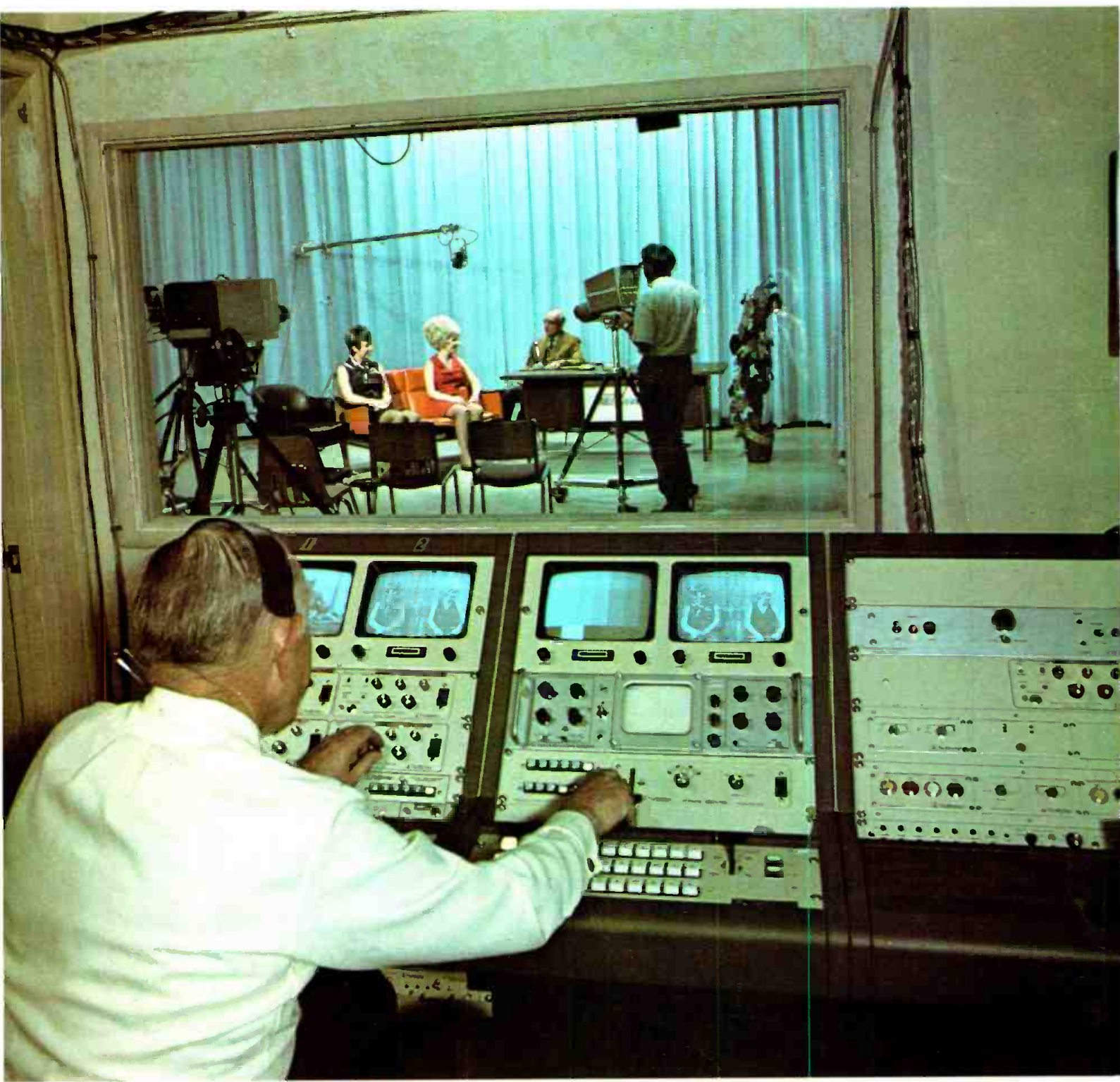


BROADCAST **engineering**

the technical journal of the broadcast-communications industry



FCC explains the proof page 21

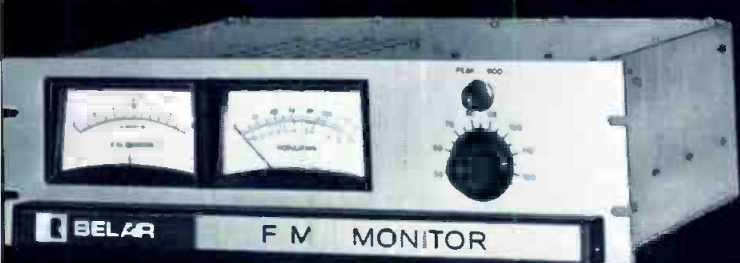
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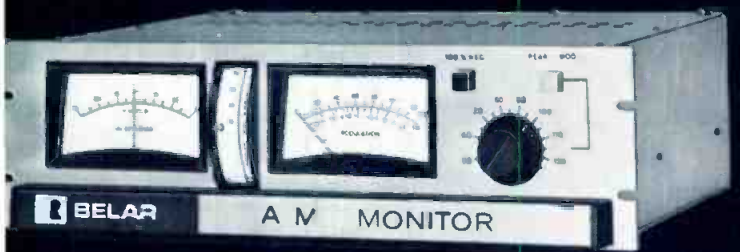
Stereo Monitor, FMS-1



SCA Monitor, SCM-1



FM Amplifier, RFA-1



AM Monitor, AMM-1



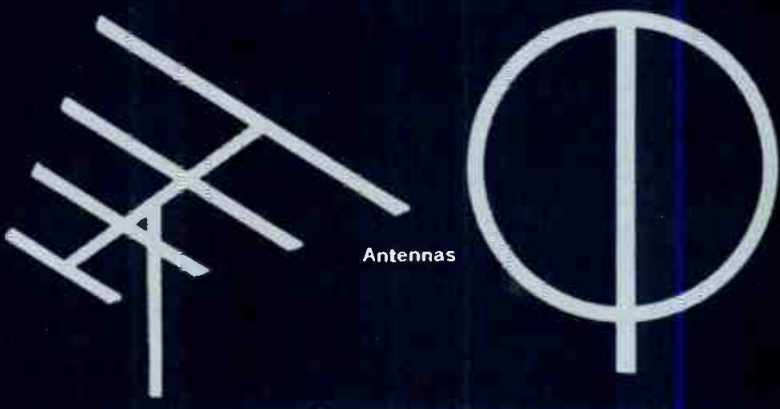
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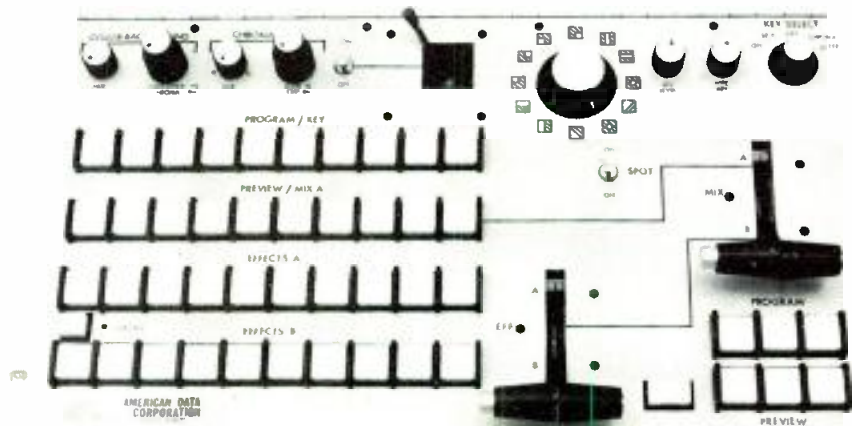
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BROADCAST engineering®

The technical journal of the broadcast-communications industry

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ABOUT THE COVER

This month's cover is taken in the studios of a successful Cable operation. Our special cable section begins on page CE-1. Photo is by courtesy of Telemation.

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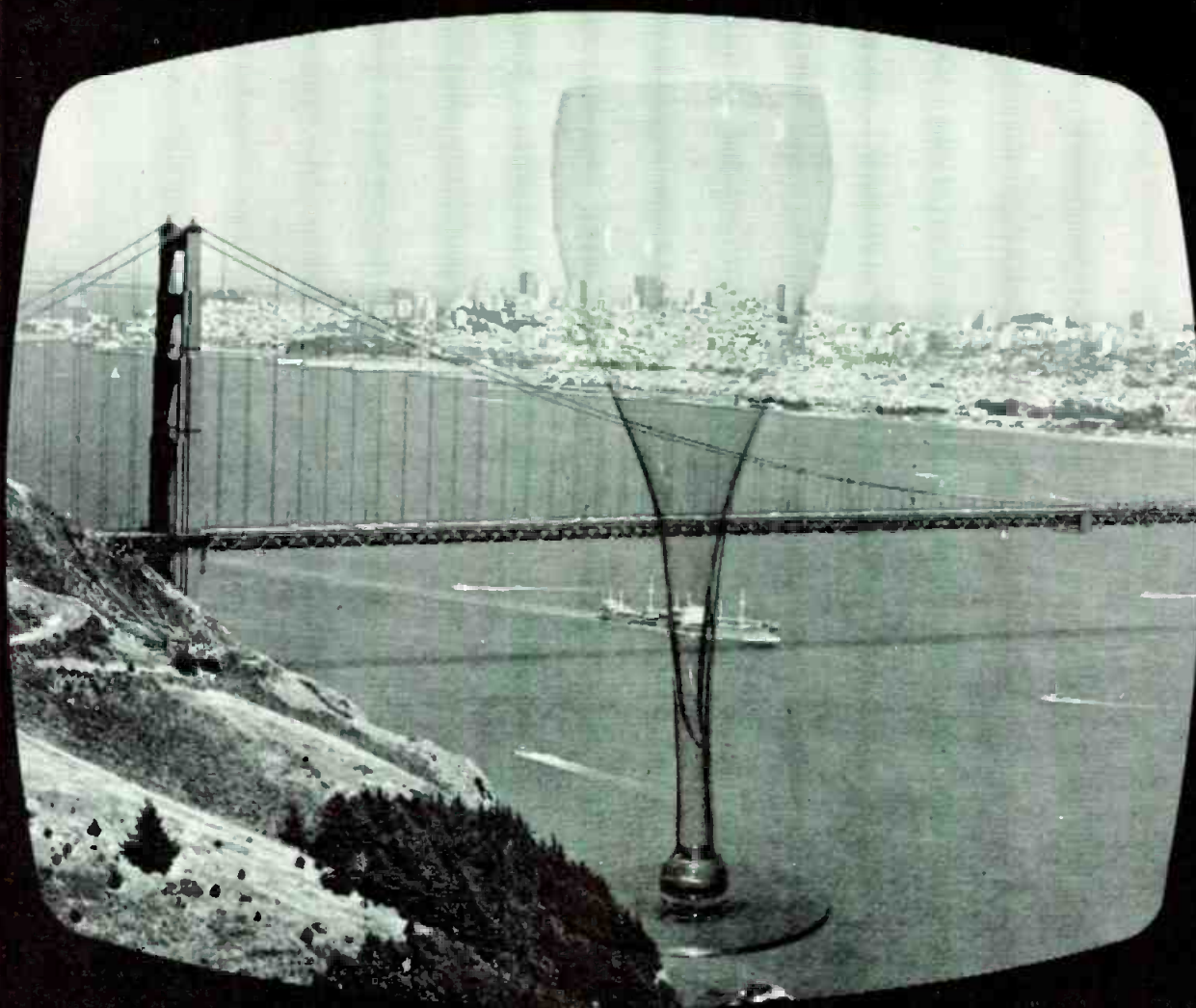
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DIRECT CURRENT FROM D. C.

June, 1973

by Howard T. Head

Comments Filed in FAA Tower Lighting Proposal

The National Association of Broadcasters (NAB) has filed comments with the Federal Aviation Administration (FAA) in response to a FAA proposal to require high-intensity strobe lighting on tall towers. Other broadcast organizations have also filed comments.

The lighting system proposed by the FAA is intended to provide sufficient light intensity to be visible during daylight hours. The brilliance would be greatly reduced during hours of darkness, with an intermediate value during periods of twilight. The system has been tested and the tests indicate satisfactory performance from the aviation standpoint.

The NAB comments emphasize the Association's interest in promoting aviation safety. NAB proposes, however, that the use of the strobe lighting system be on a voluntary rather than a mandatory basis, and urges that in no event should the strobe lighting requirements be applied to structures already existing.

NAB also emphasizes tower structural problems involved in mounting the lighting system, as well as the cost of the lighting equipment itself. This runs on the order of \$10,000 per level, with replacement lights costing over \$100 each. And, finally, attention is drawn to the "visual pollution" associated with the use of the brilliant lights.

Although the light beam is tilted above the horizontal, it is optically impossible to prevent a portion of the light from shining on the ground, and even the limited tests already conducted have drawn some complaints from nearby residents.

FCC Regional Meetings Planned

The Commission is planning a series of regional meetings which are intended to bring about closer contact and cooperation between the Commission's field offices and inspectors, and broadcast licensees. Details of the meetings remain to be worked out; consideration is being given to tying them into regional NAB meetings.

For many broadcasters, the only FCC official the broadcaster ever sees is the Commission's field inspector. These contacts often take place in an atmosphere of hostility resulting from the fact that neither the broadcaster nor the inspector fully understands the Commission's interpretations of both the technical and non-technical regulations. Rule relaxations stemming from the Commission's "re-regulation" program have in many instances added to the confusion.

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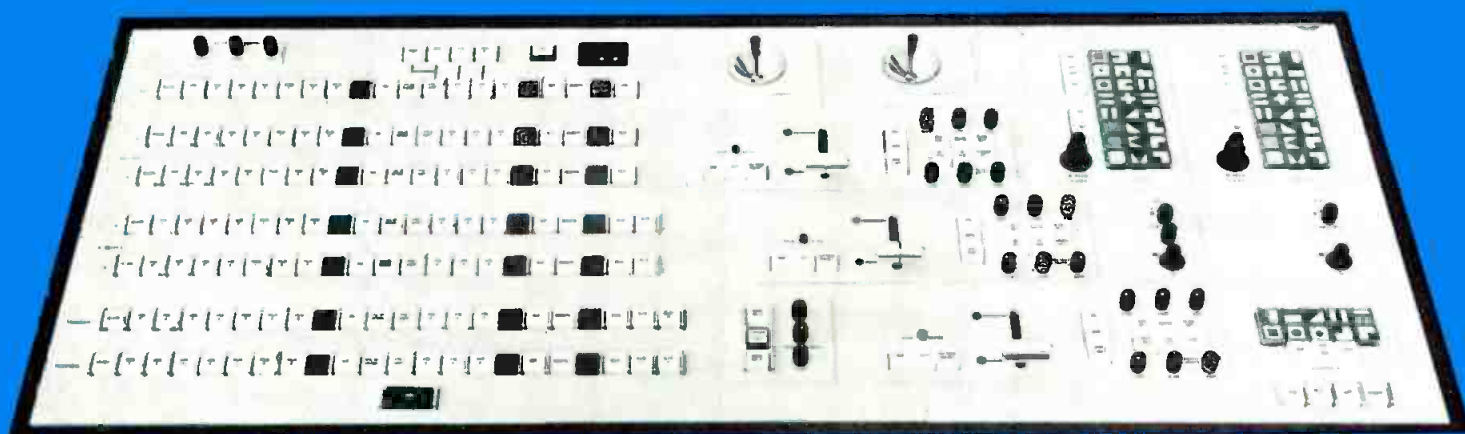
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The Commission's program is aimed at assuring evenhanded and well-understood application of the Commission's Rules, an aim which we have previously endorsed (see August, 1972 D.C.). We urge broadcasters to support the Commission's new undertaking by encouraging the fullest possible participation in the forthcoming conferences by station operating personnel.

Non-Standard Color Television System Authorized

The Commission has authorized a California School District to use a non-standard color TV system on two Instructional TV Fixed Stations (ITFS) licensed to the school district. The action is the first of its kind for a Commission licensee, although several closed-circuit color TV systems employ non-broadcast standards.

The system authorized for use is the SECAM/60 system, patterned after the European SECAM system which is standard in France, the U.S.S.R., and the eastern bloc countries. It differs principally from the standard NTSC system in employing frequency modulation of the color subcarrier and in providing alternating color-difference signals on alternate lines. SECAM receivers and monitors have no external hue control and the saturation control has limited range.

SECAM receiver circuitry is somewhat more complex than that of NTSC, including a requirement for a broadband delay line capable of delaying the picture information for the 63 usec interval corresponding to one picture line.

Short Circuits

Telesat Canada has launched a second domestic relay satellite and is leasing circuits to several U.S. companies....A Detroit man has been indicted by a Federal Grand Jury on charges of distributing counterfeit CB licenses....The Commission is inquiring into the reasons for the limited use of FM receivers in automobiles....A TV translator group in California has asked the Commission to allocate microwave frequencies to be used in transmitting locally-originated material to translators....If you still believe Washington denials, there is no truth to the rumor that the Commission plans to require type-acceptance of equipment used for annual audio proofs-of-performance.

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



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-servorized, 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.

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	PV17 x 24B1	
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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.

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Engineering Accounting

Dear Editor:

Thank you for a fine publication, and for the forum you provide for exchange of letters and information.

I am taking this opportunity to perhaps bring up a subject that engineers seem to run into about twice a year if they are lucky, more if they are in a supervisory position and have one or more subordinates. This is the cost of running the department.

In my current capacity I have to allot my own time on a basis that is efficient and profitable. As a result of this, I got into a talk with a cost analyst about the whole thing and he gave me an interesting insight into what they look for.

Many of the readers who are with a large firm will know about cost guys already and probably dread them. That's only because they don't know what they are looking for. One of the easiest things to do in any industry is to spend the same dollar twice. You perform this astounding feat this way: Poor personnel and personnel management results in overspending per job and that means that you must place each allotted dollar in more than one place. Example: If you are the only engineer in a shop and you must repair an amplifier that just suffered catastrophic failure and find that it will take you seven hours to fix you have to look at it thus: You don't just figure the

hourly rate for the repair you must figure in these costs that are unseen but very real.

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5. The difference between replacement and current depreciated value of the equipment.

The terrifying thing here is that you end up with a cost figure that may well be three times the cost of a new unit.

Certainly I do not wish to imply that we should not repair things, but we should be in a position to realistically determine how far the apparatus can deteriorate before we declare it totaled.

There is one other factor in this discussion. In the professional life of every engineer comes the fatal day when he must go up to the front office and account for his

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department. This probably is a routine investigation by management into what is it about engineers that costs so much.

Obviously, we will all stand up on our hind legs and explain about good engineers and technicians and how much they cost in salary. And we can go on and on about how equipment costs are rising, and how they just don't seem to build the stuff like they used to, and about the sloppy announcers who break stuff by looking at it, ad infinitum.

That is all well and good, but what the guy on the other side of the desk wants is some numbers. Imagine the look on his face if you unreel a chart of manhours plotted against production, and costs against breakdowns in three colors all of it showing that you do indeed run a tight department.

Managers are impressed by that sort of thing and it makes you seem like you are doing your job.

If nothing else comes of it, you can use the information you garner to run your department better. After all, who doesn't want a well run shop? So why not steal a bit from major industry, scale it down and plug it in.

James L. Sorensen
Engineer-in-Charge
The American Motor-Show
Kenosha, Wisc.

Parts Help Needed

Dear Editor:

KSLU is a student-operated AM radio station, serving the campus of St. Lawrence University by means of carrier current transmission. We have a low budget, raised partially through a grant from our student activities fund, and partially from advertising. As such, we try to do a good job with whatever equipment is available to us (a story, I am sure, that is equally true for commercial stations as well...).

At any rate, about a year ago we were given an old Berlant Concertone BRX-1. The machine was in mint condition, until recently, when some of our production people gave it a little rougher treatment than it was used to in recording chapel

services once a week. There is a rheostat which couples with the transport camshaft mechanism and controls the speed of the rewind/fast forward functions. It has a center off, and a value of 120 Ohms in either direction. I believe (but am not certain) that the Berlant part number is M-110. Since Berlant Concertone is out of business, we cannot find a replacement part for it, either in piles of old spare parts here, or in any of the electronic equipment catalogs we have. The rheostat appears to be a 120/120 Ohm, wire-wound, 25 Watt ceramic part.

Can anyone please help us find one? We would really appreciate buying a three or four dollar part than a \$1600 deck.

Timothy P. Byrne
General Manager
KSLU
Canton, N.Y. 13617

Seriously...Sears!

Dear Editor:

The operators of WEZX-FM would like to tell you a tale of Sears' dependability. On March 30, 1973, at 7:25 a.m. our twenty-three year old General Electric 3kW FM transmitter left the air due to a shorted IPA blower motor. At 10:57 a.m., we signed on the air using a Sears Kenmore vacuum cleaner to cool the IPA. We signed off at 9:16 p.m., March 31, to replace the blower motor and returned to the air at 9:22 a.m. with repairs completed and operation as usual except that the carpeting was a little dirty.

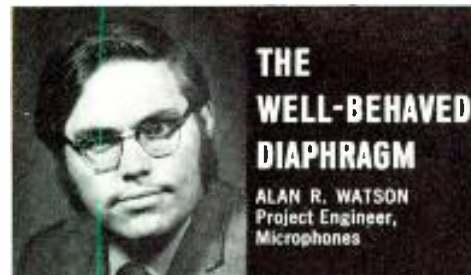
To all you people with antiquated transmitters, we recommend the purchase of a dependable vacuum cleaner...quickly.

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When a microphone design engineer finds discrepancies in the frequency response curve of a microphone under test, he can usually assume that any peaks and/or dips are the result of either faulty damping or that the diaphragm is departing from ideal piston operation. The big problem has been to determine which fault is being displayed.

A powerful tool in determining actual diaphragm behavior is the holographic camera. It can reveal and measure deformations of the diaphragm not visible by other means. Use of this research method led to the unusual diaphragm used in the new E-V Model DS35 Single-D microphone.

The problem was to design a diaphragm that offered high compliance at low frequencies yet maintained good rigidity at high frequencies to withstand the high accelerative forces without diaphragm breakup. The solution was to combine an Acoustalloy® diaphragm using a semi-toroidal surround plus a flat center section, to which is bonded a domed "pill" of molded polystyrene. This construction reduces piston breakup over a broad range of frequencies, and eliminates the minor resonant areas typical of more complex diaphragm designs. Mass of the moving system is also controllable within very close tolerances. The result is predictably flat response, especially at higher frequencies.

This flat response, in addition to being desirable in itself, makes possible more uniform off-axis performance since adjustments can be made to the phase-shifting networks necessary for creating a cardioid pattern, without upsetting the on-axis response.

The holograms also revealed a need to mount the voice coil more rigidly to the diaphragm to eliminate the decoupling that can take place at high frequencies. This was done by recessing the rear surface of the diaphragm to permit the coil cement to operate in shear rather than the usual compression-expansion mode typical of other designs. This improved mounting was made possible by the unique volumetric nature of the diaphragm assembly.

The net result of this design program was to create a Single-D microphone that is remarkably uniform in response both on- and off-axis, especially in the region from 3 to 10 kHz where non-linear diaphragm motion is relatively common with traditional designs. The same approach to diaphragm construction has also been applied to other E-V Single-D microphones including the 670 series.

Where the microphone is used for sound reinforcement a distinct improvement can be noted in gain-before-feedback as a direct result of the reduction of peaks in both on- and off-axis modes. In addition, elimination of peaks reduces the likelihood of input overload in critical installations.

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INDUSTRY NEWS

A Tough Gutsy Press

One important result of the Watergate affair will be better relations between the White House and the nation's news media, according to Joseph McCaffrey, Capitol Hill correspondent for the Evening Star Broadcasting Co., Washington.

Speaking at the luncheon meeting of presidents of state broadcaster associations, McCaffrey said if President Nixon learned one thing from the Watergate incident it is that "he must have an open administration that will allow radio, television and the press to do their job without harassment."

Had it not been for the media, he said, the Watergate scandal "would have died aborning." The American system of government, he added, cannot survive "without a tough, gutsy press."

McCaffrey said he believes the President is "shedding himself of the people who had a conspiratorial theory of American politics. With this theory it was only natural a campaign would have been mounted against the networks."

The Capitol Hill correspondent said he thinks "the suspicions which have permeated the White House approach to broadcasting and all media generally will be relaxed."

He said the Watergate affair was different from other Washington scandals because it was "an attempt to pervert and subvert the natural American political process." He called it an attempt during an election year to control completely the choice the American people would make for President.

AFCCE Has A "First" Lady

The Association of Federal Communications Consulting Engineers met in Ft. Lauderdale, Florida for their 25th annual meeting back in April. Rather than let it pass as "old news" (we got the word after the May issue was on its way to the press), we're running it now because congratulations certainly are in order for the new officers.

Undoubtedly, it will come as a surprise to some that at that meeting the AFCCE elected Elizabeth L. Dahlberg to the office of president for the coming year.

Well, Mrs. Dahlberg certainly is no newcomer to the industry. After earning her BA at Hunter College (New York City) back in 1940, she worked as a statistician and radio engineer for the radio division of the National Bureau of Standards.

During the next 10 years she worked as a radio engineer for two consultant companies. Then, in 1956, she joined Lohnes and Culver, consulting radio engineers in D.C., as an engineer and partner.

This is not the only "first" for Mrs. Dahlberg. Back in 1952 she became the first female registered Professional Engineer (No. 869) in Washington, D.C.

Other new officers are: Paul Wimmer, VP; Ogden Prestholdt, Secretary; and Carl E. Smith, Treasurer.

McCaffrey said the real questions to be answered are: Did the Committee to Re-Elect the President subvert the presidential aspirations of Edmund Muskie and control the Democratic convention in Miami?

During the next two years, he said, "we'll get closer to the answers."

McCaffrey also predicted that the five-year license renewal bill broadcasters are seeking in Congress will not be passed this year. He said he believes the House will enact such legislation, but that the Senate will not go along.

Burch Tells ITA That MDS Is Coming On Strong

FCC Chairman Dean Burch in an interview said that the real role of the Commission was that of a "traffic cop" that administers the broadcast and telecommunications spectrum.

"Spectrum management is really what the Commission is all about," Burch said. "The 'romantic' issues are the fairness doctrine, obscenity, and broadcast economics. But what we are most concerned about is that the communications spectrum is a finite national resource with infinite uses and that we are the ones who have to decide who gets a shot at what. How they use it after that is up to them. This is the Commission's most difficult, yet rewarding task."

Burch's comments on the "management role" of the Commission were made in an interview with former FCC Commissioner Robert Wells which was pre-taped for presentation to some 600 private television users attending the opening session of the International Industrial Television Association meeting at the Shoreham Hotel.

The interview and several live presentations were transmitted directly to the Shoreham via the FCC's newly authorized super-high-frequency (SHF) television service from the studios of Microband Corporation of America which is introducing the new common-

carrier, private color television service to the Washington area next month. The medium is called Multipoint Distribution Service, or MDS, and is designed for use by corporations, businesses, government agencies and institutions to beam specialized programming to pre-selected audiences.

Burch termed the current high interest in the new Multipoint Distribution Service as a "gold rush" and said that the Commission really did not foresee the

intense interest in the new medium when it was established by a corrective rule change in 1970. Since then, over 350 MDS applications have been filed for some 180 metropolitan areas. Washington, D.C. will be one of the first cities in the nation to receive the service. Microband, which operates the Washington station, has also been granted FCC construction permits for stations in six other cities. To date the Commission has issued 16 such permits.


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New Renewal Rules Coming

License renewal applicants will have to be filed four months in advance of the expiration date, and commercial TV station licensees will be required to compile annual reports under the terms of new renewal rules adopted by the FCC in an Interim Report and Order (Docket 19153).

The rules also specify the nature and frequency of announcements stations are required to broadcast to notify the public of licensee obligations and upcoming renewals, and they include a revision of the programming section of the TV renewal application form.

The new forms for the annual report and the revised TV renewal application form are subject to approval by the Office of Management and Budget. Until this occurs none of the new renewal rules will take effect.

The rule changes were proposed in a rulemaking notice issued in February 1971.

The Commission said it was extending the filing period for renewal applications from three to four months before license expiration to provide community groups "ample time" to examine renewal applications, "discuss any problems with the licensees and, if desired, to file timely applications to deny."

The first group of licensees to which the new filing dates will apply will receive eight months advance notice.

In addition to the time extension, the Commission set firm deadlines for filing petitions to deny licenses, specifying that extra time to file will not be granted unless all parties, including the renewal applicant, agree to the request, or unless the petitioner makes a "compelling showing" that the extension is warranted because of "unusual circumstances." Petitions to deny must be filed one month prior to the expiration of the license.

Under the annual reporting requirements for commercial television stations, licensees will have to place each year in their public inspection file, a list of significant

problems and needs of their service areas and typical and illustrative programs presented to meet those needs. They will also be required to compile a statistical breakdown of types of programs presented in various categories. The Commission said it hoped by this means "to develop a mechanism by which the licensee's conception of current significant community problems and needs and his efforts to meet them could be made available to the public on a continuing basis."

Licensees will be required, at intervals of at least 15 days, to broadcast announcements telling viewers and listeners how to submit their views on the station's operation of the licensee. Beginning six months before the license expires, the station will be required to run a schedule of announcements notifying the public of the impending expiration.

Commenting on the need for the announcements on a continuing basis, the Commission pointed out that since the proposed rules were issued, the number of petitions to deny broadcast renewal applications had continued to increase with the most common complaint being that licensees had not met the needs of significant segments of their service area.

The rule requiring stations to publish notice of application for license renewal in a newspaper, has been deleted. All such announcements will now be broadcast.



"JUST HOW MUCH MORE AIR TIME CAN WE SELL!"

Bob Flanders Steps Down With Call To Action



Two years ago you honored me by electing me to the presidency of the Society of Broadcast Engineers. It has been an interesting and exciting two years and it is with mixed emotions that I see this period coming to an end, but I can see nothing but good news for the future.

We have accomplished most of the tasks which were contained in my original promise to you when I took office. The membership paperwork is mostly computerized. We have successfully terminated our agreement with the old journal publishers. We have formed what should be a most beneficial relationship with a magazine dedicated to the field of broadcast engineering. We are financially sound, although not affluent, and we are growing in both the number of chapters and in membership.

I am very proud of our new association with BE. Its editor, Ron Merrell, with the blessing of his publisher, George Severovich, has for a long time had a very positive feeling that the magazine and SBE have a great common interest. I will be disappointed, however, if we do not expand our use of this magazine to inform, to educate and to promote our profession. We can do this both editorially and reportorially by using these pages

to make our stand on issues better known.

To elaborate, we can use them to publish papers on broadcast engineering subjects of use to those in our profession, and you may consider this as a general call to the membership to submit articles for the SBE editorial review.

As outgoing SBE president, my challenge to you is the development of the local chapter, both new and existing. We believe that there are many areas having sufficient broadcast engineers to adequately maintain a local chapter. The national office is prepared to help you but the success of chapter development hinges on having one or two dedicated men who will take the task to heart.

I would only add that I am encouraged by the number of recent student applicants. This, I believe, is necessary for the proper growth of interest in our profession. I would encourage everyone, especially those with operating chapters, not only to help these youngsters but to actively seek them and bring them into SBE chapter activities.

I sincerely appreciate the support you have given me and the SBE board of directors over the past two years and I look forward to the Society's continued growth under the strong leadership of Jim Wulliman and his new board.

Chapter Reports Manuscripts To SBE Editor

Reports of SBE chapter meetings and announcements of future events will be published in these pages monthly. It is important that chapters send information on meetings and other news as promptly as possible. Include photographs whenever available; preferred photo size is 8 x 10 but smaller sizes are also usable.

The monthly deadline for submitting copy is the 25th of the 2nd month preceding the month of publication. For example, the date by which copy must be received by the SBE editor for the August 1973 issue is June 25th; for the September 1973 issue, the deadline is July

25th, and so on.

Letters to the SBE Editor, for publication in the Journal, are welcome. Send all material for publication to: SBE Editor, Joseph A. Risse, P.O. Box 131, Dunmore, Pa. 18512.

Membership

Membership grades are: Student, Associate, Member, Honorary Member, Senior Member and Fellow.

Qualification for Member grade is at least a first-class radiotelephone license, or the equivalent in education or experience. Details of membership qualifications are described in "The SBE Constitution and By-Laws."

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Chapter News

**Chapter 1 - Binghamton, N.Y.
Chairman: Larry Taylor,
WENY TV,
Mark Twain Hotel, Elmira, N.Y.
14901**

Members and guests met April 10th for dinner and technical session at the Owego Treadway Inn, Owego, N.Y. to hear Jay Darrow, from Elmira Chapter of Commerce talk on the Occupational Safety and Health Act (OSHA). Darrow also showed a short movie on this topic and provided passout material. The May 8th joint meeting with Chapter 2 of Northeastern Pennsylvania and chapter 22 Central New York was discussed. Also, the June 12th picnic, which will again be held at the Newtown Reservation, was reviewed.



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ADMISSIONS COMMITTEE ACTION: _____ Date _____ Approved for Grade _____

Action Deferred for More Information _____ Candidate Notified _____

Chairman's Signature _____ Entered in Records _____

Be Sure To Sign



Chapter 2 - Northeastern Pa.
Chairman: Paul Evanosky,
WVIA TV,
Old Boston Road, Jenkins
Township, Avoca, Pa. 18641

On April 2, Ray Desmarais of Burwen Laboratories, Lexington, Mass., demonstrated his company's Dynamic Noise Filter which, unlike the Dolby System, uses no encoding and, therefore, can be used at virtually any point in the broadcast system. The demonstration showed how the equipment can reduce noise due to scratchy discs, rumble, and tape hiss. The meeting took place at WVIA TV, the chapter's usual meeting location.

Chapter 15 - New York, N.Y.
Chairman: John M. Lyons,
WWRL
41 - 30 58th St., Woodside,
N.Y. 11377

The April 12th meeting, held at WQXR Presentation Theater, 229 W. 43rd., St., New York City, as usual, at 7:30 PM, consisted of two meetings in one, in order to interest both the TV and the radio engineers. The TV meeting featured Vern Killion, TV RF Product Specialist, Gates Division of Harris Intertype who spoke on "TV Transmitter RF Switching Systems, From the Simple to the Sublime". The radio session was provided by William McCarren, Project Engineer, CBS Radio Division, Engineering Department, who spoke on "Impedance Matching AM Transmitters to Antennas for Maximum Efficiency and Power Transfer". When to "tune for maximum" and when not to were discussed in detail. Question and answer sessions followed both meetings.

Dinner, reasonably priced, in the New York Times Cafeteria, was available to all attending before the meeting. The May 10th meeting, with further information in the next issue, will concern time base correction to allow transference of 1/2-inch

videotape to Quad. Further meeting information available from John Lyons, WWRL, (212) 335-1600; Art Silver, Gates Radio (212) 889-0790; or Bob Woerner, chapter secretary, WNEW TV Transmitter, (212) 535-1000.

Chapter 16 - Seattle, Wash.
Chairman: John Maxon, KETO,
Seattle, Wash.

The April 11th meeting, which followed an 11:30 AM social hour at the Norselander Restaurant, Seattle, included election of new officers. Elected were: John Maxon, KETO, Chairman; Lew Rambo, KCTS TV, Educational TV; Secretary, William Pickering, KOMO TV (reelected). Nick Foster was reappointed as Newsletter Editor.

The FCC report was given by Bob Dietsch, commission inspector for the Seattle area. Members who made the trip to the SBE annual meeting and NAB convention brought reports of new equipment and devices and the general trend toward greater use of computers for control, storage, and programming. It was felt that these advancements will bring out the growing importance of better education and training in broadcasting. The chapter's educational committee will take these factors into account in recommendations to area schools. Those attending the meeting came from Spokane, Portland, Bellingham, Grays Harbor, and Wenatchee.

Chapter 18 - Philadelphia, Pa.
Chairman: Jack Jones,
WCAU TV
City Line and Monument Aves.,
Philadelphia, Pa. 19131

On Monday April 23rd, members and guests met for a social hour and dinner and then were privileged to hear Ken Reichel and Tom Ebling of Shure Brothers present "Feedback in the Field is Worth Listening To". Included was a demonstration of new products and testing techniques, microphones, and mixers. Information on future meetings is available from Jack Jones, WCAU TV, telephone (215) 839-7000, Extension 283.

(Continued on page 16)

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For More Details Circle (13) on Reply Card 15

Chapter 20 - Pittsburgh, Pa.
Chairman: Henry R. Kaiser,
WWSW,
1 Allegheny Square,
Pittsburgh, Pa. 15212

On April 19th, a catered luncheon was provided by WIIC TV at their studios. Bob Wehrman, WIIC TV chief engineer, talked on the new computer controlled switching facilities at his station. Note: the chapter's meetings are usually held at Buddies Restaurant.

Chapter 22 - Central New York
Chairman: Hugh Cleland,
WCNY TV FM
506 Old Liverpool Rd.,
Liverpool, N.Y. 13088

The Northway Motor Inn was the location of the April 19th meeting at which John Komardo, CBS Labs sales, and Ben VanBentham, CBS Labs video engineering, demonstrated the CLD 1300, which restructures video signals, and can simultaneously serve as a standby sync generator. The unit was shown to utilize digital lock for standard broadcast use, or it can be modified for helical-scan slow lock mode. Signal restoration is accomplished through individual control of video, chroma, reference burst, sync, and blanking. The May 8th meeting at Owego, N.Y., will be a joint meeting with chapters 1 and 2, and will feature Otis Hansen, FCC chief of Existing Facilities, Washington.

Chapter 23 - Portland, Me.
Chairman: Roland A.
Desjardins, WCBB TV
P.O. Box 958, Lewiston, Maine
04240

The March 22nd meeting was held at WMTW Studio, Poland Springs and was partially concerned with the forthcoming election of officers, and future speakers and meeting places. Marty Engstrom, staff engineer, WMTW, presented a slide talk on his trip to Mt. Washington which elaborated on the technical aspects of the mountain transmitter. The world's highest recorded wind velocities are experienced on this mountaintop.

Chapter 26 - Chicago, Ill.
Chairman: Bradley Anderson,
University of Illinois, Box 6998,
Chicago, Ill. 60680

The April 25th meeting was held at NBC. Bradley Anderson presiding. Some discussion related to the SBE relationship with **Broadcast Engineering** magazine. The program was presented by Midwestern Relay Company, the Chicago area engineer, Paul Tagge, presented a picture of the MRC microwave network in the upper Midwest and how it serves the 3 major TV networks, and also provides occasional service for sports and news. Discussion on long distance microwave problems and how MRC



Chapter 31 meeting in Fort Wayne. Left to right: Bob Cox (Prgm. Chairman), Dr. Walter Williams (Indiana Institute of Technology); Dee Hite (General Telephone Co.). Gene Chase (Chairman).



"THAT'S LERSCH'S THUMBPRINT HE HANDLED THOSE SLIDES."

copies with them generated a series of questions from those in attendance. The program was followed by tours of the Chicago MRC facility in the Merchandise Mart and also the NBC Studios.

Chapter 28 - Milwaukee, Wisc.
Chairman: Ed Wille, KENCOM
7835 W. Caldwell St.,
Milwaukee, Wisc. 53218

On April 17th chapter members and guests heard Bob Gorjance, district manager, Gates Radio company speak at WTMJ, Inc., on "Pulse Duration Modulation". Gorjance has been active in radio and television broadcasting since 1956; before that he had spent four years as a cryptographic equipment repairman in the Air Force. His talk centered on the new Gates 50-kW AM transmitter which uses pulse-duration modulation in achieving high-level plate modulation without the use of a modulation transformer resulting in reduced size and improved efficiency for the transmitter.

In the chapter's publication, **The Broadcaster**, Todd Boettcher, Editor, of WTMJ, urged members to submit articles to the **SBE Journal** for publication in SBE's section of **Broadcast Engineering**, and mentioned that SBE-endorsed articles considered acceptable by the BE editor, also, would be paid for by BE at their regular publication rate.

SBE Journal
Begins on Page 13

Chapter 31 - Ft. Wayne, Ind.
Chairman: Eugene A. Chase,
WKJG TV
Ft. Wayne, Indiana

The organizational meeting for this chapter was held on March 21st; 32 engineers attended. Officers were elected as follows: **Chairman:** Eugene A. Chase, WKJG TV, Ft. Wayne; **Vice Chairman:** Bill Ryan, WMEE, WMEF; **Secretary/Treasurer:** Bill Wolfe, WOWO AM; **Program Chairman:** Bob Cox, Indiana Institute of Technology.

At the first regular meeting, April 25th, Dee Hite of General Telephone and Dr. Jack Williams of Indiana Institute of Technology provided a technical program on the Laser.

Chapters Forming

The following areas represent locations for possible future chapters. Information on any planned organizational or technical meetings may be obtained from the individual listed as the "contact" in each case. Anyone interested in formation of a chapter in other locations may contact Virginia Doss, Assistant Secretary-Treasurer, SBE, P.O. Box 88123, Indianapolis, Ind. 46208, or at WRTV, 1330 N. Meridian, Indianapolis. Also keep the SBE Journal editor advised so that helpful promotion might be provided of your chapter-forming interests.

Tucson, Arizona: H. J. Bart Paine, Telephone 882-6644, or Chuck Deen, KOOL TV, 511 W. Adams, Phoenix, Ariz., telephone 271-2345

Miami, Florida: John Blattner, 11001 N. Kendall Dr., Apt. A107, Miami 33156

St. Louis, Mo.: Arthur H. Rounds, 1321 Aspen Drive, Florissant, Mo. 63031

San Francisco, California: Robert Daines, CBS Laboratories, One Embarcadero Center, San Francisco, Calif. 94111

Don't Overlook Ventilation

Dear SBE Editor:

One of the greatest problems that I've encountered in radio stations is that of adequate ventilation. This is caused, I believe, by the concern for acoustical problems of sound isolation and control, plus failure to take into account the generation of heat by the equipment to be installed. Poor ventilation places a strain on working personnel and has an adverse effect on their performance.

I am in favor of zone controls for each room that has to (or should) work with closed doors. There should be a fresh-air intake and exhaust with controls for mixing the amount of fresh air with recirculated air especially during temperature extremes.

Using a common duct allows sound to travel from one room to another. To reduce unwanted sounds, ducts should be staggered and treated. Block walls provide

good sound isolation, but if wooden walls are used, they should be of double construction so that they are acoustically isolated from each other. The same goes for window frames.


Beware of false ceiling construction of the suspended type; these are usually quite thin and often conceal noisy water pipes or the previously mentioned ductwork.

Flourescent lamps should have ballasts removed and mounted outside the rooms, possibly above the ceiling.

If the studios share a common building having a cement slab floor, it is a good idea to have the slab cut for sound isolation, especially if there is heavy work being done next door.

Peter H. Van Milligan
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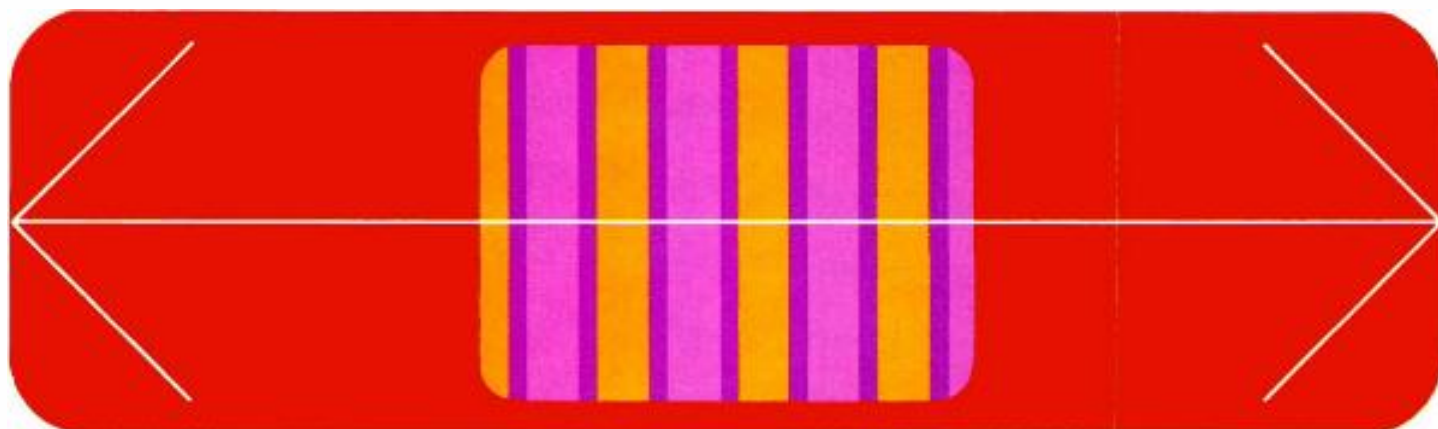
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The 1973 NAB Convention was something else again!

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The FCC gives perspective to proof requirements

By Dennis Ciapura*

Since the 1930's, the age of signal processing has slowly crept up on a smiling and receptive broadcast industry, because every broadcaster has a different idea of how a radio station should "sound" or a TV station should "sound" and "look".

While the purist may point out that the ultimate technical situation would be broadcast facilities that had no "sound" or "look", but were perfectly transparent transmission systems, practical considerations often dictate some more flexible mode of operation. An engineer looking at the hue shift or a VTR dub or monitoring a remote audio line with a raw 20 dB level variation and audible high-end loss may be inclined to take a second look at some of the corrective machinery available!

In practice, millions upon millions of dollars worth of audio and video processing gear is in use and more is on the way. Everything from simple audio AGC units to rather elaborate video processing units are presented to an eager market of ever ambitious and competitive broadcasters each year. The promotional materials describing the virtues of these miniature electronic marvels are not unlike travel brochures.

Sometimes, however, there must be the technical "day of reckoning" when the broadcast facility will make equipment performance measurements and, hopefully, find the results in compliance with the standards described by the FCC in Part 73. How one actually makes these equipment performance measurements, particularly where audio processing equipment is concerned, does, of course, have a lot to do with the results obtained.

It is obvious that if half of the program chain is "patched out" of

the circuit, proof requirements are more easily met. While the better units exhibit negligible signal deterioration and noise output, a facility employing an AGC amplifier at the studio, another at the remote end of the telco loop and a peak limiter at the transmitter input may be a tough animal to tame at proof time with all of these units in the circuit and their AGC functions disabled; unless their AGC functions are disabled by "patching out" the entire unit. This may be particularly true where some of the older audio components are in use; they, by themselves, not exceeding minimum requirements by much!

Who Is Proofing What?

Many engineers are steadfast in the belief that every single piece of

equipment normally employed in the program chain should be in the system when equipment performance measurements are made. The only alternation is the disabling of the AGC, via extracted 6AL5 or front panel switch, depending upon the age and type of equipment. In fact, much of the newer equipment does have front panel disabling switches and the manufacturers' operating instructions describe how to make a proof through the units. Certainly, this is the best way to gauge the total system performance (at least from the console input), but is the fellow who bypasses his signal processors also doing a valid proof? Broadcast engineers have widely varied opinions on the subject and each side has a good argument.



*WLIF-FM, WTOW-AM, Baltimore, Md.

What's In, What's Out?

While many engineers point out that the regulations require that everything normally employed in the broadcast chain should stay except for AGC being defeated, many others point out that the regulations are not specific in how this should be done and certainly eliminating the AGC amplifiers disables the AGC.

This area of Part 73 simply is not specific enough to provide a clear interpretation of the intent of the regulation. A far more dubious point of concept, however, is the fact that these equipment performance measurements are made through the microphone input terminals of the console. An incredible method of determining system performance in 1973 when one considers the amount of equipment ahead of the console which, as the regulations are now written, are not included in the equipment performance measurements at all!

What About Automation?

Since it is considered a signal source, an automation system may employ in its output any degree of equalization and/or AGC that its user feels suitable. One does not legally perform the same electronic acrobatics in the transmitter stereo generator, however, no matter how identical the results might be.

Somewhere this morning an FM stereo station was "proofed" and among the measurements made were harmonic distortion tests at 10 and 15 kHz, even though the second harmonic of 10 kHz tone will not be passed by the 19 kHz low pass filters in the stereo generator. Many engineers feel that an IM distortion measurement would be more appropo. Almost all agree on one thing: the proof section of Part 73 is rather ambiguous in some areas.

Changing Regulations

An annoying but ever-present

question does modify the situation though. Would the broadcaster really do well to ask for more regulation than already exists. Fortunately, the Commission is aware of the problem and the best way to approach any problem is directly, so, to gain more insight to what the regulations in this section of Part 73 are really all about, if anything, and how they apply to modern broadcasting, we talked to Harold Kassens, Assistant Broadcast Bureau Chief, to see what his thoughts might be on these same basic topics.

Kassens Interview

BE - As you interpret the rules and regulations for the AM and FM proof of performance measurements, do you think an engineer is justified or "legal" in "patching out" AGC amplifiers when running the proof?

H.K. - "Yes, as we interpret 73.47 (the sentence we're talking about is: the equipment performance measurements shall be made with the equipment adjusted for normal program operation and shall include all circuits between the main studio microphone amplifier input and the antenna output including equalizer and correction circuits normally employed but without compression if such amplifier is employed). I think the problem here is that the rule goes back to the late 1930's. Considering the equipment we had in those days, people knew about equalization and compression amplifiers were starting to come into service, so the rule was directed to that. Of course, since World War II we've had some tremendous advances in AGC amplifiers and peak limiters and the rule just hasn't been kept up to date with the type of operation we have today. In my opinion, an AGC amplifier certainly supplies compression and in that case, I don't think that anybody who patches around this type of equipment would be getting into any trouble because he certainly has a legitimate interpretation of the rules on his side."

BE - Do you think that there is anything in the rules that limits the amount of compression or signal

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processing that may be used; equalization, etc.?

H.K. - "No, there's nothing in there that specifies any values; the only area where it might be indirectly applied is the modulation rule that says you can reduce modulation to prevent excessive loudness, as in the business of loud commercials that we used to get into...there's always the possibility that you could cause excessive loudness with too much compression."

BE - If the proof was to be changed, what changes would you like to see?

H.K. - "Well, frankly, I think an engineer sitting down reading the rule and recognizing what radio broadcasting is like today, would concern himself more with the fact that the majority of the programming that shows up today comes from tape or discs and would think more about the performance of the entire system, which would include the tape deck or phono pickup. So, I think, for example, that it would be logical to have a standard tape and a standard disc and use those to run the performance measurements. The second thing that I would do would be to leave all of this accessory processing equipment in the circuit. Somehow or other, rewrite the rules so you could get a legitimate typical type of performance measurement, say at 90-95 percent negative modulation and perhaps 115-120 per cent on positive peaks so you could get an idea of what the typical operation of the entire system is; rather than the procedure we have now of removing equipment from the circuit that's normally in there."

BE - In view of the current re-regulation and the recent relaxa-

tion of technical requirements on broadcast services, is it possible that if the rules for EPM's (Equipment Performance Maintenance) were re-written that they might be even less stringent than they are and leave even more to the discretion of the broadcaster?

H.K. - "Yes, this is our big problem, we recognize the flaws in the Equipment Performance Measurements for AM and FM and, of course, none are required for TV. We've been worrying about updating these rules for some time. But under the current re-regulation program we are required to examine every rule to see if that rule is necessary and the problem we have with the rules for Equipment Performance Measurements is that we have to ask ourselves, 'is this really a concern of the Commission or is it really the concern of the broadcaster'. Should we put the requirement of suitable performance on the broadcaster so that if he chooses to have poor audio performance perhaps he is the one to suffer? This is the basic question that we have to face, and we haven't made a decision on just how far we should go to relax this rule if such a relaxation is possible."

BE - Many engineers are concerned about the fact that rules governing E.P.M.'s as they are now written require harmonic distortion tests above 7.5 kHz, even though the second harmonic of even a 10 kHz tone is outside of the bandpass of a FM stereo station. Do you think that IM distortion measurement would be a useful addition to the proof?

H.K. - "Intermodulation measurements serve a very useful purpose,

but I think you're raising a rather basic question when you consider the source material today. If you're an acid rock station with a tremendous amount of compression, I'm just not so sure how much intermodulation distortion measurement tells you. On the other hand, if you are a good music station interested in the ultimate in performance then the IM measurement could do a lot of good. So, I really think that the requirement is determined by the source material.'

From the interview, you might conclude that there is no hidden meaning in Part 73; no complex reason behind what appears to be an incongruous mating of modern broadcast technology and circa 1940 regulatory machinery.

Parting Shots

If the current movement toward re-regulation does extend to the rules governing signal processing and equipment performance measurements, a total system type of approach does certainly seem more meaningful in terms of evaluating the signal that is really broadcast. Many stations do, of course, already employ the source-to-antenna method suggested by Kassens, but much of the industry is still involved in making an annual console-transmitter test and are in full compliance with the current rules. A far more important question, however, is whether or not the Federal government should actually dictate fidelity requirements at all.

Everyone will agree that regulation of the technical criteria that involves coverage area, overlap, spurious emissions, etc., is necessary to prevent electromagnetic bedlam on earth. The question of how, or indeed if, to regulate a station's "sound" is a much more complex one. For every broadcast engineer who sees a need for minimum standards of audio performance there is another who feels that the state of art could be more rapidly advanced by a less inhibited technical atmosphere. While sociologists ponder the lack of wisdom in legislated morality, the Commission weighs the value of Part 73 technical morality. □

Management Highlights

For years, stations have been divided into two camps: we leave everything in, or we take a lot out when we pull a proof of performance. This article is based on that difference of opinion. The answer, as you'll see, comes from the FCC. You may be surprised at the outcome.

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For More Details Circle (19) on Reply Card



When the white is right, the picture is right. And that is true for everyday sets and advertising production. (Picture courtesy of WSOC)

It's your choice, but... 60 percent white is right

By E. Carlton Winckler*

From the time television blossomed into color, almost everyone has been concerned with adjacency problems. These relate to major color and contrast variations between the programs, commercials or promotional announcements that follow each other day and night on our home television screens.

Massive efforts by technical societies and broadcasters to bring these variations closer to guidelines set by industry color committees have had fairly good results as far as filmed programs are concerned. These now stay quite closely within the color and contrast range established by the SMPTE with their film and slide color reference presentations.

Many other sources of television material, especially some commercials, continue to dash themselves against the rocks of individuality, and results are still pretty

much at the whim of the art directors or producers. Of course, the more skillful originators have been able to achieve all their artistic effects and still stay well within prescribed color balance and contrast perimeters, but many go their own way—often to the detriment of the product.

Note should be made of the fact that color adjacency problems are not limited to film product—the variation is just as apparent in video tape originations, with, in many cases, differences exaggerated in the film to tape transfers often done for broadcast convenience.

Observation of on air product reveals no reason for quarrel with the design ideas or creative concept of the productions most often out of key with their adjacencies. Rather, the problem lies in the staging practices, where apparently decor and effects are done to please the human eye in the studio rather than designed for the camera system.

Watch that Ratio

It has been pointed out many times that attempts to exceed the contrast ratio limits of the television system are the basic cause of most picture quality problems. Whether we like it or not, the present color television system, which includes the home receiver, just does not have the capability of handling a contrast ratio greater than 30 to 1 without picture distortion.

Usually the major problems occur in the high luminance areas—normally through an insistence on using pure white for backgrounds, costumes or decor. As pure white reflects around 85 percent of the light falling upon it, white is so much brighter than other elements of a scene, that they all appear dark in comparison. The face or skin tone, for example, is at the very bottom of the scale when compared to pure white, and loses all visual importance.

While video operators of exceptional skill can often manage to

*Resigned from CBS TV network to join Imero Fiorentino & Assoc., W. 66th Street, N.Y.C.

contain white costumes or limited white areas of background without serious flares, there is nothing they can do to simultaneously hold detail in even slightly darker areas, especially skin tones. These just lose importance, and even legibility in contrast to the high luminance of the whites.

Producers' Note

With high key white background effects being so popular in advertising and display work, the producer can be in a lot of trouble—but there is no reason why he should be in any trouble at all if he will heed a few words of sound advice.

TV White Is Right

Television white or **Technicolor white** (same thing), appears on the screen to be perfectly white, yet is actually an off white reflecting only 60 percent of the light. So, while the producer or art director has his white limbo, white decor or white costumes just as he envisioned the effect—the other picture elements, including faces, are now within the capability of the television camera and receiver to reproduce in accurate color relationship. **Therefore, the net result of using 60 percent white instead of pure white is having your production appear on air the way you planned it.** Incidentally, television white even looks white in the studio—so it is doubly hard to understand the apparent reluctance to use it!

While "television white" results in pure white appearing on the screen, interesting variations which serve to control contrast equally well can be achieved by treating the original subject with cream color,

very pale tan, for a warm white result, or lightly tinting in pink, blue or any hue of your choice for a different white quality. Naturally, in any of these variations the 60 percent luminance value must be retained.

Sheer Force Gamble

Naturally, white is only one facet of the contrast ratio problem, but it is the biggest trouble maker. Black objects or dark colors which are too low on the luminance scale lose detail and run together. The too dark object for picture reproduction is just as easy to fix as the too bright problem—in this case, of course, you "lighten" the low reflectance items by using less deep tones or by substituting dark gray (4 to 6 percent reflectance) for dead black, so that again the picture looks the way you originally wanted it.

The loss of detail and color distortion which inevitably results from attempts to beat system limitations by sheer force is a gamble you always lose.

For the most legible pictures, easily understood by your audience, the composition should include the full range of brightness values within the 30 to 1 contrast range. Working within this ratio, the creative artist is in no way limited and can work with total freedom to achieve the most spectacular designs he can imagine.

The Problem Child

Once the contrast distortions have been eliminated, the adjacency problem is not difficult—nor, again, is it restrictive. Camera balance, light levels, Kelvin

temperature and make up combine to provide a skin tone appearance close to the SMPTE recommendation, assuring good compatibility with the preceding and following subjects. In most cases, broadcast practice is to balance projector chains and video tape output for average program material, and then operate hands off. Any subject which greatly varies from color balance and contrast norm is bound to suffer, of course, but producers can blame no-one but themselves if their product is the problem child.

Oh, What it Seemed To Be

It seems highly improbable that any producer or art director ever sets out deliberately to do a production that just can't work on television. These men are highly intelligent and super conscientious in their work, and it is suggested that because they encounter so much inertia and inaccurate opinion during production, they tend to override all obstacles good or bad in order to accomplish their objectives.

Aiding this strong positive approach, but badly deceiving them as to results, is what they see on control room monitors. These are normally highly superior pieces of equipment adjusted by skilled technicians, and viewed under ideal conditions, almost universally in a darkened area. Good monitors of this nature tolerate greater contrast extremes than receivers, and the darkened viewing area further adds to the illusion of a superior picture. Viewing under these conditions, and not having a visual standard for comparison, it is no wonder that the production team feels satisfied with the perfection of their product. Later they are indignant over broadcast results which they insist are entirely the fault of others who distort their perfect viewing room subject.

The problem of improper control room or viewing room decisions on color balance and contrast ratios, parallels the experience of the motion picture industry, where skilled film timers find that their

Management Highlights

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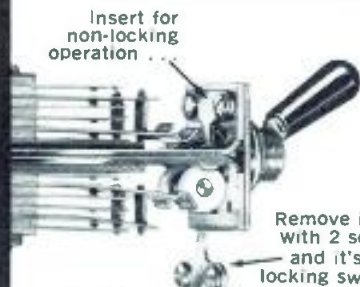
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judgements become less accurate after a time in a darkened viewing room without reference material. Many laboratories make a practice of using a slide projected on an adjoining screen to provide reference to a recognized standard at all times. Others use an illuminated surround for the screen to provide a fixed reference point. Either arrangement works quite well in preventing wide divergence from approved color quality.

The similarity of these problems strengthens the opinion that the art directors and producers whose product suffers from system and adjacency problems may be victims rather than perpetrators of picture quality hazards.

Viewing Room Wrong

Efforts to upgrade viewing room conditions everywhere have been vigorously pressed by the industry—the drive should be extended to cover all tape and film viewing facilities, plus television control rooms as well. Success in such a project would go far toward curing the adjacency problem in television broadcasting.

It would seem that there are many incentives for video tape and film production houses, or broadcasters who make commercials or other products for their clients, to look critically at their viewing room facilities. The viewing room is more than a check point for completed product—it is often the contact point with present or future clients, and always a major sales tool for either proposed or completed product. Many organizations have installed elaborate viewing facilities with good screens and monitors, comfortable chairs and plenty of ashtrays. But these deluxe rooms often provide handicaps to the house in showing their work advantageously, because the lighting in the room does not provide good viewing conditions.

Light sources, lamps, or highlight reflections in decor detract from the ability to observe the screen comfortably. Ambient light striking screen or tube areas distort the all important contrast ranges, making any quality judgement difficult.

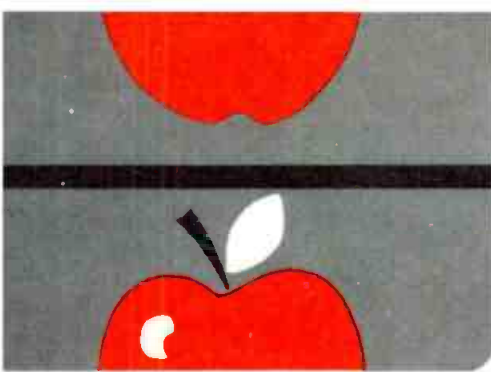
As a starting point, no visible light sources or even slight glare reflections should be allowed within the viewing range of those seated before the screen or tube. A soft

general light from behind the seating area is recommended for comfort and ease of movement. The screen or monitor should be surrounded or backed by a neutral colored matte wall or drape evenly lighted at about 4 foot candles. An easy way of providing this light is through an inexpensive slide projector (without a blower), masked to block out light from the screen area. This unit could be mounted near the ceiling, somewhere along the back wall of the room, and different slide masks used for television or film screens if the room is dual purpose.

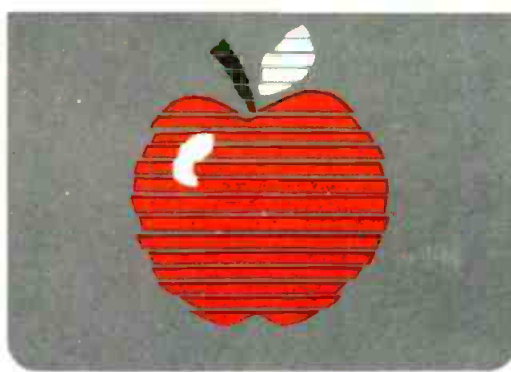
Similar effects may be done with small spotlights having shutters for masking, or by concealed strip-lights. However the effect is achieved, the objective is to provide a softly illuminated surround for the screen, plus low level ambient light in the room. This provides viewing conditions closer to those of the home audience, plus giving a fixed color reference point to which color and contrast variations on the screen or tube are related and easily identified. A side value is that minor production or recording defects which would have no effect on broadcast quality become substantially less apparent.

Going one step further and providing a small screen with one frame of SMPTE standard reference adjacent to the screen showing your product, will show how the finished product varies from the broadcast norm. While the client or his art director's decision is the final word, it will now be based on the full knowledge that the product will or will not be compatible with adjacent subjects, and he can know this factually before rather than after broadcast.

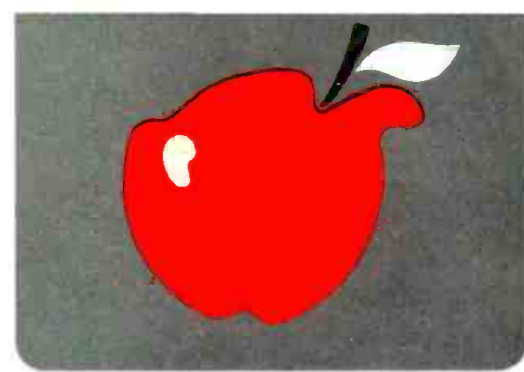
There will still be many clients who will insist on doing it their way, and do not want to be confused with any facts, so the adjacency problems will continue to be problems. But there is a chance their number can be reduced, and overall effectiveness increased by spreading the knowledge of television contrast ranges, gray scale use and improved viewing room conditions. Improved picture quality is always worth our continued efforts to provide it as a service to both our client and our audience. □



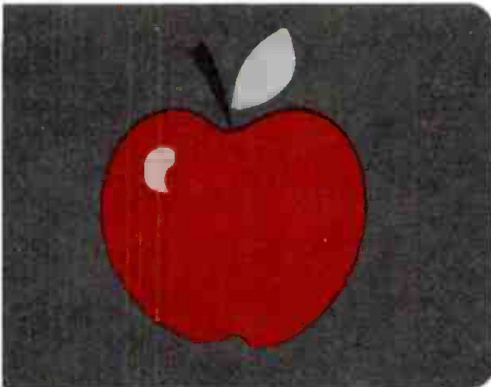
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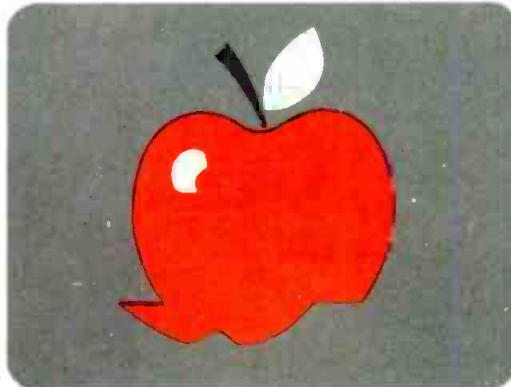
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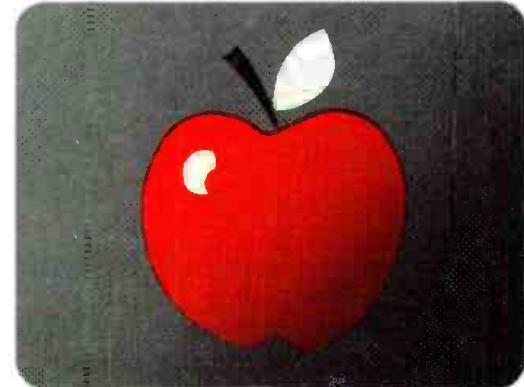
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A practical studio security plan

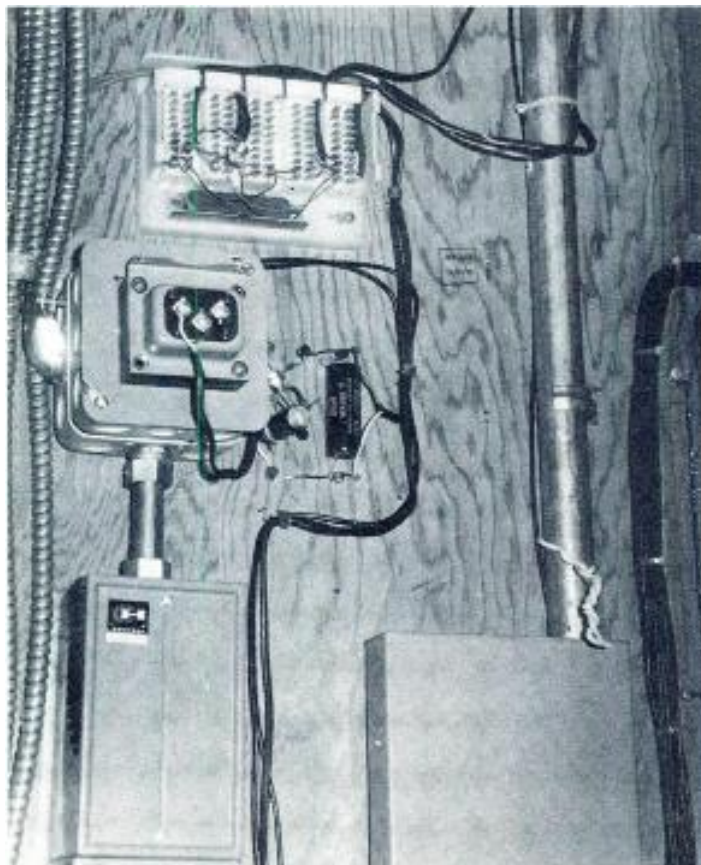
By Lee Sutherland Paar

Ours is a 24-hour operation (1 kW day/250 W night, NDA) in a major market with only a combo-DJ on duty during the evenings and nights. We have lost several good cart machines and suffered other depredations from time to time which we could not tie down to any one person.

Our first effort to control the problem was to arrange our production studios so that they could not be entered or used after normal working hours. The second stratagem was to bug our Ampex and remaining cart machines so that a very loud alarm bell would sound as soon as they were seriously disturbed (but not go off every time someone moved them around on the desk).

*Engineer, WWIN, Baltimore, Md.

Fig. 1 Here you can see the "door-bell" transformer with its rectifier temporarily bread-boarded beside it. Beneath the transformer is the Cutler-Hammer emergency transfer relay.



Big Time Nuisances

The problem of all the DJ's friends spending all evening and all night playing big-time DJ in our production rooms (and using the turntables for merry-go-rounds when tiring of the DJ bit) was nicely taken care of by installing electric door latches (like an apartment house front door) on the doors of both production studios.

The pushbutton to unlatch the door is installed right beside the door on the outside of the studio. The door knob is permanently locked from the outside, entrance always being obtained by pushing the button. The door lock is so arranged that the inside knob cannot be locked but the outside knob can only be turned with a key.

The power for the electric door latches is controlled by an electric

clock timer of the sort used for store window lights and outdoor advertising displays, and it allows the production studios to be used from about 3 am until 6 pm, weekdays only. This clock also cuts off the power to the control console, tape, and cart machines so that even forcing the door produces no dividends. We have had no problems scheduling all of our production work during regular hours though a one-hour over-ride timer could be placed in the station manager's or program director's office if desired.

The Smoke Test

This still leaves us with the problem of what happens when a big puff of smoke comes from the main control console about 11 o'clock some Saturday night and the chief is gone off to Nowheresville to visit relatives or something (and sooner or later it will happen!)? We have installed a relay that will restore power to the production room (which is a duplicate of our main "Air" studio) whenever the operator turns off the power to the main console (which he should do when it blows up in his face — or simply falls over dead). In the event of problems, we lose only a minute while the operator turns off the switch and walks next door. We avoid all sorts of nocturnal creatures playing around in the evenings while still having the use of Studio "B" in an emergency.

The Station Timer

Power for the production rooms, Studios "B" & "C", is fed through a 7-day time switch clock. We used a TORK model W200 which has a dial that revolves once a week. Small movable blocks, located along the outside edge of the dial, turn the switch off and on as they pass a fixed trip.

We've found that it is difficult to get close settings because only a hair's

movement will change the setting 15 or 20 minutes.

From the clock, power is fed through separate isolation or "cut-off" switches for each studio to the floor outlets in the studio. These switches are nice if you wish to "kill" a studio for a little while while working on it. Power switched by the clock is also fed to the doorbell transformer that supplies power for the door latches. A rectifier diode and a capacitor give us DC on the latches so that we do not get that infernal humming when the button is pushed. We use lighted doorbell buttons for each door which give us an indication that things are turned on.

The Emergency Over-ride Relay has a 120 Volt AC coil and is operated by power fed back from the console in our regular "Air" studio, Studio "A". Any failure of power to studio "A" or turning off the board in studio "A" will take the power off of the Emergency Over-ride Relay, allowing it to restore to normal and close through the circuit to studios "B" and "C" around the time-clock.

Our production studios are then restored to use so that there is no significant loss of air time. Also, the emergency restoral does not take any special actions on the part of the DJ... which might be too much to expect under emergency conditions.

Machine Alarm System

Even when the studios are not open for use little things like cart machines disappear. Some form of "bug" was needed. Regular two-conductor "phone" jacks were installed on the Ampex and each of the cart machines (some cart machines have an extra output jack which can be isolated) and insulated from chassis. The "tip" and "sleeve" contacts were shorted together (it might be easier to use three-circuit jacks, shorting "tip" and "ring" and letting the "sleeve" float - no

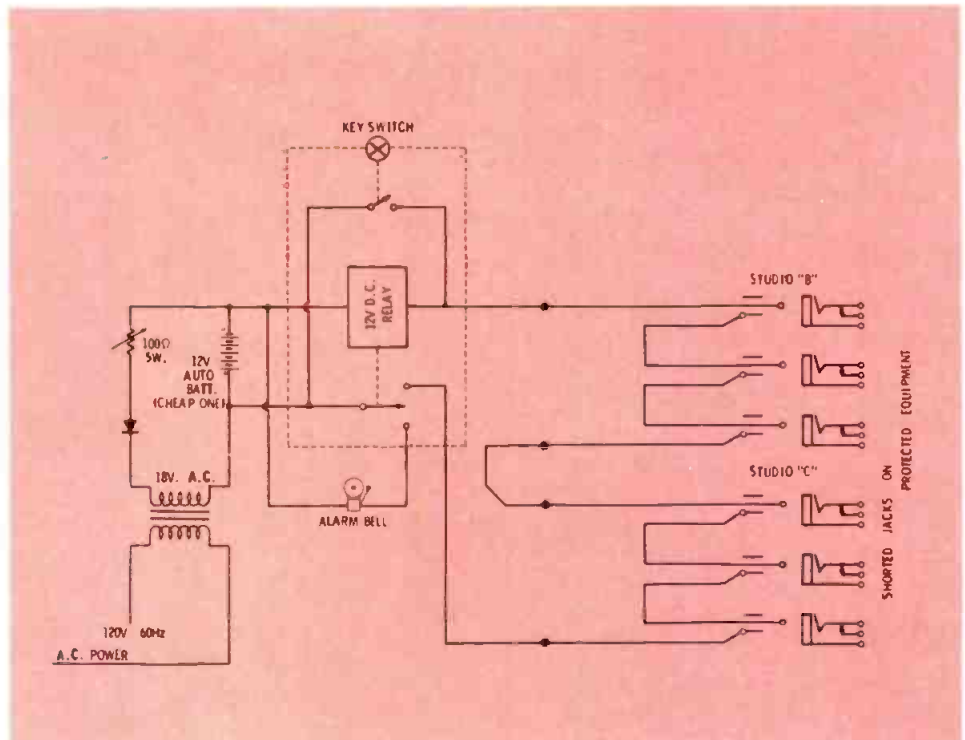


Fig. 2 This is the schematic for a simple equipment protection circuit.

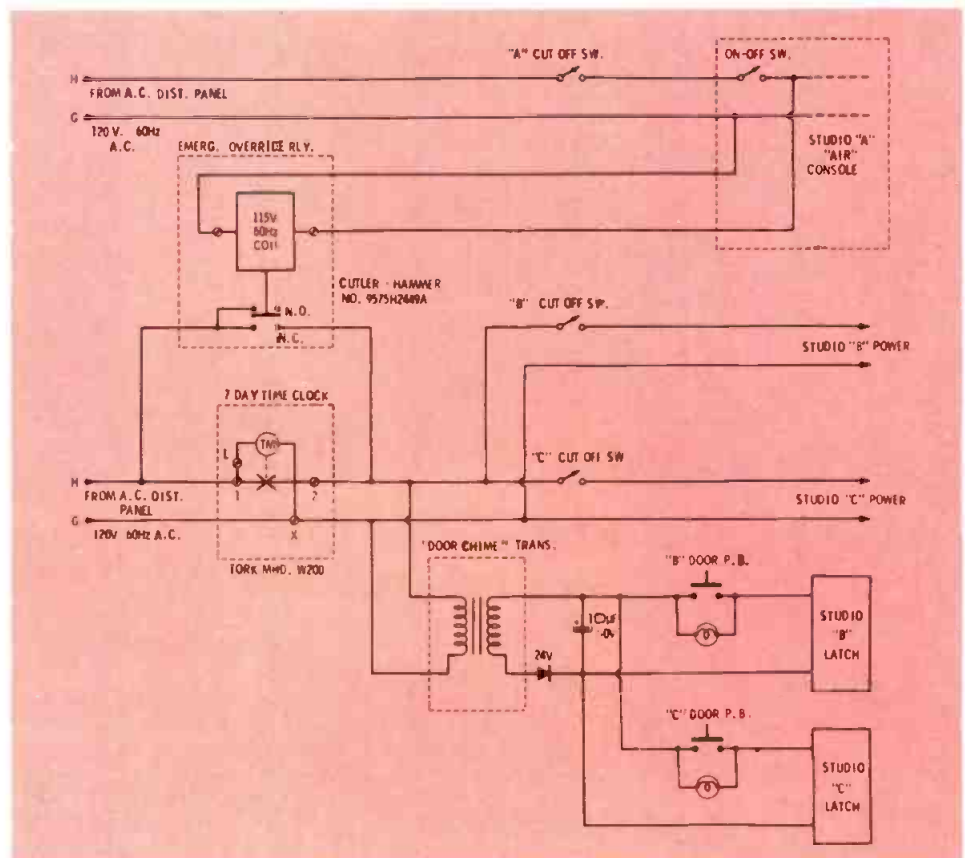


Fig. 3 This is the WINN time control studio alarm system.

problems then insulating from chassis).

A circuit was extended from the coil of a normally closed relay to a plug for each protected machine, all of the plugs being connected in series. Any time the wire is cut or the alarm plug removed from one of the protected machines the circuit is opened, allowing the relay to "drop out" and sound the alarm.

The holding circuit for the alarm relay loops through the normally open contacts of the alarm relay so that when the relay falls out the alarm will continue to sound until it is restored by the CE or management. We used a key switch but you could put the relay in a locked box along with its cutout switch. Quickly reinserting the alarm plug will not quiet the alarm.

All concerned know that any monkey business will result in something that cannot be covered up, a very powerful deterrent in itself. The system is both simple and effective. It could be defeated by someone who knows how the things are bugged and has some engineering knowledge, but this is not the cat we are looking for; and, indeed, it would take A.D.T. to fabricate something that a good engineer could not get around if engineers were larcenous. Our system

has another advantage – it is cheap.

The schematic shows how simple (and thus low in cost) the alarm system is. The power supply consists of a light duty automobile battery with a door-bell transformer and a diode to keep it charged. The diode rectifies the AC from the transformer and the resistor keeps the charging current down to a value that will not burn up the transformer. It need only supply enough current to keep the relay held up plus a few mills to keep the battery happy. It need not supply enough current for the bell, the battery will do that. We can then recharge the battery slowly. If you have doubts, you can invest a dollar in a cheap hydrometer and check the battery from time to time.

We have found that a regular automobile battery is not too expensive (as low as \$11 on sale sometimes) and it will last for years in this sort of service, easily supplying all the current that the alarm will ever need, even during power failures. To make the connections to the battery we just drilled a small hole in the lead terminal posts and used pan-head sheet-metal screws (don't forget to grease them to slow down corrosion).

Transmitter Protection

Our next problem is to protect our transmitter shack. It is in the middle

of a shopping center parking lot, between the legs of a self-supporting shunt fed tower, and surrounded by a high metal fence. The fence is made of metal plates, so anyone climbing over the fence is free to go to work on the transmitter house door without being observed. It is our intention to bug both the fence gate and transmitter shack door and additionally place some trips across the space between the fence and the transmitter house so that anyone walking around the building, inside the fence, will trip an alarm circuit. It is most likely that anyone getting inside the fence will "case the joint" before going to work on the main door, which is secure. And anyone walking around inside the fence, looking for openings in the shack, would likely send an alarm before doing any serious damage.

We are fortunate in having a 50 pair cable from our transmitter to our main studios (in the shopping center at the edge of the parking lot), but the alarm could be made to key the metering circuits of a conventional remote control or to apply reverse battery to them in the hope that the DJ on duty will note something amiss.

There are also alarm telephones available that will dial a preselected number when tripped by an external alarm. Such a device would also be useful for the studios of a part time station.

The device could call station management or the chief engineer. In some localities the police will allow the device to call them directly.

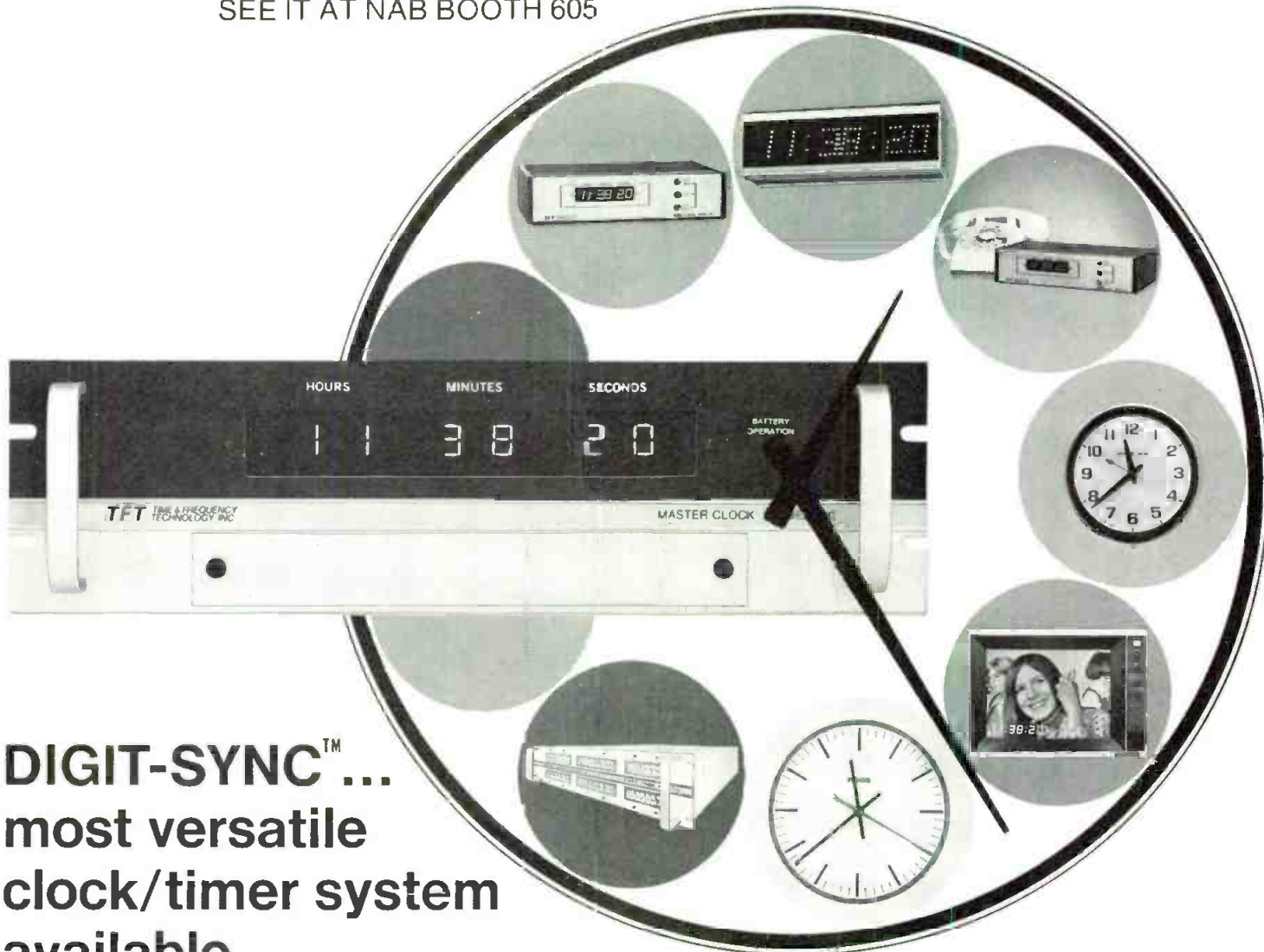
In passing, we might add that "security is having extra pairs between your studio and transmitter". We would highly recommend that anyone placing a cable between his studio and nearby transmitter spring for a little extra copper – well worth the cost.

Fig. 4 The author is shown here entering Studio B. The door is unlatched as soon as the button is pushed. No need to turn the knob... it won't turn anyway!



Management Highlights

Security at your station should cover everything from tapes and records to transmitters. Yes, even transmitters. Trouble is, too many stations overlook the possibility of burglars or vandals until it's too late. This article can help you on the way to a sound security program.



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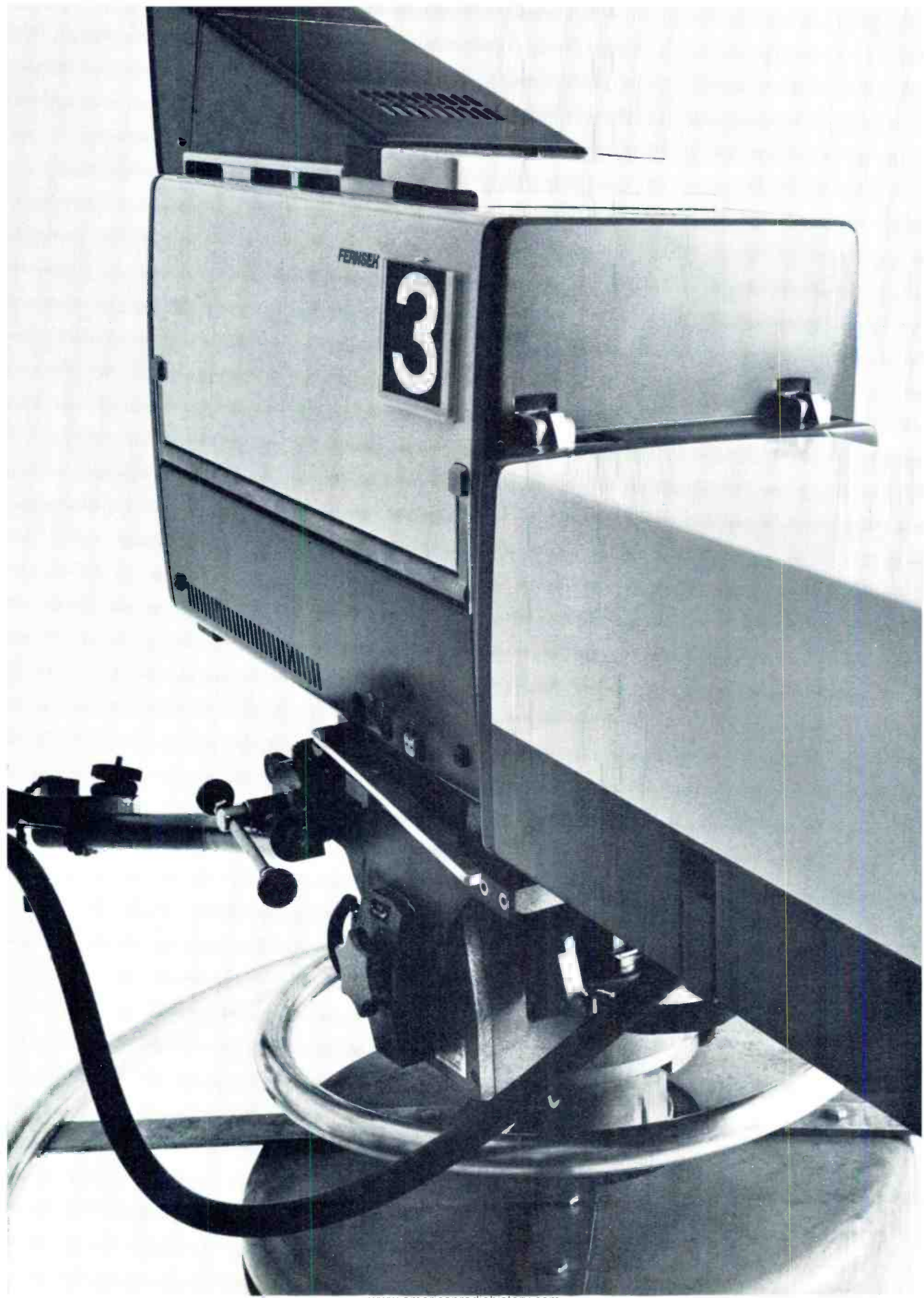
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Update on phase monitors

By Bob Jones*

This is the second part of our series on the FCC's new Rules pertaining to phase monitors. Or as we pointed out last month, the new term is "antenna monitor". This month, let's turn our attention to the FCC's decision in Docekt #18455.

History

In February of 1969, in response to an NAB petition, the FCC issued a Notice of Proposed Rule Making in the matter of Rules to govern the operation by remote control of standard broadcast stations utilizing directional antennas. This looked toward the changing of Section 73.67 of the Rules in two respects.

First, all stations who remotely log phase angles and loop currents must do so at one-half hour intervals¹, provided a type approved monitor is used. And second, stations reading and logging phase monitor indications at the remote control point need only make entries at the transmitter once each day (for any directional pattern). However, no more than 48 hours may elapse between successive readings at the transmitter.

The effect here is to relieve operators of a given station, employing more than one directional radiation pattern, of the necessity of having to take more than one set of readings at the transmitter each day. This is predicated upon the station having installed a type approved monitor and providing phase indications are read and logged at the remote control point.

Comments

Comments were filed by some 26 parties, including radio stations, networks, consulting engineers, individuals, associations, as well as

designers and manufacturers. In general, all parties concurred that the reading of phase indications at a remote control point should be permitted, if a type accepted monitor is utilized. And if such facilities were employed, the present requirements for the reading and logging of various parameters at the transmitter should be relaxed.

Considerable differences were voiced over the length of the time that should be permitted between successive meter readings. Some thought it should be every day, others every other day, and still others up to 52 or 54 hours. This was confused by the original suggested Section 73.67 (a) (6) as to how it was to be treated if only a single pattern were used.

In the case of a directional antenna system with a proven record of stability and where it operates well within the required tolerance, Storer claimed that transmitter checks at weekly intervals would be adequate. Others pointed out that this would be compatible with the weekly maintenance log requirements (Section 73.114 (a) (1) (i)). Some argued that ties with the maintenance log should not be required.

In this same vein ABC said it would be unnecessary to make daily base current readings at the transmitter if loop currents are read at the remote control point. ABC urged that base current readings be

abolished where phase monitor loop sample currents are read remotely. However, the FCC pointed out that a condition precedent to such abolition would be some standardization in the design and placement of the sampling loops and circuits. This necessity for the proper use of sampling circuits to permit the logging of loop currents, in lieu of base currents, is now being investigated by the FCC in their Docket #19692. Comments on these latest proceedings in the general field of antenna monitors follows later.

One of the big problems commented upon by ABC was in the field of satisfactory telemetry of phase and loop readings to the remote control point. Serious errors may be experienced over remote control systems using telephone lines and direct current metering. Those using tone telemetry have found it minimizes errors. The real problem with DC systems comes from the fact that induced potentials in the telephone metering lines can mask the extremely low voltages corresponding to small phase differences.

Some parties even urged that limit alarms be required for phase and loop current indications, as a way to reduce the frequency with which these indications are observed and logged.

Discussion

If facilities are provided at the

Management Highlights

The author gives perspective into the subject by reviewing dockets and comments. But most important, he tells you how you are likely to be affected in your everyday operation by the new rules.

*BE Facilities Editor and Broadcast Consulting Engineer, LaGrange, Ill.

remote control point for monitoring phases and current ratios, then there is available to the operator at that point essentially all of the information concerning the functioning of the directional array, which he would have had if he were stationed at the transmitter. This assumes that adequate telemetry is employed, and the indicating instruments at the remote control point are maintained in accurate calibration and have accuracy and reliability comparable to the indications observed at the transmitter.

In the past the FCC has never prescribed more than the barest of requirements for remote control systems. They rely on the judgment and diligence of each station to insure that its remote indicating and control facilities are fully adequate. Because of this, the FCC could not find that just the ability to be able to remotely read phase

angles justifies a reduction in the number of times per week the readings at the transmitter should be taken to just once per week.

Station Relief

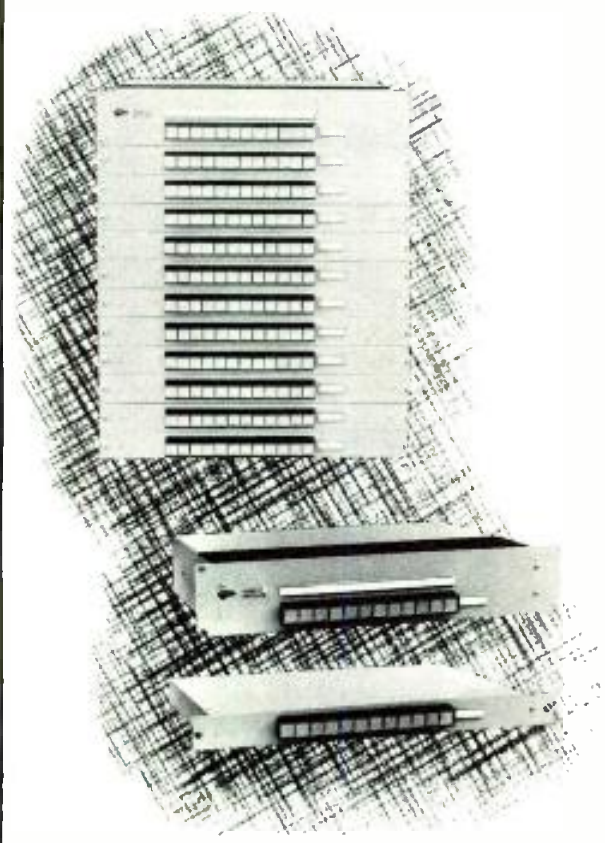
The FCC did recognize that when phase angles are read at that remote control point, it would be feasible to reduce the frequency of transmitter readings for each mode of directional operation for a station utilizing more than one directional pattern. Thus in order not to impose some new hardship on licensees in scheduling transmitter visits, a period of time of up to 48 hours would be permitted. They also propose to afford the same relief to a station that operates at all times with the same directional pattern (that is DA-1). This would likewise apply to all of those stations who operate with a non-directional antenna part of the day

and a directional antenna the rest of the time. Thus the new Rule is to require readings every second day at the transmitter, with no more than 54 hours elapsing between successive readings for each pattern. This means that the actual base currents would have to be read just every other day also.

In the past there has always been a question about how short a period of time one could operate a directional antenna by remote control, before having to visit the transmitter and take the readings. This has been of special interest to those stations using their nighttime directional for PSA hours. The FCC has decided that it will not require readings at the transmitter for any period of operation in any directional mode of less than one hours duration.

The former Section 73.67 (A) (5) required "indications of remote

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base current meters shall be read and entered in the operating log." The general policy has been to permit station licensees to read sample currents in lieu of base currents. However, under such circumstances the samples for the remote point were not "provided by the phase monitor", but were generally extracted from the sample lines feeding the phase monitor. These were done in such a manner as to cause the accuracy of indication not to affect the indications read on the phase monitor. The reason most operators resorted to this practice was that the majority of the older phase monitors do not include provision for remote current indications.

The FCC wishes to discourage any attempts to alter a phase monitor to provide this capability. The reason for this is on the theory that its performance might be adversely affected by such alteration. There, of course, has been no prohibition against such practice by station operators, since in the past phase monitors were never "type accepted."

Modern phase monitors, particularly of the type that will be eligible for FCC approval, incorporate outputs suitable for remote current indication. By requiring all licensees to change to such monitors, the Commission feels they will offer a more convenient, less cumbersome, and probably more accurate means for providing current indications to a remote control point than methods requiring the extraction of currents for remote indication from sampling lines intended primarily to provide input currents for the phase monitor.

Required Readings

This raises some confusion as to just what readings are required to be logged....especially in the interim until all stations operating by remote control have type accepted antenna monitors.

With the amended rules, the licensee is given the option of reading and logging at the remote control point either (1) remote base currents indications, (2) indications of currents extracted from phase monitor sampling lines, or (3) if he has a type approved monitor, current indications provided by the monitor. This means that where tower current indications are presently being provided to a remote control point by acceptable means, and are read and logged at the remote control point, this practice may be continued. If, however, the licensee proposes also to read and log phase relationships, a type approved instrument will be necessary. **What this means, in other words, is that if you propose to not read phase angles remotely at this time, you can continue operating and logging as you are now doing.**

The FCC again emphasizes that they do not prescribe engineering standards for remote control systems. Each licensee who operates by remote control, has the burden of providing a system which will effectively, reliably, and accurately indicate to the operator, at the remote control point, the true operating conditions of the antenna system. Thus each station owner who changes to provide for remote reading of phase angles must make changes in his remote telemetry system as necessary to insure that the phase indications are accurately reproduced at its remote control point.

Calibration

Section 73.114 of the Rules has been changed in respect to the intervals at which recalibration of remote meters must be made. The maintenance log must now show that the calibration of the phase monitor has been checked at least once per week. This calibration involves the checking and readjustment if necessary, of the zero

and 180 degree points of the phase indicating meter. The FCC points out that calibration at weekly intervals is expected to be sufficient to maintain the required degree of repeatability. The FCC points out that all other indicating instruments are also to be calibrated, on a weekly basis, at the remote control point. This of course has been the practice generally followed by licensees, and generally conforms to the requirements of Section 73.39, regarding the calibration of remote reading instruments.

Logging

In the area of logging, some variations have existed in the past as to the interval between successive entries of parameters in the operating log at the remote control point. The former official position has always been to require the intervals as specified in the current instrument of authorization. Sometimes stations had to take readings at one-half hour and others at one-hour intervals. The FCC points out that amendment of Section 73.113 will take precedence over the schedules specified in each station's current instrument of authorization. They further point out that as each station's license is renewed, these logging schedules will be deleted from their license. Thus all stations, whether they operate by remote control or not, will be required only to observe and log phase angles, base currents, etc., once each three-hour interval, and to enter these parameters in the operating log.

Who Will Read It?

There is still the question of what class operators can or can not log these values, particularly with all the changes the FCC has been adopting in Docket #18930. As has previously been reported in BE, the Rules were relaxed so that other than first class operators under certain circumstances may be utilized for routine transmitter duty at stations having directional antennas. Since the duty operator is normally responsible for the entries required in the operating log, an amendment of 73.93, without a corrective amendment of 73.113 would have created a situation

where these lesser grade operators would have been permitted or required to make the periodic observations at the transmitter, and record them in the maintenance log. The FCC of course did not mean for this to occur. First class radiotelephone operators are the ones which must perform this function and those required to make maintenance log entries.

The FCC points out that the only permanent solution to this confusion over the grade of operator, is to require that all observations at the transmitter, attendant to remote control operation, be entered in the maintenance log. Not in the operating log. Thus the FCC has made it explicit that entries in the maintenance log, and the observations or maintenance procedures which they reflect, are the sole province of the first class radiotelephone operator. Thus the general schedule for the readings of base currents in the elements of a directional antenna must be read by the first class operator and entered in the maintenance log. By now requiring these readings of base currents in the maintenance logs, this obviates the necessity of including their schedule in each station's authorization. The FCC has of course already reduced, as part of its re-regulation, the observations from daily to 5 times per week, for each pattern at locally controlled DA's; at 54 hour intervals when a type approved phase monitor is employed; and daily with a non-type approved monitor. The only additional burden placed on licensees, is that involved in meeting the specific requirements that deviations of the ratios of the observed currents from licensed values be computed and recorded. These new figures will also be logged in the maintenance log. This will prove more convenient than entering them in the operating log. And since both logs will henceforth be required at license renewal time; this will give the FCC a complete picture of the technical operation of the station, in reply to Section II of FCC Form 303.

The final comment expressed by the FCC in Docket #18455 was with regard to the term phase monitor. It is noted that the early Western

Electric, RCA and Andrew Monitors were truly "phase" monitors. That is they monitored only phase, not RF currents. However, most monitors now include facilities for indicating the relative amplitudes of the RF signals applied to their input terminals, in addition to reading phases. Henceforth the instruments designed to monitor both relative phases and amplitudes of the currents in the elements of a directional array will be referred to as an "antenna monitor."

Section 73.113

The Rules for operating logs has been amended to include the following entries under (A) (iv) (a) the total plate voltage and total plate current of the last radio stage; (b) the frequency monitor reading; (c) the antenna current or remote antenna current; or the common point current or remote common point current; (2) for stations not operating by remote control but using directional antennas, they shall log in addition to the above, at intervals not exceeding three hours in duration (i) phase indications (ii) remote antenna base currents or antenna monitor sample current or current ratio indications; (3) for stations with directional antennas and operating by remote control, the following indications in addition to those specified in (a, b, c) (i) either remote indications of base currents; or currents extracted from antenna monitor sampling lines, or current indications or their ratios provided by a type approved antenna monitor, (ii) phase indications, if provided by a type approved antenna monitor.

Section 73.114

This part of the Rules was amended by adding a new paragraph. (A) All entries in the maintenance log specified here under shall be made by the holder of a first class radio-telephone license, and shall reflect the results of maintenance procedures or of observations performed by him. (1) An entry each week of the following shall be made, (v) A notation of the calibration check of the antenna

monitor, (vi) A notation of the calibration check of indicating instruments at each remote control point against the instruments at the transmitter, (A) (2) (vii) (6). If required by the station authorization or Section 73.93 (e) (5), the results of field strength measurements at the monitoring points specified in the station authorization, (8) For stations with directional antennas, in addition to those entries of operating parameters required in the operating log, specific entries shall be made in the maintenance log, based upon observations made without modulation, including the following, (i) common point, (ii) base currents, their ratios, and the deviation of those ratios in percent, from the licensed values, (iii) remote base current or sample current indications, the computed or indicated ratios of those currents, and the deviation of such ratios, in percent, from values specified in the license, (iv) phase indications, and (9) the entries in Subparagraph (8) shall be made pursuant to the following schedule, (i) for stations not operating by remote control, entries shall be made once each day, five days of each week, for each directional pattern, (ii) for stations operated by remote control, where phase indications are not observed at the remote control point, the entries in Subparagraph (8) shall be based on observations made at the transmitter not more than two hours after the time of commencement of each pattern, provided that if operation does not exceed one hour, no observations need be made. If a station utilizes or a station has a single pattern, observations shall be made once each day, with no fewer than 12 hours elapsing between successive observations, and (iii) for stations operating by remote control, where phase indications by an approved antenna monitor is used, the entries specified by Subparagraph (8) shall be made at the transmitter every second day for each pattern, with no more than 54 hours elapsing between successive observations for the same pattern.

Next month I'll relate the latest thinking by the FCC on their new proposed sampling system standards. □

This is a plug-in readout package from Industrial Electronic Engineers, Inc. This unit uses based lamps and has a choice of red, blue, green, gray or amber screen colors.



Numeric readout maintenance

By Pat Finnegan*

*BE Maintenance Editor

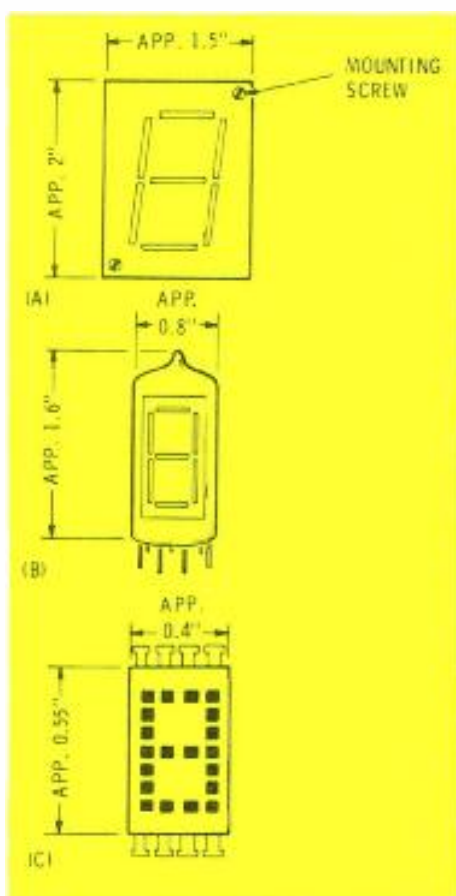


Fig. 1 These are typical seven segment readouts. Model A uses separate lamps to light the seven plastic bars. B is the nixie tube type where each filament lights a number directly. C is a monolithic LED unit. Number bars are not solid, because of the number of light emitting diodes required.

With Digital Logic in control of so many functions, particularly the larger systems, it is both necessary and desirable that readouts are provided that give an indication of the status of events at any particular time in the chain of events. The information is desirable for that instant only, so a permanent record is neither desirable nor wanted. A variety of readouts may be attached to any system, and these may take the form of status lights, alarms, a printed readout, and of course, the numeric readout. This article will concern itself with the numeric variety readout.

Numeric readouts have undergone many changes over the past several years, particularly with the advent of IC's. The development of the LED (light emitting diode) is causing even more changes. Many varieties of both old and new vintages are in use today.

One of the earlier types (newer versions still in use today) used neon as the light source in the readout. Other styles used incandescent lamps. Both of these require relatively high driving power to operate properly. In the neon style, complete numbers (0-9) are aligned front to back, with each number almost transparent. Even though each is almost transparent,

when a number in the rear of the stack is lighted, there is an amount of interference to a clear view of the number because you must look through the other unlighted numbers.

The majority of other type readouts make use of a seven segment display all on the front surface. To display any number 0-9, a number of these segments are lit, each arrangement according to the number itself. In the earlier readouts, each segment was lighted by a separate incandescent lamp, the bar made of plastic tubing conducting the light from the lamp at the rear to the front display surface.

New incandescent versions, such as the RCA model, have seven filaments on a black mounting surface, all mounted within a vacuum tube envelope (miniature tube) and it plugs into a tube socket as does a tube. This readout requires much less driving power than do those with individual lamps.

The development of LED's is causing a mini-revolution in the field of readouts. They are presently available in several configurations, from very small to relatively large units. The very small ones are built right into the driving IC's case



Fig. 2 Typical encoder, decimal to BCD. A decoder is exactly opposite. To encode a decimal 3 to BCD, the input line turns on from some source. The BCD output lines 2 and 1 turn on, which is 3 encoded into BCD.

The Signal

Both for economy of space and the cost of using fewer components, the logic signal is often encoded into BCD (binary coded decimal), for transmission through the system. When the logic information is to be put to use, it is decoded back into decimal (0-9) functions. All logic signals are not encoded only those that relate to numbers of events, or time functions, etc. Those which the system uses to keep track of where it is and what information should be fed out next.

The encoding process does save both space and components. While several BCD codes are possible, a common one is 8-4-2-1. Routing the numbers 0-9 directly would require 10 paths and the accompanying components, while encoded information requires only four paths and accompanying components.

Encoders and Decoders

A number to be transmitted, for example #3, is fed to an encoder. The encoder is a device (in one IC package) that has 10 input lines (an input for each number, 0-9), but only four output lines. Our #3 comes into the encoder on the #3 input line. Two output lines go high, the BCD lines #1 and #2. The decoding process is the opposite of

the encoding. The decoder accepts 4 BCD input lines, but has 10 output lines (one for each number 0-9). As our BCD input lines go high at the decoder, the #3 output line goes high.

Drivers

On the older readouts, because of the power requirements, the decoded information operated transistor drive stages to supply the power to light the lamps. The transistor would now light the lamp #3 in the neon readout. But in a seven segment readout, further processing is necessary. This is due to the fact that we are using a combination of bars to make up the number displayed. In the case of our #3, it requires five of the bars. The high #3 line out of the decoder must have further processing, so it is fed to a seven segment driver. It may also accept BCD directly and decode into seven segment. In any case, this driver operates the outputs for the appropriate segments that will display the number, but if driving power is required, each of these will operate a transistor that will supply the power to the lamps. If all this appears to be considerable effort to produce a simple number readout, it is. The newer readouts require less power, the

transistors are eliminated, and the LED's can be built right into the same case as the driver IC.

Troubleshooting

As described earlier, a number of events take place before a number will be displayed in the window. There are several possibilities for failures along the way and the results can take several forms. Signal tracing coupled with a little reasoning will soon isolate the problem.

Consider the case where a seven segment readout with individual lamps are in use. None of the readouts light up. There are usually more than one readout side by side. There can be three probable causes for this: the entire system is off, the power supply for the lamps is off, all the lamps are burned out (highly unlikely). Since these lamps operate at a higher voltage than the IC's, they have a separate power supply.

If one or more bars is out in the individual readout, this has several possible causes, so signal tracing back down the line is indicated. It is probably the lamp for that bar, or the transistor driving that lamp, or it may be the IC not decoding correctly. Signal tracing will soon isolate the fault. It could be in the cabling from the PC Board to the readout itself. If signal is leaving the board, the board is OK. If it is arriving at the readout, the lamp is burned out.

Substitution is often a quick method of isolating the problem from the readout itself. To do this, however, the readout must be one that is easily changed, such as those in a tube envelope or a plug in socket. If the readout has one or all the segments out when they should be lit, simply unplug the old one and try a new one. Since there are solid state circuits driving the readout, caution must be used and preferably with the power off. Plugging and unplugging components with the power on in solid state circuits can cause transients that can be deadly to some solid state components.

If the readout in question is one of the smaller units that is part of the IC driver, the whole device

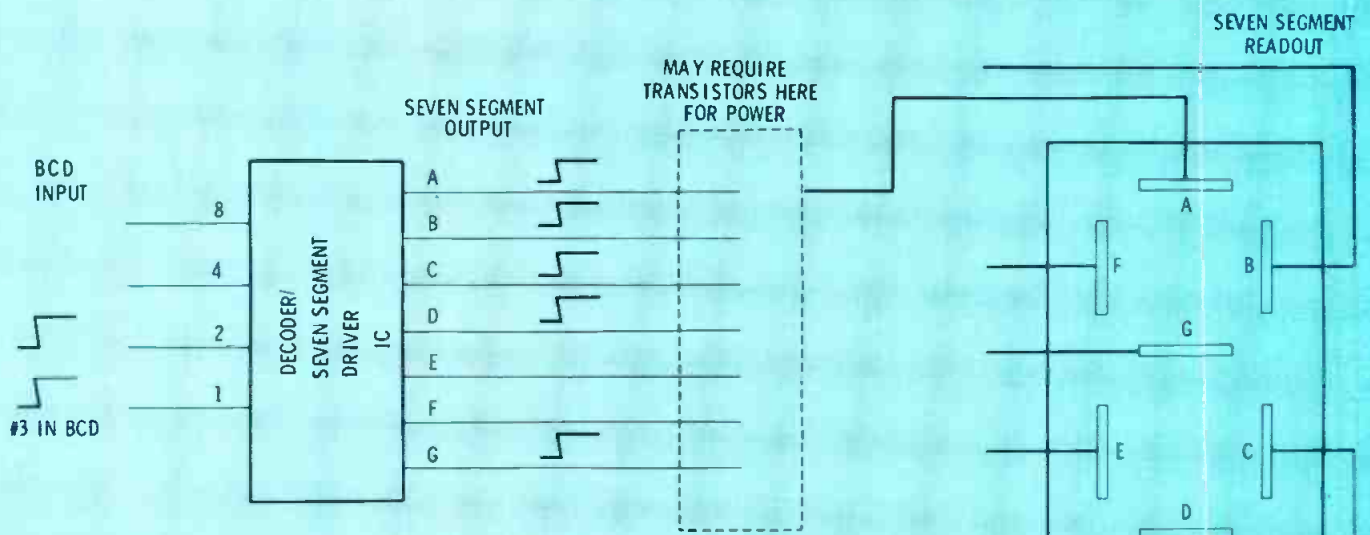


Fig. 3 In this typical arrangement, a decoder/seven digit segment driver IC is operating the seven bars of the readout. If the readout requires more power than the IC can deliver, a transistor is added in each line. As an encoded 3 comes into the decoder, the output lines a, b, c, d, and g go high. These light those bars in the readout. In this case, it requires five of the seven segments.

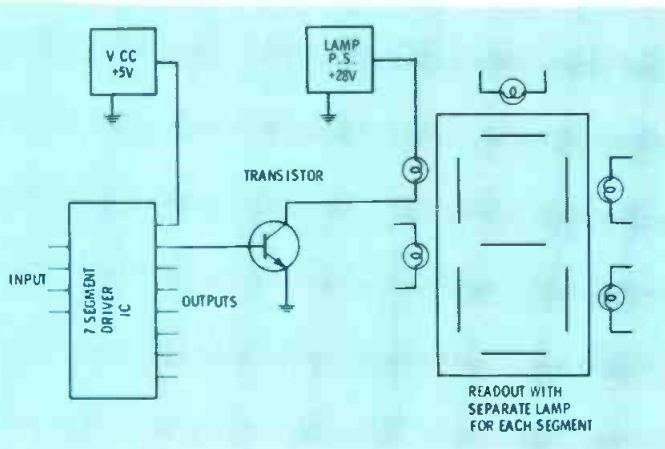


Fig. 4 Readouts that use separate lamps require a different power supply for the lamps than the IC power supply. A transistor is used in each line to turn on the lamp.

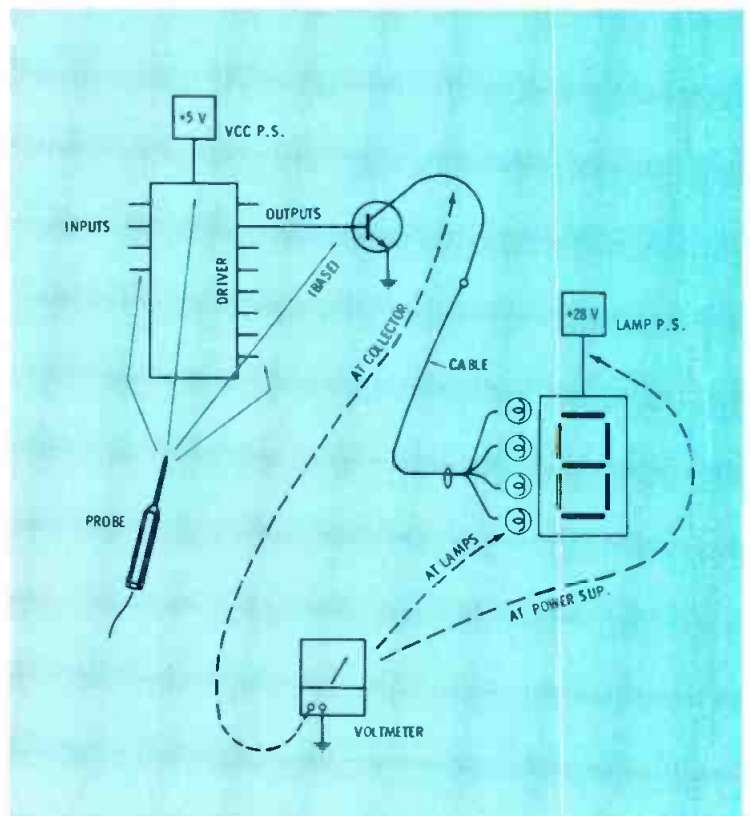


Fig. 5 Troubleshoot the readout as a subsystem. Use signal tracing. The probe can be used at the input to the driver, the output of the driver and the IC power supply and the base of the transistor. Use a voltmeter at the collector of the transistor, at the lamps, and at the power supply. If the readout is driven directly from the IC, you can use the probe for all checks.

must be replaced if any of it is at fault. The monolithic unit contains the decoder, driver, and seven segment readout as one package. Check the BCD information to the unit. If the BCD is correct, but the readout is not working, then replace the whole unit. To check the BCD, assume #5 should be displayed, but it is not. Check the input lines to the decoder of the monolithic readout. Both the BCD

4 and 1 should be reading high and with proper amplitude. If this signal is there, the unit must be replaced as no repair is possible.

Signal tracing the readout is no different than signal tracing a larger system. Consider the point where the signal is sampled and on through the readout as a subsystem. The older readouts have larger power requirements, more separated elements, so there is

more check points along the way, and more possibilities for repairs. Individual lamps and components can be replaced. The monolithic units have very few check points and the only repair is replacement of the entire unit.

Replacement

Replacement of the readout or any of its components will depend upon the equipment in use. Some

are more difficult to expose than others, let alone replace. And this is the first step—figuring out how to get the readout exposed. Some are simple arrangements. One equipment item, for example, uses the new RCA plug in readouts, and replacement is very simple. It is first necessary to remove a few knobs from the front panel. Then, the panel can be popped off without disturbing the chassis itself. It is a simple matter then to unplug the defective readout and plug in a new one. Restore the front panel, the knobs, and the job is done.

The seven segment readout that uses seven individual lamps, is another simple one—providing you can figure out how to get to the back of the readout. This will depend upon the arrangement of the equipment itself. In many cases, the whole readout panel can be detached from the main body of the unit with a couple screws, while in other cases it is far from simple.

Once the back of the readout is exposed, you will find a cable attached and four corner screws. Only two of the screws at diagonal corners are the ones to remove. Don't take the cable loose, and leave the other screws alone as these mount the readout itself to the equipment. The back will come off attached to the cable. You will now find the lamps accessible, and you will be looking at the bottom of the base of the miniature lamps.

The lamps are inserted into the readout much like cartridges in a pistol. Pull out the dead ones and replace with new ones. If the readout is on a sensitive unit, such as automation programmer, you may find it undesirable to do this operation too often. So, replace all seven of the lamps at the same time, even those that are still working.

Readouts making use of LED's are beginning to proliferate. LED's can be built into the driver IC, or they can be larger individual units.

If it is a small monolithic unit and this is mounted in a socket, it is simply a matter of unplugging the defective one and replacing with a new one. If the unit is soldered to the PC Board, however, that's going to take more work. You must be able to get the board out to work on it. It is not much different than replacing any other IC.

LED's can also be larger, separate units, similar to the miniature incandescent lamps. Some of these have solder leads, but some do have a miniature lamp base and similar envelope.

Before making replacements, it is wise to study the mechanical and physical layout of the readout your equipment is using. You want to get the unit apart but you don't want to damage other things at the same time. Making the first replacement will be the most difficult. When that has been done successfully, you will be an "old hand" and others will be easier. □

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For More Details Circle (27) on Reply Card

The sensuous test pattern

By Joseph Roizen*

No dyed-in-the-wool television engineer can ever resist the siren song of a television test pattern, calling out to fondle the knobs of the receiver and assess the performance of the television system being scrutinized.

There is an uplifting joy to setting the fine tune at the crispest picture point, a hairsbreadth away from dropping off the end of the allocated RF channel and losing everything. Then, a little clever tracking and trimming of the brightness and contrast controls sets up the pattern for a lieisurely and soul-satisfying evaluation.

Sight—that precious sense—is nurtured by the symmetry of linear circles and squares, visual acuity is satisfied by converging wedges of horizontal and vertical resolution, reason looks for a progressive gray scale and logic deduces the intrinsic deficiencies from the miniscule evidence of small element ringing and low frequency bar smear. Add to this the Lorelei of a clear 1000 cycle tone and the overall effect can be a severe case of “picture tube passion.”

The purist will roll the vertical

*Consulting Engineer. Telegen, Mountain View, Calif.

Management Highlights

It's always interesting to see what the other fellow is doing. Pure curiosity is all you need to follow Joe Roizen through his dizzy collection and reflections on how green the grass is on the other side.

and check for the presence or absence of VITS and the cynic will drive up the contrast and listen for intercarrier buzz in the audio. But, whatever the inclination, the true engineer will leave the set walking a little taller, smug in the knowledge that one has met the interpretive challenge. Test patterns are not just technical—they are sensual as well.

Test Pattern Design: To Each His Own

About as fast as someone designs a new product or service, someone else comes up with a measuring system to define and calibrate it. The calibration syndrome is so entrenched in our way of thinking that almost no human activity escapes the caliper or the stop watch. Television is no exception, and the lengths to which television engineers have gone to micro-measure the performance characteristics of TV chains are sometimes unbelievable. The degrees of differential phase, percent of differential gain and nano seconds of delay have become as common in our television vocabulary as those simpler terms of gray scale, resolution and frequency response.

Units of measurement in scientific notation are universal. Microseconds and millivolts in Moscow are the same as in Manhattan. Centimeters are alike in Tokyo and Toledo. All this would lead one to believe that test patterns for television would have a universal uniformity consistent with the tasks they are called upon to perform. But this would have been too easy.

Television engineers, being human, had to find a way to express their differences even within the demands of uniformity imposed by the system needs. The result is a proliferation of patterns patently proclaiming the patriotic position of

the purveyor. An examination of the test patterns used in various countries around the world only confirms that the NIH* factor is alive and well and flourishing almost everywhere.

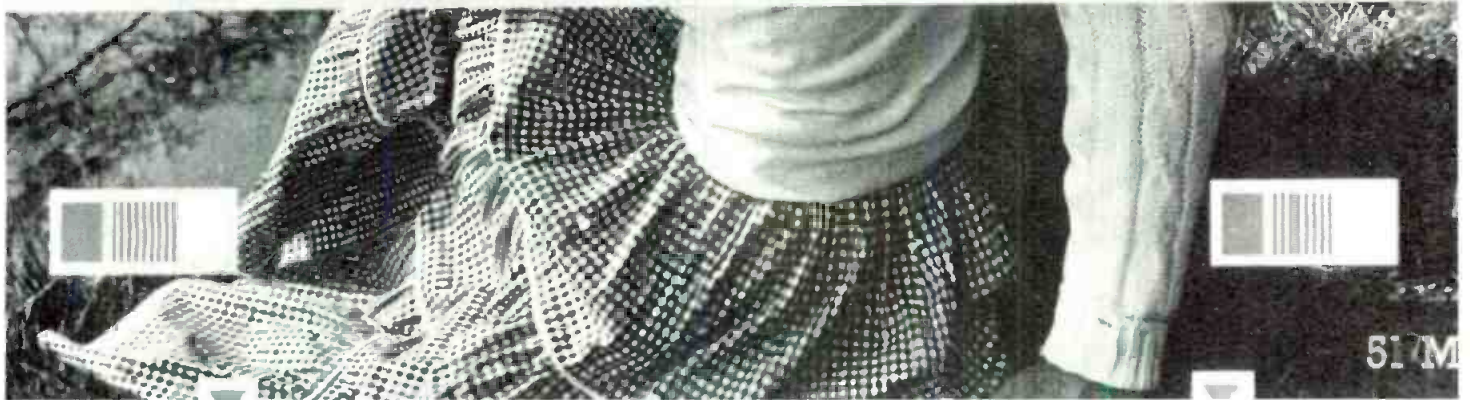
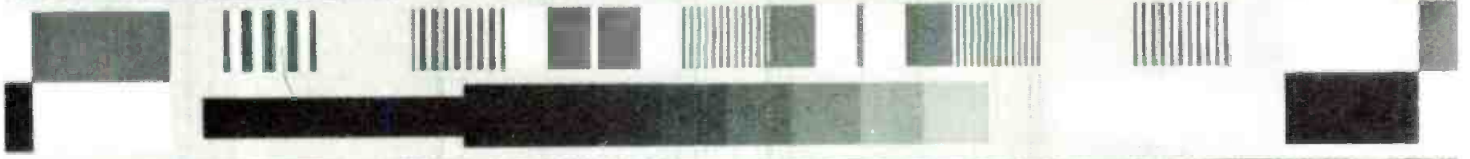
First off, test charts do not have the same importance or social status all over. In the land of the brave and the free, our free television with its round-the-clock programming, requires some early-bird bravery to catch a glimpse of this vanishing image. Gone are the days when the whole morning was devoted to an Indian head Monoscope and a steady tone that all the television service shops worshipped. Which brings up that eternal mystery of why the Redskin was there in the first place—a query to which no positive answer has yet been given.

Over The Rainbow

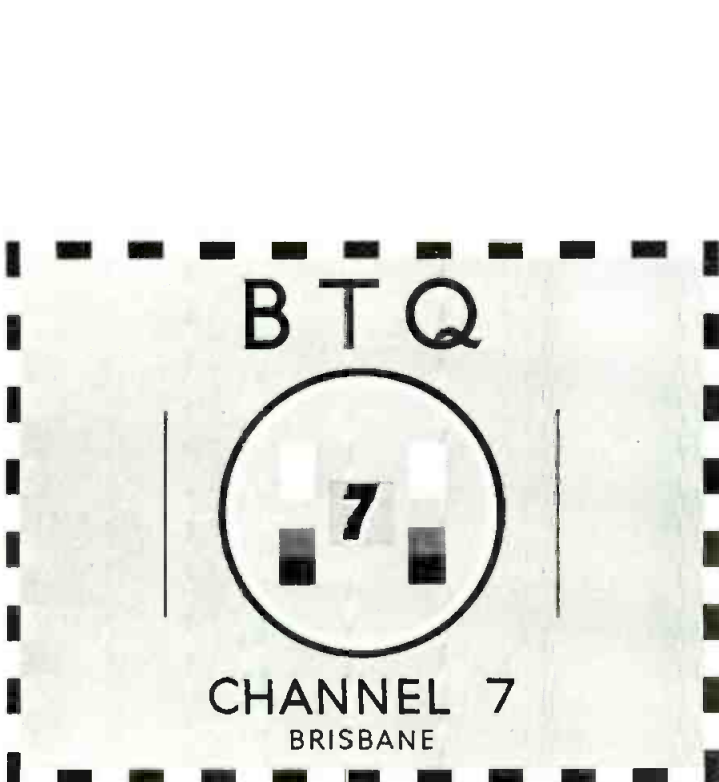
The modern RETMA chart (circa 1956) is a good example of thorough and logic design. Ten steps of gray scale in four directions, corner resolution wedges, high definition center wedges and distinct low frequency bars. Even the APL is reasonable, something that can't be said about the old Monoscope. With this kind of base to start from, one would almost expect that this pattern would surface in a few other countries who should be able to find better things to do than re-invent the wheel.

The English, who gave us inches and pounds and the length between Henry VIII's nose and forefinger (the yard), didn't accept our RETMA chart and came up with a few of their own, the Marconi chart being a good example of the British way of testing television. A little less gray scale (only five steps) but more on linearity in the form of

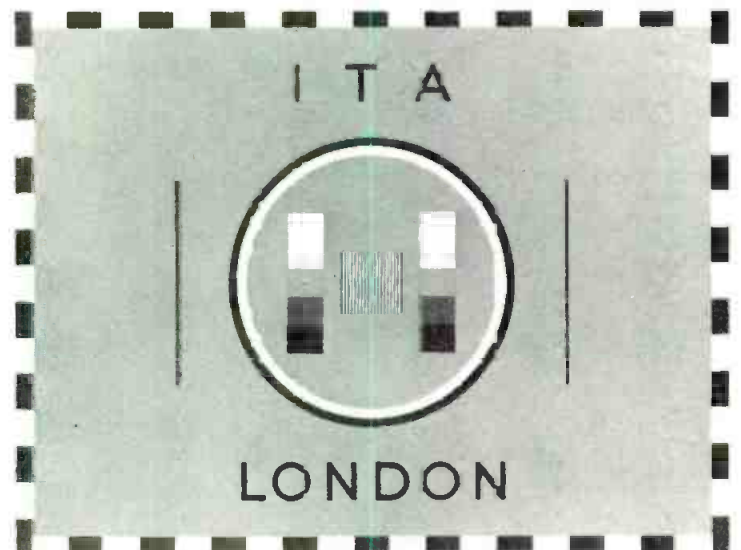
*Not Invented Here



This pattern from the BBC is deceptive. The longer you look at it, the more meaningful it is.



From down under, here's one from channel 7 in Brisbane, Australia.



ITA, London. How about this version for simplicity?



This version comes via Malaysia.



A woman riding a horse? We're not sure what that's supposed to test. But you got to admit this one is loaded with potential tests.

background squares. Englishmen believe in regularity and fair play. Give the system a chance to show what it can really do, especially the 800 line resolution block in the middle.

The Italians obviously don't want to be confronted with too stringent a set of tests and so the pattern is somewhat simpler. Corner resolution isn't calibrated beyond 350, and there is only a small gray scale bar that might be overlooked. One could get the impression that Italians concentrate on what's going on in the middle and let the corners fall where they may.

The German Fernseh Test is an example of Teutonic thoroughness, first it is electronically generated. That eliminates optical errors and camera problems. There are no distracting frills to this pattern, regular squares, a perfect circle, a stairstep and low- and high-frequency bars. Their system had better pass the 5MHz multiburst, or else!

Then, there are the French, with the "vive la difference" syndrome. This pattern has a Gallic logic that defies full understanding. The 900 line resolution wedges must go with the 819 line rate and 10.4 MHz bandwidth of their national monochrome standard. But, why in is the woman on a horse blowing a bugle in the middle of the chart? Only a Frenchman could probably



Here's an original from an unexpected source.

explain that.

A Little Spice, Thanks

The variety of patterns seems endless, but each reflects the human desire to be a little different, even with the constraints of certain necessities: Malaysias carries the national symbol in the center circle. Algeria, a Franco-phone country emulates the ORTF but adds scenes of local character to identify themselves. The Japanese patterns resemble the CBS test chart with a few added wrinkles.

Western and Japanese characters and a gray scale made out of a mountain scene, to mention a few. The ITA in London and its counterpart down under seem to have concentrated on just a few test chart parameters, while another Australian station has still a different arrangement.

My own favorite is a test card used by the BBC, which combines technical information with the pleasing pictorial scene of a young couple in a sylvan glade with their trusty punt in the background. King Henry would have liked that. □

Phase Lock Applications

The complete story of the phase-locked loop is told in a free 76-page paperback entitled **Signetics Linear—Phase-Locked Loops Applications Book**, recently published by Signetics Corporation, a subsidiary of Corning Glass Works. The book is a companion to the larger **Linear Specifications Handbook** which is also available, although it must be requested separately, according to Jack

Mattis, manager of consumer product marketing in the company's linear department.

Phase-locked loops are a new class of monolithic integrated circuits developed by the Signetics research and development department in 1969 and marketed by the firm during the following year. They are based on frequency feedback technology which dates back 40 years. A phase-locked loop is basically an electronic servo loop consisting of a phase detector, a low pass filter, and a voltage controlled oscillator. The controlled oscillator phase enables the PLL to lock or synchronize with an incoming signal.

In addition to the dash of history given in the book's introduction, other sections provide a short glossary and descriptions of the phase-locked loop principle and PLL "building blocks". Major

sections include explanations of general loop setup and tradeoffs, PLL measurement techniques, monolithic phase-locked loops, expanding loop capability, and specific applications.

A number of construction projects are suggested as a means of proving the feasibility of using the phase-locked loop circuit in specific applications. The book provides information on constructing an FM IF amplifier and demodulator with a muting gate, an FM demodulator, a phase-locked AM receiver, an IF stage with AGC and AM/FM detection, a translation loop for precise FM IF generation for TV, a phase-locked FSK demodulator, an analog light-coupled isolator, and many others.

Maze Corporation Continues Growth

Six years ago the Maze Corporation of Birmingham, Alabama opened its doors for business as an independent supplier of new and used broadcast equipment, as well as professional recording equipment.

Since growth has never stopped, the company is now moving into a greatly enlarged new facility. In June, as a way of saying "thanks" to the industry, Rick Maze has arranged a number of professional seminars to coincide with their grand opening.

Among those presenting seminars are Norm Schneider, JBL sales engineer, Robert Miller of Phillips/AKG, Joe Wells of RCA Records, and Wally Heider of Wally Heider Recording in Hollywood.

SMPTE Seminar

The 15th annual Seminar, sponsored by Motion Picture Laboratories, Memphis, Tennessee, in conjunction with the Nashville Section, SMPTE (Society of Motion Picture and Television Engineers) will be Saturday, July 21, 1973, at the Memphis State University Center, Memphis, Tennessee.

The Seminar is open to anyone interested in motion pictures.

For more information, write: Frank M. McGeary, President, Motion Picture Laboratories, Inc., Box 1758, Memphis, Tennessee 38101.

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The FCC expects you to know

By Ron Merrell*

*Editor, BE.

If you look over the monthly forfeitures for violations, it's apparent that far too many broadcasters are not constantly aware of either Part 73 rules or their amendments. This certainly is unfortunate, because the lack of this awareness is expensive.

Let's look at the case of a New Mexico station (Report No. 11367) that was ordered to forfeit \$1,000 for a presunrise violation. In this case, the licensee felt he was operating legally. He referred in his initial argument that an FCC telegram was sent in November, 1966. The telegram stated that the FCC had no objection to operation from 5:00 a.m. to sunrise with a power of 250 Watts.

However, the Commission pointed out that the telegram was

to be effective "until resolution of...Docket 14419..." regarding presunrise operation which resulted in amendment of Section 73.97 and the adoption of Section 73.99. This last Section change ended the station's permission to operate prior to local sunrise times specified in the license.

Meanwhile, the licensee also argued that the station had undergone three inspections and no presunrise violations were noted. But the Commission (or, whose face is red now?) negated this point by reminding the licensee that he is still responsible for compliance with the Rules.

Fortunately, the Commission does take a station's financial condition into consideration. This \$1,000 could be quite a bit higher if the station were in a larger market.

Operator's License

The Commission also leveled a \$500 fine against a station in Minnesota for a violation of Section 73.93 (having an improperly licensed operator in charge of the routine operation of the transmitter during a period of about one month back in 1970).

The licensee told the Commission that he had hired the operator back in 1953 and that at that time he held a Third Class license. However, the Commission noted that at the time of inspection, and for six years prior to it, the operator held a Restricted Radio-Telephone Operator's Permit.

Taking A Chance On A Lottery

There are three elements that make up a lottery. Subtract any one, and a lottery no longer exists. These elements are: prize, consideration, and chance. In other words, something is given away (prize), but in order to qualify, you buy

something (consideration). But even buying something to qualify for the prize does not guarantee getting the prize (chance). So chance (winning number or name drawn from a box, etc.) is involved.

With this in mind, let's look at how two stations in Gainesville, Florida got stuck with a \$2,000 lottery violation.

The stations apparently broadcast announcements about the awarding of a savings bond prize for purchasing a car from a particular dealer. According to the Commission, "a prize was offered in the form of a bond, consideration was necessary in that the participants were required to make a purchase, and, since participants received bonds in varying amounts, chance was present".

Both stations requested that the forfeiture be remitted or reduced, stating that they had checked with the advertiser and were told that the announcements did not relate to a lottery. They also cited their past good records.

The Commission replied that they could not be relieved because they checked with the advertiser: the advertiser was an interested party. Usually the FCC distinguishes (when it can) between flagrant, knowing abuse and short-term unknowing oversights. But, in a case like this, how can you be certain? **Broadcast Engineering** does not wish to pass judgement, but we feel that most violations—where substantial fines are levied—the problem could have been foreseen and bypassed. The history of the industry shows most broadcasters are honorable, and that they also serve their communities well. But there are others. And when the innocent fall into traps that those others obviously seek, it can be difficult to distinguish between the two.



And while the Commission says that past good performance does not overshadow a violation, we suspect it does make a difference. Imagine, if you will, how it would look if WLOX, Biloxi, Miss., had taken this kind of ad while it was risking its staff and equipment to stay on the air in order to serve its community when hurricane Camille hit!

But you just cannot escape one very basic fact: **the Commission expects you to know.**

FCC Correspondence

Here's a point that's involved in all dealings with the Commission: **Answer all correspondence with the FCC within the time limits.**

If there is anything that stirs the ire of the Commission it is unanswered correspondence. They want (1) to notify you that there is something amiss, (2) they want to know what you are going to do about it and how you will avoid it in the future, and (3) they want an explanation of the circumstances.

Apparently, many who receive

FCC correspondence feel that they are simply being informed or warned, and that action taken need not be reported. Yet a great many fines follow naturally on the heels of unanswered correspondence. So the problem seems to be that both parties - FCC and the licensee - see the correspondence differently. Make no mistake about it: **The Commission expects you to reply.**

Operating Logs Jammed

A Beaumont, Texas station has been notified of apparent liability for forfeiture of \$1,000 for violations of Section 73.265(b) and Section 73.283(a).

An inspection of the station's operating logs on May 17, 1972, indicated that the station had been operated by improperly licensed operators and had numerous omissions of all entries in the operating logs.

The station's reply to the Commission is well worth remembering, because they expect you to know what you're doing. To avoid

further misunderstandings, the station said that all employees would have their license qualifications checked and confirmed by the station manager, the program director, and the chief engineer prior to beginning work at the station.

The licensee told the Commission that inadvertent operating log omissions had resulted from confusion on the part of board operators and that all board personnel had been instructed once again on the procedures to be followed in making the meter readings.

Exit

As you can see, it pays to stay on top of the Rules and proposed amendments. It would pay **any station** to keep an active file of current Rules and pending Dockets. It may seem like...here comes another time consuming file to update. The alternative is not knowing. And that, combined with unanswered correspondence, is the case upon which most fines are built. □

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Broadcast

Richard M. Galkin has been elected president and chief operating officer of Sterling Communications, Inc., he will continue as president and chief executive officer of Sterling Manhattan Cable Television... **Frederick V. Titus**, formerly a City Planner with the Baltimore, Maryland Planning Department, has joined Malarkey, Taylor and Associates as an urban communications specialist... **Brian D. Garrett** has been appointed Engineering Manager of Continental Apparatus Company's systems equipment plant in Hickory, a division of Superior Continental Corp... Nortronics Company, Inc. has announced the appointment of **Byron R. Benson** as manager for the Norfab division...

Dean A. Bussart has been named general manager of Gulston Industries (Canada) Ltd. and its subsidiary, EV of Canada Ltd... **Frank Gaither**, executive vice president in charge of Cox Broadcasting Corporation's broadcasting division, will retire from the Company on June 30. Upon Gaither's retirement, **James M. Rupp** will become vice president and general manager of the broadcasting division. **Clifford M. Kirtland, Jr.**, has been elected to the Board of Directors of Cox Broadcasting Corp. during the ninth annual meeting of shareholders. Kirtland is executive vice president of CBC...

CCA has announced the appointment of **Charles Hallinan** former President and one of the founders of the Society of Broadcast Engineer's as Regional Area Representative for CCA Electronics for the states of Pennsylvania, New Jersey, Delaware, and Maryland.

Herb Rand has been appointed to the position of Regional Sales Manger for CCA for the area of Virginia, North Carolina and South Carolina... Communications Technology Corp. has announced the appointment of **David O. Coxe** as Regional Representative to handle marketing functions throughout the states of Florida and Georgia...

Ampex Corporation has appointed **Robert G. Schlenzig** as plant manager of its Colorado Springs operations... Clay T. Whitehead, Director of the Office of Telecommunications Policy, announced that **Walter E. Sutter** has been selected as an Assistant Director OTP... Aitech has announced the appointment of **Ernest G. Jagielo** to the newly created position of Purchasing Manager of the company's West Coast Operations... **Silvio Massone** has been appointed Latin American Sales Manager for Berkey Colortran... **Ronald Montgomery** has been selected president and chief executive officer of Collins Radio Company of Canada, Ltd...

Harris Sullivan, a broadcast field engineer with the Radio Corporation of America, has joined WTOP-TV, Washington, as supervisor of engineering... **Gerald A. Nordsiek** has been named Chief Engineer and **James O. Biggers, Jr.**, Assistant Chief Engineer for WJXT Television, Jacksonville... **Charles P. Rogers** has been appointed WRTV Promotion Manager...


CATV


Robert L. McClow is set for the newly created position of Manager-Materials & Logistics for the CATV Equipment & Installation Operation of GTE Sylvania Inc... **Dale Criswell** has joined Cable Information Systems as its Director of Technical Operations ... Television Communications Corp. (TVC) has announced the appointment of **Joan M. Reppa** as manager of system administration. **Jack L. Williams** has been named vice president in charge of programming...

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Barry D. Lemieux has been named director of corporate development for Continental Cablevision of Ohio, Inc...Theta-Com of California announces the appointment of Daniel J. Ryason to the position of Manager of Field Operations of the CATV Division of Theta-Com located in Phoenix, Ariz...Kenneth E. Landis, Jr. has been appointed Manager, CATV System Design, AEL Communications Corp. (AELCC), CATV subsidiary of American Electronic Laboratories, Inc.

bookreview

Computer Circuits Handbook

In this age of computerization, it is helpful to everyone associated with any form of electronics to understand computers and what they can do. **Computer Circuits & How They Work**, written by Byron Wels, explains the inner workings of modern computers—computer circuits and how they work.

The content begins with a discussion of how computers work, including the “language” of computers, then proceeds to explain the principles of the central processor, the memory, control section, registers, instruction decoders, timing circuits, serial and parallel operation, phase counters, adders, counter circuits, input-output sections, etc.

The second section deals with comparators, error detection, and parity checking. Section three provides a comprehensive treatment of memories—the types used and how they function. The author describes the various operating modes and various performance criteria, as well as data storage and retrieval.

Section four is devoted entirely to circuits and applications, actual circuits designed to perform a wide variety of functions. Approximately half the book is devoted to applications and circuits, an important feature for those looking for a collection of practical circuits, and an aid to beginners who want to learn computer circuits.

As a help to understanding, the author breaks the field of computer technology down into specific, smaller areas. Then in step-by-step fashion, he explains how the various parts of a computer work and the terminology associated with each part and function. Understanding how the overall system operates is thereby simplified to the most basic terms.

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

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(Continued on page 52)

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Book Review

(Continued from page 51)

Modern Sound Preproduction

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 re-production 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, theaters and auditoriums in relation to sound reproduction. It describes acoustical measurements which play an important part in the advancement of sound reproduction.

For More Details Circle (66) on Reply Card

Inside Digital Circuits

Digital Logic Theory & Practice, written by Brice Ward, is intended to give the interested amateur an opportunity to do something besides read about digital logic and digital electronics.

The first part of the book is devoted to a theoretical discussion of various types of digital circuitry, from the very simple to the relatively complex. The text is keyed to experiments in the latter part of the book. The majority of the experiments are developed around 7400 series TTL integrated circuit logic to allow you to perform the experiments with a minimum of expense for equipment. A few ICs, some lamps, slide switches, and transistors, plus a 4.5 Volt battery will put you in a position to duplicate most of the simple experiments. A small additional expense will allow the inclusion of a simple breadboarding system.

The Appendix provides complete construction plans for a very versatile logic trainer which can, at current prices, be put together for about \$50.

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

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NEW PRODUCTS

Portable Color VTR

Echo Science Corporation demonstrated two new color, high-band video recorders at the 1973 National Association of Broadcasters Convention. Both the Model 201C record/only portable and the Model 411C recorder/reproducer meet all performance levels of existing quadruplex recorders.

The 201C, including internal rechargeable battery, weighs only 38 pounds. It may be hand carried or back-packed. Its 15"x11.42"x6.42" dimensions are made possible by a unique Echo Science developed transport. This transport was first introduced into military airborne use three years ago and has seen extensive service in extremely severe and hostile environments. The color electronics are newly developed and represent the very highest state-of-the-art performance levels.

The Model 411C recorder/reproducer provides broadcast level performance. The transportable tabletop model weighs less than 140 pounds; its dimensions are 28" x 19" x 17¼". The unit may be ordered in a studio console configuration with a full monitor bridge.

For More Details Circle (68) on Reply Card

Digital VTR Signal Corrector

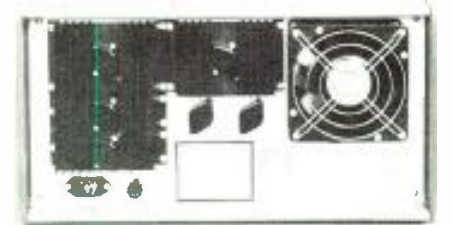
Consolidated Video Systems demonstrated a digital video signal corrector that lengthens the "window of correction" for helical video tape recorders. This development will enable broadcasters and CATV operators to reproduce broadcast level video signals with relatively inexpensive helical video tape recorders.

The CVS 500 "captures" and corrects time base errors from video tape recorders which up till now could not be used in broadcast

applications. The resultant capital equipment savings to broadcasters could be as much as 70 percent over existing tape recording and playback devices.

The CVS 500 interfaces with any wide band capstan servo VTR including models 100, 760, 825, 900 and 960 manufactured by the International Video Corporation and models 5800, 7800 and 7900 manufactured by Ampex. The only connection between the recorder and the CVS 500 is the video input from the recorder. This enables a single unit operate with several VTR's accepting their signals through a vertical interval switcher.

Although time base corrector is the major feature of the CVS 500, the unit also contains a full EIA



processing amplifier and sync generator. The unit totally locks up the color signal from most VTR's within 2 seconds from a stopped position.

For More Details Circle (69) on Reply Card

(Continued on page 54)



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Want more? Contact your Fidelipac Distributor and learn why more Fidelipac Automatic Tape Cartridges are in use throughout the world than all others combined.

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For More Details Circle (34) on Reply Card



PROTECT your broadcast equipment against lightning surges with WILKINSON AC LINE SURGE PROTECTORS

Excessive voltage surges caused by lightning, transformer arcing and induced transients are everyday occurrences that cause heavy damage to valuable broadcast equipment.

Now through the use of WILKINSON voltage sensitive Line Surge Protectors you can protect your equipment from line surges that may exceed even twenty times the normal line voltage.

A WILKINSON pulse compensated Line Surge Varistor, is placed across a line of its rated voltage. Should a surge or increase of voltage occur, the resistance of the varistor decreases at log scale as the voltage increases, thus acting as a momentary load or short circuit to the surge. WILKINSON Line Surge Protectors draw little or no current and are capacitor compensated for microsecond surges, thus damping all line disturbances as well as excessive voltage increase.

A small investment in WILKINSON Line Surge Protectors is your assurance that your valuable broadcast equipment will not be damaged due to line surges.

Model SIA-1 110 V. Single phase \$175.00

Model SIA-2 220 V. Single phase \$275.00

Model SIA-3 220 V. Three phase \$375.00

Model SIA-4 440 V. Three phase \$475.00

For complete details write to:

WILKINSON ELECTRONICS, INC.

1937 MacDADE BLVD. • WOODLYN, PA. 19094

• TELEPHONE (215) 874-5236 874-5237

NEW PRODUCTS

(Continued from page 53)

Beston Electronics Inc., a company that is gaining fast acceptance in the Broadcast and Cable market place, has developed a product that is not new to the cable industry, but it certainly has some new wrinkles.

The latest Beston product is called the "Weather Profit". This new unit is a weather device, character generator, advertising aid, and station I.D.....all in one complete package.

The Weather Profit has a memory that can be as long or short as you want it. It makes use of a standard reel-to-reel or cartridge audio tape recorder to allow 105 pages of advertising on a 10.5 minute tape or one page on a 10 second tape. The amount of time each page is on the line also is variable.

The memory section is changeable. otherwise if you want to change a spot half-way through the tape you'd be stuck. With this unit, you just record over the old spot.

For
Better
Results
Use
Classified
Ads
In The
Back
Of This
Issue

There is no need to erase the entire tape and start over.


The Weather Profit provides an accurate, automatic display of current weather conditions, while simultaneously displaying an advertising message, station I.D., weather bulletins, or any other information you want.

Aside from weather information, the unit is designed to help sell I.D.'s and spots. It also can show ball scores, stock market reports, and election day tallies, all basic to the unit's character generator.

For More Details Circle (70) on Reply Card

Headphones

The **Telex Communications Division** has introduced a new line of headphones and boom mic headsets for amateur and citizen band radio communications. The announcement came from Sidney Kitrell, director of marketing for broadcast/industrial products. "Thirty-five years of engineering and technology which developed professional headsets and headphones for use in aviation, education, business and

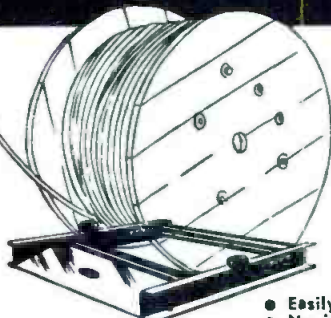

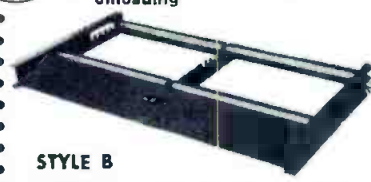


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All are drilled for optional auxiliary ball-bearing side rollers, \$8.50 per set extra.

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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

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Cincinnati, Ohio 45237

For More Details Circle (35) on Reply Card

For More Details Circle (36) on Reply Card

industry have now been incorporated in a full line of headphones and boom mic headsets that meet critical radio communication requirements," Kitrell said. "They are lightweight and exceptionally comfortable, yet shut out ambient noise enabling crisp clear communications. They materially add to the effectiveness of a rig allowing optimum transmission and reception by complimenting the operator's own senses", he added.

For More Details Circle (71) on Reply Card

Video Production Switchers

The Grass Valley Group is now producing a new generation of video switchers, the GVG-1600 series.

These new switchers offer soft wipe (video vignette), linear chroma key, linear matte key, automatic black burst, complete N/S inhibit, and separate pattern generators.

Optional features include border-line, wipe pattern borders, color background, quad split, downstream keyer, N/S fade to black, and 16 to 24 inputs.

For More Details Circle (72) on Reply Card

Video Cartridge Playback System

A new automated broadcast cartridge system designed for both commercial spot announcements as well as full-length program recording and playback has been introduced by International Video Corporation.

Michael A. Moscarello, IVC president, said the BCR-200 will be offered in 6 and 12-deck configurations with each deck offering one-hour playing time. All decks are integrated with a simple-to-operate automatic programmer so that spot announcements as brief as 10 seconds as well as one-hour programs can be randomly or sequentially selected. Up to 12 separate events can be programmed.

"We believe the BCR-200 offers many advantages over existing cartridge recorders including initial cost, which is up to two-thirds less than competitive models, and tape

(Continued on page 56)

June, 1973



PS910A
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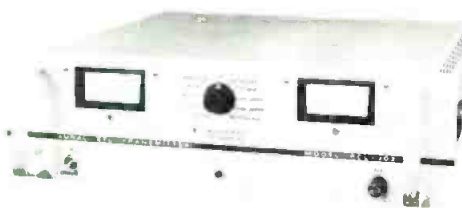
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For More Details Circle (37) on Reply Card

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For More Details Circle (38) on Reply Card

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Give to the college of your choice. Now.



Advertising contributed for the public good.

NEW PRODUCTS

(Continued from page 55)

cost, which is at least \$120 lower per hour of tape. "Moscarello said. "In fact, with up to 12 hours of continuous programming possible the BCR-200 becomes the first automated broadcast television system." Moscarello added.

BCR-200 head life is guaranteed for a minimum of 2,000 hours. Head wear is distributed over 6 to 12 transports instead of the two used with current cartridge systems.

"Head replacement cost advantages become so great that comparisons are virtually meaningless," Moscarello said.

Broadcast transports utilize a new design from IVC and operate on the standard IVC format in one-inch cartridges.

Tapes recorded on BCR-200's can be removed from the cartridge and played back on any IVC format recorder including IVC-960 broadcast recorders.

Two steps are needed to program the decks in any sequence. Decks can be preset to rewind and eject cartridges after playing, or roll forward and cue up the next program section on the tape, or rewind and cue again.

Each 6-deck system has record capability permitting network delay recording while playing back spots or full-length programming.

For More Details Circle (73) on Reply Card

Stereo Console

Wilkinson Electronics, Inc., is now offering a stereo console they call the TSC-4A. This economy-minded console features distortion-free amplifiers controlled by long life sliding step attenuators. Each attenuator has a cue position.

Fifteen inputs are provided. The lineup of inputs goes like this: Six low level inputs are switchable to two preamps; Four stereo high level inputs are connected to four faders; and five additional inputs are switchable to an auxiliary fader. This means the TCS-4A can handle nine stereo sources and six microphones. (Monitor meters with wide case fronts are provided for left and

right channels.)

The electronics are all solid state. Also, the output transformer allows the driving of both high impedance and balanced or unbalanced 600 Ohm lines. By restrapping the secondary of the transformer, you can drive 150 Ohm lines. The cost may be lower than you's expect, but it's still a quality console.

For More Details Circle (74) on Reply Card

Production Switcher

Vital Industries, Inc. is now offering what they refer to as the VIX-100-4 production powerhouse. This switcher features drift-free circuitry that makes it possible to use a three mix-effects system with quad split in a control panel no larger than most single mix-effects switchers.

Other VIX-100-4 features include: 3 presettable mix-effects; no coaxial delay lines in all re-entries; quad split with external drives; Edger on all keys; up to three chroma keys; and only one sync pulse is required. In other words, the VIX-100-4 has numerous production possibilities.

For More Details Circle (75) on Reply Card

Remote Monitoring Amplifier

The McMartin TBM-8800 is a completely self-contained AM-RF amplifier for boosting "off-air" AM broadcast signals to the levels required for driving FCC type approved modulation and frequency monitors located remotely from the transmitter.

The TBM-8800 uses the superheterodyne principle for maximum selectivity while retaining linear bandwidth and eliminating regeneration. Maximum IF selectivity is obtained through the use of ceramic ladder filters. Sum-and-difference double conversion eliminates frequency error and the local offset oscillator frequency is maintained by AFC lock techniques.

Separate power amplifiers are provided to drive the modulation and frequency monitors with independent level controls. Limiting in the amplifier for the frequency

monitor accommodates up to 99 percent negative modulation peaks.

AGC is standard; a 20 dB variation in input level results in less than 1 dB output variation. The AGC may be defeated for manual operation. In addition, the TBM-8800 has provisions for switching to compensate for power level changes. Switching of the power level adjustment may be accomplished remotely and carrier failure terminations are provided for customer-supplied alerting devices.

For More Details Circle (76) on Reply Card

Production Switcher

Richmond Hill Laboratories Limited introduced a new television product at the National Association of Broadcasters (NAB) Convention this March, in Washington, D.C.

Dubbed the VPM-41 Video Production Switcher, this newest addition to the Richmond Hill Laboratories equipment line, is a fully portable, color broadcast unit. The complete portability is achieved by packaging the electronics entirely within the control panel assembly.

Capabilities of this new unit include 10 video inputs, 12 effects, separate mix and effects faders, chroma keyer, full preview key, mask key, internal and external key - all standard features.

Broadcast color capable, the VPM-41 Video Switcher is a professional, vertical-interval switcher at a basic price of just over \$5,000 U.S. In addition, this unit has available, very popular options such as positioner control and auto-fade control.

For More Details Circle (77) on Reply Card

Stereo Alignment Cartridge

Fidelipac®, a division of **Telepro Industries Incorporated**, announces their new Model 350-STA Stereo Cartridge System Alignment Tape. This test tape, prerecorded by Standard Tape Laboratory, uses Fidelipac's Model 350 Phase Adjustable NAB Type A Cartridge. It is suitable for alignment of monophonic and stereophonic reproducers employing NAB track con-

figuration for broadcast cartridge machines. It will establish references for standard operating level, 50 microsecond playback response and precise azimuth alignment. The control track is unrecorded preventing equalization reference tones from actuating machine cue functions.

The tape, recorded for 7½ ips (19.05 cms) playback, consists of the following tones:

- 15 kHz tone for azimuth adjustment.

- 700 Hz tone at -10 dB level followed by 15 kHz, 12 kHz, 10 kHz, 7.5 kHz, 5 kHz, 2.5 kHz, 500 Hz, 250 Hz, 100 Hz and 50 Hz for adjusting equalization to a curve having time constants of 50 microseconds (high frequency) and 3180 microseconds (low frequency).

- 700 Hz tone at normal operating level: 185 nW/m, the basic operating level used by all major U.S. manufacturers of professional tape equipment.

For More Details Circle (78) on Reply Card

Broadcast Consoles

A new family of six "off-the-shelf" broadcast consoles is being marketed by **Fairchild/Robins**, designated Series 30000.

Two five mixer, stereo and two eight mixer, monaural units complete the line. All have "big board" styling and are finished in "Mod" colors. Most of the units feature stepless slide faders, mic preamps with built-in limiters, padded armrests and wood grain end panels. All of the units are built with plug-in I.C. op-amp circuitry which is accessible for service even while the units are in operation by means of hinged meter and control panels.

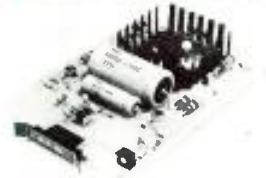
George Alexandrovich, Vice President of Fairchild/Robins said that "the new and unique Series 30000 Broadcast consoles apply advanced state-of-the-art audio control technology to meet the stringent requirements of today's broadcaster. Available off-the-shelf, these units incorporate custom features along with traditional requirements of AM, FM and TV operations. They epitomize the maximum in

(Continued on page 58)

ROH right from the start

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Roh has a quality line you can start with . . . and stay with. Buy a single module or several now. Then build an equity in fine audio equipment: modules, enclosures and accessories. Write for '73 catalog.



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214 Microphone/Line Preamplifier \$75.00



216 4 Channel LDR Attenuator/Switch \$60.00



218 Dual Channel Phono/Tape Preamplifier \$75.00



220 Dual 10 Watt/Single 30 Watt Power Amplifier \$110.00

Roh Corporation

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Norcross, Georgia 30071 Ph: 404/449-0873
For More Details Circle (41) on Reply Card

NEW PRODUCTS

(Continued from page 57)

performance, reliability and flexibility to be found in a family of compact, economical broadcast consoles.

The units were first demonstrated and sold at the National Association of Broadcasters Show in Washington D.C.

For More Details Circle (79) on Reply Card

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For More Details Circle (42) on Reply Card

One-Inch Helical-Scan Color Tape

Ampex Corporation has announced a new one-inch, helical-scan color video tape for broadcasting and sophisticated closed-circuit use. It is the first high-energy type tape to use a standard ferric oxide formulation.

New 170 Series video tape is designed for use with Ampex, IVC and other one-inch, helical-scan videotape recorders equipped with time-base correction. It is a compatible high-energy tape that is price competitive with cobalt-doped and chromium dioxide video tapes.

With 170 Series tape, print-through and pressure demagnetization are improved over cobalt-doped tapes. In addition, use of a non-doped ferric oxide provides compatibility with existing tape libraries with no machine adjustment.

Improved processing for 170 Series tape has resulted in lower dropout and chroma noise measurements.

The new video tape is available in one-half, one, and one-and-a-half hour lengths. Suggested list price of a one-hour reel in the Ampex format is \$65.00. The tape was demonstrated for the first time at the National Association of Broadcasters' Convention.

For More Details Circle (80) on Reply Card

Time Base Corrector, Servo Interface

Television Microtime, Inc., a subsidiary of Andersen Laboratories, Inc., showed a new product, designated the Delta 14 SYNC-LOCTM VTR Servo Interface Module, for correcting video picture instabilities inherent in a variety of low-cost video tape recorders. It is an accessory to the Delta 44 NTSC Color Time Base Corrector introduced last year and now in full production.

The unit is designed for installation in or on a variety of non-broadcast VTRs known as "V-lock" or "Electronic Editor" machines. It develops a correction signal for the VTR which virtually eliminates its natural tendency to

produce a jittering (and therefore non-broadcastable) signal. The resulting mean variation around an external reference is well within the capture range of the Delta 44 TBC, which then transforms the monochrome VTR output into a stable full color picture meeting FCC requirements for direct broadcasting.

The unit is also available as a self-powered accessory package for installation on or near other VTRs, or as a Delta Series module board for installation in the TBC cabinet or an accessory cabinet. Modification of the VTR to accept the interface requires a minimum of harness wiring rearrangement and only minor wiring changes within the servo system electronics to accommodate the correction signal input. No electromechanical component changes are necessary in the VTR which has been maintained and updated according to manufacturer's specifications.

For More Details Circle (81) on Reply Card

Mobile TV Camera Lens

Rank Precision Industries, Inc., exhibited a new Cooke Varotal lens for use with portable or hand-held television cameras for the first time in the U.S. at the National Association of Broadcasters Convention in Washington, D.C.

Manufactured by Rank Taylor Hobson, the Cooke Varotal is basically different from any existing lens now used on portable or hand carried TV cameras, according to Rank. Its new design features enhance optical performance by allowing wider angles of view to be shot in tight close-up situations.

Further, the use of new glass and coating formulas improves transmission, giving the Cooke Varotal extremely good resolution and transmission characteristics. With a range of 12mm-60mm, with a relative f-stop of f-1.7, the lens is available in three modes of operation: manual, motor driven and servo-controlled.

In addition to the Cooke Varotal, Rank will also feature the unique Varotal 30 television lens, which combines an 18" minimum object

distance from the front of the lens; 16mm-160mm focal length, with a T-stop of 2.2.

For More Details Circle (82) on Reply Card

Chrominance Level Corrector

The 1478 is an in-line manual chrominance corrector designed by Tektronix for use with NTSC, PAL and PAL M color video signals. Used with the 12.5 T or 20 T modulated sine-squared pulses, the 1478 is used to manually correct for relative chrominance/luminance gain errors which are usually caused by frequency response deficiencies in a video system.

Two signal channels are provided in the 1478, a program channel and a monitor channel. The monitor channel allows corrections to be previewed before committing them to the program channel. Any signal distortion measurements may also be carried out on the monitor channel. Front panel correction on/off switches have been provided for each channel.

Chrominance/Luminance gain errors are read directly from front panel controls. Delay errors may be measured with a wave-form monitor or plotted on a nomograph.

For More Details Circle (83) on Reply Card

Digitally Controlled FM Station Monitor

If you thought about the obvious control difference between a digitally controlled and manually tuned FM tuner-monitor, you might feel that the digital tuner would take away that familiar sense of flipping across the FM band. And you'd be correct!

It's much the same feeling many of us got when we moved from manual shift cars to the automatic shift. Heathkit's AJ-1510 FM stereo tuner will give you that same feeling, but like it was with cars, you still have plenty of control.

There are three ways to tune the AJ-1510. You can push the keyboard button and punch up a station. If you want to use the tuner as a station monitor, you can use a second method.

The unit is supplied with programming cards. You punch them to read the frequency of desired stations, and insert them in the tuner behind a front access panel. The unit will take three of these cards. And in order to get one of these stations, you simply hit the pre-program button and then press channel button A, B, or C. Obviously, you use the three stations on this card that you want to check most often.

The third tuning method is the automatic sweep. By punching the auto sweep button, the tuner will scan the FM band from top to bottom, stopping only on stations with a signal strength you've selected as a minimum. If you want the unit to continue to scan down, you hit the bypass button. When it has counted down to the bottom of the band, it will automatically start at the top again.

Of course, no matter how you punch up a signal, the receiving frequency will always be shown on a digital frequency display. In fact, when the unit is in the auto sweep mode, it will display each frequency it passes over, even if no signal is received.

In the AJ-1510, a state-of-the-art digital frequency synthesizer using phase-lock-loop techniques handles the tuning. The result is a channel frequency accuracy of better than 0.005 percent.

An inductorless digital frequency discriminator of the pulse counting type follows two fixed-tuned five-pole LC IF filters. This eliminates all IF and discriminator adjustments and gives distortion levels of 0.1 percent.

The kit comes with a pre-assembled varactor FM RF front end, using FET's to provide high sensitivity (less than 1.8uV) and low cross modulation with no overload on strong local signals.

There is no worry over tuning a station exactly. The tuner hits it on the nose. And after testing one on our bench, we feel the AJ-1510 would be an excellent station FM monitor.

For More Details Circle (84) on Reply Card

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To Broadcast Engineering
For Better Coverage**

Spotmaster

Compressor-Limiter Amplifier



(The Great Leveler)

\$465!

You can stop riding gain now, even when a shouter and whisperer are on the same talk show. The Model CLA 20/40 Compressor-Limiter Amplifier does it automatically instantaneously for both AM and FM. Switchable controls permit symmetrical (FM) or asymmetrical (AM) peak limiting; pre-emphasized or flat response; compress limit, compress only, or compress limit off. Automatic gain control range is 40 dB dynamic, and the compression ratio is better than 10:1. All solid state, plug-in modular construction assures trouble free reliability. Write for details.

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For More Details Circle (46) on Reply Card

TECHNICAL DATA

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

100. ALDEN ELECTRONIC & IMPULSE RECORDING EQUIP. CO.—A new two-page data sheet describing the Model 421C Radiofacsimile Converter is now available. The converter is a rack mounted, solid state electronic chassis which converts audio frequency shift signals into corresponding amplitude gradations. The unit features a detector which provides complete recovery of the modulation envelope from the FM signal and a high pass filter which restricts frequencies below the desired band pass to minimize noise. The Alden 421C Radiofacsimile Converter is compatible with single sideband or double sideband transmitters and operates in conjunction

with all 3-30 MHz band HF receivers and shipboard or shore based recorders designed to monitor HF weather facsimile transmissions or other graphic communications. No operating adjustments are required. Output AC signal volts are related to input frequency on a linear basis. A 20 decibel output wedge is obtained in the 1500-2300 Hz region fixed by international standard.

101. APELCO—Apelco's complete 1973 line of radiotelephones (VHF and single sideband) antennas and mounts, depth indicators and recorders, automatic and manual radio direction finders, and a loud hailer are described and illustrated in a new 20-page brochure.



the complete video tape editing switcher

Broad flexibility, a compact and convenient operating console and all the facilities required. That's the Model 2850 in a nutshell.

We've put all the conventional features plus some rather unique ones into this audio/video switcher designed for video tape editing. The package provides 8 inputs, 5 buses, keying, wipes, color matte with internal color background generator and an audio mixer with equalizer and noise gate. Sophisticated transition circuitry includes both manual and adjustable rate automatic on video or audio or both.

There are more features than space allows us to tell you about so write for our complete brochure.

DANSCOLL

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(514) 631 9884

For More Details Circle (40) on Reply Card

chure.

102. B & K INSTRUMENTS, INC.—Their latest "Technical Review" contains three technical articles on topics such as RMS Rectifiers, Acoustic Response of Theaters, and Noise Dose. Beginning on page 44 is news from the factory which announced their electronic voltmeter, measuring microphones, and force transducer.

103. C. P. CLARE & CO.—A new 10-page booklet, depicting complex electronic interface problems and how they were solved by various dry-reed and mercury wetted relays, is now available. Selected applications, each representative of a wide variety of industrial electronic systems, are diagrammed and explained briefly in terms of problem and solution in order to establish a quick understanding of different types of relays and the kind of application for which each is particularly well suited. The booklet, titled "Six Tough Interface Designs," also offers the company's complete technical dissertation on the design and application of dry reed and mercury-wetted relays, including performance characteristics.

104. COHU, INC.—A low light level TV camera 500 times more sensitive than a standard vidicon camera is described in Data Sheet 6-589. The 2855 Series camera, in an environmental housing, will produce a usable picture during a cloudy moonlit night with only 5×10^{-5} footcandle on the vidicon faceplate. All light and lens controls are fully automatic. Remote controls can be used if desired.

105. ELECTRONIC ENG. CO. OF CALIF.—A broad line of photoelectric punched tape readers for commercial, industrial and ruggedized military applications are covered in a new 56-page catalog. Models shown feature accurate tape reading with up to 60 percent tape transmissivity, photo transistors, L.E.D.'s, fiber optics stop-on-character reading speeds up to 800 cps, as well as solid state designs eliminating need for gears, pulleys, clutches, capstans or brakes. Application information

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covers punched tape materials, tape punching, field practices, EIA tape standards and computer interfacing. The catalog includes readers developed for, and proved in, a wide range of numerical control, test equipment, process control, flight line, airborne, mobile van and shipboard applications.

106. FREDERICK ELECTRONICS—A new six-page folder on the company's ELTEX II Switching System is now available. The brochure "provides complete details on this optimized approach to Telex switching," according to Marvin Lekstrum, Vice Pres., ELTEX Systems. ELTEX II can serve as a concentrator, local exchange, trunk transit exchange, international gateway or in any combination. Features include: computer call processing; operational flexibility; minimum maintenance; time division switching; total turnkey software; and a wide range of available computer peripherals. Its cost and performance benefits provide users significant long-range economies, while typical system installation occupies approximately 1/10 the space required for comparable electromechanical systems.

107. GENERAL CABLE CORP.—The availability of Specification 600, "Guidelines and Procedures for Splicing Filled and D-Shielded Cables" has been announced. With every step clearly illustrated, this publication provides splicing instructions for joining two filled cables, splicing filled to non-filled cable, splicing two D-shielded cables and making a Y-joint splice of one large to two small D-shielded cables.

108. GENERAL ELECTRIC CO.—A new technical data book, which provides a convenient reference source on the utilization of silicone resins for protective coatings, is now available. The illustrated publication includes an introduction to the new silicone resin line, and covers types of resins, pigmentation, catalysts, processing and baking. Two basic types of resins comprise the line for protective coatings—pure silicone resins and silicone-organic copolymers.

Protective coatings that utilize these General Electric silicone resins are used for high temperature industrial equipment, aerospace hardware, building panels, fabricated metal components, marine and industrial maintenance applications where resistance to heat and/or weathering is required. Because of the simplicity of the General Electric line of silicone

resins, paint manufacturers and formulators can quickly and easily select the silicone resin, silicone-organic copolymer or silicone-organic cold blend vehicles best suited to their requirements.

109. GENERAL MICROWAVE CORP.—Bulletin 440 describes General Microwave's new 10 MHz to 18 GHz Thermoelectric Power
(Continued on page 62)

The V11/21 Automatic Digital Logging System



from the industry's Creative Product Innovators.

The V11/21 Automatic Digital Logger records and prints out all necessary meter readings, saves valuable engineering time and assures total accuracy.

Here's a complete, self-contained system, including a printer which can display and print date identification, time, channel number and meter readings in volts, amps, watts, etc. The system is capable of sampling, measuring, displaying and

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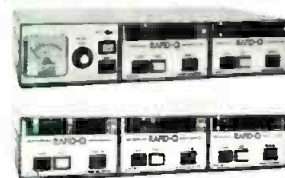
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BROADCAST ELECTRONICS, INC.
A Filmways Company
8810 Brookville Rd., Silver Spring, Md. 20910

TECHNICAL DATA

(Continued from page 61)

Head for use with the Company's extensive line of precision microwave power meters. The Model 440 measures up to 10 milliwatts of average power and is equipped with an SMA input connector.

110. GTE LENKURT INC.—A new Telecommunications Products Catalog which describes every major product in the company's broad line of video, voice and data transmission systems is now available. The 32-page booklet is divided into sections covering microwave radio transmitter-receivers, microwave radio subsystems, coaxial cable transmission systems, multiplex systems FDM cable carrier systems, N-type repeated line equipment, PCM cable carrier systems, auxiliary data equipment, supervisory and control systems, and VF and signaling equipment. Over 50 telecommunications products are described including technical data, pictures of each item, and reference sources for further information.

111. GULTON INDUSTRIES, INC.—Recorder Systems Div. New data sheet describes the Rustrak 225 miniature temperature/relative humidity recorder. Only 5 5/8" high, the recorder provides two months of inkless writing on rectilinear chart paper. Temperature from 60°F to 90° and from 10 percent to 90 percent relative humidities are recorded side by side on a single strip of chart paper. The

data sheet provides typical applications, operation information, features, specifications, photos of the recorder and the sensor, and an actual size photo of a typical recording.

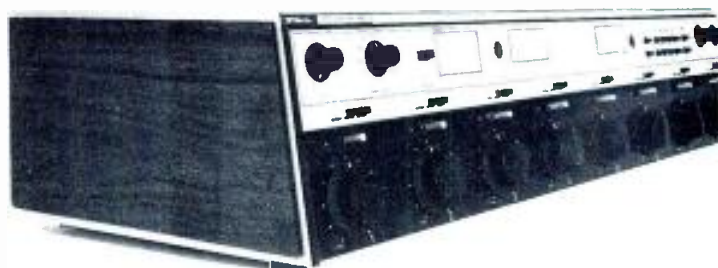
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116. ITT JENNINGS—A new catalog for their complete line of fixed and variable vacuum capacitors is now available. The catalog lists over 160 different units with maximum values from 8 pfd to 5000 pfd and with peak voltage ratings from 2 kv to 60 kv for use in transmitters, antenna couplers, filters, and multicouplers. Also covered is key application data including a discussion of capacitor ratings, testing, installation, and maintenance.

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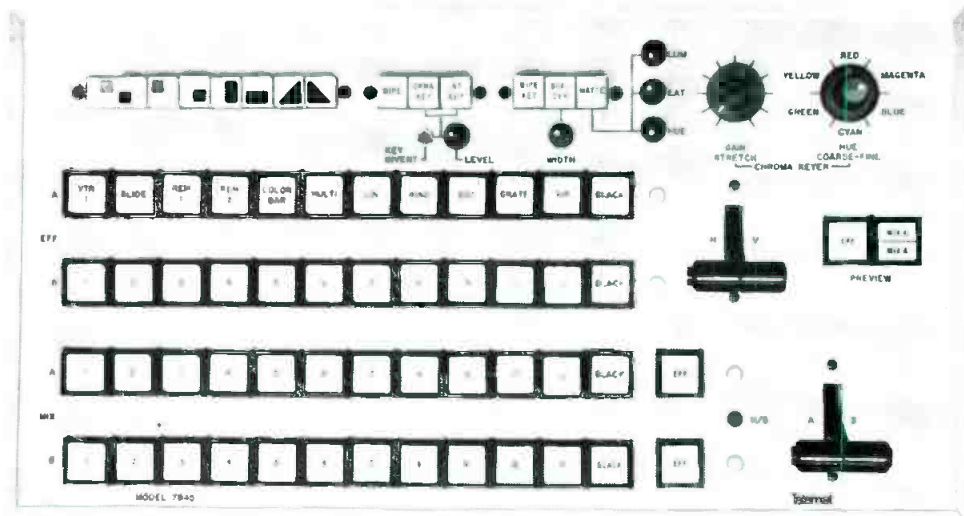


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