

Indiana University
JAN 2 1973
Library

CPR

December, 1972/75 cents

BROADCAST engineering®

the technical journal of the broadcast-communications industry

**FCC
revising
part 73**
see page 14



Coax Line Installation Tips
Building A Monitor Stretcher
1972 NAEB Convention Review

B1172 N DNC 774 X
INDIANA UNIVERSITY LIBRARY
SERIALS DEPARTMENT
BLOOMINGTON IN 47401

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

P10 x 20B1



P17 x 30B1



P17 x 30B2



PV10 x 16B



PV17 x 24



PV10 x 15



More and more people are discovering how significantly superior Canon Zoom Lenses are for TV broadcasting purposes. Their outstanding color characteristics, even in dim light, is one of the many reasons why Canon was chosen for telecasting the Munich Olympics.

Canon's wide range of excellent zoom lenses encompass three types of operation control—all servozized, via flexible cables and by effortless push-pull rod control. 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
1 1/4" 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 Lens Naming System



Applications	Image Format	Pick-up Tubes
P	21.4mmφ	1 1/4" Plumbicon
PV	16mmφ	1" Plumbicon

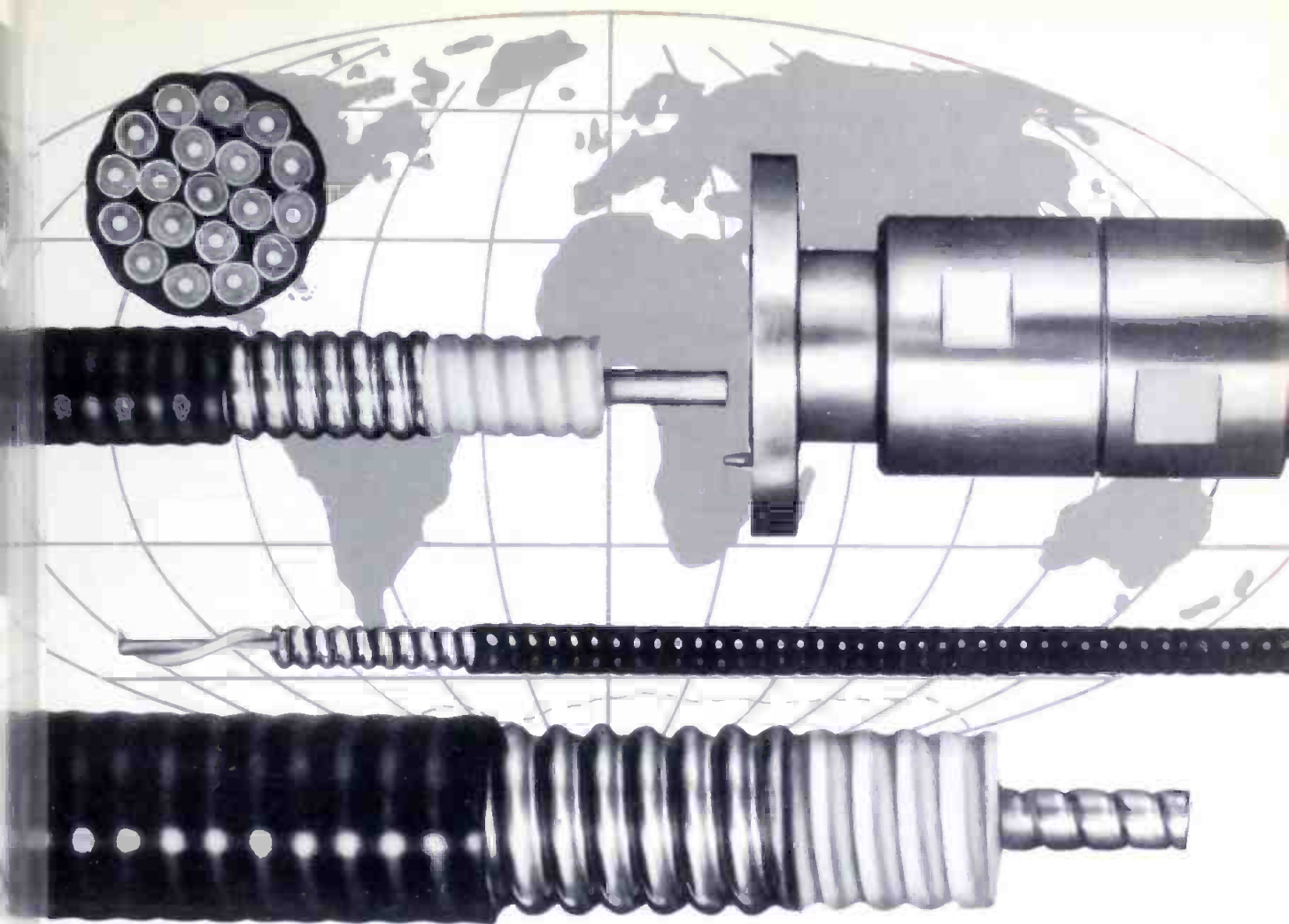
Apart from the above, Canon has available TV zoom lenses for 3" or 4-1/2" image orthicon cameras and can also build special lenses to fit your requirements.

Canon

● CANON U.S.A., INC.: 10 Nevada Drive, Lake Success, Long Island, New York 11040, U.S.A. (Phone) 516-488-6700 ● CANON U.S.A., INC.: 457 Fullerton Ave., Elmhurst, Illinois 60126, U.S.A. (Phone) 312-833-3070 ● CANON OPTICS & BUSINESS MACHINES CO., INC.: 3113 Wilshire Blvd., Los Angeles, California 90005, U.S.A. ● CANON AMSTERDAM N.V.: Gebouw 70, Schiphol Oost, Holland ● CANON LATIN AMERICA, INC.: Apartado 7022, Panama 5, Panama ● CANON INC.: 9-9, Ginza 5-chome, Chuo-ku, Tokyo 104, Japan

For More Details Circle (1) on Reply Card

www.americanradiohistory.com



WORLD LEADERSHIP IN COAXIAL CABLES AND WAVEGUIDES

Introducing its HELIAX[®] product line in 1954, ANDREW has become the largest independent producer of semi-flexible coaxial cables, waveguides and associated fittings used in radio frequency applications.

Four years of innovation in product design and manufacturing have, with emphasis on effective performance of installed systems, produced for ANDREW a position of world leadership, and for HELIAX cables and waveguides the assurance of superlative value for money to cost.

Plants in the United States, Canada, Great Britain and Australia, ANDREW is well situated to provide prompt delivery service and competent assistance with problems, anywhere in the world.



ANDREW

ANDREW CORPORATION 10500 W. 153rd St., Orland Park, IL, U.S.A. 60462

ANDREW ANTENNA SYSTEMS Lochgelly, Fife, Great Britain KY5 9HG

ANDREW ANTENNA COMPANY LTD. 606 Beech St., Whitby, Ontario, Canada

ANDREW ANTENNAS 171 Henty St., Reservoir, Victoria, Australia 3073

For More Details Circle (4) on Reply Card
www.americanradiohistory.com

BROADCAST engineering

The technical journal of the broadcast-communications industry

in this issue...

- 14 **FCC Relaxes Part 73 Rules.** Commission finally begins review and de-regulation of the broadcast Rules. **Marvin Blumberg.**
- 16 **Transmission Line Installation Tips.** A discussion of basic considerations for line installations at AM, FM, and TV stations. **Pat Finnegan.**
- 22 **FM Audio: Technique or Pandemonium?** Should your audio be the same all day? The author thinks your audience changes and receiving equipment are in the driver's seat. **Dennis Ciapura.**
- 30 **Getting More Out. . . A Monitor System In The Stretch.** A simple means of making greater use of available monitors when space and budgets are a problem. **Daniel Long.**
- 32 **Parade Display Switch Handles Two Cameras.** Pictures and schematic of a switch that allows simultaneous video signal monitoring on one monitor. **Steven R. Sharits.**
- 36 **Educational Broadcasters' Convention Report.** Recap of the recent NAEB convention in Las Vegas. Also see new products section. **Ron Merrell.**
- 40 **Reviewing A New Cartridge For Automated Music.** The Aristocart, a Canadian invention, is discussed in detail.

ABOUT THE COVER

This month's cover shows how difficult it is to install an antenna atop a tall building. But this month's hottest item is our Rules article on page 14. (Photo courtesy of RCA.)

DEPARTMENTS

Direct Current	4
Letters To The Editor	8
Cable Engineering	CE-1
Industry News	8D
New Products	43
Tech Data	51
Book Reviews	54
People In The News	55
Ad Index	57
Classified Ads	57

EDITORIAL

RONALD N. MERRELL, Director
CARL BABCOKE, Technical
MORRIS COURTRIGHT, Automation
PAT FINNEGAN, Maintenance
HOWARD T. HEAD, FCC Rules
ROBERT A. JONES, Facilities
WALTER JUNG, Solid State
ANDRA BOYLE, Editorial Assistant
H. G. ROESLER, Cartoonist
WEBB G. STREIT, Graphic Designer
LED G. SANDS, CATV

EDITORIAL ADVISORY BOARD

LES NELSON, Chairman
Howard W. Sams & Co., Indianapolis

CIRCULATION

EVELYN ROGERS, Manager

ADVERTISING

E. P. LANGAN, Director
R. JACK HANCOCK, Manager
Aida Casanova, Production
JAKE STOCKWELL, Sales

REGIONAL ADVERTISING SALES OFFICES

MICHAEL KREITER
1014 Wyandotte St.
Kansas City, Mo. 64105

Indianapolis, Indiana 46206

ROY HENRY
2469 E. 98th St.
Tele: 317/846-7026

New York, New York 10019

GEORGE FLECK
60 East 42nd Street
Room 1227
New York, N. Y. 10017
212/687-7240

Los Angeles, California

RICHARD BOHEN
3600 Wilshire Blvd., Suite 1510
Los Angeles, California 90005
Tele: 213/383-1552

London W. C. 2, England

JOHN ASHCRAFT & CO.
12 Bear Street
Leicester Square
Tele: 930-0525

Amsterdam C, Holland

JOHN ASHCRAFT & CO.
W. J. M. Sanders, Mgr.
for Benelux & Germany
Herengracht 365
Tele: 020-240908

Tokyo, Japan

INTERNATIONAL MEDIA
REPRESENTATIVES, LTD.
Shiba-Kotohiracho, Minato-ku
Tele: 502-0656



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

BROADCAST ENGINEERING is mailed free to qualified persons engaged in commercial and educational radio and television broadcasting. Non-qualified subscriptions in the U.S. are \$6.00 one year, \$10.00 two years, \$13.00 three years. Outside the USA add \$1.00 per year to cover postage. Single copy rate 75 cents. Back issue rate \$1.00. Adjustments necessitated by subscription termination at single copy rate.

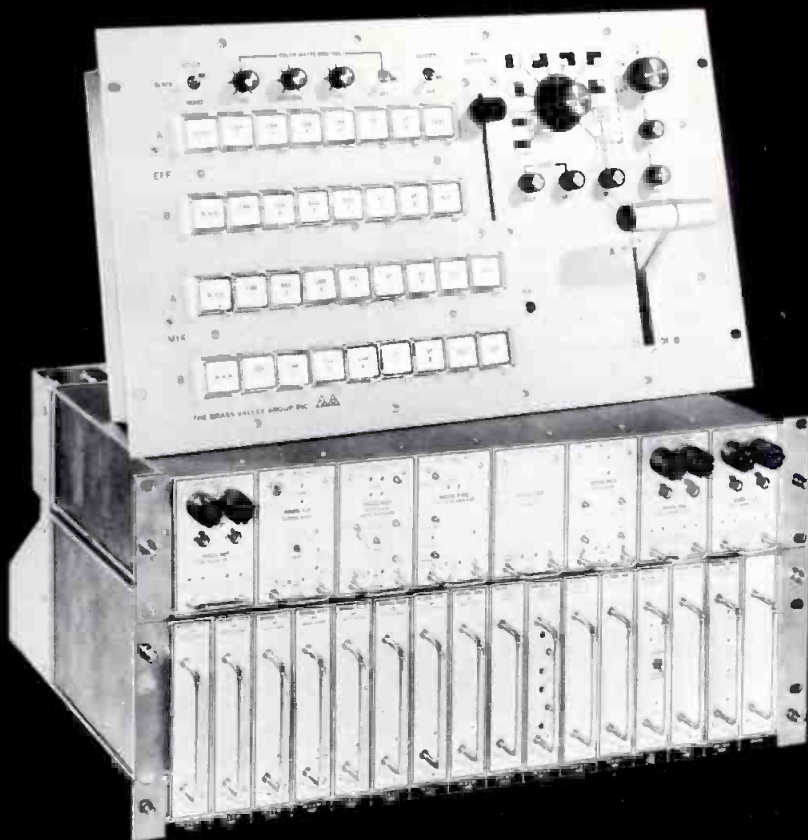
Controlled Circulation postage paid at Indianapolis, Indiana.



Robert E. Hertel, Publisher
INTERTEC PUBLISHING CORP.
Subsidiary of HOWARD W. SAMS & CO., INC.

MODEL 1400-12 VIDEO SWITCHER

PROFESSIONAL PERFORMANCE IN A SMALLER FORMAT



FEATURES

- 8 inputs - composite (loop through) ● 4 buses - Mix A and B, EFF A and B ● True re-entry system - allows dissolves to wipes and inserts ● Complete color special effects system - 8 wipe patterns, internal keying, external keying, and matte ● Bordered wipe patterns ● 3 input mixer - allows split fades to black ● Vertical interval switching ● 2 program outputs ● Effects monitor output ● Meets NTSC color specifications ● Compact - Control panel 10½" x 19" (rack mount), electronics 8¾" x 19" (rack mount)
- OPTIONS: Color black/color matte generator ● Automatic sync-add crosspoints for non-composite inputs ● Chroma key ● Non-synchronous inhibit for MIX buses ● Video processing system ● AFV system

Price \$7,000.00

THE GRASS VALLEY GROUP, INC. 

FOR ADDITIONAL INFORMATION, CONTACT GRAVCO SALES, INC.

6515 Sunset Blvd.
LOS ANGELES, CALIF.
(213) 462-6618

Station Plaza East
GREAT NECK, N.Y.
(516) 487-1311

125 South Wilke Road
ARLINGTON HEIGHTS, ILL.
(312) 394-1344

Redbird Airport
DALLAS, TEXAS
(214) 330-1245

1644 Tullie Circle, N.E.
ATLANTA, GEORGIA
(404) 634-0521

DIRECT CURRENT FROM D. C.

December, 1972

by Howard T. Head

Stop The Press: Rules Change Update

As we were ready to put BE on the press, the Commission called attention to two important and misunderstood aspects of the new Broadcast Rule Relaxations (See article on page 14).

1. Meter Readings: The relaxation from 30 minutes to 3 hours between successive meter readings does not apply to stations whose licenses require readings to be taken at specified intervals.
2. Transmitting Equipment: Only AM and FM rules are changed. The previous TV rules continue in effect.

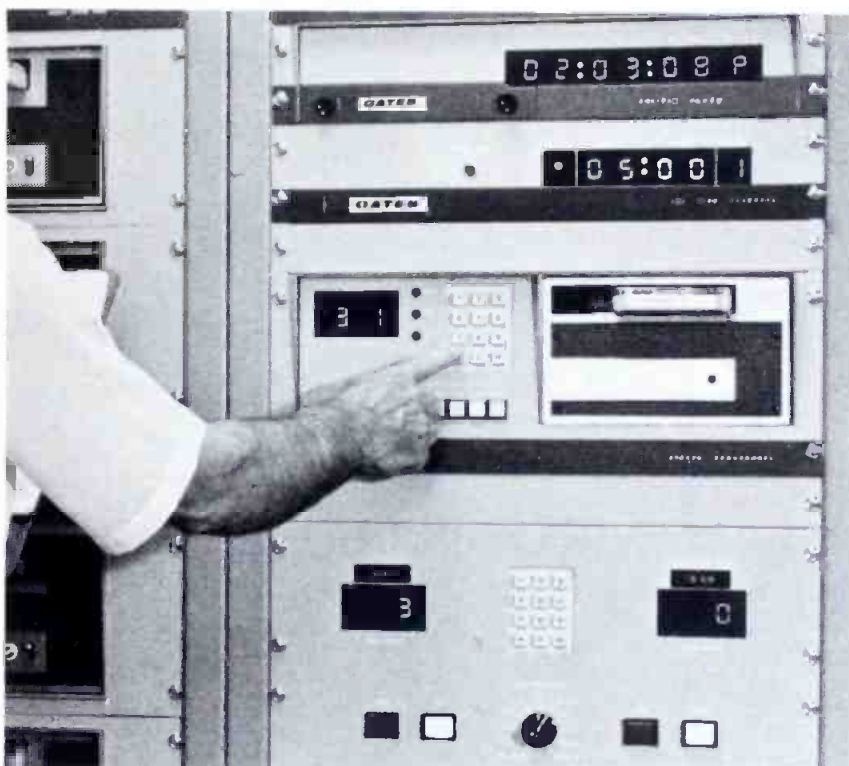
Updating of Broadcast Rules Gets Under Way

As reported in a special article beginning on Page 14 of this issue, the Commission has finally begun the long overdue task of clearing out some of the deadwood from the broadcast Rules and Regulations. Simplified rules are being adopted concerning meter readings, logs, transmitter inspections, station identification, rebroadcast consent, mechanical reproduction announcements, and filing of contracts with the Commission. Although the changes may appear to be deceptively minor, the aggregate relief to the 8200 broadcasting stations in this country is substantial.

One of the most remarkable things about this new movement is that the impetus for change has come from within the Commission itself. This is manifested in several ways. For one thing, the work is receiving the personal attention of FCC Commissioner Wiley and Broadcast Bureau Chief Wally Johnson, who rose to his present post through the engineering ranks of the Bureau. Furthermore, the Task Force undertaking the actual work is made up of three competent fulltime people--not part-time hacks. And finally, this activity is generating a new outlook at all levels of the Commission, with enthusiasm for improvement, avoiding change simply for the sake of change, but willing to consider any new ideas whether generated from within or without.

There are already those who have criticized the Task Force for having taken such a small first step, but these critics miss the mark: The alternatives are not limited change or sweeping rule revisions, but limited change or no change at all--which has been the pattern for nearly three decades. The critics carp because they find the bottle partly empty; we applaud because it is partly full.

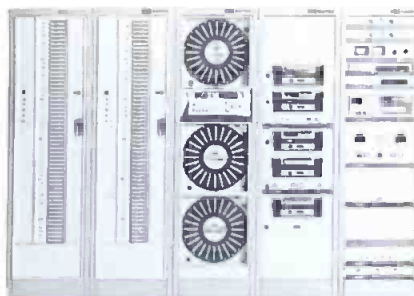
Gates' new Touch-Control Program Automation is custom-tailored to improve your operating efficiency. And profits.



Using advanced digital technology with MOS memory, Gates has developed a flexible program automation system. Custom-tailored to *your* needs.

The Gates system features keyset controls and numerical readouts for fast, easy operation and immediate verification of upcoming events. A new KSP-10 programmer that allows expansion of the number of possible events. And a touch-control system that is easy to use and understand (no special computer language is required). And that enables you to change programming, or correct entry errors, without reprogramming the entire memory.

These are just a few of the advantages. Write us for more details. Gates Division, Harris-Intertype Corporation, Quincy, Illinois 62301.



HARRIS
 **GATES DIVISION**
Quincy, Illinois 62301, U.S.A.

For More Details Circle (6) on Reply Card

To be sure, there is much more that the Task Force can do. It is to continue in existence and much is already under way. There are 34 priority areas under consideration, headed by new rules for automatic transmitters, AM directional antennas, and simplification of forms, especially license renewal forms. Some rule changes cannot be made outright, but under law must be the subject of Notices of Inquiry or Proposed Rule-Making. Other complex problems, many already in docket, such as the Fairness Doctrine and license renewal policies, are so controversial that if the Task Force awaited their resolution before handling simpler matters nothing at all would be accomplished. But with the Task Force's present approach, the tough jobs can come later --the simpler changes can be made now.

This is not to say that the Task Force is availing itself of all available resources. Industry input for the changes already made was limited to something less than 500 letters which the Commission received in response to public solicitations. There was little consultation with industry in drawing up the changes, although outside task forces are devoting substantial amounts of time and energy to studying changes in the Broadcast Rules. And the Task Force does not appear to have availed itself of experience in other countries, especially Canada, where experience in routine broadcast operation could be of considerable benefit in charting patterns of regulation in the U.S.

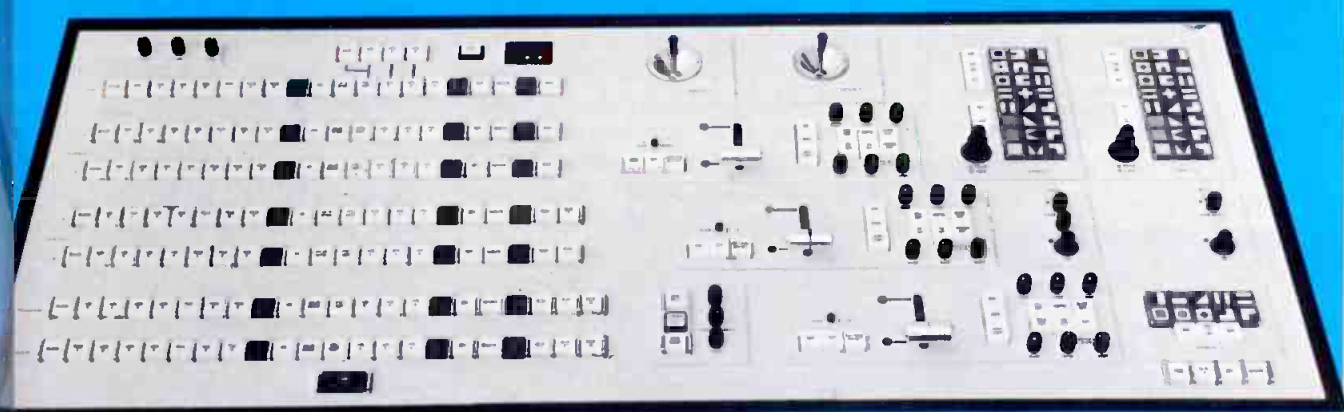
Nonetheless, input from individuals, on which the Commission relied in arriving at the changes already made, is important and will continue to be more so. We cannot urge you too strongly to send your complaints to the Commission, because for once the Commission is listening. Be as specific as possible as to why a particular requirement is troublesome, and if you have your own ideas as to changes these are valuable too. No formality, no red tape, just a simple letter to the Commission's Broadcast Bureau Re-regulation Task Force. Don't miss what might be the chance of a lifetime.

Short Circuits

The U.S. and Mexico have reached agreement on FM channel allocations. Agreement has already been reached with Canada, paving the way for a table of educational FM allocations in the U.S...The Commission is expected to grant a delay past the present deadline of December 31, 1972, for CATV performance measurements at least for older, smaller systems...Here we go again: the Land Mobile Communications Council has asked for the outright re-allocation of UHF Ch. 14 from television to land mobile service in Washington, D.C...A consultant's report on "high-resolution TV" has been drafted and is expected to be released by the Commission early next year...The Commission has turned down a proposal to permit 10-Watt "howlers", whose function would have been to "jam" AM reception in the path of emergency vehicles...Experimentation continues at Los Angeles International Airport to communicate with arriving and departing automobiles; first it was 550 kHz, then 830 kHz, now 530 kHz...A manufacturer has proposed to operate wireless TV transmitting surveillance cameras in the UHF TV band.

GET THE VITAL EDGE

with the **VIX-100-4**
production
powerhouse



VIX-100-4

Drift-free circuitry makes it possible to enjoy three mix-effects system with quad-split in a control panel no larger than most single mix-effects switchers. Discover the advantages of a switching system that satisfies ad agencies and insures dominance in production capabilities.

SALIENT FEATURES:

- ☐ 3 presettable mix-effects systems
- ☐ No coaxial delay lines in all re-entries
- ☐ Quad split with external drives
- ☐ Edger on all keys
- ☐ Up to 3 chroma keys. Composite and RGB type
- ☐ Ultra stable system
- ☐ Easy to install. Only one sync pulse is required
- ☐ All the extras used in today's production techniques

10 years of specialization. Designed, manufactured and delivered some of the world's largest and most complex integrated telecommunication systems.

GOOD ENGINEERING IS VITAL



VITAL INDUSTRIES, INC.

1620 Ridgewood Rd., N.W., Atlanta, Ga. 30327
404/233-9459

960 W. Beverly Blvd., Los Angeles, Calif. 90048
213/653-9438

2644 N. Seventh St., Terre Haute, Ind. 47804
812/466-3212

MAIN OFFICE: 3614 S.W. Archer Road, Gainesville, Fla. 32601 - Phone 904/378-1581

For More Details Circle (7) on Reply Card

www.americanradiohistory.com

NEW VERSATILE VIDEO TIMER



for only **\$695.00** VTG-33

A unique device to serve a multitude of requirements such as studio timer, sports timer, security reference, and 100 other tasks.

IMPORTANT FEATURES

- Crystal control for super accuracy
- Plugs into any video system, no modifications needed
- Displays months, days, hours, minutes, seconds, 1/10 seconds, 1/100 seconds
- Display is selectable by front controls
- Horizontal and vertical size adjustment
- Horizontal and vertical position adjustment
- Reset, start, and hold controls
- Mat intensity adjustable
- External time reference for computer or editing interface
- Clear high definition characters
- Color or black and white composite input
- 2 video outputs



The VTG-33 is a compact solid state — IC package built to give versatile, dependable service, compatible with both new or existing video systems. Many new features previously unavailable have been added while the cost is less than that of far less sophisticated units. Alternate character designations available on special order.

For details, call or write
Dave MacDonald at:

CRAMER

Video and Audio Systems
120 Hampton Avenue
Needham Hts., Mass. 02194
(617) 969-7700

Dealer's Inquiries Invited

For More Details Circle (8) on Reply Card

LETTERS TO THE EDITOR

Forum Open On Cartridges And Cartridge Machines

It has been brought to my attention that the industry is indeed overdue for a discussion of cartridges and cart machines. They are important to the ever increasing movement toward the all taped sound of compatible formats. They were important enough when taped spots fell in behind promos, and ID's. Now, with their growing use for total sound, a long, hard look is in order.

Our intention is not to field letters and articles aimed at condemning manufacturers and their products. Rather, we want **BE** to fairly reflect the user and the manufacturer. If there are problems that need to be resolved, we think progress will be made. But that progress is dependent upon users calmly stating their needs, and manufacturers listening and reflecting on

what is practical.

And we should be hearing about how the manufacturers feel. Do they see problems? What is being done? And how soon can we expect to see changes, if any? In the past few months at least three manufacturers have developed new cartridges, their efforts based upon refinements in tape travel and tape guides.

From engineers and managers, we'd like to hear their opinion of currently available carts and cartridges. If there are problems, how can they be solved?

How important is phasing, response, and machine-to-machine compatibility? Send your letters and articles to: Ron Merrell, **Broadcast Engineering** magazine, 1014 Wyandotte, Kansas City, Mo. 64105.

Breakdown Prediction Formula

Dear Editor:

While cleaning out my desk (another move-another milestone), I ran across a letter which I had posted, for a time, in the shop of a local area TV station. I thought your reader's might get a chuckle out of it.

To answer the often asked question in Engineering: **WHY?** I have tracked down, isolated, and distilled my findings, and they are herewith presented.

They were discovered by re-ordering and re-stating Murphy's Laws. The results shall be known as "The Chiefs Law & Order" or "Maintenance- Love It or Leave It Go".

1. The likelihood of any equipment breakdown requiring atten-

tion is inversely proportional to the availability of engineering personnel.

2. Breakdowns requiring the replacement of out-of-stock parts will occur with the following multiples applied to their normal probabilities:

2X—Saturday or evening

5X—Sunday

8X—Holiday-not Sunday or long weekend

10X—Holiday-Sunday

Certainly X—Holiday of long holiday weekend.

The above figures to be doubled across the board if the chief is out of town.

Ray B. Orfor
Rochelle, Ill. 61068

Last In The Lineup?

Dear Editor:

Here's a poem that I thought your readers might get a chuckle out of. The people here at WABB seemed to like it:

*It's not my place to run the station
the records I don't spin*

*It's not my place to say what
kind of music is placed upon the wind*

*It's not my place to shoot off steam
or use my voice to yell*

*But let the damn thing go off the air
and see who catches hell.*

John D. Rabon
Chief Engineer
WABB Radio
Mobile, Ala.

Let's Hear It For Over-regulation

For years the grumbling throughout the industry has been that radio is over-regulated. As we have reported in recent issues, those walls of regulations may soon be in for a major overhaul. Now, rather than sit back and wait to see what will happen, it is important to air the problem regulations in an effort to help the Commission de-regulate where regulation is really not necessary.

To that end, we invite your comments. We will publish an extensive cross section of views we receive and send copies of all comments to the FCC. Here's your chance to be heard!

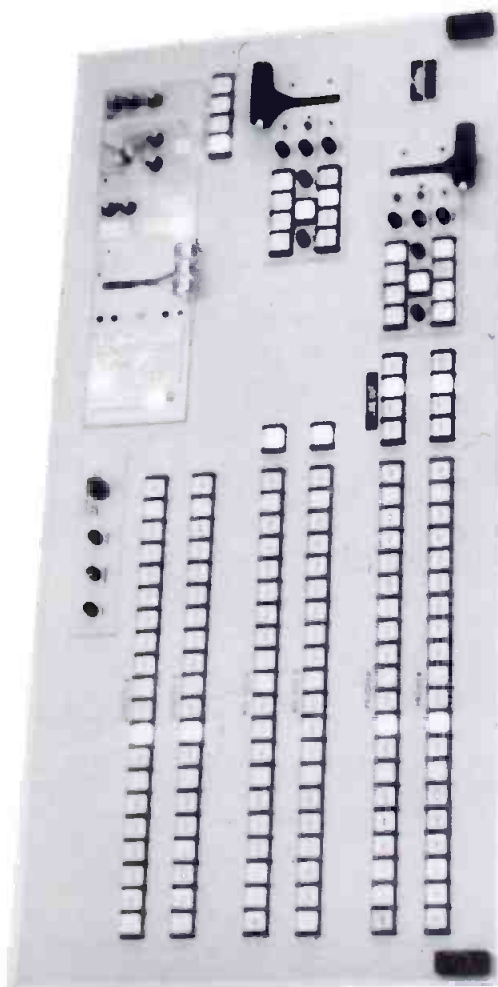
IC Audio Corrections

Looks as if we had an elbow in the typewriter in our October article on advanced IC audio article (page 41). Here are a few changes that should put everything in order: second paragraph, last sentence should end with "notably slew rate problems and Miller effect." And in the second paragraph on page 44, insert $1\mu V$ RMS for μVRS .

In Figure 3, R2 is 470 Ohms; Figure 6 capacitor on A2 should be 2000 pf; and in Figure 7 the unmarked capacitor on pins 9 and 10 of 540 is 2000 pf.

Features

- ☆ 20 x 6 VERTICAL INTERVAL SWITCHER
- ☆ 24 EFFECTS PATTERNS
- ☆ DUAL MIX SYSTEM
- ☆ UP TO THREE (3) KEY SYSTEMS
- ☆ INTERLOCKED TALLY
- ☆ NON-SYNC CROSSFADES
- ☆ CHROMA KEY
- ☆ PROGRAM AND PREVIEW OUTPUT SWITCHING



Model 570.1 is a deluxe television production system which will meet the stringent requirements of the largest production studios.

A complete special effects system is incorporated with a mix-key system that can be combined with a third mix-key system. This arrangement provides maximum flexibility without the high cost of multiple special effect systems.

Two complete Mix-Key amplifiers allow fades, dissolves, crossfades (synchronous and non-synchronous), color and mono external and internal keying, wipe key, chroma key, output drive signals for non-sync keying, split supers plus much more.

AMERICAN DATA CORPORATION

HUNTSVILLE, ALABAMA

4306 Governors Drive / Huntsville, Alabama 35805
Phone (205) 837-5180



For More Details Circle (9) on Reply Card

Norelco's New PC-72:

The Green

An innovative
new 3-Plumbicon®
color camera
that eliminates

- Camera mismatch
- Cable mismatch
- Color mismatch



Gremlin Killer

Innovators at Norelco introduce today's most advanced color camera in its price range. Not an updated model. A new generation. It kills many stubborn problems that have tormented video production men for years. And its CLUE feature lets you get better performance from other cameras you already have.

With the latest solid state circuit technique and modular design, the PC-72 achieves new standards of stability, reliability, and ease of maintenance. Plus three major new standard features you can't find in other cameras.

CLUE for quick, precise set-up and camera matching.

CLUE allows you to set up accurately and more easily without a waveform monitor. Using a black and white monitor, CLUE compares alternate scan lines from the red, green and blue signals. Peak white, black levels and gamma tracking in the color channels are quickly and accurately adjusted

for optimum color balance. CLUE allows the same reference to be used to match between cameras.

Presto, your cameras are set up and matched in a fraction of the usual time!

Precise compensation for standard cable, mini cable or any combination of both. Now ringing and smearing from cable mismatch disappear. It's as easy as dialing a phone. The PC-72 operates with up to 3,000 feet of standard cable or 2,000 feet of mini. Mix 'em up in the line if you like. Just dial the footage of each into the camera. Presto, perfect camera/cable compensation!

Pre-set pushbutton varichrome variable matrixing holds the color the sponsor wants on every shot. Varichrome gives independent remote control of hue and saturation settings for all primary and secondary colors. Without affecting grey scale. Once you've decided the settings you want to compensate for lighting from each camera angle, your final take is routine. Just push a button for each angle. Presto, the color you want in every shot!

Bias light—no lag at low light levels. Bias lighting, adjustable individually in Red, Green and Blue, virtually eliminates lag at low light levels.

And—scene contrast compression. A flick of a switch and scene contrast compression brings out detail lost in shadowed areas...without loss of highlights.

Take your last look at color gremlins... write now for complete information on the new-generation PC-72.

*Reg. TM N. V. Philips of Holland

Norelco

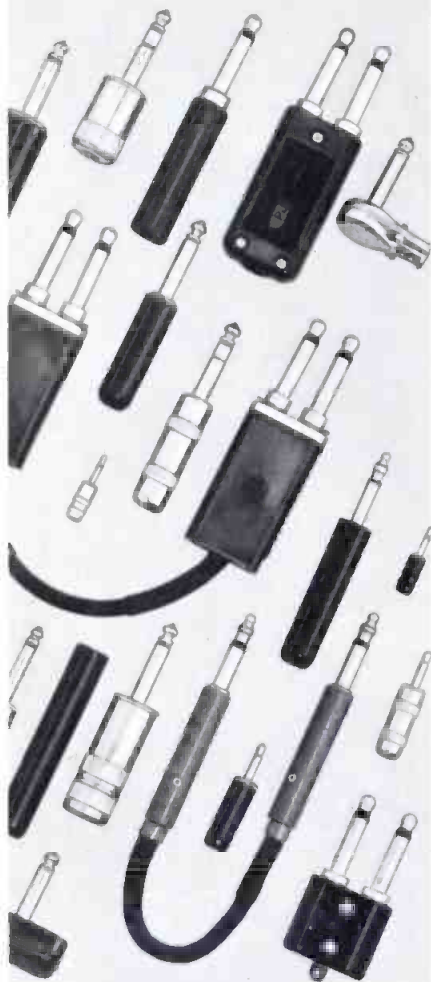
PHILIPS BROADCAST EQUIPMENT CORP.

A NORTH AMERICAN PHILIPS COMPANY

One Philips Parkway
Montvale, N.J. 07645 • 201/391-1000

For More Details Circle (44) on Reply Card

UNLIMITED VARIETY



INCOMPARABLE QUALITY

SWITCHCRAFT PHONE PLUGS

Why waste time "shopping around" . . . whatever your plug requirement—regardless of size or type, Switchcraft makes it, and makes it better! The one piece tip rod, for instance, is staked into the terminal to assure tightness . . . the tip rod can't fall out! Switchcraft offers you the world's largest selection of phone plugs . . . with solder terminals, screw terminals, cable clamps; .250", .206", .140", .097" finger diameters; shielded handles, or tough plastic handles; single plugs, twin-plugs; 2-conductor or 3-conductor—you name it! Chances are it's a thoroughly proved, field-tested STOCK plug from the incomparable Switchcraft line of plugs.

SEND FOR NEW CATALOG P-202 or see your Switchcraft Authorized Industrial Distributor for immediate delivery at factory prices.

SWITCHCRAFT®

5535 No. Elston Ave.
Chicago, Illinois 60630

Industry News

(continued from page 8D)

Bay-Minnesota Vikings game. As a result of this incident, the Commission issued a public notice warning other stations that severe action would be taken against any repetitions.

"There is also the background matter of cable television and sports blackouts. We instituted a rule making proceeding in the entire area of cable's sports carriage on February 2, 1972, the same day the Commission adopted its new rules for cable television.

"To focus the proceeding, we proposed a specific rule to deal with Section 1292 and requested comment on other possible rules to carry out the purposes of the law as a whole. Under our proposed rule, when a major league football, baseball, basketball, or hockey team is playing at home, a cable system licensed to the home city of a team may not carry a professional game of the same sport unless it is available on a local station. (In this event, of course, it must be carried.) For example, if the Washington Redskins were playing the New York Giants in RFK Stadium, a cable system in the District of Columbia could not carry the signal of a New York station that was televising the Redskins-Giants game. Furthermore, the cable system could not import from distant cities any other NFL games that were not being broadcast locally. The thrust of the rule is to carry out the intent of Section 1292—to insure the cable systems operate on precisely the same footing as local television stations under the present law.

"It goes without saying, Mr. Chairman, that the comments have been varied and at polar opposites. It also goes without saying that, should the Congress adopt one of the amendments now under consideration, our proposed rule would automatically reflect this new situation. We intend to complete the cable rule making before the year is out.

"... the bills' main thrust is directed to professional football, all of whose regular season games are televised as part of a total league package. But Section 1292 also includes the sports of professional

baseball, basketball, and hockey, and these three sports make much less extensive use of league agreements for televising their games—running as low as 2 or 3 percent of total games played. In all three sports, most games that are televised at all are shown pursuant to individual team agreements with local or regional broadcasters. The impact of the bills under consideration will almost certainly be very different on professional sports other than football.

"Insofar as any impact on the continued health of professional sport is involved, that is a matter for your judgment entirely. This consideration must, of course, be balanced against the desire of the public for the most diverse possible menu of sports programming."

NAEB Has First Cable Member

The National Association of Educational Broadcasters has its first cable member: the Public Cable Television Authority of Westminster, California.

A "joint powers," independent agency, the Authority has a strong interest in harnessing cable for educational tasks and has joined NAEB as a member of its Instructional Services division.

While not empowered to grant cable franchises, PCTA acts as coordinator of public interest and technical considerations for the five California cities of Fountain Valley, Huntington Beach, Costa Mesa, Newport Beach and Westminster in a projected cable interconnection of those municipalities. According to PCTA consultant John Bateman franchises will probably be awarded next February or March.

Among the applications under study by PCTA are a cable link-up of schools in 12 school districts located in the five-city area for the exchange of educational materials; pre-kindergarten programming; and a library information retrieval system utilizing two-way cable technology.

NAB: Cable Is Pay Version of Free TV

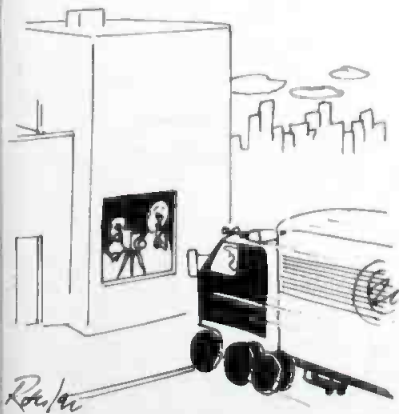
The National Association of Broadcasters said recently that cable television (CATV) is trying to establish itself as a "pay version of free television" that would require Americans to pay a fee to watch the same movies, sports and other programs they now see free.

It made the statement in comments filed with the Federal Communications Commission in urging early adoption of anti-siphoning rules for all CATV originations and stricter limitations on CATV's presentation of feature films and sports.

Despite CATV promises of a "bright new source of program diversity and local self-expression," NAB said, it is now clear that CATV instead is "insinuating itself into the world of wired pay-TV" where it would offer for a fee the basic programming tools of free TV.

"If anyone has any doubts as to what is up CATV's sleeve," NAB said, "there is ample documentation of the fact that CATV is quietly girding itself, not as a source of new program material for the subscribing American public, but as a direct carbon copy of free television's program service."

"The time has come for CATV to stop playing games with the commission and insisting with a straight face that it has no interest in the program."



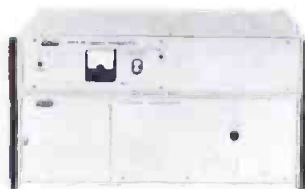
Down With Co-Channel Interference.

Tracor's 6500 Visual Carrier Generator System is available "on frequency." Or with a $\pm 10,010$ Hz offset. Unattended, it keeps your station within .05 Hz per year. Frees your engineers from slavery. Provides larger audience with better reception. FCC approved, this rubidium-based system is already in wide use.

For the inside story, call (512) 926-2800 today. Or write,

Tracor Inc., Industrial Instruments,
6500 Tracor Lane, Austin, Texas 78721

TRACOR
Free-The-People
Box.



For More Details Circle (22) on Reply Card

Memo to Consulting Engineers

Broadcast Engineering's "Professional Services Section" is your most economical and effective way to display your Professional Card.

- **LOW MONTHLY RATES**
\$16 per monthly issue, 12 or more times
\$18.50 per monthly issue, 6-11 times
\$21 per monthly issue, 5 or less times
- **REACH ALL PROSPECTS**
Greater at-station circulation: FM, AM and educational radio; TV, ETV, CCTV and CATV; recording studios.
- **MORE AD SPACE**
Your Professional Card in BE is a full column wide!



TR-E2
FM/SCA
EDUCATIONAL
RECEIVER

a moderately priced crystal controlled sca receiver designed specifically for educational broadcasting and services to the blind; a product which reflects McMartin's recognized multiplex experience.

McMartin

605 NORTH THIRTEENTH ST
OMAHA, NEBRASKA 68102
TELEPHONE (402) 342-2753

For More Details Circle (29) on Reply Card

SCA RECEIVERS

Why pay the contestants fees?

The National Association of Broadcasters has opposed as "crippling" and "regressive" any government rule or policy that would sanction station payment of consultancy fees to groups contesting broadcast license renewals.

In comments filed with the Federal Communications Commission, NAB warned that such action would constitute "an open invitation to a wide range of diverse and conflicting groups to seek such consultancies" in filing — and often settling for a price — competing applications or petitions to deny.

"It would be myopic to assume that citizen participation will stop with a few minority groups and the women's liberation movement if there are advantages to be gained," it said. "The Commission is dealing with merely the tip of the iceberg. . .

"What is good for one group of citizens is good for another Homosexuals have entered the arena in California. Every national origin or ethnic group in the country is a potential petitioner. . .

"If the squeaky wheel is to get oil via paid consultancies, a station could find itself knee deep in consultancies resulting in a prohibitive overall price tag and a babble of voices which would defy description."

NAB said consultancies "were spawned by . . . a blatant and arrogant abuse" of the 1966 court ruling in a case involving station WLBT, Jackson, Miss., which granted citizen groups the right to file petitions with the FCC to deny renewal of a station's license.

"Stations were largely at the mercy of petitioners who worked their little blackmail game with increasing dexterity," it said. "... With few exceptions, citizens groups have capitalized on the use, or threatened use, of the petition to deny to wrest control of programming from stations, dictate employment quotas, force the naming of selected individuals to stations' board of directors, obtain free advertising for minority businesses, and a host of other concessions in areas which are the sole province of the licensee. . .

"The price of getting a group 'off your back' was to enter into an agreement and commit yourself to certain specified demands.

"The same tactics were employed in (license) transfer and assignment cases and the bigger the sale price the greater the 'hold up' price."

Noting that petitioners quickly realized money is involved in the process, NAB said many of them turned to consultancies "as a

means of financing their activities. If enough "agreements" with stations could involve paid consultants, it said, "the groups could become self-sustaining at the expense of the very people being extorted."

NAB Hits Pay TV

The National Association of Broadcasters has opposed as "manifestly improper" a request by Theatre Vision, Inc., for a waiver of anti-siphoning rules so it can use 20 feature films in a programming "test" on a CATV system in Sarasota, Fla.

NAB told the Federal Communications Commission that if it grants the request "all pay-TV operators will seek waivers in order to obtain programming with more mass appeal."

"This chipping away process," it said, "will only be complete when pay-TV is firmly entrenched and has wrapped up great quantities of the mass appeal programming now enjoyed by the public via free TV."

Engineer Fined

A First Class Radiotelephone Operator employed by a Norfolk, Va. Station had his license suspended for 30 days by order of the FCC Field Engineering Bureau, for willful violation of Section 73.111(a) of the Rules by making false entries in the station's technical logs.

An investigation by FCC Field engineers revealed that the engineer who was responsible for making certain transmitter inspections and antenna current readings at the transmitter site when the station was operating by remote control, had failed to take the readings. He had, however, entered data in the station logs and records indicating that the readings were made. The suspension prohibits him from carrying out any of the functions requiring a First Class Radiotelephone Operator's license.

"FIVE" MIXER AUDIO CONTROL console

B-500 series

the B-500 monaural

\$750

the B-502 stereo

\$1050

B-503 dual channel

\$950

For complete information
please contact
the Director of Sales
Dept B-50



McMartin MCMARTIN INDUSTRIES INC., 605 NORTH THIRTEENTH STREET
OMAHA, NEBRASKA, 68102 TELEPHONE (402) 342-2753

For More Details Circle (43) on Reply Card



**"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

"We're an all-news station.
Cartridges are one
of our basic tools.
A substantial portion
of our programming
is on carts."

"We've got to be able
to depend on them."

"We use Audiopaks exclusively.
Our people prefer them."

"A few years ago,
we had a problem with
cartridges. We talked
to the Audio engineers.
We worked with them
to come up with
the present Audiopak.
We're happy with it."

"With a weekly audience
of 2,305,800 (according
to the latest ARB),
we'd better have
dependable cartridges."

**New
Audiopak® A-2
Broadcast
Cartridges**

Devices, Inc.
Audio Industries Company
Research Drive
Frank, Conn. 06806

www.americanradiohistory.com

Radio and TV re-regulation begins to pay off

By Marvin Blumberg*

The Commission has opened its program of radio and TV "re-regulation" by revising seven rules governing radio and television broadcasting. This represents the first concrete step in a planned general revision of the rules, as part of a comprehensive study announced in a Public Notice dated April 6, 1972.

Both engineering and non-engineering requirements are affected. In the technical area, the rule changes relax the frequency of meter readings, the interval be-

* A.D. Ring & Assoc., Washington, D.C.

tween transmitting equipment inspections, and operating and maintenance log requirements. In non-technical areas, the changes relax requirements for station identification, notification of re-broadcast consent, mechanical reproduction announcements, and for filing certain contracts specified in Section 1.613 of the Commission's Rules.

The table (see box) gives details of the rule changes, and summarizes each requirement both before and after the revision. In every case the new rules represent a significant relaxation of previous re-

quirements. The new rules are effective December 15, 1972.

The changes are the work of a special Task Force under the supervision of Commissioner Richard E. Wiley. Wallace E. Johnson, Chief of the Broadcast Bureau, heads the study group, which includes three experienced members of the Commission's staff assigned fulltime to the project.

The Task Force is continuing its work and further rule changes will be made as its studies progress. Each rule will be examined in light of its intended purpose and current technology. In addition to relaxing

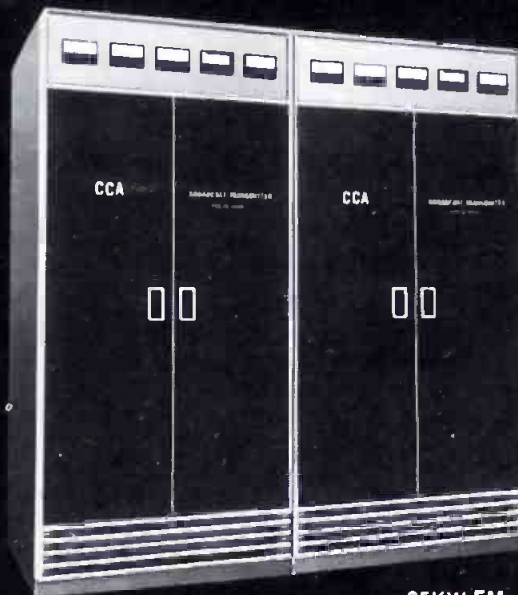
News Flash: Two of these rules were further changed at press time. Please See Direct Current, Page 4.

Summary of Rule Changes*

	Requirement Before December 15, 1972	Requirement After December 15, 1972
1. Meter Readings (AM,FM,TV)	Read and entered into operating log at beginning of operation and at intervals of 30 minutes or less.	Read and entered into operating log at beginning of operation and at intervals of 3 hours or less.
2. Transmitting Equipment Inspection (AM,FM)	Inspection once a day, five days a week, at intervals of not less than 12 hours between inspections.	Inspection at least once a week, with an interval of not less than five days between inspections.
3. Operating Log & Maintenance Log (AM,FM,TV)	Separate operating log and maintenance log required.	Combined operating log and maintenance log permissible on same sheet in one technical log.
4. Station Identification (AM,FM,TV)	Station identification at beginning & end of operation and within 2 minutes of hour and half-hour for AM and FM; within 2 minutes of hour for TV.	Station identification at beginning and end of operation and, hourly, as close to hour as feasible, at a natural break in program.
5. Rebroadcast Program of another broadcast station (AM,FM,TV)	Requires consent of originating station and Commission authority or notification of consent.	Requires consent of originating station but no Commission authority or notification of consent. Written consent to be made available to Commission only upon request.
6. Mechanical Reproduction (AM,FM,TV)	Daily announcements required indicating that some network programs were taped for later rebroadcast. Complex rules concerning announcements required to avoid misleading the public.	Daily announcements that some network programs were taped for later rebroadcast eliminated. No requirement on taped, filmed, or recorded announcements which are commercial, promotional or public service in nature. Simpler rule concerning announcements required to avoid misleading public.
7. Contracts (AM,FM,TV)	Copies of contracts with time brokers, SCA operations and time sales over 4 hours daily to same sponsor must be kept on file at station and filed with Commission.	Copies of contracts with time brokers, SCA operations and time sales over 4 hours daily to same sponsor are to be kept at station (not filed with Commission). Must be available for inspection upon request.

*Refer to the Rules for complete explanation.

YOUR BEST COMBINATION FOR FM COVERAGE!!



25KW FM

CCA offers a complete line of field proven FM transmitters from 10 watts to 50KW. Features include 75% plate circuit efficiency, minimum tube life 10,000 hours with zero bias triodes, 65 db signal to noise, distortion less than 0.3%.



CCA TRUE CIRCULAR ANTENNA

CCA circular antennas are available in low and high power versions with antennas from one bay to 16 bays. Null fill and beam tilt together with radomes permit the broadcaster to obtain coverage where he desires with reliability.

CCA ELECTRONICS CORPORATION
GLOUCESTER CITY, NEW JERSEY 08030 • (609) 456-1716

Canadian Subsidiary:

CALDWELL A/V EQUIPMENT CO., LTD.
1080 BELLAMY ROAD, NORTH
SCARBOROUGH, ONTARIO, CANADA
Phone: (416) 291-5595
NO. 1 AM & FM

revising rules by simple Commission Order in non-controversial areas, as was done for the seven rule changes already made, the Commission will issue Notices of Inquiry or Proposed Rule-Making where substantive changes would be involved. This procedure is required by the Administrative Procedure Act; comments will be requested from all interested parties in these cases.

The Task Force will not — in fact, cannot — get involved in problems of a controversial nature which are already in docket. These include such matters as the FM "freeze", the Fairness Doctrine, license renewal, and the use of AM clear channels.

Priority for further study is being given to rules governing automatic transmitters, directional antennas, and proof of performance requirements. Other related areas will be reviewed to determine the validity of current rules. FCC application and renewal forms will be studied, to determine whether the information requested is necessary and pertinent, or whether the format may be simplified.

Many of the broadcast rules were promulgated in the early days of radio broadcasting; the Task Force is finding that many of these rules are no longer pertinent and should be revised or eliminated based upon subsequent experience and current technology.

The Commission's Task Force is relying heavily upon input from interested broadcasters for its ideas. The initial changes being made reflect the ideas contained in some 500 letters from broadcasters all over the country. All members of the industry and other interested parties are urged to send in comments and constructive suggestions. These letters can be quite informal and only a single copy is necessary. The address is:

Broadcast Bureau
Re-Regulation Task Force
Federal Communications Commission
Washington, D.C. 20554
Keep those letters coming!

Radio and TV re-regulation begins to pay off

By Marvin Blumberg*

The Commission has opened its program of radio and TV "re-regulation" by revising seven rules governing radio and television broadcasting. This represents the first concrete step in a planned general revision of the rules, as part of a comprehensive study announced in a Public Notice dated April 6, 1972.

Both engineering and non-engineering requirements are affected. In the technical area, the rule changes relax the frequency of meter readings, the interval be-

* A.D. Ring & Assoc., Washington, D.C.

tween transmitting equipment inspections, and operating and maintenance log requirements. In non-technical areas, the changes relax requirements for station identification, notification of re-broadcast consent, mechanical reproduction announcements, and for filing certain contracts specified in Section 1.613 of the Commission's Rules.

The table (see box) gives details of the rule changes, and summarizes each requirement both before and after the revision. In every case the new rules represent a significant relaxation of previous re-

quirements. The new rules are effective December 15, 1972.

The changes are the work of a special Task Force under the supervision of Commissioner Richard E. Wiley. Wallace E. Johnson, Chief of the Broadcast Bureau, heads the study group, which includes three experienced members of the Commission's staff assigned fulltime to the project.

The Task Force is continuing its work and further rule changes will be made as its studies progress. Each rule will be examined in light of its intended purpose and current technology. In addition to relaxing

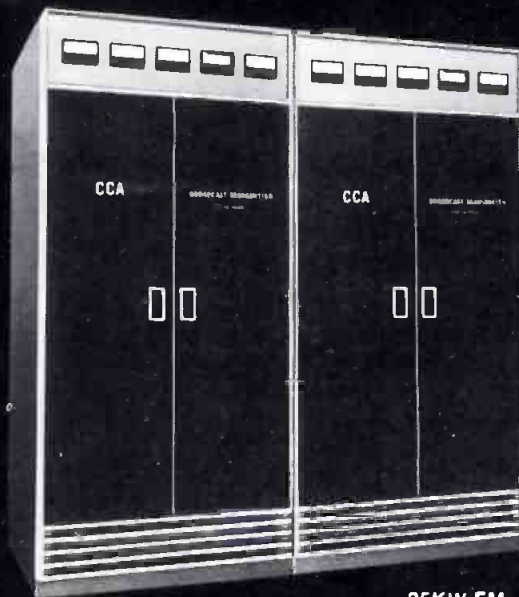
News Flash: Two of these rules were further changed at press time. Please See Direct Current, Page 4.

Summary of Rule Changes*

	Requirement Before December 15, 1972	Requirement After December 15, 1972
1. Meter Readings (AM,FM,TV)	Read and entered into operating log at beginning of operation and at intervals of 30 minutes or less.	Read and entered into operating log at beginning of operation and at intervals of 3 hours or less.
2. Transmitting Equipment Inspection (AM,FM)	Inspection once a day, five days a week, at intervals of not less than 12 hours between inspections.	Inspection at least once a week, with an interval of not less than five days between inspections.
3. Operating Log & Maintenance Log (AM,FM,TV)	Separate operating log and maintenance log required.	Combined operating log and maintenance log permissible on same sheet in one technical log.
4. Station Identification (AM,FM,TV)	Station identification at beginning & end of operation and within 2 minutes of hour and half-hour for AM and FM; within 2 minutes of hour for TV.	Station Identification at beginning and end of operation and, hourly, as close to hour as feasible, at a natural break in program.
5. Rebroadcast Program of another broadcast station (AM,FM,TV)	Requires consent of originating station and Commission authority or notification of consent.	Requires consent of originating station but no Commission authority or notification of consent. Written consent to be made available to Commission only upon request.
6. Mechanical Reproduction (AM,FM,TV)	Daily announcements required indicating that some network programs were taped for later rebroadcast. Complex rules concerning announcements required to avoid misleading the public.	Daily announcements that some network programs were taped for later rebroadcast eliminated. No requirement on taped, filmed, or recorded announcements which are commercial, promotional or public service in nature. Simpler rule concerning announcements required to avoid misleading public.
7. Contracts (AM,FM,TV)	Copies of contracts with time brokers, SCA operations and time sales over 4 hours daily to same sponsor must be kept on file at station and filed with Commission.	Copies of contracts with time brokers, SCA operations and time sales over 4 hours daily to same sponsor are to be kept at station (not filed with Commission). Must be available for inspection upon request.

* Refer to the Rules for complete explanation.

YOUR BEST COMBINATION FOR FM COVERAGE!!



25KW FM

CCA offers a complete line of field proven FM transmitters from 10 watts to 50KW. Features include 75% plate circuit efficiency, minimum tube life 10,000 hours with zero bias triodes, 65 db signal to noise, distortion less than 0.3%.



CCA TRUE CIRCULAR ANTENNA

CCA circular antennas are available in low and high power versions with antennas from one bay to 16 bays. Null fill and beam tilt together with radomes permit the broadcaster to obtain coverage where he desires with reliability.

CCA ELECTRONICS CORPORATION
GLOUCESTER CITY, NEW JERSEY 08030 • (609) 456-1716

Canadian Subsidiary:
CALDWELL A/V EQUIPMENT CO., LTD.
1080 BELLAMY ROAD, NORTH
SCARBOROUGH, ONTARIO, CANADA
Phone: (416) 291-5595
NO. 1 AM & FM

revising rules by simple Commission Order in non-controversial areas, as was done for the seven rule changes already made, the Commission will issue Notices of Inquiry or Proposed Rule-Making where substantive changes would be involved. This procedure is required by the Administrative Procedure Act; comments will be requested from all interested parties in these cases.

The Task Force will not — in fact, cannot — get involved in problems of a controversial nature which are already in docket. These include such matters as the AM "freeze", the Fairness Doctrine, license renewal, and the use of AM clear channels.

Priority for further study is being given to rules governing automatic transmitters, directional antennas, and proof of performance requirements. Other related areas will be reviewed to determine the validity of current rules. FCC application and renewal forms will be studied, to determine whether the information requested is necessary and pertinent, or whether the format may be simplified.

Many of the broadcast rules were promulgated in the early days of radio broadcasting; the Task Force is finding that many of these rules are no longer pertinent and should be revised or eliminated based upon subsequent experience and current technology.

The Commission's Task Force is relying heavily upon input from interested broadcasters for its needs. The initial changes being made reflect the ideas contained in some 500 letters from broadcasters all over the country. All members of the industry and other interested parties are urged to send in comments and constructive suggestions. These letters can be quite informal and only a single copy is necessary. The address is:

Broadcast Bureau
Re-Regulation Task Force
Federal Communications Commission
Washington, D.C. 20554
Keep those letters coming!

Transmission Line Installation Tips

By Pat Finnegan*

BE Maintenance Editor

Whether a brand new installation or a replacement for an existing system, the transmission line connecting the transmitter to the antenna requires extra consideration.

Coaxial line used to interconnect the transmitter and antenna usually falls into three types: flexible, semi-flexible or rigid. Diameters of the lines may be as large as 9 inches, and the dielectric may be solid foam or air.

Regardless of the type line used in a particular application, a plan of the installation should be the first step. One would not consider building a new Control Room without a plan, so neither should he build a transmission line system without one. A carefully made plan of the proposed installation will be helpful in selecting the correct amount of materials to do the job.

Typical Flexible Installation

These lines are handled in a different manner than rigid lines. In the first place, the line is usually one complete length cut to the station requirements, flanged on the ends and if air dielectric, pressurized at the factory before shipment. Whether the line is air dielectric or not, the flanges are usually factory installed before shipment. The station may order the lengths required and field install the flanges, but field installation of the flanges on larger diameter line is somewhat difficult.

Since the lines are ordered to correct length and flanged at the factory, it is important that correct measurements of the required lengths are made. For a vertical run that will be installed on the tower, measurements should be taken from an accurate set of blueprints of the tower and antenna, or someone should climb the tower and actually measure along the route the line will run. Allowance must be made in the measurements for bends and for turning corners.

The more accurate the measurement, the easier the installation. Inaccurate measurements will result either in the line being too long or too short, and both can be a problem at the time of installation.

Typical Rigid Installation

Rigid lines are supplied in 20 feet sections. The sections are either bolted or clamped together during the installation. Many pieces of hardware are required. This is where a plan is helpful in making sure that all the necessary items are on hand when the installation day arrives.

The length measurements are not as critical as those of a flexible line, although reasonably accurate measurements should be made. Seldom will any run of line work out to be an even multiple of 20 feet, so at least one section must be shortened.

Beginning the Installation

Flexible Line. Before the installation begins, everything that is required to do the job should be on hand. This will permit work to continue to completion without delays.

The line itself will come on large spools. These spools should be arranged so that the line will roll off the end in normal fashion and not spiral off the end. Some type of axle arrangement should be set up so that as the cable is pulled off, the spool will turn on the axle.

A pulley is attached to the top of the tower or at least above the highest point the line will go. A cable from a winch is run through this and attached to the cable by two or more steel cable hoists. These hoists are spread out so that the total pull is not on one place on the cable. The winch pulls the cable up into place and the cable is attached to a tower leg by steel bands. The hoists are left on the cable and attached to the tower and they become the top mounting supports for the cable.

You might wonder that would happen if the tower should be an AM tower and it has power on it. The answer: plenty! First of all, if

the winch cable is steel, it will get hot with RF energy and the line itself will get hot with RF energy. Both will be hard to handle even with gloves. Because of the long metal lines close to it, the tower will become detuned causing the transmitter to go on a rampage. Whenever the metal cable or the line touches the tower, it will arc and cause noise to be heard on the program that is broadcast. Everyone involved can end up with several RF burns. Antenna power of more than 250 Watts should be considered unworkably hot. The practice is to take the AM station off the air at least during the period the winch cable and line are in place on the tower. Once the line has been rigidly attached at the top and at least a few places down the tower and the cable off, the power may be reapplied. Obviously, the best rule is to cut power.

Flexible line may be either jacketed or bare. If the line is bare and used on an AM tower, it should be bonded at several places to the tower with a good metallic bond. A jacketed cable should be bonded at least a few places on the tower. This bonding will prevent instability of the AM tower tuning and, possibly, noise from arching.

Crossing the AM tower base can be done in two ways. FM antennas may use an isolation unit or an insulated quarter wave section of the line. This quarter wave length is at the AM carrier frequency and is a high impedance at the AM carrier. When an isolation unit is to be used, the line is ordered in two sections, each section flanged on both ends. Installing the line under these circumstances is easier than when using the $\frac{1}{4}$ wave section as isolation. In that installation, the line is in one continuous piece.

Rigid Line

It is more important that all material is on hand before beginning a rigid line installation. Once the work is started, it should be pushed to conclusion as soon as possible so that the open line sections get as little weather into them as possible.

The long and short of it.

First, the long story. That sleek beauty on the left, Eastman 16mm television projector, model CT-500, is the latest in videofilm projector design. Some of its features: channel threading (the first real breakthrough in film transport in many years), rapid forward and reverse, solid-state circuitry for sound reproduction, automatic shutdown at the end of a film, and a tungsten-halogen projection lamp.

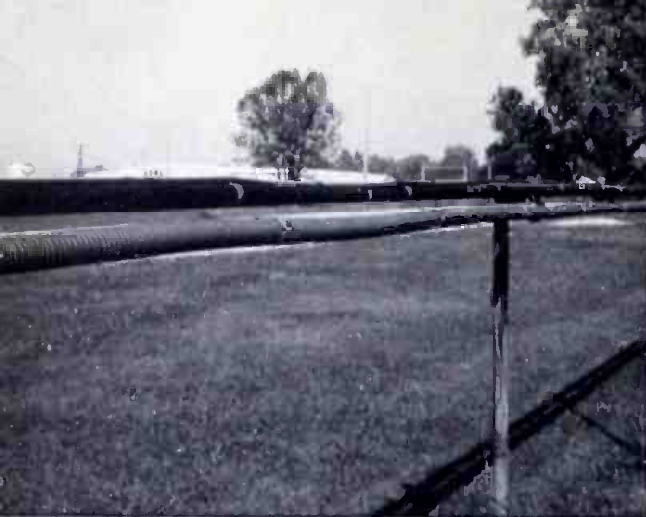
Not that we mean to sell our newest Eastman 16mm videofilm projector short. Model TV-12M6 is ideal for a lower cost videofilm projection system. It offers both magnetic and optical sound playback and magnetic recording. It has a five-blade shutter, twenty-four frames per second, synchronous projection, and is wired for remote control. Of course it has the same extra gentle film-handling system our projectors are famous for. In short, it's long on performance and high on economy.

For full details on either projector, call or write your nearest Kodak Sales Engineering Representative.



EASTMAN KODAK COMPANY ATLANTA: Bob Baker 404/351-6510/
CHICAGO: Dick Potter 312/654-5300/DALLAS: Frank Reinking 214/351-3221/
HOLLYWOOD: John McDonough 213/464-6131/NEW YORK: Dick Schiavo 212/262-
7100/SAN FRANCISCO: Joe Semmelmayr 415/776-6055.





Horizontal run for AM and FM coax. The dark line is jacketed, while the FM line is bare. No protection is needed at this point from the tower, only supports. Lines are banded to supports every three feet.

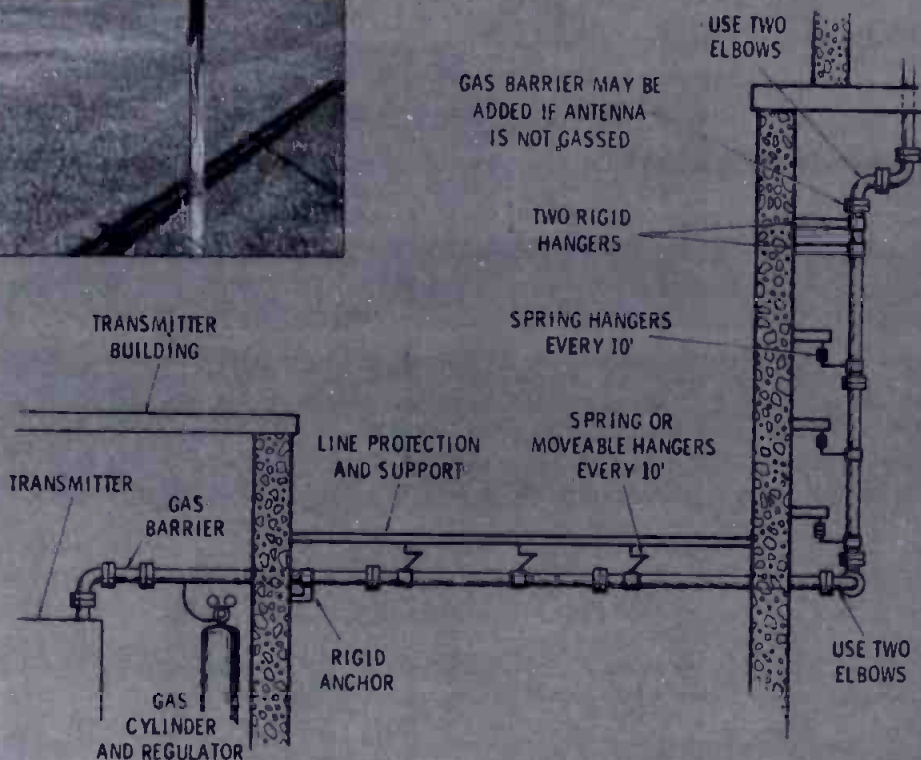


Fig. 1 Typical right line installation plan. It need not be to scale, but all necessary items should be shown and their positions in line.

The horizontal run of line can be done easily by station personnel, whether it be AM runs, FM or TV and either flexible or rigid. However, vertical run on a tower should not be attempted by station personnel because this requires rigging equipment.

Some construction crews like to build the rigid line from the base up to the antenna. I, however, prefer that they build it from the antenna down to the base. Since it is almost always necessary to cut at least one line section, it is best that this short piece be at the base of the tower. Field flange soldering may not be as strong as a factory flange, and should anything happen at a later date, it can be corrected by station personnel without calling in a rigging crew.

Always use two elbows as the line connects to the antenna. Each elbow should have swivel flanges. This arrangement will allow quite a variety of angles to be accommodated as the line meets the antenna. There is also another important advantage in using elbows at this

junction. Should any problems occur at a later date, one man can open and close the line. Should the line run directly into the antenna without elbows, the man would need to loosen the rigid top clamps so the line and antenna could be pulled open. He would not be able to lift the weight of the line to close it up again without rigging equipment.

Fixed hangers are necessary at the top of the vertical run so that they support the line and not the antenna. The line weight could damage the antenna. These hangers also prevent line movement from applying any force to the antenna.

Spring hangers are necessary every 10 feet of line down the tower. These spring hangers will allow movement of the line due to temperature changes but will restrict the movement after the predetermined limits are reached. Where a $\frac{1}{4}$ wave section is to be insulated, these hangers also are available in insulated types.

At the base of the tower, two 90°

elbows with swivel flanges should be used. Again, this makes it easier to open the line and meeting the horizontal run is easier. The line should not be anchored at the base but must be allowed to move.

The horizontal run is also installed with spring or movable hangers so that this section can move with temperature changes which cause contraction and expansion of the line metal. At the building, the line must be anchored with rigid clamps or hangers. The line must not be allowed to move into the building or it can cause damage to the transmitter output equipment. Thus, with the line anchored rigidly at the top and at the building, all the line movement ends up at the base of the tower. Severe temperature changes can cause much line movement. The author has seen a line move 6 inches during frigid weather.

A protection shield should be built over the horizontal run when ice is a problem. This will protect the line from falling ice off the tower as well as tools or other objects

CABLE engineering

in this issue...

Upgrade Your Antenna
System.....CE-2

Industry
News.....CE-5

New
Products.....CE-7



Upgrading your antenna system

By Donald R. Mackenroth*

CATV Systems affect great numbers of people, and a lessening of signal quality that might be ignored by one subscriber is sure to be reported by another. Accordingly, an upgrading or revamping of the antenna system is often de-

*Leo G. Sands & Assoc. N.Y.

sired. This upgrading may also be occasioned by greater interference problems or by the necessity of providing a greater number of channels.

It should be pointed out that it may not be necessary to change antennas. A well-designed antenna

system has few components that will deteriorate with age, and simply cleaning insulators and terminals will often restore an antenna system to its original condition. A program of periodic antenna inspection is highly recommended.

The same is not true, however, of transmission lines. These deteriorate with age and cannot be repaired, and the replacement of older transmission lines with new foam dielectric cables may result in greatly enhanced signal quality without the necessity of changing antennas or servicing front-end amplifiers and converters. A monitoring and recording of signal levels is a good idea. This can allow the technician to see a gradual decline in signal quality that might otherwise go unnoticed.

If results are still unsatisfactory, the front-end amplifiers and converters should next be suspect. These components, particularly tube-type devices, are subject to aging and may need to be serviced or replaced. Newer solid-state devices are designed with higher signal-to-noise ratios than the older equipment, and their utilization may result in greatly improved picture quality.

If periodic inspection of the antennas reveals excessive or continuing corrosion or wind damage (breakage and bending of elements, etc.), a change of antennas may be required. Aluminum antennas are more corrosion-resistant than steel, but are also much more subject to metal fatigue. If aluminum is subjected to a great deal of vibration or bending, it will crystallize and break at the point of stress.

Steel may be used for those installations where stress and fatigue is a problem, but steel also has attendant problems of being of greater weight and higher cost than aluminum. Stainless steel alloys and plated steel are used by some manufacturers, but these alloys are difficult to machine and produce an antenna that is both heavy and expensive.

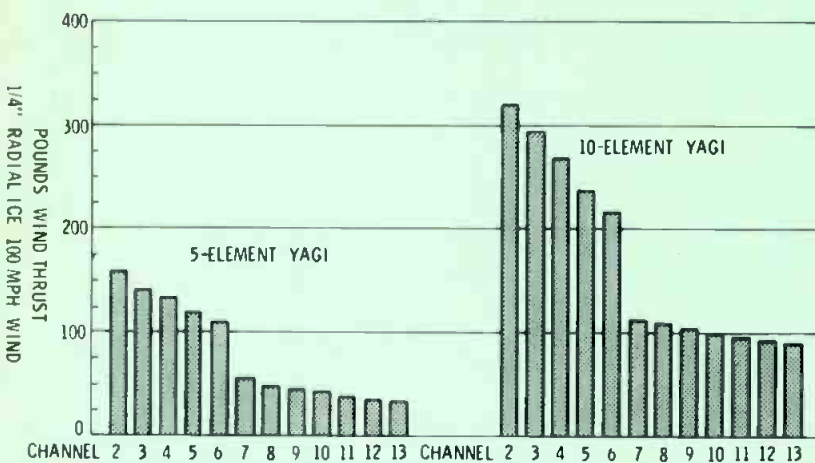


Fig. 1 Graph of wind thrusts on 5-element and 10-element yagi antennas with 1/4-inch elements and 1/4-inch of radial ice.

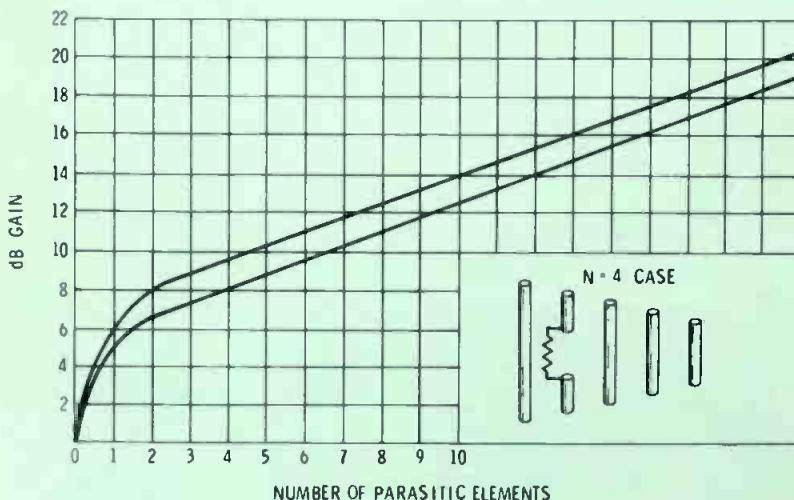


Fig. 2 Gain of yagi antennas versus number of elements.

INTRODUCING THE ALL NEW... DITCH WITCH R30 ...MORE THAN A TRENCHER!

The **R30** is the all-new 30-horsepower trencher from **DITCH WITCH**. But it's much more than a trencher. It's got more to give you more for your equipment dollar. The **R30** incorporates the ultimate in trencher design — what we call the modular concept. In the **R30** you get a basic trencher vehicle that's the most rugged and dependable in its class. And there's a selection of optional modular attachments that are quickly and easily interchangeable. You pick the modular set-up to fit **YOUR** needs. Put a utility backhoe on the front and a vibratory plow attachment on the back. Add the new Pavement Breaker. Or a front-end loader or a clean-sweep broom. The **R30** gives you more versatility than anything in its class. Let us provide you with more information on the new **R30**. Better yet, we'd like to bring one to your job site and demonstrate it for you. We think once you've seen the **R30** in action, you'll agree that it is more than a trencher.



PAVEMENT
BREAKER

UTILITY BACKHOE

FRONT-END LOADER

BROOM

VIBRATORY PLOW



A Division of

CHARLES MACHINE WORKS, INC. P.O. Box 66 Perry, Oklahoma 73077

For More Details Circle (38) on Reply Card

www.americanradiohistory.com

CE-3

*Special from
Sadelco!*



INSTALLERS CATV METER MODEL FS-733

2 Units @ 199.50
each

A real CATV Meter.
Reads Adjacent Channels.
Covers 2 to 13 in one continuous range.
Plus or minus 2 dB or better.
Indicates average signal level.
UHF tuner or low frequency adaptor
can be added later when required.

*Special from
Sadelco!*



PROFESSIONAL CATV METER

MODEL "FS-3 SPECIAL"
VHF ONLY 54-216 MHz

2 Units @ 299.50
each

HIGH ACCURACY: ± 1.5 dB or better
INDICATES PEAK LEVELS
READS ADJACENT CHANNELS

Built to the same high quality standards
as our regular FS-3 Series but does
not have the extra UHF or Super-Band
tuner. (Either a UHF tuner or Super-
Band tuner can be factory added at a
later date if required.)

Will work with our Low Frequency
Adaptor, extending range down to 5
MHz.

For Complete Information Write or Phone:

SADELCO Inc.

299 Park Ave., Weehawken, N. J. 07087
(201) 866-0912

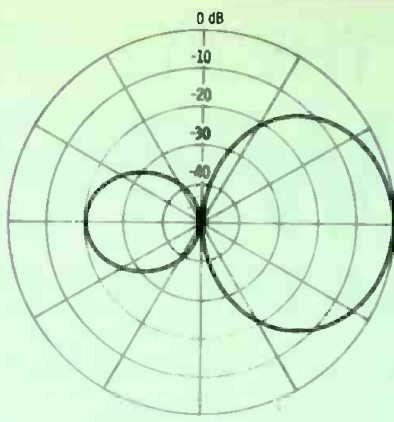


Fig. 3 Horizontal pattern of a 5-element yagi.

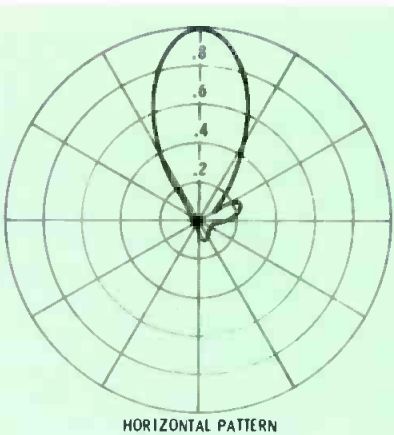


Fig. 4 Horizontal pattern of a 10-element yagi.

SIGNAL LOSSES PER 100' OF CABLE AT SELECTED FREQUENCIES

	100	150	200	400	1000
	MHz	MHz	MHz	MHz	MHz
RG-11	2.2	2.7	3.2	4.7	8.2
.412"	.96	1.2	1.5	2.4	4.0
.500"	.76	1.0	1.2	1.8	3.5
.750"	.58	.70	1.0	1.5	2.5

Table 1 Signal losses per 100 feet cable for different types of cable.

EXAMPLE:

SPACING OF ANTENNAS FOR CANCELLATION
OF UNWANTED SIGNALS.

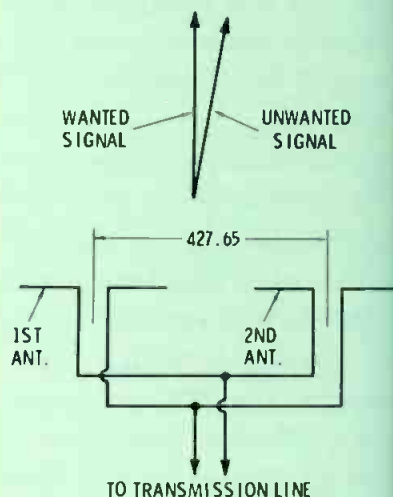


Fig. 5 Spacing of antennas for cancellation of co-channel interference. (Data courtesy of Scala Radio Corp.)

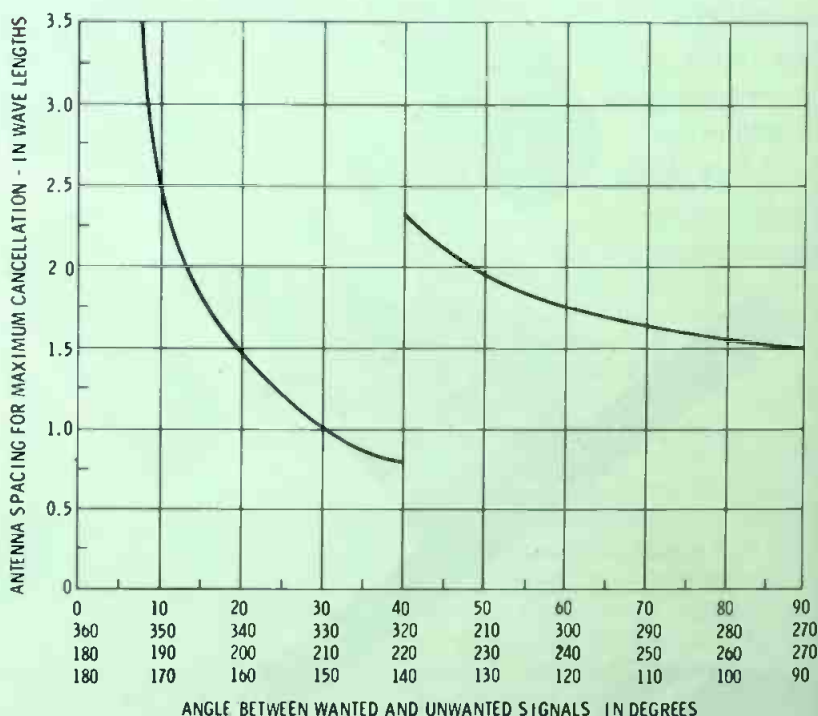


Fig. 6 Graph of angle of unwanted signal versus antenna spacing for maximum cancellation.

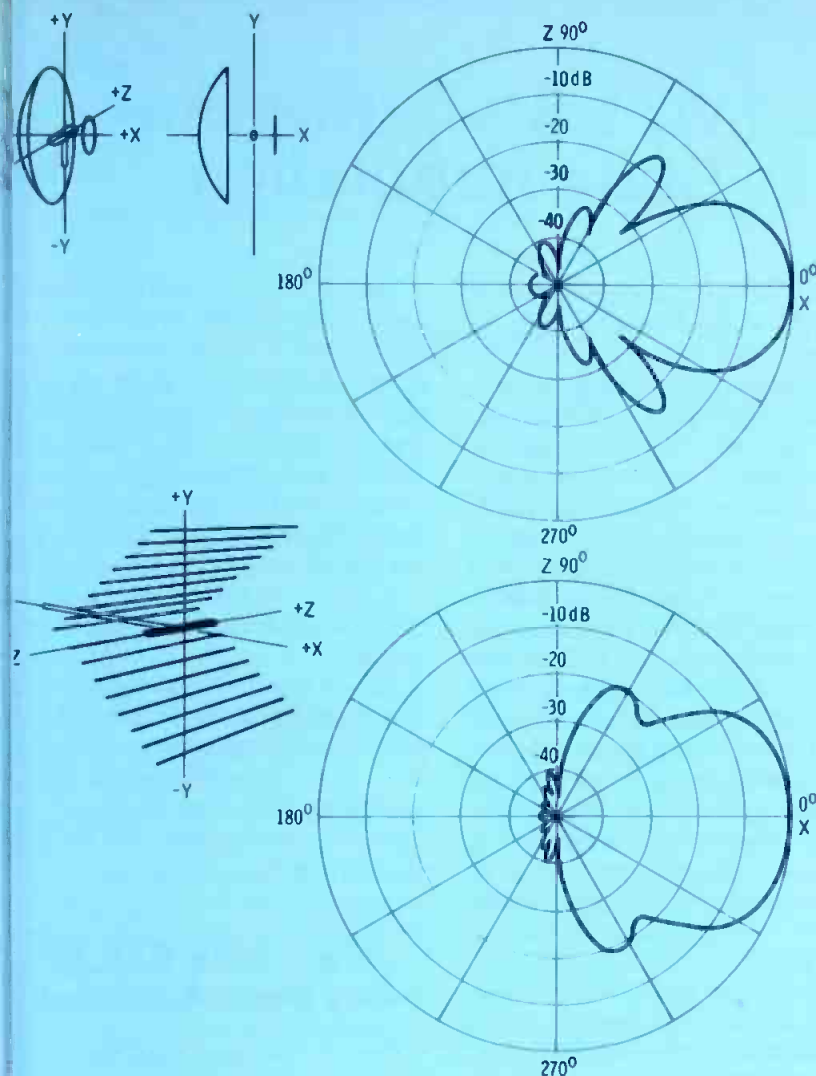


Fig. 7 Parabolic antenna and corner reflector antenna and their horizontal polar patterns.

Weather Problems

When an installation is exposed to particularly severe conditions, reducing the number of elements also reduces the surface presented to the wind and ice. As can be seen in Figure 1, a table of wind loads on Yagi antennas with 3/4-inch elements and 1/4-inch of radial ice, the stress on a 10-element Yagi, particularly on the lower channels, is much greater than that on a 5-element Yagi. Yagi antennas are also subject to severe detuning due to ice and snow, and for locations where this is a problem, the use of long periodic antennas is recommended, since these arrays have more stable characteristics under the above conditions than do Yagi antennas.

If antenna requirements have changed because of co-channel in-

terference or because the bandwidth response is not flat enough for color reception, it may be necessary to change the array. Figure 2 shows that adding parasitic elements in an array generally increases gain (although not always linearly—hence the two limits on the curve). We see by comparing the horizontal pattern of a 5-element yagi (dipole, reflector, and three directors) in Figure 3 with the horizontal pattern of a 10-element Yagi (Figure 4) that not only is gain increased by about 5 dB., but directivity is also enhanced. However, the added directivity and gain are achieved at the cost of a narrower bandwidth, and this in itself can prove to be a problem, particularly on the lower channels, due to the flatness required for a good color signal. Thus an antenna array

that provided a bandwidth of 2.5 percent would mean that the bandwidth would be 5.3 MHz. at 213 MHz., Channel 13, but only 1.4 MHz. on Channel 2.

Antenna Stacking

A variety of problems may also be alleviated by stacking antennas. Gain may be improved a great deal, and more specific problems, such as co-channel interference or noise from a particular direction, may be cured by studying the polar patterns of different types of arrays and then choosing the pattern that best suits the needs of a particular system. Scala Radio Corporation (1970 Republic Avenue, San Leandro, Ca., 94577) has done a great deal of research, both theoretical and practical, into the polar patterns that result from the stacking of antennas, and a series of reprints on the practical aspects of antenna installation is available from them.

Interference

Many techniques are available for the reduction of interference and the improvement of gain. One of these is the use of collinear antennas to reduce or eliminate co-channel interference. In this technique, two identical antennas are pointed so that the waveform of the desired signal arrives at each at the same time (hence the two signals are additive), but spaced so that the unwanted signal arrives out of phase at the second antenna, and is therefore cancelled. This cancellation is achieved by first computing the angle of the unwanted signal to the desired signal (Figure 5). This angle is then located on the graph (Figure 6), and the point where its axis intersects the curve will indicate the spacing in wavelengths necessary between the two antennas. To convert from the spacing in wavelengths to the spacing in inches, divide the frequency in MHz of the TV Channel into 11803, and multiply the result by the spacing in wavelengths shown on the graph for the particular angle in question.

If, for example, there is co-

TVC's Stern Knocks State Regulation

channel interference on Channel 4 (the center frequency of Channel 4 is 69 MHz) at 10° away from the desired signal, an examination of the graph shows that this would be 2.5 wavelengths. Dividing the frequency of Channel 4, 69 MHz, into 11803 gives 171.06 inches. Multiplying this by 2.5 gives the required spacing for maximum cancellation, 427.65 inches from the center of one antenna to the center of the other.

That is:

$$\begin{aligned} 2.5 \text{ wavelengths times } \frac{11803}{69 \text{ MHz}} = \\ 2.5 \text{ times } 171.06 \text{ inches} = \\ 427.65 \text{ inches} \end{aligned}$$

With the utilization of most of the existing VHF channels, CATV must often turn to UHF for expansion of their facilities, and the use of these higher frequencies may cause problems that were not already in evidence. Transmission line losses are greater (See Table 1), and provisions may need to be made for higher gain antennas and more efficient front-end equipment.

On UHF Frequencies

In UHF work, certain techniques are possible that might not have been available at VHF frequencies. For example, although the physical size of corner reflector and parabolic antennas prohibits their use in many VHF installations, the smaller size of these arrays when used for UHF work allows may make them ideal in some applications. They offer excellent gain, about 10 dB over that of a dipole for the corner reflector and 12.5 dB over a dipole for the parabolic, as well as good bandwidth and directivity (See Figure 7).

The importance of a good, clear signal to the system cannot be overstressed, and the good CATV engineer will look to the upgrading of the antenna network as a key to the improvement of performance throughout the entire system. In doing so, he must determine if the existing network is delivering its best possible performance, and then he must decide whether that performance is, in fact, good enough.

"The long-range consequences of state CATV regulation could be so onerous as to wipe out any immediate benefits the cable television industry may reap," Alfred R. Stern, chairman and president of TeleVision Communications Corp. (TVC), told an audience of CATV system operators in Pennsylvania.

Speaking before the fall meeting of the Pennsylvania Cable Television Association in Lancaster, Pa., Stern called upon CATV system operators to "take a long, hard look at what the addition of state control could mean to an industry which is already regulated on both the local and federal levels. We must ask ourselves whether we really can serve not one, not two, but three masters and still maintain a viable communications service for the public."

In citing the problems of three tiers of government control, Stern denounced the utility-type rate-of-return regulation which might be imposed on cable television systems under a state's control, saying that "such rate calculation ignores the realities of a market-limited industry which is still in a relatively high-risk, innovative stage of growth."

"Should the trend towards state regulation of cable TV accelerate," Stern continued, "it will be increasingly difficult to achieve the uniform national policy which is required if we are to play a key role in shaping the wired cities of the future. The role of cable television as a major force in a national communications web could be seriously hampered, if we are shackled with 50 different state regulatory policies throughout the land."

Speaking before the Financial Analysts Federation Fall Conference in Cincinnati, Ohio, Stern referred to the Federal Communications Commission's requirement that certificates of compliance be obtained before new systems commence operation and before new signals are added to existing systems.

"With 1400 applications already filed, and only 300 acted upon, we have 1100 CATV operators and potential operators still in a holding pattern and unable to proceed with their planned service," Stern said. "While we appreciate the attention being given this knotty problem by the Commission, we nevertheless are faced with a crucial situation and must strongly urge a better solution than anything we've seen to date."

TeleVision Communications Corporation, a wholly owned subsidiary of Warner Communications Inc., is the nation's second largest cable television systems owner and operator, serving over 375,000 subscriber homes.

State Rule-Part 76 Has Been Amended

Part 76, Subpart B of the Cable TV rules (procedures) has been amended by the FCC to emphasize that where the State has authority over Cable TV it must be served with copies of the application for certificate of compliance even where that authority is in dispute.

The Commission pointed out that in Par. 117, **Reconsideration of Cable Television Report and Order**, (FCC 72-530, 36 FCC 2d 326, 366, July 14, 1972) it had discussed the subject of disputes between franchising bodies and had stated that compliance applications should be served on each of the bodies involved in the dispute. Since several states have set up bodies with the authority to regulate cable television, including the jurisdiction of confirming or denying locally granted franchises, the Commission concluded that certain editorial changes were needed to insure that applicants would understand the proper procedures to follow.

For more details about products in this issue use free readers service card in the back of this issue.

NEW PRODUCTS

See circle number on reader service card for further information.

One-tube Cameras

Cohu, Inc., Electronics Division, San Diego, California, has introduced three new single tube color television cameras. Identified as the 1200 Series, these TV cameras offer the market a choice of configurations suitable for a variety of applications.

The Model 1210 is designed for remote operation as an inexpensive film chain. The Model 1220 is packaged in an environment-resistant housing making it an ideal camera for surveillance use.

The Model 1230 was developed to meet the needs of educators, CATV operators and industry for a low cost color studio viewfinder camera. Each of the three cameras uses the same basic circuit design with single inexpensive separate fresh vidicon tubes for economical cost and maintenance.

The Model 1230 Camera is similar to the Model 1210 Camera with the addition of a built-in 5" viewfinder and an amplified intercom with program audio capability. All versions have identical modular circuitry. The color video outputs are

NTSC type, and conform to RS-170 scanning standards. All models of the Cohu 1200 Series Single Tube Color Television Cameras operate in conjunction with a Model 1290 Camera Control Unit.

The 1290 CCU is available with a pulse generator for use with your present synchronous systems when the camera is to be externally driven or provided with an RS-170 sync generator. The sync generator will supply all of the camera requirements and also provide sync, blanking and subcarrier outputs to drive associated equipment. The pulse generator is used when these same signals are available as inputs.

For More Details Circle (90) on Reply Card

Envelope Delay Measuring System

An envelope delay measuring system, in the frequency range of 0.1 to 10 MHz for the video modulator and 25 to 250 MHz for the RF modulator, is available from Telemet Company, Division of Geotel Inc.

The unit has everything in one box and that includes a low harmonic content sweep generator. Accuracy is said to be excellent, with delays of ± 30 nanoseconds to ± 1000 nanoseconds measured in four ranges, and resolution of 2 nanoseconds achieved.

The test signal can be generated with inserted sync and blanking pulses allowing the user to measure envelope delay in clamped circuits. For this, no external sync generator is required.

Readout can be seen on a front panel meter that provides point by point measurements, while a scope-jack offers the opportunity for continuous sweep display.

For More Details Circle (91) on Reply Card

Program Automation System

TeleMation Inc., has unveiled the production of its T-MATIC Program Automation System.

T-MATIC is designed to provide automatic programming of multiple cassette tape players for industry, education, CATV, MATV and entertainment industries. It sequentially operates a series of videocassette players or other program sources automatically. Each T-MATIC console combines Sony U-Matic® Videocassette players with TeleMation manufactured control equipment. Up to six machines can be sequenced by one control chassis.

The advantage of a T-MATIC system to cable operators or hotel

Marketing Workshop Transcript Available From NCTA

"The Selling of Cable Television: 1972," the official transcript of NCTA's first annual marketing workshop, is now available from the association.

The 368-page publication is the first comprehensive compilation of information in paperback form on the current state of marketing cable television. The transcript is available at the following rates: NCTA members and associates — \$1.95 per copy; non-members — \$2.95 per copy; bulk orders of 35 or more copies — \$1.50 per copy.

The first marketing workshop was held July 20-22 in Denver, Colorado. The transcript contains

panel discussions by industry leaders and question and answer sessions on 13 cable television marketing subjects. They include: direct mail and printing, advertising, marketing a top-100 market system, direct sales, telephone sales, marketing pay-cable and two-way services, handling disconnects, commercial marketing, and the public relations/marketing interface.

Copies of the transcript can be ordered by sending a check or money order to: Marketing Workshop Transcript, National Cable Television Association, Inc., 918 Sixteenth Street, N.W., Washington, D.C. 20006.

Send Your News On Non-commercial Broadcasting

To Our Editors For Better Coverage

Broadcast Engineering
1014 Wyandotte
Kansas City, Mo.
64105

managers, for example, is its ability to run for hours unattended. According to TeleMation President Lyle O. Keys, a person with no technical training can handle any T-MATIC operational requirement. All that is needed to start several hours of programming is the loading of the cassettes and starting the system in operation.

T-MATIC switches automatically from one machine to another. As one program ends, another machine is switched on the program channel. Commercial announcements which are loaded onto a separate cassette can be inserted into program material, followed by an automatic return to the original programming.

For More Details Circle (92) on Reply Card

Seven-Port Amplifier Housing

Theta-Com CATV has developed a seven-port amplifier housing specifically designed for use on dual cable two-way CATV trunkline systems with single cable distribution.

The amplifier housing accommodates AGC or MGC amplifier modules, 2- or 4-output bridgers and the necessary filters to direct forward and reverse signals.

Primarily developed for use on Focus Cable's Oakland, Ca. dual-trunk system, the amplifier will transfer reverse signals from the "A" trunk to "B" trunk through a coaxial jumper. Theta-Com's XR2AB4-7 seven port amplifier will be on display at the NCTA Convention. Theta-Com, a division of Theta-Com of California, was formerly Kaiser CATV.

For More Details Circle (93) on Reply Card

Tape Products

An extensive line of products for educational broadcasters, including Scotch brand U-Matic videocassettes, was shown by 3M Company's Magnetic Products division, at the 1972 National Association of Educational Broadcasters meeting here Oct. 29-Nov. 1.

Compatible with Wollensak, Sony and all other U-Matic videocassette systems, the Scotch brand units are loaded with 3M's cobalt-energized "High Energy" $\frac{3}{4}$ -inch back-treated helical video tape.

The videocassettes are available in 10-, 20-, 30-, 40-, 50- and 60-minute configurations. Write-on videocassette labels and reversible storage case labels provide space for indexing and identification. The units also provide a removable record lock-out button which prevents accidental erasure.

For More Details Circle (94) on Reply Card

Two-Way Distribution Amplifiers

Scientific-Atlanta has introduced a complete line of two-way distribution amplifiers. The Series 6500 Amplifier line employs hybrid integrated circuits in all units. Downstream signals are transmitted in the 54-300 MHz band while upstream signals are transmitted between 5-108 MHz. A single housing contains all circuit modules including forward and return amplifiers, bridging amplifier, dual-pilot AGC, and power supply.

Unique packaging techniques enable the amplifier housings to be opened in either direction with respect to signal flow. Output connectors may be located in a manner to eliminate cable loops for pedestal mountings.

For More Details Circle (95) on Reply Card

Two-Way Broadband Communications

Ameco, Inc. has developed a unique two-way broadband telecommunications system. Called "METRO-COM", this system is already providing several new improvements to cable television signal transportation and distribution.

METRO-COM is based on the principle of converting off-air and micro-wave TV and FM signals to the lowest VHF frequencies (6-48 MHz) and transporting them to distribution points. In addition to this, there are two applications of METRO-COM distribution. The first utilizes METRO-COM UNIVERTORS at distribution points to reassign the signals to conventional VHF frequencies interfacing with regular, single or dual trunk systems.

The second carries signals in the 6-48 MHz range directly to the customer through the use of Ameco-patented Area Distribution Cen-

ters and customer set-top Channel Selectors avoiding the use and expense of conventional set-top converters.

"There are many advantages to these METRO-COM systems", a company spokesman stated. "Not only can they be installed with complete flexibility in high density (top-100-type) markets and for tying multiple population centers together, but they can transport signals for extremely long distances with absolute minimum degradation."

"The two-way channel capacity of a METRO-COM system is unlimited in both forward and reverse directions", he adds. "And, because there are fewer amplifiers in the trunk, this allows for longer amplifier cascades for distribution."

For More Details Circle (96) on Reply Card

Trunk Amplifier

The Super-Band Challenger Mark V, providing versatility and flexibility in a single housing, is introduced by AEL Communications Corporation (AELCC), the CATV subsidiary of American Electronic Laboratories, Inc. (AEL).

Utilizing the latest push-pull, hybrid integrated circuits, the Mark V Trunk Amplifier is designed for either single or dual cable operation with bi-directional capability available in one of the two cables.

The complete bandwidth of 50 to 300 MHz is available in the forward direction while 5 to 32 MHz can be carried in the reverse. This bi-directional RF transmission design feature has a minimal effect on forward transmissions in long amplifier cascades and offers extremely low group delay.

Equipped with bridgers, the Mark V station incorporates functions for distribution from one or both cables and for return signals from bi-directional distribution.

For More Details Circle (97) on Reply Card

**For More Information
On Items Advertised
Use Our
Reader Service Cards**

ropped from the tower. Should the installation be at a completely new station, it would be wise to consider ice fall and place the tower in the proper relation to the building.

Techniques

Cutting rigid line is not as difficult as it may seem, but it cannot be done carelessly. As near perfect as possible should be made, otherwise the flange will be mounted at a slight angle to the line.

Field flanges should be of the swivel type for two reasons. A swivel flange is easier to solder and also, it is not necessary to line up bolt holes. Instructions come with the flanges which give the correct amount of undercutting of the inner and outer conductors for the type flange used. Make accurate measurements.

Making the cut: The inner conductor should be completely removed from the line before making the cut. Place the inner conductor in a safe place where it will not be damaged.

1. Mark the outer conductor where the cut is to be made. Use a sheet of paper that has a straight edge and edge. Wrap the paper completely around the conductor and overlap and line up the edges. Mark with a pencil all the way around the conductor.

2. Remove the paper guide and use a hacksaw with a fine tooth arrangement to score the line all the way around. Turn the conductor as you make the score. This will provide a permanent mark.

3. Keep the pipe slanted slightly towards the cut end so filing will fall out rather than into the pipe. Cut with the hacksaw only until the blade breaks through the copper, then turn the pipe and make another small cut. Do this until the section is cut off. Someone should hold the section so that it doesn't twist and distort the copper walls of the pipe. Cutting in small cuts will make a straight cut, while one can seldom cut straight through the pipe and come up with a straight cut.

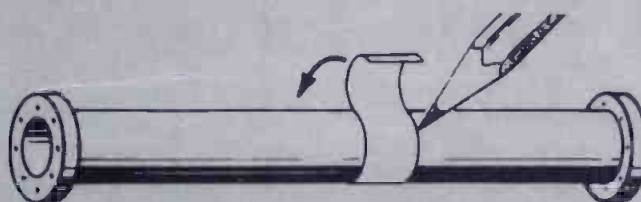
4. Use a file to dress up the cut end and steel wool to polish the copper. Polishing will make the soldering quicker and a straight smooth cut will allow a good fit into the flange.

5. Clean all the filings out of the

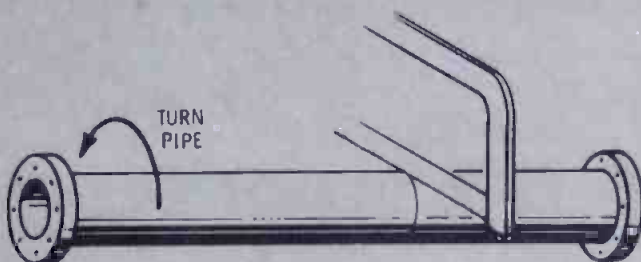
Entrance to building and weather covering. The rigid line anchors are inside the protective covering.



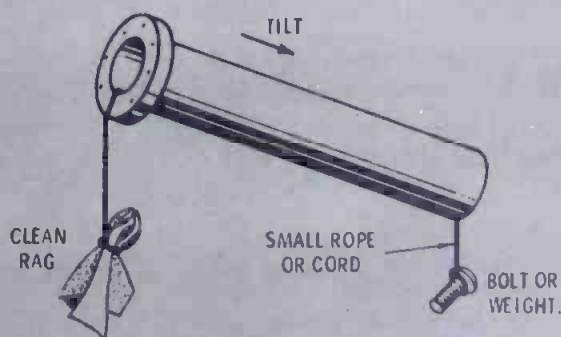
Fig. 2 Suggested steps for cutting the outer conductor of rigid line.



STEP #1 ALIGN EDGE OF PAPER AND MARK ALL THE WAY AROUND WITH PENCIL.



STEP #2 SCORE PENCIL LINE FOR PERMANENT MARK.
AND STEP #3. MAKE SMALL CUTS UNTIL BLADE BREAKS THROUGH.



STEP #4. CLEAN OUT FILINGS.

line. Do this: tie a clean rag to a small rope and tie a weight such as a heavy bolt to the other end of the rope. Drop the bolt through the pipe. Its weight will pull the rope through. With the rope, pull the rag through. Do this two or three times until all the filings are gone from inside. The section is now ready for the flange and soldering.

Soft or hard solder may be used. If the section is to be outdoors, the silver solder (hard) is the better for this application. Indoors may use soft solder. The hard solder requires a somewhat hotter flame on the torch, but most stations have these small torches either on hand or available. A large welding outfit is not necessary. Avoid the wind when soldering with these small torches and the job will go faster.

Cutting the inner conductor is no great problem, but it must be cut to

the correct length as it is shorter than the outer conductor. This makes allowance for the inner connectors. The instruction sheet with the flange and inner connectors will show the correct length the inner conductor should be in relation to the outer. The cut should be made between insulators or it might be impossible to insert the inner connector or the line may not have proper support near the cut. If the insulators are wide apart, it is well to try and cut in the center of two so as to maintain the impedance property of the line correctly.

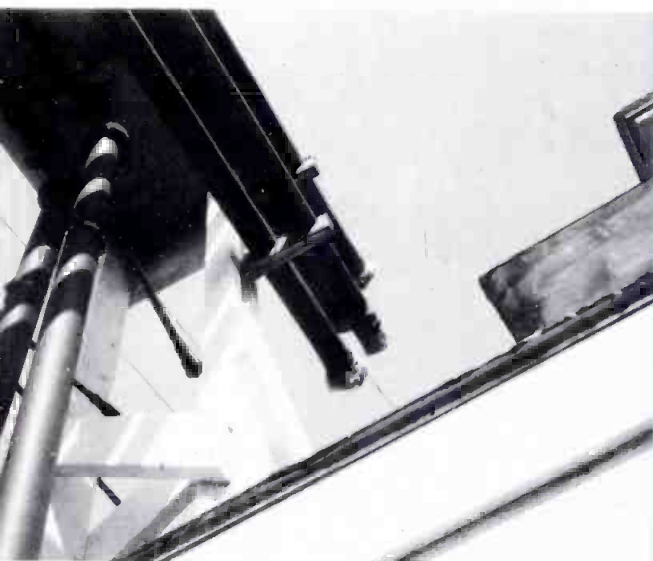
This measurement and cut is not too difficult. If the correct desired length will bring the cut directly in line or very near an insulator, move the length along the line so that the cut will fall between insulators. This will require two cuts, one at

each end of the desired section of inner conductor. Cutting the inner conductor should be done just as carefully as cutting the outer conductor. A good, square cut without tubing distortion is necessary so that the inner connector will make a snug fit to the inner conductor. If the fit is loose or there are gaps, the RF power can later burn at this point and a section may need replaced.

Gas barriers are necessary at the ends of the line where gassing is not desired. For later maintenance purposes, gas barriers may be installed at different points in the line and permanent pressure gauges installed. To gas the whole line from one source, the additional barriers must be jumped with copper tubing and a shut off valve. When leaks are suspected, various sections of line may be shut off and the gauges observed for pressure drops which would indicate which section was leaking.

Once the line has been installed and sealed off, it should be checked for leaks and then flushed out with dry air or gas. To do this, turn the pressure into the line and pressurize the line to 20 psi or as much as the pressurizing equipment can supply. Once the line has reached the 20 psi pressure, shut off the air valve to the line. Observe the pressure gauges for a short period to see if the pressure remains at 20 psi. If it drops off there is a leak and this should be located. A large leak and the air will hiss out. A slower leak will require other methods. Slow leaks will probably not be observed until the line has been under pressure for some time and the pressure will drop slowly. Under 20 psi, if the line pressure is dropping in a very short period, there is a large leak.

If the line holds pressure, open the plug at the end of the line. Care must be taken as this pressure can blow the plug out of the man's fingers. As it is usually a long way to the ground, one should take a spare plug along to save a trip. Allow the air to rush out of the line until it is empty. Reinsert the plug and pressurize the line again, and flush it once more. If the line has been installed during very humid weather or it rained on the job while the line was unsealed, flush the line 3 or 4 times to make sure all the moisture



Horizontal run line support and ice protection shield. Also visible are spade line sections stored on side of support on opposite side from tower.

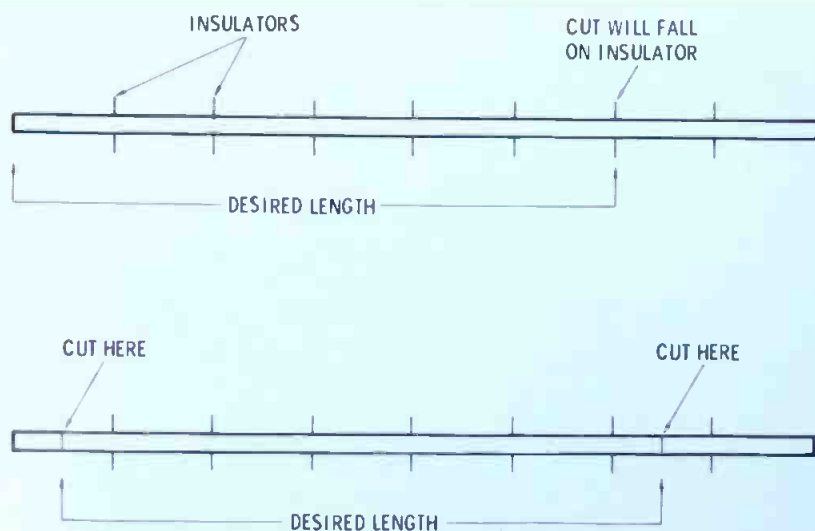


Fig. 3 When cutting the inner conductor, make two cuts - if necessary - to clear the insulators.

cleaned out of the line. Reinstall the plug, sealing the threads with a thread sealer. Pressurize the line to its normal pressure. Most lines need only be 5 psi or less. Other lines that are near maximum ratings should use a higher pressure.

Settling in will take place in any new line installation. Pressure gauges should be observed for the first few weeks for signs of leaks that may now be occurring. Bolts may have missed being tightened, or a gasket may have been pinched and will now start to show up as leaks. Any such faults should be corrected as soon as possible.

Checkout

A DC resistance check of the line should be made, using a DC resistance bridge or ohmmeter. The ohmmeter is only good to show if it is shorted. Without the antenna connected, the line should show open circuit. The end of the line should then be shorted together and the ohmmeter should show short—otherwise an inner connector has been left out.

After the FM or TV antenna has been installed, measure the DC resistance with the resistance bridge. This should be less than $\frac{1}{2}$ Ohm DC resistance. Save this reading for future reference. Any increase of this reading at a future date will indicate that contact resistance is increasing—most likely from a burned inner connector.

FM and TV lines should also be checked out for VSWR across the passband of the channel. The measurements should be made first on the line only terminated in a good dummy load resistor, and again with the antenna as the termination. Save these measurements for future reference. Note also if the measurements were made in warm weather or cold weather. VSWR readings on a rigid line usually are a little different in hot weather than in cold weather. This is due to the contraction and expansion of the line and antenna itself being a small amount different during such periods and it shows up as a VSWR change. These can be expected, but if there is a very large change, something is definite-

ly wrong and the line movement is showing it up.

After RF power has been applied to the line, checks should be made at joints, elbows and along the line itself for warm or hot spots. Contacts may be heating during the settling in period. These checks should be made for the first few weeks. Naturally if a flange or elbow is getting hot immediately, the section had best be opened and inspected. Remember that the signal generator used for VSWR measurement has little power. An inner connector may be making sufficient connection to show up as low VSWR, high power can change those conditions quickly.

Any good coax installation is well planned beforehand, installed with attention to small details, handled with the care given to any electronic equipment, and checked out both before and after power has been applied. Proper attention to the earlier details and the checkout will only confirm that a good line has been installed which can be expected to give reliable service for several years.

**If you are contemplating
a switching system,
you should take a look at
DYN AIR's
Series-5100 equipment.**



BASIC 20X5 MATRIX

That's right. Take a look at the Series-5100... take a look at the leader. Take a look at the equipment used in many of the world's largest video switching systems, including numerous critical aerospace, military and broadcast applications.

You'll find a very flexible package which is designed to simplify assembly of systems of virtually any size or configuration, and with most methods of switch control. And a complete machine-control capability too. A total system concept, designed to fill your needs, regardless of the complexity of your requirement. And, if you desire, we will design your system, rack it, wire it and test it as a system. Custom control panels are no problem either.

We manufacture a variety of other switching equipment too, including a full line of inexpen-

sive production switchers, 70-MHz computer-controlled IF switching systems, and solid-state video switching systems for bandwidths of greater than 50 MHz, with full equalization of all video paths.

Whether you need a local-pushbutton-controlled 12X12 matrix, or a 500X500 computer-controlled audio-follow system, your best bet is DYN AIR.

So leave your problem with the experts... send us your requirements today. We'll fire back a design and quotation with a realistic approach to the solution.

DYN AIR ELECTRONICS, INC.

6360 Federal Blvd., San Diego, Calif. 92114
Telephone: (714) 582-9211

DYN AIR

FM Audio:

TECHNIQUE OR PANDEMONIUM?

By Dennis Ciapura *

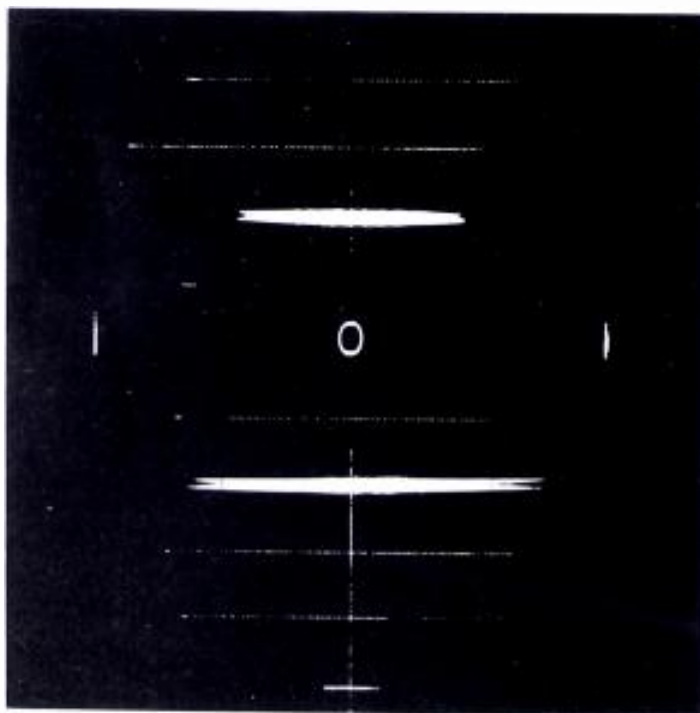


Fig. 1 Oscilloscope photo showing modulation for 1 second time period of uncompressed (top) and 6 dB compressed (bottom) FM signal. Marks at extremes denote ± 75 kHz.

*Chief Engineer, WLIF/WTOW, Baltimore.

A great deal of thought usually goes into the selection and adjustment of each component in the FM audio chain. Unfortunately, the qualities (or lack of them) of the average listener's receiver are often overlooked. In the early days of FM broadcasting, almost all stations were operated to titillate the senses of the audiophile/music lover who comprised the largest segment of the FM listening audience. But "baby" has come a long way and a lot of things have changed, including the listener and his receiver.

The age of audio signal processing is upon us and for good reason; the Little Orphan Annie of the airways has evolved into an economic May West. On one hand, optimum coverage criteria dictates one motis operanda while audience reaction and fidelity requirements may suggest a modified approach. The most accurate way to approach the problem is to analyze the format and target audience to determine what fidelity requirements may exist and what the average listener's receiver is like, to see if these requirements are modified. If we begin by selecting the equipment and method of operation that would yield the loudest signal and best fringe coverage and then alter that method, if necessary, to meet those fidelity requirements, an effective balance between coverage and audience response, two of the essential engineering elements of rating generation, will be achieved.

The casual reader might conclude that this is a difficult task, and he would be correct as there are a great many variables to consider. Let's take a look at some of the factors involved, and then see how they fit into the "big picture" and a final system decision.

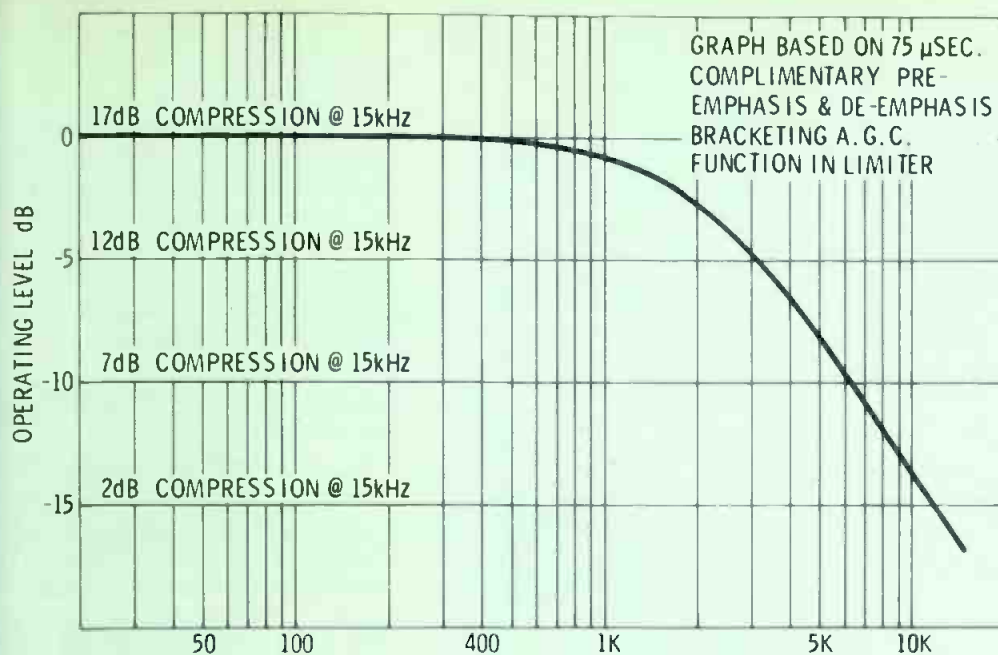


Fig. 2 Frequency response at peak levels versus operating level of FM peak limiter.

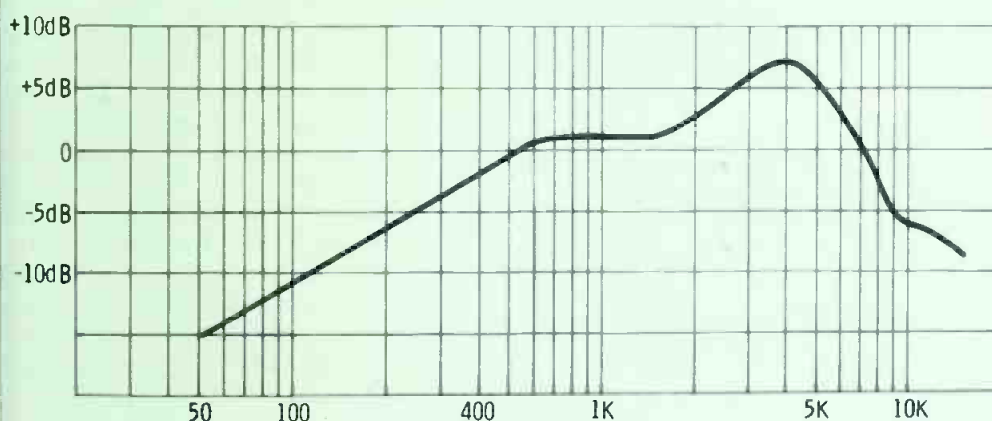


Fig. 3 Frequency response of average human ear at moderate levels.

Relative Loudness

The relative loudness of the audio signal depends principally upon two factors: energy per unit time and frequency distribution. A highly compressed signal will have most every peak at full modulation by virtue of the fact that the highest peaks have been limited down to the level of the lower peaks and then the overall level brought up to full modulation. We are, of course, talking about classic peak limiter operation with a fast attack and release time. By observing the before and after compression

signal photos in Figures 1a and 1b it's easy to see why the highly compressed signal in b contains more energy per unit time!

There is, however, a practical limit to how much compression is useable. First of all, we begin to reach a point at about 40 dB of compression where the apparent loudness approaches that of a continuous tone and does not increase beyond that. And secondly, record surface, tape hiss, rumble and electronic noise begins to detract from the intelligibility of the signal. There are other tradeoffs as well. When a short release time is employed, low frequency distortion increases as the limiter attempts to

limit a fraction of a cycle on more and more cycles. The newer units use gated circuitry to minimize these effects, but when driven to extremes most units will exhibit these phenomena.

Most FM peak limiters employ pre-emphasis prior to the control or clipping stage and complimentary de-emphasis after to protect against over-modulation. This results in a high frequency loss that is defined by the complement of the standard 75 usec. curve as shown in Figure 2. Fortunately this effect is not as audible as you might think due to the fact that at any given time the loss is only related to the program level at that instant.

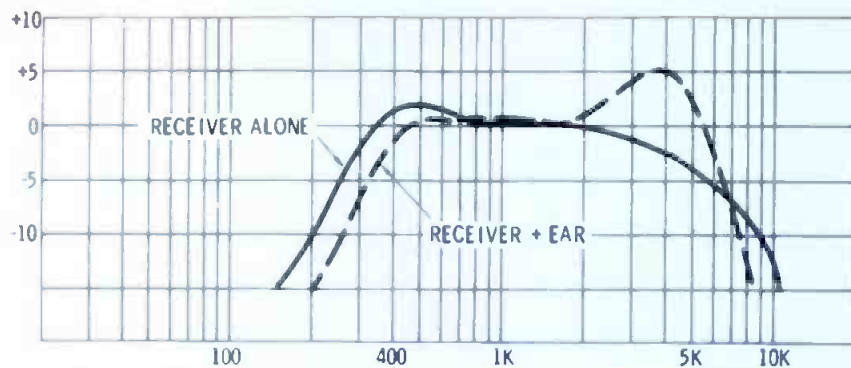


Fig. 4a Perceived frequency response for category A receivers.

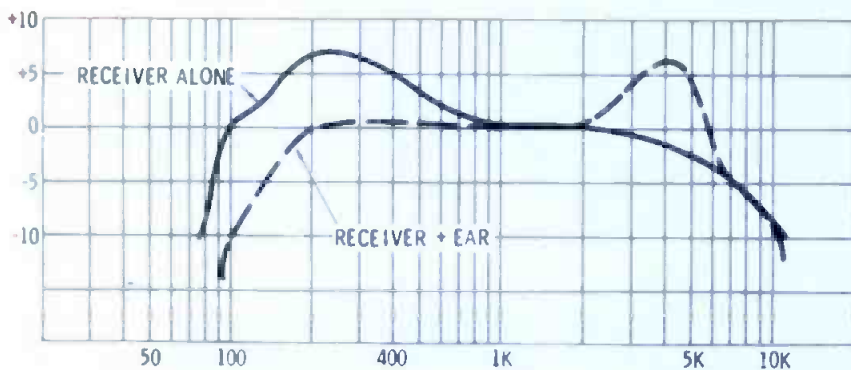


Fig. 4b Perceived frequency response for category B receivers.

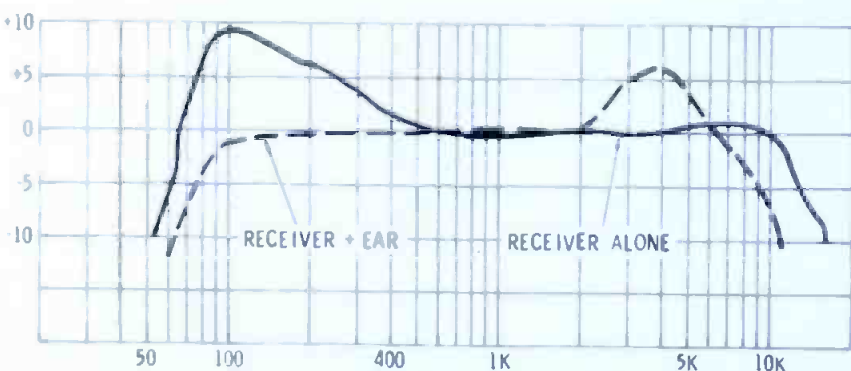


Fig. 4c Perceived frequency response for category C receivers.

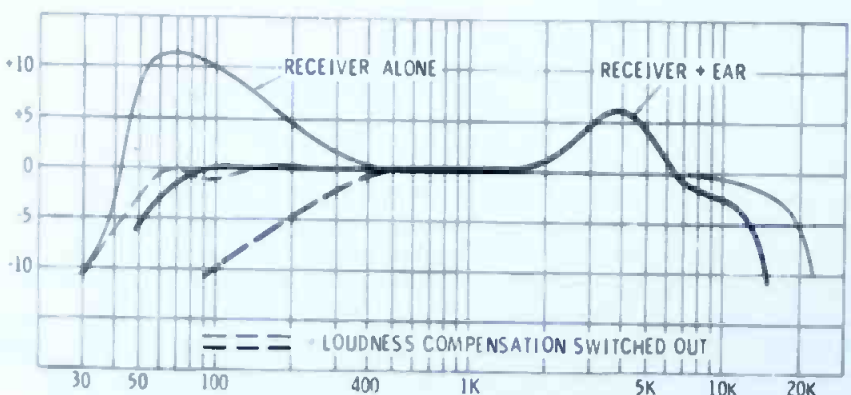


Fig. 4d Perceived frequency response for category D receivers.

If a constant, compressed and high level signal is fed into such a limiter, a treble loss is quite noticeable in A-B listening tests however. The loss is predictable though and the best balance between average modulation level and loss of fidelity can be easily determined by switching the monitor system from the program to air monitor circuits and listening to the difference.

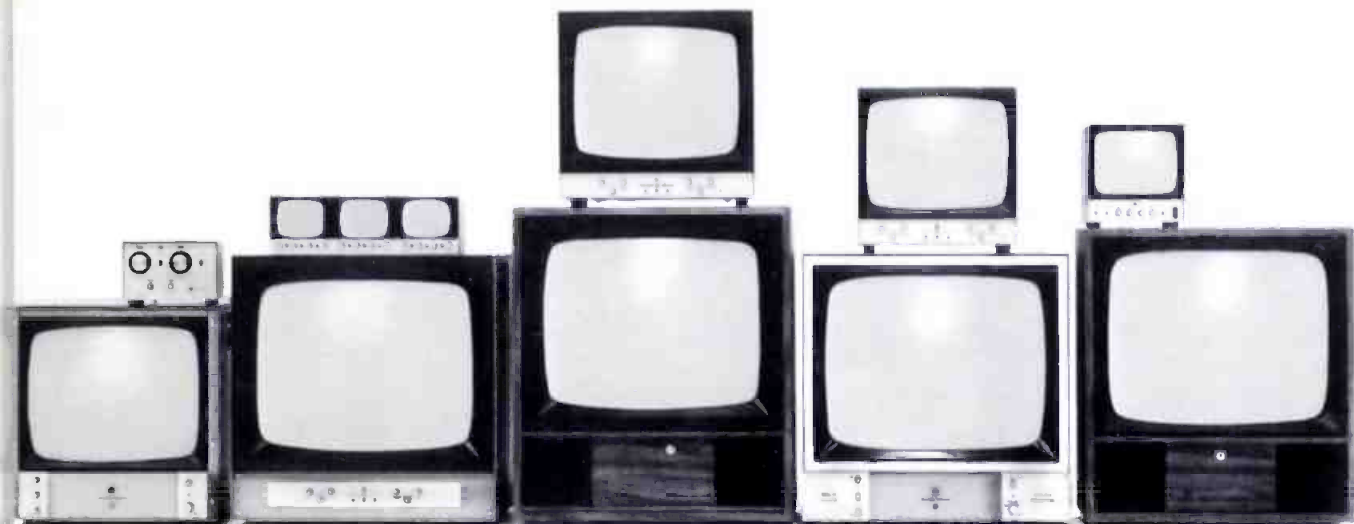
At any rate, it is possible to achieve any desired degree of compression with a frequency linear AGC ahead of the FM peak limiter without altering the high frequency response, but the operating level of the limiter will largely determine the maximum level attained. Up to this point everything is pretty straightforward but let's take a look at some interesting variables and see how they affect what the listener hears.

Figure 2 was derived by averaging the Fletcher Munson and CBS equal loudness curves. This curve does a good job of describing the frequency response of the human ear at normal listening levels, and clearly shows a pronounced peak at about 4 kHz. It naturally follows that program material that contains a great deal of 4 kHz components will sound louder than material with less 4 kHz content. Part of the operation of loudness enhancers and loudness meters is based on this premise.

Looking At The Receiver

At this point, if we stop and take a look at the program chain and the listener's receiver as a single system, we must take a long, hard look at that wondrous little (and sometimes not so little) device on the receiving end. For simplification, we have broken down the entire array of available reproducing equipment into four categories.

Figure 3 gives average response curves for these categories; small portable and table model sets; auto and larger table model units; moderately priced console; and component systems and finally; very good console or component systems. If you are unimpressed by the level of fidelity displayed, please remem-



NEW FAITHFULS

The Setchell Carlson reputation for **QUALITY** and **RELIABILITY** is demonstrated over and over in every S.C. Electronics monitor and monitor/receiver with features such as plug-in circuit modules (pioneered by S.C. to assure operating dependability and ease of maintenance); 100% solid-state circuitry for maximum stability, long-life, low power drain, and a minimum of heat; up to 640 lines horizontal resolution; and regulated circuitry that provides extremely stable operation while preventing raster size or brightness deviations due to line voltage fluctuations.

Available in a broad line of screen sizes, Setchell Carlson products lack only one thing ... a high price. Whatever the application, broadcasting, CCTV, Medical training, industrial TV applications, custom remote installations, industry, education, or many others, Setchell Carlson has the monitor you need.

Ask about them today at your nearest S.C. Electronics dealer, or write for full information and descriptive literature.

ALSO ASK OR WRITE FOR INFORMATION AND FULL-COLOR LITERATURE ON QUALITY COLOR MONITORS.



SC ELECTRONICS, INC.
A SUBSIDIARY OF AUDIOTRONICS CORPORATION
530 5th AVE. N.W. ST. PAUL, MINNESOTA 55112
PHONE (612) 633-3131

A SMALL PORTABLE & TABLE MODEL SETS	B AUTO & LARGER TABLE MODEL SETS	C COMPONENT SYSTEM & AVERAGE CONSOLE	D VERY GOOD COMPONENT SYSTEM OR CONSOLE
1. 300Hz BASS ROLL-OFF	1. 150Hz ROLL-OFF	1. 50Hz ROLL-OFF	1. 50Hz BASS ROLL-OFF
2. PEAK @ 4000Hz	2. PEAK @ 4000Hz	2. LESSER PEAK @ 4K & ON VOICE ONLY	2. LESSER PEAK @ 4000Hz & ON VOICE ONLY
3. 8000Hz ROLL-OFF	3. 8000Hz ROLL-OFF	3. LESSER DEGREE OF COMPRESSION	3. DEGREE OF COMPRESSION LESS & DEPENDENT UPON PROGRAM
4. COMPRESSION AS DESIRED	4. COMPRESSION AS DESIRED		

Fig. 5 Conditions for producing maximum loudness without perceptable loss of fidelity for each category of receiver. See text for details.

ber that all measurements are relative sound pressure level, true speaker output, and are very realistic.

The minor peaks and dips that invariably occur, particularly in the less expensive units, are omitted because the number of variations is as great as the number of receivers and disclose no pattern. The lower curve in each case is the combined receiver and ear response. The curves for the receivers alone in categories B, C, and D show some bass boost which is due in part to loudness compensated volume controls which give some bass boost at low and moderate levels, and in part to speaker resonances.

As can be seen from the lower curves, this boost does correct for the ear's lesser sensitivity to bass at the lower levels-up to a point. When the wave-length becomes very long it becomes increasingly difficult to couple acoustic energy to the room, but that's another story. The combined receiver-ear curve really shows what the listener hears. And what he hears does of course depend a great deal on the equipment he's listening to.

The System Engineering Approach

Now that we have touched upon some of the most important factors that affect the end acoustic product, we may begin to logically de-

duce certain criteria to best suit our programming goals. For the most part we are limited by the loudness vs. fidelity trade-offs, but the losses in either case must be weighed against the advantages and a balance achieved.

Figure 5 lists the conditions resulting in maximum loudness without perceptible loss of fidelity for each category of receiver. The basis for the processing indicated by Figure 5 for categories A and B is that the lowest bass range and highest treble octave contribute almost nothing to the apparent loudness of the signal as perceived when listening to the program on the restricted response sets, particularly under high ambient noise conditions. It is more efficient therefore, to use the available modulation capability to transmit the most easily heard spectrum at the highest possible level. For categories C and D, a lesser degree of processing is more appropriate as the fidelity requirements increase.

There are stations which still endeavor to provide the best possible reproduction of the original program material and there are still purists around to marvel at the degree of success achieved. But the "all talk" operator and the resort area broadcaster who finds that 96 percent of his target audience listens to portable radios 85 percent of the time may want to take a look at the possibility of gaining some real "ear-power".

More often though, specific programming goals will suggest system parameters somewhere in between unprocessed and super-processed audio. As a matter of fact, it may well be that for some stations in some areas a flexible system involving a change of equipment settings during the broadcast day might be the best answer.

For example, if the morning personality program is aimed at the drive time auto listener, why not set up for maximum coverage in category B? If the evening music schedule calls for less compression and flat response it's a simple enough matter to reset to different audio chain adjustments, or even automate the change-over. The number of "ideal" situations will of course be as varied as the number of FM radio stations because every market and every format has it's own peculiarities and each outlet's sound must be tailored to meet the situation at hand.

While the engineering implications of this approach are rather easily deduced, the foundation lies in determining who is listening to what kind of receiver when. But it's not as difficult as one might think. Surely when most sales and programming departments can generate voluminous data on the tooth width of their target audiences, somewhere there's the investigative machinery to identify the type of apparatus stimulating his auditory nerves.

SIMPLER AND MORE RELIABLE VHF TRANSMISSION

With cavity-matched VHF power tetrodes

Our transmitting tubes for VHF applications are supplied with matched cavities to ensure optimal system performance. It's a simple idea that Philips introduced, that the market liked and others copied. Something that's harder to copy is our unique 'K'-grid material. This allows a high power gain and excellent linearity to be combined with long-life stability. Philips cavities and air-cooled tubes go from 5 to 25 kW for operation in channels 2 to 13, for both vision and sound service.

If you're a television engineer, who's looking for minimum design problems and optimum operating efficiency, we have another simple idea. Check out our claims in detail by sending for the relevant data sheets.

Philips Industries
Electronic Components and
Materials Division
Eindhoven - The Netherlands

Distributed and sold in the U.S.A. by:
Imperex Electronic Corporation
30 Duffy Avenue, Hicksville N.Y. 11802

Canada:
Philips Electron Devices
Division of Philips Electronics
Industries Ltd.
16 Vanderhoof Avenue
Toronto 17 - Ontario



tube type		useful output power*		cavity type ¹⁾
		Band I (kW)	Band III (kW)	
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.



Electronic
Components
and Materials

PHILIPS

When a low-priced broadcast camera looks like a good buy, keep right on looking.

Take a good look inside. Check out the design and construction features.

Then think about what they mean in terms of reliability, maintenance, and long-term picture quality after the camera has been put to a lot of hard, daily use.

Look at the RCA TK-630 color camera.

The heart of its optical system is a simple one-piece sealed prism rather than the ordinary arrangement of mirrors.

It's simpler to maintain; stays in perfect alignment; eliminates the secondary reflections that even slight contamination of mirror surfaces can cause.

And for stability, the entire optical system is mounted on a sturdy bed-plate for extra rigid support of pickup tubes, lens and prism.

The result? Less shock and vibration. Extra dependability. And pictures that stay sharp and true.

Components are easily accessible so maintenance is fast and simple. The pickup tubes for example, can be replaced in two minutes. Without disturbing the

optical alignment and causing deterioration of picture quality.

Circuit modules are easy to get at, too. And they're totally solid state for compactness and long life.

And the TK-630 is made for portability—with a plug-in detachable viewfinder and carrying handle that make it easy for one man to carry.

There are other quality features which set the TK-630 apart: Calibrated test pulse; built-in encoder with color bar generator; automatic pulse timing; deflection failure protection; electronic lens capping, easy setup. And many more.

The new low price is the first thing that looks good about the TK-630.

But by no means the last.

Ask your RCA Representative, or write for new brochure. RCA Broadcast Systems, Bldg. 2-5, Camden, N.J. 08102.



RCA

New TK-630 color camera.



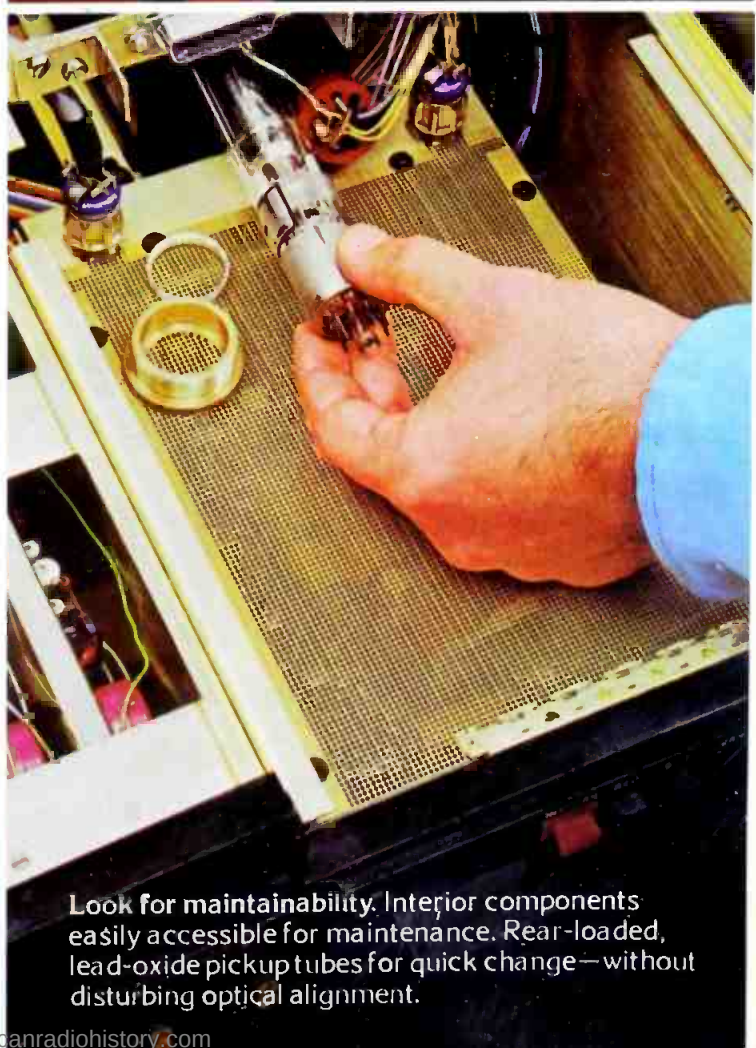
Look for versatility in field or studio use. Plug-in viewfinder quickly detaches for easy portability.



Look for rugged construction. An extra measure of design integrity. Sturdy circuit boards take hard knocks. Premium components for extra life.



Look for optical efficiency. Sealed dichroic prism and rigid optical bedplate produce brilliant color pictures with quality that lasts and lasts.



Look for maintainability. Interior components easily accessible for maintenance. Rear-loaded, lead-oxide pickup tubes for quick change—without disturbing optical alignment.

Getting more out...

A monitor system in the stretch

By Daniel Long*

One of the problems that often plague television studios is lack of space for picture monitors. In one of our control rooms, we discovered that we had space for two less monitors than we needed, even though we were using very compact 9-inch monitors. It was obvious that we would have to double up somewhere.

The most likely candidates seemed to be the VTR monitors. These contributed nothing when the machines were not running. For that matter, they were useful, but not indispensable, when their signals were on the air. If we had one monitor that would show the lock-up of any VTR that was run and would continue to show that VTR unless it became necessary to show the lock-up of another machine, then we would be missing no essential service. In terms of practical use, we needed a circuit that would show a program on one VTR, switch to any other VTR which might be inserted in that program, and then return to the program automatically.

Monitor Switcher-Stretcher

The switcher shown here was built for a fraction of the price of one monitor and accomplishes the objectives mentioned. It is capable of indefinite expansion — that is, it is not confined by the number of relay contacts.

The schematic reveals a basic circuit, repeated for each tape machine. Part numbers with suffix

"A" will be used for "VTR 1", suffix "B" for "VTR 2", etc.

The first thing needed is the creation of a "play" voltage referenced to station ground, rather than VTR common. Each VTR has its own 24 volt control supply, and there is no common reference for the machines. Any attempt to ground the negative sides of these supplies quickly reveals the complexity of the situation, as unpredictable voltages appear in different modes of operation. The easiest solution is a simple one: the use of K2 to supply station +24 (to ground) when the VTR "plays."

Stretcher Operation

When the +24 play control voltage is applied to the circuit, it reaches the hot side of the relay coil by two routes: first, through C1A and D2A; second, through Q1A (an on-state switch), D1A, and C2A. The DC voltage at the junction of D1A and C2A is ap-

plied to the lock-in contact of K1A. Thus, when the VTR "plays" K1A closes, locking itself in, and a voltage appears at "Reset Out." VTR 1 is now feeding video to the monitor. It should be noted here that the lock-in contacts short out C2A, returning it to a discharged state.

This circuit will be released by one of two things. Either the play voltage will be removed when the machine is stopped, or a reset voltage will appear at one of the "Reset Inputs", when another machine is started.

Let's assume that the sequence just described occurred at the beginning of a syndicated show in which there is a cut-in to be handled by another VTR. When the second VTR starts, its monitor relay circuit will repeat what we have shown, except that, in this case, the path through C1B alone will close the relay, due to the fact that Q1B is turned off by Q2B, which is



Fig. 1 At WESH-TV, the problem of lack of space for picture monitors was solved by the monitor-stretcher in operation here. See schematic in Figure 2.

*WESH-TV, Orlando, Florida

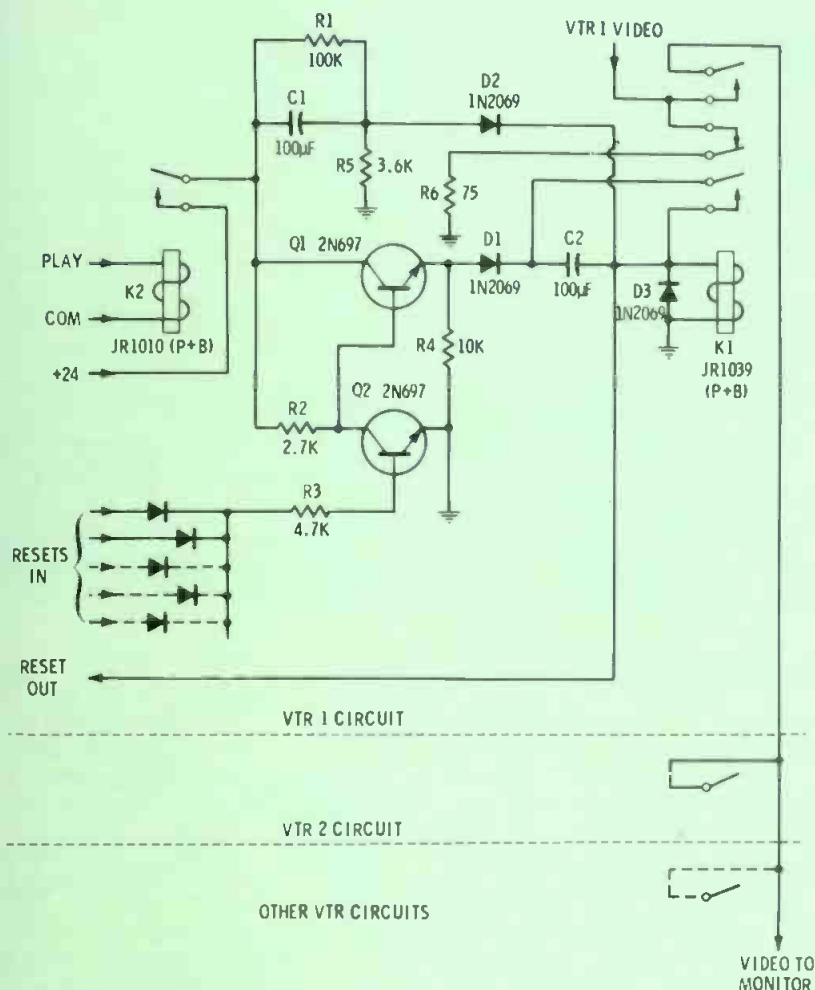


Fig. 2 Schematic of the WESH-TV monitor stretcher.

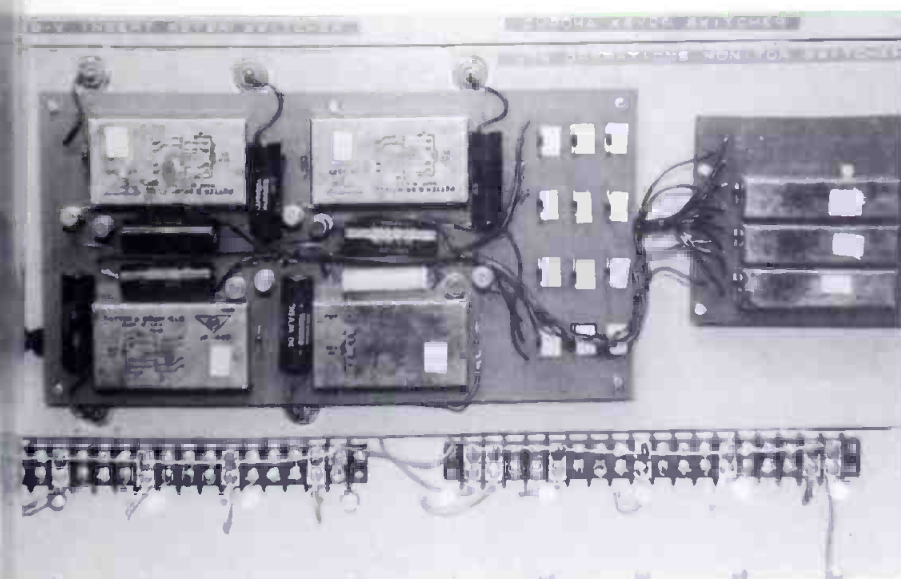


Fig. 3 Photo shows parts layout of the circuit design of Figure 2.

in the presence of a reset voltage at the start. C1B supplies voltage simultaneously to the relay and the "Reset Out" circuit.

Referring to the first circuit, we find that its lock-in is now broken: as Q1A is turned off. C1A is already charged to about 22 volts - determined by the R1A - R5A voltage divider - and cannot supply enough current to hold K1A closed. Thus the first circuit is turned off, including its reset voltage. This allows Q1B of the second circuit to turn on and lock-in the VTR 2 monitor feed. Thus, when VTR 2 starts, the monitor is disconnected from VTR 1 and connected to VTR 2.

When the second VTR is turned off, its relay is released and its reset voltage is removed, which allows Q1A of the first circuit to turn back on. The play voltage of this circuit, which has been on continuously, now has a path to C2A, charging it through K1A, closing and locking-in K1A.

D1 and R4 prevent a high positive voltage from being fed to the emitter of Q1 when its base is essentially at ground. More than 5 volts of reverse bias may damage the transistor.

The "reset out" voltage of each circuit connects to the "reset in" connection of all the other circuits through diodes. For this purpose, then, if you have N number of tape machines, you will need $N(N-1)$ diodes. For the whole switcher, you will need $3N + N(N-1)$ - a lot of diodes, but they are still a lot cheaper than monitors. And they take up much less space!

Parade display switch handles two cameras

By Steven R. Sharits*

Used properly, this electronic switch can have several television applications, including use as a troubleshooting or maintenance tool.

Often it becomes necessary or desirable to view two video signals in a parade manner on a waveform monitor. The need for this requirement presented itself recently in the CCTV network at Mankato State College, but we had another problem.

A two camera remote video taping system was being used on location at various areas throughout the state. The portability and economy of the system necessitated the purchase of only one waveform monitor, a Tektronix 528. This monitor had to be used for shading purposes on both cameras. Initially, a passive switch was installed, enabling the recording engineer to select the appropriate camera for video adjustment. A short period of use proved this method to be highly undesirable, since the rapidity of on air switching sometimes precluded the necessary video shading, thus inhibiting the optimum conditions necessary for a high quality production.

It was deemed desirable to develop a method whereby both camera signals could be displayed simultaneously on the scope, thus allowing the engineer to shade each camera continuously. A parade display meets these requirements nicely, and for this reason, the Parade Display Electronic Switch was developed. It is likely that similar conditions occur in the industry quite often, and the relative simplicity and low cost of this unit makes it easily adaptable to any

recording or monitoring situation. In many cases, this unit will essentially replace an additional waveform monitor, thus reducing capital equipment expenditures considerably.

The versatility and simplicity of the switch is evident from an examination of the schematic diagram. There are no range switches or level controls to adjust, thus eliminating possible errors from this source, and saving considerable set-up time. The unit will accept one volt television signals with ease, and virtually no distortion will occur using composite or non-composite inputs. No noticeable deterioration of frequency response was noted, thus preserving the function of the bandpass filters on the scope itself. A very small loss in gain occurs through the unit, but this loss is not significant in regard to shading purposes. The use of high quality diodes minimizes this amplitude loss, and essentially renders the unit with unity gain.

Monitor Switching

The switching signal is derived from either vertical drive or horizontal drive, depending upon user

requirements. Either high or low frequencies can be used for triggering the switch, with no effect on performance. The only requirement for the triggering signal is that it have a fast rise-time. Signals obtained from the sync generator fulfill this requirement nicely, and can be fed directly to the unit. With the scope externally triggered to the line or field rate, extremely stable displays become available.

The unit can also be converted for sine wave triggering merely by removing the 75 ohm terminating resistor, and placing a conventional Schmidt Trigger in front of the switching multivibrator. Sine wave inputs of any frequency up to 100 kHz can then be used for switching, thus expanding the versatility of the unit immeasurably. The original unit has been used in this manner for time division multiplex of two audio channels, switching at a 100 kHz rate, with outstanding results.

Note that absolutely no switching transients have been observed at the output of the unit at any trigger frequency, thus attesting to its freedom from distortion. When viewing television signals, separation of the two traces is

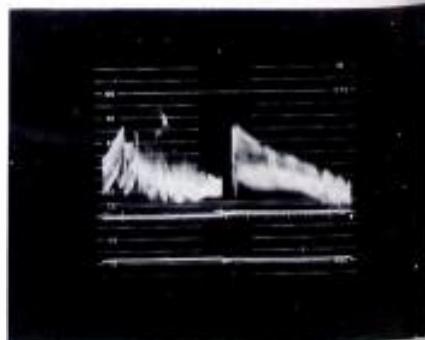
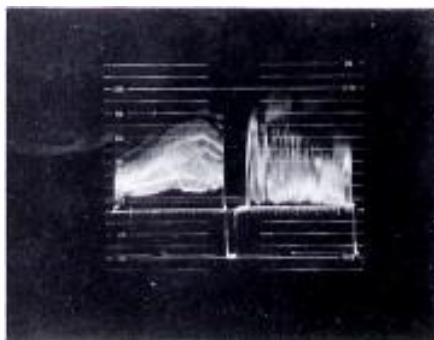


Fig. 1 Vertical and horizontal rate shots using the parade display switcher. Split comes during the blanking pulse.

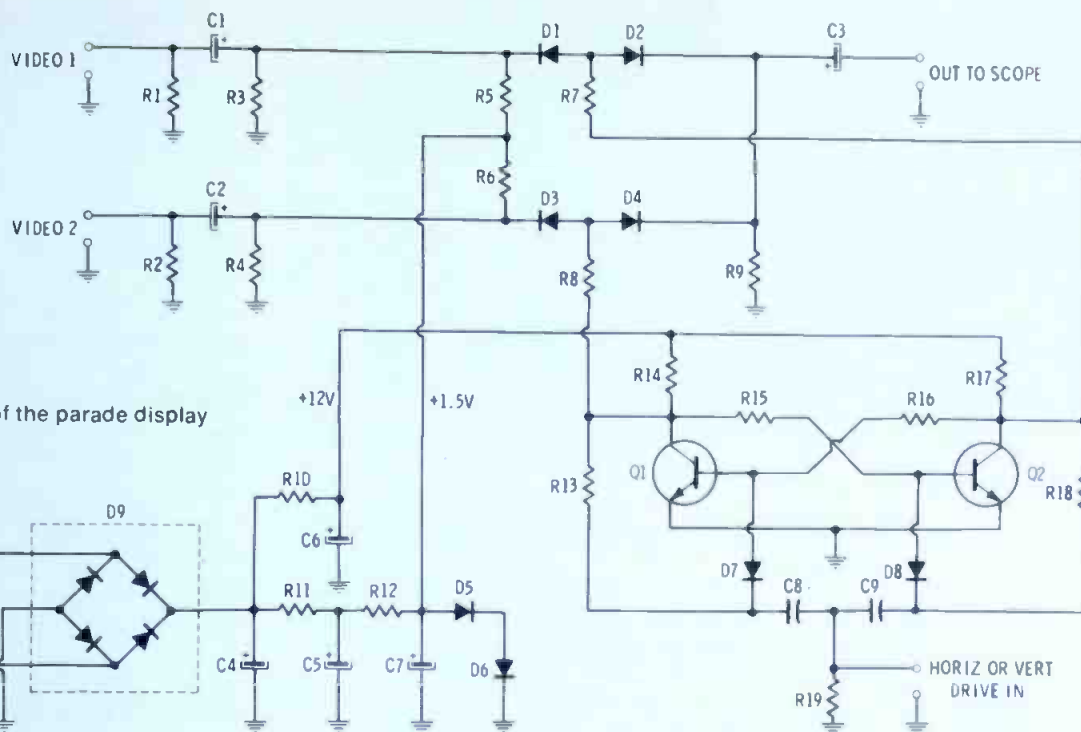


Fig. 2 Schematic of the parade display switcher.

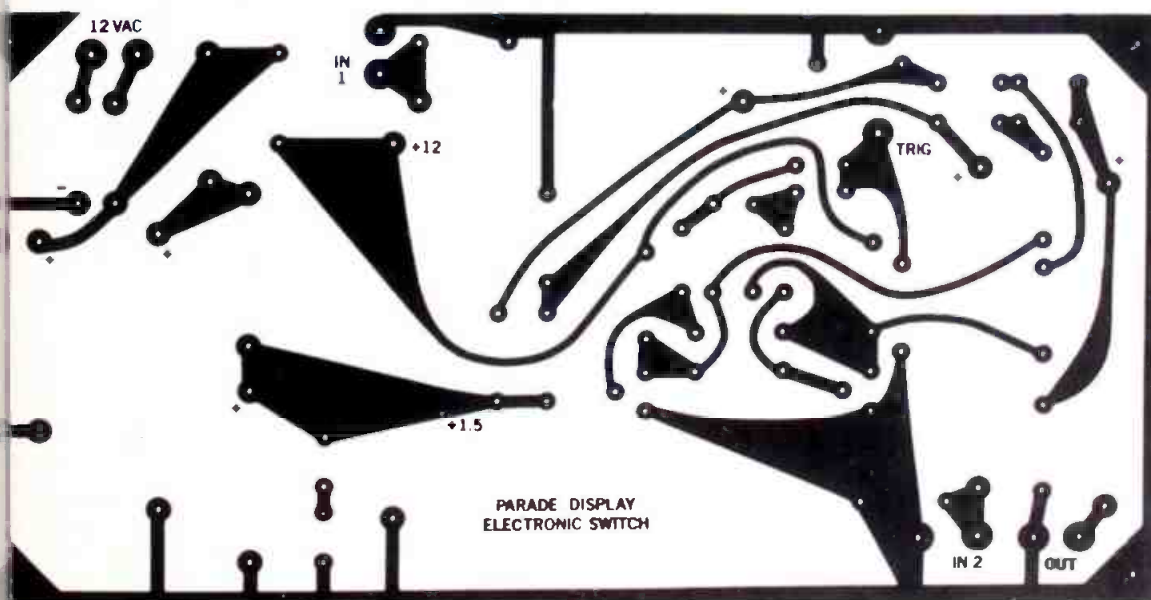
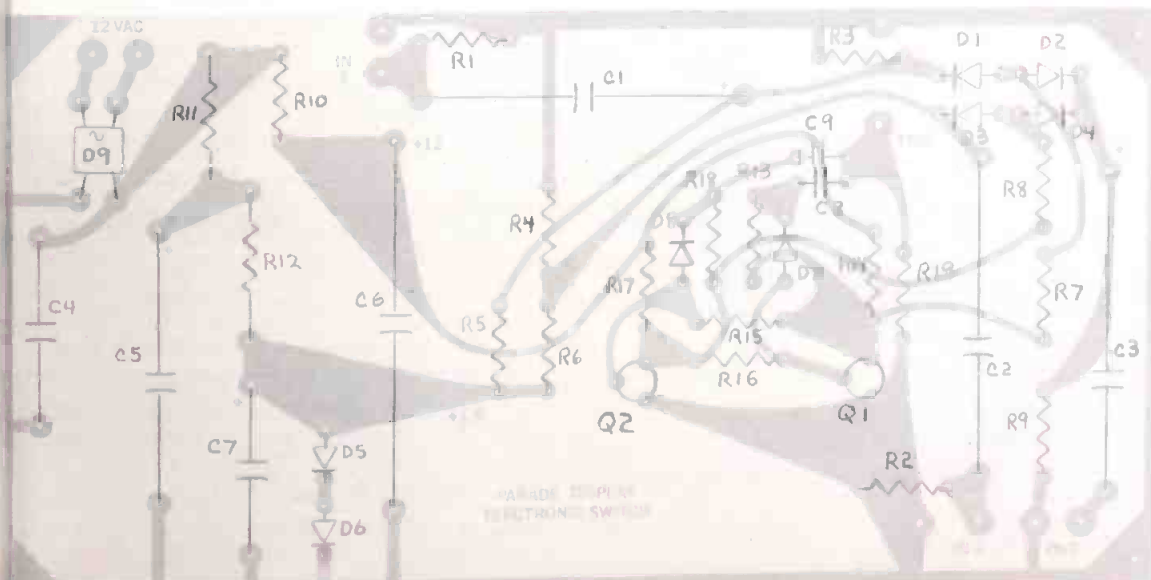


Fig. 3 Exact size of circuit board and parts layout for the switcher.



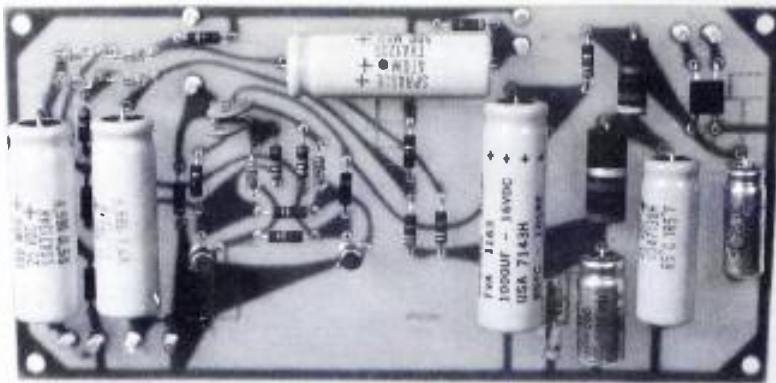


Fig. 4 Photo of the finished unit

PARTS LIST

T1	12 VAC (or 24 VAC, C.T.) .4 Amp. Control Transformer, Stancor P-8391, P-8396, or equivalent.
Q1,Q2	Motorola 2N708 Transistor
D1-D4,D7,D8	Sylvania 1N276 Germanium Diode, or equivalent.
D5,D6	T 1, 1N2069 Silicon Diode.
D9	Motorola MDA-920-4 Full Wave Bridge Assembly, or equivalent.
C1-C3	500 mf., 25v Capacitor, Sprague TVA-1209.
C4	50 mf., 25v. Capacitor, Sprague TE-1209.
C5	250 mf., 25v. Capacitor, Sprague TVA-1208.
C6	1000 mf., 16v. Capacitor, Sprague TVA-1163.
C7	200 mf., 6v Capacitor, Sprague TE-1104.
C8,C9	.001 mf., Disc Ceramic Capacitor
R1,R2,R19	75 ohm, 1/2w.
R3,R4	1000 ohm, 1/2w.
R5,R6	470 ohm, 1/2w.
R7-R9,R13,R1	10K ohm, 1/2w.
R10	330 ohm, 1/2w.
R11	47 ohm, 1w.
R12	100 ohm, 2w.
R14,R17	2.2K ohm, 1/2w.
R15,R16	15K ohm, 1/2w.
Miscellaneous: Input and Output Connectors, Circuit Board, Chassis Box, Power Cord, Hardware, Etc.	

Note: All resistors except R11 and R12 can be 1/4 watt units.

automatic, and occurs because the blanking interval appears between the two signals. The vertical or horizontal blanking interval becomes the separating factor, thus allowing both signals to be viewed completely independently.

Unit Construction

Construction of the unit is relatively straightforward. All components excepting the power transformer and connectors mount directly to the circuit board. If point to point wiring is used, care should be taken to keep leads short and circuits isolated, to prevent channel feed through and high frequency rolloff. The original unit was mounted in a small aluminum box, but almost any type of container would do as well. The 47 ohm and 100 ohm resistors do get warm, so they should be mounted off the circuit board slightly. Parts are not critical, and 10 percent resistors can be used throughout; however, if identical channel gains are to be realized, then matched components should be used in the switching and multivibrator sections.

If a 24-volt center tapped transformer is used, remember to use only half the total winding, as the unit only requires 12 volts AC. The type of germanium diodes used is not critical—any germanium with a high front to back ratio can be used, as long as the voltage and current requirements of the diode are not exceeded. The higher the quality of diode used, the less crosstalk there will be between channels.

Power Supply

The power supply is a conventional full wave bridge supplying +12 volts for the switch operation, and +1.5 volts for diode bias. The barrier potential of two 1N 2069 silicon diodes in series is utilized to regulate the bias voltage to approximately 1.5 volts. Enough current is run through these diodes to hold this voltage essentially constant.

even with large line voltage fluctuations.

The polarity of the voltage during initial turn on conditions on the switching diodes is such that one pair is switched on (forward bias) while the other pair is switched off (reverse bias). Under these conditions, the forward biased pair will pass the input signal to the output. A small forward bias from the 1.5 volt supply is placed on the diodes when they are conducting, to prevent rectification of the input signals from occurring around the barrier potential of the diodes. Isolation is accomplished by the second diode in each pair.

Switching Action

Switching action is accomplished by a bistable multivibrator. Q1 and Q2, with the outputs direct coupled

to the diode pairs. When the multivibrator switches states, the bias voltages are reversed on the diode pairs, and switching action occurs. Steering diodes, D7 and D8, along with integrating capacitors C8 and C9, are used to provide positive alternate switching action to the multivibrator, even under high frequency triggering conditions.

Note that all inputs are terminating in 75 ohms, and the output is high impedance. Any attempt to feed a low impedance device with the unit has produced unsatisfactory results, so this must be kept in mind if using the switch into anything but a high impedance scope. An on-off switch can be installed if desired—the original application was such that none was necessary. Conventional SO-239 or BNC connectors may be used, or any

other type if the use requirements dictate some other format.

Used properly, this electronic switch will prove invaluable in television applications, as well as many others, including use as a troubleshooting or maintenance tool. Additional uses are limited only by the reader's imagination.



Spindler & Sauppé TV film chain 2x2 projectors

your widest
and wisest choice

Seven models in all—one of which will fit your needs exactly. Color or monochrome; uniplex or multiplex; forward or reverse actuation; sequential or random access; 16- to 96-slide capacity. These are thoroughly proved performers, built to the highest professional standards, and recently updated with advanced electronics.

For complete information, write
Spindler & Sauppé, 13034 Saticoy St.,
North Hollywood, Calif. 91605;
phone (213) 764-1800.



SPECTRUM 32B: The most advanced film chain slide projector available. For color or monochrome chains; 32-slide capacity. Many exclusives. Operates at 120V, 50/60 Hz. Spectrum 32F operates at 220V, 50/60 Hz.



MODEL 332: Newest version of the workhorse of the industry. For monochrome chains; 32-slide capacity. Model 322: single turret for 16 slides, monochrome or color.

MODEL SLX-TV: 96-slide capacity, random access. Model SLS-TV: 48-slide, random access. Model SLD-TV: 96-slide, sequential. Model SLR-TV: 48-slide, sequential, forward/reverse. All for monochrome or color chains.

Educational broadcasters convention report

NAEB members heard many stern words in their national convention. Macey called for non-interference. And then came Hooks. . . .



NAEB president William Harley. . . . "We are in the pursuit of service, not the development of an industry."

This year's National Association of Educational Broadcasters' convention was held in Las Vegas. The casinos were doing a brisk business, the sessions were well attended, and exhibitors reported an upsurge in interest and business compared with last year.

The meeting site was new, but the problems of the industry were mostly centered on the oldest and biggest: government funding. Meanwhile, it is obvious that a great many states have either increased or developed new budgets aimed at a greater use of video innovations and standard lines for educational purposes.

This year, with the pressure on the CPB to strengthen their public image and to gain long term funding, major speakers were coming on strong. And John W. Macy, former president of the CPB got it started by saying that public broadcasting must avoid "electronic pork barreling."

Macy keynoted the theme of independence from government interference in his accepting the NAEB Distinguished Service Award. But Macy warned that this independence must be maintained, even at the risk of losing government support for public broadcast operations.

Harley Speaks On Local Determination

Recent changes in administration for the Corporation for Public Broadcasting "will tell us a very great deal about whether it is vulnerable to political pressures or whether it can accommodate changes in leadership without sacrificing the important principles which led to its establishment," William G. Harley, NAEB president, indicated in his keynote address at the opening convention session.

It is the field, the local stations, which must evaluate the CPB, "not the other way around," Harley said. If CPB "drifts into a role of undue centralization, rationalized by the rhetoric of accountability, it will be a significant change in its intended institutional role."

Such a trend, Harley said, "could render impotent the strength of our diverse system of local assessment, local determination, and local accountability."

"I am not predicting this result," Harley continued. But he stressed the necessity to dramatize the importance of local community service. This was a primary concern of Harley's keynote theme: "Toward Maturity." He added:

"We are in pursuit of service,

not the development of an industry. . . . Public broadcasting must become the parklands of this nation's communication system."

Looking Ahead to 1973

A key emphasis of industry efforts for the coming year will lie in increasing public awareness and support for public broadcasting, according to actions and a consensus of the NAEB executive board at its Sunday meeting.

The board approved creation of an action plan to achieve this increased awareness and support, and it was presented by Chalmer Marquis, NAEB vice president.

Included in the plan are: A coordinated public awareness campaign; A strengthening of current NAEB legislative information efforts; Involvement of lay chairmen of governing boards of public television stations; and, Increased efforts with volunteer groups.

The board directed NAEB's staff to prepare a specific implementation design to be considered by division boards and the executive committee in the light of their respective programs and priorities. In the area of priorities, the staff was asked to complete a study of current association functions that

ould identify where those functions are not being carried out adequately. This study is to relate current functions to the future-oriented action plan.

The board also received a report on activities of a coordinating committee for the chairmen of public television stations. The committee reported:

A projected budget of \$125,000 for the coming year; Appointment

Edward J. Pfister, currently AEB director of information services, as staff coordinator.

The committee is composed of lay board chairmen for public television stations. Its formation began with a meeting in Scottsdale, Ariz., in June. This session, attended by 65 public television station board members, set preliminary goals for the activity. A second meeting, held in New York in October drafted the program reported at the board meeting.

In addition to its responsibilities for building public awareness, the new committee will work to establish programs which will lead to both sound fiscal operations and realistic future goals for public television.

Chairman of the new committee is Ralph B. Rogers (KERA, Dallas). Vice chairman is Edmund F. Ball (Ball State University, Muncie, Ind.) Sidney L. James (WETA Washington, D.C.) is secretary-treasurer.

Staff work on the committee's programs will begin immediately. The next session of the full group is scheduled for January, 1973.

One session was told that institutions of higher education must themselves be educated and assisted in implementation of programs of educational technology, including television. A Monday morning session discussing the report of the Carnegie Commission on Higher Education.

Creation Of Learning Centers

Verne A. Stadtman, assistant director and editor with the Carnegie Commission on Higher Education, reported on a recommendation for formation of a series of cooperative learning centers to develop programs and techniques at educational technology at the post-high school level.

The great need, Stadtman said,

is for educators to commit themselves to the design of good programs using available technologies. The regional centers were seen as a means of achieving this requirement through cooperative funding and effort.

It was also indicated that government funding for educational technology at the college level could be expected to reach \$100 million during fiscal 1973. The commission report held that this amount would be increased gradually until it represents 1 percent of total expenditures for higher education. At present expenditure levels, this sum would be \$250 million.

The Defense Rests

Hartford N. Gunn, Jr., president of the Public Broadcasting Service, squared off against the critics who say the CPB is a "government run chicken network", or who call it the "liberal, left-wing Pinko Broadcasting Service."

Quoting from various publications, Gunn reviewed the bad press public broadcasting has received. "Each time these attacks have come," Gunn said, "most of us have politely asked our critics to



The exhibit areas were crowded, and exhibitors this year reported increased sales.



Live exhibits such as this one at the Dynasciences booth attracted as much interest as the sessions.

watch our programs and then relaxed because we felt that once our critics saw our programs, they would understand. That is, public television is neither a "spineless" system run by government nor are we "left-wing revolutionaries" trying to overthrow the government.

Gunn added up his points by referring to a summation of PBS programming:

"From October 1 of last year to October 1 of this year, PBS distributed some 1700 hours of programming. Of this, some three-fourths had nothing to do with public affairs but were made up of children's and cultural affairs programs.

"Our critics, therefore, are only talking about one-fourth of our total output — only 400 hours out of the 1700 hours of programming. So let's take a look at this less than one-quarter of the programs distributed by PBS which concerned public affairs.

"We all understand the difficulties of program content analysis. But there are some program elements which can be quantified, or represented numerically.

"First, we went through and

counted up all clearly identifiable political figures who appeared on our public affairs programs. This included U.S. Senators, U.S. Representatives, Governors and high-ranking Administration officials.

"Then we took a look at programs which dealt specifically with partisan issues in an election year and featured acknowledged spokesmen for one or the other major parties. 56 percent of these programs featured Republican Party spokesmen, 44 percent featured Democratic Party Spokesmen.

"Another thing we looked at was coverage of the two national political conventions. Some 40 hours were devoted to the two conventions. Of the 40 hours, 58 percent of the time was devoted to the Republican Convention, 42 percent to the Democratic Convention.

(As you recall, following widespread criticism of the manner in which commercial and non-commercial television covered the Democratic Convention, PBS and NPACT — the National Public Affairs Center for Television — provided experimental, uninterrupted podium coverage of the GOP Convention.)

"Finally, we took a specific look at NPACT's election year series, **A PUBLIC AFFAIR/ELECTION '72** which PBS began distributing on February 2, 1972.

"Forty-nine percent of NPACT's programs were devoted to such bi-partisan issues as the youth vote, political polls, the history of Presidential primaries, the convention delegate selection process, women in politics, etc.

"Of the remaining half of NPACT programs, 30 percent featured Democratic Party spokesmen, issues and activities while 14 percent featured Republican spokesmen, issues and activities. The remaining programs were devoted to coverage of other political factions, such as the George Wallace campaign."

Moving Up

O. Leonard Press, executive director, Kentucky Authority for Educational Television and current chairman of the ETS board, will be 1973 chairman of the NAEB executive board. Press was elected to this position at the board meeting Sunday afternoon.

Press will follow Lloyd Kaiser (WQED, Pittsburgh) in this post.

Burt Harrison (Manager, KWSU, Washington State University) was re-elected vice-chairman.

Edmund Ball (Ball Corporation, Muncie, Ind.) was elected to a second four-year term as a public member of the NAEB executive board.

Public members Clifford Alexander, a Washington, D.C. attorney, and Elvis Stahr, president of the National Audubon Society, resigned from the NAEB executive board. Both members left because of other duties.

Dr. Hugh V. Cordier, (WSU-KSU, Univ. of Iowa) has been elected chairman of the National Education Radio division of NAEB. Burt Harrison (KWSU, Washington State Univ.) is the new vice-chairman.

Clyde Robinson (Univ. of the Pacific) has been named to the new post of practitioner director.

They will take office January 1, to serve through December 31, 1973.



While not many really new products were on display, those that were new drew considerable interest. At left, the new Broadcast Electronics Titlmaster. At right, the Skirpan automated lighting module system. For more product reviews, see our new product section in this and following issues.

Black Journal Or Else.....

Federal Communications Commissioner Benjamin L. Hooks lauded public broadcasting for the "many fine things" it has done in educational and cultural programming and then proceeded to blast its "abyssmal" record on minority hiring and representation.

"I can never be the friend of public television I'd like to be until you get your own house in order," Hooks told the convention of the National Association of Educational Broadcasters.

Commissioner Hooks indicated he will support efforts to obtain long term federal financing in proportion to the effort expended by public broadcasters in giving minority peoples a fair shake in employment and programming. But he admonished public broadcasters not to "get so excited about what is to come that you neglect what you can do with what you have."

Hooks had harsh words for stations electing not to carry such

Black-oriented programs as "Black Journal," charging that "there is still too much overt and covert racism in this country."

One of public television's problems, Hooks suggested, is that it tries to be all things to all people. He said programming should principally involve (1) education; (2) culture ("... of paramount importance"); and (3) programming that is responsive to all—Whites, Blacks, Indians, Orientals and all ethnic groups in this country.

Commission Begins Radio De-regulation

As part of a comprehensive study of the re-regulation of broadcasting, the Commission has relaxed or deleted certain rules (Parts 1 and 73), for meter reading, transmitter inspection, station identification and taped, filmed or recorded material. Changes were also made in requirements for logging, rebroadcasting the programs of

another station and filing certain contracts.

The action follows receipt of more than 400 replies to an FCC Public Notice of April 6, 1972, announcing the re-regulation study. The Commission said it was considering other changes "to reflect more accurately the present state of broadcast technology and operation," and may soon issue additional Orders relaxing and deleting existing rules as well as Notices of Inquiry and Proposed Rule Making on fundamental aspects of broadcast regulation.

The rule changes permit certain meter readings of all broadcast transmitting systems to be made every three hours, instead of every 30 minutes. AM, FM and educational FM transmitting equipment may be inspected once a week, at intervals of not less than five days, instead of once a day, five days a week. Broadcast station operating and maintenance logs may both be kept in a common log, if the licensee wishes.

preset take memory



The low cost PTS-120 provides:

- Smooth master control switching
- 17 event storage • Easy operation
- Editing of stored information
- Individual prerolls for films and VTRs
- Interfaces for a variety of master control switchers



CENTRAL DYNAMICS LTD

CANADA-147 HYMUS BLVD., MONTREAL 730, QUE.
U.S.A.-230 LIVINGSTON ST., NORTHVALE, N.J. 07647

Reviewing a new cartridge for automated music

By Don Kalmokoff*

One of the most troublesome problems in automated systems has been how to achieve the freedom to change the order and mix of music tied to reel-to-reel record-reproduce equipment. This problem disappears if you use cartridges as a music source. But many broadcasters would reply: "Poor or inconsistent frequency response. . . . Poor wow and flutter characteristics. . . . Inconsistent, machine to machine. . . . Costly; Too many carts must be culled to select a few useable ones."

Nevertheless, when we established our new FM outlet, CFMI-FM in New Westminster, British Columbia, our very bright production people insisted that music on cartridges was the way to go. Faced with the problems, we set about finding solutions. The answer required us to develop the ARISTOCART.

To understand our solutions, consider first an idealized reel-to-reel machine. (Figure 1) "A" and "B" are supply and take-up-reels; "C" is an idler guide, normally incorporating an inertial flutter filter; "Es" are transducers and "D" is a capstan roller drive as-

sembly. Tape is supplied from "A" past "E" to "B". If the following criteria are met, we have a well designed reel-to-reel machine.

- (A) Tape travel is in one plane.
- (B) Surfacers contacts tape on path and parallel to tape.
- (C) Tensions are constant.
- (D) Transducers are mounted on an arc of a circle.

If these conditions are met, other guides are not necessary to ensure a consistent tape path past the transducers. Some wandering at the drive point could occur if the roller becomes concave, but a very slight convex doming on the rubber roller takes care of this.

You may not believe that the idealized machine shown will guide a tape in a consistent path. I suggest a simple test procedure to convince yourself.

Use any reel-to-reel machine and a couple of rods for this test. Bypass the normal tape path and use one of your rods as a "head." Start the tape and observe how simply it can be guided into a desired path by varying the zenith angle of your "head." If the "head" is perpendicular to the plane of the reels, the tape stays in the plane of the reels. Secondly, while the "head" is perpendicular to the plane of the reels,

use your second rod to "guide" the tape into another path. Note the tape distortion which occurs at the "head." This tape distortion can be a cause of flutter, drop-out, or phase shift in stereo equipment.

Please note I say can cause these problems. "Guiding" is not normally the sole cause, but if you experience these problems in your equipment, check to see that no inadvertent guides are operative.

Keeping Figure 1 in mind, we can summarize the basic requirements for an idealized record-reproduce reel-to-reel machine:

(A) Supply and take-up reels for tape handling, incorporating a suitable tape braking system.

(B) Transducers and electronics.

(C) Drive mechanism.

(D) Some form of flutter filter. This function is normally performed by an inertial guide at the input end of the path past the transducers. It is the one guide we acknowledge to be necessary, as it serves another very important function: namely, isolation of tape perturbations due to reel and tape wind anomalies. Since tape wind is not truly controllable on other than very expensive precision reels, means of isolating supply variations from the transducer path are essential. This inertial guide performs as a flutter filter because it usually has a relatively large mass attached to it in the form of a fly wheel.

(E) A tape path in one plane with transducers on an arc of a circle.

(F) Means of supplying constant tension to tape.

(G) All parts contacting tape on path "A" to "B" must perpendicular to the plane of tape travel.

Back now to our subject, which was cartridges in case you have forgotten.

Figure (2) shows an idealized NAB, type A, standard cartridge. A cartridge such as this, in conjunction with a record-reproduce mechanism is essentially the reel-to-reel machine we have been dis-

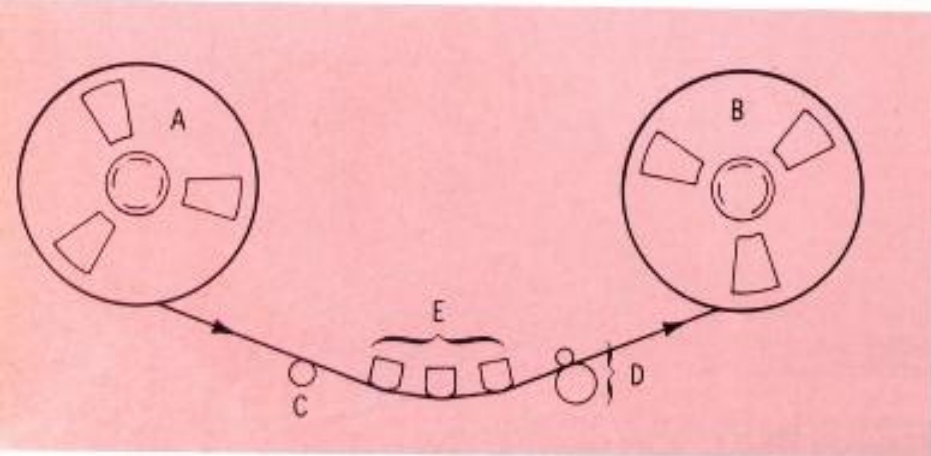


Fig. 1 An idealized reel-to-reel machine. The E's are transducers, C is an idler guide, and D is a capstan roller drive assembly.

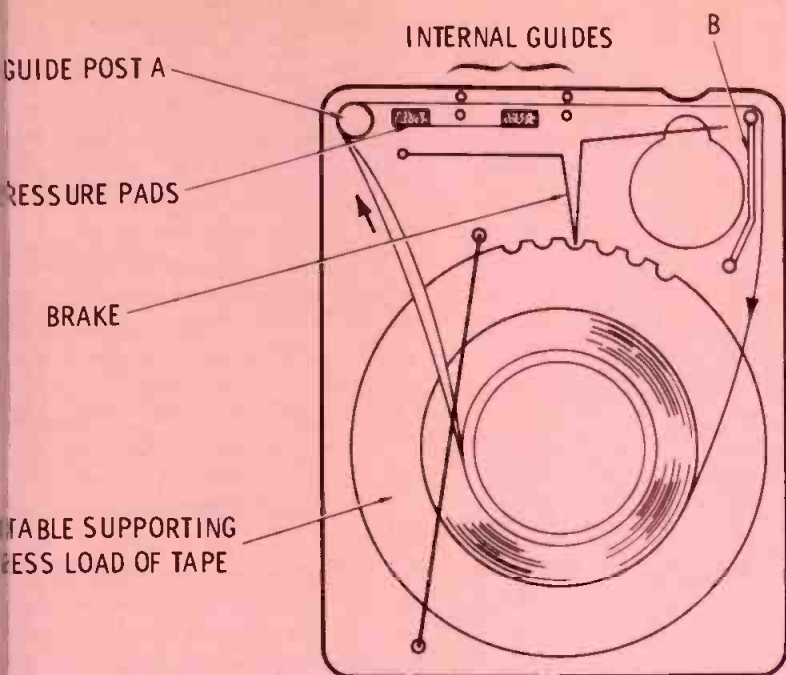


Fig. 2 Drawing of an NAB type A standard cartridge.

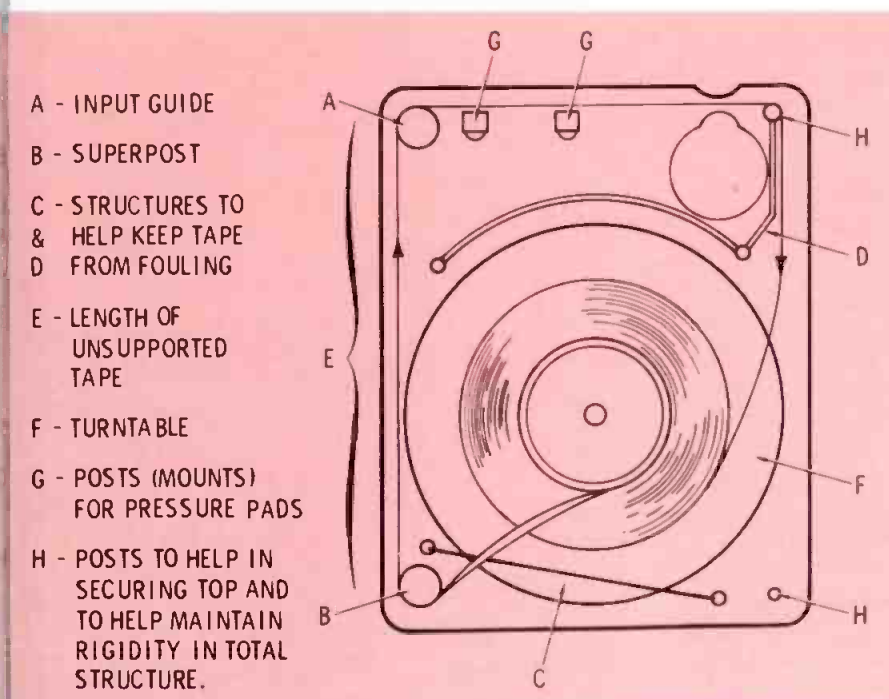


Fig. 3 Artists version of the Aristocart.

ussing. However, several very obvious differences are immediately apparent.

(1) Supply and take-up reel are the same and the same.

(2) Tape travel is in several planes, in different places at the same time.

(3) There is no flutter filter.

(4) It has pressure pads. Reel-to-reel machines often have these too.

(5) Heads are mounted in line.

(6) It has a brake which does not control the tape.

There are also some differences which are not so obvious.

(7) One post doing several jobs.

(8) A drive mechanism which can be troublesome to adjust.

(9) A path, past the transducers, subject to the whims of cartridge distortion.

We believe that all these differences are considered and dealt with

in a practical manner in the Aristocart, as shown in an idealized version in Figure 3.

Dimensionally, the Aristocart is NAB type A. You will notice a funny tape path, no brake, and if you were able to take off the tape, a special turn-table. (see Figure 4).

Let us go through the differences.

(1) Supply and take-up reels the same.

Since it is difficult to have an endless loop on other than one reel, it may appear that we're stuck with this one. "Stuck", however is not the word, because a single reel actually turns out to be an advantage. If we design it so that pressure at the center is due mainly to a fixed amount of tape, tension can be relatively constant. It will vary directly with tape load, but within narrow limits. The design in Figure 4 does just that. Central core pressure is mainly a function of the tape on the lowered portion of the turntable.

(2) One plane tape travel.

This is also one we are "stuck" with. The solution: simply add post B and at least get the maximum uniplane tape travel allowed by geometry. Other benefits also result:

- It relieves Post A of two important duties; namely, tape straightening after leaving T-T-hub, and isolation of tape reel perturbations from transducer path.

- In combination with post A it gives us a length of free running tape which performs like a mechanical flutter filter.

(3) Flutter filter— dealt with by adding Post B.

(4) Pressure pads, and (5) In line heads

These two go together since consistent tape-to-gap contact is extremely difficult without pressure

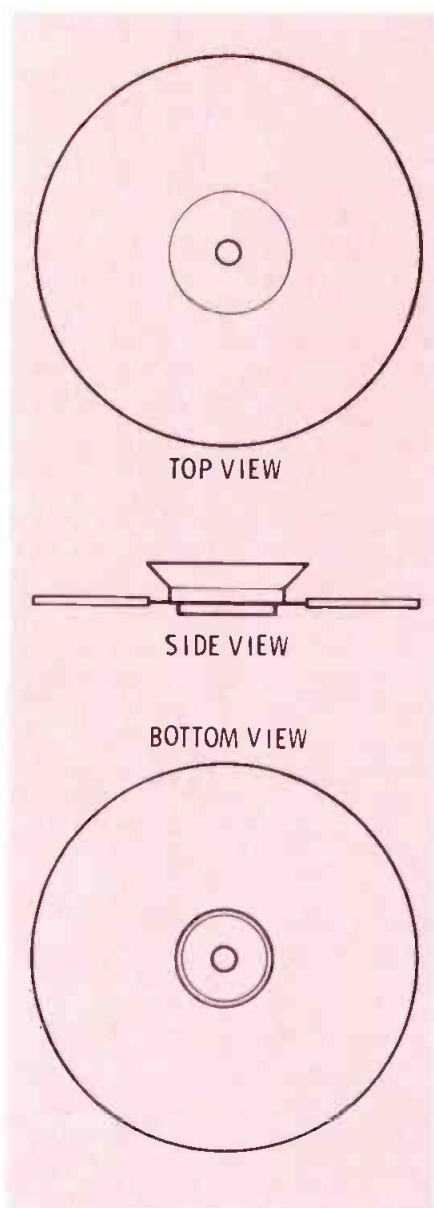


Fig. 4 Using the same reel for supply and take-up. Central core pressure is mainly a function of the tape on the lowered portion of the turntable.

pads on an in-line head assembly. It is possible. If manufacturers would cant their heads in opposite directions approximately 10° , pressure pads could be eliminated but for the inevitable burble of a splice. We have done checks on machines with moveable heads. The results indicate an area which should be further explored.

Since we have opted for pressure pads, why the particular structure we used? They appear to be overly intricate pads, mounted opposite to most other pads. They are attached to posts which are an integral part of the case.

The reasons for their structure are too complicated to list fully, but include:

(A) They are special foam which is dimensionally rigid in the plane of tape travel.

(B) They are pliant and give excellent gap-to-tape contact without unduly altering tape path.

(C) They are mounted on posts which are perpendicular to plane of tape travel. (See point "g" in reel-to-reel discussion).

(D) They are separate because we like the odds. One may be crooked, but not both on the same cartridge. Path distortion is again minimized.

(6) A brake which does not control the tape.

We believe the braking system generally employed is of no value. Its only function is to immobilize the turn-table. Violent handling of a cartridge loaded with more than 60 seconds of tape will result in tape fouling whether or not the turn-table is immobilized.

Another very important problem caused by brakes ordinarily escapes notice. Since the brake release system utilizes the cartridge drive mechanism, an uncontrolled and uncontrollable variable is introduced into capstan tension settings. Therefore, there is no brake on the Aristocrat.

(7) One post doing several jobs.

The addition of Post B has freed Post A to do its most important single task. Its single function, in

the Aristocrat, is to introduce tape at a height of $0.300 + 0.002$ inches above the deck, to the input end of the path past the transducers.

(8) Drive mechanism adjustment.

This ceases to be a cartridge problem once the brake has been eliminated. However, you must make sure of one thing: it is absolutely essential that the motor drive shaft and the capstan bearing shaft be parallel when the capstan is engaged at the correct tension setting.

(9) Rigid path past transducers.

The Aristocrat has been made structurally rigid to prevent distortion when the cartridge is clamped into position. This feature is necessary to provide what we get automatically in a reel-to-reel machine; namely, repeatable placement of tape in the critical transducer path.

What does actual experiences show after six months of full cartridge operation by Western Broadcasting's FM Station CFMI? The station is completely automated using an IGM automation system. There are three Sonomag Carousels for music and two for commercial runs. There are three single play units, also Sonomag. The station is in full stereo, all from cartridge.

Frequency response is $\pm 2\text{dB}$ from 50-15KHz in stereo. For the mono listener, we have been able to maintain the response to within 63dB to 12KHz. This means that phase cancellation is held to a maximum of 45° (3dB) and averages only about half of that.



NEW PRODUCTS

Economy Color TV Camera

A moderately priced three-tumbicon tube color television camera using light, inexpensive triaxial cable instead of conventional multi-conductor camera cable was demonstrated to educational TV executives and engineers at the annual convention of the NAB by Philips Broadcast Equipment Corp.



The camera is designated the Norelco LDH-1T, and is a modified version of the highly successful Norelco LDH-1 which uses regular cable. The most significant difference in exterior appearance between the LDH-1 and the LDH-1T is the compact cable adaptor unit and the smaller and more economical cable between the camera and camera control unit.

Field tests in remote telecasts of the LDH-1T have been conducted successfully over the past several months.

In the new LDH-1T, the camera head and C.C.U. can be separated by as much as 4,000 feet without any requirement for video compensation. The use of triax provides significant operational and economic advantages. Triax weighs and costs approximately 20 percent less weight and cost of the multi-conductor cable used with the

LDH-1. In new construction, as in school, studio, or hospital buildings, permanent installation of a multi-outlet system is greatly eased. Size of the cable along with the 4000-foot capability eliminates most of the problems associated with permanent installations. On outdoor and remote assignments the advantages in handling, labor, storage and cable costs are obvious.

The Norelco LDH-1 camera has met with wide acceptance and is already in use by educational TV facilities, medical schools, industrial studios, cable operators, race tracks and video tape production firms. It is being used extensively in telecine systems as well as self-contained and systems configurations.

For More Details Circle (60) on Reply Card

Mini-Weight Fill Light

Berkey Colortran, Inc. a division of Berkey Photo, Inc. announces the new Minibroad — a strong fill light in a mini-weight compact package. Mini-broad utilizes the latest technology for powerful and efficient light output. Its 650 watt "quartz" lamp delivers a maximum amount of light with a minimum amount of heat — lets you get in close to your subject.

Colortran's Minibroad weighs only 20 ounces. Compact size and light weight make the Minibroad an easy traveler. You can almost slip it in your coat pocket. Great for newsmen, photographers, cinematographers — everyone on the move who needs rugged professional lighting equipment.

Colortran's Minibroad features a quick pan and tilt handle for fast

(Continued on page 44)

Number 92 in a series of discussions
by Electro-Voice engineers



THE SEARCH FOR HERTZ

WILLIAM RAVENTOS
Professional Products
Marketing Manager

Perhaps the most critical design problem facing any manufacturer is to clearly define the needs to be met by a new product. Not only must performance goals be carefully considered, but also such aspects as appearance, size, weight, and price must be examined in terms of the user and his application of the product.

An example of how these factors affect the product can be seen in two closely related monitor speaker systems now being produced by Electro-Voice. The initial design project was to create a high-efficiency, high-level utility monitor for studio, theater, and sound reinforcement applications that would provide improvements in dispersion, uniformity of total acoustic output, flatness of response, and extended frequency response over previous designs. The result was the E-V Sentry IVA system.

Proof that the Sentry IVA meets its design goals is evident in the broad acceptance of the product in the field. The emphasis on high efficiency, however, resulted in an all-horn-loaded system that is relatively bulky to achieve a low-frequency limit of 50 Hz (3 dB down point). While this exactly suits many applications, a need was also expressed for a system that would offer more extended low frequency response. The Sentry III was designed to meet this modified goal.

Both systems use identical high frequency and mid-range sectoral horns and drivers to achieve good dispersion and uniform total acoustic output. But while the Sentry IVA employs two 12-inch woofers in a folded-horn enclosure for maximum efficiency, the Sentry III uses a single 15-inch woofer in a direct radiator vented cabinet tuned for fourth order Butterworth response characteristics. Response is extended to 40 Hz while output is just 4 dB less than the Sentry IVA at 50 watts input. The overall height of the system is reduced about 1/2 and a furniture cabinet permits use in home environments as well as in the studio.

The Sentry III bridges the gap between high-efficiency studio monitors and wide-range home speaker systems. For instance, most acoustic suspension speakers have insufficient efficiency and output level to satisfactorily reproduce either symphonic or popular music at levels equal to a live performance. But with an output of 113 dB at 4' on axis with 50 watts input, the Sentry III generates useful sound levels with modest amplifier power, and with substantially less danger of amplifier clipping than is possible with typical home-oriented wide range systems.

While there are many applications where either the Sentry III or Sentry IVA might be used interchangeably, each can provide unique benefits depending on the application. And each responds to specific needs of professional sound engineers in studio and sound reinforcement as expressed in field surveys and on-site testing.

For reprints of other discussions in this series,
or technical data on any E-V product, write:
ELECTRO-VOICE, INC., Dept. 1223V
638 Cecil St., Buchanan, Michigan 49107

Electro-Voice

a GULTON subsidiary

For More Details Circle (19) on Reply Card



convenient adjustment. Full 180° vertical tilt. Each light has 12 feet of cord with an in-line switch. A full line of completely detachable accessories is also available.

For More Details Circle (61) on Reply Card

Pre-Set Stripper Cutter For Coax Cable

Xcelite Incorporated has just added to its line of quality professional hand tools the No. 590 Coax

Stripper/Cutter, designed specifically for use with the popular RG-59U coaxial cable.

Featured is a three-position selector lever. With the lever in Position 1, the hardened and ground blades cut cleanly through the jacket, shielding, and dielectric



without fraying, to expose the undamaged conductor. Position 2 removes the jacket and shielding, while Position 3 strips the jacket off without damage to the shielding, or dielectric. With the selector lever disengaged, the entire coax cable, in fact many other wires and cables, too, can be cut neatly to length. Handles have cushion grips

for user comfort and to lessen fatigue.

The No. 590 Coax Stripper/Cutter, made in U.S.A. to highest quality standards, has a list price of \$4.75.

For More Details Circle (62) on Reply Card

Rectifier Stacks

Amperex Electronic Corporation, wholly owned subsidiary of North American Philips Corporation, has introduced a new line of heavy duty, high voltage silicon rectifier stacks intended for high power industrial and communications applications in which trouble-free performance and economy are major requirements.

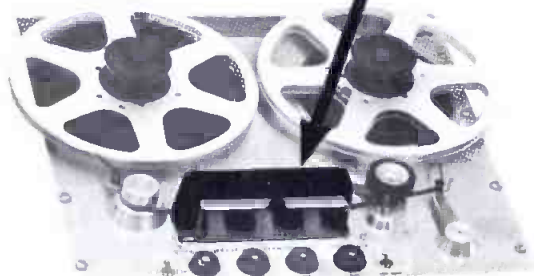
Designed for use as single- or three-phase full wave rectifiers, these high voltage stacks are available in two standard configurations and in a variety of individual types.

One configuration consists of series-connected diodes encapsulated in a molded plastic package that is designed for mounting on a

ERASE RECORD REPRODUCE MONO - STEREO

Professional Direct Replacement Heads with complete written and pictorial instructions

Our factory will clean, rebuild, adjust and test your head ASSEMBLY, install new MMI heads... replace minor hardware and modify your gate to accept our "NON-POPPING" springs



36 HOUR SERVICE - LOANERS AVAILABLE
(612) 884-7393



MINNEAPOLIS MAGNETICS, INC.

8125 PLEASANT AVE. SO., MINNEAPOLIS, MINN. 55420



LET ROLL-A-REEL ROLL THE LOAD

Load cable, wire, rope or anything on reels onto Roll-A-Reel for easy, smooth pay-out or take-up.

All are drilled for optional auxiliary ball-bearing side rollers, \$8.50 per set extra.

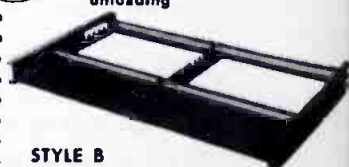


- Easily portable
- No jacks
- Handle any reel diameter
- Heavy steel frame
- Slanted front
- Ball-bearing, adjustable rollers
- Positive roller lock for unloading



STYLE A

1,500 lbs. cap. for reels up to 28" wide. Weight 60#
PRICE \$72.50
f.o.b. Cincinnati



STYLE B

3,000 lbs. cap. for 1 reel up to 48" wide; or for 2 reels up to 24" wide each. Weight 110#.
PRICE \$117.50
f.o.b. Cincinnati

• Special sizes on request.

ROLL-A-REEL

7386 Reading Road
Cincinnati, Ohio 45237

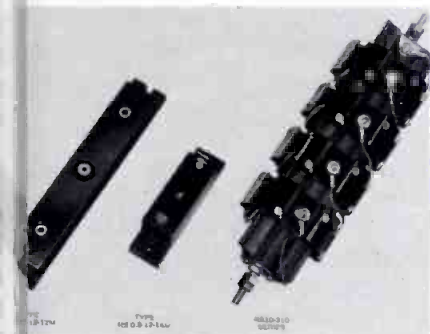
For More Details Circle (41) on Reply Card

For More Details Circle (20) on Reply Card

BROADCAST ENGINEERING

at surface by means of bolts. The second configuration consists of 9 39 series-connected diodes arranged in sets of three on a triangular frame, stud-mounted.

Average forward current for the various types ranges from 0.5 amperes to 10 amperes; and non-repetitive 4-cycle (67 millisecond) maximum RMS surge currents range from 12 amperes to 310 amperes; peak inverse voltages range from 9 KV to 39 KV.



To simplify the selection of the optimum rectifier stack for any application, Amperex is making available to designers of high voltage rectifier circuits, an engineering calculator consisting of a detailed application report and six factor nomographs for both single and three-phase circuits.

The application report, (No. P-11) contains brief technical discussions of voltage transients, and power supply voltage and current relationships. It also contains step-by-step instructions for the use of the nomographs, which are not bound into the report but are separate for ease of use.

For More Details Circle (63) on Reply Card

Antenna Alignment Transceiver

The Series 4600 Link Alignment System by Scientific-Atlanta reduces the costs of antenna alignment in microwave communications relay system installation and maintenance. The system provides both a microwave signal and two-way voice communication to simplify the antenna alignment process.

The Series 4600 Link Alignment System consists of two small microwave transceivers with two-

ALL-IN-ONE SPORTSCASTER HEADSET

This sportscaster can roam about a football field, rubberneck at a basketball game, or quickly position himself for an important golf shot. All with just one piece of equipment. The new Telex CS-90 Sportscaster headset lets him broadcast live (fixed station or mobile) listen to production cues, and monitor his own transmission, all with hands free convenience.

He can do all this because Telex has now combined the finest professional microphone available, one of proven broadcast quality, with an equally high-performance headphone.

This wide-range, dynamic, boom microphone has a low frequency response to transmit his voice clearly and crisply, and an omni-directional design to pick up colorful crowd noise. The two channel headphone fits comfortably with a padded headband and foam filled earcushions to screen out ambient noise. It is adaptable to any application or equipment by means of non-terminating cordage and features exclusive Telex audiometric type driver elements. And both headphone and microphone are designed to stand up even if the sportscaster has to work in all types of weather extremes and can't avoid some hard bumps. In fact, if the sportscaster doesn't hold up as well as the CS-90, there is a "push-to-cough" switch that mutes the mike when necessary.

Constructed of high-impact ABS plastic and stainless steel. Styled in non-reflective black and grey to eliminate glare on camera. Write for further information.



PRODUCTS OF SOUND RESEARCH

TELEX®

COMMUNICATIONS DIVISION

9600 ALDRICH AVENUE SOUTH
MINNEAPOLIS, MINN. 55420

CANADA: DOUBLE DIAMOND ELECTRONICS, LTD., Scarborough 4, Ontario
EUROPE: ROYAL SOUND COMPANY, INC., 408 North Main Street, Freeport, N.Y. 11020 U.S.A.
INTERNATIONAL: TELEX EXPORT DEPT., 9600 Aldrich Ave. So. Minneapolis, Minn. 55420 U.S.A.

For More Details Circle (32) on Reply Card

precise timing for precision programming at very low cost...



the quartzmatic clock by WESTCLOX

- Precision accuracy of plus or minus only 1 minute in 525,600 minutes (1 year) ... that's reliability.
- Perfect for radio and TV stations, recording studios, news bureaus, ham radio operators, weather stations.
- Completely portable, move it anywhere ... accuracy unimpaired.
- Easy to read at a glance, large 12" diameter face with 1 1/2" numbers, red sweep second hand.

and only \$55⁰⁰

- Powered by two "C" size batteries, over 1 full year battery life.
- Choice of colors — white or tan face with charcoal numbers, both have woodhue case.
- One year Factory Guarantee from Westclox, a division of General Time, the world's foremost maker of precision clocks and watches.

For precise timing, order the latest advance in timekeeping technology, the WESTCLOX QUARTZMATIC CLOCK ... only \$55.00

Send check or money order and we'll pay shipping charges. Please include all applicable taxes. If preferred, we'll send C.O.D. Please indicate color; white or tan. Batteries not included. Allow two weeks for delivery.

ORDER FROM: GENERAL TIME SERVICE
NEW YORK 150 E. 47th St., N.Y. 10017
CHICAGO 206 N. Michigan Ave., Ill. 60601
LOS ANGELES 5404 Wilshire Blvd., Cal. 90036
AKRON 25 Ghent Rd., Ohio 44313
PHILADELPHIA 1214 Walnut St., Penna. 19107
PHOENIX 2047 East Camelback Rd., Ariz. 85201

Quartzmatic movements available separately, write for details.



GENERAL TIME SERVICE
A TALLEY INDUSTRIES COMPANY

For More Details Circle (23) on Reply Card

New Products (Continued from page 45)

way voice circuits operating at 6 GHz. Accessories include a remote meter, carrying case, battery



pack, headset, and horn antennas for coarse alignment.

For More Details Circle (65) on Reply Card

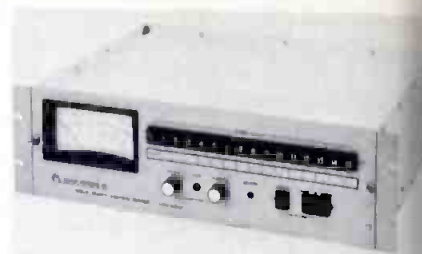
Remote Control System

Moseley Associates, Inc. has announced the introduction of their new TRC-15A Remote Control System. Using no rotating stepper switches, this new 15-channel system offers a dramatic step forward in remote control equipment.

Basic reliability is increased by removal of the customary mechanical stepper switch. Individual relays in the TRC-15A have replaced the stepper switch. All relays are socketed and retained by a spring clip simplifying replacement. Total consideration has been given the serviceability of the TRC-15A. As noted, all relays are socketed and are identical. Full access to all functional circuitry is provided by slide-out drawer mounting. All transistors and integrated circuits are socketed.

Complete shielding in both studio and transmitter units makes the TRC-15A extremely immune to RF energy. A second shielded compartment is provided in the transmitter unit to further isolate the circuitry from high RF fields. Further, all wiring to this section is passed through feed-thru RF filters.

Two versions of the TRC-15A are available; the TRC-15AW for operation over a single telephone line, and the TRC-15AR for total



wireless operation. Field conversion to either configuration is straight-forward. Options include a telemetry subcarrier (SCA) generator and telemetry subcarrier (SCA) demodulator.

For More Details Circle (66) on Reply Card

Maintenance Kit For Tape Machines

Nortronics Company, Inc. has introduced ToteKit, a new concept for the total maintenance of every cassette, cartridge and reel-to-reel recorder/player.



Nortronics' new ToteKit concept for total preventive maintenance solves a long standing user problem: which products to select in order to properly maintain each type of recorder. Each new ToteKit provides the solution by bringing all necessary maintenance products for each recorder type together in kit form at a significantly lower cost than the same products purchased individually — and by providing industry's most comprehensive instructions for their use illustrated by clear, concise photographs.

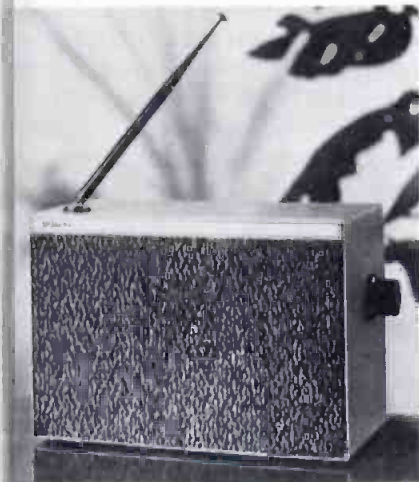
A separate ToteKit is available for cassette, cartridge and reel-to-reel machines. Each contains carefully-selected Nortronics QM-SERIESTM quality maintenance accessories required to establish an effective preventive maintenance program that will ensure continued

otimum performance and longest possible machine life.
 or More Details Circle (67) on Reply Card

FM-SCA Receiver

The McMartin TR-E2 multiplex receiver is a completely self-contained professional educational receiver designed for continuous use. Operation is as easy as using a standard FM receiver. The controls consist of a combination OFF/ON switch and volume control; a full-size 34" telescoping antenna included.

Housed in attractively styled metal cabinet with a beige textured finish and front loudspeaker with fabric grill, the TR-E2 incorporates many of the fine features found in the TR-55 and TR-66B professional background music receivers. Good main channel sensitivity and high-Q input circuits minimize cross-talk and give wide dynamic range. The oscillator is crystal controlled to guarantee on-frequency



operation, without user adjustments. The TR-E2 FM/SCA multiplex receiver is certified to comply with Part 15 of the FCC Rules and regulations.

Optional features include a rear mounted main/subchannel switch, headphone jack to match the Library of Congress Cassette Talking Book and main/subchannel

or More Details Circle (68) on Reply Card

Solid State Lighting Dimmers
 SKIRPAN LIGHTING CONTROL CORPORATION, Long Is-

land City, N.Y., has introduced a new line of solid state dimmers for stage and studio lighting control under the trade name ASTRAL.



Available in power capacities of 2 kw, 3 kw, 6 kw and 12 kw, the new ASTRAL dimmers feature relay rack format design, minimizing installation time and cost while guaranteeing system expandability.

ty. The ASTRAL 2 (2 kw) requires only 1 3/4 inches of rack space and weighs only 7 pounds. Other features include quiet operation (less

than 35 db), RFI noise reduction (less than 10 quasi-peak microvolts), adjustable transfer characteristics and a plug-in, printed circuit logic card.

For More Details Circle (69) on Reply Card

2.5kW FM Transmitter

American Electronic Laboratories has introduced their new 2500 Watt FM Transmitter. As you can see in the picture, human engineering was a major factor in the front panel design.

Almost entirely solid state, the FM-2.5KD transmitter features automatic recycling, allowing only three overloads within one minute before shutting down the transmitter. The driver section uses a 4X150A power tetrode which feeds a 3CX1500A7 final amplifier.

PROGRAM IN- PRODUCTION and LOG OUT AUTOMATICALLY!

**LET US
AUTOMATE YOUR NEW SYSTEM—
CUSTOM AUTOMATED PROGRAMMING BY:**

RICHMOND HILL LABORATORIES LTD.,
 AUTOMATED ENGINEERING,
 1240 ELLESMERE ROAD,
 SCARBOROUGH (TORONTO) ONTARIO
 CANADA. (416) 291-7921

Write for information
 or call your local sales office:



Eastern
 New Jersey
 (201) 381-5955

Midwest
 Illinois
 (312) 822-4622

For More Details Circle (24) on Reply Card

STUDIO MONITOR AMPLIFIERS

by
Crown

D60



compact

Delivers 30w RMS/channel at 8Ω
Takes 1 3/4" rack space, weighs 8 1/2 lbs.
THD distortion less than 0.05% from
1/10w to 30w at 8Ω
S/N 106dB below 30w output
\$229 rack mount

D150



universal

Delivers 75w RMS/channel at 8Ω
THD distortion less than 0.05% from
0.01w to 75w at 8Ω
S/N 110dB below 75w output
Takes 5 1/4" rack space, weighs 20 lbs.
\$429 rack mount

DC300



power

Delivers 150w RMS/channel at 8Ω
THD distortion less than 0.05% from
0.01w - 150w at 8Ω
S/N 110dB below 150w output
Lab Standard performance and
reliability
\$685 rack mount

All Crown amplifiers are warranted
3 years for parts and labor. They
are 100% American-made to profes-
sional quality standards. All are
fully protected against shorts, mis-
match and open circuits. Construc-
tion is industrial grade for years
of continuous operation.



PO BOX 1000, ELKHART, INDIANA 46514, U.S.A.

For More Details Circle (25) on Reply Card

(Continued from page 47)

AEL uses positive forced air cabinet and tube cooling to insure long tube life and decreased dust accumulation. Remote control readings and functions are conveniently provided as parallel circuitry to the main transmitter metering and control. Automatic power output control and VSWR metering and control are optional.

For More Details Circle (70) on Reply Card

Super Wide-angle Lens

Century Precision Cine/Optics of North Hollywood, California announces the availability of their new 3.5mm f/1.8 Super Wide-Angle Lens for 16mm motion picture cameras. The lens covers an angle of 165 degrees, seven times greater than the normal lens. Covering an entire room is possible without moving the camera.

Made with the latest and finest grade optical glass for sharp resolution, full color correction and brilliant saturation, the manufacturer points out that this is not a "fish-eye" lens that renders only a circular field. It covers a full 16mm frame without vignetting. Depth-of-field is enormous. Available in 16mm "C" or Bolex RX fixed focus mounts. Objects 4" to infinity remain in sharp focus with only a moderate 10 percent distortion. Valuable for documentary news and special effects filming.

For More Details Circle (71) on Reply Card

3/4-inch Cassette

Memorex has announced development of the first domestic chromium dioxide tape cassette for the 3/4" video cassette recorder.

Wow, Rumble And Flutter Meter

Rek-O-Kut announces a portable Wow, Rumble and Flutter Meter designed to meet the most exacting broadcast specifications to meet the broadcasters requirements. This unit contains metering to 0.01 percent accuracy. It can be used as a voltmeter and contains a built-in oscillator. The selling price below \$500 and is available from all Rek-O-Kut Dealers.

For More Details Circle (73) on Reply Card

Available in blank cassettes in 60, 30, 20 and 10 minute lengths, the new video tape can be used for both color and black and white recording. The cassette is fully compatible with Sony, Japan Victor, Panasonic and Wollensak 3/4" systems.



Chromium dioxide tape provides dramatically higher recording output quality over conventional ferric oxide tapes at high frequencies. Memorex was the first company to be licensed to manufacture chromium dioxide tapes of all kinds, including video, audio and computer.

Shipments of the new cassettes will begin in January, 1973, and will be available through authorized Memorex helical scan video tape distributors. Prices for the new chromium dioxide cassette will be competitive with present products.

For More Details Circle (72) on Reply Card

500 MHz to 1.25 GHz Signal Analysis

An advanced solid-state signal analysis system with CRT display and 8-digit frequency indication has been introduced by the Microwave Division of Systron-Donner Corporation. The new Model 760 tests and measures radiated and



conducted signals throughout the frequency range from 500 KHz to 250 MHz.

The Systron-Donner Model 760 Signal Analysis System is suitable for a broad variety of applications, such as spectrum analysis, signal monitoring, frequency measurement and RF power measurement, in any environment, airborne, mobile or laboratory. It provides scan widths from 300 MHz to 10 KHz and resolution from 300 Hz to 1 MHz. Sensitivity is -117 dBm. Other features include: 60 dB calibrated amplitude display and 60 dB RF attenuation; accuracies of 0.0005 percent for frequency and ± 1.0 dB for RF level; AM/FM detection and X-Y recording outputs.

For More Details Circle (74) on Reply Card

Super 8 Camera

Hervic Corporation/Cinema Beaulieu announces the immediate availability of the new Beaulieu 008ZM2 Super-8 camera, with the new super wide-angle 6-66mm "Beaulieu-Optivaron" f1.8 zoom lens (11:1 zoom ratio).

At its 6mm focal length setting, the "Beaulieu-Optivaron" zoom lens provides a 67° angle of acceptance. In addition, the new



"Beaulieu-Optivaron" 6-66mm zoom lens provides 46.8 percent more area when filming at its maximum 6mm wide-angle focal length, as compared to filming at an 8mm focal length.

Some of the other exciting features available on the new Beaulieu 008ZM2 Super-8 camera are: Lap-Dissolves and Superimpositions, fully controllable up to 100 frames duration; Macro Motorized Focusing to 1 millimeter from the front element of the Beaulieu-Optivaron 6-66mm zoom lens, and even closer if desired (without requiring any

accessories... and where the covered field is approximately 23.5mm x 17.7mm); and interchangeability of Lenses (C-mount, and most still "miniature" camera lenses).

For More Details Circle (75) on Reply Card

Microwave Intrusion Detector

A new, microwave motion detector system has just been announced by Mountain West Alarm of Phoenix, Arizona. The A5-001 Space Switch is designed to provide total premise protection by giving an alarm due to forced entry through roof, wall, door, or window.

The A5-001 should be of interest to alarm installers, security managers, warehouse managers, and small businessmen who have to protect valuable inventory, documents, or buildings from thieves and vandals.

The Space Switch is an all solid state Microwave (UHF) Doppler Radar System. Wall to wall and floor to ceiling protection is provided over as much as 3500 square feet or a 30 foot radius. Microwave transmissions penetrate most non-metallic structures, i.e., plaster, wood and concrete (somewhat) and are reflected by metal. Thus, an entire premise may be protected. Movements from an intruder set off the alarm circuits while a digital filter rejects movements of small animals and other false alarms.

Installation requires only power and alarm output connections. Powered by 110 VAC or optional 12 VDC battery. Box measures just 3 3/4" high x 6" wide x 7" deep, weighs 4 lbs.

For More Details Circle (76) on Reply Card

Lapse Time Recorder

For the first time, the broadcast industry has a time lapse video tape recorder that can simultaneously record audio and video, according to GYYR Products, Odetics, Inc., developers.

Until availability of the TL 550, broadcasters requiring a permanent record of transmission had to use either very expensive real time

(Continued on page 50)

Sony's award presenting microphone.*

*Used at Academy Award and Emmy Award T.V. presentations 1972.



Featuring a high-performance condenser capsule of electret design, the ECM-53 is specifically designed for broadcast, recording studio, public address and similar applications.

The cardioid capsule assembly contains a permanently charged condenser capsule and FET/IC amplifier. A Cannon connector houses the battery supply.

- Frequency Response: (Frontal ± 3 dB): 40 Hz to 16 kHz
- Output Impedance (at 1 kHz $\pm 20\%$): 50, 250, 600 ohms Balanced
- Maximum SPL (1 kHz): 134 dB

Also Consider:

Tie-tack/lapel condenser mic ECM-50.

Telescopic (from 7 3/4" to 17 1/2") condenser mic ECM-51.

SONY SUPERSCOPE

©1972 Superscope, Inc., 8211 Vineland Ave., Sun Valley, Calif. 91352. Send for free literature.

For More Details Circle (28) on Reply Card

UP TO

65 % SAVINGS

Plus performance that is creating excitement in Engineers around the country! "Fantastic sound" ... "Very Clean" ... "Superb!" ... Send two more ...

Proof? Our standard 10 day evaluation period lets you see and hear the performance and the full service. 2 year warranty demonstrates the reliability.

Place your order today. Then prepare yourself for a very satisfying experience!



TURNTABLE
PREAMPLIFIERS

MP-8 (Mono) \$60
SP-8 (Stereo) \$90

Outstanding sensitivity and near perfect reproduction. RIAA/NAB equalized 0.5 mv sensitivity @ 1 KHz for +4 dbm out — Balanced 600 ohm out — minus 65 db S/N ratio — +20 dbm out max — 1 db freq. response — Internal power supply — Table top/bracket mount. Shipping weight, 3 1/2 lbs.



MIC/LINE AMPS

MLA-1 (Mono) \$68
MLA-2 (Dual) \$96

Dual function utility amp. Inputs for mic and/or line — 600 ohm balanced outputs — mic input, -65 db for +4 dbm out — +20 dbm out max. — 0.5 db response, 10 Hz-20 KHz — 0.1% or less dist. — Internal power supply — Tabletop/bracket mount, MLA-2, Stereo/Dual Mono. MLA-1, Mono. Shipping weight, 4 lbs.



DISTRIBUTION AMP
6 BALANCED OUT

DA-6 \$95

One third the cost of comparable units. Six 600 ohm balanced outputs — Balanced bridging input — 26 db gain — +20 dbm out max. — Input level control — 0.1% or less dist. — 0.5 db response, 10 Hz-20 KHz — Internal power supply — Tabletop/bracket mount — Shipping weight, 4 lbs.



TAPE CARTRIDGE
LOADER (AUTOMATIC)

ACL-25 \$159

Precision winding without guesswork. Dial in the minute and/or seconds desired, throw switch to run. That's it! The exact amount of tape is fed onto the cartridge hub to the second, and shuts off automatically. No waiting around, no guesswork and 1 sec. accuracy. Also has exclusive torsion control for proper tape pack and winding of various cart hub sizes. TTL digital control circuitry. Shipping weight, 30 lbs.



RAMKO RESEARCH

2552 "E" Albatross P.O. Box 6031
Sacramento, Calif. 95860 (916) 489-6695

recording equipment with cumbersome storage or settle for recording only the audio. For several years time lapse recording has offered a possible solution but was excluded because the sound portion of the video was undistinguishable at slow speeds.

The new GYYR Model TL 550 time lapse recorder embodies a new audio head and provides 24 consecutive hours of uninterrupted play without rewinding; therefore transmission for an entire day can be stored on one convenient and relatively inexpensive tape. **PLAYBACK** can be accomplished



in less than one hour. **STOP ACTION** and **VARIABLE SPEED PLAYBACK** are also featured.

For More Details Circle (77) on Reply Card

Digital Clock

Aero-Metric offers a complete line of economical, 60 Hz time base, 12 and 24 hours/minutes or hours / minutes / seconds digital clocks, accurate to within 3 seconds at any given interval. Available in modular (PC board) and all metal table model or panel mounted packages. Features include TTL or HNIL logic, IC sockets, heavy duty power supply, 0.6" high bright red neon readouts and colons. Options include buffered BCD output, power failure indicator, rechargeable battery "time



hold" and "time run" circuits, interval indicators, strobing, internal timing and time control circuits, remote displays, high temperature range, 50 Hz time base, table model walnut covers, custom designs.

For More Details Circle (78) on Reply Card

A Continuous Processor

Three new automatic, continuous processors for 110-size and other Kodacolor II films are introduced by **Houston Photo Products, Inc.** Operating at high speeds, the machines are designed to handle a high volume.

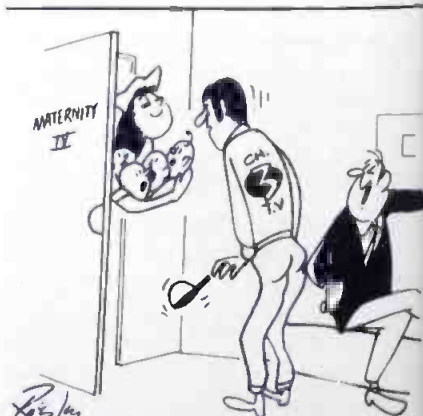
The machines utilize a demand-type film transport system for low film tension. Wobble Rollers eliminate film scratches, breakage and abrasion. Removable film racks simplify maintenance.

Temperatures are precisely controlled. The developer solution is held to a tolerance of + - .25°F. Temperature for the fix is held to + - 1°F, considerably closer than the film maker's specifications. Heat exchangers are provided in the recirculation lines. Accurate replenishment of solutions is provided by flowmeters. Film is dried by the impingement of warm, filtered air.

Model K11-16-15 processes

16mm or 110 film at 15 feet per minute. Model K11-16/35-8 processes 16mm, 35mm, 110 or 126 film at 8 ft. per minute. Model K11-16/35-15 is a Duplex machine and handles 110 film and 35 mm or 126 film simultaneously at 15 feet per minute.

For More Details Circle (79) on Reply Card



"I THOUGHT YOU GUYS KNEW ALL ABOUT GAIN CONTROL."

TECHNICAL DATA

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

100. AEL COMM. CORP.—A new four-page brochure introducing AELCC's line of Test Accessories for CATV amplifiers and other equipments is now available. The brochure presents all the vital data, including features and prices, for AELCC's test adapters, return loss bridges, RF detectors, cross modulation filters, notch trap filters, power supplies, cable adapters and current probes. The illustrated brochure stresses low cost maintenance features and applications possible with these AELCC accessories.

101. AMPEX CORP.—A new six-page brochure describing the features of recently introduced Series 406 and 407 low noise audio mastering tapes is now available. Both tapes are backcoated and feature a new oxide formula and a new binder system that provides better recording and playback characteristics and greater durability than previous Ampex mastering tape. Series 406 tapes use a 1-1/2 mil base film and 407 tapes use a 1-mil base film.

102. AMP INCORPORATED—Over 14 product families containing a total of nearly 1,000 individual components are described in this new 64-page catalog. Complete specifications, plus application and dimensional data are included for: two-piece connectors, card-edge connectors, single-lead connectors, flexible flat cable connectors, and a variety of other types for printed circuit applications. Complete packaging concepts such as modular interconnection systems and programmed wiring systems are explained. Hand tools for maintenance and production of interconnection systems for printed circuitry, as well as automatic and

semi-automatic machinery are also described.

104. B & K INSTRUMENTS, INC.—B&K's new 1972/73 Short Form Catalog describes briefly the firm's full line of precision transducers and instrumentation for sensing, measuring, and analyzing all aspects of sound, noise, and vibration. Included are accelerometers; artificial ears, mastoids, and voice; audiometer calibrators; deviation bridges; digital and data processing equipment; filters; frequency response tracers; hearing aid test boxes; spectrum shapers; graphic level recorders; measurement mi-


Spotmaster

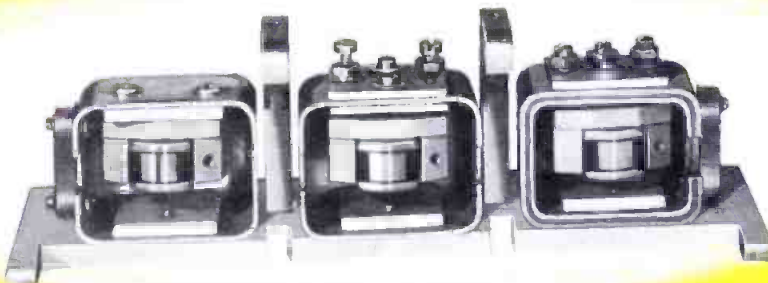
AD1B Audio Distribution Amplifier



The solid state AD1B distributes audio signals to five separate points within a studio system or to telephone lines. Output level controls are individually adjustable. Adding our AD1B-X channel extenders allows up to 25 channels to be accommodated, with input metering and audio monitoring for all 25 provided by the AD1B. Both units meet traditional SPOTMASTER standards of performance and reliability. Response is essentially flat from 40 to 20,000 Hz with low distortion and noise and 60 db channel isolation. Input transformers are standard; the user may specify either balanced output transformers or unbalanced emitter follower outputs. Write for details:

BROADCAST ELECTRONICS, INC.
A Filmways Company
8810 Brookville Rd., Silver Spring, Md. 20910

NORTRONICS rebuilds Ampex nests only once!



Nortronics proudly announces a practical solution to downtime and head replacement problems in professional Ampex recorders.

Our reliable QUIK-KIT!

Once it's installed in your Ampex, your nest need never again be removed and sent to the factory for replacement. Instead, new heads install in minutes with plug-in simplicity—without unsoldering leads or re-aligning.

We rebuild nests and supply professional series replacement heads for Ampex 300, 350, 351, 354,

AG350/355, AG440 and 3200/3300 Series machines.

There is NO CHARGE for rebuilding your nest; only for the professional-quality components we supply.

For complete details on our Ampex nest rebuilding program, write for Form No. 7306 or call Nortronics today!



**NORTRONICS
COMPANY, INC.**

6140 Wayzata Blvd., Minneapolis, Minnesota 55416 • (612) 544-0381
Nortronics also offers VTR audio head stack relapping services.

For More Details Circle (30) on Reply Card

HOWARD Johnson's motor lodges

Serving
you at
23
locations
in the
West



CALIFORNIA

L. A. Airport
San Diego
Santa Maria
Baldwin Park
San Luis Obispo
Riverside
San Jose
Thousand Oaks
North Hollywood
Disneyland
Redwood City
Barstow
Santa Barbara
Colton

Santa Clara
Mill Valley

ARIZONA

Tempe
Tucson

COLORADO

Colorado Springs
Denver (2)

NEBRASKA

North Platte

UTAH

Salt Lake City
Openlog 6/73

Write for your
FREE TRAVEL-PAK!

Howard Johnson's Travel Desk
500 South Main St.
Orange, California 92668



For reservations at any Howard Johnson's
Motor Lodge call toll free (800) 323-2330
from the states west of the Mississippi.
Over 460 lodges coast-to-coast.

For More Details Circle (31) on Reply Card

Tech Data

(Continued from page 51)

crophones; noise generators; noise monitoring equipment; oscillators; power amplifiers; sound level meters; and real-time analyzers.

105. CHRONO-LOG CORP.—

Chrono-log announces a new bulletin for the Series 30,000 IC Digital Clocks which describes new features now available. A new Positive Logic feature is offered (+5 Volts as Logic "One" and 0 Volts as Logic "Zero"), in addition to the previously offered Negative Logic (+5 Volts as Logic "Zero" and 0 Volt as Logic "One"). Also included in the new bulletin is a description of the standby power feature which allows the Series 30,000 Clocks to continue operation without losing time during power failure. This new Series 30,000 bulletin is accompanied by a new price list which allows the design engineer to designate these new features properly by selecting the unique Suffix in the Model Number.

106. CTS CORPORATION—

Complete electrical, mechanical, and environmental specifications of CTS Corp. 450/45 Series, 15/16" Commercial Composition Variable Resistors are fully described in a new 20-page catalog. The 450/45 series line provides engineers with a choice of virtually thousands of control designs. The most frequently requested constructions available to meet the majority of customer requirements are fully described in catalog 1001A. These include single, tandem, multisection and vernier adjust types. Resistance range for the 450 series is 500 Ohms through 15 megohms; the 45 series 50 Ohms through 15 megohms. Both types offer a choice of three power ratings; 1/2 Watt through 10K ohms, 3/8 Watt above 10K ohms through 100K ohms, and 1/4 Watt above 100K ohms.

107. DATATRON—A four-page technical data sheet providing details on Datatron's new low cost 5050 video tape editing system is now available. Also included are specifications for Datatron's Mod-

el 5100 Time Code Generator, and 5250 SMPTE Editing Time Code Translator. The Viducue Tape Editing System provides remote manual control for up to three helical or quadruplex Video Tape Recorders or any combination thereof and generates a display of all edit points. The Viducue can also interface to a digital computer or other digital device for automatic editing. The 5050 Video Tape Editing System—available for only \$10,000—provides manual remote control of two helical or quadruplex Video Tape Recorders. An internal SMPTE Time Code Generator with a unique "JAM SYNC" feature saves time and VTR head wear by eliminating the need for pre-recording SMPTE Time Codes on the master tapes.

108. ELECTRONIC ENGINEERING CO. OF CALIF.—

General specifications, controls, operation and typical applications of the EECO BE 450 Wide Range Synchronizer are covered in a new four-page brochure. BE 450 synchronizes video and/or audio tapes in such applications as audio sweetening of video tapes, simultaneous



MULTI-CHANNEL LINE DRIVER

Set up your own DDD Sports Net
Up to 10–60 DB Isolated Line Outputs for driving loops, couplers or lines direct. 19" rack mount. Flexible.
— Order number of channels needed.
— Add up to 10 later.

Model 183 \$333.95

Model 283 (w/built-in Voice Coupler) \$384.95

(Above are 10 Channel Prices)

PULSE DYNAMICS MFG. CORP.

Colchester, Illinois 62326
Phone (309) 776-4544

For More Details Circle (27) on Reply Card

angénieux service corporation of california
13381 BEACH AVE., VENICE, CALIF. 90291 • (213) 821-5060

Now Two
FACTORY SERVICE CENTERS

angénieux corporation of america
440 MERRICK RD., OCEANSIDE, N.Y. 11572 • (516) 678-3520

For More Details Circle (26) on Reply Card

BROADCAST ENGINEERING

ereo FM/TV broadcasts, precise switching from the first to the second reel of a movie broadcast and keeping different types of mag tape such as quad video and sprocketed audio in precise sync. Initial capstan range between two tapes is up to ± 30 seconds. BE 450 compares identical SMPTE Edit Codes recorded on any two magnetic tapes. . . quad, slant-track, sprocketed or unsprocketed audio. . . and automatically adjusts control voltage to one recorder until both tapes are in sync. Frame to frame lock, or manually adjusted offset is maintained indefinitely regardless of normal tape stretch or slippage.

109. EXACT ELECTRONICS INC.—Available now is a complete catalog covering Exacts' line of Function, Sweep and Digital Function Generators plus Waveform Synthesizers. The Exact line covers a frequency range of 0.000.001 Hz (1 μ Hz) to 20 MHz. The catalog contains specifications, prices, options and rackmounting information along with ordering and warranty information.

110. FERROXCUBE CORP.—Ferroxcube, manufacturer of linear ferrite materials and components and magnetic recording heads, announces the publication of an eight-page, two-color brochure on Recording Head Pole Pieces—how they are made, and how to generate specifications for specific applications. The brochure first describes the two standard pole pieces. 3R7 is a manganese-zinc ferrite of high flux density and initial permeability, especially well suited for non-contact digital recording. 4R5 is a hard nickel-zinc ferrite with high flux density and low losses at high frequencies, especially suitable for contact recording. Detailed electrical specifications for each are supplemented by curves for permeability, flux density, and loss factors. Because of the great diversity of recording head applications, however, pole pieces are usually made to order to suit individual requirements. They are obtainable either as individual pieces or in glass-or epoxy-bonded sets. The design and machining of the pieces and the

special advantages of the two bonding techniques are described in detail.

111. HEWLETT PACKARD—Troubleshooting digital IC's while they're operating in-circuit is the subject of a new 20-page Hewlett-Packard brochure, "The IC Troubleshooters." It describes the whole family of Logic Probes, Logic Pulsers, Logic Clips, Logic Comparators and accessories, and gives specifics on how to cut downtime by fast, on-the-spot in-circuit trouble-shooting.

112. MAGNAVOX—The latest edition of a catalog sheet on their 2600 Series Underground Directional Taps is now available. Given for the 5-300 MHz units, designed for pedestal, vault or direct burial, are full specifications key features, and application and cutaway diagrams. Magnavox' 2600 are described as "true underground taps, foam-filled, with bonded polycarbonate, overcase, epoxy sealed and feature "Seal-Port" heat-shrink accepting connector bosses."

113. MOTOROLA INC.—A new technical brochure concerning the many facets of electronic communications is now available. This 64-page book, titled "Semiconductors For Communication Systems", covers the solid state device types suggested for both radio and wire communication systems. Special emphasis is given to data communications and new industry trends such as hybrid construction, phase locked loops, monolithic voltage regulators, etc. Each section of the brochure presents a discussion of new developments and processes, as well as preferred device tables listing solid state products suggested for each particular application area. The tables are designed to aid in the selection of a proper device type from the multitude of type numbers available. This is particularly important in receiver front end, IF amplifier and audio section designs. New integrated circuit types are also tabulated for easy selection.

(Continued on page 56)

Tech Data Begins on pg. 51



Broadcasters' Choice:

A77 Mk. III-B

Spotmaster/Revox



\$799

- Lifetime guarantee
- Superb specs & performance
- Advanced features
- Accepts 10½" reels & NAB hubs

Check that price again . . . for a broadcast quality stereo tape recorder with all the performance and features of machines costing 50% more. Spotmaster and Revox have joined forces to create the Model A77 Mark III-B (the "B" stands for "broadcast"), a ruggedized version of the recorder that is winning laurels all over the world.

Guaranteed for life. Every basic part of the A77 Mark III-B is protected by a lifetime guarantee except the heads, capstan and pressure roller, which are guaranteed for a full year. This should tell you something about the reliability engineered into the Mark III-B.

18 new features. The original A77 model, so widely praised since its introduction, has been improved in 18 ways. For example, a new oscillator circuit for greater efficiency, lower distortion. A modified and strengthened braking system. A new hardening process to reduce capstan wear. Improved tape handling and spooling.

But we didn't change the already great things: servo control capstan, outstanding speed stability, 10½" reel operation, modular and plug-in electronics, pinpoint editing ease, separate bias adjustment for each channel and speed, remote control of all functions, undetectable wow and flutter, 30 Hz to 20 KHz response, etc.

Designed for rack-mounting, the A77 Mark III-B provides 2- or 4-track stereo operation at 7½ and 3¾ ips. Other speeds, full-track heads, accessories optional. Call or write:

BROADCAST ELECTRONICS, INC.
A Filmways Company
 8810 Brookville Rd., Silver Spring, Md. 20910
 (301) 588-4983

Harry F. Olson has written **Modern Sound Reproduction** for enthusiasts, audio laymen, scientists, engineers, and technicians! The book describes today's newest and most important elements, systems, and accessories used in high quality sound reproducing equipment, along with methods and applications that help achieve high levels of excellence and performance in sound reproduction. It highlights such aspects of the field as effects of electrical and acoustical noise—quadraphonic sound reproduction in magnetic tape and disk record reproduction—theory, action, and performance of transistor and integrated circuit audio amplifiers—electronic modifications used to heighten the emotional impact and artistic embellishment of recorded sound.

The book covers generic monaural, monophonic, binaural, stereophonic and quadraphonic sound reproducing systems, and uses a study of room design and acoustics to show you the performance of rooms, studios, theatres and auditoriums in relation to sound reproduction. It describes acoustical measurements which play an important part in the advancement of

sound reproduction—explains the characteristics of the human ear that relate to performance of sound reproducing systems.

This book is available through the Van Nostrand Reinhold Co., New York, N.Y.

For More Details Circle (80) on Reply Card

Installing & Servicing Electronic Protective Systems, written by Harvey Swearer, gives the reader everything he needs to know to break into the challenging field of installing and servicing electronic fire and theft security systems. The up-to-date handbook not only covers virtually every available system, but also provides guidance for technicians who want to build a career in the growing alarm system field.

The author fully covers the subject, and explains how to select just the right system for any particular job, how to estimate costs, how to install and check the system, and even how to build and expand one's business, train help, and finance the operation. The text is supplemented by over 160 photographs and illustrations, including complete schematic diagrams of various protective devices... many never before having appeared in a book.

This modern text thoroughly discusses all the basic systems, and then, starting with sensing and detecting methods, proceeds with individual Chapters on the various types of alarm systems.

An Appendix carries the complete Federal Crime Insurance regulations, and provides a comprehensive Glossary, and a complete list of manufacturers and suppliers.

This book is available through Tab Books, Blue Ridge Summit, Pa.

For More Details Circle (81) on Reply Card

Portable Cable Reel



Handle up to 600 feet of 1/2" O.D. cable on this low-cost reel on wheels. Solid steel construction for years of service. Easy crank rewinding. Adjustable drag and brake control. Steel disc wheels with rubber tires.

Send for complete catalog of standard and custom-built reels to handle cable for broadcast equipment.



HANNAY REELS

CLIFFORD B. HANNAY & SON, INC., WESTERLO, NEW YORK 12193

For More Details Circle (21) on Reply Card

This Fourth Edition of the **Audio Control Handbook** for Radio and Television Broadcasting has been revised and expanded. The author is Robert S. Oringel. This Fourth Edition is to all intents and purposes a new text. While it closely follows the format of its three predecessor editions, it has been re-written almost in its entirety, following suggestions made by faculty members at many colleges and universities where it has been extensively used. Completely reset, this edition reflects changes in equipment and techniques, and delves deeper into the technical and electronic aspects of audio operation. With all this, it still is a "how-to" book rather than a technical theory treatise.

In clear and non-technical language, are complete step-by-step directions and full explanations of every phase of audio control in all types of broadcasting. The many diagrams and photographs, almost all of which are new in this edition, supplement the text. For the newcomer or seasoned professional it is an extremely practical aid.

This book is available through Communication Arts Books, Hastings House, Publishers.

For More Details Circle (82) on Reply Card

PEOPLE IN THE NEWS

Nortronics Company, Inc. has appointed William Christensen to a newly-created management post as general manager of its Minnetech Labs Division. . . . Richard Goldstein has been appointed to a newly created post of vice-president, engineering for Synascan. . . . TeleMation, Inc. has announced the appointment of Frank Benson to its Marketing Department as Manager of Broadcast Sales. . . . TeleMation has also announced the appointment of Chuck Clark as marketing specialist for the T-MATIC[®] Program Automation System. . . .

Gridtronics, Inc., a division of TeleVision Comm. Corp. (TVC), has named George Manina as chief operations officer. . . . Albert L. Cavalieri, Jr. has been appointed Director of Engineering, AEL Communications Corp. . . . SC Electronics, Inc. has elected Harry Hansen to the position of Vice President of Manufacturing. . . . Peter Reuter has been appointed Marketing Manager of the Hicksville Division of Amperex Electronic Corp. . . . Neil L. Thompson has been appointed general manager of Diamond Expansion Bolt Co., a division of General Cable Corp. . . .

The Board of Directors of General Cable Corp. (NYSE) elected Robert P. Jensen president and chief operating officer of the company effective January 1, 1972. . . .

Henry A. Schollet has been named to the new position of chief application engineer for the Aemco Division of Midtex, Inc. . . . David W. Day has been appointed vice president of corporate development for Collins Radio Co. . . . William A. McCullough has been appointed as Quality Control Manager for the CATV Operation of GTE Sylvania Inc. . . . RCA Electronic Components has appointed Donald R. Ronson as Director, International Operations for the Entertainment Tube Division. . . . Switchcraft, Inc. has appointed Warren Rose as Regional Manager, Eastern Industrial Sales, a newly created post. . . . Kenneth B. Schneider, formerly Product Manager for Audio, AM/FM Broadcast Equipment at Visual Electronics, has rejoined the Visual organization, and will function as Director of Marketing for Barron Electronics, A Visual Electronics subsidiary. . . .

In an announcement by George Comte, Vice-President and General Manager, Radio and Television, WTMJ-AM-FM-TV, Milwaukee, James C. Wulliman has named to the position of Manager of Engineering, Broadcast Division, Journal Company, and Raymond L. Hernday to the post of Chief Engineer for Broadcasting. . . . Two men have been appointed to head the operation of the new 50,000 Watt AM station, KAAT, Colorado. Ben Avery will be Vice President and General Manager of the regional station and Jerry Rhoads has been named Vice President and Sales Manager. . . .

"I jumped from tugboat to television



after I got my First Class FCC License"

What do you do with your off-duty hours if you work in the engine room of a tugboat? Well, if you're Richard Kihn of Anahuac, Texas, you learn electronics with CIE. As he tells it: "Even before I finished my course, I passed my First Class FCC License exam and landed a job as broadcast engineer with KFDM-TV in Beaumont, Texas. Then in my first year at KFDM, I finished my CIE course, earned two raises and became a 'two-car' family! Not bad for an ex-tugboat hand! 'I'd recommend Cleveland Institute of Electronics to anybody interested in broadcasting.'"

You need an FCC ticket to move ahead in broadcasting, and five out of CIE's seven career courses prepare you to "sit for" the Government FCC Commercial License exam. In a recent survey of 787 CIE graduates, better than 9 out of 10 CIE grads passed the Government FCC License examinations. That's why CIE can offer this famous Money-Back Warranty:

When you complete any CIE licensing course you'll get your FCC License or be entitled to a full refund of all tuition paid. This warranty is valid during the completion time allowed for your course. You get your FCC License . . . or your money back.

Send coupon below for FREE book. For your convenience, we will try to have a representative call. If coupon is missing, write: Cleveland Institute of Electronics, Inc., 1776 E. 17th St., Cleveland, Ohio 44114.

Approved Under G.I. Bill

All CIE career courses are approved for educational benefits under the G.I. Bill. If you are a Veteran or in service now, check box for G.I. Bill information.

MAIL COUPON TODAY FOR FREE BOOK

CIE Cleveland Institute of Electronics, Inc.

1776 East 17th Street, Cleveland, Ohio 44114
Accredited Member National Home Study Council

Please send me your FREE book,
"How To Get A Commercial FCC License."

Name _____ (please print)

Address _____

City _____

State _____ Zip _____ Age _____

Veterans and Servicemen:

☐ Check here for G.I. Bill information.

BE-79

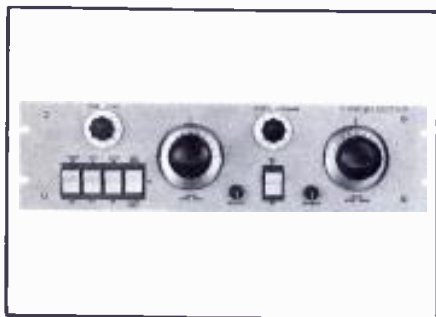
For More Details Circle (33) on Reply Card

114. NORTRONICS CO., INC.—A revised and expanded edition of Nortronics "Recording Equipment Maintenance Manual" is now available. The new second edition contains 28-pages which describe the importance of regular preventive maintenance to preserve listening quality and extend the operational life of real-to-real, cassette and cartridge recorder/players. Factors such as spacing loss, gap damage due to accumulated dust and dirt particles and other quality and life reducing factors are discussed in detail. The updated maintenance manual also describes Nortronics "Look-Touch-Listen" program for determining the condition of recording equipment and features sections describing head demagnetization, splicing and splicing tapes, lubrication, capstan

PLASTIC REELS FOR MAG TAPE

all sizes shipped from inventory
POLYLINE CORP. 2449 N. Western Av.
Chicago 60647—(312) 489-1757
Manufacturers of AMERLINE Reels
20 years of reel experience

For More Details Circle (34) on Reply Card



THE COLORIZER

Electronically converts monochrome logotype, or similar high contrast material into single or dual color video combinations using most existing EIA monochrome cameras. Ideal for producing color supers, I.D., full screen colors, fades! Also supplies any desired phase BLACK BURST by a patent pending process. MODERN VIDEO ENGINEERING CO., P.O. BOX 298, 1781 FIFTH STREET, MUSKEGON, MICH. 49440, PHONE: (616) 726-3312 (TECHRAND CORP.)

For More Details Circle (35) on Reply Card

FREE CATALOG **TOOLS**

HARD-TO-FIND PRECISION TOOLS

Lists more than 1700 items—pliers, tweezers, wire strippers, vacuum systems, relay tools, optical equipment, tool kits and cases. Also includes four pages of useful "Tool Tips" to aid in tool selection.

JENSEN TOOLS
4117 N. 44th Street, Phoenix, Ariz. 85018

For More Details Circle (36) on Reply Card

and pinch roller maintenance, liquid and spray cleaners and a typical recorder maintenance program.

115. N.V. PHILIPS OF HOLLAND—Subscriptions to "Test and Measuring Notes" are now available to engineers and scientists in the United States. The publication, a quarterly magazine, presents information on applications of Philips electronic instruments and microwave devices and also surveys new products as they are added to the Philips line. The information presented in "Test and Measuring Notes" is intended to assist users of Philips equipment in both practical and theoretical areas. Articles in a recent issue described the design of a new FET oscilloscope probe for high-frequency measurements, presented a new method of precisely measuring the period of a complex waveform, described a proposed "moon-bounce" VHF communication system and began an introductory course in digital techniques.

116. RF SYSTEMS, INC.—A new bulletin describing the firm's UHF and VHF Zig Zag antennas is available. The bulletin describes models for channels 7 to 13 and 14 to 83, illustrates typical horizontal and vertical patterns. Complete dimensional data are provided for all models.

117. RHG ELECT. LABS., INC.—A six-page product bulletin (DM-101) describing their new line of double balanced MIC mixers, mixer preamps and image rejection mixers is now available. Photos, specifications and prices for over 100 models, including their recently patented 0.5 to 18 GHz mixers, are shown along with nine graphs noting specific performance characteristics. Additional technical information is also included on intermodulation, dynamic range, LO injection levels, upconverter performance and single sideband up-conversion.

119. TEKTRONIX, Inc.—Portability, five quickly interchangeable probes, low cost, internal recharge-

able batteries, and digital LED readout are some of the many features presented in the "TEKTRONIX Digital Photometer/Radiometer" brochure. Also discussed are the instrument's small size, light weight, and its stable operation through the extensive use of integrated circuitry. The six-page brochure outlines the wide variety of light measurements the Photometer/Radiometer is capable of making. Eight full-color photos illustrate a few of the many applications in illuminance, irradiance, luminance, and relative intensity measurements.

120. TELE-CARTRIDGE, INC.—Tele-Cartridge, Inc., producers and distributors of software (programming) for the new video cassette industry, has produced a catalog of more than 450 titles available in the new medium. The catalog lists entertainment, instruction, training, education, music and information, including 75 titles of films from Sweden.

121. VICON INDUSTRIES INC.—A new catalog of the company's product line of security and surveillance equipment for the CCTV industry is now available. Vicon manufactures a line of electronic control devices used for commercial and industrial security and remote surveillance systems. The product line includes pan-and-tilts, scanners, motorized zoom lens, sequential switchers, environmental housings, consoles, amplifiers, for use in closed-circuit TV systems, and the various accessories needed for installation. There are some 300 items shown or listed in the new Vicon catalog, under ten conveniently tabbed sections.

Moving?
Send Your Change
Of Address To:
Broadcast Engineering
1014 Wyandotte
Kansas City, Mo. 64105

PROFESSIONAL SERVICES

CAMBRIDGE CRYSTALS PRECISION FREQUENCY MEASURING SERVICE

SPECIALISTS FOR AM-FM-TV

445 Concord Ave. Phone 876-2810
Cambridge, Mass. 02138

SMITH and POWSTENKO

Broadcasting and Telecommunications
Consultants

2000 N Street, N.W.
Washington, D. C. 20036
(202) 293-7742

VIR JAMES

CONSULTING RADIO ENGINEERS
Applications and Field Engineering
345 Colorado Blvd.

Phone: (Area Code 303) 333-5562

DENVER, COLORADO 80206

Member AFCEE

ALPH E. EVANS ASSOCIATES

Consulting Radio Engineers
AM - FM - TV - CATV - ITFS

3500 North Sherman Blvd.

MILWAUKEE, WISCONSIN 53216

Phone: 414-442-4210

COURTRIGHT ENGINEERING, INC.

MORRIS COURTRIGHT, Jr., P.E.
Automation - Applications Field Engineering
ELECTRICAL AND BROADCASTING
Route No. 1, Box 854A, Flagstaff, Ariz. 86001
Phone (602) 774-8206

B. F. GOLDBERG & ASSOCIATES

Consulting Radio Engineers, Architects-Engineers
since 1961

AM, FM and TV Applications
Facilities Planning & Architectural Service
Acoustical Expertise
Field Engineering

Antenna Measurements & Proofs

(3) 782-5302 2100 Beltline Blvd.
Columbia, S. C. 29204

SESCO, Inc.

47 NICHOLS AVENUE
P. O. BOX 518

(206) 378-2137

FRIDAY HARBOR,
WASHINGTON, 98250

ADVERTISERS' INDEX

American Data Corp. 8A
Andrew Corp. 1
Angenieux Corp. of America 52

Broadcast Electronics, Inc. 8D, 51, 53

CCA Electronics Corp. 15
Canon, Inc. IFC
Capitol Audio Tape 13
Central Dynamics 39
Cleveland Institute of Electronics 55
Cramer Video & Audio Systems 8
Crown International 48

Ditch Witch, Charles Machine Works CE-3
Dynair Electronics, Inc. 21

Eastman Kodak Co. 17
Electro-Voice Inc. 43

Gates Radio Co. Div. of Harris-Intertype
Corp. 5
General Time Service 46
The Grass Valley Group Inc. 3

Clifford B. Hannay & Son, Inc. 54

Jensen Tools and Alloys 56
Howard Johnson's 52

McMartin Industries, Inc. 11, 12

Minneapolis Magnetics 44
Modern Video Engineering Co. 56

Nortronics Inc. 51

Philips 27
Philips Broadcast Equip. Corp. 8B-8C
Polyline Corporation 56
Pulse Dynamics Mfg. Corp. 52

RCA Broadcast Systems 28-29
Radio Research Int. Co., Inc. 57
Rapid-Q 57
Ramko Research 50
Richmond Hill Laboratories 47
Roll-A-Reel co. 44

SC Electronics 25
Sadelco, Inc. CE-4
Sesco 57
Shure Brothers, Inc. 8C
Spindler & Sauppe 35
Spotmaster 8D, 51, 53
Superscope, Inc. 49
Switchcraft, Inc. 10

Telemet Co. 18C
Telrex Communications Div. 45
Tracor Industrial Instruments Div. 11

United Systems Corp. 9

Vital Industries, Inc. 7

RAPID-Q



Record-Playback-RQ-71-RP



Stereo Record-Playback-RQ-71-SRP



Single Playback In dual cabinet-RQ-71-P1



Dual Playback-RQ-71-P2



Triple Playback-RQ-71-P3

RAPID-Q

CARTRIDGE TAPE EQUIPMENT

1216 Kifer Road Sunnyvale, Calif. 94086
(408) 736-8737

GET COMPLETE DETAILS

about the products
advertised or described
in this issue.

Use Free Inquiry Card.

Be sure to include your
name and address

CLASSIFIED

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.

MICROWAVE LINKS KTR-1000-A

Color TV Microwave Links, C Band, NTSC Color TV Plus Program Audio, CATV/Studio Xmtr/Remote uses Raytheon. As new also Collins MW-103 Components in stock. \$950 per rack W/4 CH MUX.

WEATHER RADAR 3CM RCA 50KW up to 40 mile range. 12" Indicator Console as new \$1975.

**RADIO RESEARCH
INSTRUMENT CO., INC.**
3 Quincy Street,
Norwalk, Ct. 06850
(203) 853-2600

HELP WANTED

JOB HEADQUARTERS for all Radio and Television Engineers. Immediate openings exist in 9 western states and elsewhere for qualified engineer and technical personnel. All categories from trainees to experienced transmitter maintenance, chief, assistant chief, live color video maintenance and technical operations. Send us your complete resume now. The AMPS Agency, 11661 San Vicente Blvd., Suite 300, Los Angeles, Calif. 90049. Telephone: 213-820-2678. By Broadcasters—For Broadcasters. 11-68-tf

AUDIO/VIDEO SYSTEMS ENGINEERS

F & M Systems Co. has immediate requirements for senior level audio/video systems engineers.

Will be responsible for design and development of complete studio-network and mobile audio, video and automation systems. Scope of responsibility also includes installation supervision, system checkout and other on site activities. Candidates should possess BSEE or equivalent and minimum of 8 years experience in systems design.

Please RUSH RESUME including salary history in confidence to:

Don R. Gathright
F & M SYSTEMS CO.

A Division of Fischbach and Moore, Incorporated, P.O. Box 20778 Dallas, Texas 75220 an equal opportunity employer

TECHNICIAN-CUSTOMER SERVICE. Check out and installation of broadcast automation systems. Must have experience in radio engineering and programming. Considerable nationwide travel, expenses paid. Send resume and salary requirements to Glenn Shaw, Schafer Electronics Corp., Santa Barbara Research Park, 75 Castilian Drive, Goleta, California 93017. 12-72-1t

HELP WANTED CONT

BROADLINE MANUFACTURE of Radio Broadcast Equipment needs established Representatives to call on Radio Stations, Schools, and Audio Sound. May work on a commission basis or act as Distributor. Many territories open. Write Dept. 272, Broadcast Engineering, 1014 Wyandotte St., Kansas City, Mo. 64105 12-72-1t

WANTED: Tower erectors and riggers for Midwest's largest microwave system. Call (219) 495-2515 12-72-1t

ENGINEERING OPPORTUNITIES: One of the Nations leading Public Television & Radio Production Centers offers challenging Engineering career openings. Candidates must be technically qualified and fully capable of quality production & State-of-the-Art techniques. Send resume to: Bonnie Wells WGBH TV 125 Western Ave. Boston, Mass. 02134 12-72-1t

MAJOR MARKET AM-FM Stereo-SCA operation seeking experienced engineer for assistant chief position. Promotion to chief after familiarization period certain. Call Tom Sullivan 513-621-6960. 12-72-1t

WANTED

PLEASE HELP BUILD a worthwhile community-oriented educational FM. Donations of used studio equipment gratefully accepted. Send details to Redesign Office, Central School District, No. 1, Box 7197, North Greece, New York 14515. 11-72-2t

REK-O-KUT 16" V or G deluxe turntable 78RPM Idler (circa 1953). Write R. Eressy, 71A Pine Street, Hyannis, Mass. 02601. 12-72-1t

SERVICES

CRYSTAL & MONITOR SERVICE. Frequency change, repair or replacement of oven type broadcast crystals. Also frequency change and recalibration or repair of AM frequency monitors, and H-F PM monitors. Fast service at reasonable prices. 30 years experience! Call or write: Eidson Electronic Co. Box 96, Temple, Tx. 76501. Pho 817 773-3901 9-70-tf

CARTRIDGE RELOADING. Send us your worn cartridges for reconditioning. Carts cleaned, new pressure pads installed, and minor parts replaced. Tops replaced at manufacturers cost. 48 hour service. Competitive prices. New cartridges also available. Call or write: Marlin Cartridge Co., 195 Prentiss Ave., Drew, Miss. 38737 (601) 745-8380 11-72-6t

CARTRIDGES RECONDITIONED - new tape 12 years experienced personnel. Fidelipac, Tapex, Audiopak cartridges. Write for new and reconditioned price sheet. Mastertone Company, 1105 Maple, West Des Moines, Iowa 50265 12-72-1t

TRAINING

PASS FCC EXAMS with Ameco books. Each book contains FCC questions plus simplified answers plus FCC-type exams and answers. 3rd class 75c, 2nd class \$2.25, 1st class \$1.50. Free catalog. Ameco Publishing, 314G Hillside Ave., Williston Park, N. Y. 11596. 8-72-tf

FIRST PHONE through tape recorded lessons at home plus one week personal instruction in Washington, DC, Atlanta, Boston, Detroit, New Orleans, Minneapolis, Seattle, Denver, Portland, Los Angeles. Proven results. Our 17th year teaching FCC license courses. Bob Johnson Radio License Preparation, 1060D Duncan, Manhattan Beach, Calif. 90266. Phone 213-379-4461 1-69-tf

PASS FCC first and second class exams with new 21 lesson, 450-page course. Starts with basic electricity. Over 600 FCC-type, multiple-choice questions and sample exams included. No previous technical knowledge required. Commercial Radio Operator Theory Course, #15-01. Only \$5.95. Ameco Publishing, 314G Hillside Ave., Williston Park, N. Y. 11596. 8-72-tf

TRAINING CONT.

EARN ELECTRONICS DEGREE, mainly by correspondence. FCC license preparation included at your option. Accredited by Accrediting Commission of NHSC. G.I. Bill approved. Free brochure. Write: Dean, Grantham School of Engineering, 1505 N. Western, Hollywood, California 90027. 8-72-ut

EQUIPMENT FOR SALE

RCA TK-27 COLOR FILM CAMERA, \$18,500. Contact Dr. Thomas Cyrs, Northeastern University, 360 Huntington Avenue Boston, MA. 02115. 617-437-2274. 12-72-1t

AMPEX spare parts, technical support, updating kits, for discontinued professional audio models, available from VIF International, Box 1555, Mtn. View, Calif. 94040 (408) 739-9740. 9-72-e.o.m

'65 FORD remote vehicle. Built-in leveling jacks. Reinforced roof. 12500 miles. 3 RCA tk31a - 2 with zooms. 4 channel audio. Intercom. Small GE SS switcher. \$10,000. H. L. VanAmburgh (207) 772-4661 12-72-1t

MOTORS FOR SPOTMASTERS

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

ONE STOP for all your professional audio requirements. Bottom line oriented. F. T. C. Brewer Company, P.O. Box 8057, Pensacola, Florida 32505. 7-71-tf

"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

SURPLUS AUDIO PATCH PANELS. All Standard Configurations. Gulf Telephone & Electronics, Inc., 6325 Beverly Hill, Houston, Texas 77027 7-72-tf

Standard RCA Style VIDEO PATCH JACKS unused \$1.75 each. You supply panels and save. Norman Gillaspie, P.O. Box 2124, Monterey, Calif. 93940. 1-408-375-7424 11-72-3t

END OF YEAR SALE

Start 1973 with good reliable equipment. Completely rebuilt cartridge tape playbacks on sale only until December 31 and ready for immediate delivery.

Spotmaster 505		\$200.00
Tapecaster 600P		200.00
Spotmaster 405A		225.00
Spotmaster 505A		225.00
Spotmaster 505B		250.00
Tapecaster 700P		250.00
Spotmaster 505R (rack mount)		275.00
Tapecaster 700PS (stereo)		375.00

30 day unconditional money-back guarantee. 90 day warranty. Terms: check with order, FOB Rockville, Md.

AUTODYNE

P.O. BOX 1004
Rockville, Maryland 20850
Phone: (301) 762-7626

FAIRCHILD 663 LIMITERS - five available at \$100.00 each Fairchild Model 675 Dynamic De-esser - one available at \$100.00 **ACCURATE SOUND CORPORATION**, P. O. Box 2159, Garland, Texas 75041 (214) 278-0553. 12-72-4t

AMPEX PARTS, head stacks and head assemblies, complete inventory - write for price quotation. **ACCURATE SOUND CORPORATION**, P.O. Box 2159, Garland, Texas 75041. (214) 278-0553. 12-72-4t

READER SERVICE CARD BROADCAST engineering

For issue of December 1972-Use until March 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

For issue of December 1972-Use until March 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

BROADCAST engineering FREE SUBSCRIPTION CARD

To start or renew your subscription to Broadcast Engineering on a no-charge subscription basis you must check all appropriate boxes, print your name and address, sign and return this card promptly.

☐ I want to START a subscription to Broadcast Engineering now.

☐ I want to RENEW my subscription to Broadcast Engineering now.

Please check all boxes
that apply AND occupation title

My company is:

- ☐ AM Radio Station
- ☐ FM Radio Station
- ☐ TV Station, Commercial
- ☐ TV Station, Educational
- ☐ CATV System
- ☐ CCTV or Instructional TV
- ☐ Campus Radio Station
- ☐ Consulting Firm

- ☐ Dealer or Distributor of Broadcast Equipment
- ☐ Educational Radio Station
- ☐ Industrial or Medical TV
- ☐ ITFS
- ☐ Recording Studio, Audio or video
- ☐ Microwave
- ☐ Government Agency

My occupation title is:

- ☐ Owner, President, Officer
- ☐ Gen. Manager, Advisor or Director
- ☐ Chief Engineer
- ☐ Engineer, Technician

- ☐ Engineering Supervisor, Director
- ☐ Program Manager, Station Manager
- ☐ Consulting Engineer
- ☐ Other: specify _____

Are you responsible for more than one station or facility? ☐ Yes
Be sure you have checked one box by each arrow ☐ No

PLEASE PRINT

Name _____

Title _____

Station or Co. _____

Street _____

City _____ State _____ Zip _____

6 cents
Postage
Required

BROADCAST engineering

P.O. Box 21502
El Paso, Texas 79998

Attn: Engineers Tech Data Dept.

6 cents
Postage
Required

BROADCAST engineering

P.O. Box 21502
El Paso, Texas 79998

Attn: Engineers Tech Data Dept.

6 cents
Postage
Required

BROADCAST engineering

1014 Wyandotte Street
Kansas City, Missouri 64105

Attn: Evelyn Rogers

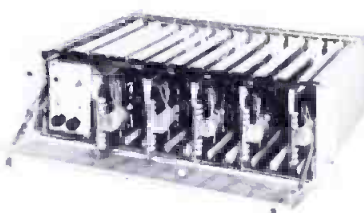


BROADCAST EQUIPMENT SHOWCASE

For more than 20 years, Telemet has built precision products for the broadcast industry. Products designed for long life. To function with the ultimate of efficiency.

That's why each Telemet product undergoes extensive development and final field testing before it is available to the industry. The result: a long and growing list of satisfied customers.

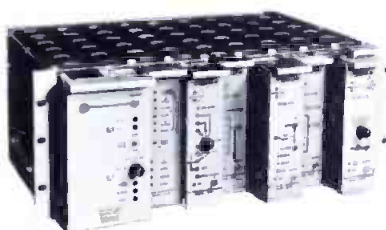
For more information about our products, write or call your nearest Telemet sales office.



**Video &
Audio DAs**



**VIT
Packages**



**Test
Sets**



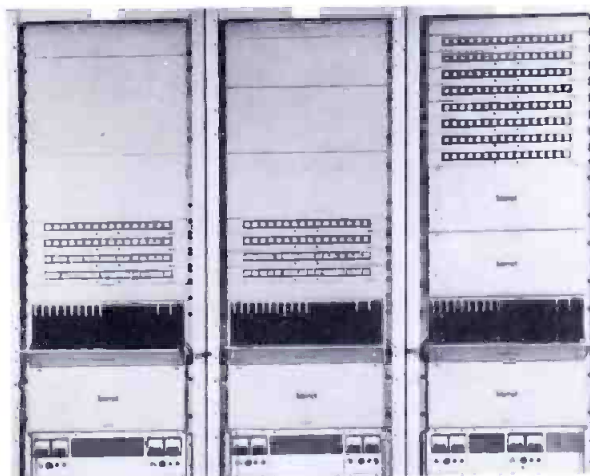
**Production
Switchers**



**Precision
Demodulators**



**Chroma
Keyers**



**Routing
Switchers**

See us at
Booth No. 7
NAEB



better ideas for broadcasting
Telemet

COMPANY, DIV. OF GEOTEL COMPANY

Amityville, New York 11701, (516) 541-3600

REGIONAL OFFICES

Chicago, Ill. (312) 627-6026 Atlanta, Ga. (404) 361-2951 Houston, Tex. (713) 946-5796 Santa Ana, Calif. (714) 540-6756

For More Details Circle (2) on Reply Card

www.americanradiohistory.com



A production console* for \$312 !



Eureka! A complete remote and studio production console for a fraction of what you'd expect to pay for a console with comparable features and performance! Simply purchase a new *Shure M675 Broadcast Master* and the extremely popular *Shure M67 Professional Microphone Mixer*. By combining these two units*, you get inputs to handle microphones, turntables, phone lines and tape machines — *with cuing provision on line and magnetic phono inputs*. Result? A versatile low-noise, low-distortion broadcast production console for in-studio, remote, and standby assignments; a complete CATV console; a studio production console. All for \$312! For complete technical data, write:

Shure Brothers Inc.,
222 Hartrey Ave., Evanston, Ill. 60204.



*Each model is also available separately: M67 — \$162 net; M675 — \$150 net.

For More Details Circle (3) on Reply Card