivers, TV, Color

Ameco, Inc.  
Heath Co.  
RCA  
Setchell Carlson, Inc.  
Singer Prod. Co., Inc.  
Sony Corp. of America  
Standard Radio Corp.  
Sylvania Comm. Electronics

#### Receivers, TV, Monochrome

Ameco, Inc.  
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Nemo Recording Labs  
Setchell Carlson, Inc.  
Singer Prod. Co., Inc.  
Sony Corp. of America  
Standard Radio Corp.  
Sylvania Comm. Electronics

#### Recorders, Disc, Magnetic

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Gen. Electrodynamics  
Gotham Audio Corp.  
Albert Schultz, Inc.  
Telectro Systems Corp.  
Visual Electronics Corp.

#### Recorders, Film, Light

3M Company, Mincom Div.  
Visual Electronics Corp.

#### Recorders, Film, Magnetic

3M Company, Mincom Div.  
W. A. Palmer Films, Inc.  
Rangertone Electronics  
Telectro Systems Corp.  
Visual Electronics Corp.

#### Recorders, Logging, Magnetic

Amplex Corp.  
Lang Electronics, Inc.  
Metrotech, Inc.

Miles Reproducer Co.  
Nagra Magnetic Recorders  
Rangertone Electronics  
RHG Electronics  
Scovill Div.  
Tape-Athon Corp.  
Telectro Systems Corp.

#### Recorders, Tape, Audio

Accurate Sound Co.  
Alcor, Inc.  
Allied Electronic Corp.  
Amer. Geloso Electronics  
Ampex Corp.  
Audio Magnetics Corp.  
Bauer/Sparta Trans. Prod.  
B&K Instruments Inc.  
Bell & Howell Tape Div.  
Broadcast Electronics  
Cine Sonic Sound, Inc.  
Concord Elect. Corp.  
Continental Elect.  
Crown International  
Gates Radio Co.  
Gauss Electrophysics  
Gotham Audio Corp.  
Heath Co.  
Interntl. Good Music, Inc.  
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Magnetech Co.  
Magna Tech Corp.  
Magnecord  
Magnetic Recording Systems  
Martel Electronics, Inc.  
McKenzie Labs  
Metrotech, Inc.  
Miles Reproducer Co.  
Nemo Recording Labs  
North Amer. Philips AKG  
Philips Broadcast Equipment  
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Superscope, Inc.  
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Teac Corp.  
Telectro Systems Corp.  
Telecommunications Div.  
VIF International  
Visual Electronics Corp.

Mosley Electronics  
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G E Electronic Components  
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Collins Radio Co.  
Concord Elect. Corp.  
Gates Radio Co.  
Internatl. Good Music, Inc.  
International Tapetronics  
Lang Electronics, Inc.  
Macarta, Inc.  
Magna Tech Corp.  
Martel Electronics, Inc.  
McKenzie Labs  
Nemo Recording Labs  
Philips Broadcast Equipment  
Power Optics, Inc.  
Rangertone Electronics  
Recordex Corp.  
Albert Schultz, Inc.  
Scovill Div.  
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Standard Radio Corp.  
Superscope, Inc.  
Tandberg of America, Inc.  
Tapecaster  
Telectro Systems Corp.  
Telecommunications Div.  
Visual Elect.

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Nemo Recording Labs  
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Singer Prod. Co., Inc.  
Sound Studios, Inc.  
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Industrial Elect. Reels

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GBC CCTV  
GPL Div. Singer General  
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B&K Instruments, Inc.  
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Engineering Assoc.  
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RCA Broadcast Comm. Prd.

### Rewinders, Tape

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Harvey Radio Co., Inc.  
Neumade Prod. Corp.  
Recordex Corp.  
Singer Prod. Co., Inc.  
Sparta Elect. Corp.

S

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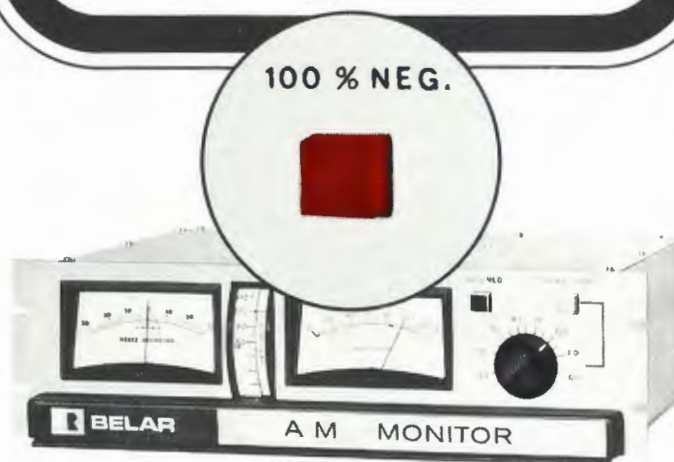
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 Kliegl Bros. Lighting  
 Motorola Semiconductor  
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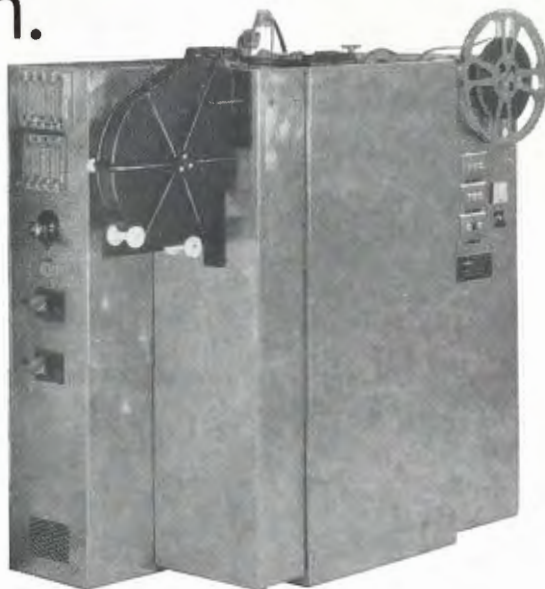
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It is fully instrumented and automatically controlled.

It has a warm-up time of just 10 minutes, a put-through time of just 23 minutes.

At that rate the Jamieson Mark IV color processor for 16mm and 8mm Ektachrome at 30 F.P.M. delivers processed film at a rate twice that of other machines its size.

But there's more to our Mark IV than just speed.

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The Mark IV is no bigger than a standard office desk so you can easily install it in existing space.

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For more information on the Mark IV color processor and the names of current users, write us.



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Singer Prod. Co., Inc.  
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Telefunken Sales Corp.  
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Texas Instrument  
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Heintz and Kaufman, Ltd.  
JSH Elect. Co.  
Motorola Semiconductor  
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Terminal Hudson Elect.  
Texas Instrument  
Thor Electronics Corp.

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Motorola Semiconductor  
RCA Electronic Comp. Div.  
Singer Prod. Co., Inc.  
Sylvania Semiconductor  
Telefunken Sales Corp.  
Terminal Hudson Elect.  
Texas Instrument  
Thor Electronics Corp.

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Motorola Semiconductor  
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Singer Prod. Co., Inc.  
Solitron Devices, Inc.  
Sylvania Semiconductor  
Telefunken Sales Corp.  
Texas Instrument  
Thor Electronics Corp.

## Shifters, Phase, Microwave

Collins Radio Co.  
Hewlett Packard Co.  
Microlab  
Microwave Assoc., Inc.  
Narda Microwave Corp.  
Weinschel Engineering Co.

## Sound Systems, Outdoor

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Altec Lansing  
Amer. Geloso Electronics  
Applied Elect. Mechanics  
Audio Distributor, Inc.  
Bell P/A Prod. Corp.  
Bogen Communications  
Electrodyne Corp.  
Electro-Voice  
Harvey Radio Co., Inc.  
Houston Electronics  
Jensen Mfg. Div.  
Magnetic Studios Corp.  
McMartin Industries, Inc.  
North Amer. Philips AKG  
Phillips Broadcast Equipment  
RCA Broadcast Comm. Prd.  
Rangertone Electronics  
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Altec Lansing  
Amer. Geloso Electronics  
Applied Elect. Mechanics

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Electrodyne Corp.  
Electro-Voice  
Harvey Radio Co., Inc.  
Houston Electronics  
Jensen Mfg. Div.  
Magnetic Studios Corp.  
McMartin Industries, Inc.  
North Amer. Philips AGK  
Philips Broadcast Equipment  
RCA Broadcast Comm. Prd.  
Rangertone Electronics  
Ultra Audio Products

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Amer. Geloso Electronics  
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Bogen Communications  
Electrodyne Corp.  
Electro-Voice  
Harvey Radio Co., Inc.  
Houston Electronics  
Jensen Mfg. Div.  
Magnetic Studios Corp.  
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North Amer. Philips AGK  
Philips Broadcast Equipment  
RCA Broadcast Comm. Prd.  
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Universal Audio, Inc.

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Bogen Communications  
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Hartley Prod. Corp.  
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North Amer. Philips AGK  
Philips Broadcast Equipment  
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Albert Schultz, Inc.  
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Superscope, Inc.  
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#### STL Equipment

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Marti Electronics  
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Moseley Assoc., Inc.  
Moseley Electronics  
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RHG Electronics  
Sarkes Tarzian, Inc.  
Scala Radio Corp.  
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Tektronix, Inc.

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Catal Corp.  
Central Dynamics  
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Dynair Electronics  
Essex Wire Co., RBM Div.  
Jerrold  
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Singer Prod. Co., Inc.  
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Telemet  
Terminal Hudson Elect.  
Vidion Corp.  
Vikoa

Visual Electronics Corp.  
Vital  
Ward Electronic Indus.

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Brd Electronic Corp.  
Blonder Tongue Lab, Inc.  
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Matrix  
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Tape-Athon Corp.  
Trompeter Electronics  
Vital Industries

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Bradford Information Sys.  
Canoga Elect. Co.  
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Cohu Electronics, Inc.  
Collins Radio Co.  
Dynair Electronics  
Grass Valley Group  
Holland Electronics  
International Video  
Matrix  
RCA Broadcast Comm. Prd.  
Richmond Hill  
Riker Video Industries  
Rust Corp.  
Sarkes Tarzian, Inc.  
Singer Prod. Co., Inc.  
Switchcraft, Inc.  
Tartan Electronics Corp.  
Telemation, Inc.  
Trepac Corp. America  
Trompeter Electronics  
Videon Corp.  
Vikoa, Inc.  
Ward Electronic Indus.  
Vital Industries

#### T

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Ampex Corp.  
Bauer/Sparta Trans. Prod.  
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Collins Radio Co.  
Crown International  
Gates Radio Co.  
Gotham Audio Corp.  
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Internatl. Good Music, Inc.  
Lang Electronics, Inc.  
Magna Tech Corp.  
Magnecord  
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RCA Broadcast Comm. Prd.  
Recordex Corp.  
Albert Schultz, Inc.  
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Superscope, Inc.  
Tandberg of America, Inc.

Tape-Athon Corp.  
Teac Corp.  
Telecommunications Div.  
Visual Electronics Corp.  
Wide Response

#### Tape Duplicators

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Alcor, Inc.  
Ampex Corp.  
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Crown International  
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Lang Electronics, Inc.  
Magna Tech. Corp.  
Magnecord  
Magnetic Studios Corp.  
Minneapolis Magnetics  
Orbit Radio and Video  
Philips Broadcast Equipment  
Recordex Corp.  
Sonocraft Corp.  
Telectro Systems Corp.  
Telecommunications Div.  
WTTW Recording Serv.

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Audio Magnetics Corp.  
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Crown International  
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Elektromesstechnik  
Magnatech Co.  
Magnetic Prod. Div.  
Magnetic Studios Corp.  
Miles Reproducer Co.  
Philips Broadcast Equipment  
RCA Broadcast Comm. Prd.  
Recordex Corp.  
Ryder Magnetics Sales  
Sarkes Tarzian, Inc.  
Albert Schultz, Inc.  
Singer Prod. Co., Inc.  
Sonocraft Corp.  
Stancil-Hoffman  
Superscope, Inc.  
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Tape-Athon Corp.  
Teac Corp.  
Wide Response

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Concord Elect. Corp.  
Continental Elect.  
JOA Cartridge Service  
Magnetic Prod. Div.  
Marathon Broadcast Equip.  
McKenzie Labs  
Nemo Recording Labs  
RCA Broadcast Comm. Prd.  
Recordex Corp.  
Albert Schultz, Inc.  
Singer Prod. Co., Inc.  
Superscope, Inc.  
Tapecaster  
Telepro Industries

#### Tape, Magnetic Recording, Computer

Audio Devices  
Magnetic Prod. Div.  
Memorex Corp.  
Singer Prod. Co., Inc.  
Wide Response

#### Tape, Magnetic Recording, Test

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Audio Devices  
Nortronics Co., Inc.

One of a series of brief discussions  
by Electro-Voice engineers



## ENTER THE LASER

THOMAS LININGER  
Microphone  
Project Engineer

A singular light seems on the threshold of a major contribution to audio transducer design. This light is the laser, and its unique properties are opening up new techniques for the development of many audio products.

A laser beam is a very special kind of light. It can be described as a monochromatic coherent light source. This means it is a single frequency (wave length) with all parts of the beam in strict phase relationship, compared to the broad bandwidth and random phase relationship of ordinary light.

By a special technique developed at the Cooley Electronic Laboratory of the University of Michigan, laser beams can be used to "see" vibration. Movement as small as a fraction of the wave length of the light being used can be revealed. This technique is known as holographic interferometry. E-V engineers recognized the potential importance of this research as applied to audio products, and the company supported further study. Thus E-V is now able to analyze the motion of such things as microphone or speaker diaphragms without interfering with their operation.

Using the laser, the engineer can see whether the diaphragm is operating as a piston, or whether it is simultaneously vibrating in more than one mode. He can locate the nodal points of the diaphragm at any specific frequency, and observe as they shift with changing frequency.

The precision afforded by the laser permits the measurement of the amplitude of vibration at any point on the diaphragm, in comparison with other parts of the moving surface. In this respect it is a vast improvement over prior art.

While it would be impossible to explain the operation of the laser in this brief discussion, basically a hologram of the face of the diaphragm is made, using a CO<sub>2</sub> continuous gas laser with the unit at rest. A second hologram is made through the first, with the diaphragm driven at the desired frequency. Finally, a photograph is taken of the interference patterns displayed as a result of slight image replacement between the two holograms.

The laser and the hologram hold out great promise as unique new tools for basic investigation into all kinds of audio transducers. Study of the first photographs reveals aspects of diaphragm behavior impossible to reveal by any other method. Further discussions in this column will detail some of the findings of these new techniques.

For reprints of other discussions in this series, or technical data on any E-V product, write:  
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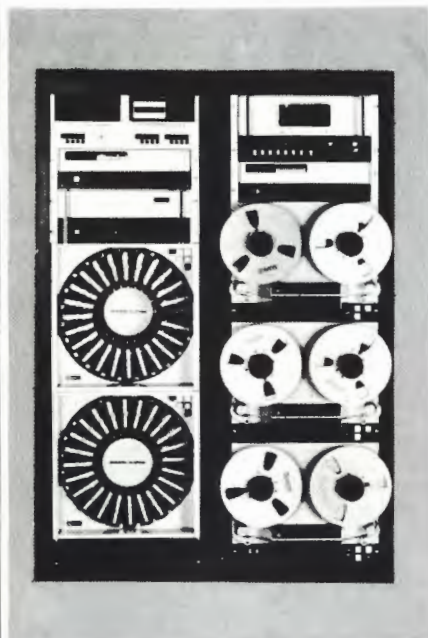
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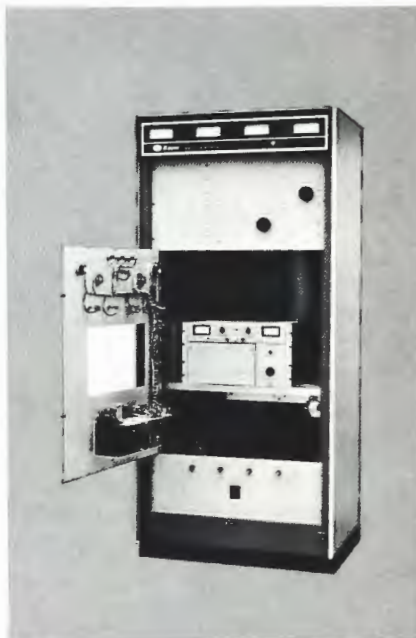
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Flexible, versatile, dependable and profitable. This is a glorious total-sound system for network affiliates. Lots of commercial and music capacity plus time checks and even local news and weather.



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GBC CCTV  
Lerro Electrical Corp.  
Magnetic Prod. Div.  
Memorex Corp.  
Philips Broadcast Equipment  
RCA Broadcast Comm. Prd.  
Recordex Corp.  
Shibaden Corp. of Amer.  
Sonocraft Corp.  
Sony Corp. of America  
Telectro Systems Corp.  
Tele Measurements, Inc.  
WTTW Recording Serv  
Wide Response

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RHG Electronics  
Tele Cine, Inc.  
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**Testers, Vacuum Tube**  
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Sencore, Inc.  
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Triplett Elect. Instrument

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Gates Radio Co.  
Jampro Antenna Co.  
Kline Iron Steel Co.  
Little Joe Enterprises  
Microelect Co., Inc.  
Multronics, Inc.  
Rohn Mfg. Co.  
R F Systems  
Paul Shepard, Inc.  
Stainless, Inc.  
Swager Tower Corp.  
Up Right Scaffolds

**Towers, Antenna, Receiving**  
Ameco, Inc.  
Antenna Prod. Div.  
Dresser Crane  
E Z Way Prod., Inc.  
Little Joe Enterprises  
Microelect Co., Inc.  
R F Systems  
Rohn Mfg. Co.  
Singer Prod. Co., Inc.  
Stainless, Inc.  
Swager Tower Corp.

**Towers, Antenna, Transmitting, AM**  
Advance Industries  
Antenna Prod. Div.  
Collins Radio Co.  
Dresser Crane  
E Z Way Prod., Inc.  
Fort Worth Tower Co.  
Gates Radio Co.  
Jampro Antenna Co.  
Kline Iron Steel Co.  
Little Joe Enterprises  
Microelect Co., Inc.  
RCA Broadcast Comm. Prd.

# READER SERVICE CARD **Broadcast Engineering**

FOR ISSUE OF JUNE, 1970

CARD EXPIRES SEPTEMBER 1, 1970

After that date, please contact manufacturer direct.

Please print or type.

Name .....

Firm .....

PO Box or Street .....

City & State ..... Zip .....

Please sign .....

Circle Numbers below which correspond to items on which you want information:

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

Please check every box which applies to you.

I want to continue to receive Broadcast Engineering regularly without charge. ☐ Yes ☐ No

(Note: Complimentary circulation limited to occupations listed below.)

Please check both your business and occupation:

- ☐ A. AM Radio Station
- ☐ B. FM Radio Station
- ☐ C. Television Station
- ☐ D. ETV Station
- ☐ E. CATV Station
- ☐ F. Instructional TV
- ☐ G. Network Station
- ☐ H. Consulting Engineer
- ☐ I. College Station
- ☐ J. Recording Studio
- ☐ K. Manufacturer or Distributor
- ☐ L. Government Agency, Library
- ☐ M. Engineering School
- ☐ N. Owner, Manager, Officer
- ☐ O. Engineer, Technician
- ☐ P. Other .....

Please check boxes that apply.

- ☐ specify ☐ purchase
- ☐ approve purchase of:
  - ☐ Services
  - ☐ Capital Equipment
  - ☐ Replacement Parts



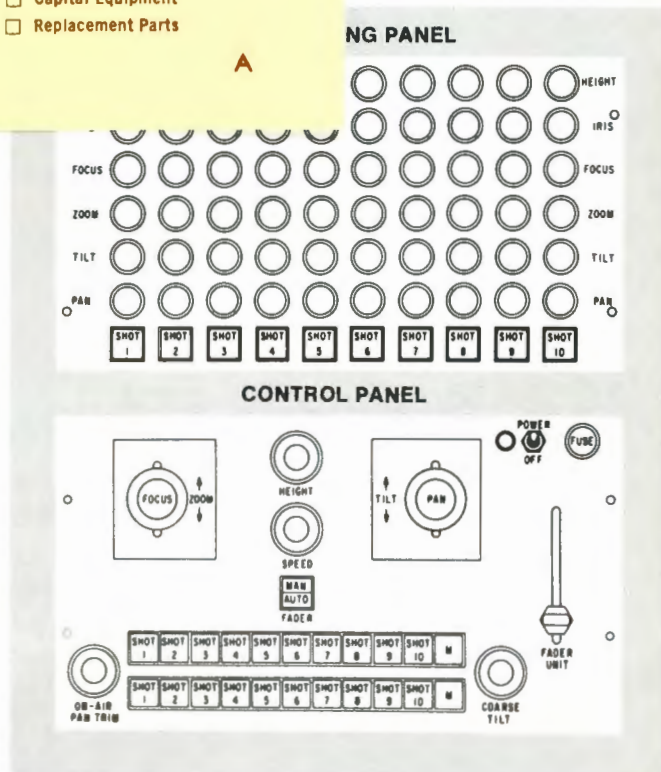
under the complete control of a production staff.

The speed of the shot-to-shot transitions may be varied to suit the situation.

Each shot is recalled, on air, by the simple pressing of appropriate shot buttons. If a subject should move from prearranged pattern, on-air adjustments can be made at the Control Panel. The pre-set shots may be used in predetermined sequence or at will, depending on the nature of the production.

Investigate the P.O.I. Remote Control System as a production aid, it will open your eyes to unlimited possibilities, not only in production but in the economic aspects of automated camera control.

We invite inquiries on this equipment and urge you to request our material describing it, together with a list of stations now using it.



## POWER OPTICS, INC.

FAIRVIEW VILLAGE, PA. 19409 • (215) 272-5300 • TELEX 846411

Western Inquiries contact: Television Products, Inc. (213) 678-2388

Circle Number 55 on Reader Reply Card

**FOR ANY BROADCAST  
TAPE RECORDERS...**

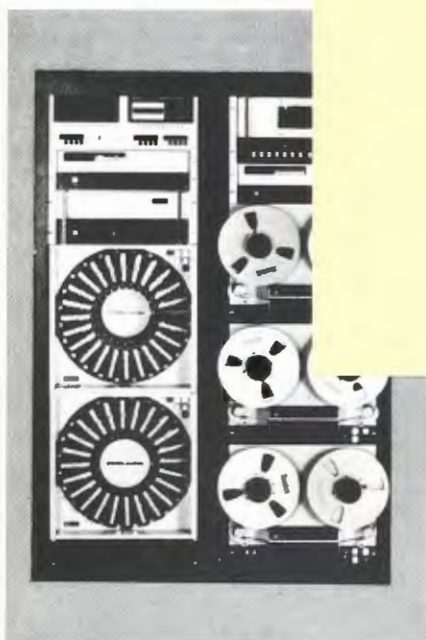
**ANTENNAS...COM**

**STUDIO CONSOLES**

**MICROPHONES**

**AND BROADCAST**

The set-up of a  
complete CATV aud  
and delivery can  
Sparta Electronic C  
can give you ful



**SPARTA-MATION Model SS-232**  
Flexible, versatile, dependable and  
profitable. This is a glorious total-  
sound system for network affiliates.  
Lots of commercial and music capac-  
ity plus time checks and even local  
news and weather.



**2.5KW FM TRANSMITTER  
Model 602**  
Revolutionary stripline final ampli-  
fier and solid state exciter gives 25%  
more power than competitive mod-  
els. Requires only single phase  
power and has swing-out front panel  
for easy accessibility.

**SPARTA**  
**ELECTRONIC CORPORATION**  
**5851 FLORIN-PERKINS ROAD (916) 383-5353**  
**SACRAMENTO, CALIFORNIA 95828**  
A DIVISION OF COMPUTER EQUIPMENT CORPORATION

FIRST CLASS  
PERMIT No. 217  
Clinton, Iowa

**BUSINESS REPLY MAIL**

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**BROADCAST ENGINEERING**

**P. O. BOX 2606  
CLINTON, IOWA 52732**

**ATTN: ENGINEERS' TECH DATA DEPT.**

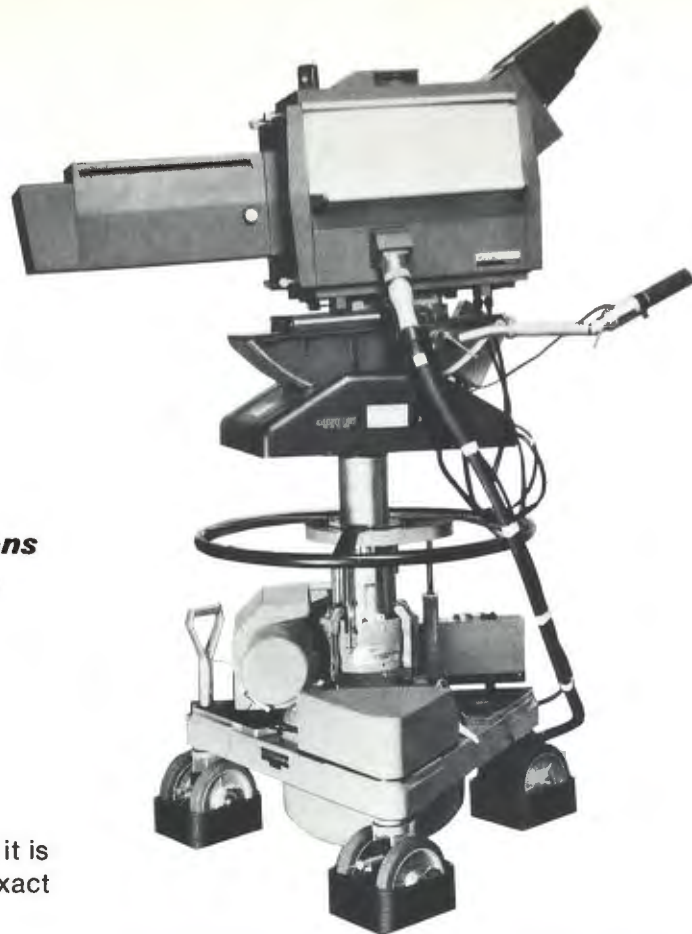
**Towers, Antenna**  
Advance Industries  
Dresser Crane  
E Z Way Prod., Inc.  
Fort Worth Tower Co.  
G C Electronics  
Gates Radio Co.  
Jampro Antenna Co.  
Kline Iron Steel Co.  
Little Joe Enterprises  
Microelect Co., Inc.  
Multronics, Inc.  
Rohn Mfg. Co.  
R F Systems  
Paul Shepard, Inc.  
Stainless, Inc.  
Swager Tower Corp.  
Up Right Scaffolds

**Towers, Antenna, Receiving**  
Ameco, Inc.  
Antenna Prod. Div.  
Dresser Crane  
E Z Way Prod., Inc.  
Little Joe Enterprises  
Microelect Co., Inc.  
R F Systems  
Rohn Mfg. Co.  
Singer Prod. Co., Inc.  
Stainless, Inc.  
Swager Tower Corp.

**Towers, Antenna,  
Transmitting, AM**  
Advance Industries  
Antenna Prod. Div.  
Collins Radio Co.  
Dresser Crane  
E Z Way Prod., Inc.  
Fort Worth Tower Co.  
Gates Radio Co.  
Jampro Antenna Co.  
Kline Iron Steel Co.  
Little Joe Enterprises  
Microelect Co., Inc.  
RCA Broadcast Comm. Prd.

# REMOTELY CONTROLLED CAMERA SYSTEMS

for: *News & Weather Presentations  
Workshop & Demonstrations  
Interviews & Panel shows  
Commercial Video Taping  
Special Effects*



With the P.O.I. Remote Camera Control System it is possible to precisely set shots for repetitive exact recall:

*Pedestal Height ... Pan ... Tilt ...  
Zoom ... Focus ... Iris.*

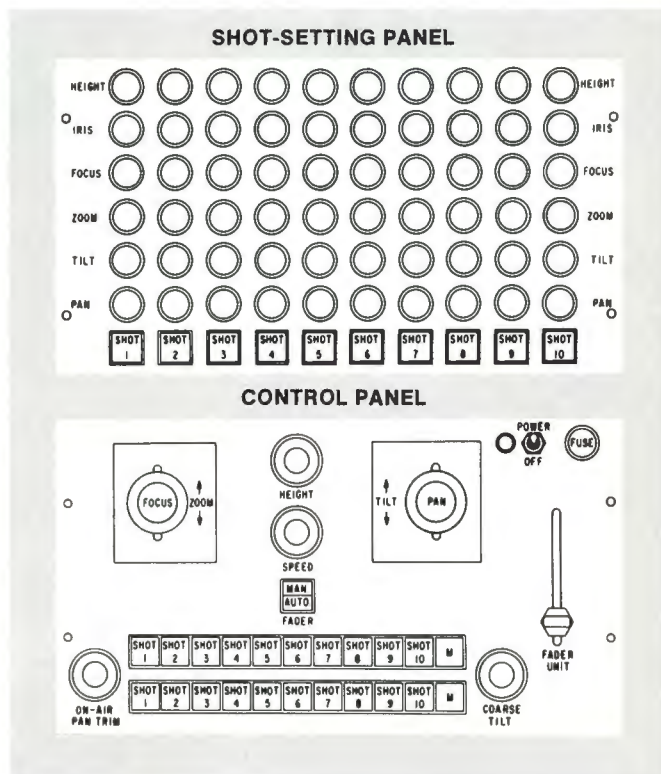
The Shot-Setting Panel provides for up to ten shots, each of which may be carefully pre-set in rehearsal under the complete control of a production staff.

The speed of the shot-to-shot transitions may be varied to suit the situation.

Each shot is recalled, on air, by the simple pressing of appropriate shot buttons. If a subject should move from prearranged pattern, on-air adjustments can be made at the Control Panel. The pre-set shots may be used in predetermined sequence or at will, depending on the nature of the production.

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We invite inquiries on this equipment and urge you to request our material describing it, together with a list of stations now using it.



006



## POWER OPTICS, INC.

FAIRVIEW VILLAGE, PA. 19409 • (215) 272-5300 • TELEX 846411

Western Inquiries contact: Television Products, Inc. (213) 678-2388

Circle Number 55 on Reader Reply Card

# If you want a tube distributor who knows your business, give it to him.



## He's your RCA Broadcast Tube Distributor. No.1 in tubes for all broadcasting applications.

What made him No. 1? Emergency service is one reason. It's like money in the bank.

For example:

You're on the air. It's late, a tube fails. You're low on replacements. Too low for comfort. So you call your RCA Broadcast Tube Distributor. To keep you on the air, he'll get out of bed to fill your order!

There are more reasons.

Experience. He talks your language, knows your needs. Some of our distributors have been in the business of supplying broadcasters for as long as we have—40 years!

Engineering service. He has a "hot line" to RCA's Field Engineers. Call him any time you need their services. Call even if you need help in servicing our competitor's equipment!

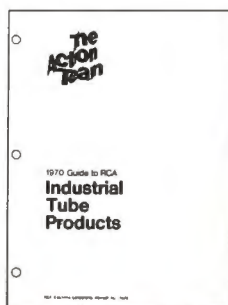
Quality. You know the story. He stocks the finest.

In power tubes, for example, brand preference studies by leading electronic publications have listed RCA as the first choice of professional designers year after year!

Inventory. The widest. Power tubes, rectifiers, vidicons, image orthicons. Think of his establishment as your tube warehouse. For all practical purposes, that's what it is!

Need more reasons? Call your local RCA Broadcast Tube Distributor. For starters, ask him for the new 1970 Guide to RCA Industrial Tube Products, or write: RCA Electronic Components, Commercial Engineering, Dept. F24, Harrison, New Jersey 07029.

P.S. Your RCA Broadcast Tube Distributor is also the man to call for RCA Starmaker Microphones.



# RCA

Visual Electronics Corp.  
Rohn Mfg. Co.  
Paul Shepard, Inc.  
Singer Prod. Co., Inc.  
Stainless, Inc.  
Swagger Tower Corp.  
United State Towers  
Visual Electronics Corp.

**Towers, Antenna, Transmitting, FM**  
Advance Industries  
Antenna Prod. Div.  
Collins Radio Co.  
Dresser Crane  
E Z Way Prod., Inc.  
Fort Worth Tower Co.  
Gates Radio Co.  
Jampro Antenna Co.  
Kline Iron Steel Co.  
Little Joe Enterprises  
Microelect Co., Inc.  
RCA Broadcast Comm. Prd.  
Rohn Mfg. Co.  
Singer Prod. Co., Inc.  
Stainless, Inc.  
United State Towers  
Swagger Tower Corp.  
Visual Electronics Corp.

**Towers, Antenna, Transmitting, TV**  
Advance Industries  
Antenna Prod. Div.  
Dresser Crane  
E Z Way Prod., Inc.  
Jampro Antenna Co.  
Kline Iron Steel Co.  
Microelect Co., Inc.  
RCA Broadcast Comm. Prd.  
Rohn Mfg. Co.  
Paul Shepard, Inc.  
Singer Prod. Co., Inc.  
Stainless, Inc.  
Swagger Tower Corp.  
United State Towers  
Visual Electronics Corp.

**Translator Systems**  
Ampex  
Collins Radio Co.  
Emcee  
Ikegami Co., Ltd.  
Rodelco  
RCA Broadcast Comm. Prd.

**Transmission Lines**  
Ameco, Inc.  
Andrew Corp.  
Andrews Towers, Inc.  
Gates Radio Co.  
Narda Microwave Corp.  
Phelps Dodge Electronic  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.  
Surface Construction

**Transmission Test Sets**  
Hewlett Packard Co.  
Narda Microwave Corp.  
Phelps Dodge Electronic  
Riker Video Industries  
Telemation, Inc.  
United Recording  
Universal Audio, Inc.  
Videometrics, Inc.

**Transmitter Kits**  
Allied Electronic Corp.  
Bauer/Sparta Trans. Prod.  
Eico  
Gates Radio Co.  
Heath

**Transmitter, AM, Carrier**  
Collins Radio Co.  
Low Power Broadcast Co.  
Marconi Div.  
Singer Prod. Co., Inc.  
Telefunken Sales Corp.

**Transmitters, AM, Low Power**  
American Elect. Lab.  
Bauer/Sparta Trans. Prod.  
CCA Electronics  
Collins Radio Co.  
Gates Radio Co.  
Low Power Broadcast Co.  
LTV Ling Altec, Inc.  
Marconi Div.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.

**Transmitters, AM, 250 Watts**

Amer. Electronic Lab.  
Bauer Electronics Corp.  
CCA Electronics  
Collins Radio Co.  
Gates Radio Co.  
Singer Prod. Co., Inc.  
Visual Electronics Corp.

**Transmitters, AM, 500 Watts**

Amer. Electronic Lab.  
Bauer Electronics Corp.  
CCA Electronics  
Collins Radio Co.  
Gates Radio Co.  
Singer Prod. Co., Inc.  
Visual Electronics Corp.

**Transmitters, AM, 1 kw**

Amer. Electronic Lab.  
Bauer Electronics Corp.  
CCA Electronics  
Collins Radio Co.  
Gates Radio Co.  
Marconi Div.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.  
Visual Electronics Corp.  
Wilkinson Elect., Inc.

**Transmitters, AM, 5 kw**

Amer. Electronic Lab.  
Bauer Electronics Corp.  
CCA Electronics  
Collins Radio Co.  
Continental Electronics  
Gates Radio Co.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.  
Visual Electronics Corp.  
Wilkinson Elect., Inc.

**Transmitters, AM, 10 kw**

Amer. Electronic Lab.  
Bauer Electronics Corp.  
CCA Electronics  
Collins Radio Co.  
Continental Electronics  
Gates Radio Co.  
Marconi Div.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.  
Visual Electronics Corp.  
Wilkinson Elect., Inc.

**Transmitters, AM, 25 kw**

Amer. Electronic Lab.  
CCA Electronics  
Continental Electronics  
Gates Radio Co.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.  
Visual Electronics Corp.

**Transmitters, AM, 50 kw**

Amer. Electronic Lab.  
CCA Electronics  
Continental Electronics  
Gates Radio Co.  
GE Visual Comm. Prod.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.

**Transmitters, AM, over 50 kw**

Amer. Electronic Lab.  
CCA Electronics  
Collins Radio Co.  
Continental Electronics  
Gates Radio Co.  
Marconi Div.  
Singer Prod. Co., Inc.  
Visual Electronics Corp.

**Transmitters, AM, to order**

CCA Electronics  
Collins Radio Co.  
Continental Electronics  
Gates Radio Co.  
Marconi Div.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.  
Wilkinson Elect., Inc.

**Transmitters, FM**

Amer. Electronic Lab.  
CCA Electronics  
Collins Radio Corp.  
The Catal Corp.  
Gates Radio Co.  
Marconi Div.

Miles Reproducer Co.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.  
Standard Elect. Corp.  
Telefunken Sales Corp.  
Utica Electronics  
Visual Electronics Corp.  
Wilkinson Elect., Inc.

**Transmitters, FM, 10 Watts**

Ampex  
Amer. Electronic Lab.  
CCA Electronics  
Collins Radio Co.  
Gates Radio Co.  
Marti Electronics  
Moseley Assoc.  
Singer Prod. Co., Inc.  
Visual Electronics Corp.  
Wilkinson Elect., Inc.

**Transmitters, FM, 50 Watts**

CCA Electronics  
Collins Radio Co.  
Gates Radio Co.  
Hammarlund Mfg.  
Moseley Assoc.  
Singer Prod. Co., Inc.  
Utica Electronics  
Visual Electronics Corp.  
Wilkinson Elect., Inc.

**Transmitters, FM, 100 Watts**

CCA Electronics  
Collins Radio Co.  
Gates Radio Co.  
Hammarlund Mfg.  
Marti Electronics  
Singer Prod. Co., Inc.  
Visual Electronics Corp.  
Wilkinson Elect., Inc.

**Transmitters, TV, 500 Watts**

Amer. Electronic Lab.  
CCA Electronics  
Collins Radio Co.  
Gates Radio Co.  
Singer Prod. Co., Inc.  
Standard Elect. Corp.  
Visual Electronics Corp.  
Wilkinson Elect., Inc.

**Transmitters, FM, 1 kw**

Amer. Electronic Lab.  
CCA Electronics  
Collins Radio Co.  
Gates Radio Co.  
Marconi Div.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.  
Standard Elect. Corp.  
Visual Electronics Corp.  
Wilkinson Elect., Inc.

**Transmitters, FM, 3 kw**

Amer. Electronic Lab.  
CCA Electronics  
Collins Radio Co.  
Gates Radio Co.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.  
Standard Elect. Corp.  
Visual Electronics Corp.  
Wilkinson Elect., Inc.

**Transmitters, FM, 5 kw**

Amer. Electronic Lab.  
CCA Electronics  
Collins Radio Co.  
Gates Radio Co.  
Marconi Div.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.  
Standard Elect. Corp.  
Visual Electronics Corp.  
Wilkinson Elect., Inc.

**Transmitters, FM, 7.5 kw**

Amer. Electronic Lab.  
CCA Electronics  
Collins Radio Co.  
Gates Radio Co.  
Singer Prod. Co., Inc.  
Visual Electronics Corp.  
Wilkinson Elect., Inc.

**Transmitters, FM, 10 kw**

Amer. Electronic Lab.  
CCA Electronics  
Collins Radio Co.

Gates Radio Co.  
RCA Broadcast Comm. Prd.  
Standard Elect. Corp.  
Singer Prod. Co., Inc.  
Visual Electronics Corp.  
Wilkinson Elect., Inc.

**Transmitters, FM, 15 kw**

CCA Electronics  
Collins Radio Co.  
Gates Radio Co.  
Singer Prod. Co., Inc.  
Visual Electronics Corp.

**Transmitters, FM, 20 kw**

Amer. Electronic Lab.  
CCA Electronics  
Collins Radio Co.  
Gates Radio Co.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.  
Standard Elect. Corp.  
Wilkinson Elect., Inc.

**Transmitters, FM, 40 kw**

CCA Electronics  
Collins Radio Co.  
Gates Radio Co.  
Singer Prod. Co., Inc.  
Standard Elect. Corp.  
Visual Electronics Corp.

**Transmitters, FM, 50 kw**

CCA Electronics  
Gates Radio Co.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.

**Transmitters, FM, 100 kw**

CCA Electronics  
Gates Radio Co.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.

**Transmitters, FM, to order**

CCA Electronics  
Gates Radio Co.  
RCA Broadcast Comm. Prd.  
Singer Prod. Co., Inc.

**Transmitters, TV**

Ampex  
Du Val I Fit Corp.  
Gates Radio Co.  
Ikegami Co. Ltd.  
The Janson Industries  
Marconi Div.  
Micro Link Div.  
RCA Broadcast Comm. Prd.

**Transmitters, TV, 1 watt**

Dynair Electronics  
Gates Radio Co.  
Micro Link Div.  
Rohde Schwarz Sales

**Transmitters, TV, 10 watts**

Gates Radio Co.  
Marconi Div.  
Micro Link Div.

**Transmitters, TV, 20 watts**

Gates Radio Co.

**Transmitters, TV, 60 watts**

Gates Radio Co.

**Transmitters, TV, 100 watts**

Gates Radio Co.  
GE Visual Comm. Prod.

**Transmitters, TV, 500 watts**

Gates Radio Co.  
Marconi Div.  
Standard Elect. Corp.

**Transmitters, TV, 1 kw**

GE Visual Comm. Prod.  
Gates Radio Co.  
Marconi Div.  
RCA Broadcast Comm. Prd.  
Sarkes Tarzian, Inc.

**Transmitters, TV, 2 kw**

Gates Radio Co.  
Standard Elect. Corp.

**Transmitters, TV, 5 kw**

GE Visual Comm. Prod.  
Gates Radio Co.



AMF Cybertran  
Video Preampifiers  
... Seen but not heard.  
If you're looking for low noise at extremely low cost, our Video Amplifiers are the ones. Available with bipolar or FET front end, they also feature gain from 0 to 60 db, frequency range from 10 Hz to 50 MHz,  $Z_i$  of 50 $\Omega$  to 1000 M $\Omega$ , and  $Z_o$  of 50 $\Omega$  or 75 $\Omega$ . For more information on standard or special Quiet Ones from AMF, contact: Ed Rosenthal, AMF Alexandria Div., 1025 N. Royal St., Alexandria, Va. 22314

**AMF**  
ALEXANDRIA

Circle Number 53 on Reader Reply Card

**Spotmaster**

## TP-1B Tape Cartridge Winder



This rugged and dependable tape winder fills a need in every station using cartridge equipment. No longer is it necessary to restrict your cartridge operation to stock sizes, or to tie up your conventional tape equipment loading cartridges. The TP-1B handles all reel sizes (up to 3600' of 1 mil tape), winds new or old cartridges in any length. Available with or without Spotmaster tape timer, providing precise minute and second calibration for creating exact-length tapes. TP-1B is \$104.50, with Tape Timer \$129.50. Lubricated tape and empty cartridges are also available.

**BROADCAST ELECTRONICS, INC.**  
A Filmways Company  
8810 Brookville Rd., Silver Spring, Md. 20910

Marconi Div.  
RCA Broadcast Comm. Prd.  
Standard Elect. Corp.

**Transmitters, TV, 6 kw**  
GE Visual Comm. Prod.

**Transmitters, TV, 10 kw**  
Amplex  
Marconi Div.  
Philips Broadcast Equipment  
RCA Broadcast Comm. Prd.  
Standard Elect. Corp.

**Transmitters, TV, 11 kw**  
GE Visual Comm. Prod.

**Transmitters, TV, 12 kw**  
Amplex  
RCA Broadcast Comm. Prd.

**Transmitters, TV, 15 kw**  
Amplex  
GE Visual Comm. Prod.  
Marconi Div.

**Transmitters, TV, 25 kw**  
Amplex  
Marconi Div.  
RCA Broadcast Comm. Prd.  
Standard Elect. Corp.

**Transmitters, TV, 30 kw**  
Amplex  
GE Visual Comm. Prod.  
Philips Broadcast Equipment  
RCA Broadcast Comm. Prd.  
Visual

**Transmitters, TV, 35 kw**  
GE Visual Comm. Prod.  
Standard Elect. Corp.

**Transmitters, TV, 50 kw**  
Amplex  
GE Visual Comm. Prod.  
Marconi Div.  
RCA Broadcast Comm. Prd.  
Standard Elect. Corp.

**Transmitters, TV, 55 kw**  
Amplex  
Gates  
Philips Broadcast Equipment  
RCA Broadcast Comm. Prd.

**Transmitters, TV, 100 kw**  
Amplex  
GE Visual Comm. Prod.

**Transmitters, TV, Specify Power**  
Amplex  
GE Visual Comm. Prod.  
Gates Radio Co.  
Multronics, Inc.  
RCA Broadcast Comm. Prd.

**Transmitters, TV, to order**  
Gates Radio Co.  
Multronics, Inc.  
RCA Broadcast Comm. Prd.  
Shibaden Corp. of Amer.

**Turntables, Phonograph**  
Allied Electronic Corp.  
Bogen Communications  
Collins Radio Co.  
Gates Radio Co.  
Gotham Audio Corp.  
Gray Research  
Koss Electronics, Inc.  
Magnetech Co.  
QRK Electronic Prod.  
RCA Broadcast Comm. Prd.  
Russco Electronics Mfg.  
Albert Schultz, Inc.  
Singer Prod. Co., Inc.  
Sparta Elect. Corp.  
Superscope, Inc.

**TV Systems, Closed Circuit**  
ATV Research  
Aerovox Corp.  
Alcor, Inc.  
Amer. Cable Electronics  
Anaconda Electronics  
Bell & Howell Tape Div.  
Canoga Elect. Co.  
Cohu Electronics, Inc.

Colorado Video, Inc.  
Dage Bell Div.  
Diamond Electronics  
Dynair Electronics  
FB Ceco, Inc.  
Jerrold Electronics  
GBC CCTV  
G E Electronic Components  
GE Visual Comm. Prod.  
Gen. Electrodynamics  
Ikegami Co., Ltd.  
International Video  
The Janson Industries  
JFD Electronics, Co.  
Kaiser Cox Corp.  
Lerro Electrical Corp.  
MTI Div. KMS Industries  
Marconi Div.  
Micro Link Div.  
Philips Broadcast Equipment  
RCA Broadcast Comm. Prd.  
Riker Video Industries  
Sarkes Tarzian, Inc.  
Singer Prod. Co., Inc.  
Superior Continental Co.  
Surface Construction  
Sylvania Comm. Electronic  
Tartan Electronics Corp.  
Tektronix, Inc.  
Telemation, Inc.  
Tele Measurements, Inc.  
Telequip  
Television Presentations  
Vikoa  
Visual Electronics Corp.

**V**

### Vacuum Tubes, Camera, Image-Orthicon

Amperex Corp.  
G E Distributor Sales Op.  
G E Electronic Components  
G E Pickup Tube Operation  
Heintz and Kaufman Ltd.  
JSH Elect. Co.  
Lerro Electrical Corp.  
RCA Broadcast Comm. Prd.  
RCA Electronic Comp. Div.  
Shibaden Corp. of Amer.  
Singer Prod. Co., Inc.  
Thor Electronics Corp.  
Visual Electronics Corp.  
Westinghouse Elect. Corp.

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G E Distributor Sales Op.  
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Philips Broadcast Equipment  
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Thor Electronics Corp.  
Visual Electronics Corp.

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Du Val I Fit Corp.  
GBC CCTV  
G E Distributor Sales Op.  
G E Electronic Components  
G E Pickup Tube Operation  
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ITT Electron Tube Div.  
JSH Elect. Co.  
Lerro Electrical Corp.  
North Amer. Philips AGK  
Philips Broadcast Equipment  
RCA Broadcast Comm. Prd.  
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Heintz and Kaufman Ltd.  
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Thor Electronics Corp.  
Westinghouse Elect. Corp.  
Zenith Sales Corp.

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Singer Prod. Co., Inc.  
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ITT Electron Tube Div.  
JSH Elect. Co.  
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Singer Prod. Co., Inc.  
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American Data Corp.

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Calif. Instruments Corp.  
Eico  
G E Electronic Components  
Heath Co.  
Hewlett Packard  
Hikok Elect. Instrument  
Honeywell, Inc.  
Interntl. Instrument, Inc.  
Leader Instruments Corp.  
Hewlett Packard Co.  
Metrics Div.  
Metrologie Compagnie Gen.  
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Singer Prod. Co., Inc.  
Terminal Hudson Elect.  
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Honeywell, Inc.  
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Metrics Div.  
Metrologie Compagnie Gen.  
RCA Electronic Comp. Div.  
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Heath Co.  
Hikok Elect. Instrument  
ITT Jennings  
Sencore, Inc.  
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Eico  
Heath Co.  
Hewlett Packard Co.  
Hikok Elect. Instrument  
Leader Instruments Corp.  
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### W

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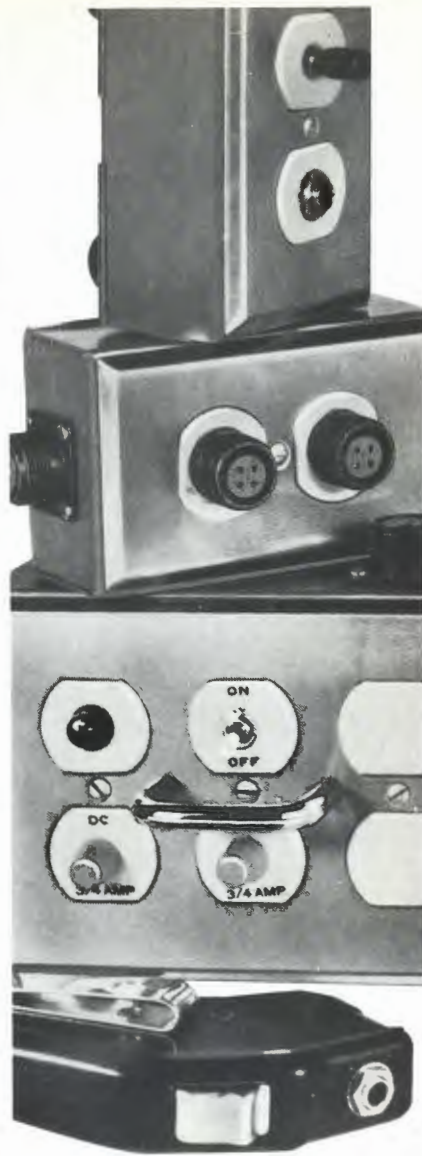
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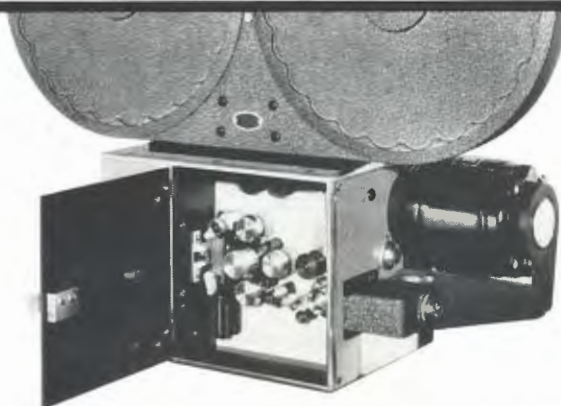
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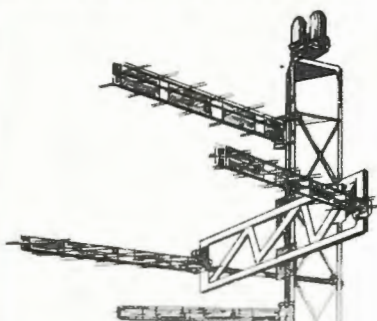
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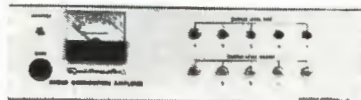
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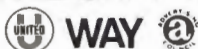
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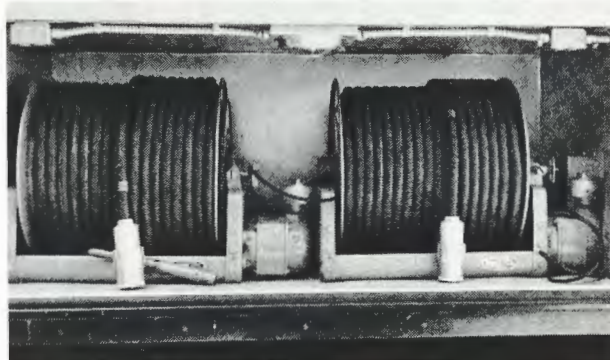
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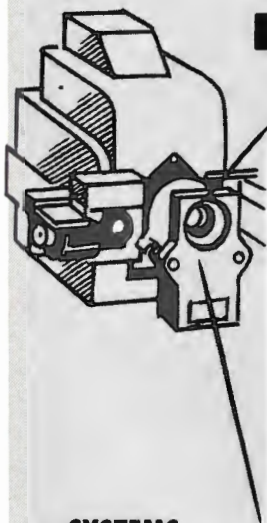
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**Applications** • VHF TV pick-up & transmitting • CATV • Commercial off-the-air monitoring

- **A frequency-independent array** designed to meet the most exacting requirements of VHF TV pick-up antennas.

- **Excellent color response.** Careful design and exhaustive quality control guarantee that the gain will be held to less than 1/2 db throughout the channel.

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- **Thoroughly tested:** This product is the result of two years of research; and before release to the CATV industry, 24 Color Logs were field-tested (for a full year) nationwide.

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**EQUIPMENT FOR SALE—ATC PB 150** cartridge tape deck w/AB 150 record amp. \$200.00. Sparta (QRK custom) 12" turntable w/Rek-O-Kut S-320 tonearm, \$100.00. Fairchild Conax limiter, \$200.00. Contact Dan Tynus, Suite 222, 230 N. Michigan Ave., Chicago, Ill. 60601, 312-236-4814. 6-70-1t

**Gates 10 watt FM transmitter model BFE-10C, 91.1 MHz.** Includes complete set extra tubes, Gates FM-22 (2-bay) antenna. Total package, perfect condition, 1-yr. old, sacrificed, \$1000 FOB. 6-70-2t

**MAURER OPTICAL RECORDER 16MM MODEL 10 COMPLETE & PERFECT —** \$5000.00. Dekko Films, Inc., 126 Dartmouth Street, Boston 16, Massachusetts. 6-70-1t

## Help Wanted

**Job Headquarters** for all Radio and Television Engineers. Immediate openings exist in 9 western states and elsewhere for qualified engineer and technical personnel. All categories from trainees to experienced transmitter maintenance, chief, assistant chief, live color video maintenance and technical operations. Send us your complete resume now. The AMPS Agency, 3924 Wilshire Blvd., Los Angeles, California 90005. Telephone DU 8-3116. By Broadcasters—For Broadcasters. 11-68-tf

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The engineers we seek will include their talents in Video, Audio and Computer related circuitry designing products for the Television Broadcasting Equipment market. Send resume to the personnel manager, Vital Industries, Inc., 3614 S. W. Archer Road, Gainesville, Florida 32601.

**TECHNICAL SERVICES —** Metropolitan NYC and surrounding states. BSEE provides sales and technical services for out of town firms. Flexible working arrangements. Broadcast Engineering, Dept. 238, 1014 Wyandotte St., Kansas City, Mo. 64105. 4-70-3t

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We seek a profit oriented candidate with a CATV and TV industry background who is capable of spearheading research, development, production, marketing, customer and inter-corporation relations. An executive leader who can manage and develop our new CATV products program to its full potential with sales, profits and ROI equalling or exceeding plans. That's the "diamond" we're seeking. A person with the same indestructible qualities and many-faceted capabilities of this valuable gem.

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**WANTED: STUDIO SECTION HEAD —**With at least three years experience in performing and supervising broadcast studio operations, trouble shooting studio equipment and proof-of-performance. Experience in conducting training classes desirable. Church-related short wave station in Ethiopia. Qualified applicants write: Station Director, Radio Voice of the Gospel, P. O. Box 654, Addis Ababa, Ethiopia.

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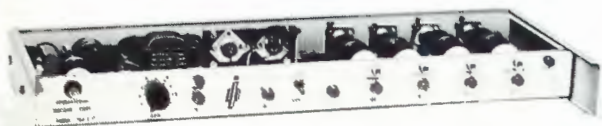
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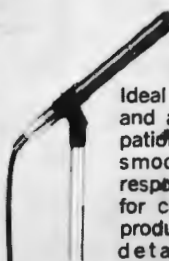
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Extremely versatile in studio, control room, and remote use. Also widely acclaimed for rhythm recording. Bright, clean sound. Exceptionally uniform cardioid pattern gives optimum control of environment.



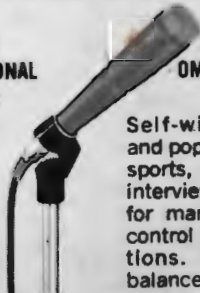
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