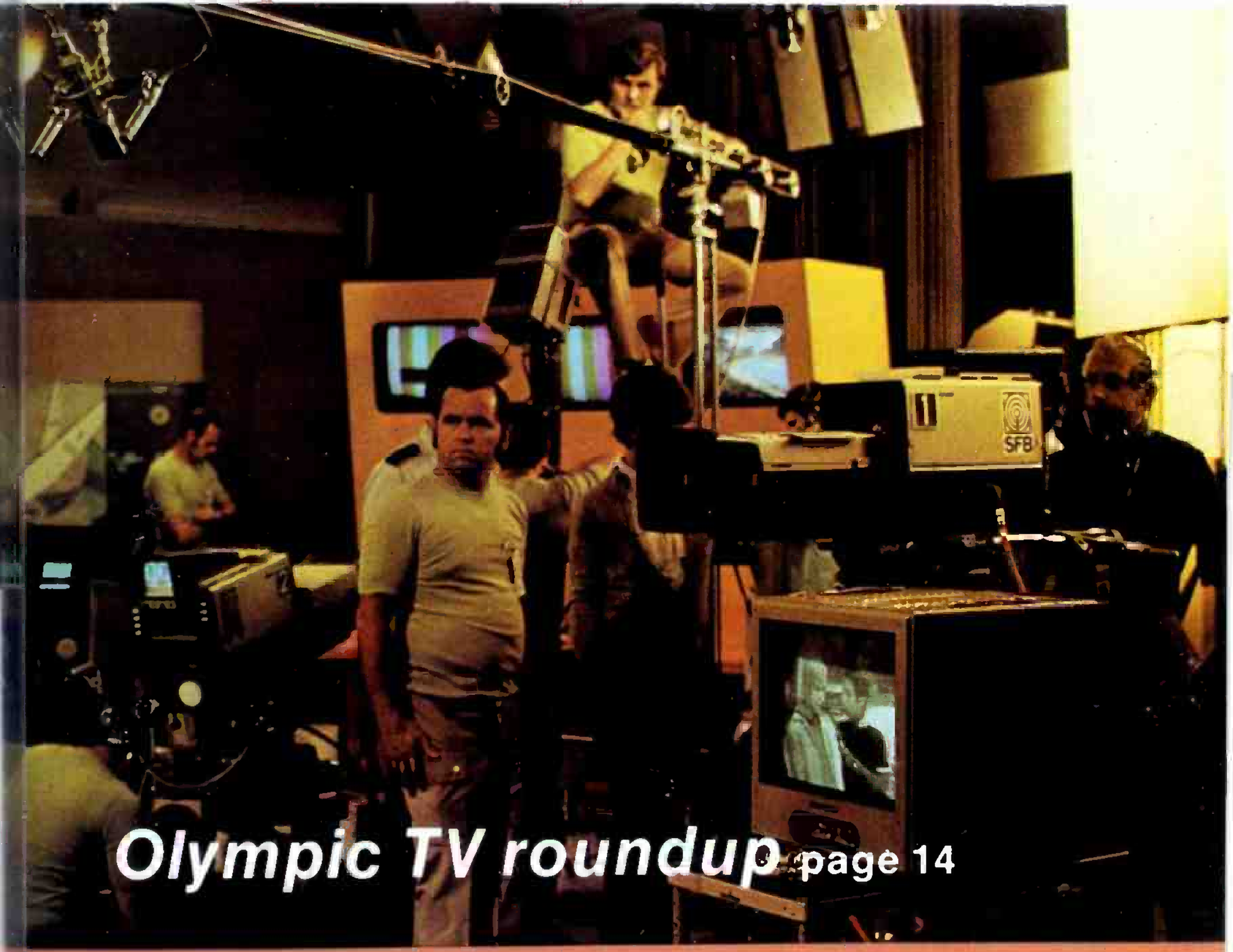
November, 1972/75 cents

BROADCAST ENGINEERING

the technical journal of the broadcast-communications industry



Olympic TV roundup page 14

Stereo Separation
IC Timing Device
AES Convention Review

Canon offers the perfect zoom lens for the camera of your choice

10 x 20B1

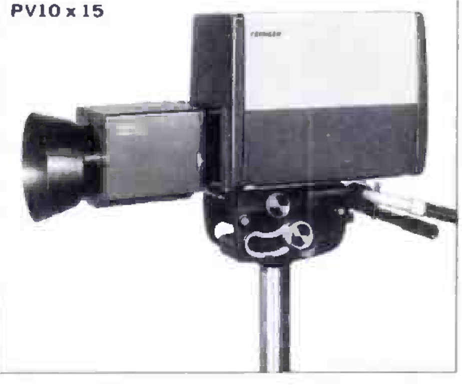
P17 x 30B1

P17 x 30B2

V10 x 16B

PV17 x 24

PV10 x 15



lore and more people are discover-g how significantly superior anon Zoom Lenses are for TV roadcasting purposes. Their utstanding color characteristics, ven in dim light, is one of the nany reasons why Canon was hosen for telecasting the Munich lympics.
anon's wide range of excellent oom lenses encompass three ypes of operation control—ll-servorized, via flexible cables nd by effortless push-pull rod ontrol. And it can be attached to fit and operate with any make of TV camera.
Shown on this page are only a few examples of the quality lenses Canon has available to more than meet your particular demands. Specify Canon to stay ahead.

The following are Canon TV Zoom Lenses for the Plumbicon® color cameras currently available on the market:

Size of Image tube	Lens	Image format covered
1¼" Plumbicon® color camera	P10 x 20B4 P17 x 30B1 P17 x 30B2	17.1 x 12.8mm (21.4mmϕ)
1" Plumbicon® color camera	PV10 x 16B1 PV10 x 15B2 PV17 x 24B1 PV 6 x 18B1	12.8 x 9.6mm (16mmϕ)

® Reg. TM N.V. Philips of Netherlands.

The Canon TV Lenses Naming System

P10 x 20B

- Glass Compensation for Beam Spliter
- Minimum Focal Length
- Zoom Ratio
- Application

Applications	Image Format	Pick-up Tubes
P	21.4mmϕ	1¼" Plumbicon
PV	16mmϕ	1" Plumbicon

Apart from the above, Canon has available TV zoom lenses for 3″ or 4·1/2″ image orthicon cameras and can also build special lenses to fit your requirements.

Canon

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BROADCAST ENGINEERING®

The technical journal of the broadcast-communication's industry

in this issue...

ABOUT THE COVER

The cover picture this month was supplied by Joseph Roizen of Telegen. The article on page 14 describes some unique systems designed for use at the Olympics.

DEPARTMENTS

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DIRECT CURRENT FROM D.C.

November, 1972

by Howard T. Head

Changes in Broadcast Rules Imminent

While a blue-ribbon industry committee continues work on a complete overhaul of Part 73 of the Commission's Rules (Broadcast), a special task force of Commission personnel has been working on its own to examine relaxations of the Technical Rules which might be made with little or no red tape. Under consideration are such diverse requirements as that for reading transmitter meters every 30 minutes, and the reliability of monitoring point field strength measurements in maintaining AM directional antennas.

Substantial progress is being made by both the industry group and the Commission Task Force. Plans are under consideration for a public briefing of the Commission Task Force's work to be sure that both groups are moving in the same direction and are not duplicating one another's activities.

Congress Considering Receiver Standards Legislation

A bill has been introduced into the House of Representatives (H.R. 16916) which would empower the Commission to set performance standards for radio and television receivers. The only such power vested in the Commission by present law provides for standards with respect to local oscillator radiation and the provision of all-channel tuning for television receivers.

The principal purpose of the new legislation appears to be that "of requiring the filtering out of interference". Amateur-station interference is the only type of interference specifically mentioned in the bill.

Even if such a bill becomes law and the Commission requires "the filtering out of interference" in new receivers, this would obviously have no effect on the 90 million television receivers and estimated 200 million radio receivers now in the hands of the public. In the meantime, there is no progress to be reported in the Commission's inquiry into possible measures for alleviating existing interference from various sources to television reception.

Commission Getting Tougher On License Revocations

In two cases involving an AM station on the West Coast and an FM station in the Midwest, the Commission has proposed license revocations for a variety of rule violations. The FM case involved consistent attempts by the station to identify itself in such a way as to lead listeners to believe it to be licensed to a nearby

(Continued from page 4)

large city rather than the actual small town of license, a problem which faces the Commission repeatedly . Not only that, but the program loop from studio to transmitter was only "Class C" compared with the Commission's requirements for a 15 kHz response.

In the case of the West Coast station, a Commission Administrative Law Judge characterized the case as one of the most flagrant ever to come to his attention. Among other things, he found that the licensee had moved the transmitter to an unauthorized site and had instructed the chief operator to file an application for direct measurement of power without making actual antenna resistance measurements.

Commission Rules on CATV Channel Carriage

In a case involving local station carriage on a Midwestern cable TV system, the Commission ordered the cable system to refrain from changing the local station carriage from "off-channel" to "on-channel". The cable system had originally undertaken off-channel carriage because of expected ghosting which would result if on-channel carriage were attempted.

When the cable system later proposed to switch the TV station to its own channel, the station wasn't convinced that the cable system had licked the ghosting problem. Later, a private agreement was reached between the station and the cable system.

Short Circuits

The Commission has granted several temporary relaxations of the requirements for comparable television tuning accuracy at VHF and UHF and has postponed for one year (until July 1, 1975) the deadline date for full compliance with the requirements...How the Commission spends its time: The Commission has notified a complainant that dog food advertisements, discussion of humane animal treatment, and entertainment programs involving animals do not come within the scope of the Fairness Doctrine.

LETTERS TO THE EDITOR

Automation vs. Contacts

Dear Editor:

After considerable debate, I.B.E.W. International has approved a new contract for our I.B.E.W. 1259 radio engineers. The contract contains precedent setting language related to automation, computer data entry and retrieval, graphics (titling) jurisdiction.

The following are some excerpts from the contract dated May 1, 1972. **1.)Section 1.4 b 1. (1) pg. 4.** Electronics special effects and graphics can be set up and changed by any station personnel if the equipment is not located in the video master control room. The actual switching will continue to be handled by I.B.E.W. personnel.

2.)Section 1.4 (c) pg. 6 Nothing contained herein shall prevent any station personnel from entering or extracting of data and/or information via input and output entry and display devices of any type connected to computer type equipment or other electronic memory devices, provided that any such entering or extracting of data and/or information by other than engineers shall not be performed in engineer operating areas, and that any manual operation of television program switching devices controlled by such computer and electronic equipment shall be done by engineers.

This language is universal and should be adaptive to future changes in automation technology in the Broadcast Industry.

I hope this precedent will be of value to organizations in preparing for the age of automation.

Steven A. Smith
Director of Eng.
KCMO Broadcasting
Kansas City, Mo.

Compatible Cable

Dear Editor:

Over the years we have always done our Noon Newscast live on the AM Radio but now we added a new media and are combining our

newscast with our Cablevision and are now offering verbal as well as visual news coverage.

We insert pictures of the local

CABLE ENGINEERING

in this issue. . .

The case for expansion loops

By James B. Wright*

Doesn't it always seem to end up that the best way to do things is also the most expensive way? Maybe it works out that way because we are not aware of all the alternatives.

James Wright, Cable TV of Rockford, Illinois, has taken a long, hard look at a problem area that has been of concern to cable systems for as long as they have been in existence. The problem is that every material used in cables is subject to expansion and contraction. In long line runs, this can create very real problems, especially when we think of the two-way future.

Wright takes an approach to expansion loops that warrants consideration. And it could just be that loops are more reasonable and more economical.

*Electronic Systems Mgr Cable TV of Rockford Rockford Ill

The Line Problem

When aluminum sheathed coaxial cables became available and began to show up in CATV systems, it was apparent that compensation was needed for the expansion and contraction of the cable following changes in temperature. More specifically, it's the difference in the expansion of the different materials used that causes the problem.

After a great deal of agony, a number of partial solutions evolved and were applied singly or in combinations. These included the bonding of center conductor to the dielectric, the compression of the dielectric by sheath, the use of fittings which seize the center conductor and sheath, the use of expansion loops.

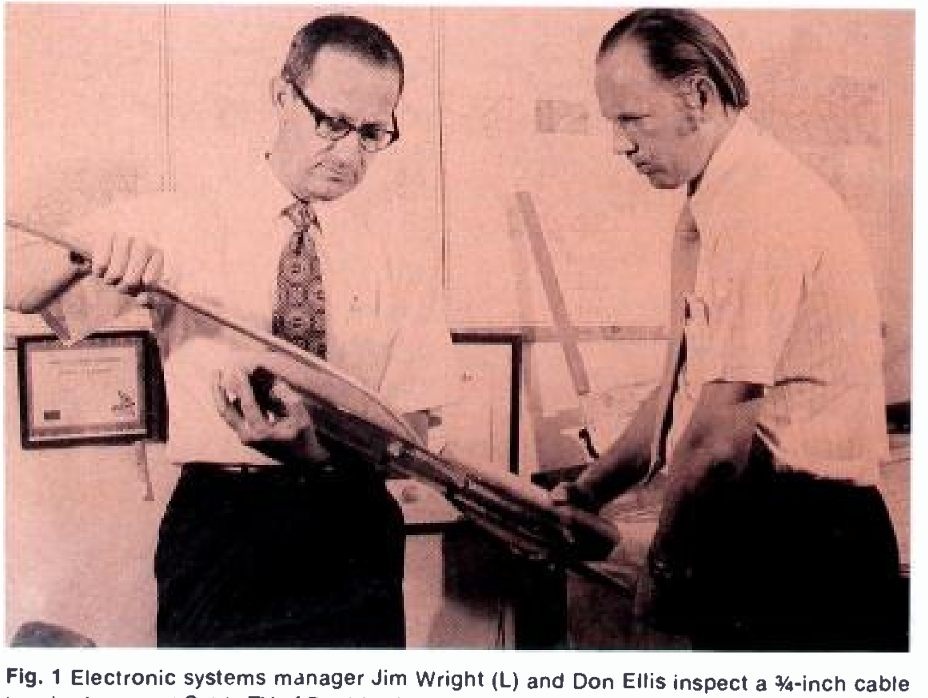


Fig. 1 Electronic systems manager Jim Wright (L) and Don Ellis inspect a ¾-inch cable bender for use at Cable TV of Rockford.

Material Expansion

The coefficient of expansion of a material is its change in size, in inches per inch per degree of temperature change. Expressed in inches of change for a cable length of 120 feet over a temperature swing of 150°F we get (approximately) the data for Figure 1.

The Case Against Expansion Loops

One of the partial solutions, for the expansion difference in center conductor to sheath, was to stop relative material movement by bonding the center-conductor to the dielectric and by forming the sheath tightly over the dielectric. This caused the stresses to be distributed along the length of the cable where they were offset by counter-stresses, and so they could not cause relative movement of the center conductor and sheath. If aluminum cable could be made to adhere to the steel strand in a similar manner, the stresses caused by their different rates of expansion would also be contained and nullified.

The technique suggested for this approach is straight-forward and consists of double lashing the two materials tightly together, using a maximum number of turns per foot, with cable ends (only) being provided with expansion loops. Assuming one wrap of lashing wire per foot of cable, the differential in expansion would be about 0.01 inch per foot, a small enough difference so that it could theoretically be absorbed by counter-stresses and/or by a "snaking" of the cable, with the effect of the whole span becoming an expansion loop. To be effective, the lashing wire must prevent the cable from moving along the strand.

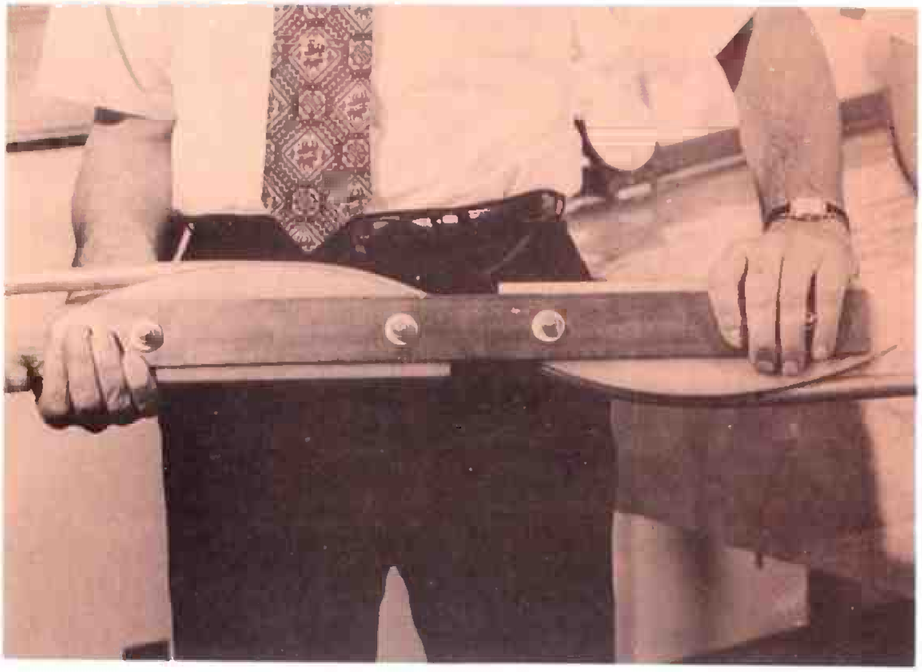


Fig. 2 Closeup view of the ¾-inch cable bender.

The Case For Expansion Loops

The major weakness in the foregoing approach is that with the larger sizes of cables it is doubtful whether normal lashing wire, even when double lashed, would be strong enough to hold. If it did, would it stay tight over the years so as to continue to hold properly? The expansion loop approach accepts the expansion differences as inevitable and, rather than try to restrain the surplus movement, channels it into the loop.

It should be noted that an inadequate loop is worse than no loop and also that if a loop is to be used it must be properly designed.

For an expansion loop to be able to contract and expand for years without metal fatigue, it must be designed so that the limit of elasticity of the aluminum is not exceeded. The limit can be roughly determined by flexing a piece of cable and noting the flex point beyond which the cable will no longer snap back to its original shape, i.e., the point at which it takes a "set".

Another consideration is that the "minimum bending radius" is not the radius which should be used in loop design as this refers to the extreme to which a cable may be permanently formed without buckling the sheath or seriously imparing the structural return loss. A bend incorporated in an expansion loop should be 1½ to 2 times this minimum radius figure. Manufacturers' tests indicate that fatigue failure of expansion loops need not be of concern if the loop is large enough to absorb the maximum movement of the cable, i.e., it is matched to the length of cable being served by the expansion loop.

On The Loop

The size of the loop, its shape, its positioning, and its frequency of use, is determined by the length of cable feeding into that loop and by the loop size. Some considerations are:

1. There should be enough loops to keep the amount of movement of the cable relative to the strand, to a minimum, i.e., the cable should be able to move from the middle of a span toward both supporting poles.

2. The lashing wire should be tied off at each end so as not to restrict the cable movement (particularly at the loop) and should be loosely lashed for the same reason.

3. The maximum amount of change in cable length from the coldest night to the hottest day (add 20° for black jacketed cable in the sun) over the length of span being provided for, should be calculated and from this the change in length of the supporting strand should be subtracted.

4. This net cable excursion should be used with graphs provided by the cable manufacturer to determine, (a) the size of the loop needed to absorb the excursion and (b) whether a single loop spanning the pole will suffice or if a loop should be provided on each side of the pole.

5. The life expectancy of a loop depends on how much cable is used in the loop (i.e., the ratio of cable excursion to total loop length) and not on the exact loop shape as long as it can flex evenly over its length.

6. If an amplifier or passive device is used a double loop is mandatory, unless one wishes the cable on the non-looped side to travel over the full length of the adjacent span to the far loop.

7. The use of adequate loops will also relieve the powerful forces acting on fittings and eliminate the problems arising from these forces.

Loop Formation

The problem of forming loops without cable deformation has been partially solved by the half-round bending tools available. The use of two such tools properly made and mounted in opposition on a single handle will permit the formation of a compound bend without danger of cable flattening. By extending the handle, a sufficient amount of leverage is obtained to permit bending the larger sizes of cable as well. The radius of the bend must exceed the minimum bending radius, otherwise, the cable in the bend will not expand and contract freely enough to give the desired life expectancy.

Economics

If you adopt the "no-loop" approach you must carefully and tightly double lash the cable and dress it at each pole to prevent a "breakout" of the cable at any one point. This double lashing could

film
N4
N5
EFF I

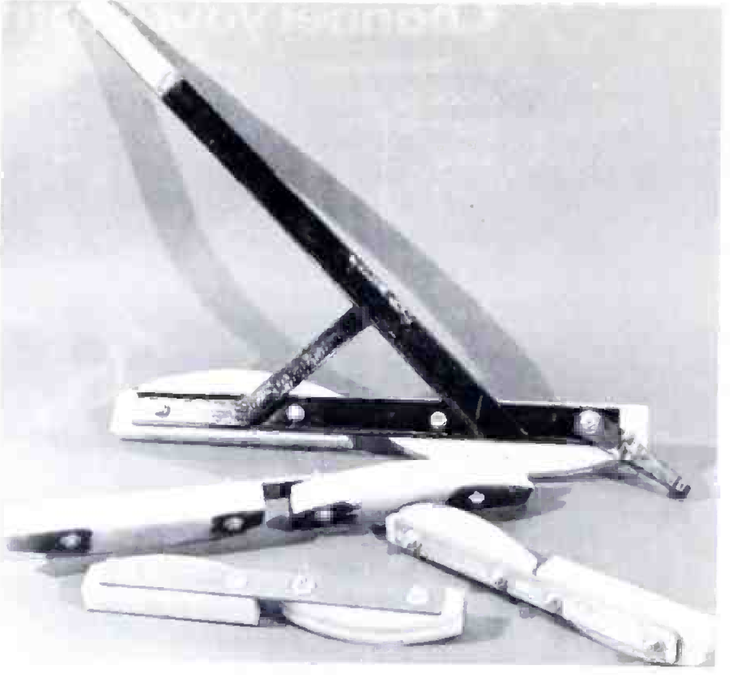


Fig. 3 Shown here are 1-inch, ¾-inch, and 2½-inch cable benders.

average an extra $250 per mile, or about $6 per pole. With a proper bending tool, expansion loops can be made rapidly and as often as required at an estimated average of $4 per pole.

Conclusion

Either the "no-loop" or, the "loop" approach may be used successfully if all conditions are met and maintained. With the "no-loop" technique a slight deviation from complete control of the cable could mean catastrophic failure, while the "loop" technique such a slight deviation would be inconsequential. It is my opinion that expansion loops should be used and, that, except in short span situations, they should be used on each side of every pole on the span side of any equipment.

Editor's Note: We invite your comments and your ideas. And yes, we do pay for all articles used in **Cable Engineering.** If you have found some answers to nagging problems that you want to share with the industry, drop us a line and we'll send you our author's guide.

Send all correspondence to: Ron Merrell, Editor, **Cable Engineering,** 1014 Wyandotte, Kansas City, Mo. 64105. Meanwhile, if there are certain subjects you would like to see covered in CE, let us know.

Foster Sees Positive Cable Signs

National Cable Television Association President David Foster told the New York Society of Security Analysts that "there are a number of positive signs that the cable communications industry is moving into the decade of the 70's with strength and dedication." The following are excerpts from a luncheon address in New York City:

"I have become totally convinced that cable communications is an inevitably strong growth industry, profoundly involved with the public interest, capable of utilizing the best of our nation's technological resources, and made up of the most energetic group of hard-headed optimists I have ever met.

"I think it is clear there are a number of positive signs that the cable communications industry is moving into the decade of the 70's with strength and dedication. For the moment at least, capital seems to be available in good supply. The industry is attracting a new generation of professional managers to work alongside, but never to replace the hard-headed entrepreneurs who brought the industry this far. Technological problems are being solved almost faster than the industry's ability to put the solutions into operation. The brightest sign of all of course is that our subscribers continue to love us. This point cannot be over-emphasized in evaluating the health of an essentially service industry in what has rightly been called the age of the consumer.

"The distant signal importation problem is not all problem. There are many large markets that will be built and are being built at least partly on the strength of those added signals. This is particularly true in light of the increasing program diversity of the independent broadcast stations.

"FCC Chairman Burch has characterized the Commission's cable plan, at least in part, as designed to keep the CATV industry 'lean and hungry.' We hope not lean bordering on starvation. But the metaphor does suggest one thing. The signal limitations will also serve as an incentive to bring to these larger markets additional cable services which will attract subscribers and profit. Observers have noted that perhaps the one value of the five year cable television freeze was that it allowed - indeed forced - us to create a solid base upon which to build the wired nation.

"One more word on programming: it seems clear that economical, widespread specially-originated programming for cable will come about only by means of networking - linking systems together to share programming. Today this is being done only to a limited degree but with the growth in saturation of cable systems, and more importantly, with the availability of a domestic satellite system, we can begin to think in terms of a national cable network."

Honesdale TV goes to color origination

By Leo G. Sands*

lthough the residents of Ho- dale, Pennsylvania are served one of the nation's oldest TV systems, they're getting a more than subscribers of most ver systems. Their enterprising TV system originates local in- st programs — in color.

This fall, Honesdale residents be watching their home foot- team on their TV screens. The mes are videotaped and then yed back over the CATV sys- . These football programs are nsored by 18 advertisers.

le Editor and head o G. Sands & Assoc.

Live programs are originated in a studio near the head end which is on a mountain top, some 1700 feet above sea level. The studio building is a converted mobile home, a permanently parked long, long trailer. As shown in the floor plan, Figure 1, the building is divided into three rooms — a studio, a news room and a control room.

Behind the announcers' desk, is a drapery which can be drawn to expose a sofa when more than one guest is participating in a program.

A unique feature of the announcers' desk is the way its two microphones are mounted out of sight from the cameras, shown in Figure 2. Near the desk, but out of camera range is a huge clip board on which commercials, announcements and news items are displayed. The use of the clip board eliminates the noise of papers being shuffled.

Two GBC color cameras are used. One is on a tripod and is used for viewing the performers. The other color camera is used in the film camera chain which is equipped for showing 16 mm movies and 35 mm slides. A third input of the optical multiplexer is available for future use. A Vikoa weathercaster is also located in the studio.

The control room is as complete as one used at some TV stations. Directly above the center of the sleek-looking console is a huge RCA color monitor. At the top of

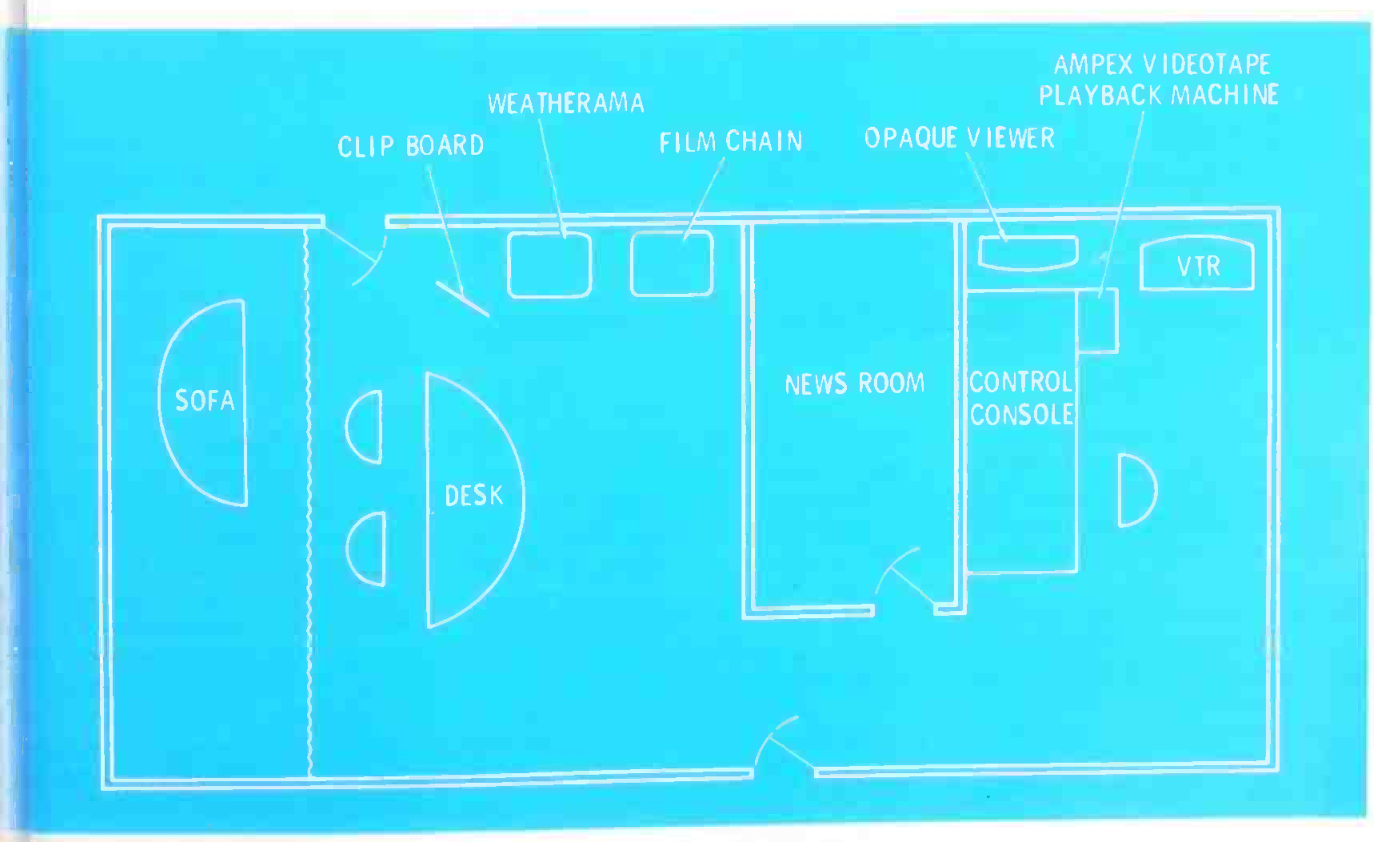
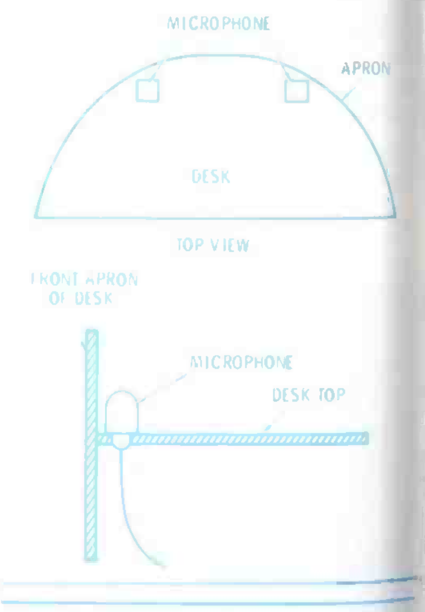


Fig. 1 Honesdale TV's floor plan.

Fig. 2 Unique announcer's desk layout.



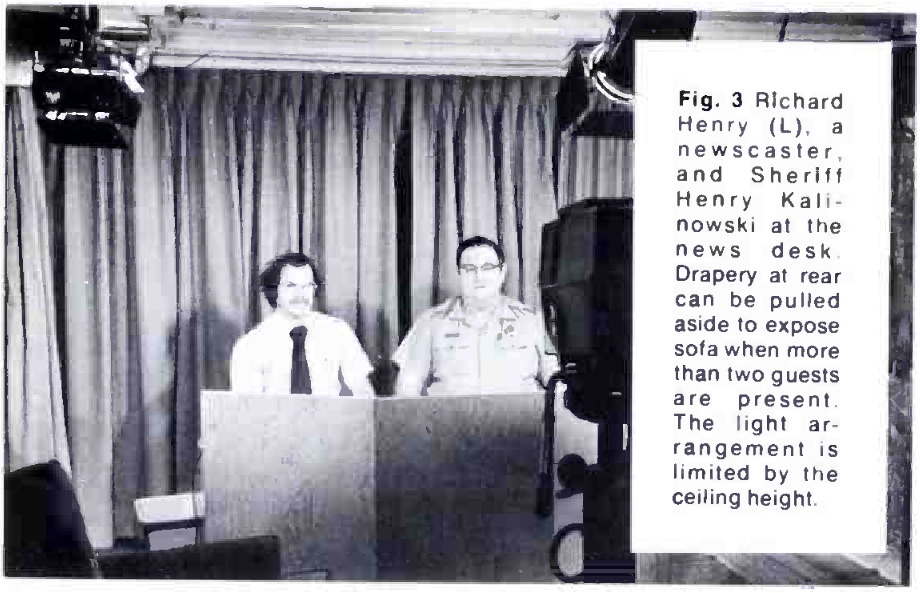


Fig. 3 Richard Henry (L), a newscaster, and Sheriff Henry Kalinowski at the news desk. Drapery at rear can be pulled aside to expose sofa when more than two guests are present. The light arrangement is limited by the ceiling height.

the console are six GBC color monitors. And at the left and right of the console are the controls for the two GBC color cameras. The console also contains a Bogen audio mixer, a GBC video effects generator and switcher, projector control panels, an Anaconda TV modulator and a Tektronix RM-529 TV signal waveform display.

Also in the control room are an audio tape player/recorder, a record player, an Ampex videotape playback unit, an automated opaque card viewing system and a Sony videotape recorder with its own monitor.

Since programs are televised in color, the studio is lighted by quartz lamps in addition to incandescent spot lights.

The Honesdale CATV system carries 12 channels of television plus the entire FM radio broadcast band. Although, the head end is some 95 air miles from the Empire State Building, the programs of all of New York City's VHF television stations are piped to Honesdale residents.

Without CATV, television reception would not be possible in Honesdale which is surrounded by heavily wooded mountains and is 50 miles southeast of Binghamton, New York and 25 miles northeast of Scranton, Pennsylvania. The only TV antennas to be seen are at homes on hilltops quite a few miles out of town.

The CATV system was initially installed in 1950 and serves more than 1700 homes in this community of approximately 2000 homes. Originally, SKL amplifiers were ed. The system now uses Ameco lid state amplifiers and tube-type XL AGC amplifiers which are ing replaced by solid state Ame- amplifiers.

Heading up the CATV operation the sheriff of Wayne Coun- Henry Kalinowski, who said he eds a 12-day week to stay on top all of his activities. However, en he was interviewed for **Cable gineering,** he seemed to have erything well under control.

In addition to being the county's law enforcement officer and the ad man of the local CATV sys- n, he runs a TV and appliance es and service operation and is o an MR (manufacturer's repre- ntative) for RCA two-way mo- e radio equipment.

His service shop is very well uipped and staffed. Hewlett- ckard, Lampkin and Motorola t equipment is used for servicing bile radio equipment. One of his chnicians pointed out that one ng is missing — a UHF band TV nal for checking TV sets owned customers who live out in the untry where direct reception of UHF TV stations is possible. Since UHF TV stations can't be picked up in the shop, an RF signal generator is used for determining that a TV set is responsive to UHF signals, but no check of picture quality is possible. This points up that there is a requirement for a tunable UHF band test pattern generator.

Honesdale is an example of many communities that have to depend upon CATV to bring televised entertainment and information to its residents. Honesdale is fortunate to have a civic-minded man, such as Sheriff Kalinowski heading up its CATV system which not only delivers off-the-air TV programs but also produces locally-originated programs — in color.

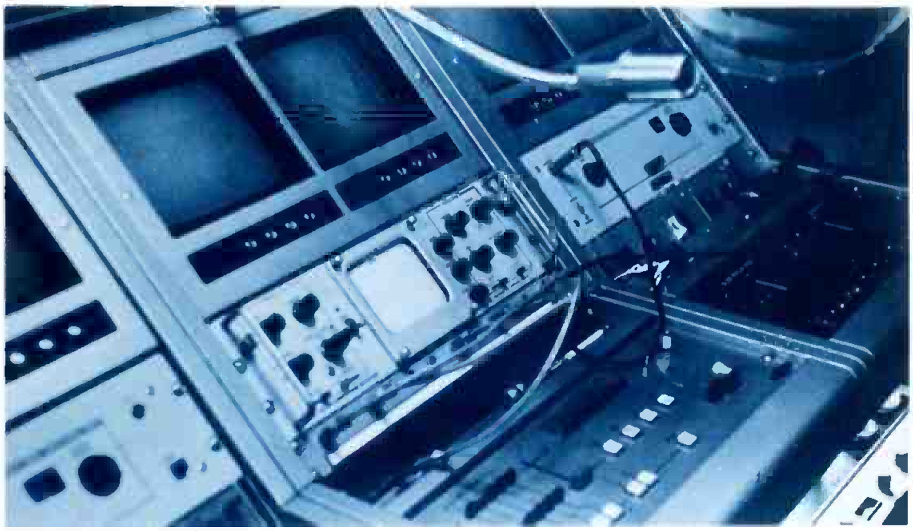


Fig. 4 Close-up of the Honesdale control console.

Accelerating Tape Duplication

Last October, Net Television, Inc., Ann Arbor, Michigan, in- lled an Ampex ADR-150-5 high eed quadruplex videotape con- t duplicator in anticipation of at st doubling the output of tape ies within a year.

Along with the requirement for h speed and high volume capa- ity, we expected other benefits m the system, including a reduc- n in per-unit duplication costs d the ability to maintain and even prove our level of efficiency and xibility.

The development of the duplica- was quite timely. When Ampex d other manufacturers first be- n to discuss the feasibility of high eed duplication of two-inch vi- otapes late in the 60s, Net urged at the capability be made availa- e as soon as possible. Although were able to handle a rapidly owing demand for tape copies, it was apparent that standard machine-to-machine copying was not the most satisfactory method of meeting our requirements.

In 1971, we sent more than 30,000 half-hour units of quadruplex recordings to stations throughout the world and by the end of 1973, we expect to distribute at least 60,000 to 70,000 units.

(Although Net Television, Inc., copies and distributes materials ranging in duration from a few seconds to 90 minutes or more, the half-hour increment is used as the basic unit in describing volume).

Before the high speed duplicator was pressed into service, our battery of two-inch recorders, installed during more than 15 years in business, was used for all quad copying. During multiple-copy, machine-to-machine duplication, several of the VTRs could be slaved simultaneously to the VTR on which the master was played. In addition, two master modulation systems, equipped with VR-1200 signal electronics, could be used to feed geometrically corrected RF to the record drivers of the duplicating recorders. This technique makes minimum use of the electronics in each VTR and insures that uniform signals reach each VTR.

Net operates around the clock with three eight-hour shifts. The night shift and parts of other shifts are devoted to duplication. Even with the use of 15 or more slave recorders and at least a full eight-hour shift for dubbing, our capacity was barely able to satisfy incoming requests.

With the ADR-150, Net is now making copies at ten times normal playback speed, so that a copy of a half-hour program can be made in three minutes. The machine uses a five-slave system allowing five copies of a half-hour program to be completed in three minutes of duplicating time.

The duplicator system uses transfer chambers in which mirror-image masters (intermasters), recorded on high-coercivity tape, come into direct contact with from one to five blank slave tapes.

During contact in the transfer chambers, the oxide side of the master tape meets the oxide surface of the slave tapes so transfer of the video information can take place. At the same time, the audio information and the control and cue tracks are read from the master and recorded on the slave tape in full syncronization.

Masters are made on an AVR-1 which can be equipped with a modification kit enabling it to produce a mirror-image recording.

Allowing for rewind and reload time of seven minutes for a five-slave process, the average operating volume is thirty duplicate half-hour tapes per hour, or 240 during an eight-hour shift. This compares to 120 half-hour tapes for each eight-hour shift using the machine-to-machine method with 15 slave recorders.

Only two engineers are required to keep the high speed duplication operation at maximum efficiency. Individuals ordinarily involved in machine-to-machine copying may be assigned to do post-production work, to make film-to-tape transfers or to tend to other operations at the facility.

Thus, computed in terms of man-hours, two engineers using the ADR-150 in a single shift can match the output of two two-man shifts employing machine-to-machine duplication.

(It should be noted here that the Net capabilities are rapidly being broadened beyond the requirements of domestic educational stations and networks. We are expanding into the commercial market, and offering high-volume, low cost services for commercial producers.)

Our services include copying and distributing videotape recordings on a contract basis, post-production work, a customer library from which individual programs can be ordered, specialized functions such as film-to-tape transfers and the capability of broadcasting over leased phone lines.

In addition to the 18 quadruplex VTRs, including the Ampex AVR-1, we also have 16 helical-scan videotape recorders, color and monochrome film chains and a full range of control, switching, modulating and tape cleaning equipment.

An important benefit of high speed and high volume distribution, of course, is much more efficient utilization of personnel and equipment, resulting in increased economies—economies that ultimately can be offered in commercial work.

As an example, the cost of black-and-white tapes produced by machine-to-machine methods is roughly comparable to that of black-and-white film (although color tapes can be produced less expensively than color film copies). In some cases, in fact, it is more expensive to make B&W tape copies with the old copying method compared with monochrome film. But the economics of scale resulting from the use of the high speed duplicator bring the cost of B&W tapes below that of monochrome film copies.

Flexibility And Quality

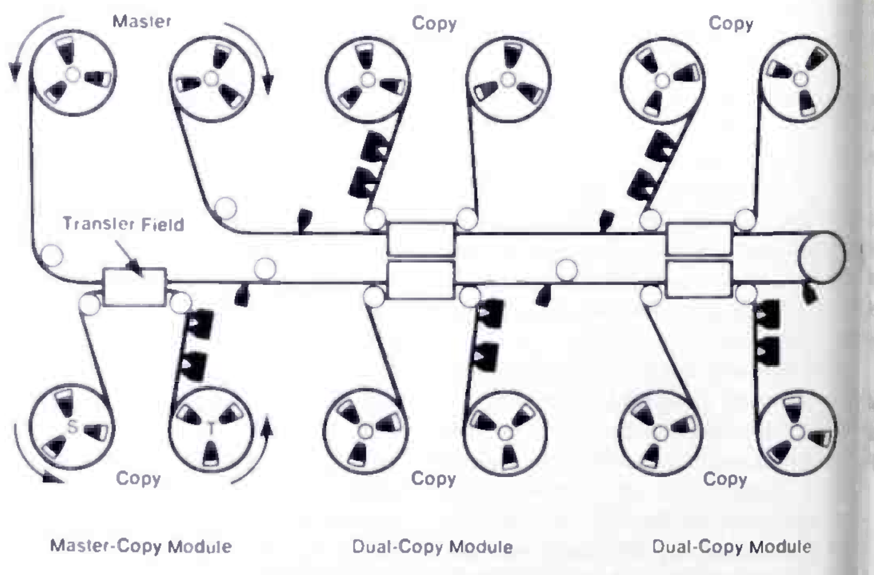
Along with providing high speed duplication, high volume output and increased efficiency, our equipment capabilities must be consistent with Net requirements—flexibility and quality.

The terms "flexibility" and "quality" are widely used to mean a variety of concepts. But one can appreciate their importance for Net by realizing that we send out more videotape recordings than any other facility in the country, perhaps in the world—all from a small facility (16,000 square feet) with only 48 employees.

In order to satisfy a complex array of requirements with consistently high quality recordings, we have always been committed to finding and developing innovative methods and products.

Consequently, Net was first to use the 7½ ips conversion kit, the VR-1200 conversion kit and the VR-1200 signal electronics (as a master modulator system for multiple duplication). Among Net inventions are the LEXAN plastic reel which will break before allowing flange distortion; the octagon box which firmly holds tape reels for safe packing and shipping; and the two-inch reel strap which wraps around the tape at its outer periphery on the reel and is sealed by use of the velcro-type fastener.

Specialized routing and booking forms, color coded boxes and a procedure of attaching mailing labels to incoming orders, aid the production and shipment of large orders quickly and without error.



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ews items covering the news roadcast which of course adds pecial interest to the viewing audience.

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We feel we are one of the first ations in the United States to ork out this electronic system and e proud to say the results are uite rewarding.

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Robert F. Wolfe, Pres.
Fremont Cablevision
Div. of Wolfe Bcstg. Corp.
Fremont, Ohio

UHF Parts Needed

ear Editor:

I have a GE TT-25-A UHF ansmitter that is missing its aural d visual klystron output waveuide cavities.

Twice I have located the trace of me, only to learn that they had en scrapped for brass after being ored for years.

There must be someone who has ther junked the transmitter or nverted to Eimac klystrons and vities. I would be interested in aring from anyone that has made at conversion himself.

I am also looking for any freuency sensitive components necsary to convert a TT-24 exciter Channel 43.

Maury Goldberg, CE
WONH-TV
345 Peat St.
Syracuse, N.Y. 13210

rial, and provides detailed information concerning its use to television station engineering and operating personnel.

This Bulletin is available from the EIA Engineering Department - Standards Orders, at $1.60 per copy. The EIA address is 2001 Eye St., N.W., Washington, D.C. 20006.

Set Makers Get Extension On UHF Tuners

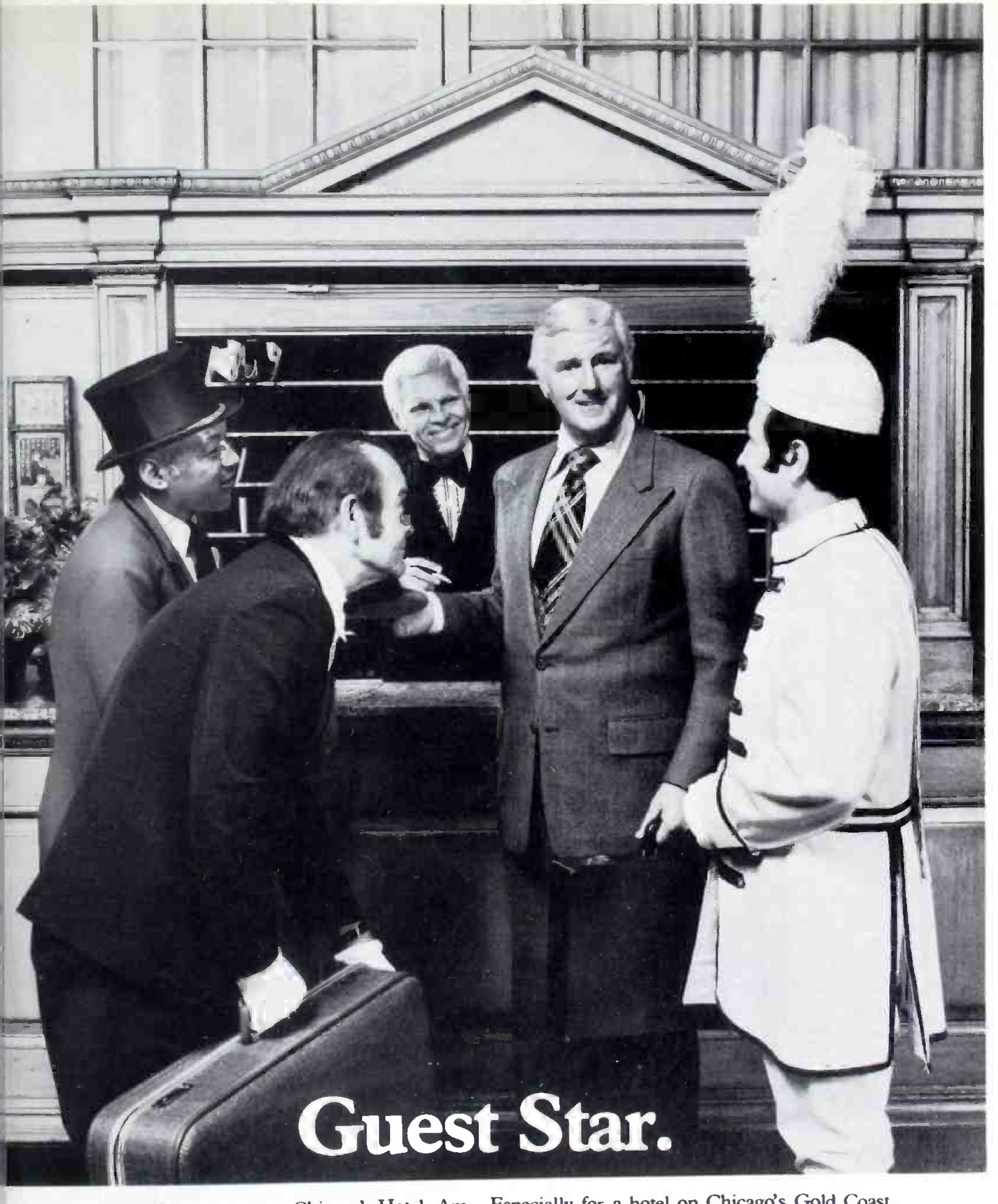
Rules governing the tuning accuracy of television receivers utilizing a 70-position non-memory UHF detent tuner have been retained by the Commission in an action disposing of a petition for reconsideration filed by the Philco-Ford Corporation (Docket 19268).

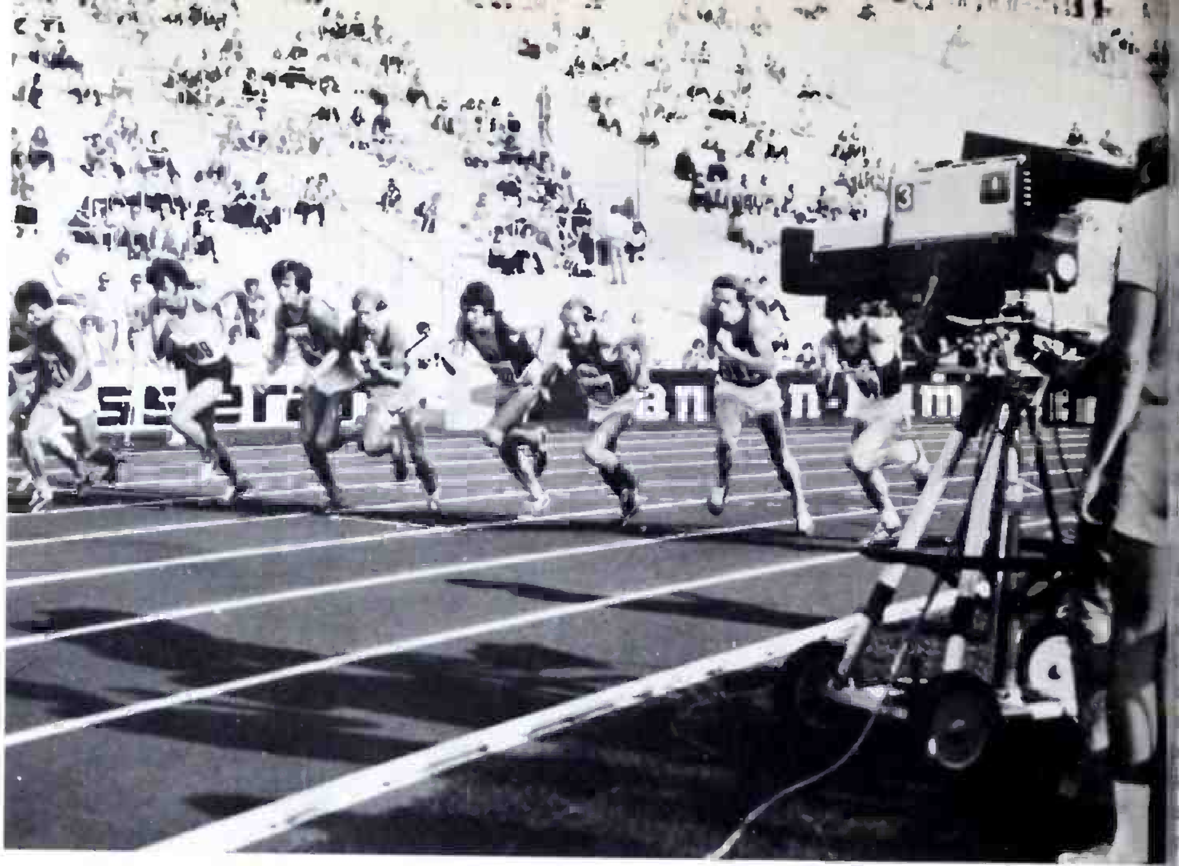
The date by which receiver manufacturers must meet these requirements was extended one year, to July 1, 1975, to ease the problem of transition to receivers meeting those requirements.

Rules authorizing the use of a 70-position non-memory UHF detent tuning system were adopted by the FCC on November 24, 1971. The regulations specified that black and white and color television receivers using the 70-position UHF tuning system should be equipped with AFC circuitry and with a channel selector mechanism capable of positioning the tuner within the "pull-in range" of AFC. These requirements were to become effective July 1, 1974.

Philco-Ford opposed the requirement that black and white receivers with a 70-position tuning system should be equipped with AFC. It also questioned the technical feasibility of the requirement that the 70-position channel selection mechanism be capable of positioning the tuner within AFC pull-in range.

To help monitor progress toward fully comparable accuracy, the Commission said it would require that each application for certification of a television receiver using a 70-position UHF detent tuner be accompanied by a report of measurements of tuning accuracy.


Guest Star.



Camera on special large wheeled dolly to permit rolling across grassy sections on the main stadium.

Television at the Olympics

By Joseph Roizen

Whatever other facet of the Twentieth Olympiad in Munich maybe subject to controversial opinion, the television coverage was by all accounts the best pictorial presentation ever achieved for so large an international spectacle. The combination of Teutonic thoroughness in planning the vast complex of communications equipment and the cooperative assistance of the world major television networks, ABC, BBC, CBS, etc. produced a monumental chapter in television history that will long stand as a model for future activities of the same character.

Every run, every jump, every throw, whether in an elimination heat, a semi-final or a final was under the constant scrutiny of a sharply focussed color camera. Relayed live or recorded, every athletic event was available to a billion viewers on five continents, at their own convenience, in their own time zone. Whether seen in the original PAL 625/50 format or transcoded to SECAM and NTSC, the uniformly good quality of the color pictures and the sound were constantly self evident.

Twelve-hundred hours of sporting events, spread over thirty-three venues and compressed into seventeen days required over 150 color cameras and more than 100 VTR's to register and record all that was going on. No single television entity could field the 30 million dollars worth of equipment necessary to do the complete job. At the venues, mobile units from all over Germany, including the ARD (national network), and ZDF (commercial network) sat side by side with camera and VTR vans from RAI (Italy), ORTF (France), ORF (Austria), BBC (UK), and others. Complete studios were installed at the DOZ center by various German television station personnel. The ABC complex was the responsibility of Norddeutscher Rundfunk, while Sender Fries Berlin engineers installed and maintained Studio 5, the combined ARD and ZDF studio.

The combination worked to perfection so much so that the most unused slide in the caption scanner at the DOZ Weltregie (World Program Control) was the one that stated in three languages, "We regret the breakdown." The equipment just didn't dare to.

Technical Picture Quality

The uniformity of the picture quality that was evident not only in Munich, but in all the countries where the color coverage of the games was being radiated was certainly not a technical accident.

The first consideration that was given serious attention and eventually proved to be of greatest importance was the unique approach to lighting proposed by Dr. Schwarz, the Head of Engineering for the

Z. The familiar afternoon shad- that creeps across a stadium ng a sporting event creating h differential lighting between sunny and shady sections is a tle most television engineers cameramen have fought and since color television began uding in athletic arenas.

he solution proposed was a sparent roof over part of the n stadium and other adjacent rt halls, which would allow suf- ent natural illumination to avoid late afternoon sun syndrome. architects and structural engi- rs designed the roof, built and ed a small section to prove the ory over a year before the es and then budgeted the trans- nt cover at 5.3 million dollars. s was probably the greatest sin- cost run of any structure at rwiesenfeld, the final price was r 60 million dollars. . . more the total cost of the Rome es in 1960. The saving grace that it all worked to perfection n the pictures coming from under this free form acrylic umbrella were "wunderbar."

Of course many of the events were held at night or indoors. Here also carefully color balanced, high intensity lighting not only turned night into day, but gave the color cameras the right color temperature to produce correct colorimetry under almost all circumstances.

A special phase lock system was developed by Legeler of Fernseh GmbH and installed by that company to all of the fixed cameras at the venues. The Legeler system uses audio lines to provide feedback information that maintains proper phasing of the color encoders at each camera and held the PAL subcarrier phase to within a 2° tolerance at the switcher input in the DOZ control center.

During installation, each venue feed was color timed to 1° of the 4.43 MHz subcarrier through the use of phase correcting networks at the ends of the cables. Once installed, the phase correction loop would then hold all the color frequency generators at the various television installations in the venues locked to the rubidium standard at the DOZ center. Switching between over one hundred color cameras connected through miles of cables and microwave links still yielded an amazing degree of pictorial chromatic uniformity that showed the meticulous care with which the cameras themselves had been color balanced by the camera crews.

The Legeler system tied in not only to the 120 Fernseh KCU-40 cameras that provided the major coverage, but also to the BBC mobile units with their EMI 2001 cameras and the ORF's Philips PC-70's. Even the portable cameras were phase matched when they were tied into the network. To make sure that the system kept operating at peak performance levels during the critical 17 days, the DOZ's own maintenance engineers were augmented by teams of

Main stadium camera at the top of the especially covered grand stand immediately above commentator positions. This camera came from the ZDF.

camera and generating equipment specialists from Fernseh, and VTR experts from Ampex, all of whom worked around the clock shifts from August 26th to September 11th. Test equipment and spare parts were plentiful and near at hand. Three additional key links maintained the high quality of the original images.

All the VTR's used were high band quadruplex recorders. Half of the 85 video tape machines assigned to key coverage were the latest version AVR-1's, and all of the slow motion discs were HS-100 PAL versions. Transcoding to NTSC at Raisting and transmission via Comsat's latest North Atlantic 'bird' to the U.S. (or Canada) were done with precision equipment that kept the subjective quality at more than adequate levels.

Total Television

The ancient motto of the Olympics is "Higher, Swifter, Stronger." It could easily be applied to the camera coverage of the 20th Olympiad. Television cameras seemed to be everywhere. The 'highest' was a KCU-40 perched 750 feet above the ground on a unipod that is Munich's newest and tallest landmark, the "Fernsehturm." This 951 foot tower comes complete with rotating restuarant (the Goulash soup and Vienerschnitzel weren't bad), microwave relay stations, and topped by television antenna arrays. This camera with its 18:1 Varatol zoom could take in the whole spectacular layout of the Olympic park or tighten up to a team sport in the main stadium which it looked down upon directly. Cameras moved 'faster' than ever in minicars and vans, on dollys and hand trucks. Motorized or man handled, they got to the scene and shot the story.

In the Gymnastics Hall when Olga Korbut blew her performance on the uneven parallel bars and began to cry copiously, the nearest floor camera, a KCU-40 on a bulky pedestal was at the diametrically opposite corner of the floor. Sensing a great human interest potential, the television director ordered the camera trucked around the perimeter of the floor to the balance beam for a close up of the young Russian gymnast. The three man crew sprinted the camera, playing out 250 feet of snaking cable along the way and got there in time to pick up the tearful trauma.

The 'stronger' aspect relates to the growing breed of camera crew members who strap on a bewildering array of shoulder harnesses and backpacks to get right in where the action was. Good health and stamina are prerequisites for carrying around a KCR camera head or a VR-3000 backpack for a few hours, staying focussed, pushing buttons, and trailing a fast moving event all at the same time.

Some of the more unusual camera set-ups were as follows:

1. A KCU-40 on a track dolly that rolled at the edge of the swim pool at the pace of the swimmers. This mobile camera cart was pushed by hand.

2. Underwater views were obtained by other KCU-40's looking through windows at the end of the diving and swimming pools just below the water line. Beneath the surface fouls in water polo were harder to coverup with all that submarine camera coverage.

3. A third camera of the same type was installed over the center of the pool just below the ceiling support structure and could zoom from a full wide angle shot of the entire pool to an overhead close-up of individual swimmers.

4. A three man crew handled a PCP-90 that roamed at the edge of the track in the main stadium. The cameraman shouldered the camerahead, his first assistant carried the camera electronics on his back,and the second assistant kept the required length of cable moving in or out. Many hundreds of feet away under the grandstand, a video engineer in a small van operated the camera control unit.

5. At peak periods, another portable camera using two pick-up tubes and operated by the ORTF, ranged in the stadium. Its C
was in a little car, and produ
SECAM encoded images that w
converted to PAL before being
layed to master control.

6. At the edge of the track, s
eral EMI-2001 cameras supplied
the BBC were specially moun
on short unipods close to t
ground. The camera operat
manipulated these cameras fr
the photographers pit circling t
track.

7. On the playing field seve
KCU-40 were on special lar
wheeled carts and could get ve
close into the athletes competing
the pole vault, high jump, bro
jump, javelin, shot put, etc.

8. The CBC brought an Edi
camera pack consisting of a mo
fied BC-230 in a small vehicle w
a VR-3000 inside. This was us
for local color since it did not ha
access to the venues.

9. The BBC minicam unit co
sisted of an EMI 2001 mounted
a roof platform on a pneumatica
self-levelling Citroen vehicle. Th
was called the Safari wagon a
gave amazingly stable pictur
while following road events.
VR-3000 in the vehicle record
the camera output or it could
linked through a helicopter mic
wave relay to the television cente

10. A KCR hand-held portal
on an electric cart (so as not to c
ate pollution for the contestan
was allowed to accompany so
road events, like the marathon.
a close look. This camera sig
was also relayed by a hover
whirly bird to the switching cent

Commentators

Without proper commentar
video images would be far less
teresting. This fact poses a rath
difficult problem for an internatio
al event like the Olympic gam
Pictures are automatically inter
tional, sound isn't. To provide n
ration for the television netwo
from over 60 countries required
complex installation involving sp
cially designed commentator a
announce booths both at the ve
ues and at the DOZ center.

There were over 300 televisi
commentary booths at the venu

d 60 "off tube" cubicles for ce over operation. Eleven separate color television studios at the ter and four interview studios at Olympic stadium, the Schwine and the Sporthalle covered origination requirements.

At the venues a commentator d at his disposal a pair of small evision receivers that carried up 2 channels of pictorial coverage m active sites.

The RF distribution system fed r 2000 color and monochrome eivers all over the Olympic k, including the press center the participating networks assigned offices. The commentator, h good direct visual contact of event under way could also ch the camera coverage on their nitors. Their commentary went microphones attached to their adset that brought the background sound of the activity in one phone and instructions from the ector in the other.

Sound picked up by field microbnes located on site or 'shotgun' kes on the cameras became the nternational sound" that accomnied the pictures. Specific lanuge commentary was overlaid by dio mixers, the output of which re either aired live or recorded an assigned VTR for later playck. In addition, a bank of multick audio recorders (Ampex M-1000 16 track machines) lved to the master AVR-1 video tape recorders could register up to 45 separate languages for subsequent editing.

The Canadian Broadcasting Corporation's need for dual language coverage for all programs led to the installation of two sound over studios in their section at the DOZ center and the unique use of the audio and cue tracks on their four AVR-1's for simultaneous two language recordings. These were relayed back to Canada over Comsat's link with both English and French sound for the pictures.

Production and Editing

While each of the networks used their own production techniques to satisfy their different end viewer requirements, the commonality of technical equipment led to some similarities of program production.

Only ABC had managed to get the rights to unilateral coverage to American tastes, and could augment the DOZ World Service Program with separate cameras under their own control.

Most of the other networks had to use the DOZ camera coverage by selecting the feeds they wanted from the venues. Usually up to six simultaneous inputs were available. The main switching center at the DOZ could handle up to 13 parallel television feeds and route them through Weltregie for distribution to the production studios. The major networks like ABC, BBC, NHK, etc. had their own studios, VTR's, graphic cameras, and master control rooms and could put together programs on a live or recorded basis.

The recordings were edited by a variety of means. Straight mechanical editing of videotape by cutting and splicing was still in evidence. Because of spooling time on VTR's and tight schedules, this is still the fastest way of getting a few seconds or minutes of an important scene out of a long tape. Manually placed cue pulses and electronic editors were the next step and many of the VTR's in the DOZ center, the venues and mobile VTR vans had this facility built in.

The most sophisticated editing was done with the new 80 bit SMPTE address code which was simultaneously recorded on the cue track of the AVR-1's in the central VTR room. Editing could then be done by transferring the tapes to several pairs of AVR's equipped with RA-4000 random access editing accessories which automatically search out the specified addresses on the tape and perform the edit on command of the editor.

Other production techniques involved the use of chroma key with the familiar blue backdrop. Graphics insertion using color cameras or monochrome cameras with colorizing devices, character

The excellent camera coverage was due in part to very close cess to the events. This is a KCU-40 on the floor of the volley ll hall following the action.

Central switching room at DOZ center provided constant checking on inputs from venues. Labeled by venue along venue along the bottom two rows and by destination on the top two rows.

generator titling with moving or flashing titles and of course timing overlays during a race.

Eleven slow motion HS-100 disc units provided the instant replay and time base manipulation of the video images where it contributed to the informational or esthetic quality of the program.

What the viewer saw as a final composite image often took several color cameras, miles apart, mixed with local ident signals that were later eliminated, overlayed by keying and special effect techniques, inserted by character and graphic sources, recorded, edited, copied into final program form, relayed by microwave to Raisting, standards converted from PAL 625/50 to NTSC 525/60 by an optical transcoder sent by satellite to a ground receiving station thousands of miles away, then distributed over a network where further re-recording to accomodate time zone requirements preceded the actual local transmission. Notwithstanding all this, the picture and sound got rave revues from all televiewers.

Personal Commentary

A fortunate set of circumstances permitted my wife (who is a Video Consultant) and I to see not only the studio origination and closed-circuit distribution of the World Service Program of the DOZ but also to watch air transmissions of the games on color sets in our apartment in Munich, in Paris, and London. Since returning to the U.S., I have seen recordings of what happened here. The European color pictures whether in PAL or SECAM were excellent and required no manipulation of the home receivers to keep them that way. While the flicker factor of a 50 field image is noticeable at first, it disappears in a few days and one begins to enjoy the superior bandwidth and more stable colorimetry of the European color systems. It should be the goal of the U.S. color television industry to achieve the same kind of picture quality through careful control at the o gination and less manipulati range at reception.

The assembly of the informati and pictorial material describi the Olympic television faciliti was made possible by the kind he of Dr. Richard Theile, Director the Institute fur Rundfunk Techn in Munich who arranged for o accomodation, Dr. Schwarz, H. Mandl, K. H. Schulte and M Grape of the DOZ for accredit tion, access and information, sp cific details about the Fernse equipment was obtained from M Poehl, that company supervisor Oberweisenfeld and similar info mation about Ampex's installatio came from Klaus Eichstadt, an o friend and co-worker at the Mexi games.

Thanks are also due E. Alter an H. Wolff of Sender Freis Berlin f a tour of Studio 5 and H. Reidel NDR for the revue of the AB complex. Norm Taylor of the BB and A. Daigneault of the CB filled in the technical backgroun about their operations.

One of the very best broadcast color monitors is on the shelf...waiting to brighten your day.

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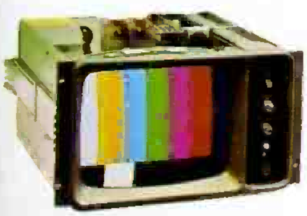
The TCB-19 performs the way it's built, and it's built well. Check it out!

MIRATEL

The rest of the family is also standing by.



And it's a large one. Color and monochrome monitors from 9 to 25 inches. Rack-mounted, frame-mounted, broadcast or information display. All Miratel monitors feature over-design of critical circuitry for exceptional long-term performance. Each unit is power aged, and subjected to quality control checkout before shipping. Miratel monitors are designed to serve as your single best check of signal quality.

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Circle Number 20 on Reader Reply Card

Stereo separation for microphone lines

The Design of a two-channel, hybrid, passive splitter-mixer.

By Todd A. Boettcher[*]

This article should provide assistance especially to the broadcaster who has the opportunity to utilize two-channel stereo for live or recorded broadcasts.

Traditionally, it has been necessary for the broadcaster to provide a quality broadcast with a minimum of complexity and set-up time. Within the last few years, however, there has been a growing trend to provide recording studio flexibility, since many contemporary artists have had their images molded in the recording studio. Conventional microphone techniques would be detrimental to that image. As a result, the close-microphone-placement technique, which allows better mixing control by the audio engineer, is being experimented with and used more frequently.

Eliminating The Hole In The Middle

Close-micing can cause a problem for many broadcasters, because few broadcast audio consoles have pan-pots or other special audio processing equipment. Close-micing, plus the lack of pan-pots, will tend to exaggerate separation to the point at which instruments in a band, will appear in one channel or the other, with very little chance to be heard by microphones in the opposite channel. Hence, the "hole-in-the-middle."

This hole-in-the-middle can be eliminated in the limited-flexibility console by using two microphones on each instrument—one mic in each channel. Then each instrument can be placed anywhere in the stereo spectrum. The result is the same as if a pan-pot had been used. In practice, this is not a feasible alternative because most broadcast consoles do not have enough microphone inputs to offer this luxury.

An economical solution is the following simple construction project that was designed to fill in the hole-in-the-middle that sometimes creeps into two-channel stereophonic recordings and live broadcasts, yet will still allow the sound in the middle to have a stereo dimension. Just as importantly, it does not require the use of extra microphone inputs.

Specifically, a portion of Input 2 is fed to Output 1, and a portion of Input 1 is fed to Output 2 (see Figure 1 and Figure 2). The "x" in the output formulas is the ratio of the voltage of the primary channel to the secondary channel. I have arbitrarily chosen that the secondary channel information should be one third the voltage of the primary channel for initial testing; thus $x = 3$.

Six resistors were incorporated for isolation (see Figure 3). R_1 and R_4 isolate the input, R_3 and R_6 isolate the output, and R_2 and R_5 reduce interaction related to mixing resistors R_7 and R_8.

Voltage ratios can be determined at points "c" and "g." Using the "$x = 3$" formula above, the resistor formulas are:

(1a) $3(R_1 + R_2) = R_4 + R_7$ for point "c"

(1b) $3(R_4 + R_5) = R_1 + R_8$ for point "g"

R_1, R_2 and R_3 form a series resistance in Channel A, and R_4, R_5 and R_6 form a series resistance in Channel B. Unless these resistors are incorporated as a portion of a pad (resistive attenuator), they will alter the terminating impedance.

Although Figures 1-3 are drawn as unbalanced circuits for clarity, this circuit is to be used in a 150-Ohm, balanced microphone line. In a balanced circuit, the

[*] Mequon, Wisconsin.

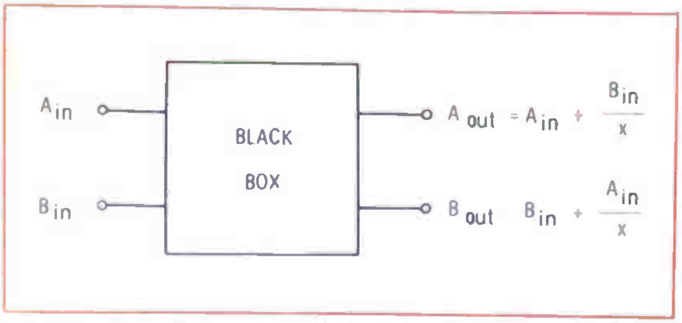

Fig. 1 Diagram of the basic concept. The output formulas indicate that both input and output signals need to be combined in some way at each output.

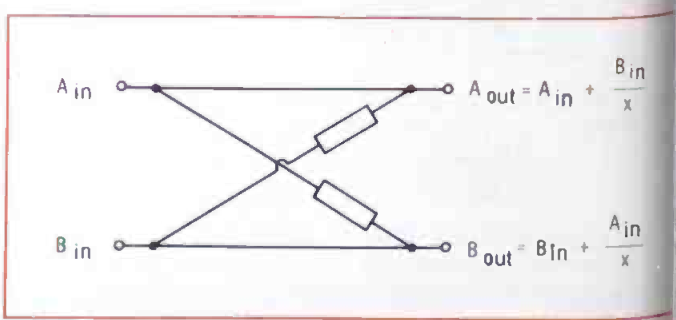

Fig. 2 Simplified schematic of the resistive network. This shows that a portion of each input is fed to the opposite output, resulting in the desired mixing.

logical pad to use is the "H" pad (see Figure 4). Since Figure 3 is unbalanced, it must be duplicated for the second leg of the balanced circuit. The series resistance in Figure 3 can be summed and substituted for the pad input resistors R_a and R_b. Therefore, the formulas would be:

(2a) $R_a = R_1 + R_2 + R_3$
(2b) $R_b = R_{1a} + R_{2a} + R_{3a}$
(2c) $R_{a'} = R_4 + R_5 + R_6$
(2d) $R_{b'} = R_{4a} + R_{5a} + R_{6a}$

Practical resistor values were calculated after determining the loss of the pad. 10 dB of loss was chosen because it will provide a start at attenuating the mic lines for high-level sound sources (i.e.: close-micing a music pick-up), yet is low enough to be usable with a speech-level input. In the "H" pad with equal input and output impedances, the following formula is true:

(3) $R_a = R_b = R_c = R_d$

The closest E.I.A. 5 per cent resis- tor value for these resistors is 39 Ohms. The closest value for R_e is 110 Ohms. Dividing R_1 through R_6 equally to evenly distribute the iso- lation, those resistors all become 13 Ohms. Checking back to For- mula 1, R_7 and R_8 become 6- Ohms for the 3:1 ratio.

In Channel A, points b-c can be considered a series-parallel circuit with b-c forming one side and b-g-f- c forming the other side. So that b-

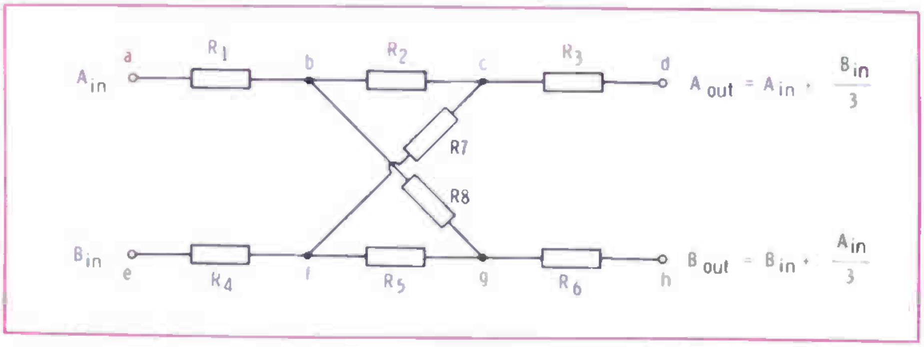

Fig. 3 The complete mixing network with all isolation resistors. It must be remembered that, although the mixing network is complete, if used as drawn, the characteristic impedance of the line would be altered considerably.

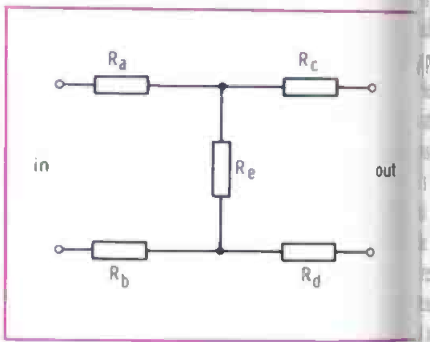

Fig. 4 The "H" pad. This network is one of the basic balanced circuit attenuators, being derived from the unbalanced "T" pad.

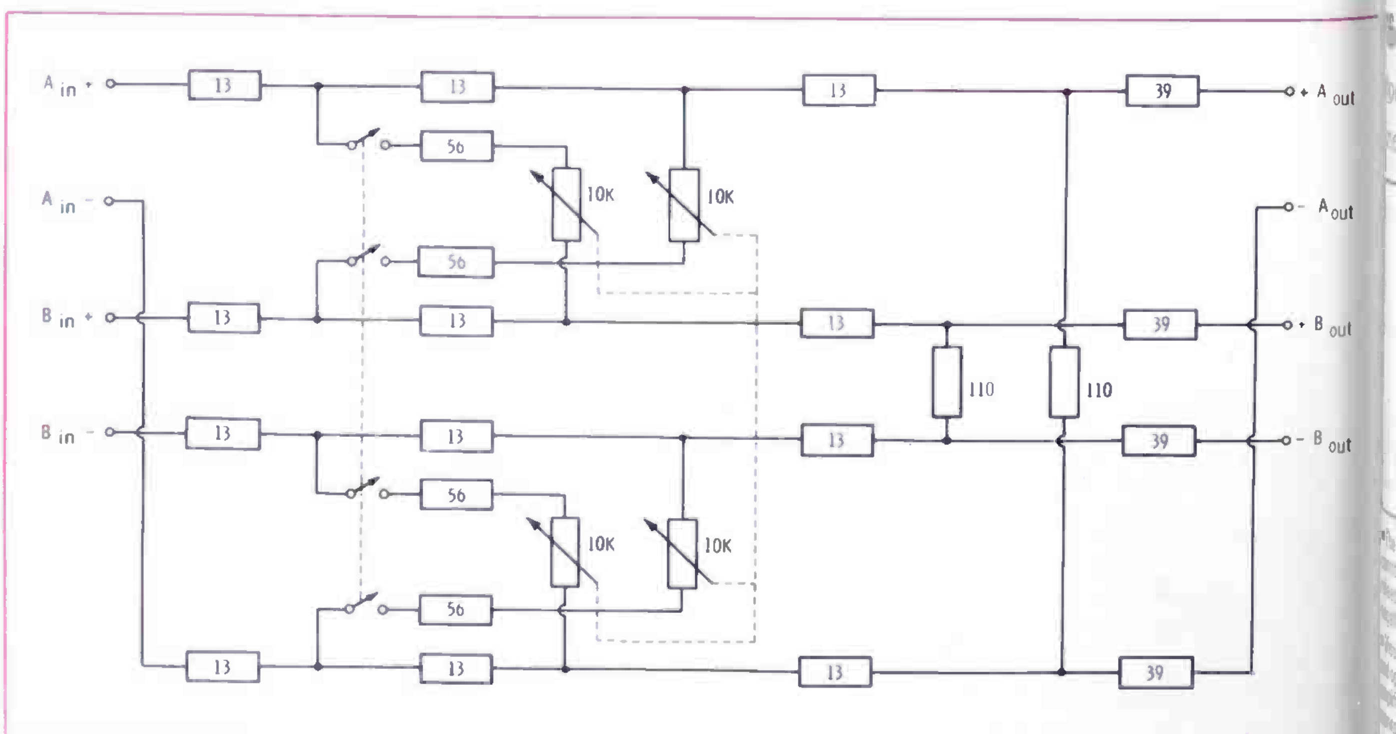

Fig. 5 Complete schematic of the circuit. If greater stereo separation is needed between channel A and B, the 10K-Ohm pot may be replaced with one of higher value. However, that would produce less control over the lower resistance range where the most audible effect takes place.

[illegible]-f-c will have [illegible] negligible effect on [illegible]-c, $R_8 + R_5$ [illegible] must be at least [illegible]en times R_2, [illegible] Ohms. To ful[illegible]ill that requi[illegible], R_7 and R_8 [illegible]nust be at le[illegible] Ohms, which [illegible]hey are. Th[illegible]e relationship [illegible]olds true wh[illegible] considering Chan[illegible]el B at points [illegible] f-c-b-g.

On The Breadboard

A test circuit w[illegible] breadboarded [illegible]nd found to give [illegible] main channel [illegible]oss of 12.5 dB [illegible] an alternate [illegible]hannel loss of 16 dB. These fig[illegible]res are close enou[illegible] to the design [illegible]oal to be considered acceptable [illegible]or practical applic[illegible]on.

Several minor, b[illegible] handy, modi[illegible]ications were m[illegible] before final [illegible]onstruction. The [illegible]5-Ohm resis[illegible]ors were removed [illegible]om R_7 and R_8 [illegible]nd replaced by [illegible] Ohm resistors [illegible]the design minim[illegible]). They were [illegible]vired in series [illegible]th a ganged, [illegible]inear-tapered, 10 [illegible]Ohm pot. This [illegible]ot will allow vari[illegible]e stereo sepa[illegible]ation from appro[illegible]mately 3dB to 25 dB. Also wired in series in a rotary switch (4-pole, 2-position) to open the mixing circuit, allowing the use of two independent 10 dB attenuators (see Figure 5).

Two comments need to be made in summation. First, it is possible to produce a much less complex stereo separation circuit. Consumer-type stereo amplifiers often utilize just a single potentiometer across the preamplifier outputs of the two channels to achieve variable stereo separation. Of importance to the audio professional is that, in the circuit described here, impedance matching at both inputs and both outputs will remain correct within a reasonable tolerance. Other than the intended mixing of signals, there should be no other interaction between the channels.

Control Pot

Second, some discussion might arise on the desirability of inserting controls in a microphone-level audio line. The fixed resistors are of no concern with respect to noise generation, but the potentiometer is a possible source of noise, especially after extended use. Remember, however, that this pot will not be used actively after initial set-up at a session, so wear will not be severe. A good quality pot should give plenty of service. This pot is inexpensive enough so that if and when replacement is necessary it will not be a financial hardship.

This design was conceived to utilize existing equipment without modification. If you want to install this circuit directly into an audio board, it would probably be worthwhile to wire it in following the microphone preamps. Resistor values would have to be re-calculated to provide impedances matching those within the board at that point. Still, the estimated construction cost is under twenty dollars.

Circle Number 17 on Reader Reply Card

There is another method for...

Emergency Broadcasting

Part II of a 2-part Series
By Stephen A Russell*

Mr. Russel's discussion of the technical aspects of the DIDS system began in the October issue of BE. A change of the FCC rules (Part 73, Subpart G) is scheduled for November. The proposed change would delete all stated references of the broadcasters potential role in alerting the public, to include automatic home warning during a national disaster.

Any comments our readers wish to submit should be sent to the Editors of BE or sent directly to Commissioner Charlotte Reid, Defense Commissioner, FCC, 1919 M Street, N.W., Washington, D.C. 20554.

An alternative system that would dramatically reduce warning receiver costs is available. It is a signalling system operated by broadcast stations. The broadcaster method of distribution, as noted in Part I, is far more secure, because the danger of sabotage is distributed over 6,000 transmitters.

Receivers demuted by broadcast stations could be simple and low cost. The warning function could add less than $10 to an existing entertainment receiver if it were mass produced. A low cost tuning fork filter and decoder would be the only major changes necessary to add the warning option to a radio. Only the broadcast receiver meets Mr. Joyce's criteria, namely, "The price of such a receiver should be so low that every household can afford one. Economic discrimination in the distribution of warning receivers would undoubtedly be recognized as grossly unfair." Given this fact, why is the current DIDS being favored? I believe the answer rests on serious technical misinformation, in addition to the aforementioned failure to confront the national security implications and the problem of receiver cost.

*International Electronic Corp., (IEC).

How About UPAS?

UPAS stands for Unified Public Alerting System. The creation of a Japanese inventor, Dr. Masao Fukata, the UPAS was devised to unite the different agency requirements. The word "unified" specifically refers to the unification of the DIDS and the EBS so as to guarantee warning, not just in test conditions, but in an actual emergency.

The February 20, 1971 EBS failure demonstrated the difference between test and emergency conditions. DIDS, as it is currently proposed, may perform in a test but it is doubtful its transmitter antennas would be standing to serve in a national emergency.

The UPAS system features signalling by a patented system known at the Cue Signal System. The Cue Signal System was designed for use by both DIDS transmitters and broadcast stations throughout the country. DIDS transmitters are to be used to signal government facilities, air raid sirens, AP-UPI facilities, and the broadcast industry. The task of signalling home receivers under the UPAS is the responsibility of broadcast stations. In addition to receiving warning information from DIDS, the broadcasters would have a redundant source of warning via the EBS.

The technical defects of DIDS and the technical strengths of the UPAS Cue Signal System are revealed when the contradictory nature of the warning system goals in the Joyce Status Report are recognized. The goal of alerting reliability directly conflicts with the goal of security against false alerts; the requirement of a 30-second response time conflicts with the desire for selectivity; and the goal of 24-hour coverage conflicts with receiver cost.

Demuting Reliability vs. Falsing Security.

The principal enemy of a radio wave signalling system is atmospheric and man-made noise. Noise contains virtually every signal pattern. It has unexpectedly persistent power to cause receiver falsings. There is no way to prevent all noise at its source. The only way to prevent noise falsing is to employ a special filter with an extremelly narrow passband and sharp cutoff characteristics. This type of filter will pass only the control signal frequency. This narrow filter also prevents falsing by spurious signals that randomly occur in broadcast program material. **The narrower the filter bandwidth is, the better is the security against false alerts.**

Unfortunately, every type of narrow passband filter (e.g. tuning fork filter, active filter) is subject to the problem of filter frequency shifting due to temperature variations, aging and divergence in mass production. Thus, **the wider a filter bandwidth is, the better is the chance for reliable alerting.**

The ability of a system to resolve this contradiction is a critical test of system effectiveness. DIDS has failed to resolve this. Rather, DIDS has employed the conventional techniques of a fixed frequency control signal on the transmitter side and a high quality, costly, filter on the receiver side.

Filter stability and high production quality is seen by DIDS simply as a cost the receiver must bear.

Back To The Xmtr

The UPAS Cue Signal System features a unique solution. The system places the responsibility for security and reliable alerting on the transmitter, leaving the receiver unburdened. Using a patented technique known as wobbling, the Cue Signal generator transmits a control signal frequency that sweeps back and forth across its ssigned center frequency. In each ceiver an extremely narrow pass- nd filter that eliminates noise sing is used, since the wobbling mpensates for any center fre- uency shifts that might otherwise use a failure to demute. The bbling function may add $1,000 each transmitter but this is insig- ficant when the role of each nsmitter in a public warning sys- m is considered.

In a typical non-broadcast com- nications system there may be e transmitter and a few hundred ceivers, and the cost of the total stem may be apportioned ac- rdingly. In a broadcast station blic alerting system, each trans- tter will service thousands of ceivers. Virtually any transmitter st that will reduce the technical rden and costs borne by the indi- dual receiver is justified. With e wobbling technique, a warning ceiver may now employ a narrow ssband filter that is a fraction of e cost of the quality filter neces- ry in the current DIDS receiver.

Program falsings, it was noted rlier, are also eliminated by a rrow passband filter. Unlike ise falsings, the filter alone can- t guarantee to prevent program sings. Noise falsing duplicates e control signal frequency along th a spectrum of other frequen- es. There is not enough power in y single frequency contained in ise to overcome filter attenua- on. A program falsing signal, wever, may have enough power easily pass through a narrow ssband filter, assuming the un- nted program signal is the right equency.

Once again the technique used DIDS to deal with a falsing oblem burdens the receiver. IDS features a complex 12-bit gital control signal to reduce the obability of program material plicating this signal. This coded gnal is also used for multiple ad- essing but its primary role is to event false alerts. A less com- ex multiple addressing scheme ould be possible if preventing lsings was not a goal.

More False Alerts?

To further reduce the effect of a lsing, the DIDS signal is a "driv- " signal, that is, receivers will rn on and remain on only when the DIDS signal is being transmit- ted. When transmission ceases, the DIDS receiver returns to a muted condition. This "driven" or "hold- ing tone" principle eliminates fals- ings that would permanently latch open receivers, but it is detrimental to alerting reliability.

If an atmospheric storm exists when the 12-bit digital signal is being transmitted, which is likely in weather emergencies, one of the bits may be blocked by interfer- ence in the receiver. Noise not only causes falsings but prevents reliable alerting when warning is most needed.

To compensate for this possibili- ty, the DIDS system developers once again added to the cost of the receiver by requiring a receiver "holding memory". They hold the receiver open for up to 60 seconds in the event of a control signal in- terruption. This creates a new problem, since this holding memo- ry will also hold open for 60 sec- onds, receivers that have been falsed.

In summary, DIDS use of a complex digital signal plus a "driv- en" signal technique, produces a signalling method that is, at best, probability challenging. In the short run it may appear to have eliminated the falsing problem, but without any guarantees, and at great cost to the receiver.

Spurious Signal Self Suppressor

The UPAS Cue Signal System uses another patented technique to resolve the contradiction between program falsing and alerting relia- bility. A Spurious Signal Self Sup- pressor, known simply as the 4S is a device that again burdens the transmitter to spare the receiver. Accepting the principle that "space pollution", i.e. program material falsing, should be stopped at its source, the 4S is built into the broadcast studio signal generator. Just prior to a complete duplication of the control signal by the latest rock and roll hit, the 4S automati- cally switches into the program line a band elimination filter that blocks the falsing elements. After 5 seconds the filter is automatically removed. The 4S technique is not "probability challenging" but can guarantee elimination of program falsings at no cost to home receivers.

Spoofing

A third type of falsing, in addition to noise and program falsings, is spoofing. DIDS has no preventive measure against warning receiver activation by an enemy originated spoofing signal that duplicates the control signal. DIDS, at present, can only correct spoofing after the fact. Using the 4S principle, the UPAS Cue Signal System features strategically placed monitor receivers in each transmitter's service area. Like the 4S, these monitor receivers are set to detect a spoofing signal prior to the false alerting of home receivers. The monitor receivers are connected by land line to a signal generator in the broadcast studio. When signalled by the monitor receivers, this generator automatically sends out a signal to override a spoofing signal.

It is important to note that this Anti-Spoofing Technique is one of the critical measures necessary to make a broadcast station operated warning system possible. This anti-spoofing technique eliminates the danger of adjacent channel or skywave channel warning signals, that travel beyond the area that needs to be warned, from accidentally demuting home receivers outside the emergency area. The override signal, that will automatically be transmitted when a warning signal from an adjacent or skywave channel exists, will generally be strong enough to prevent local receivers from being spoofed.

The UPAS system resolves the conflict between security against falsings (program material, noise and spoofing) and reliable alerting, by burdening the transmitter as opposed to using various complex receiver techniques. The result is a receiver that is within the economic means of most Americans.

Selectivity vs. Response Time

The Joyce Status Report stated that over 5,000 different addresses were possible with the DIDS signal. These were allocated to reduce a single address area to only 1/10 the area served by a typical broadcast station (i.e. 25 to 40 mile radius). In addition, it was reported that all of these addresses could be signalled within the OCD time requirement of 30 seconds.

My studies have revealed serious exceptions to this latter claim. One of the reasons why the DIDS signal is a "driven" signal, is to insure alerting reliability. As noted, when any one of the bits in the 12-bit digital signal is interrupted by atmospherics, the receiver will fail to demute. Repeating the signal is necessary. Since one transmission of the 12-bit signal plus the necessary pause requires nearly 30 seconds, many instances will occur in which the 30 second objective will not be met. This is an inherent defect of a digital signal.

Address Problems

A second exception occus on the many occasions when the same message must be delivered to an arbitrary combination of different addresses. For example, tornado funnels may suddenly appear in several non-adjacent areas at the same time. The capability to alert an arbitrary combination of addresses via a "group call" is needed.

DIDS cannot perform a group call. It would be virtually impossible for DIDS to pre-program every combination of 5,000 addresses for instantaneous retrieval by an operator. Instead, DIDS must signal each address sequentially. In addition, because the driven technique is used, each address must be followed by the entire emergency message. Since only one address can be transmitted at one time and must be sustained throughout the message, extensive delays will occur as the same message is repeated and repeated before the last address area is warned. Because of this fact, the smaller address areas proposed for DIDS are detrimental. Reducing the size of the DIDS address only increases the probable need for group calls which DIDS cannot perform.

Apart from the technical problems of dividing the country into such small address areas, the DIDS addressing scheme creates serious policy problems. First receiver cost is once again not considered. A fixed-tuned, multiple address receiver may quickly become obsolete. The U.S. citizen is extremely mobile. One out of every five households move every year. This mobility will require decoder addresses in masses of receivers to be changed annually. The percentage of the population that will go to the trouble and cost of keeping their receiver addresses current after every move is likely to be very small. Second, too selective an addressing system may be undesirable. In many emergencies particularly weather emergencies it is just not possible to predict what percentage of a community is being affected. It would be far safer to err on the side of warning a larger area than too small an area. Finally, the complexity of the DIDS multiple addressing scheme may call for a super human operator. Someone erred in selecting between two taped addresses in the February 20th EBS incident. What is the probability of an operator erring when faced with a choice of hundreds of addresses in a crises situation?

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Circle Number 19 on Reader Reply Card

Test Those SCR's And Triacs

Once you understand these solid state devices, you'll find them easy to test and to use in broadcast circuits.

By Ron Merrell

Silicon controlled rectifiers and triacs have made their way into rather common use in broadcast equipment these days. What's more, you may even find them in modifications made on standard units as well as in home brew circuits.

Although we're now taking their existence for granted, how much do we know about testing SCR's and triacs? Suspecting that we all need more than their theory of operation, we went to our lab to see if some simple tests could be devised to check these solid state components.

Solid state devices can be checked against their specs, and this may suffice when they are used in fairly simple units or modules. The problem in checking solid state components comes when we realize that each is often directly connected to a network of circuits. And the problem initiated by just one part can dovetail into several other circuits.

In order to understand what tests are meaningful, it is necessary to take a step beyond explicit construction descriptions and translate their operation into practical terms.

Conventional diodes are really voltage controlled switches. The diode becomes a conductor when the anode voltage is more positive than the barrier voltage (relative to the cathode). When the opposite polarity is applied to the diode, the circuit will remain open.

We've backed up to the diode here, because diode actions form the basis for SCR and triac functions. Figure 1 helps describe the comparison. SCR's and triacs have more than one PN junction, and one of these added sections is called a gate. In this case, the gate also can block conduction.

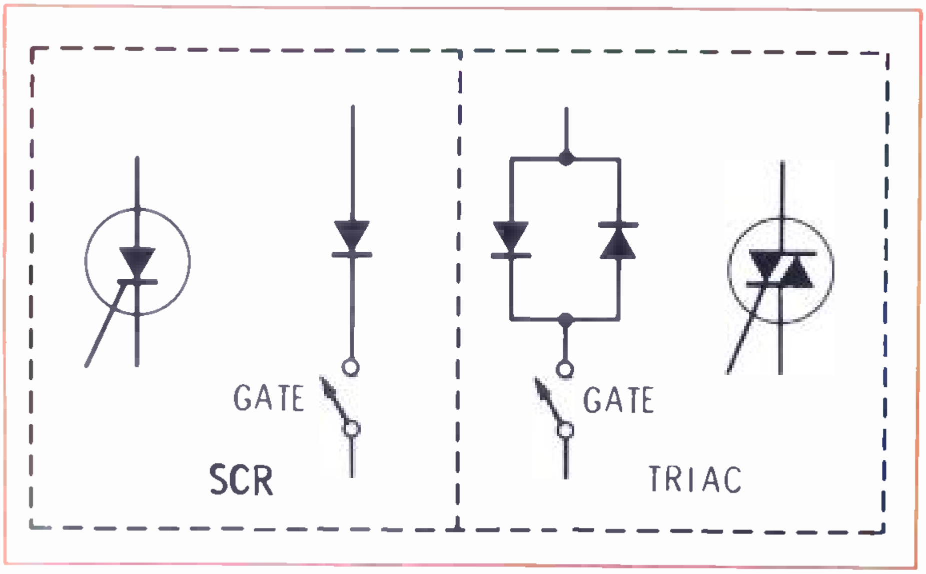

Fig. 1 The SCR symbol and circuit equivalent at left, basically, a diode and a switch. At right, note that the triac uses back-to-back diodes and a switch. Both can be tested by the device in Figure 2.

SCR Actions

An SCR can be visualized as a diode in series with a switch. But conduction can now be controlled by the gate and the polarity of the applied voltage. The anode voltage may be positive, but if the gate is zero or negative (relative to the cathode) conduction will not take place.

A positive anode voltage and a sufficiently positive gate will allow conduction. The change from nonconduction to full conduction takes place instantaneously when the gate-cathode voltage raises enough to pass the "trigger" point. Once conduction has started, the gate loses control and cannot block conduction. This latching effect continues until the anode voltage and current drop below the holding point.

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tube type	useful output power* Band I (kW)	Band III (kW)	cavity type ¹⁾
YL1520	20	25	40768
YL1430	12.5	17.5	40747
YL1420	6.25	8.5	40745
YL1440	1.5	1.5	40743

** Peak sync power in C.C.I.R. system with B(-1dB) = 7 MHz*
¹⁾ Only cavities Band III vision shown from total range.

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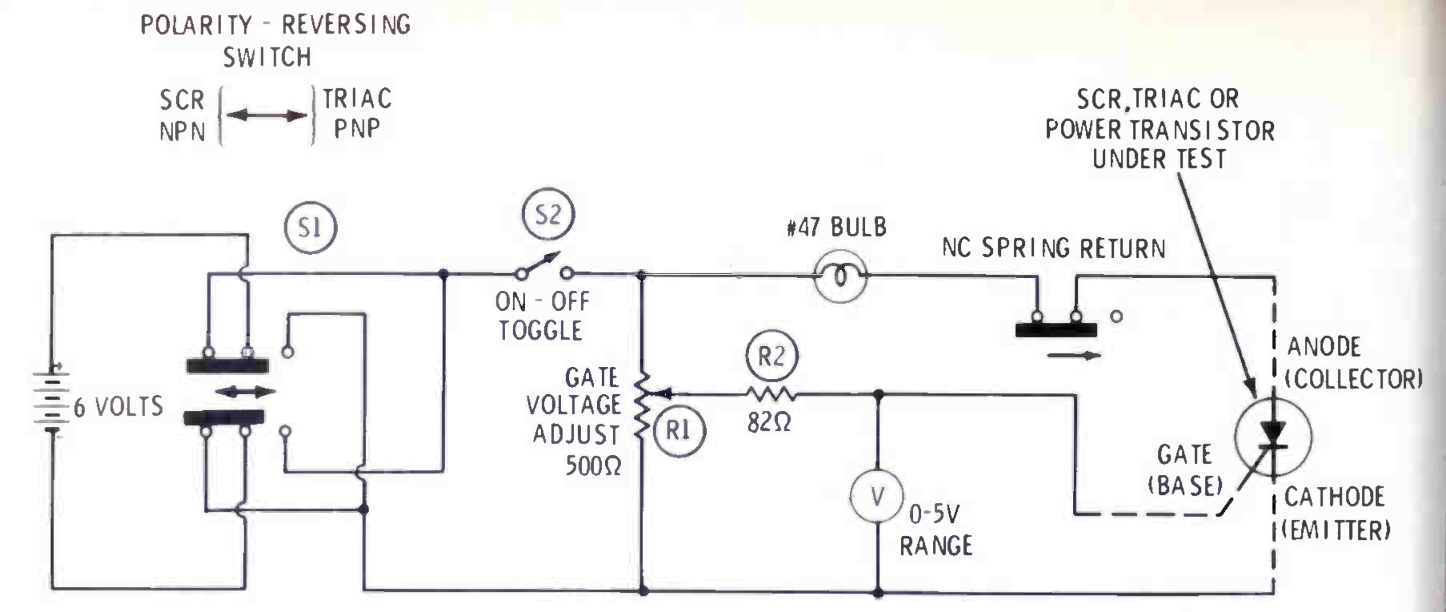


Fig. 2 Schematic of a tester you can build to determine whether a device is a transistor, SCR, or triac, and it will indicate whether or not the component is operating correctly.

Resistance readings between the gate and cathode usually are under 1000 Ohms. If you reverse the test leads, you'll get about the same reading.

Anode measurements are something else. The anode should measure nearly infinite resistance to both the cathode and the gate.

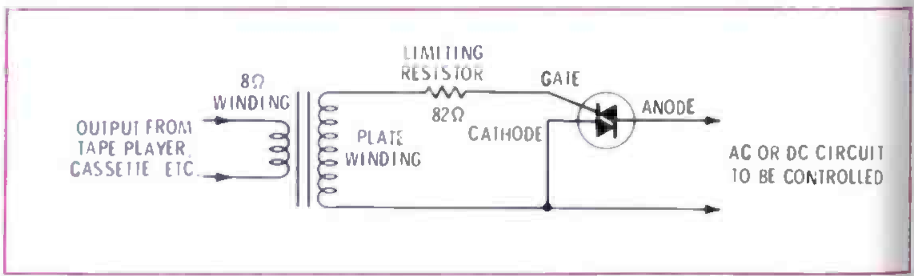


Fig. 3 Schematic of a triac used to start the change cycle of a slide projector. It also will control lamps (or other devices) according to the amplitude of the audio input.

Triac Basics

By now you should begin to suspect what we will get for resistance tests on the triac. Figure 1 shows that it consists of back-to-back diodes and a gate. The following list will give you a better idea of triac operating conditions:

- When the anode is negative and the gate zero (relative to the cathode), no conduction is possible. This is diode action.

- With anode voltage positive and the gate at zero (relative to the cathode, no conduction is possible). This is gate action.

- If the anode is negative and the gate voltage sufficiently negative, conduction will take place.

- Anode voltage positive and the gate voltage sufficiently positive will cause conduction.

- After conduction begins, a latching effect takes place. The gate loses control and conduction continues until the anode voltage and current are reduced below the holding point.

Resistance measurements for triacs are nearly identical to those of SCR's. The anode should measure nearly infinite resistance to both the cathode and gate.

An open circuit between gate and cathode, or a short or leakage from anode to gate or anode to cathode is a sure sign of a defective part.

Tester For SCR, Triac, Transistor

The tester shown in Figure 2 will check SCR's, triacs and power transistors by applying 6 Volts DC limited to 150 mills. This is a good operational test for these devices and should give you a good demonstration of triggering and holding actions.

If you have any doubts about the identity of the component, the test results indicate whether it is a transistor, triac or SCR.

Use the following proceedure with this tester:

A. Prepare the tester by adjusting the polarity switch (S1) to the SCR-NPN position, the toggle switch (S2) to off, and the gate-voltage control (R1) to minimum.

B. Connect the device by use of color-coded clips and test leads.

C. Flip on S2, the power switch. If the bulb lights, the device is shorted, or the test leads are touching.

D. Gradually turn up the gate-voltage control. At a certain critical voltage (measured by a meter for the most detailed information) the bulb should light, indicating conduction.

E. A gradual brightening of the bulb when the control is turned up, and a gradual decrease in brightness as the control is turned down icates that the device is a NPN-arity transistor.

F. A sudden lightning of the bulb full brilliance at one point on the e-voltage control, and no reduc-n in brilliance when the gate-tage control is turned down indi-es that the device is a SCR or a ic. Subsequent tests will deter-ne which. The bulb should re-in lit after the control is turned wn until a momentary open in S3 kens it permanently.

G. Slide the polarity-reversing itch (S1) to the TRIAC-PNP ition, and starting at minimum, n up the gate-voltage control.

H. A gradual brightening and kening of the bulb when the e-voltage control is increased d decreased indicates that the vice is a PNP-polarity power nsistor.

. No lighting of the bulb when gate-voltage control is in-eased indicates the device is a R.

. A sudden lighting of the bulb full brilliance at one point on the e-voltage control adjustment, no reduction in brilliance when control is decreased indicates device is a triac.

K. Flip the power switch to the position to minimize battery in.

Testing LDR's

Maximum resistance of a LDR be obtained only by maintain-the cell in complete darkness several minutes before measur-it with an ohmmeter. Many cir-ts, including this one, do not utilize the high-resistance characteristic; therefore, this reading is usually not critical.

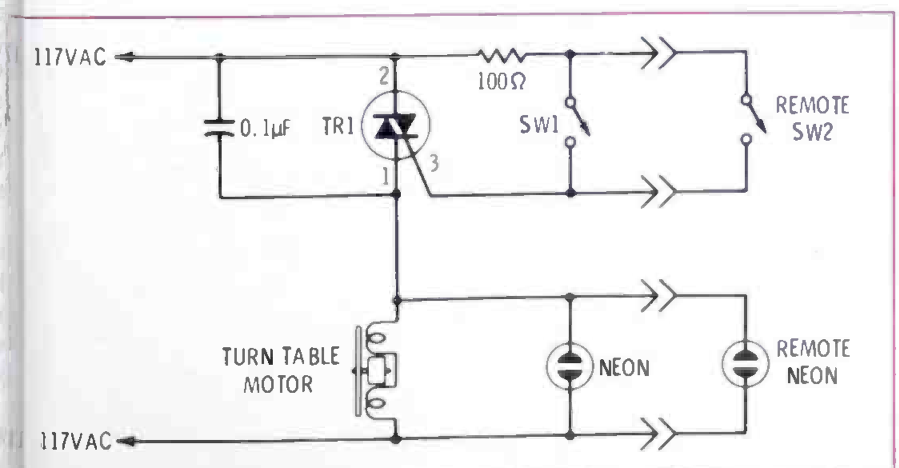
Minimum resistance is obtained when the CdS cell is subjected to bright light. A rough test can be made by shining a flashlight at the cell from the same distance each time.

Remote Start For Turntables

A simple static switch, using a triac, is used to control six turntables and one cart machine here at WHCN (FM). When we tried to start and stop our turntables remotely, a large pop would occur because of the high switching currents encountered from the reverse EMF from the turntable motors and switches, even though the manufacturers include a capacitor to counteract this. This pop came across "air", being picked up in our pre-amps.

The circuit shown included switches for both the turntable and the remote switch plate. This enables the DJ to cue records at the table or start the table from the board. Neon indicators are located both places for a positive on indication. The current in the switch leads is just enough to fire the triac, not enough to cause a pop in the pre-amps. The by-pass capacitor by-passes radio frequency currents generated by the triac in its off condition and is rated at 600 VDC.

This interesting triac use was sent to BE by Lawrence Titus of WHCN, Hartford, Conn.



. 4 Turntable switch used at WHCN-FM. The triac is a IRT82-C.

Background Monitor System

By Clint Tinsley

If you haven't kept up with the state-of-the-art in audio equipment, you may think your station's sound is far worse than it really is. Of course, you can look at your sound to make sure. Trouble is, other people visiting the station may not understand your monitoring problem.

In the September issue of BE, Pat Finnegan opened the door on monitoring. We've all been inside before, but let's take one more look around and see if we've advanced as far as we need for today's market.

Constant Voltage Distribution

We will return to the concept of constant impedance as it relates to 8 Ohm systems and is used in present-day broadcast consoles. Basically, assume that constant voltage and constant impedance are synonymous. Given the formula $Z=E^2/P$, Ohms, Volts and Watts respectively, you can determine the source impedance or the load impedance of any amplifier or speaker load.

KATN Boise Idaho

Table I details the various values of impedance based on line wattage and voltage. Note that secondary impedance is not specified but if a transformer is intended to work into a 8 Ohm load and you place a 4 Ohm load across the secondary, you effectively half the primary impedance value and double the wattage required from the line.

The Amplifier Output

Of prime importance in any speaker system is the rated RMS value of the amplifier. Inflated IHF or Music Power ratings will not suffice. In any speaker matching system, you are-in reality-matching impedance and nothing else, and the impedance of a C.V. system is based on the wattage rating of the amplifier.

You may have an amplifier which does not show an RMS rating but gives an IHF or music power rating. Check the ratings of the output transistors and use that figure as the maximum. This will give you the collector dissapation rating and you shouldn't get into trouble. For example, say you have an amplifier which is rated at 20 Watts RMS into 8 Ohms and you use a transformer to convert i to 70.7 Volts. You will obtain source impedance of 250 Ohms provided you use the proper trans former. To this end, you shoul obtain a 20 Watt/8 Ohm 70.7 Vol transformer and use it for the am plifier output by working it back wards. These are called line trans formers.

Some commercial amplifier have auto-transformers in the out put, but most of them use a regula transformer from which a balance output or floating line can be ob tained, at the 25 and 70.7 Volt lev els. The commercial amplifier als carries two ratings: The RM power rating and the line imped ance values. If not published, yo can obtain the impedance value fo each line (25V and 70.7V) from ta ble I based on the RMS rating.

The Line Transformer

Each speaker, or speaker pai should have its own line transform er. This transformer will have multitapped primary and at leas one secondary value, usually Ohms. Normally, the primary wi be marked in Watts and the sec ondary in Ohms. Again, you ca

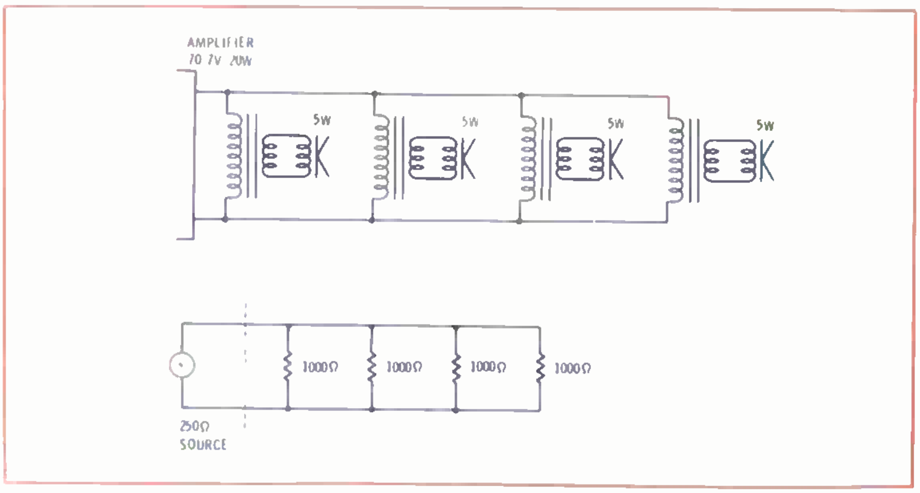
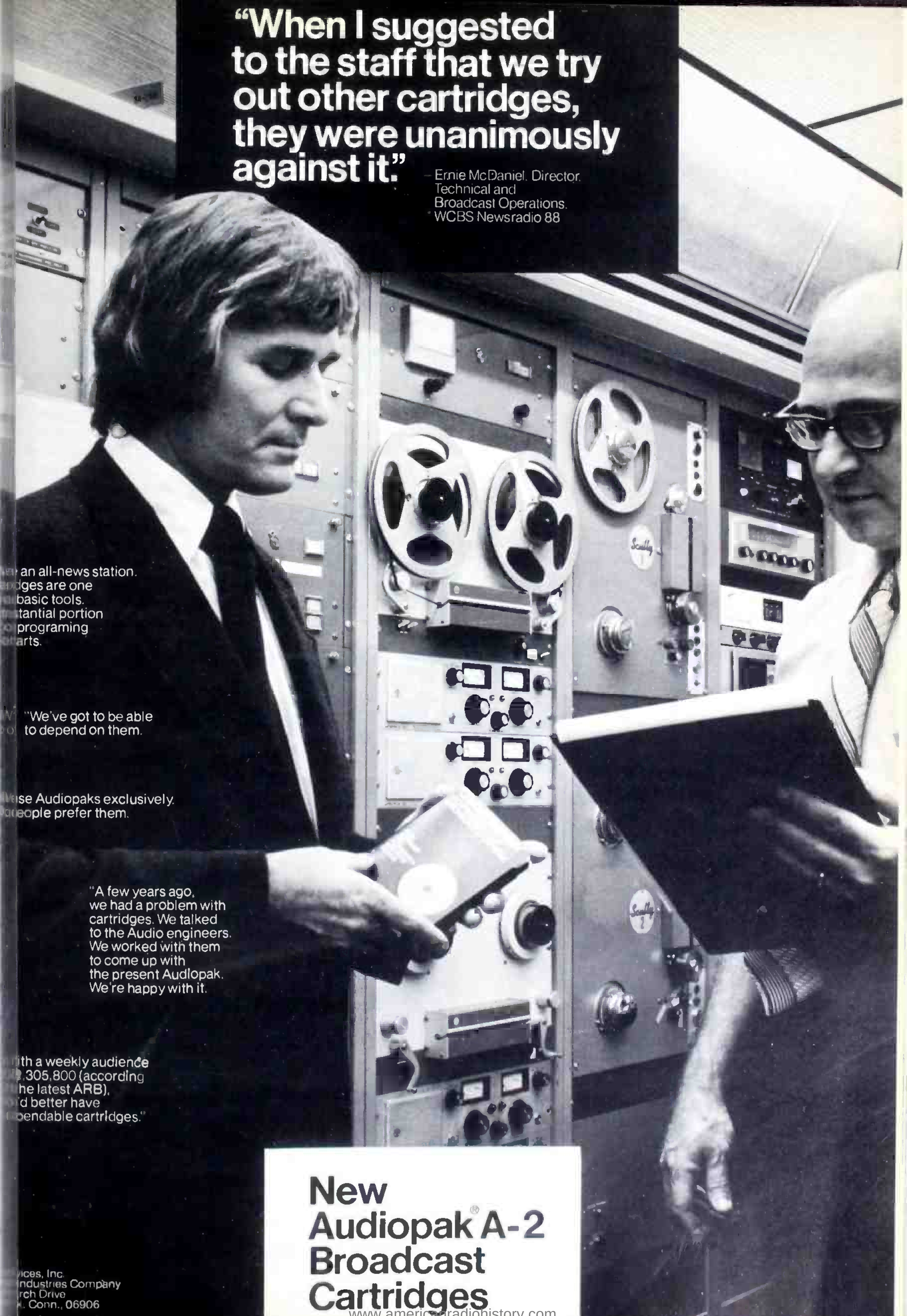


Fig. 1 Example of a house monitor system using a 70.7 Volt line and a 20 Watt RMS amplifier. Using Table 1, we see that 5 Watts in a 70.7 Volt system is equivalent to 1000 Ohms, and the 20 Watt source impedance will be 250 Ohms.

TABLE 1
CONSTANT VOLTAGE TRANSFORMERS FOR IMPEDANCE MATCHING

PRIMARY IMPEDANCE OHMS	70.7 VOLT LINE WATTS	25 VOLT LINE WATTS
45	—	[illegible]
90	—	[illegible]
100	50	—
166	30	—
180	—	[illegible]
200	25	—
250	20	—
325	15	[illegible]
500	10	—
670	7.5	[illegible]
1000	5.0	—
2000	2.5	[illegible]
4000	1.25	—
8000	0.63	—
16000	0.32	—

NOTE TABLE IS BASED ON COMMERCIALLY AVAILABLE LINE TRANSFORMERS


"When I suggested to the staff that we try out other cartridges, they were unanimously against it."
– Ernie McDaniel, Director, Technical and Broadcast Operations, WCBS Newsradio 88
an all-news station. ...dges are one ...basic tools. ...tantial portion ...programing ...arts.
"We've got to be able to depend on them.
...se Audiopaks exclusively. ...eople prefer them.
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...ices, Inc. ...ndustries Company ...rch Drive ..., Conn., 06906

refer to Table 1 to make any necessary adjustments, remembering that if you place a 4 Ohm load across the 8 Ohm secondary you double the wattage value as you would do if you placed two 8 Ohms speakers in parallel across a common transformer. There are line transformers designed for use in only 25 or 70.7 Volts systems as well as transformers with a proliferation of power taps that make them useful in both systems.

The Sound Distribution System

Premise: The advantage of constant voltage speaker systems is the ease in which a speaker line can be matched out such that the amplifier matches the load.

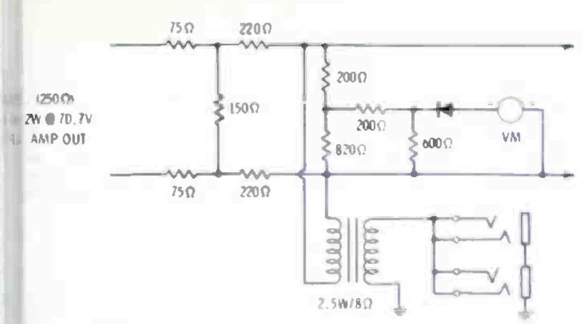
Example: Station house monitor system using a 70.7 Volt line and a 20 Watt RMS amplifier. There are four speakers, each of which is receiving an equal amount of power, which will be 5 Watts. You simply tap off each line transformer at 5 Watts across the 70.7 Volt line as in Figure 1 resulting in a 20 Watt load to the amplifier. In most systems, this reasoning will prevail even with different power values being tapped off to different speakers in locations of varying noise levels. As long as the total of the power taps equal power rating of the amplifier, you will have achieved a perfect match between the amplifier and the load.

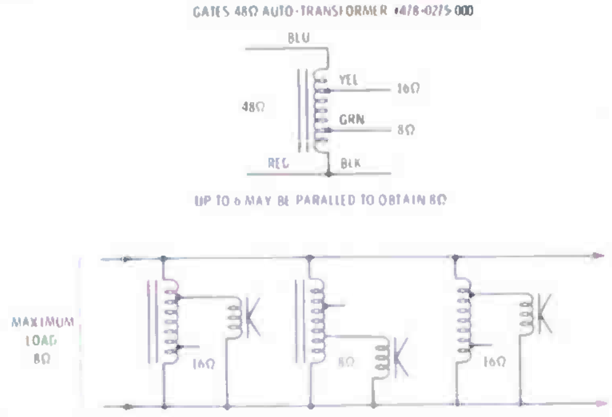
VOLUME CONTROLS AND THE C.V. LINE

This could be considered one of the "gray" areas of constant impedance matching. You have two or possibly three choices of location of volume controls. I would first consider the headend approach in which you have a remotely located source. In this case, an L or T pad at the source impedance level would be advised. For a 10 Watt amplifier, the value of the pad would be 250 Ohms.

A second point of consideration is the speaker end of the line, afte the line matching transformer When purchasing speakers fo commercial background music in stallations, I usually have tw choices: a 20 Ohm pot or an 8 Ohn L pad - as a matter of economy. W normally have our speaker baffle prewired with the 20 Ohm pot, al though the 8 Ohm pot would be better approach.

In examining the 20 Ohm pot approach, the pot bridges the secondary of the line transformer in the voltage divider concept with one side of the speaker connected to the wiper. This approach has a couple of minor drawbacks: In attempting a constant impedance match, (1) when the speaker is fully turned down, the line transformer is terminated in 20 Ohms and (2 when the speaker is fully turned up, the line transformer is terminated in approximately 5.7 Ohms and this error in "wattage matching" for a wattage relationship based on





F. 2 A 20 Watt/250 Ohm source amplifier is matched to a 600 hm broadcast loop or telephone circuit which includes a head- ne monitor circuit.

Fig. 3 Gates' suggestions on using their speaker matching transformer.

8 Ohm load multiplied 20 times n installation could cause prob- s.

My "favorite approach" is use a 10 K pot on the line side of the nsformer on a 70.7 Volt line (for 5 Volt line, I would use a 500 m or 1 K pot). When using this roach I simply add a Watt per ume control in my calculations. I can locate the control anywere along the line instead of running wires from the speaker, in the case of a secondary oriented volume control arrangement.

You would note from previous publication in this field (BE July, 1972) that in the 45 Ohm monitor circuit in the Gates Solid State Duolox II console I have used 100 Ohm pots with good success in a line side approach. This line side approach has been proven in practice as being the most economical approach; you can always load a amplifier at something less than its rate load for protection of the amplifier, and in this volume control arrangement, the total load to the source will always be something

(Continued on page 43)

Color After Modulation

By Pat Finnegan*

Video information going into a transmitter and that coming out is not the same. Aside from distortions that can be added due to improper operation, there is vestigial sideband transmission. Detection devices for recovering the video information should tell the truth all the time. Yet even when telling the truth, the information sometimes requires interpretation.

For our discussion, consider that the transmitter is operating properly and the signal is not being distorted in any way, and not consider VSB transmission as distortion.

In VSB transmission, one full sideband and only a part of the other sideband is transmitted. The color information is only on the full sideband.

Detection devices, such as a diode, are non-frequency selective, and can be very non-linear due to an internal fault or to the signal levels applied to it. Other devices (such as a demodulator) can have an improperly adjusted bandpass or yield the same results due to component failure. The output also can be distorted due to RF overload, improper circuit voltages, or non-linearity can be introduced by component fault.

*BE Maintenance Editor

An irregular video response curve or improper bandpass in the demodulator can cause improper burst to chroma amplitudes. This is due to the fact that the chroma and the burst lie in somewhat different regions of the transmitter response curve.

Detection And Interpretation

If only a diode is used for demodulation, some consideration must be given to its placement in the system and interpretation of the results. The diode cannot be placed in the circuit where the sound carrier is present since it cannot reject the unwanted signal.

Placement before the carrier diplexer, brings up another question. Has bandpass shaping already taken place? If it has, the output of the diode will be the ideal response curve as given in the FCC Rules. That is, low frequency video information below 1.25 MHz will be present as double sideband, the color will be single sideband. This means that video information below 1.25 MHz will be twice the amplitude of the information above 1.25 MHz. A good example is the horizontal sync pulse and the color burst on the back porch. The burst will appear as only half amplitude to that going into the transmitter. For this mode of monitoring, that is the correct display, and the operator should not try to correct it. For the same reason, a color monitor fed from this diode will show colors that appear more pale than when fed from the video line. This is especially apparent on monitors with a preset color control.

A demodulator is simply a single channel receiver, minus all the sync, audio and other circuitry of regular receivers. The IF bandpass is deliberately shaped to complement the VSB signal, the output of the detector is a flat video bandpass. The output video is the same as the input video to the transmitter.

Overload

Front end overload can cause several problems, two of which are non-linearity and bandpass distortion. Use the step test pattern or the one in the VIT signal, adjust the probe for noncompression on either end. Check the multiburst pattern for video amplitude distortion. Reduce the probe pickup below the point where the multiburst is effected. If neither signal is available during programming, adjust on

(Continued on page 47)

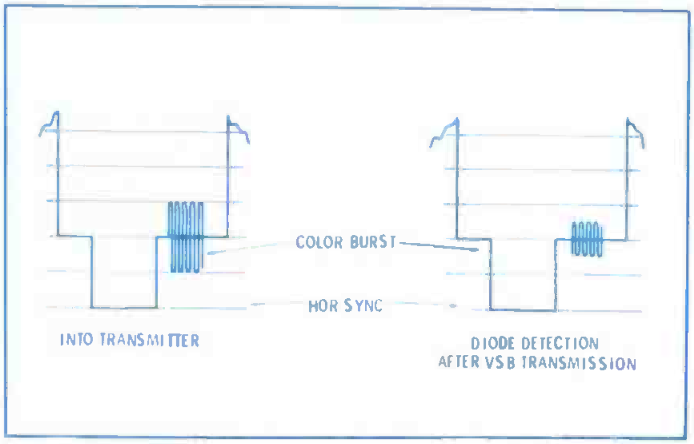


Fig. 1 Example of two important parts of the signal which ride in different sections of the sideband. Color burst is in the single sideband section, and it is only half the amplitude of the sync pulse which is in the double sideband section.

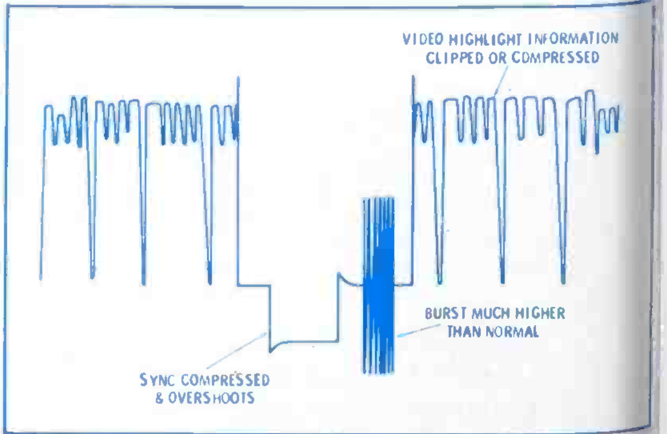


Fig. 2 Improper line probe adjustment can cause an overload of the demodulator as well linearity problems, sync compression, white clipping, and a distorted video response curve.

AES Convention Review

By Walt Jung

New York's Waldorf Astoria was recently the meeting place for the Audio Engineering Society's 43rd annual convention. This convention features the annual unveiling of the latest audio gear and the platform for state-of-the-art reports on industry R and D.

The biggest item in audio these days is quadraphonic sound, both recorded and broadcast. Considerable convention program time was devoted to quad, and highlights of the technical sessions of particular interest to broadcasters are covered here by ***Broadcast Engineering's*** *solid state editor.*

Quadrasonics

The technical proceedings of the AES got underway with the session on Quadrasonics, chaired by John Woram of Vanguard Records.

Albert Grundy of the Institute of Audio Research, Inc. gave a paper entitled "On the Mathematics of Quadraphonic Matrices", a look at a simplified means of describing various quad matrixing systems with algebraic expressions of the various signal components. With a minimum of higher mathematics, this paper gave an excellent view of what happens in the processes of encoding and decoding of 4 channel signals.

John Eargle of Altec Corporation gave a paper, "4-2-4 Matrix Systems: Standards, Practice and Interchangeability"* which goes a long way toward putting the various matrixing systems in current use into persepctive. Describing the different systems in terms of Peter Scheiber's spherical notation (which presents a matrix system's phase and amplitude inter-relations in an x-y-z form), Eargle illustrated the basic differences of the popular systems such as EV and SQ, the Sansui QS matrix, and the Cooper-Shiga UMX matrix. Transformation from one matrix to another was discussed, as well as inter-matrix compatibility. This paper serves well to sort out the region of confusion between various matrixing systems, not only in regard to the material it contains, but also its bibliography on previous material.

Do you have a quad monitoring requirement via headphones? If so the paper "Can We Hear Four-Channel Via Headphones" by Peter Tappan of Bolt Beranek and Newman, Inc. should be of interest to you. This paper examined the fore-aft depth perception effects of the ear and the results with 4 and 2-transducer headphones towards the 4-channel effect.

"Some Single and Multiple-Source Localization Effects"* by Mark Gardner of Bell Telephone Laboratories examines directivity effects of multi source reproduction from a common program origination. Control of a sound image's placement is useful for various special effects, such as pseudo stereo. The paper has a very extensive bibliography.

"A Quadraphonic One-Point Pickup Microphone"* by Takeo Yamamoto of Pioneer Electronic Corporation (Japan) describes a one-point pick up microphone with 4 unidirectional patterns.

A paper by Rex Isom of RCA, "An Analysis of the Frequency-Modulation of the Carrier in Discrete 4-Channel Records" analyzed performance of the FM modulated ultrasonic subcarrier used in RCA's discrete 4 channel disc.

"Characteristics of the Sansui QS Vario-Matrix Based on a Psychoacoustic Study in Four Channel Stereo, Part I & II" * by Ryousuke Itoh, Susumu Takahashi, and Kouichi Hirano of Sansui (Japan) and Massao Nishimaki, Tokyo Institute of Technology.

This extensive paper examines the Sansui Vario-Matrix system and the psychoacoustic requirements of 4 channel sound reproduction. The vario-matrix concept alters the matrix coefficients on a continuous basis to enhance inter channel separation.

Broadcast Engineering

The Broadcast Engineering session was chaired by Eric Small of WOR-FM and included a number of papers of general broadcasting interest as well as quad-broadcasting considerations.

Leading off the session was a paper, "The Status of Broadcast Cartridge Design"*, by Robert Manierre of Audio Devices Inc. This paper describes the improvements in tape cartridge design over the years necessitated by tough handling consumer usage and the improvements in broadcast cartridges resulting from this feedback.

"Compatible FM Broadcasting of Panoramic Sound" * by J. James Gibson, Roy M. Christensen and Allen L. R. Limberg of RCA Laboratories, described a new system for 4 channel transmission over FM radio. The basis of the system is transmission of the most important information to convey an acoustic picture around the horizon. Signal constraints of compatibility, fidelity, and economy are discussed.

"Effects of Multipath Interference Upon FM Transmissions" by Raymond Schwartz, Alford Manufacturing Company examined the effects of large buildings in metropolitan areas on signal reflection and shadowing, with particular emphasis on audio distortion components.

The last part of this session was composed of a panel discussion devoted to 4-channel broadcasting. The panel, moderated by Eric Small, included Duane Cooper of the University of Illinois, George Endres, CE of WGMS AM/FM Washington DC, Jim Gibson of RCA Labs, and Emil Torick of CBS Labs. The discussion was a lively one, both among the panel members and augmented by quesns from the floor.

George Endres described GMS's experiences relating to trix quad broadcasting which it s on a live basis. Endres choose Dynaco (Gately Electronics) trix scheme from a standpoint of nimum listener cash outlay and e of implementation. Speaking ther, Endres said he feels a me and obvious consideration to oroadcaster is the return on his estment when he gets into 4-annel. Since the situation is still y unclear as to standardization hin the matrix camp, this is a fficult decision facing any broad-ster ready for this step.

Papers From Other Sessions

The sessions already mentioned re the main topics of interest to broadcaster, but there were ite a few other general interest pers from other sessions. The ti-s are listed here, and any paper h a asterisk* may be ordered by il from: Audio Engineering So-ty, Room 929, 60 E 42nd Street, Y., N.Y. 10017. Price: $.75 for ES members; $1.00 non-mem-rs.

Papers from other sessions:

"The Piezoelectric Loudspeak- Its Use In Audio Systems", nald M. Schmetter, Motorola ., Preprint# 876.

"Performance and Interface ecifications For Professional idio Magnetic Recorders", John McKnight, Scully/Metrotech vision of Dictaphone Corp., print# 903.

"EIA RS-400 "Reproducer Test pe" Reviewed", John G. Mc-night, Magnetic Reference Lab-atory, Preprint# 898.

"Use of Capstan Servo Systems Audio Recorders For Multime-a Synchronization", Louis J. rtalano, Robert Z. Langevin, npex Corporation, Preprint# 2.

"Multitrack Audio In Video oduction", Eugene M. Nothaft, m W. Irby, Mincom Division, 1 Company, Preprint# 877.

"The Pitfalls of The General rpose IC Operational Amplifier Applied To Aduio Signal Proc-sing", Walter G. Jung, BE Solid ate Editor, Preprint# 893.

"Equalizing The Monitoring hvironment", John M. Eargle, Altec Corporation, Preprint# 887.

"Practical Considerations In Sound System Feedback Control", G. R. Thurmond, G. R. Thurmond and Associates, Preprint# 890.

"An Objective Proof of Performance Test Program For Sound Reinforcement Systems", Mel Sprinkle, Sprinkle & Associates, Preprint# 897.

"Design Considerations For A Transportable Sound Reinforcement System", Allan P. Smith, Naval Training Equipment Center, Preprint# 880.

"A VU Meter For The Blind Operator", Richard G. Allen and Ralph A. Antonacci, CBS Laboratories, Preprint# 902.

The AES equipment exhibits were by and large oriented toward the recording industry's needs, with broadcast interests taking a lower priority. The glamour items in studio equipment at this convention were automated mixing equipment, with new systems being introduced by a number of manufac-

(Continued on page 42)

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(Continued from page 41)

turers.

Quad Demos

However, broadcasters were served by the demo rooms of the various quad systems where they could personally assess the differences in performance of the systems. This writer's observations will not, of course, serve as a substitute for your own, but there are some factors which might be noted.

There has been a great deal of improvement by the matrix camp in apparent inter-channel separation. This was evident in both the CBS-SQ demonstrations and the Sansui QS demo room. CBS is currently working with a major IC manufacturer on soon to be announced decoder and logic "separation enhancement" chips. Sansui has the equivalent effect with their Vario-Matrix encoding/decoding. An A-B test of this system against a 4 channel tape over short periods yields a quite favorable comparison. Not as "discrete"-but certainly the effect is there.

The other side of the matrix/discrete picture was demonstrated by JVC with their 4-channel subcarrier disc. When listening to this discrete disc, one is immediately impressed with the total separation of the four channels. However the technical problems yet to be resolved are formidable. Cutting speed is reduced to 1/2.7 of playing speed to accommodate cutter head frequency response limitations, and a special pickup is still necessary for playback. The decoder is relatively complex, using a PLL to offset carrier signal strength reduction with wear, a noise reduction circuit and a newly developed Shibata stylus is recommended for best reproduction.

Never-the-less, this method is the only current 4 channel disc, and reproduction is certainly adequate for a large percentage of users. By the time FCC standards for 4-channel transmission are set, the JVC disc may well be a highly refined product.

**See BE Reference on SCA Birdies. "A Manufacturer's View . . . Can Stereo—SCA Be Compatible," Feb. 1971, pg. 38.

ntinued from page 35)

s than the computed installation ue, it is a field proven approach.

Impedance Matching Using Transformers

et us return to the Figure 1 and luate the systems. By using ble 1, we can see that 5 Watts in 0.7 Volt system is equivalent to 0 Ohms and the 20 Watt source edance is going to be 250 ms. Four 1000 Ohms loads in allel results in our 250 Ohm load match the 250 Ohm source. This logy will prevail regardless of ver taps used, or number of akers in the system. As long as sum of the power taps equals rating of the amplifier, conver- n to impedance values will result he load matching the source.

Jsing power values can be con- ing. It might be said that you are sapating 5 Watts in a given aker. The only time this might open is if you were driving the plifier at a continous 20 Watt put level. In reality you are ply matching impedances by of this 5 Watt factor.

Various Considerations On C.V.

Another use of the C.V. trans- mer is in monitoring various lio lines of varying impedance ues with a 8 Ohm headset.

One use of the C.V./constant pedance concept is shown in ure 2 (as reprinted from the y, 1972 issue of BE) in which a Watt/250 Ohm source amplifier natched out to a 600 Ohm broad- t loop or telephone circuit ich includes a headphone moni- circuit.

Another possible application is use of line transformers back- back to obtain a impedance tch without the loss attendant in istive networks.

Gates Console Monitor Systems

The Gates company uses a htly different form of constant edance matching which uses 48 m auto-transformers but the nitor amplifier impedance value ctually 8 Ohms. Figure 3 shows ne of the installations Gate's gests when using their #478 5 000 speaker matching trans- mer.

Controlling Film Chain Light Levels

By Donald R. MacClymont*

The different densities of film and slide material used in color film chains has long been a source of video level problems. This article describes a fast reacting, simple, and automatic method of controlling these level changes with a servo-controlled Neutral Density Disc system.

Film Chain Light Control System

A film-chain is normally composed of a color camera, two film projectors, and one or two slide projectors. These projectors transmit light through the film, on to a field lens, and into the camera. If the film density varies, the amount of light into the camera varies, thereby varying the video level out of the color camera.

*Beston Electronics, Kansas City.

By inserting a Neutral Density Disc somewhere in the light path, we can compensate for these changes in film density, keeping the apparent density of the film constant and, therefore, the light level input to the camera constant. (Figure 1)

A Neutral Density Disc is a circular piece of glass which has varying amount of neutral density material on it. Starting at one point on this disc it is very dense and as we rotate the disc it slowly diminishes until it reaches clear glass at the other end. The disc used in this system can compensate for a 100:1 change in light (approximately 6 F-stops), and attenuates all colors of light equally. (Figure 2)

A motor is connected to the center of the disc which can rotate the disc in either direction. The motor direction is controlled by a servo amplifier. The position of the disc is indicated to the servo amplifier by a variable resistor called a "follow pot" which is connected to and rotates with the disc and motor.

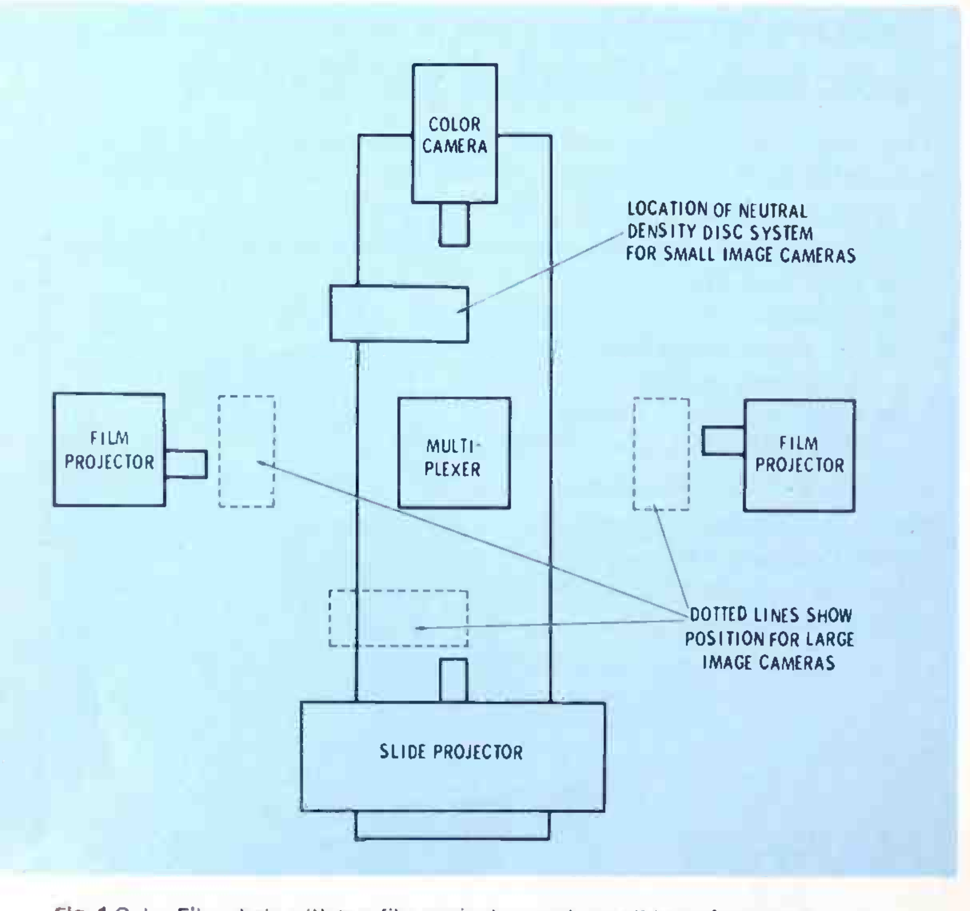


Fig. 1 Color Film chain with two film projectors and one slide projector.

Manual Control

In manual operation the position of the follow-pot corresponds to the exact position of a "control-pot" which is another variable resistor located on the operator's control console. If the control pot is rotated 15° the follow-pot, motor, and disc will rotate 15° also.

In this mode of operation, the operator can manually control the video level of his film chain by turning his "control pot" which rotates the disc to a less dense or more dense position.

Automatic Control

In the automatic mode a composite video signal is used to generate an error voltage which drives the wheel in the correct direction to compensate for the change in light level. If the light level is too low the unit will sense low video and drive the neutral density disc to a less dense position. If the light level is too high the unit will sense high video and drive the Neutral Density Disc to a more dense position. As soon as the video level reaches the 1.0 volt nominal setting the error voltage decreases to zero and the Neutral Density Disc drive motor stops.

When showing a film, the system will correct continually for changes in the film density from scene to scene. With slides the unit will correct once to 1.0 volts nominal video level and hold until the next slide.

The response time for a 10:1 light change is less than 0.07 seconds and the end to end response is 0.7 seconds.

Automatic Black Level Sense

When no film or slide is on, the unit will automatically return to its mid-range position. This eliminates th unit having to correct from the ld open position when the film or ile is first turned on.

The system provides fast correction for film and slide density changes. It can be used on large or small image film chains. Use of composite video for its sensing allows it to be used with any camera system and there is no color or hue shift problem incurred during its operation.

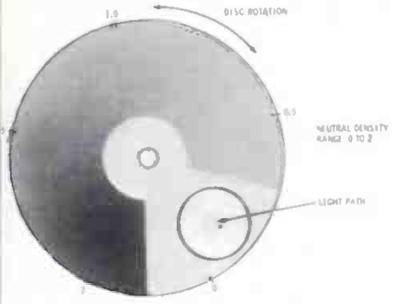


Fig. 2 Neutral density disc begins with 80 percent black and gradually decreases to 0 percent.

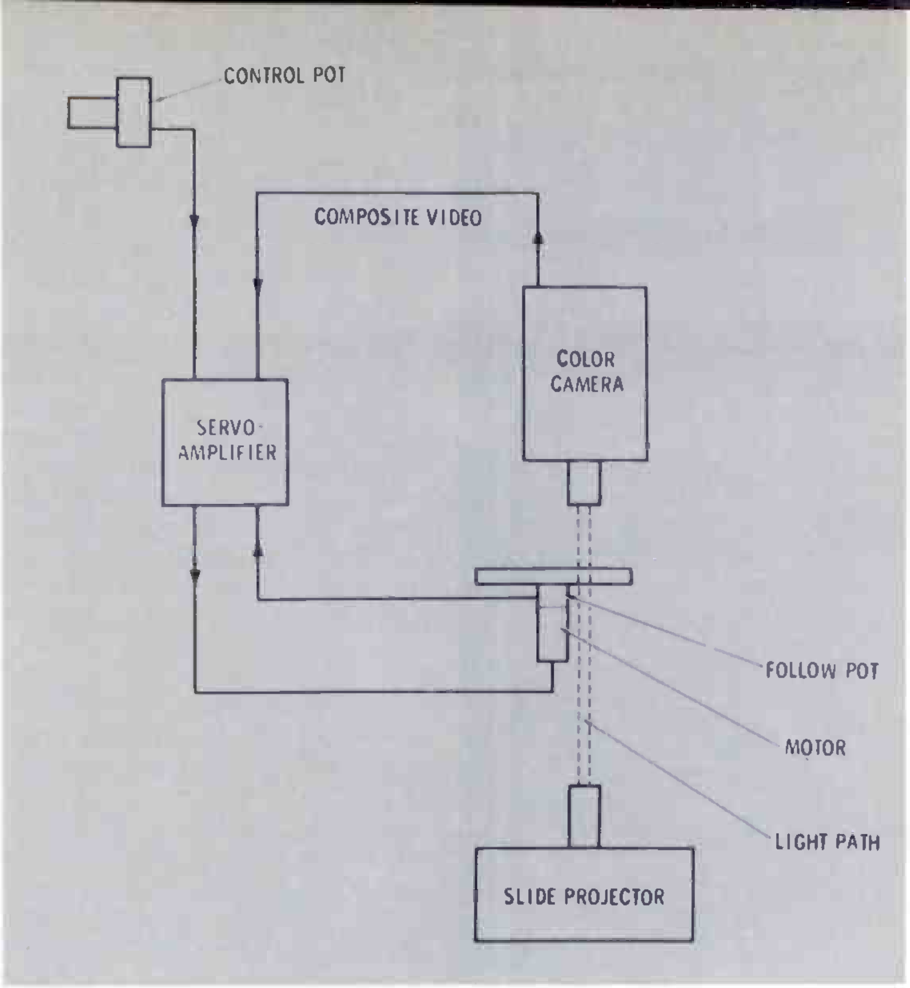
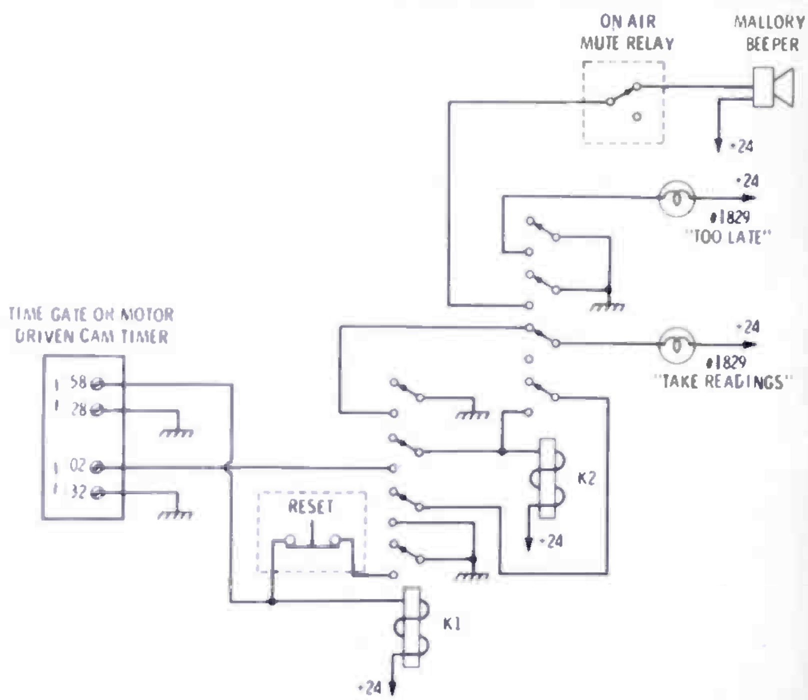


Fig. 3 Block diagram of neutral density disc system.

ENGINEER'S EXCHANGE

Accurate transmitter logs are one of the many headaches of most small station engineers. How can you be sure that the third class operator on duty always takes the required readings on time? There is no foolproof method of course, but we felt that a "gentle reminder" might be helpful.

Our "Live" AM Operation coexists with a fully automated FM Station which uses a "Broadcast Products Model 5025 Time Gate" for all real time functions. (If this unit is not available, a cam timer would work equally well.) This was programmed to give a relay closure at :58 and :28 minutes after each hour and another closure at :02 and :32. These functions were used to latch relays K1 & K2 respectively, and the reset switch was incorporated with the "modulation kill" switch on the front of our AM



nsmitter.
n use, as soon as the four min- window begins, a light turns on front of the announcer, telling he has four minutes in which to e his readings. If he has not ked the modulation and taken his dings during this time, K2 is al- wed to latch, lighting another p and turning on a mallory bee-per. The announcers seldom let this happen! Construction is not at all critical but should be as tamper proof as possible.

Now if I could just figure out a method to eliminate 4AM trouble calls. . .

George L. Bevins
WLPM & WFOG
Suffolk, Va. 23434

Logic Reprints Available

ROADCAST ENGINEER- G now has a limited supply of prints on the four-part series Dig- Logic Basics written by E.S. by, Jr. The series started in the ptember 1971 issue and ended n the January 1972 issue.

you would like to receive a y free of charge, write to: The tor, 1014 Wyandotte St., Kan- City, Mo. 64104.

HE'S TRAINING TO BE A STATION ENGINEER, LIKE HIS DADDY."

Color After Modulation
(Continued from page 38)

the signal. Watch for sync compression as the probe is inserted deeper, and also watch for a change in the color burst amplitude. Leave the probe at a point below either of these distortions. The same linearity check should be made with a diode only type monitor.

If the video bandpass (as shown by the multiburst) is distorted and yet it is not overloaded, the demodulator needs to go to the shop for repair and or realignment. Alignment is a ticklish job so it must be done with care. Remember, the demodulator also is a standard.

Color phase measurements can be made on the VIT signal step pattern and the color bar, using a vectorscope. The step pattern will check differential phase shifts. Be careful when using VIT signals from outside program sources as they may already be distorted. If you can insert your own signals, you have control.

Color measurement after modulation calls for devices that are kept in good adjustment so they can act as a standard. Even then, interpretation may also be needed for the results you obtain.

PEOPLE IN THE NEWS

The appointment of **James R. Treble** to the position of chairman of the Department of Television-Radio, Ithaca College, has been announced by the director of the Division of Communications, John E. Keshishoglou. . .Dave L. Fornshell, Executive Director of the Ohio Educational Television Network Commission, Columbus, has announced the enlargement of his staff as the ETV Network in Ohio begins interconnecting affiliated stations. **Edwin M. Eakins** will serve as Program Coordinator for the 10 station Ohio network; Public Information Director will be Mrs. **Paula H. Walker**; and **Dr. A. Edward Foote** has joined the Network Commission staff as Project Director for the Ohio Valley Medical Microwave Television System. . . .

TeleMation, Inc. announces the appointment of **Hank Maynard** as Chief Engineer of Research and Development. . .**Marion L. Stage** has been appointed director of engineering for the radio-television operations of Rollins, Inc., Atlanta, Ga.. . .McClatchy Broadcasting of Sacramento, Calif. has named **Richard Thompson** as its Director of Engineering. He replaces **Irwin Dickinson** who recently retired after 40 years with the company. . .**Elliot Klein** has joined

UF/KNIX in Phoenix as Director of Engineer-
. . .

udvik Jachimowicz has been named associate ector of research and Jerzy Olszewski as assistant ector of research for the communications cable sec- of the laboratory, General Cable Corp. . .Anixter- zan has tapped Charles K. Lindsey of Ormond ch, Fla., as Southeastern sales representat- . .Burnup & Sims Inc. has announced the appoint- t of Billy R. Jones as Divisional Manager of the pany's eastern CATV operations. . .J. K. Davis, eral Cable Corporation vice president, general keting and sales, has announced the election of E. Iolton as vice president and communications sales nager . . .

Magnavox Company, CATV Division has an- nced the promotion of James B. Emerson as acting ector of Advertising and Sales Promot- . . Harold E. Horn has joined the staff of the Cable evision Information Center in Washington, C. . . .Paula M. Span has joined the staff of the Ca- Television Information Center as special assistant e director of information. . . .

ouglas C. Williamson has been named National es Manager for Sadelco, Inc., Weehawken, ...Collins Radio Company has announced three or promotions: Vice President C. I. Rice, general ager of the company's avionics division in Cedar pids, was promoted to senior vice president; M. W. quelin, general manager of the special programs di- ion in Dallas, and G. W. Sullivan, general manager he telecommunication equipment division in Cedar pids, were promoted to vice presidents. . . .

he appointment of Larry Freemire as manager of ixter-Pruzan's Los Angeles office has been an- unced. . .John Bacon has been named General nager, Optima Division, Scientific-Atlanta, . . .Robert W. Butterworth has been appointed Re- nal Sales Representative for Ohio, Pa., New Jer- , New York and New England, Continental Appa- us Co. . . .William F. Roberts was recently selected Senior Systems Engineer for the Coastcom Divi- n of the Scott-Buttner Corp., Oakland, Calif. Howard B. Flink has been named a sales engineer Jerrold Electronics Corp. . . .

William C. Taylor, manager of East Coast Technical erations, has been elected an assistant vice presi- nt of ITT World Comm., a subsidiary of Interna- nal Telephone and Telegraph Corp. . . .EMR Com- er has announced key executive appointments: mes J. Harmon to the post of Manager, Systems partment, Robert W. Hippe appointed National es Manager; and, John T. Montilino to the post of nager, Marketing Operations. . .James W. Emmick been named Director of System and Field Engi- ring for Ameco, Inc., Phoenix. . .Robert M. Jones joined Malarkey, Taylor and Associates as a Fi- ncial Analyst. . .Bryant Ellis has been named the w Los Angeles Area Sales Representative, Table nufacturing & Engineering Co., San Leandro, Cal- . .IGM, Bellingham, announces the appointment Joseph D. Coons as sales director. . .M. Jean Land- mer has been named market research manager of ss Corp., Milwaukee. . .

NEW PRODUCTS

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

Building-Block Console Design

A new concept in broadcast console design that utilizes only seven easy-to-plug-in IC op-amp modules—with unique limiters on some inputs—has been developed by **Fairchild Sound Equipment Corporation,** of Commack, L. I., N.Y. 11725. The unique approach is said to provide custom features for no more than the cost of a standard wired-in system.

Fairchild Sound is a subsidiary of Robins Industries Corp., also of Commack.

Its new integrated circuit broadcast modules (ICBM) are assembled in building-block fashion, according to need. They provide for mic, medium-level, high-level and remote inputs and outputs, communications and monitoring.

Each module is a complete operating channel, with frequency response, distortion and noise characteristics claimed to exceed NAB proof-of-performance standards.

A major advantage of the concept is that a broadcast studio can be started with a few channels and gradually expanded. Also, channels can be moved from one studio to another, as programming requires. Plugging in and out is said to be as easy as handling a household appliance, eliminating testing or repair downtime.

he new ICBMs are packaged
durable Formica-covered alumi-
n strips with "Blue Ribbon"
nectors. Although black is the
ndard color, almost any desired
or can be supplied to fit a stu-
's decor.

lodules are available individu-
l, in kit form with console shell,
completely assembled at the fac-
y.

lthough there are some varia-
s, the mic, medium and high-
el inputs have essentially similar
tures. Two of them, the mic
BM-MI and the medium-level
BM-LI modules, contain limi-
s that make them impervious to
rload, no matter how strong the
signal.

he ICBM-MI also features a
tical fader with a cue switch and
egation and cough switches.
BM-LI is similar, except for the
gh switch and gain. The high-
el input module, ICBM-HI, has
anced input, followed by gain
ntrol with a cue switch and an
ignment circuit.

remote input (ICBM-RI) provides six, switch selectable lines that are fed into an input fader with cue switch and then are delegated into a mixing bus. A talk-back facility into the remote lines, via momentary pushswitch, is part of the circuit.

Circle Number 65 on Reader Reply Card

Emergency Power

The ELECTRO-PAC "A" Inverter is a solid state DC to AC inverter, capable of providing uninterruptible power for critical load requirements, a product of **ICS Inc.** A patented feature allows critical load requirements to be shifted from the primary AC source to the inverter output as an AC source within a 0 - 4 milliseconds (less than ¼ cycle) time period. A solid state AC line switch is employed to prevent the inverter output from feeding into the AC source line.

The "switchless" transfer is accomplished by lagging the output of the inverter by approximately 20° to the AC source signal. An

(Continued on page 52)

automatic cutoff of the line switch occurs when the AC source voltage drops to 95 VAC (or customer specified cutoff point). An 8 second delay is built in to function at restoration of the AC source voltage to prevent "hunting".

Because of this switchless feature, the ELECTRO-PAC "A" allows sensitive and critical equipment such as boiler controls, medical monitor equipment, computers and instrumentation to function without interruption whether the unit is to be used as sole source of emergency power, or to fill in during a time lag for motor generators' start up.

This switchless feature is available on all of the ELECTRO-PAC Inverters and systems, sized from 125 VA through 25.0 kVA single phase units.

Circle Number 66 on Reader Reply Card

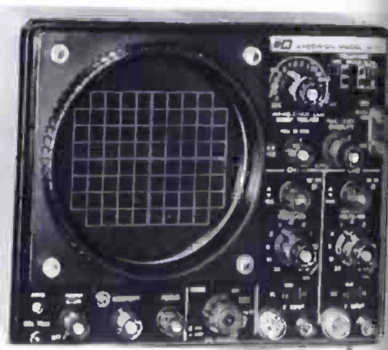
Dual Trace, Triggered Sweep Scope

Dynascan Corp. has announced the availability of the new B & K Model 1470 Dual-Trace Triggered Sweep Oscilloscope, developed "to meet the ever-increasing demand for a moderately price dual-trace scope in industry, labs, schools and the service field." Selling price is $499.95.

For those applications where inputs and outputs are to be compared, or outputs of multiple stages triggered by the same pulse are to be compared, a dual-trace scope is ideal. Used in industry and labs for years, the dual-trace scope is showing up on service benches with increasing frequency.

Applications include: viewing simultaneously two waveforms that are frequency or phase-related, such as in digital circuitry; checking frequency dividers; checking differential amplifiers for balance; relay testing and sequencing; measuring amplifier phase shift.

The B & K 1470 offers DC to 10 MHz bandwidth, 10 mV/cm sensitivity, maximum sweep of .2 microseconds/cm, and fully automatic and triggered sweep. It permits dual display of waveforms in 6 modes: Channel 1, Channel 2, Chopped (for low-frequency waveforms), Alternate, Add and Channel 2 Invert. In the first 2 modes, only one input signal will be displayed. In the Alternate mode, Channel 1 and 2 inputs are displayed on alternate sweeps—the two traces appearing as simultaneous waveforms.

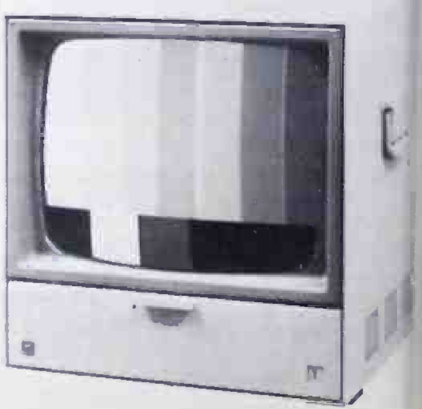


In the Chopped mode, the amplifiers are switched at a 140 KHz rate by an internally generated signal. At low sweep rates, this switching frequency provides two individual traces on the screen. This eliminates flickering that would occur if low-frequency waveforms were observed in the Alternate mode. In the Add mode, any two waveforms can be added algebraically. Also the Channel 2 Invert switch inverts the polairty of the Channel 2 waveform; thus, in the Add mode, it is possible to obtain the difference between 2 waveforms under study by inverting Channel 2.

Circle Number 67 on Reader Reply Card

19-Inch Color Broadcast Monitor

The Miratel Division of **Ball Brothers Research Corporation** has



roduced a new ultra-stable color oadcast monitor, the TCB-19. e TCB-19 is designed to serve as color standard for any video tallation. This series is also ailable in a cabinet-mounted 25-h version.

This TCB-19 addition to the ratel family of broadcast moni-s is available either with cabinet closure or in rack mount configu-ion. Stability and reliability are ured with temperature compen-ion, power supply regulation d low-drift chroma demodula-n.

Special features include switcha- long or short time-constant C (automatically returns to rt time-constant when sync is t, for wide capture range); all id-state circuitry; and controlled osphor picture tube. A black trix Hi-Light picture tube is op-nally available.

Circle Number 68 on Reader Reply Card

Sync Pulse Generator

CBS Laboratories introduces a w sync pulse generator.

The Model CLD-1100 Sync lse Generator incorporates the est digital-circuit design technol-y, and makes extensive use of gh-quality integrated circuits. nique design affords maximum aptability and use as a master it, as a standard sync generator, in pulse system applications.

Unit stability is derived from a ning circuit employing a single rvoloop in which the 3.58 MHz. lor frequency is generated from a 14.31818 MHz. crystal reference source. Subcarrier drift is less than 0.1 Hz. per month. Horizontal and vertical pulses are subsequently created directly from the 3.58 MHz. signal, thus virtually eliminating jitter between horizontal, vertical and color burst.

The CLD-1100 Generator also features a 15 Hz Color Frame Ident Pulse to assure correct color subcarrier-to-sync phase relationship.

To assure correct color phase editing for network sync lock application, the new generator also has a 100 nanosecond "window" to allow for minor sync time instabilities and references only to 3.58 MHz., thus eliminating certain problems associated with video tape recording sensitivity to such sync instability.

Pulse timing is easily accomplished up to a maximum of 2 lines, advance thus simplifying system timing application. The new line is available immediately from stock.

Circle Number 69 on Reader Reply Card

ITFS Transmitters

Nine new **Varian** Micro-Link TV transmitters have been type accepted by the Federal Communications Commission for use in 2500 MHz instructional television systems. The transmitters are also suitable for other applications such as the two-way conference TV network being installed for the Metropolitan Regional Council in New York, New Jersey, and Con-

(Continued on page 54)

Four-Channel Headphones

Koss Corporation, Milwaukee, has introduced three new sets of headphones specifically tailored to four-channel audio.

Each of the new headphone models features a two-channel/four-channel switch, making it compatible with both popular modes of sound reproduction.

Last year, Koss pioneered four-channel headphones with the introduction of the Quadrafone K2+2.

Each incorporates a new Koss-designed pressure-type dynamic driver element which delivers quality sound reproduction and features volume/balance controls on each cup for convenience.

Circle Number 76 on Reader Reply Card

necticut.

The new transmitters range from a four-channel, micro-power studio-to-transmitter link unit to a dual-channel, 10 watt transmitter that will broadcast omnidirectional signals up to 20 miles. All models feature improved color performance, high stability, and vestigal sideband operation.

According to D. D. Milne, Micro-Link Marketing Manager, new modulators in the transmitter exciters provide greatly improved stability of the aural carrier due to the use of a phase-locked loop to maintain the 4.5 MHz visual-aural spacing.

"In addition," Milne pointed out, "the differential phase and gain specifications have been tightened to improve color performance."

The metering panel of the new exciter includes means for measuring the exciter output as well as the remote transmitter output, and means to independently adjust the picture and sync amplitude.

Circle Number 70 on Reader Reply Card

Multiple H Line Rate Sync Generator

A new crystal controlled, multiple H line rate sync generator is now available from **Telemet Company**. The unit is said to eliminate the need for several units usually required to provide multiple drives.

Model 3519A is housed in a compact 19" wide X 4" high X 14" deep frame. Flexibility is built-in, enabling the unit to provide line rates of 525, 875, 945 and 1023. A single front panel switch selects the desired line rate required for driving high resolution video systems.

Outputs provided are horizontal drive, vertical drive, composite blanking and composite sync.

Circle Number 71 on Reader Reply Card

Broadcast Audio Console

CCA announces its new "Futura" professional Audio Broadcast Console. CCA is now offering, in both mono and stereo versions, a new line of audio consoles with capacities of 6 and 10 faders. These units feature modern, slide attenuators, plug-in electronics, full accessibility, switchable meters and independent, but identical, audition and program channels.

These consoles are also available in prewired audio systems and can be purchased from CCA Electronics Broadcast Division in Gloucester City, N.J. and CCA's subsidiary, QRK Electronic Products in Fresno, Calif.

Circle Number 72 on Reader Reply Card

Installer's Signal Level Meter

The **Mid State Communications** DT-12V utilizes a new approach for measuring signal levels at the subscriber's drop. The LOW band makes a wide-band composite measurement from 54 MHz to 86

MHz. The HIGH band makes a similar measurement from 150 MHz to 250 MHz. The operating range is from −10 dBmV to +36 dBmV.

Only four pushbutton controls select the band of operation or attenuate the signal. The two band approach permits the DT-12V to used as a trouble shooting aid on op installations. Near normal els on the high band and a low ding on the low band would inate a broken center conductor. ate a broken center conductor. lequate low band performance t weak high band reading would dicate a crimped center conduc-

The DT-12V also contains a 0 to Volt AC and DC voltmeter. ne voltage can be measured and plifier and power supply trouble ooting can be performed with the me instrument.

The DT-12V is a small, light eight, high quality test instru- ent. For example, electronic reg- ated power supplies are utilized r absolutely stable operation roughout the life of the batteries, d all circuits are temperature ompensated for all weather use.

Circle Number 73 on Reader Reply Card

Video Monitors

Modtec will soon be in full pro- uction on a line of modular video onitors. The modular design is ased on a series of maintenance atures.

The Modtec line is available in 9, 2, 16, 18, and 23-inch models. All odules plug in from the rear of the hassis and are interchangeable egardless of CRT sizes.

The line includes a 9 and 12-inch olid state monitor with a chassis at can be pulled out from the ont. Their 9-inch color monitor is ot a "jeeped" receiver. This unit will be available in cabinet, chassis, rack, and dual rack configurations.

Circle Number 74 on Reader Reply Card

Video-Typer

Developed by Kapco Enterprises, the KG-1632 is a low priced Character Generator designed to title live TV programs, or existing helical scan video tapes. The unit can be used with a monitor to display messages only, or in conjunction with a VTR to add titling.

Unique features of the KG-1632 are the ability to add titles to black and white or color recorded video tapes.

The slightly modified typewriter keyboard contains sixty-four characters including letters, numbers, and punctuations. Sixteen lines of copy, with thirty-two characters per line, can be typed and displayed on a television screen against a black background, or overlaid on another picture.

A window may be inserted to mask out all but one of the sixteen lines, or an entire page of copy can be displayed. The individual line appearing in the window, or an entire page, can be rolled upward or downward on the screen, and can be stopped at any location.

Circle Number 75 on Reader Reply Card

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

TECHNICAL DATA

106. AEL COMMUNICATIONS CORP.—A new four-page brochure on the new "AELCC Tunerless Converter" is now available. The brochure presents AELCC's single output and dual output tunerless "block" converters for Mid-Band and Super-Band ranges. The converters feature flexibility and low operating cost; each adds seven channels and together they can provide up to 14 additional channels on existing cable. Charts and block diagrams delineate specific applications. Converter accessories and their specifications are listed.

107. ANIXTER-PRUZAN—A new 100-page CATV catalog describing all products necessary to build and maintain a CATV system is now available. The catalog contains most wanted items, and is completely indexed and cross-referenced, using both technical and popular names of items. It includes CCTV items such as cameras, microphones and microphone stands. The company will also offer FM processing equipment and public address accessories. The catalog's complete table of contents includes these section headings: aerial construction material; underground construction material; cable; connectors and fittings; splicing materials; drop and installation material; antennae; electronics, including both active and passive devices as well as head-end equipment; test equipment; tools and safety equipment; and specialty items, including CCTV items.

108. AVANTEK—A new Application Note featuring Avantek's Remote Automatic Sweep System is now available. The 20-page application note describes CATV system measurements that can be performed with the remote automatic sweep system. The system consists of the Model CT-1000 Cable Transmitter and the Model CR-1000 Cable Receiver. Working together, these two equipments employ a very low level test signal to measure the swept frequency response of a CATV system without interference to subscriber's reception. Also included are line drawings and schematics.

109. GENERAL ELECTRIC—Bulletin GIZ-1916 on the Model TE-21 high resolution closed circuit television camera is now available. TE-21 is for camera applications involving very low light levels where a maximum of resolution ul a minimum of noise are criti- . Offering a standard line rate of ner 525 or 875, TE-21 provides n optimum combination for such s as image intensification, radi- aph analysis, data transmission, h chain systems and radioactive erial monitoring.

10. INTERNAT'L. RECTIFIER RP.—The new 1972-73 Com- ercial Products Catalog is now ilable. The 32-page catalog con- ns details on a wide range of ducts from replacement compo- nts for home entertainment and ustrial electronic equipment, to mponents for hobbyists. Re- cement components for home ertainment equipment include nsistors, integrated circuits, rec- ers, diodes, solid state tube re- cements and electrolytic capaci- s. Products featured for the byist, consumer and research d development engineer include ar cells, fiber optics, instrument obs, printed circuit board mate- , relays, switches, heat exchan- s, project and engineering hand-books and a complete selection of semiconductors.

111. JOSLYN MFG. AND SUPPLY CO.—A pocket-sized reference bulletin of materials for CATV is now available. The 16-page folder lists the most common items used in the construction of CATV lines. These include anchors, guy attachments, bolts, clamps, preformed deadends, porcelain strain insulators, nuts, anchor roads, and hundreds of other items of construction hardware.

112. LASER LINE CORP.—A new booklet describing "How to Layout an Airlink CATV System" is now available. The 12-page booklet covers such subjects as installation, selection of transmitter and receiving sites and how to determine power requirements. Technical and engineering layouts and schematic drawings are also included in the booklet.

113. LITTELFUSE, INC.—A new 56-page, multi-color, product catalog featuring complete mechanical and electrical specifications of all types of glass and ceramic tube fuses, fuseholders, fuse clips and blocks, automatic and manual reset circuit breakers, heavy and medium duty relays, alarm buzzers and momentary action switches is now available. The new catalog is a necessity for the circuit designer, industrial distributor and purchasing agent in the electronics, electrical, automotive aerospace and appliance industries.

114. MAGNAVOX—A new catalog sheet on "Ultra-High-Quality" coaxial connector Series 990 is now available. A complete description, specifications and ordering information are given for the 5-300 MHz, high RFI integrity, anti-pullout connector line. The series is made for standard .412, .500 and .750 cable and comprises splice, feed-thru, long-pin chassis and short-pin chassis types.

115. MALLORY DIST. PRODS. CO.—An electrolytic Capacitor

(Continued on page 58)

Guide edited for the electronic technician is now available. This 32-page brochure tells how to find a good capacitor replacement for an original equipment capacitor of a given rating, size and shape. Over 4500 capacitors including singles, duals, triples and quad types are listed in the Guide. Complete information on how to use the Capacitor Guide is included. All capacitor replacements are listed by microfarad and voltage rating and physical case sizes.

116. MOUNTAIN WEST ALARM SUPPLY CO.—A new alarm equipment catalog "Space Age Security" is now available. This 64-page catalog describes and offers over 350 intrusion and fire alarm products. Many are UL listed. The broad product lines presented are of particular use to alarm installers, dealers, and skilled industrial electronic and electrical technicians who require local alarm systems, parts, and accessories. The alarm equipment offered ranges from relatively simple "open loop" hardware to the latest ultrasonic, radar, and infrared instrusion detectors. Many storeroom supplies also are available. Major product categories include Intrusion Systems, Fire Systems, Fire and Intrusion Detectors (Radar, Infrared, Ultrasonic, CCTV, Switches, Heat, Smoke), Remote Controls, Annunciators (Bells, Horns, Sirens, Oscillators, Lights). Telephone Dialers, Lock Specialities, Tools, Accessories, and Books. Products are described in some detail regarding application, principle of operation, and specifications to allow skilled technicians to make the right choices-eliminate guesswork.

121. RF SYSTEMS, INC.—A new price list for CATV products ranging from new co-channel Rejection Kit to Astro Logs, Parabolic Antennas, Yagi and Zig Zag antennas is now available.

SEND YOUR LETTERS TO THE EDITOR to Broadcast Engineering 1014 Wyandotte Kansas City, Mo. 64105

ADVERTISERS' INDEX

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Advertising rates in Classified Section are 15c per word, each insertion, and must be accompanied by cash to insure publication.

Each initial or abbreviation counts a full word. Upper case words, 30c each.

Minimum classified charge, $2.00.

For ads on which replies are sent to us for forwarding, there is an additional charge of $2.00 to cover department number, etc., which is printed in advertising copy, and processing of replies.

Classified columns are not open to advertising of any products regularly produced by manufacturers unless used and no longer owned by the manufacturer or a distributor.

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FOR SALE
RADIO STATION . . . 5,000 Watts . . . Eastern Arizona $175,000 . . . substantial cash . . . Harold Bruzee KHIL . . . Willcox 6-72-6t

FOR SALE
TV MOBILE BUS 1970 Bluebird coach, 30 feet. Empty interior paneled, carpeted, no side windows, full width rear door. Ready for installation of your equipment. Includes two 6kw generators, two overhead 110V air conditioners plus engine air conditioner, fluorescent lighting, wired for internal and external power. Many other extras. Write Dept 271, Broadcast Engineering, 1014 Wyandotte St., Kansas City, Mo. 64105 11-72-1t

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TV MAINTENANCE ENGINEER & SUPERVISOR seeks position at top of major market station. Resume and references on request. Box 270 Broadcast Engineering, 1014 Wyandotte St. Kansas City, Mo. 64105 11-72-1t

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, 11661 San Vicente Blvd., Suite 300, Los Angeles, Calif. 90049. Telephone: 213-820-2678. By Broadcasters—For Broadcasters. 11-68-tf

VTR—maintenance engineer with AVR-1 experience and first phone seeks job with innovative firm. Presently working in Europe, available as of November 8, 1972. Write Dept. 269, Broadcast Engineering, 1014 Wyandotte St., Kansas City, Mo. 64105 11-72-1t

HELP WANTED CONT.

CUSTOM BUILDING licensed engineer Lab Equipment 20 years experience in the Broadcast Field Equipment repair service J & J ELECTRONICS, 153 Chestnut St., Manchester, Conn 06040 11-72-1t

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AMPEX 1200 VTR from Owner Reply to D ZULLI (213) 466-7757 11-72-1t

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EQUIPMENT FOR SALE

RCA TFE-10A: 2500 Mhz transmitting antennas Broadband, omnidirectional New, in original packing Bob Reynolds, 609-877-0881, 32 Mosshill Lane, Willingboro, N.J 08046 9-72-3t

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NEW Paps hysteresis synchronous motor HSZ 20 50-4-470D as used in series 400 and 500 machines Price $39.00 each prepaid, while they last 90 day warranty Terms check with order only, no COD's. Not recommended for Tapecaster series 600 or 700
TAPECASTER TCM, INC., Box 662, Rockville, Maryland 20851
1-72-TF

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"NEW & USED TOWERS, Buy, Sell or Trade, Erect. Ground wire 85c lb. Bill Angle, 919-752-3040, Box 55, Greenville, N C. 27834." 2-71-tf

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CARTRIDGE TAPE EQUIPMENT—Rebuilt. New paint, heads, flywheel, pressure roller, belts, etc. Spotlessly clean and thoroughly tested. 30 day money-back guarantee, 90 day warranty. Also contact us for possible discounts on new equipment and accessories. AUTODYNE, Box 1004, Rockville, Maryland 20850, (301/762-7626). 7-72-tf

SPECIAL—NEW FIDELIPAC NAB CARTRIDGES 10 secs to 6 minutes. Only $1.25 each. Minimum quantity 50 carts. Specify lengths when ordering. Gately Electronics, 57 W. Hillcrest Avenue, Havertown, Pa. 19083. 9-72-3t

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RCA TT25 SOUND AMPLIFIER CHANNEL 5 can be modified to picture. RCA TT5A TRANSMITTER CHANNEL 5 can be modified to air cooled. Just removed from standby service, fully operational. Harmonic filter, VSBF, and Diplexer not included. PRICED TO MOVE. Chief Engineer, KSD-TV, 1111 Olive St., St. Louis, Mo. 63101 10-72-2t

EQUIPMENT FOR SALE CONT.

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RCA CSF-60A, 60w FM base station on 26 mhz, 600 ohm out for board, local and remote control panels, handset or speaker operation mint $250. Rust RI-108 system, complete $1 RCA 77-D factory reconditioned, $135 RCA 44BX $95. 639A stand, $50. AKG D-24, case chart, cable $130. Gates M-6034 preamps each (4) $95. Daen pots (12) 600 in/out sorted ladders and T's with cues, lot $10 WEED 89 Pansy Street, Schenectady, New York 12306 Telephone 518-356-0441 11-72-1t

SPARTA 600CRP & 600CP-RK stereo cartridge playback and recorder both with 150 & 8KHz aux cue. One year old in excellent condition KZST (FM) Box 2755, Santa Rosa, California 95405. (707) 528-4434 11-72-1t

STATION ENGINEERS—LOOKING FOR A CONSOLE? Like-new Electrodyne 1204 desktop console for quad, stereo. Nine 711 input strips, wired for fifteen, 8 freq. equalization Altec faders, AB pots. Four output busses, two stereo mixdown busses, all with VUs, faders For details and photo write: Earth Audio Techniques, 113 Church St., Burlington, Vt 05401 11-72-1t

FOR SALE: Mobile Unit 24 ft. International custom van, 4 RCA TK-30 cameras, 2 RCA sync generators, RCA TS-30 switcher, 6 input audio mixers, intercom, adjustable power transformer. Chief Engineer, WTMJ-TV Milwaukee Wisconsin. 414-332-9611 11-72-1t

COAXIAL CABLE—jacketed 3 inch air dielectric heliax—270 feet—Andrew's No HJ8-50A/Milit. RG 322U—fitted with two male, factory installed, EIA flanges. Excellent condition $1,300. Write/Call WKJF, Inc., 1715 Grandview Avenue, Pittsburgh, Penna. 15211. 412-3 8100 11-72-1t

Standard RCA Style **VIDEO PATCH JACKS** unused $1.75 each. You supply panels and save. Norman Gillaspie, P O Box 21 Monterey, Calif. 93940. 1-408-375-7424 11-72-1t

RCA TG-4 Color Test Generator. New condition. Complete Instructions $500.00. RIKER SYNC GENERATOR #520 Color Standard, Color Lock, Bar & Dot Modules. Complete instructions. $250.00 K Whitman. 8346 Brim field Ave., Panorama City, Calif. 91402 (21 780-1624 11-72-1t

READER SERVICE CARD

BROADCAST ENGINEERING

For issue of November 1972–Use until February 1, 1973

After that date please contact manufacturer direct

Use This Handy Card For More Information On The Products Described

Name ____________________ Title ____________________

Station or Company ____________________

Address/City ____________________

State ____________________ Zip ____________________

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

READER SERVICE CARD

BROADCAST ENGINEERING

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Name ____________________ Title ____________________

Station or Company ____________________

Address/City ____________________

State ____________________ Zip ____________________

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

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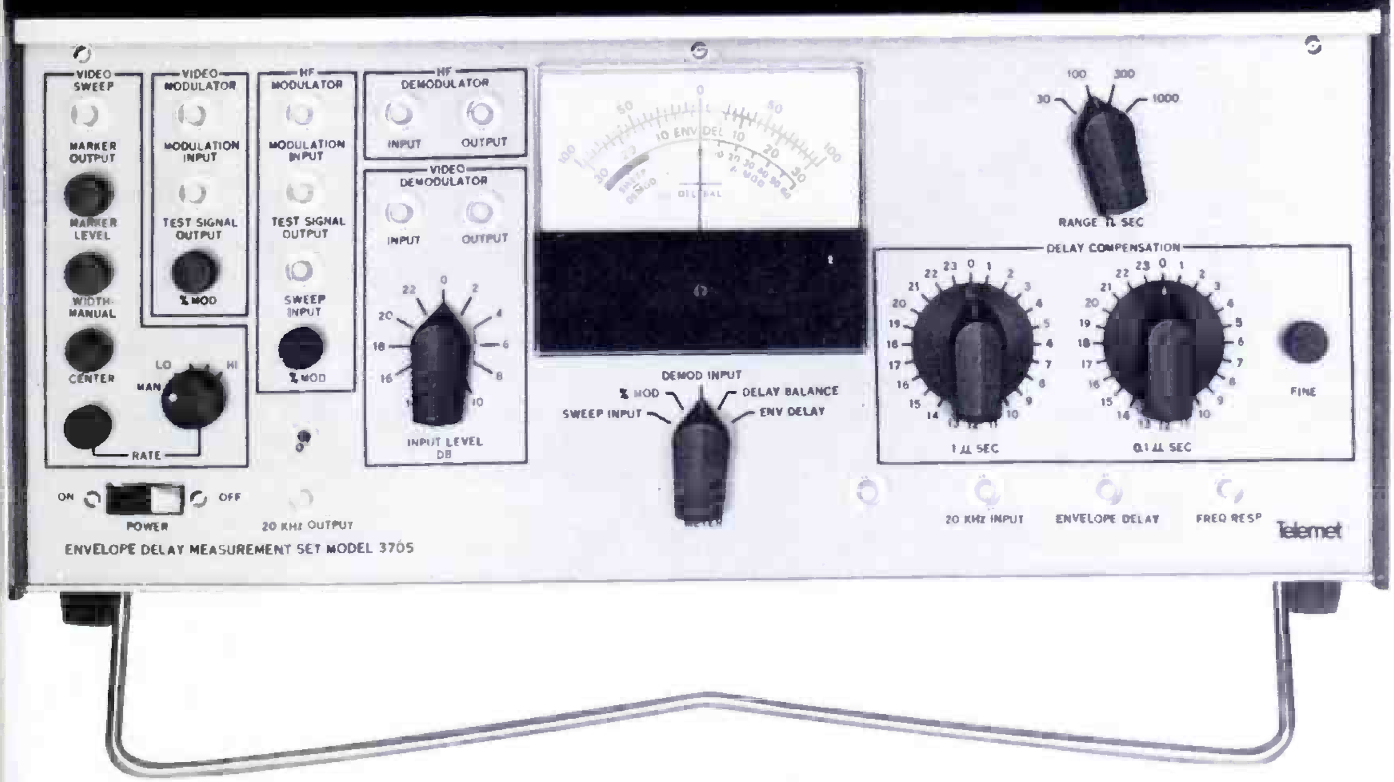

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