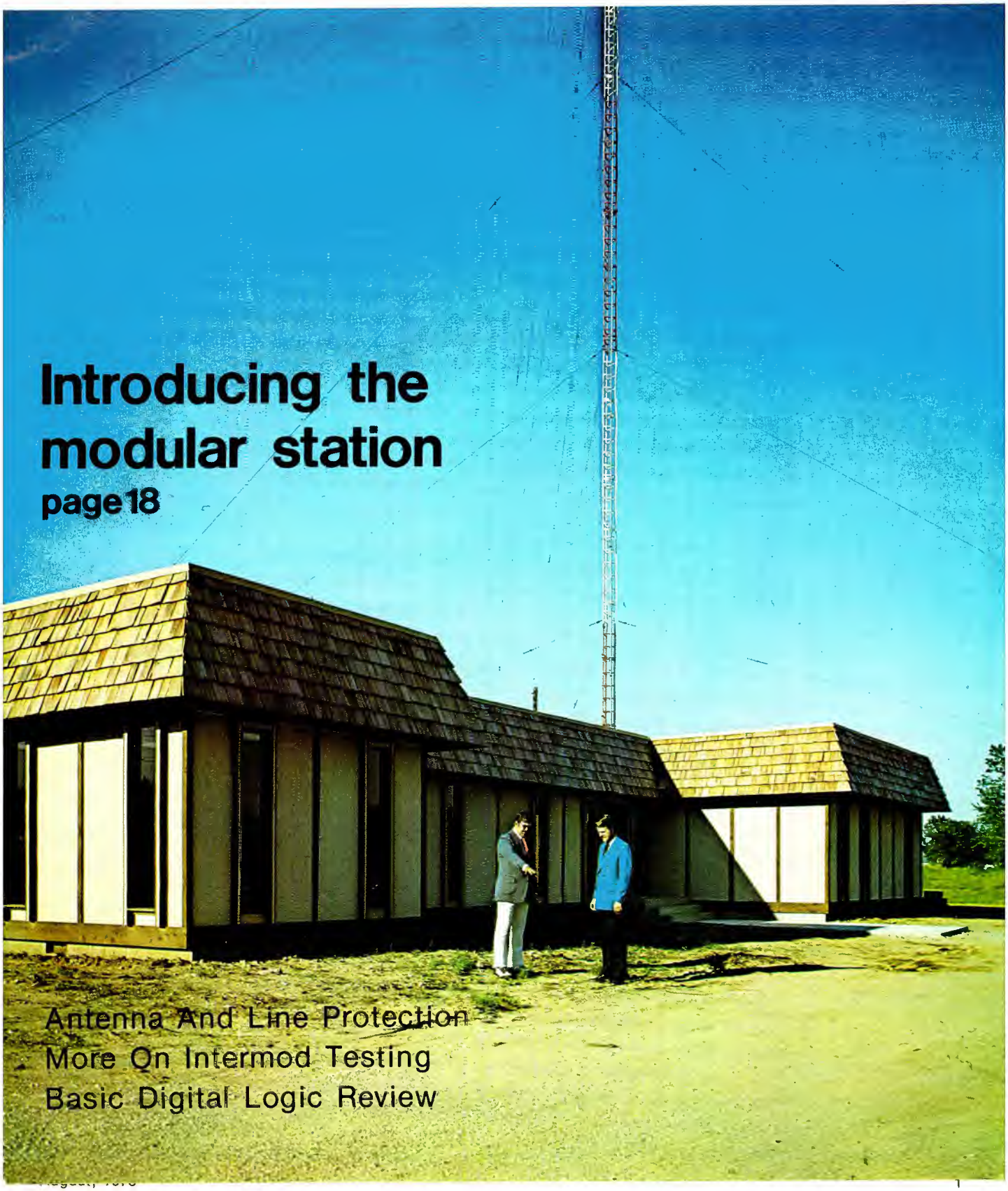
August, 1973/75 cents

BROADCAST engineering

the technical journal of the broadcast-communications industry



Introducing the modular station

page 18

Antenna And Line Protection

More On Intermod Testing

Basic Digital Logic Review

August, 1973 • Volume 15, No. 8

BROADCAST engineering

The technical journal of the broadcast-communications industry ®

in this issue...

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24 **Antenna And Transmission Line Protection.** BE Maintenance Editor explains sentry units, their calibration and repair. **Pat Finnegan.**

30 **Color Camera Basics.** The Author describes ison methods for camera selection. **Joe Roiz**

34 **Basic Digital Logic Review.** Part two of a keep you up-to-date on the state-of-the-art.

40 **More On IM Testing.** A review of the inter IM meter and further application note on a the station. **Dennis Ciapura.**

Buyer Guide

About The Cover

BE covers the construction of a modular broadcast station, a concept that adds new dimension to broadcast facilities.

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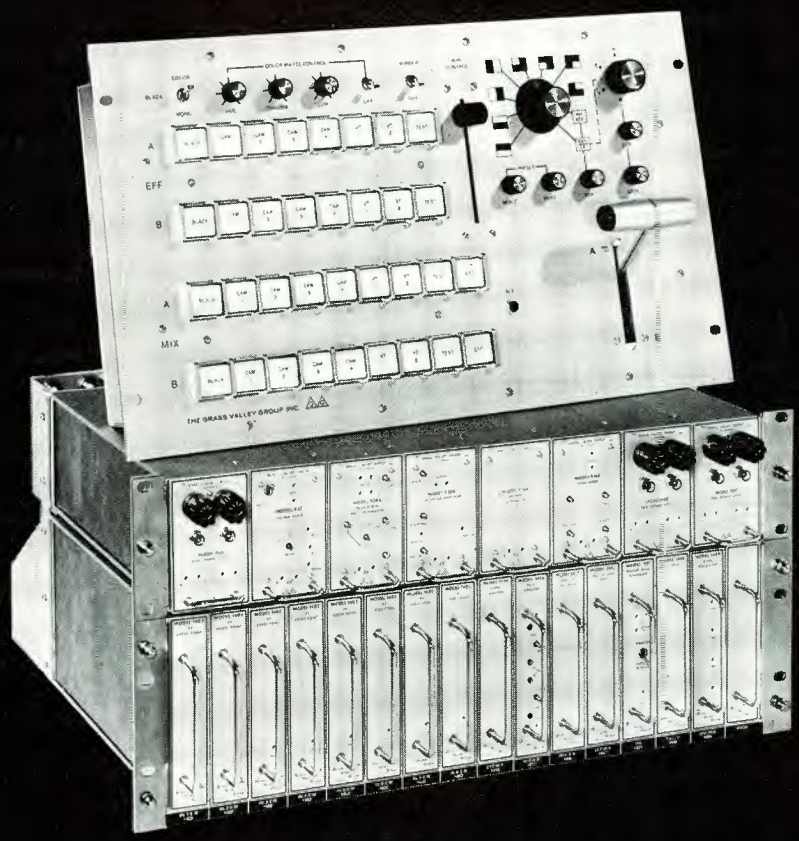
BROADCAST ENGINEERING is published monthly by Intertec Publishing Corp., 1014 Wyandotte Street, Kansas City, Missouri 64105. Telephone: 913 888-4664.

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

Controlled Circulation postage paid at Indianapolis, Indiana.

Robert E. Hertel, Publisher

INTERTEC PUBLISHING CORP.
Subsidiary of HOWARD W. SAMS & CO., INC.



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DIRECT CURRENT FROM D.C.

August, 1973

By Howard T. Head

FCC Re-regulation Enters "Phase III"

The Commission's Re-regulation Task Force (see articles Dec. 1972 and March 1973 BE) has made a number of further minor changes in the Rules governing radio broadcast stations and radio and television auxiliaries. This is part of the Commission's continuing program to relax or eliminate unnecessary and outmoded regulations.

Rules governing AM stations licensed to operate during specified hours (there are a few left) are relaxed for operation past specified time periods; performance rules are amended to make clear that equipment performance measurements must be made at each licensed transmitter power output level; and rules governing rebroadcast of transmissions of non-broadcast stations are simplified. The requirement for Commission notification in conducting equipment or performance tests for all classes of broadcast auxiliary station (such as STL and remote pickup stations under Part 74 of the Commission's Rules) is eliminated.

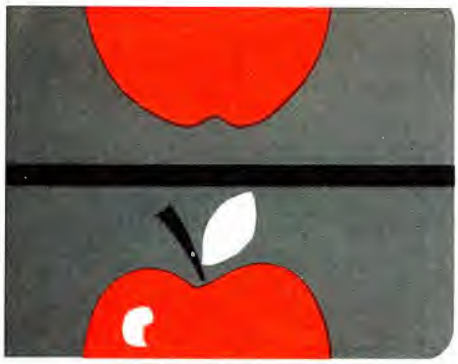
New Call Sign Rules Adopted

The Commission has adopted new Rules governing the assignment of new call signs to AM, FM, and TV broadcast stations. The new Rules, which are essentially procedural in nature, spell out the practices to be followed in requesting new call signs or in instances where outstanding licenses or construction permits are transferred.

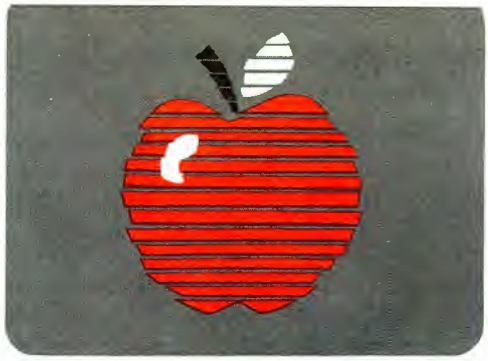
The present practice of reserving the initial letters W and K for stations east and west of the Mississippi River, respectively, is retained. Relaxation will be permitted, however, in instances where stations qualifying for common call signs are across the river from one another. You may not reserve a call sign prior to the issuance of a CP, nor have a call sign effective retroactively. Only by special permission may your call include the initials of the President of the United States or a living former President (listeners to WRMN, Elgin, Illinois, may take this any way they want), or of the United States of America or any Department or Agency. Finally, your combination is required to be in good taste.

Dual Language "Sound Tracks" Continued in P.R.

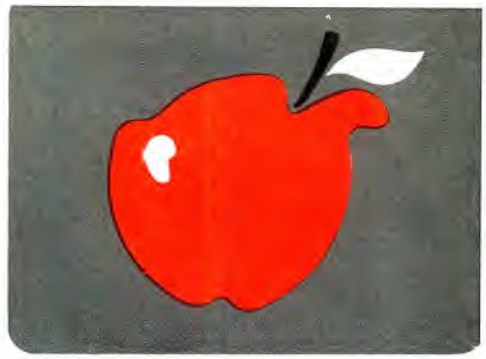
The Commission has extended an experimental authorization for a television station in Puerto Rico to operate on a dual-language basis, carrying the dialogue in the second language on a companion FM station. The usual practice is to carry the Spanish language version on the TV aural carrier with the English language being carried on the FM station.



PICTURE ROLLS

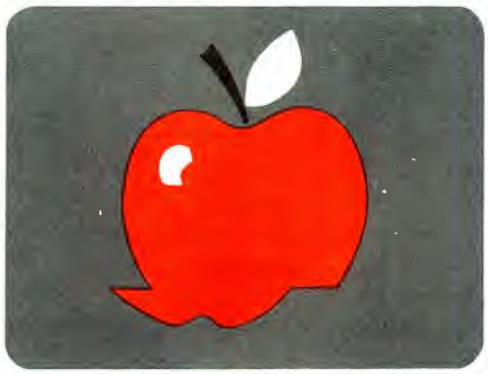


TEARING

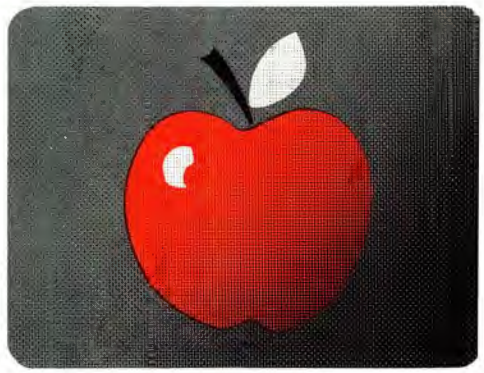


FLAGWAVING

HUE SHIFT



SKEW ERROR



COLOR STREAKING

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Like 'em or not, them apples show composite errors in video signals which accumulate every time you use VTR equipment. Errors caused by changing tape geometries, varying tape speeds, fluctuating head velocities.

But how do you get rid of the bad apples?

With a standalone Delta Series TBC from Television Microtime.

Delta TBCs give you broadcast quality from every VTR — 2-inch "quads," 1-inch helicals, ¾-inch cassettes, ½-inch EIAJ — in monochrome, or direct or heterodyne NTSC color. And you can get them with standalone or built-in velocity error correction.

Delta accessories convert V-lock VTRs to H-lock operation and add automatic skew tension correction to low cost cassette and EIAJ VTRs. Our new full line brochure, *Meet The Compatibles,* describes over 20 different models . . . covers time base errors, the causes and the solutions. Use the coupon to send for your free copy. Or send for our special tape demonstration. We're available anytime to tell you how we can help solve time base problems.

For More Details Circle (6) *on Reply Card*

Dear Sir,

I want to know more about time base error correction and Delta Series TBCs.

- ☐ Please send me your new brochure: *Meet The Compatibles.*
- ☐ I would like to see your tape demonstration.
- ☐ I want to talk with one of your representatives. My application is:

_____

Name _____

Title _____

Company _____

Address _____

City, State, Zip _____

TELEVISION MICROTIME, INC.
1280 Blue Hills Ave., Bloomfield, Conn. 06002

(Continued from page 4)

This experimentation has been continuing for the past six years. In authorizing further experimentation, the Commission turned down requests of other Puerto Rican stations for similar authority, expressing the view that regular operation of this type should be conducted only after suitable changes in the Commission's Rules. A Notice of Proposed Rule Making is promised for the near future.

Various proposals have been made and are under study for the provision of a second aural signal within the regular TV channel. A number of schemes have been statisfactorily tested, including the modulation of a portion of the horizontal synchronizing pulse. This second sound channel has been considered for various uses, including stereo sound for TV.

Short Circuits

The Commission has denied an application of a daytime-only AM station in Georgia for non-directional nighttime operation with 100 Watts power, pointing out that the Rules require minimum nighttime power of 500 Watts for Class III stations...The Commission has permitted a Montana TV translator, required to provide non-duplication protection to a TV broadcast station, to install remote control equipment and transmit a continuing slide announcement on the translator explaining the reason for the program blackout...Deciding that such a rule is unnecessary, the Commission has declined to require extinction of the FM stereo pilot subcarrier for monophonic transmissions exceeding five minutes' duration...Channeling standards have been adopted for Local Distribution Service (LDS) stations in the Community Antenna Relay band... The Commission has awarded a quarter-million dollar research contract to study "Future TV Spectrum Requirements"...A request to permit coded transmissions in the AM broadcast band to alert First Aid Crew members has been turned down...The Commission is expected to reassign one megahertz of spectrum space in the 1¼ meter amateur band to the Citizens Band for "hobby-type operation...Two short-spaced television stations in the middle West, required by their licenses to employ directional antennas for mutual protection, have proposed to substitute precise carrier offset for the directional antennas...Land-mobile sharing of the seven UHF television channels is being proposed in the Gulf of Mexico for offshore oil drilling operations...The Annual Fall Symposium of the IEEE Broadcasting Group will be held in Washington, D.C. on September 20-21, 1973. Sessions will include papers on radio and television broadcasting, helical-scan VTR standards, and an address by the General Counsel of the Office of Telecommunications Policy (OTP) on "Future Directions of Government Communications Policy."

LETTERS TO THE EDITOR

Back To The Reservation

Dear Editor:

In the June issue of **Broadcast Engineering** the article, "The Sensuous Test Pattern," you raised a question of history on one of the test patterns. Quoting, "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.**

Since it was my job in the early days with RCA to develop the Indian head Monoscope maybe I can help you with the mystery. The type 1899 was announced to the trade in November 1938 and was later supplemented by the 2F21 in February 1946. Prior to these commercial announcements we were working on the development of the Iconoscope for cameras along with picture tubes. It was my function to help with the test equipment. Many arguments ensued among the engineers as to where the deficiencies in the system were occurring: in the camera tube, in the optics, in the amplifier, the deflection or the picture tube. It was decided to evolve a standard which could be used for reference. The vehicle of the Monoscope was chosen and the now well known "Indian head test pattern" was evolved; and surprisingly, has been used for many years by a great many people.

Why the "Redskin?" I had quite a collection of the then "beautiful girls" which by today's standards are perhaps not so beautiful, but it was realized that style change would occur. In the quest for some type of half-tone material it was decided to use the Indian because his style hadn't changed over the years and he probably would retain his style while our "beautiful girls" would probably change—and have; thus the "Redskin."

I hope this helps with the mystery and I am flattered to see the Indian head Monoscope still receiving attention.

C. E. Burnett
Division Vice President
and General Manager

GE Info Needed

Dear Editor:

The PBS member stations on American Samoa and Guam have

between them seven aging G.E. television transmitters. Particularly since the sale of much of G.E.'s Visual Communications Products Operation to Gates Radio Division of Harris-Intertype Corporation, they are having great difficulty getting certain spare parts and tubes, and the situation is reaching critical proportions.

If anyone knows of a ready source of parts for G.E. transmitters, Model 4TT32, it would be greatly appreciated if they would write to the respective Chief Engineers at these addresses, or to me:

Ken Henderson
Guam Educational TV Comm.
P.O. Box 3615
Agana, Guam

Dick Stevens
Dept. of Education
KVZK-TV
Pago Pago, American Samoa 96799

Gene Swanzy
Manager, Technical Operations
Public Broadcasting Service
Washington, D.C. 20024

Cutting Your Throat?

Dear Editor:

I read with great interest the story by Dennis Ciapura on FCC requirements regarding proofs (BE, June '73). I would like to take this opportunity to express some of my views on the subject.

First of all, the quality of the sound transmitted by any radio station should be a matter of pride to the individual station engineer. A poor sounding station may sound that way for a number of reasons. Station management may be unwilling to hire or pay a good engineer or to buy the necessary quality equipment to do the job properly. Announcers may be careless in their setting of levels, resulting in overdriven amplifier stages and possible overmodulation. But all too often a poor sounding station reflects an engineer who, for various reasons, is either incompetent or just doesn't care.

Such stations are the precise reason why the FCC must not relax the rules for minimum standards of audio performance. If anything, the standards should be tightened. Modern broadcast equipment is perfectly capable of far exceeding the FCC technical requirements. So why adhere to antiquated standards designed for broadcast equipment thirty years ago?

I personally take a dim view of patching equipment out of the chain from console to transmitter. If a component is in the chain, it is going to be contributing its share of distortion and noise to the final product, so patching it out appears to be only a way of cheating on the proof. If the component is a limiter or AGC amp, its gain riding function can be defeated while the component remains in the chain.

Given the low quality of many monitor speakers in use in broadcast stations today, the only way a distortion producing component can come to light is through the proof. So in effect, you are doing yourself a favor by not patching anything out. I am not advocating, though, the use of cheap monitor speakers. The quality of recorded sound today demands decent quality speaker systems for monitoring purposes. A recording studio would never even dream of using an eight dollar speaker in a ten dollar wall baffle to monitor their finished product with a bargain basement speaker. But this is getting away from the issue.

Given today's broadcast equipment, there is no excuse for a poor sounding station. Unfortunately, if annual proofs were not required, there would probably be an epidemic of really abysmal-sounding radio signals on the air. The present audio standards required are far too lenient anyway, and eliminating them entirely would be unwise.

From another standpoint, a station that allows its signal to deteriorate is cutting its own throat. The quality of the average broadcast receiver, especially FM receivers, is far greater than a scant ten years ago. The general public, especially the younger people, are demanding higher quality sound that modern equipment is capable of providing. If the station cannot "put out", it is most likely going to be "tuned out" in favor of another station providing a high quality signal.

Robert I. MacDonald, CE
Golden Strand
Broadcasting Company

INDUSTRY NEWS

250,000 Letters Needed

Broadcasters have been urged to generate among friends more than a quarter million letters to Congress stressing the urgent need for broadcast license renewal legislation.

Mark Evans, vice president, Metromedia, Washington, D.C., said that is "the kind of showing that will not be ignored even in blase Washington."

Addressing a meeting of the Alaska Broadcasters Association, the chairman of the License Renewal Task Force of the National Association of Broadcasters, commended broadcasters for an unprecedented job in persuading 228 House members to introduce or co-sponsor such legislation and persuading many more to support it.

Evans called it "the most effective single coordinate action" in the history of broadcasting.

"But all of this work adds up to nothing if the bills do not become law," he said. "This is the worst possible time to relax...We have come this far because we have worked hard. Let's not let the issue fail because we were not willing to give it that last ounce of effort."

Engineers Selected

Six broadcast executives have been named to the Engineering Conference Committee of the National Association of Broadcasters.

Appointed to help plan the Conference to be held in Houston March 17-20 in conjunction with the 52nd annual NAB convention are: Chairman LeRoy A. Bellwood, director of engineering, KGTV, San Diego, Calif.; John Bowman, manager of engineering, WMAL, Washington, D.C.; Eldon Kanago, chief engineer, KICD, Spencer, Iowa; William B. Honeycut, director of engineering, KDFW, Dallas, Tex.; William C. Hunter, director of engineering, WHAS, Inc., Louisville, Ky., and Russell B. Pope, director of engineering, KHSL, Chico, Calif.

Other committee members are John R. Kennedy, vice president, operations and engineering, NBC, New York, N.Y.; Leslie S. Learned, consultant, MBS, Centerport, N.Y.; James D. Parker, staff consultant, Telecommunications, CBS Television Network, New York,N.Y., and Royce LaVerne Pointer, director, broadcast engineering, ABC, New York, N.Y.

The appointments were made by the NAB president and the chairman of the Joint Board of Directors.

Canadians Set Convention Dates

The Central Canada Broadcasters Association has announced that their annual convention will take place this year in Toronto at the Skyline Hotel, October 21-23.

For further convention information, we suggest you contact Bert Verwey, Secretary-Treasurer, CCBA Engineering Section, c/o CKVR-TV, PO Box 519, Barrie, Ontario.

Station Activity

Ken Cowan of Media Horizons signs construction agreement for new KMEO facility. Ralph Eaton (l) and Tom Kent (r) of Eaton International look on. Bottom picture, down in Nashville, Robert Shepard (WDCN-TV), Mayor Briley, and Charles Duke (WSIX-TV) prepare to swap channels 2 and 8.

Cox Broadcasting Deals For KFI

Cox Broadcasting Corporation has announced it had consummated the purchase of AM Radio Station KFI, Los Angeles, for $15.1 million cash. In making the announcement, J. Leonard Reinsch, president of CBC, said papers formally transferring ownership of KFI to Cox Broadcasting Corporation were signed in Los Angeles.

CBC's acquisition of KFI, one of the nation's pioneer radio stations, had been approved by the Federal Communications Commission on April 18, 1973. An agreement under which Cox Broadcasting would acquire the operating assets of KFI from the trustees of the Earle C. Anthony Trust, was announced in July, 1972

KFI, a 50,000-Watt, clear-channel facility, serves an audience of 10 million people in the Los Angeles metropolitan area. In 1972, the station celebrated 50 years of broadcasting.

The acquisition of KFI brings to five the number of AM radio stations owned and operated by Atlanta-based Cox Broadcasting Corporation. The Company also operates four FM radio stations, along with five VHF television stations serving Atlanta, Dayton, Charlotte, Pittsburgh, San Francisco-Oakland and Miami.

Emmy Award To CMX Systems

The Emmy, the most prestigious honor conferred by the National Academy of Television Arts and Sciences, was awarded to CMX Systems for its development of computer controlled video tape editing and assembly systems.

A CBS/Memorex company, CMX developed the technical concept and manufactures the electronic, highly automated editing systems for the processing of video tape programs.

CMX produces on-line and off-line editing and assembly systems. On-line systems interface directly with quadruplex video tape recorders (VTR), permitting video tape editing decisions and programs assembly to be accomplished simultaneously. Off-line systems allow editing decision to be made independently, with final program assembly being performed automatically during hours of low VTR demand.

For Latest News See Direct Current page 4

SBE Insurance Program

Several years ago our Board of Directors approved a Group Insurance Program for SBE members. The first plan introduced was the Life Insurance Plan, which now offers member coverage up to $50,000.00, with lesser amounts for dependents. For the past policy year ending October 1, 1972, eligible insured members received a 40 percent dividend credit on their spring contribution notices. There is now over one million dollars of member and dependent coverage in force.

Last year, the Program was expanded to include a host of accident and sickness plans to suit the individual insurance needs of members. These include a **Disability Income Plan** to protect a member's wages during period of disability due to sickness or accident; a **Hospital Dollars Plan** providing daily cash payments during periods of hospital confinements; a **Major Hospital-Nurse-Surgical Plan** with benefits up to a maximum of $15,000.00 and a $200,000.00 **High-Limit Accidental Death and Dismemberment Plan** which will have all benefits increased by 15 percent on October 15, 1973, without a corresponding increase in premium.

The success of the Program depends upon the interest and active support of our membership. While SBE has made the Program available to its members, no expense is incurred by the Society.

If you wish to have a brochure describing the Program, please contact the Administrator, SBE Group Insurance Program, 1707 L Street, N.W., Suite 800, Washington, D.C. 20036 (Tel: 202-296-8030).

Annual Rebate Reminders

Here are some reminders from SBE Headquarters: Chapters: Be sure to apply for annual rebates from SBE headquarters. A rebate of up to $100 annually is possible based on membership attendance for the preceding year. To obtain this rebate it is necessary to complete the Annual Attendance Report Form which may be obtained from Virginia Doss, SBE, P.O. Box 88123, Indianapolis, Ind. 46208. Virginia would also like chapters to remind members that attractive SBE tie tacks are available from her for $3.50 (members only).

When corresponding with SBE

(Continued on page 14)

Deadline Reminder For Chapters

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 October 1973 issue is August 25th; for the November 1973 issue, the deadline is September 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.

New SBE 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 chapter activities 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. In some cases, assistance from SBE national officers and directors may be available. Contact any officer or director, or SBE President James C. Wulliman, at WTMJ, 720 East Capitol Drive, Milwaukee, Wisconsin. Those involved in the development of new chapters should also keep the SBE Journal Editor posted so that this work can be aided by promotion in the Journal.

LOCATION	CONTACT
Tucson, Ariz.:	H. J. Bart Paine, telephone 882-6644, or Chuck Deen, KOOL-TV, 511 West Adams, Phoenix, Arizona, telephone 271-2345.
Miami, Fla.:	John Blattner, 11001 N. Kendall Dr., Apt. A107, Miami 33156.
St. Louis, Mo.:	Arthur H. Rounds, 1321 Aspen Drive, Florissant, Mo. 63031.
Puerto Rico:	Bob Beurket, Asst. Chief Engineer, WRIK-TV, Ponce/San Juan, Puerto Rico, telephone 809-724-7575.
San Francisco, California:	Robert Daines, CBS Laboratories, One Embarcadero Center, San Francisco, Calif. 94111.

(Continued from page 13)

about your membership include your membership number. Submit change of address promptly. If you are not receiving **Broadcast Engineering** magazine, provided as a courtesy by the publisher to SBE members at no cost, notify Virginia Doss. Letters to the Editor, Chapter News, articles, and other information for publication should be sent to SBE Editor, Joe Risse, P.O. Box 131, Dunmore, Pa. 18512. Articles need not be professionally written but they should be technically informative—diagrams can be hand drawn, but legible and accurate.

Chapter News

Chapter 1 - Binghamton, N.Y.
Chairman: Larry Taylor, WENY-AM-FM
Mark Twain Hotel, Elmira, N. Y. 14902

The chapter held its annual picnic on June 12th at the Newtown Battlefield Reservation, in the covered pavaillion. The chapter provided members, families and guests with hamburgers, hot dogs, beer, pop, paper plates and plasticware.

The next meeting will be in September. The preceding meeting was held jointly with Chapter 2 (Northeastern Pennsylvania) and Chapter 22 (Central New York). Scenes taken at that meeting are shown in this issue of the **Journal**.

Chapter 2 - Northeastern Pa.
Chairman: Paul Evanosky, WVIA-AM-FM
Old Boston Road, Avoca, Pa. 18640

Charles Hallinan, a former SBE president, was the guest speaker at the June 4th meeting at the studios of WVIA-FM-TV. Hallinan, who has made himself available for meetings of other chapters in this region described broadcast equipment manufactured by his employer, CCA Electronics. Several items of equipment were also on exhibition for close examination by members and guests. Included were a new RF amplifier and a modulation monitor. A question-and-answer session was included. While the next official meeting was scheduled for September, members were invited as in previous years to attend a clambake scheduled for sometime in July with the Luzerne County Radio-TV Service Technician Association, to be held at the Irem Temple Country Club, Dallas, Pa.

After-Dinner Scene at Joint Meeting of Chapters 1, 2, and 22, held at the Owego Treadway Inn, Owego, N.Y. Dinner preceded talk by guest speaker Otis Hanson, Chief of Existing Facilities, FCC, Washington, D.C. Broadcast Engineers from the Binghamton, N.Y., Syracuse, N.Y., and Scranton-Wilkes Barre, Pa. areas were well represented.

Chapter 9 - Phoenix, Ariz.
Chairman: Charles Deen, KOOL-TV
511 W. Adams, Phoenix, Arizona 85003

Delaun Rester, vice chairman, presided over the April 12th meeting at Shakey's Pizza Parlor; the host was Dalis Electronics. Reports on the NAB Convention and SBE Annual meeting were provided by Cliff Stephens, KTAR; Al Hillstrom, KOOL; and Roger Johnson, KOY. On May 18th chaired the meeting at the College of Medicine, University of Arizona, at which Ed Fitzgerald and Dick Johnson of Sparta Electronics described Sparta's new FM exciter, stereo generator, and FM transmitter. Members from the Tucson area scheduled a special get-together for May 24th to discuss a possible chapter for Tucson.

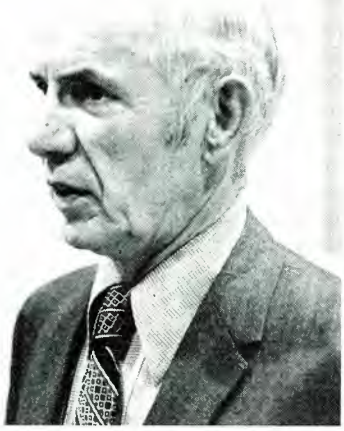
Chapter 15 - New York, N. Y.
Chairman: John M. Lyons, WRRL AM 41-30 58th St., Woodside, N. Y.

Bernard Wise, president of CCA Electronics, was the guest speaker at the June 14th meeting, held at WQRX Presentation Theater, 229 W. 43rd St.; his talk was The State of the Art of Radio, Television, and The Industry in General, centering on new equipment recently introduced and ways of working around equipment you presently have. Those interested in attending future chapter meetings, which are held in the New York Times Building, and preceded by dinner for those interested in the cafeteria, may contact chairman John M. Lyons at 212-335-1600, or Art Silver at Gates Radio, 212-889-0790, or secretary Bob Woerner, WNEW TV, 212-535-1000. The next meeting is scheduled for September 9th.

Chapter 16 - Seattle, Wash.
Chairman: John Maxson, KETO-FM
17425 63rd Pl., S.E., Issaquah, Wash. 98027

The luncheon meeting on June 13th at the Norselander Restaurant was a feature program on the TV pickup of the Apollo 17 Recovery splashdown of last December, pro-

vided by NMT Manager Stan Carlson who told about KING-TV's Northwest Mobile Television truck, equipment, and personnel, all of which were aboard the TICONDEROGA carrier with NBC-TV. Bud Johnson, Technical Director, was nominated but lost out for an Emmy Award for his work. Bob Dietsch, of the local FCC office, presented his monthly report on commission activities.



Guest Speaker at recent Joint Meeting of Chapters 1, 2, and 22, held at Owego, N.Y., was guest speaker, Otis Hanson, Chief of Existing Facilities, Federal Communications Commission. Hanson Spoke on the internal workings of the FCC and provided a look at the why of past rules and regulations and discussed what to expect from the future.

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

Peirce Phelps discussed and demonstrated the Consolidated Video Systems Time Base Corrector at a June 25th meeting at Williamson's Restaurant. The meeting was preceded by a refreshment hour and dinner, all of which were handled by Ed Kushner of WCAU-TV. Information on future meetings may be obtained by phoning (215) 839-7000 and speaking either with Jack Jones or Ed Kushner. Scheduled dates for Fall meetings are September 24, October 22, and November 26.

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

On June 12th, dinner at the Dinkler Motor Inn preceded the technical session at WSYR where their new Vital production and on-air switching systems were demonstrated and explained. Eric King represented Vital Industries. The WSYR-TV production switcher features drift-free circuitry, enabling three mix-effects systems in a control panel no larger than most single mix-effects switchers.

The previous chapter meeting was the one for which Chapter 2 was the host, held in Binghamton.

Chapter 25 - Indianapolis, Ind.
Chairman: Joe Missick,
WISH-TV
1950 N. Meridian St.,
Indianapolis, Ind. 46202

Chairman Missick presided at the April meeting, held at the Holiday Inn, Northwest, which was mainly in honor of three retirees: Benny Weimer of WISH-TV; Hal Trosper, WIRE, and Martin Williams, WFMS. Plaques were presented to these veterans for their contributions to broadcasting. The May meeting, at the Television Department of the Indiana State University in Terra Haute, included a tour of the facility by Buddy Kline, chief engineer.

Chapter 30 - South Bend/
Elkhart, Ind.
Chairman: Chris Frederick,
WJVA
South Bend, Ind. 46624

The chapter met on May 17th at the CTS plant in Elkhart. Included was a tour of the plant, conducted by Jerry Ash and Max Long, both of CTS. The next meeting is scheduled for September. Members and those on the mailing list will receive advance notice. Others interested may contact Mark A. Carey, chapter secretary-treasurer, at WTRC, Elkhart.

The SBE now has one more active chapter, in Tucson, Arizona, as a result, at least partially, of enthusiasm and support generated by officers and other members of

Chapter 9, Phoenix. At the regular meeting of the Phoenix chapter on May 18th, H. J. Bart Paine called for an opinion of those present on forming a Tucson chapter. Unanimity resulted in the first regular meeting of the Tucson group on May 25, 1973. Bart Paine and Charlie Glickman are acting as the Chairman and Secretary, Pro Tempore, respectively. Voluntary committees of membership and elections were voiced by Bob Hendrickson, Armand Sperduti, Charlie Glickman, and Rich Heatley. The assistance and direction of the Phoenix chapter, namely Chuck Deen and Roger Johnson were cited as being especially valuable.

Future meetings of the Tucson chapter will be reported in the listings of other chapter meetings.

Use Your Journal

Through these pages, provided by special arrangement with the publisher of **Broadcast Engineering** magazine, members of the Society of Broadcast Engineers may now communicate with each other; SBE headquarters can pass along information to the general membership; SBE chapters can report and announce information concerning their meetings or other activities; and we can air issues of vital concern to all of us who are employed one way or another in the field of broadcast engineering.

A means of communication is vital to any organization. Let's utilize this unusual opportunity which is now available.

The first meeting of the Tucson, Arizona chapter. Front Row, left, George Wickle, Armond Sperduti, Richard Heatly, H. J. Paine. Second Row, left, Dick Ward, Bob Hendrickson, Tom Inman. Third Row, John Chitwood, Roy Holsdaw, Bob Collett, Roger Johnson. Last Row, Gene Kuklin, Bob Wilson, Charlie Glicksman, Kevin Windren, Tony Novak.

NAB Committee To Review TV Code Fees

Robert F. Wright, president, WTOK-TV, Meridian, Miss., and chairman of the Television Board of Directors of the National Association of Broadcasters, has appointed committees to review the fee structure of TV Code subscribers and to develop methods of informing the public about the effect pay television will have on free TV.

Named to the Television Code Dues Committee were Peter Storer, executive vice president, Storer Broadcasting, Miami Beach, Fla., chairman; Leslie G. Arries, Jr., vice president and general manager, WBEN-TV, Buffalo, N.Y.; Walter Bartlett, senior vice president, Television, Avco Broadcasting, Cincinnati, Ohio; George Comte, general manager, WTMJ-TV, Milwaukee, Wis.; Richard W. Jencks, vice president, Washington, CBS, and Ray Johnson, executive vice president and general manager, KMED-TV, Medford, Ore.

The committee on pay-TV consists of Willard E. Walbridge, senior executive vice president for corporate affairs, Capital Cities Broadcasting, Houston, Tex., chairman; Eugene S. Cowen, vice president, Washington, ABC; George Gray, vice president, Washington, Avco Broadcasting; Richard W. Jencks, vice president, Washington, CBS; Peter Kenney, vice president, Washington, NBC; Dale G. Moore, president, KGVO-TV, Missoula, Mont., and Fred Weber, executive vice president, Rust Craft Broadcasting, New York, N.Y.

"WILL YOU EVER CATCHUP WITH YOUR STATION METER READING?"

Rebuilding WFMS, or . . . .

A new approach to broadcast facilities

By Bobbi Simmons

The clock in the production studio stopped at 1:53 p.m., then a fire of unknown origin silenced WFMS, the oldest commercial FM station in Indianapolis, Indiana. It was Friday, February 2, 1973.

At 10:49 p.m. on Sunday, just 57 hours after the fire, WFMS returned to the air, with full power and in stereo, with the "Good Life" sound of music. Working conditions were very primitive, but at least they were on the air.

The happy conclusion that you see pictured on **Broadcast Engineering's** cover this month occurred when WFMS moved into its new, fully equipped radio center on May 9, 1973. Only 14 weeks after the tragedy, WFMS was at home in a permanent new broadcasting facility, custom designed and built for them. How was such a speedy recovery possible?

Ron Voss, station manager of WFMS, began the story with the hectic weekend following the fire. When they could get back into the ruins, staff members salvaged what records and files they could. A motorcade formed to take everything to the program director's apartment, a temporary office. At that evening's staff meeting, amid somber talk, a staff resolve was formed to get back into operation as fast as possible. They agreed: "We're a team. Let's get WFMS back on the air!" That dedication, and the help they got from their parent company and some suppliers, made a fast comeback a reality.

On Saturday after the fire, corporate management people from Susquehanna Broadcasting Company, owner of WFMS, and engineers converged on Indianapolis. New equipment was rush ordered. Susquehanna stations in Ohio and Pennsylvania began reproducing the WFMS music tape library. Many offers of assistance, such as loaned office furniture, came in during that weekend.

On Saturday, two portable buildings, each about 8 x 10 feet, were placed next to the tower. Sunday, a new transmitter arrived from New Jersey. Voss flew to Chicago to pick up a new audio console. Rick Bernard, program director, retaped commercials and production materials at Susquehanna's Cincinnati station. Fifty-seven hours after the fire, WFMS came alive again.

Fig. 1 Station Manager Ron Voss and Program Rick Bernard get operations underway in their new WFMS facility. (Photos by McGuire Studio, Indianapolis)

Getting Back To Normal

How to get back into a permanent operating facility, however, remained a big problem for Ron Voss. He wanted to get out of the little portable buildings as soon as possible. Sounds of demolishing the rubble went right through the temporary studio's thin walls. A nearby train track didn't help much either. Months on the air with that kind of sound pollution wouldn't do much to get the station's new sound of the "Good Life" off the ground.

Of course, one of Voss's alternatives was to rebuild a conventional building on the same site. Any

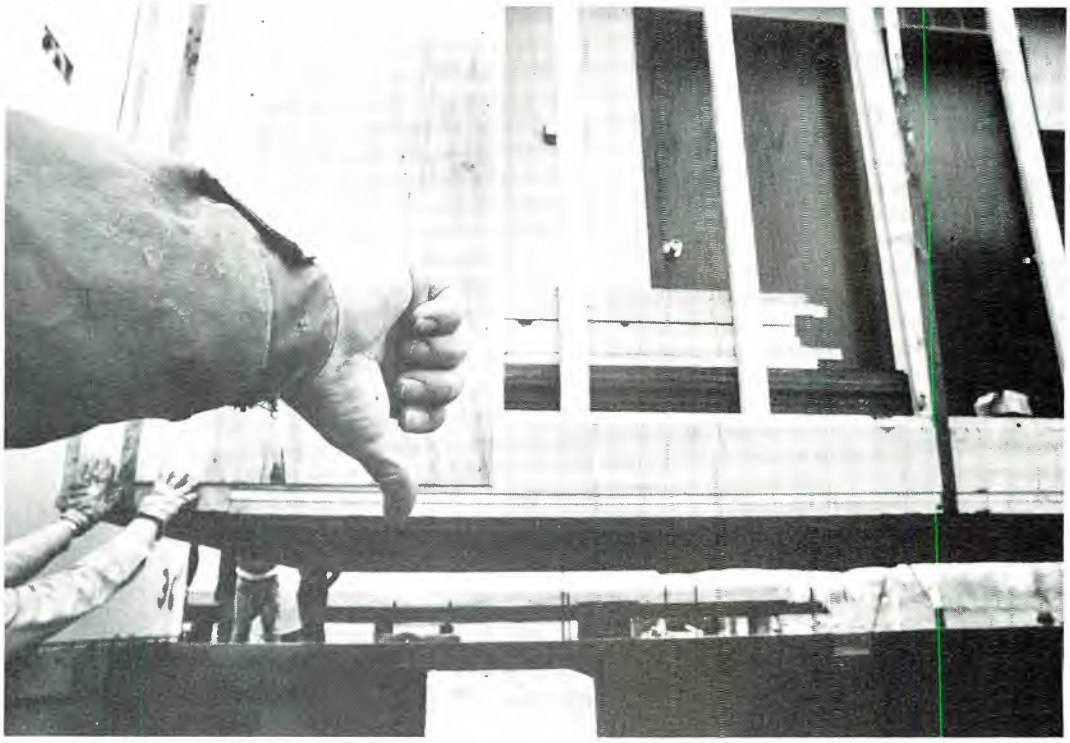


Fig. 2 As you can see in the detail of this picture, the WFMS structure was pre-built inside the SAI factory before being hauled to the new site. Note that the doors are already hung, and even the thermostat is wired in.

on-site construction begun during an Indiana February, however, would have an uncertain completion date at best.

As another alternative, Voss considered movable offices and other mobile home-type structures that would be available immediately. All WFMS would have to do is move them in . . . . and convert them into a radio station. That job would be difficult, particularly in terms of acoustics and soundproofing. And their appearance wasn't satisfactory to Voss for a permanent home for WFMS. He decided against movable buildings; but he didn't want to wait months for on-site construction, either. In talking to building contractors in Indianapolis, he found a third construction alternative that sounded good.

Structures of America, in Elkhart, Indiana, makes custom-built modular commercial buildings. The reason SAI looked so interesting to Voss is that their construction methods are identical to methods used in on-site conventional construction, but SAI produces a new, custom-designed building in only 6 to 8 weeks from its order.

A radio station, of course, has special construction needs in terms of acoustics and electrical wiring

A COMPARISON OF CONSTRUCTION METHODS

(based on an investigation of costs in Indianapolis, Indiana, in February 1973)

Building method	Cost	Flexibility	Time necessary for completion
Conventional on-site construction	$33 per sq. ft.	Completely versatile	At least three months
Steel buildings	$25 per sq. ft.	Completely versatile	7 to 8 weeks for steel delivery plus 60 to 90 days for finish
Temporary buildings	$15-$16 per sq. ft.	Have to be remodeled for soundproofing	4 to 5 weeks for delivery plus in-field alteration
SAI commercial buildings	$23 per sq. ft.	Completely versatile	6 to 8 weeks

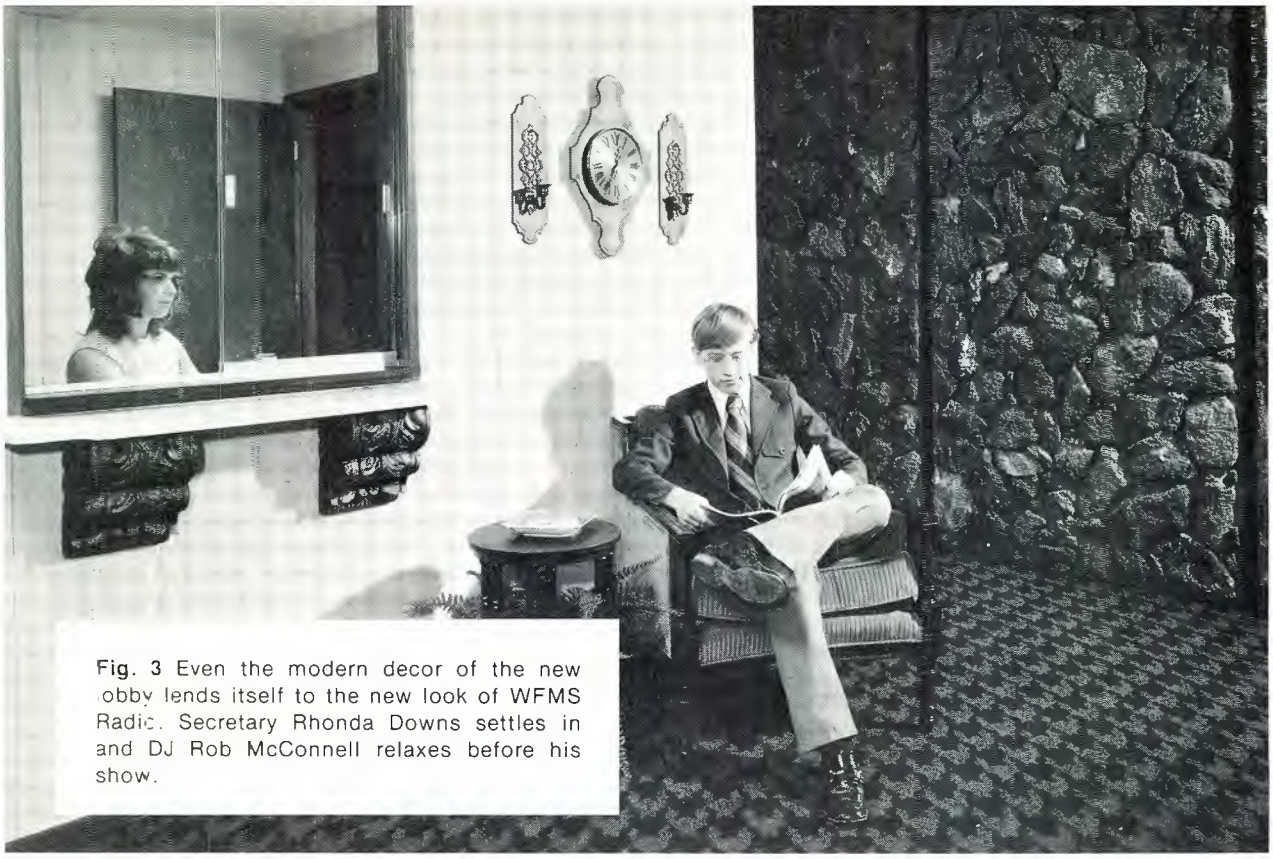


Fig. 3 Even the modern decor of the new lobby lends itself to the new look of WFMS Radio. Secretary Rhonda Downs settles in and DJ Rob McConnell relaxes before his show.

Fig. 4 Chief Engineer Rick Martin doubles at the new board.

Management Highlights

In an effort to serve the decision-making team, this magazine has covered many major facility design changes. We've gone from renting, to complete facility design, and on to even the use of mobile homes. Recently, we found a new approach: the modular broadcast building. We think you'll find this building concept interesting.

that no mobile structure can fill without extensive remodeling. Any such special feature, however, can be built into a modular building right at the factory, just as it can in conventional construction.

Since SAI buildings are built in the factory, delays of weather and work crew holdups don't affect completion of the building. This approach extends the construction season to a full 12 months. And the units can be built to assemble in any configuration, even to make a two-story building.

Hold Everything

At first, Voss was skeptical. "The idea of modular construction meant less than optimum construction methods to me, based on what I knew about other modular companies," Voss said. "I was afraid it would compromise the quality I wanted in a permanent facility. But Ernie's sales story did sound convincing, so I decided at least to check it out."

Voss visited two other modular radio stations which SAI had built — WMEE in Fort Wayne, Indiana, and WSJM in St. Joseph, Michigan. He saw the custom-designed construction SAI had done for them, then went to SAI's plant in Elkhart to see how they did it.

He learned that SAI doesn't make units of typical residential-type construction, and then call them offices. They can't because of building codes. "Commercial building codes are much more strict than residential codes, especially in Indiana," according to Lou Britt, SAI's marketing vice president. "The quality of modular construction becomes apparent just in comparing module weight. A residential unit will weigh about 10,000 pounds; an SAI commercial unit of the same size (about 12 x 48 feet) weighs between 22,000 and 24,000 pounds," Britt said.

Because these buildings are all custom designed, the customer gets a true broadcast facility. WFMS is a good example. They looked at a small rough sketch of WFMS's space needs. Then they drew up a set of plans to meet that layout and include all the special acoustical and electrical requirements.

A New Look, Too

Voss chose the kind of look he wanted the building to have. He had a choice of any number of factory-applied wood or prefabricated masonry sidings to complement SAI's bronze frame and

Fig. 5 Steve McNeal, amid a completely new array of Control Room equipment, renews the WFMS "Good Life" sound approach to programming.

tinted windows. He found out that the units could even be bricked on the site, if he wanted brick. He chose a contemporary rough-sawn grooved cedar siding, stained brown, and panels of Sanspray[R] aggregate stone siding for accent. A mansard roof of shake shingles was put on the WFMS building after the units were set in place to add another design element to its contemporary lines. Inside, Homasote decking, made of 100 percent recycled wood fiber, was chosen in 1-7/8" thickness to soundproof the studios effectively.

Four weeks after Voss told Ernie Dallman to order the SAI building, it was time for a party. The occasion: watching a gigantic crane hoist the six SAI units into place.

Voss summed up his decision to go with modular building. We did consider every alternative carefully. SAI could give us exactly what we needed in building design . . . . and in a very short time. And we've saved about 20 percent over the cost of building the same thing by conventional means, not to mention the time involved.

Can there be anything good about a fire? Certainly not by design, but WFMS does have a new, modern radio center. And the staff was able to put their good humor to work to make the most of their difficulties in the meantime. The fire became a sales promotion, too, on the air: "Too hot to cool down." "WFMS is carrying a torch for Indy." "Stereo 95.5 has crossed burning bridges to bring you the sound of the Good Life."

WFMS also ran a fire-prevention promotion. Listeners were encouraged to write in for a pamphlet on preventing fires.

The WFMS staff gained something personal from the fire, too. They know how to be humble, if they didn't before the fire. And they learned how to be grateful—in this case, to each other, the company, and everyone who helped them get WFMS back together again. Their cooperation and hard work to resume operations are indicative of the staff's dedication to the business of broadcasting. After all, as Rick Bernard said in his post-fire commentary, "When you're hot, you're hot!" □

Editor's Note: While BE is in no position to pass judgement on facility construction detail, we do believe the modular construction concept will add an interesting alternative for the decision-making team. More than half of our readers are operating today from facilities that were not designed for their current tasks. Because of this, these facilities may always get in the way of progress and profit, not to mention station electronics.

The quality that TAV produces is like the camera it uses.

Trans-American Video does great work. They really have an eye for video tape. In fact, they're quite a unique video facilities company. When it started in business over a year ago, it ordered nine of the first Fernseh cameras sold in the U.S. TAV used those cameras to cover the U.S.-Russia track meet and then proceeded to become the world's largest independent mobile color video tape facilities company. Their current credits include NFL Monday Night Football, Young Dr. Kildare series, Burt Bacharach in Shangri-La special, Duke Ellington . . . We Love You Madly special, and Frankenstein, Parts I and II feature.

Today, TAV has over $8 million worth of equipment. And here's what they have to say about Fernseh cameras:

"It took only a short training period for our operators to learn to use the cameras, and for the cameras to establish themselves as quality pieces of equipment."

"The Fernseh cameras are easy to set up and strike. Once they're registered, they're extremely stable. A video operator does not have to continually ride the pictures."

There's a lot more we can tell you about the family of Fernseh cameras. Interchangeable modules. Small diameter cabling. Performance specifications, etc. For more detailed information, contact your local Fernseh division representative at one of the offices listed below.

Chicago Hdqts. (312) 681-5000
Houston (713) 681-8461
Los Angeles (213) 649-4330
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Ramsey, N.J. (201) 825-1550
San Francisco (415) 583-9470

Robert Bosch Corporation Fernseh Division

the wings of vision

Antenna and transmission line protection

By Pat Finnegan
BE Maintenance Editor

Coaxial transmission lines and antennas used in television and FM service, are important and expensive investments. This is the final link between the station and its audience. What makes the problem of greater significance is the fact that the major part of this equipment is in a rather inaccessible location and can't easily be inspected on a daily basis.

There is one unfailing barometer of pending problems up the line and antenna, and this is the reflected power back down the line — the VSWR. It only makes sense, then, to use this reflected power to protect the line and antenna system.

The protection unit is a relatively simple device that is manufactured and sold under several trade names. This sentry unit monitors the VSWR at the sending end of the line. If the VSWR rises above a value which has been preset on the unit, it will turn the transmitter off automatically. Not only that, but it also will not allow the transmitter to be returned to the air until the fault has been corrected, or the unit itself disabled.

The heart of this sentry unit is a meter relay. Voltage derived from the reflected power by a diode is measured by the meter which is a DC movement. But contained within the meter is a relay that is actuated by the meter hand itself as it passes a preset trip point (or the meter hand may operate photoresistors which in turn operate the relay). When the internal relay contacts operate, these usually operate an external relay. The external relay may have higher rated contacts than that in the meter and these contacts of the external relay, then, open the transmitter interlock circuit.

To assist getting the transmitter on in the morning, there is usually a delay circuit or a time delay relay in the unit, set for 1 or 2 seconds. This and the other few components of the unit are generally panel mounted for mounting in a rack.

Three inputs to the sentry unit include: 120 VAC for internal use, DC sample voltage from the sample diode, and connection to the transmitter interlock circuits.

VSWR is a ratio between the forward and reflected power, so the sentry unit must be calibrated if it is to read VSWR correctly. During the calibration process, the transmitter forward power and the transmitter power raise/lower controls

Management Highlights

A VSWR meter or sentry unit are transmission line and antenna quality indicator devices. They can indicate developing problems and - as in the case of the sentry unit - protect transmitting equipment. The decision making team should have this in mind the next time transmission line and transmitter problems or changes are discussed.

The sentry unit should be a vital protection unit in your system. This unit, called the "Watchdog", is shown in the rack at WLBC.

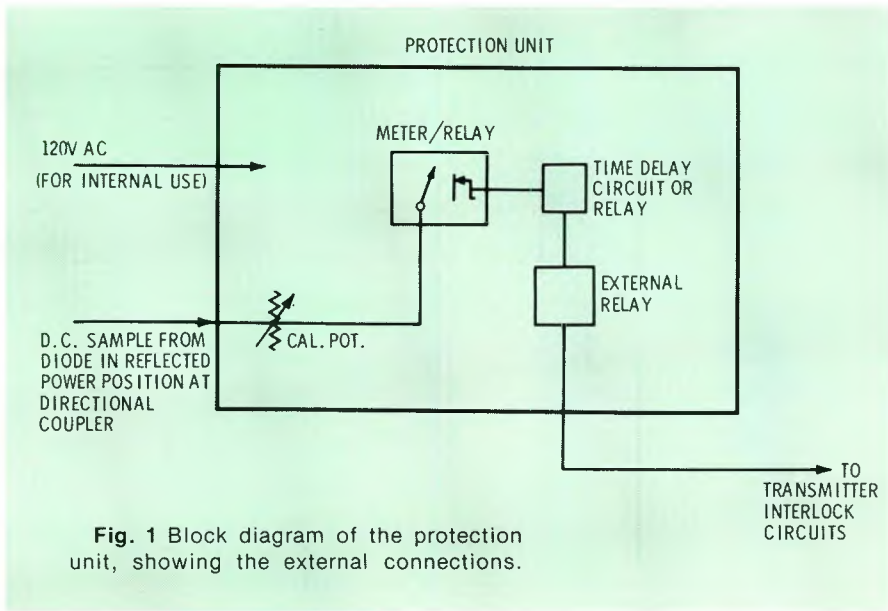


Fig. 1 Block diagram of the protection unit, showing the external connections.

We'd like to sell you a product that isn't working.

Color television took years to perfect. But the potential was there.

We have a product with great potential. Perhaps you've heard our name, but not known what we do. We're the National Alliance of Businessmen. We're in business to help America's disadvantaged citizens. Products of the ghetto, poverty, poor education and life's bad breaks. Our purpose is to make the American system work, by seeing that everyone who wants to work can become a fully participating citizen.

If you read on, you'll see why 30,000 NAB participating companies have found it good business to employ and train a million disadvantaged persons. Why thousands of talented executives have been loaned to us by America's leading corporations.

We were formed by presidential mandate to serve as a catalyst between government and business. Business provides the jobs and government finds the persons to be hired and trained. Most companies pay the training cost themselves. Companies that cannot afford to take on the task of employing and training the hard-core unemployed can be given financial support by the government. We think this partnership between business and government is a good way for our society to deal with its problems.

We have programs that deal with the hard-core unemployed. Hiring, training and retraining the disadvantaged across America. Transforming the disadvantaged into full citizens —people with hope, training and the experience that helps them move within our society.

Our youth programs represent the preventive side of the Alliance. If we can keep kids in school, they'll be less likely to fall into the continuing cycle of poverty. So we have programs to give disadvantaged youth summer and year-round employment and training, and others designed for career guidance, motivation and practical business education.

And because thousands of Vietnam-era veterans are having trouble finding jobs, we have responded to a presidential request to find jobs for hundreds of thousands of Vietnam-era veterans.

With 500 full-time loaned executives manning offices in 164 cities, we are fully committed to helping the nation solve one of its most pressing problems.

As President Nixon has said:
"The National Alliance of Businessmen has displayed a remarkable capability to mobilize the American business community in response to a national problem."

We have a product to sell. And programs that make it easy to buy. Contact the National Alliance of Businessmen. Help us get our product and our country working.

The National Alliance of Businessmen.
The Jobs People
1730 K Street, N.W., Washington, D.C. 20006

are used to simulate high VSWR conditions.

Turn on the transmitter and make sure it is loaded with the normal line and antenna. Adjust its power output to 100 percent on its regular power meter. Now, at the sentry unit, rotate its trip control to the far right, which is about 120 percent. This will allow calibration without the unit tripping the transmitter off. Connect the input lead of the sentry to the Forward Power diode, after disconnecting the transmitter meter lead from the diode. The sentry should now read the transmitter power output, but probably not 100 percent. Turn the calibration potentiometer on the unit until the meter reads 100 percent. The unit is now calibrated for 100 percent power forward.

To calibrate the trip point, reduce the transmitter power output by its own controls until the meter on the sentry reads about 1.1 VSWR. Now rotate the trip adjustment pointer until it is setting at 1.3 VSWR. Slowly increase the transmitter power until the unit trips the transmitter off. Try this two or three times. Each time the unit trips, you must reduce the power below the trip point and then push the reset button on the unit.

Meters often are not exact, so the trip may be slightly different than the setting. For example, the trip point is set at 1.3, but it actually trips at 1.35 VSWR. Take this into account when setting the final trip point. For sentry use, you can set it to trip at any figure you desire, but 1.3 is a typical setting. The higher the power of your transmitter and the closer to ratings the line and antenna are working, the more you may desire to set this trip point much lower.

The unit is now calibrated, so lock the calibrating controls and restore the connections to the diodes at the coupler. The Forward Diode will now feed the regular power meter on the transmitter, while the reflected power diode will feed the sentry unit. The meter on the sentry unit will now be indicating the actual VSWR at the sending end of the line.

Only minimal maintenance is required on the unit, and this is basically inspection during the normal transmitter inspections, and some checkout out maintenance during "after signoff" maintenance periods.

During inspection, note the VSWR reading. If the reading shows zero VSWR, congratulate yourself on a perfect line only after the unit has been checked out. More than likely, it isn't telling the truth. But don't resort to tapping or wiggling wires. You may trip the transmitter off the air. Temporarily, borrow the diode from the forward position and substitute it for the reflected diode. If the meter now reads, the diode is defective. Don't switch the cable positions, interchange the diodes only! You still want to read reflected power! If the diode is OK, you can't go any further without taking the transmitter off the air.

After sign-off, you can check out

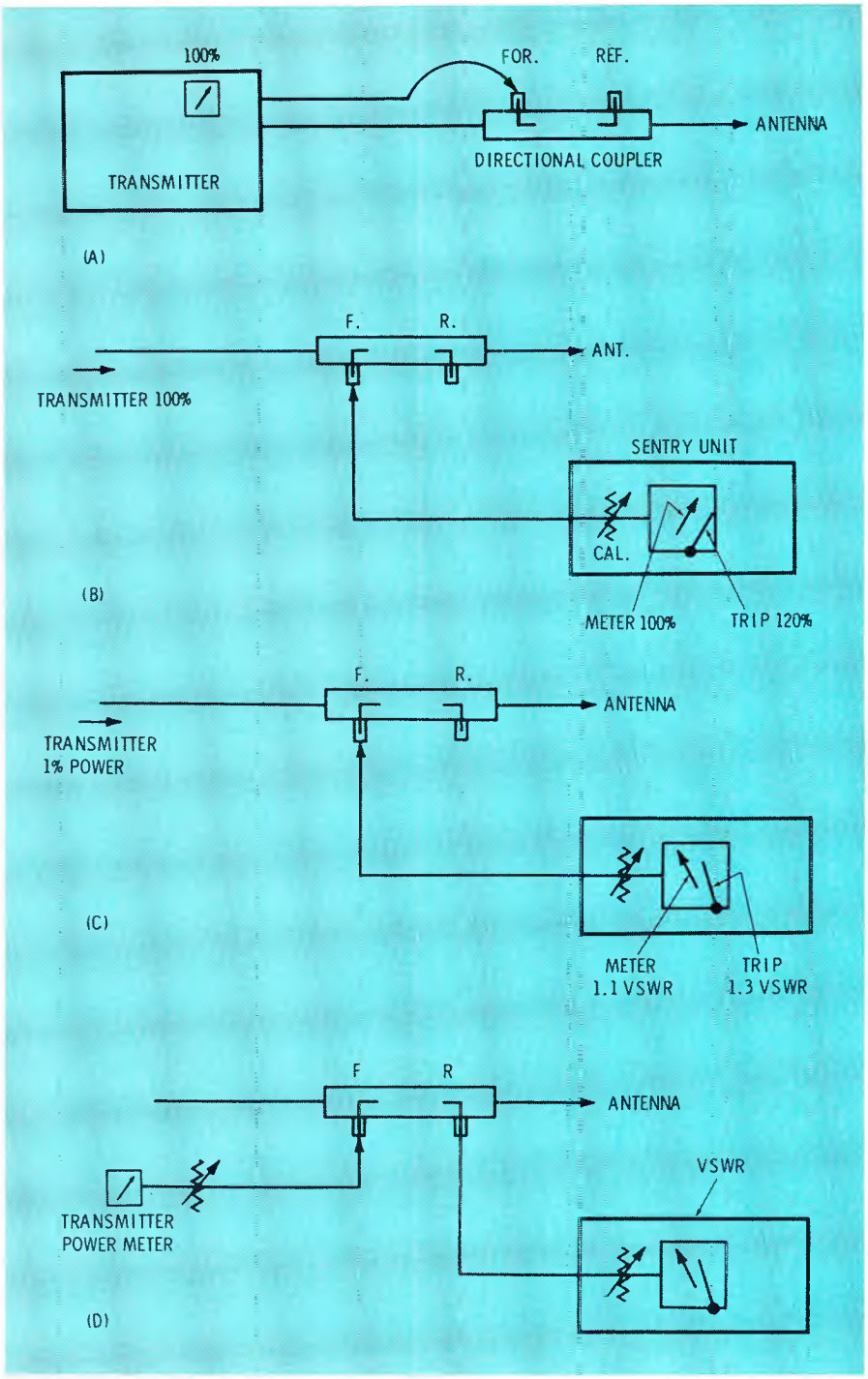


Fig. 2 Calibration procedure and normal connections: **(A)** Adjust transmitter output to 100 percent; **(B)** Set trip control to 120 percent and adjust Cal pot for 100 percent. Lock Cal pot; **(C)** Reduce transmitter VSWR to 1.1 and set trip for 1.3. Increase power until trip occurs. **(D)** Normal operation: Forward diode feeds transmitter power meter; reflected diode feeds sentry and measures VSWR.

the cable with an ohmmeter. Work from the diode end, then at the input to the unit, and at the meter. At the meter itself you will be past the calibrating resistor, so use a resistor in series with the ohmmeter lead, otherwise you can damage the meter (if it was OK in the first place). Should the meter relay be defective, it is less expensive to replace it than to repair it.

If normal readings are obtained on a daily basis, during sign off maintenance, occasionally, check out the trip of the circuit. Follow the regular setup, although it isn't necessary to do the whole procedure. Just reduce transmitter power to about 1.1 and then change the leads to the diodes. Increase power until the unit trips. Doing this occasionally will assure you that the unit is working properly.

Other areas to check during this maintenance are the external relay contacts and connections. Clean any burnt contacts or replace them. If the relay is the type with non-replaceable contacts and they are badly burnt, replace the entire relay. Erratic contacts on the relay are the same as loose contacts on the interlocks in the transmitter, and intermittent transmitter outages are a possibility.

Lightning can cause high line surges, and these surges can cause the relay contacts to burn off or burn together. Such surges can also damage the internal relay in the meter. If such failures do occur, you may not be able to get the transmitter on the air at all. Disconnecting the unit entirely from the transmitter is the best procedure in this case. This will also allow removing the unit to the bench for repairs.

To remove the unit, make sure power to the transmitter is turned off, because the interlock voltage will be in the unit. Then disconnect its local AC power. Next, disconnect the leads that connect to the transmitter interlocks. Ordinarily, these are connected to a terminal strip on the sentry unit, so they are easy to disconnect. These two wires are a series connection of the interlocks normally through the sentry relay, so you now must connect them together. But rather than twist or solder them together, use a bolt and nut. This will preserve the wire lugs when you will reinstall the repaired sentry. Make sure all the bare surfaces of the connection are taped to prevent shorting out the interlock voltage.

If the meter relay itself is defective, try to get an exact replacement from the manufacturer. Before you

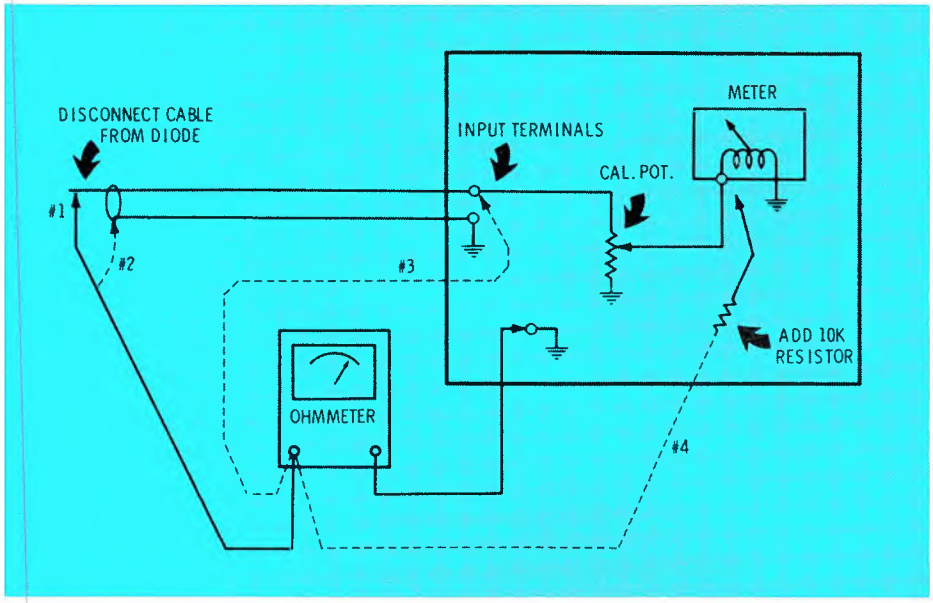


Fig. 3 You can check the meter circuit with an ohmmeter. Disconnect from diode, and make sure transmitter is off. Add a series resistor to the lead when checking the movement itself.

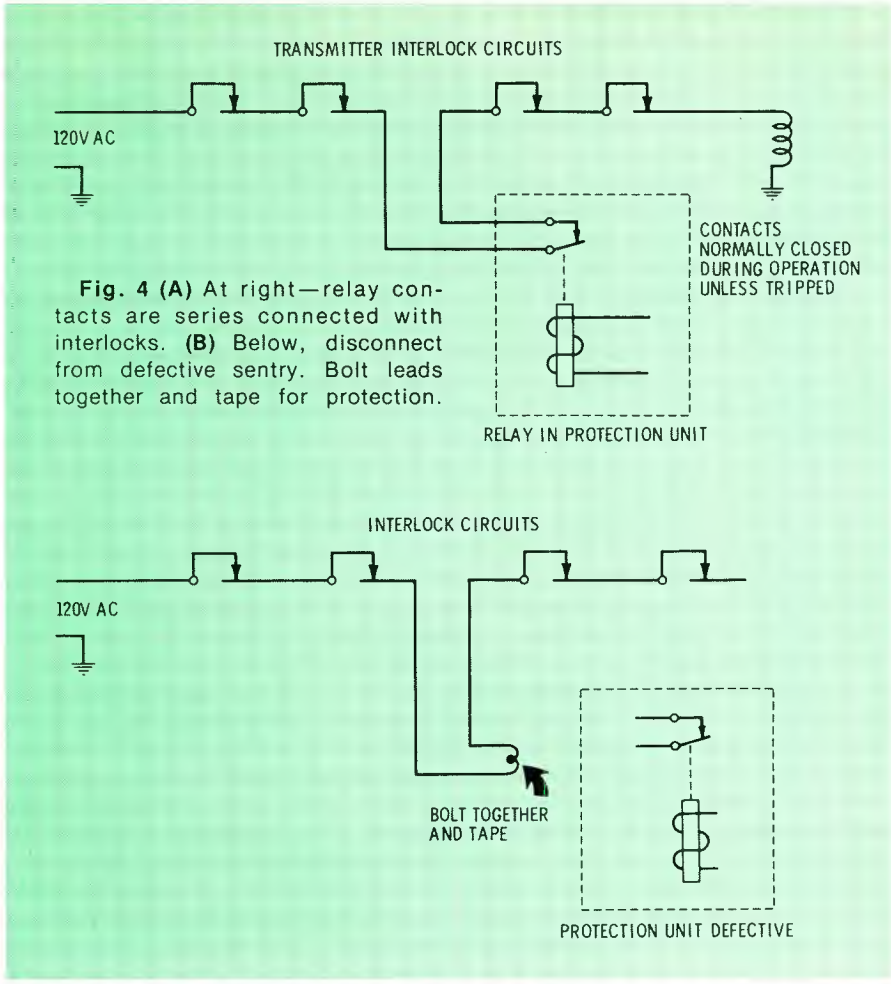


Fig. 4 (A) At right—relay contacts are series connected with interlocks. **(B)** Below, disconnect from defective sentry. Bolt leads together and tape for protection.

strip off all the leads to the old meter, you should make a rough sketch of the wiring, terminals, wire color coding, and compare this with the schematic for its operation.

The meter you get for a replacement may not be an exact replacement either electrically or physically. Sometimes the manufacturer will change the type of meter they are supplying. This is OK so long as you don't have too many physical modifications to make. If it is a different model of meter, make sure there is a schematic sent along with it. The meter may have a schematic imprinted on its case which will tell you what you need to know. Unless the meter is exactly the same as the one you took out, don't wire it up without a circuit diagram. You can't assume that the terminals are wired internally the same as the old one. If you wire it up incorrectly, you can burn it out as soon as you plug it into the AC power.

During normal operation, the unit simply monitors the line. But you may have to operate in abnormal periods, such as sleet or icing at the antenna. The VSWR will rise because of the antenna detuning and will trip the sentry. Even though the VSWR is higher, you can still operate if you reduce the transmitter power. How much you reduce the power will depend upon how close to maximum ratings you are operating the line. As far as the sentry is concerned, it is calibrated at 100 percent power and is reading the reflected power. Reducing the transmitter power will not change the ratio, but it will reduce the actual amount of reflected power. The unit won't trip so long as the amount of reflected power does not cause the meter to rise above the trip point. The meter is not indicating true VSWR under these conditions, because it is now essentially uncalibrated.

The cost of the sentry unit is small in comparison to the investment in the antenna and line, to say nothing of the days the station could be off the air to replace a burned up line or antenna. Some stations have operated for years without such a protection circuit and have never had problems, but then, everyone can't be that lucky.

The Impatient Listener-Alarm

The arrow points to the WDZ impatient listener alarm. Such alarms are vital to automated stations.

By Fred Moore
Station WDZ
Decatur, Ill.

Build up this circuit on a 3 x 3" piece of perfboard, mount it on a 3" rack panel with a miniature speaker and a switch or two and you will never have to ask the question, "Are we on the air?"

Lose either modulation or carrier and this little wailer screams bloody murder until both return or until somebody kills its power. It doesn't holler on short lapses of audio, either. I built mine for 30 seconds of "patience". You may choose to "empirically determine" (cut-and-try) the value of C1 for a different interval.

Circuit Description

Transistors Q2 and Q3 form a "siren" generator, giving the alarm its voice. This part of the circuit is straight out of the RCA Hobby Circuits Manual. Adding Q1 gives us a delayable switch on the oscillator operating at very low base current. This way we can use plenty of R and C to get all the time delay we want.

Rectified audio from the 8-Ohm speaker output of the modulation monitor drives Q1, holding it saturated. The siren generator can't operate this way because Q2's base is too negative. But when the audio disappears (for any reason - carrier off, program line failure, etc.) C1 bleeds into Q1's base circuit through the 100K resistor. When the charge is about gone, Q1's collector resistance lets Q2's base go positive enough to start the awful racket, which promptly gets worse as C2 charges. The frequency stabilizes long before your nerves do, and the urge to do **something** to cause quiet soon gets irresistable.

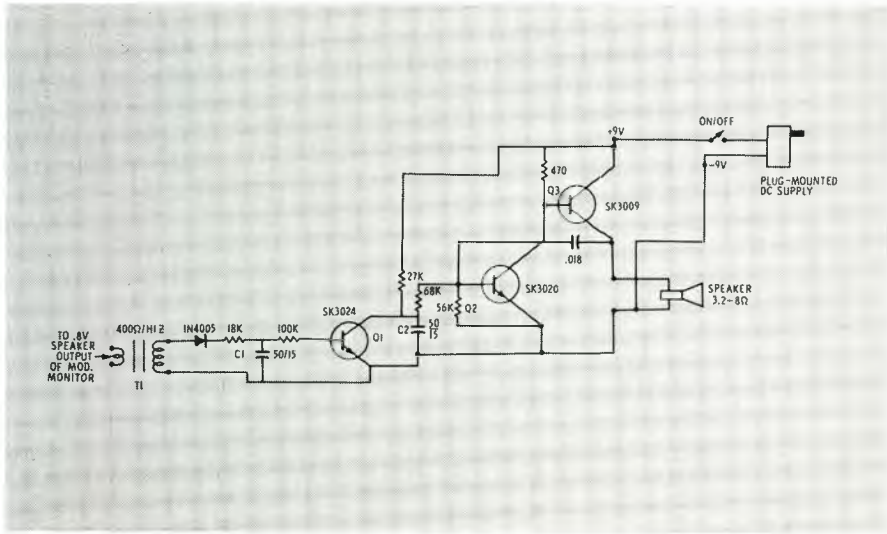
The only connections to the little monster are about .8 Volt of input audio from the modulation monitor and 9 Volts of DC power. I powered mine from one of those small black boxes built on the back of an AC plug. They're normally used to run a transistor radio without batteries. Don't forget the power switch or you'll have an instant insanity machine.

In Operation

This alarm is in use at WDZ, a daytimer, so each signoff checks the circuit daily. At a 24-hour station, a normally closed push-button in series with the input might prove a safer test than taking the transmitter or program off, a practice that is still generally frowned on by management.

If you want to use some other audio source, play with transformer impedances and the 18K resistor so that your circuit doesn't load its source. Normal levels should produce about 10 Volts of DC across C1, measured with a VTVM or equivalent.

Happiness is knowing for sure you're on the air. □



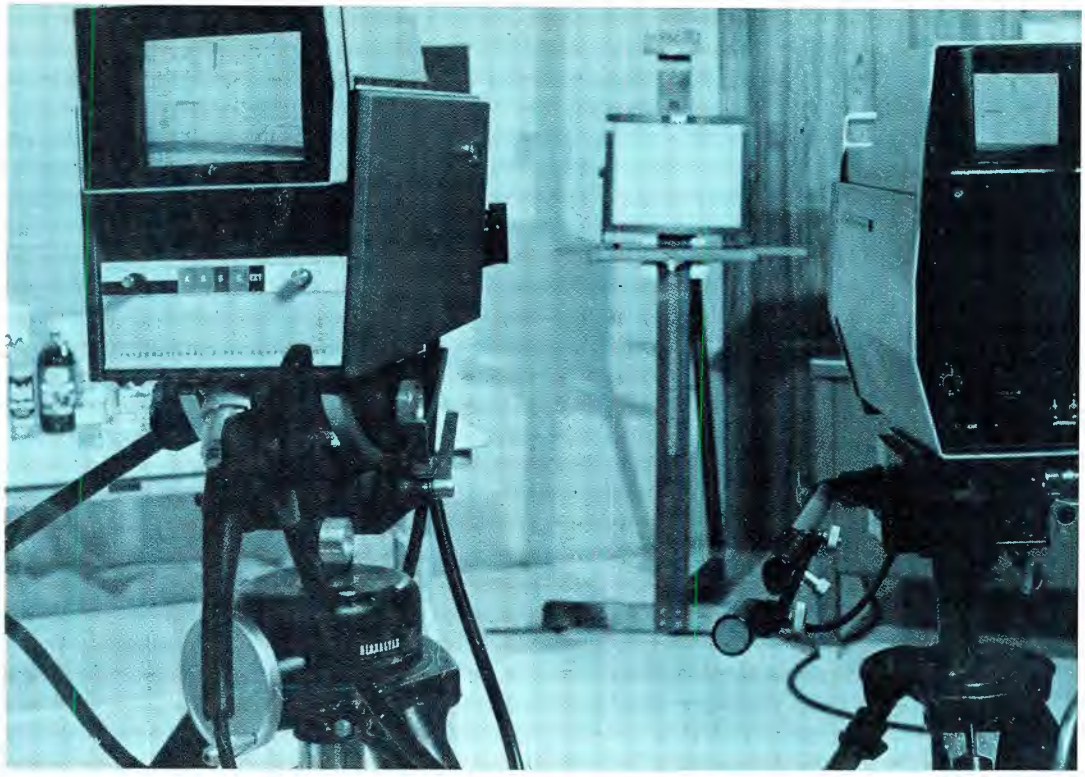


Fig. 1 Here you see two cameras being tested and compared. Note that first set up against a test pattern. Then they will be pointed at a test scene.

Part 2

Color camera basics

By Joe Roizen

Telegen, Mountain View, Calif.

A three-tube color camera is essentially three monochrome cameras in which the images from the individual pick up tubes have been super imposed on each other. The process of setting up a color camera is a fairly complex sequence of amplitude and positional adjustments that establish the correct colorimetery and the proper geometry of the image.

The best evaluation of performance and stability of a color camera can be made with a precision RGB monitor connected directly to the camera outputs ahead of the encoder. After a sufficient warm up period (30 minutes) the camera should exhibit essentially the same colorimetery and acceptable registration for at least four hours and should require little readjustment when turned on again the next day.

Colorimetery drift is especially noticeable if two or three cameras are color balanced and matched to each other at the start of a production and then progressively exhibit relative color shift while being switched on the same scenes. While less subjectively annoying, registration drift will slowly decrease image resolution in an RGB camera to the point where the set up procedure must be repeated.

Cameras with YRB matrixing are almost immune to normal small registration drifts which occur in most cameras over an eight-hour period. Very expensive studio cameras have automatic corrective circuits for white balance and registration as optional features on them. These extras are not available on the lower cost cameras and they must depend solely on the basic stability of the circuitry to provide adequate performance.

Special test charts are available for testing resolution, registration and color balance. When using these charts it is important to assess performance over the entire image area and not just in the middle of the image. Cameras with poor scan linearities, mismatched yokes, poor internal optics, etc., will usually show significant fall off toward the corners.

Some cameras use full size optical images on all three pick-up tubes, others minify the red and blue image since theoretically these are limited acuity color channels. While both approaches are valid, the scans of the minified images may require dynamic correction to maintain good registration between the narrower scan angles of the red/blue tubes and the normal scan of the green tube.

Self Contained Versus CCU

Yet another variability in color camera configuration is the "Self Contained" versus "CCU" (camera control unit) type. Self-contained cameras are usually cheaper, lighter and simpler than the separate control unit type. They are preferable where equipment and personnel budgets are at a minimum and where the camera operator can double as a technical type and do his own setup, ride gain, adjust focus, vary iris and still frame in a pleasing picture.

Self-contained cameras have

built-in encoders and sync generators making them independant devices that can be easily moved to remote locations for out of studio coverage. However, they do have some disadvantages. Maintenance, measurement and manipulation are not as easy or as flexible as on a CCU type camera.

The CCU type camera is the most appropriate for studio or sophisticated remote application. The camera operator is concerned only with the mechanics and esthetics of image composition, framing, focus, pan, tilt, zoom etc., while the video controller handles the electronics involved with waveform monitoring, signal balance, iris adjustments etc.

The camera should have delegation controls allowing the transfer of various functions from the camera head to the CCU and vice versa. The CCU unit should permit final trim adjustments on registration and color balance, control of the iris, video gain and pedestal and an optional choice of degree of enhancement.

The associated waveform and picture monitor in the CCU should be switchable to a variety of test signals including individual RGB outputs, subtractive and additive matrixing for registration adjustment, field and line waveform rates and RGB sequenced displays (parade). The camera head should allow easy access to the main controls for initial setups and to the pick-up tubes for simple replacement and positive positional indexing. Provision for indexed gamma settings are also useful in setting up the camera. Some cameras can be used in either self-contained or CCU configurations, the conversion being accomplished easily.

Management Highlights

The author explains that camera comparison tests can tell you quite a lot about what you'll get after a purchase. He also explains how to make the tests and how to compare camera features from a cost/performance standpoint.

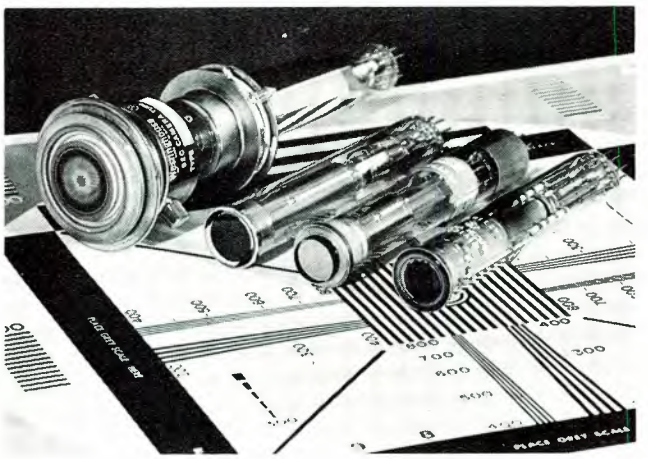


Fig. 2 Camera features and options can be almost bewildering. Your production needs are the first criteria. But if you ask why certain cameras are bought, the answer often is that engineers recommend cameras (and other equipment) to other engineers.

Viewfinders

The viewfinder serves as the major device by which the camera operator can frame and focus the image. It is important therefore to have a finder that has the following characteristics.

1. Maximum practical size for operational ease.
2. Good contrast and brightness range to combat high ambient lighting.
3. Video peaking to enhance edges and aid determination of critical focus.
4. Tiltable shading to accommodate unusual shooting angles or lighting conditions.
5. Easily removable in case of failure or for interchange.
6. External video-feed input to allow the camera operator to see special effect inserts, etc.
7. External output to feed outside monitor in case of emergency.
8. A high degree of reliability since the loss of the viewfinder function can severely handicap a production in progress.

Cable Compensation

The trend toward smaller cables between the camera and the CCU increases the need for compensating circuits to accommodate line losses in the cables. The camera should have adjustable cable compensation that can handle the longest cable that is expected to be used.

Peripheral Features

There are a wide variety of accessory or built-in features that may or may not be worth the added cost and complexity they engender. Here is a partial list of such devices.

1. Internal Sync Generator
2. Internal Gen Lock
3. Remote Iris and Gain control panel
4. Internal color bar pattern
5. Integral encoder
6. Built-in system test signal
7. G.G.B. Enhancer
8. Composite Enhancer
9. Switchable "paint pots"
10. Split audio systems
11. Internal filter wheel
12. Elapsed time indicator
13. Attachable diascope
14. Talley light defeat
15. Modification kits to upgrade performance.

Camera Comparison

The best way to compare color camera performance is by looking at the competing cameras at the same time and with the same subject material. Camera manufacturers are often reluctant to do

this because of the highly subjective nature of such evaluations and the direct exposure of each of their advantages and deficiencies to the competitors's staff.

Ideally, after a short set of instructions on how to operate each camera has been absorbed, the cameras should be left to the customers studio personnel to operate and evaluate against a check list of desired performance parameters. If a good VTR is available, then the results of each test can be recorded and kept for subsequent critical review. The suggested test procedure is as follows:

1. The cameras are optimized by the manufacturer's representatives to make sure they are operating properly and have no significant deficiencies.
2. A series of tests are conducted under the scrutiny of the camera company representatives and recorded with appropriate audio commentary.
3. The cameras are turned off and left overnight in the studio or allowed to cool to ambient room temperature.
4. The manufacturers representatives are asked to leave cameras for further testing without their presence.
5. The cameras are turned on and allowed to warm up for five minutes at which time a short recording is made of a registration and chip chart image on each camera. No controls are adjusted at this time!
6. A further warm up period of at least 25 minutes is allowed and with no control adjustments the cameras are evaluated with registration and chip charts again. Short recordings of these tests are made.
7. Operational camera controls are now optimized and notes should be made of the degree of manipulation and the time consumed in doing this. New recordings at the optimum settings are made.
8. The cameras are now ready for a series of critical tests with the following conditions:

   a) Registration chart. Note geometery of the three superimposed images especially out to the edges and corners of the chart. Be sure the cameras scan equi sized images.

   b) Resolution chart. Check horizontal and vertical resolution both at the center and in the corners of the image.

   c) Grey scale/chip chart. Check for color balance especially in the low luminance chips where color shading is most noticeable. For best evaluation, use the same monitor for all cameras so as to avoid monitor phospor chromaticity differences or set up variations.

   d) Point cameras at a wide variety of colored objects (the easiest to obtain and set up are grocery and food products) of various degrees of saturation and note colorimetric response of each camera.

   e) Incrementally reduce light levels and recheck each camera for adaptability to the new level and for color tracking. Pan from side to side to check for image lag.

   f) Use one or more human subjects with head and shoulder shots against a variety of solid and varied colored backdrops. Note overall colorimetery and color shading in dark areas.

   g) After a few hours of operation and without readjusting any of the registration and color balance controls, recheck the cameras on the test charts and record the results.

   h) Check all lens controls for smooth operation and proper focal tracking of the zoom mechanism.

   i) Check the viewfinder for framing accuracy, range of brightness, contrast, image crispening, etc.

   j) Roll the camera around, tap it lightly on the sides, manipulate cable plugs, etc., to check for microphonics, intermittents, poor connections, etc. Open and close camera housing, where practical, and note effect on the picture.

Assuming the cameras have passed all of these tests, you can now invite the camera purveyors back in to recheck your results and to explain the unique features that make each camera the best buy for the money.

The author wishes to thank Fred Haines for his meticulous review and useful suggestions for this article. His fund of knowledge about color cameras seems inexhaustable. In addition, valuable information came from Dr. Skipwith Athey, William Higgins, and Mark Broemmelsek. Ed Flowers and Donna Roizen helped with the photographs and the manuscript. □

Experimental Public Access

William Johnson of the Federal Communication Commission's Cable Television Bureau described the Commission's rules on public access cable TV programming as "still in the experimental stage" at an Eyeopener panel on "Public Access to CATV" held at the National Cable Television Association's annual convention.

Johnson said the Commission was "listening" to some of the problems that have already arisen in current public access programming. He called the present rules which bar cable operators from exercising control of programming but also require that no obscene material be presented "unfortunate for the cable operator but an inevitable situation." Proposals to institutionalize funding for public access by assessing cable operators an additional fee would be examined by the Commission, he said, asking the practical question "Would the cable operator be able to bear the additional financial burden of such an assessment?"

Johnson said that the Commission's thinking, as reflected in the rules, on technical standards for public access channels is that stringent technical standards inhibit local programming efforts and therefore must not be applied to public access channels. He expressed concern that strict technical standards imposed at the state or local level would have the same effect of impeding local programming efforts before they could really get going.

Richard Galkin of Sterling Communications Corp., New York City, concurred that the main problem of public access programming at this point is raising public awareness of it. Panelists Galkin, Cohen and Shamberg discussed practical problems they encountered in running public access operations. Johnson explained the FCC's current rules on public access programming which Charles Tate challenged as recognizing individual rights but ignoring group and community rights.

Part 2 of a series

Basic Digital Logic Review

By John Lee
Hewlett Packard

The previous article discussed the type of logic known as combinatorial logic. These were functions which have no memory or storage capability. They form the decision making elements of any logic system. As equally important as the decision making elements to any logic circuit are the memory and storage devices. These devices belong to a class of logic functions called sequential logic. They will be the topic of Part Two of this series.

Sequential Logic

The basic building block of sequential devices and circuits is the flip-flop. The flip-flop is a bi-stable (2 state) device which can be switched easily from one state to the other. The time at which the output switches is controlled by a signal called the clock. As we'll see later, there are several clocking modes. The state to which the output goes upon the appearance of the clock signal is controlled by the flip-flop data input.

As with combinatorial devices, the flip-flop's operation can best be described by the use of a logic truth table. Due to the clocked nature of these devices, the truth table for flip-flops and other sequential elements are time dependent. This means we need to express not only the input state required to cause a given output state to occur, but we must also indicate at what time this input state occurs.

Figure 1 shows a truth table for the simplest flip-flop, the D type flip-flop. The timing information is indicated by the subscript t and t + 1. D_t represents the state of the D input just prior to the occurrence of a clock pulse and Q_{t+1} represents the resulting output just after the clock pulse. Between clock pulses the Q output will remain constant regardless of the signal activity on the D input. Thus, the D flip-flop remembers the state of the input at the occurrence of a clock pulse.

Basic Clocking Modes

Before discussing the various types of flip-flops it is important to understand the three basic clocking modes (Figure 2). These are edge triggered, level triggered and master slave. In the edge triggered

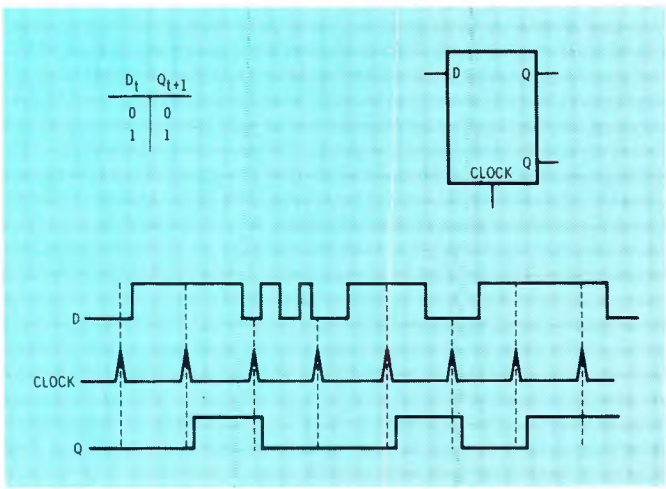


Fig. 1 D type flip-flop. Timing information for sequential devices is usually indicated in subscripts on the parameters of the truth table. The D type flip-flop stored the state of the D input that existed just prior to the clock pulse. The output switches on the occurrence of the clock pulse.

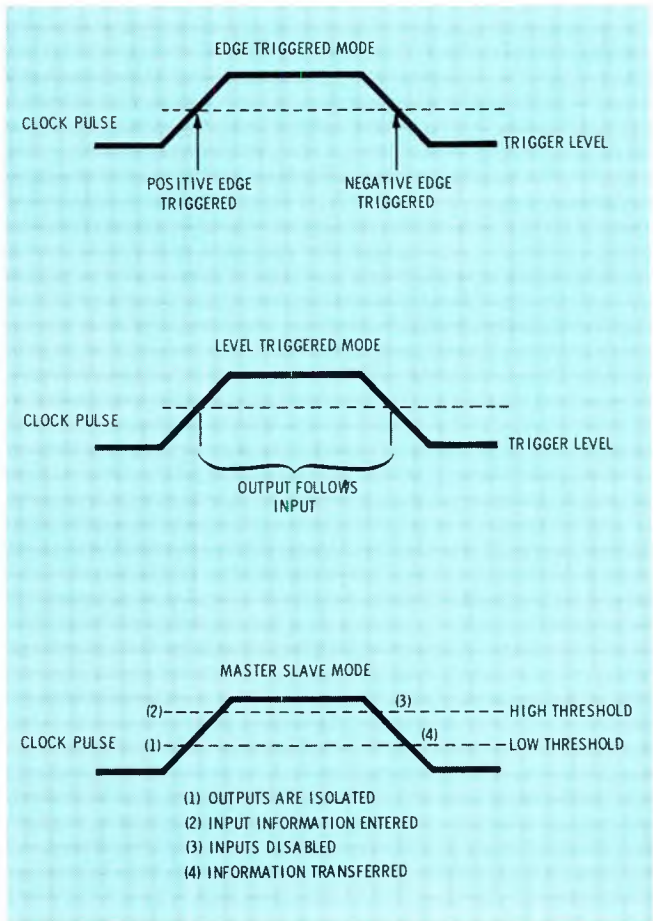
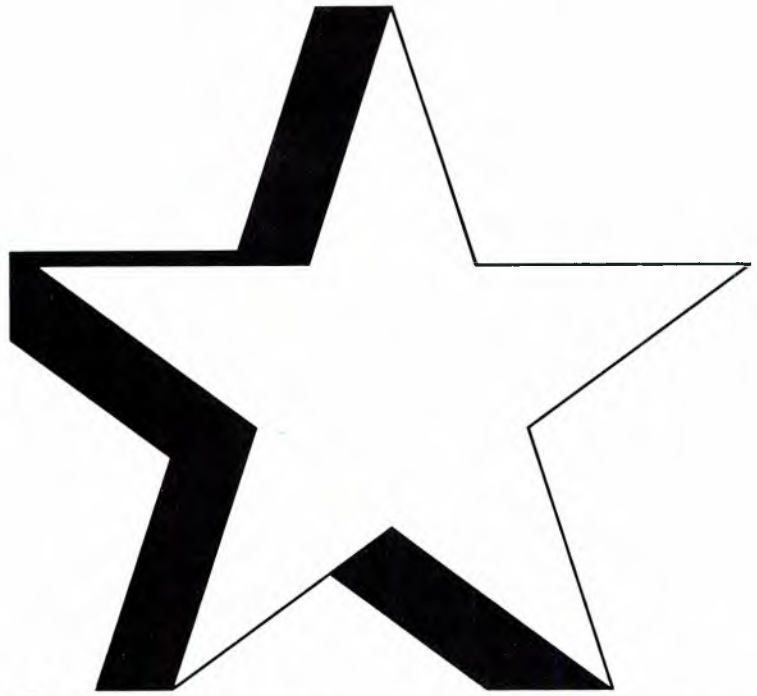


Fig. 2 Edge triggered: The output state changes on the occurrence of a specific voltage on the edge of the clock. Level triggered: The output follows the input while the clock is above the threshold voltage. Master slave: Input information is allowed to enter the flip-flop between (2) and (3) and is transferred to the output at (4).



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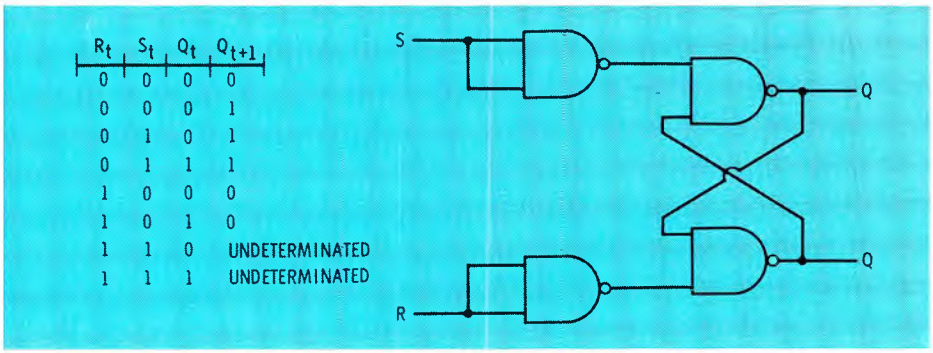


Fig. 3 R-S (Reset-Set) flip-flop. This NAND gate implementation is unclocked. The subscripts t and t + 1 now refer to the amount of time required for a change on the input to cause a change on the output. Q_{t+1} represents the output state this time interval after applying the inputs R_t and S_t.

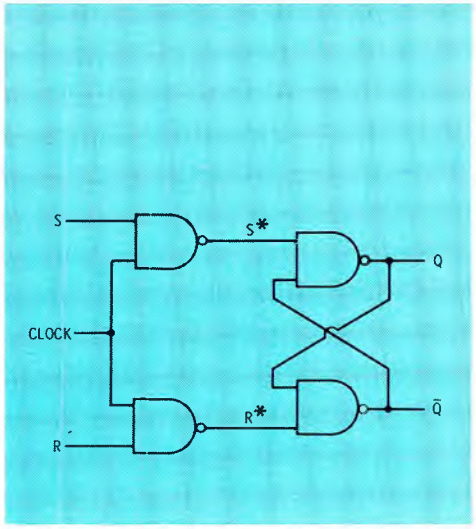


Fig. 4 A NAND gate implementation of a clocked R-S flip-flop. Only when clock is high can R and S affect the output.

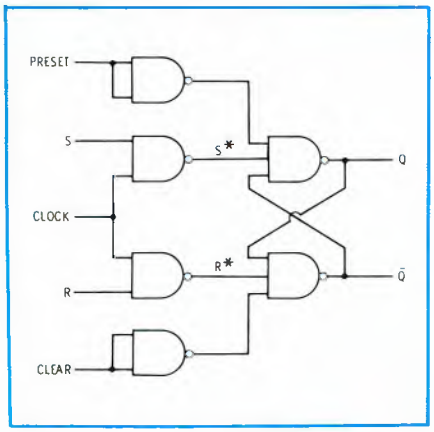


Fig. 5 An R-S flip-flop with preset and clear inputs. Regardless of clock, R, and S states, the preset or clear input will directly affect the output.

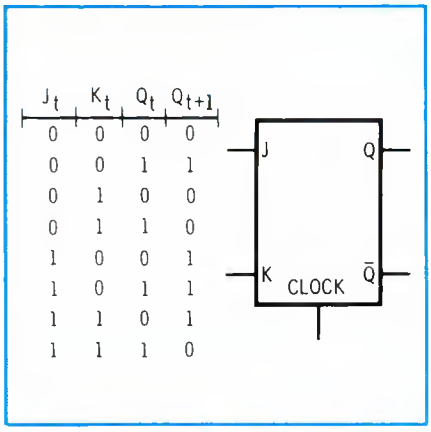


Fig. 6 A J-K flip-flop. It's similar to an R-S flip-flop. The J = K = 1 state is defined as a toggle mode. In this state, each clock pulse causes the output to change states.

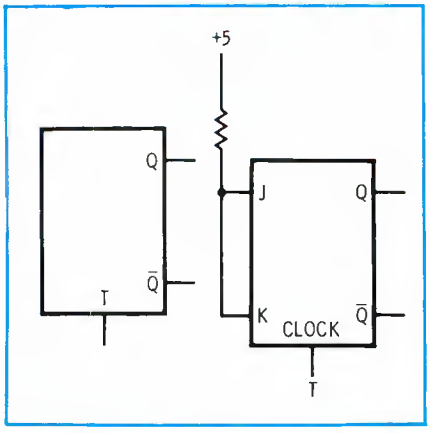


Fig. 7 The T (Toggle) flip-flop. The output of the toggle flip-flop changes state on the occurrence of a pulse at the T input. This device can easily be implemented from a J-K flip-flop as shown.

mode, the flip-flop changes state on the occurrence of a specific voltage level on either the rising or falling clock edge. If the flip-flop switch is on the rising edge, it is called a positive edge triggered device. If the switch is on the falling edge, it is called a negative edge triggered device.

In the level triggered mode, the flip-flop output is allowed to follow the input as long as the clock signal is above a specific threshold voltage level. When the clock goes below this level, the output captures the state of the input and remains constant until the clock again rises above the threshold level. This is often referred to as a latch mode of operation.

The most sophisticated mode is the master slave mode. As the clock signal reaches the low threshold at Point 1, the outputs are isolated from the input. At Point 2 the information at the input is enabled to enter the flip-flop but not transmitted to the outputs. During the interval from Point 2 to Point 3 the information is continuously entered into the flip-flop. At Point 3 the inputs are disabled and the current information stored. At Point 4 this information is transmitted and held on the output pins.

In addition to the D type flip-flop (D stands for data since the output goes to the data input state on the occurrence of a clock pulse), there are four other basic flip-flops. These are the R-S, J-K, T, and LATCH.

R-S Flip-Flop

The R-S (reset, set) flip-flop is a very basic and often used circuit. It may or may not have a clock input, since the occurrence of the input signal can determine the time at which the output changes state.

Figure 3 shows the truth table and implementation using NAND gates for this device. Unlike the other flip-flops which can be purchased in an integrated circuit package, the R-S flip-flop is most often built from NAND or NOR gates.

As you can see from the R-S truth table, when R and S are both 0, the output Q does not change states. When S is 1 and Q is 0, the Q output will change to 1, it is thus set. When S is 1 and Q is 1, Q re-

mains unchanged, since it was already in the set condition. When R is 1 and Q is 1, Q will change to 0. It thus becomes reset. If Q is already 0 then it will remain unchanged. The state in which R=S=1 is undefined. It can not be determined whether the device will set or reset. In most designs this state is unallowed.

R-S flip-flops can also be clocked. Figure 4 shows a NAND gate implementation of a clocked R-S flip-flop. Only when the clock is 1 are the intermediate signals R* and S* allowed to follow the inputs R and S. So while the clock is 0, the outputs are isolated from the inputs and remain in a constant state.

Common to many flip-flops are preset and clear inputs. Some have only one or the other, and some have both. These inputs allow the state of a flip-flop to be set to 1 or 0 regardless of the clock or input signals.

As an example, Figure 5 shows an R-S flip-flop implemented with NAND gates with both preset and clear inputs. It is obvious that regardless of the input and clock states, a 1 on the preset line will cause the Q output to be a 1 and if held longer than the propagation delay time of 1 gate, the output will remain in the set condition after the preset signal is removed. Similarily, the clear input will cause the output Q to become 0.

J-K Flip-Flop

The J-K flip-flop (Figure 6) is very similar to the R-S device, with the J input corresponding to the S input and K input corresponding to the R input. The distinction is that the J=K=1, (R=S=1), state which was previously undefined is now defined to be a toggle mode. That is, if J=K=1 when a clock pulse occurs, then the output will change states. If it was a 1 it will become a 0. If it was a 0 it will become a 1, hence, it toggles. J-K flip-flops can be either edge triggered or master slave devices.

Toggle Flip-Flop

As a special case of the J-K flip-flop, the toggle flip-flop is a device with only a clock input and whose output changes state (or toggles) on the occurrence of each clock pulse. A toggle flip-flop can be easily implemented from a J-K flip-flop (Figure 7) by tying both the J and K inputs high through a resistor to 5V.

Latch Flip-Flop

The latch flip-flop is really a form of a D type device. In general, D type flip-flops are edge triggered devices. When a D flip-flop is level triggered it is called a latch. A latch's output follows the input as long as the clock signal is high. When the clock goes low it latches the output to the input state at that moment. That's how we get the term "latch".

Counters

Using flip-flops as a basic storage unit and building block, more sophisticated sequential devices can be implemented. Counters represent a large class of sequential devices.

Using feedback of the flip-flop outputs, many types of counters are built. Decade, divide by 12, binary, and variable module are

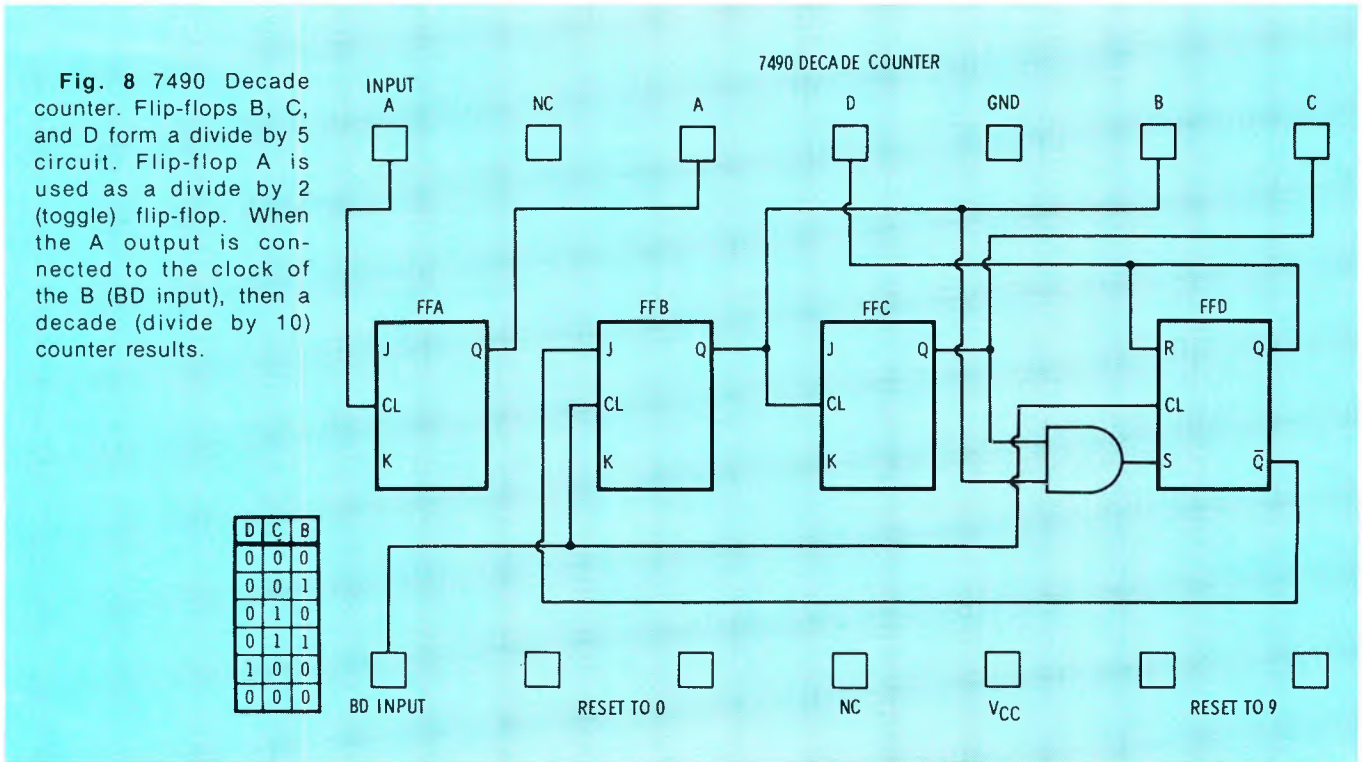


Fig. 8 7490 Decade counter. Flip-flops B, C, and D form a divide by 5 circuit. Flip-flop A is used as a divide by 2 (toggle) flip-flop. When the A output is connected to the clock of the B (BD input), then a decade (divide by 10) counter results.

just a few of the varieties available today. Because of the vast number of devices it is impossible to discuss each counter individually. Therefore, let's analyze a decade counter in detail to see how counters can be designed from flip-flops.

Decade Counters

The counter we will study is a 7490 Decade Counter. As you can see in the logic diagram of the 7490 Decade Counter (Figure 8), the decade counter is composed of J-K and R-S flip-flops. Without making any external connections, this decade counter acts as a divide by 2 (see FFA) and a divide by 5 (see FFB, C, D) counter.

To understand the divide by 5 operation, consider the desired sequence of outputs shown in Figure 8. The B flip-flop acts like a divide by 2, except immediately following the reset to 0 condition. This reset occurs on the first clock after the D output goes high. Using the D output as a reset to the D flip-flop and using the D output as an input to the J of the B flip-flop will cause the outputs of both these devices to go to 0 on the next clock pulse.

Since the output of B prior to this clock pulse is 0, this will have the affect of causing the B and C flip-flops to skip a count. Looking at the B and C states in the truth table, you see that this is what they do. The only remaining problem is how to get the D output to go high at the proper time.

The D will go high following the condition that B and C are both high. Thus using the AND function of the B and C flip-flop output to drive the S input of the D flip-flops will cause the D output to go high at the proper time. This then explains the feedback paths used to generate the divide by 5 signal.

It should be noted that the unused inputs are assumed to be in the high state. In order to get a divide by 10 (a decade counter), it is only necessary to divide the clock input of the B flip-flop by 2. Thus when the output of the A flip-flop is used to drive the clock of the B flip-flop (note that A is used as a toggle or divide by 2 circuit) and the clock input of A is used as the count input, then a decade counter is achieved.

Shift Registers

Shift registers are another important group of sequential devices based upon flip-flops as a basic building unit. They are characterized by their length and type of data they accept. There are four types of data. They are parallel in/parallel out, serial in/serial out, serial in/parallel out, and parallel in/serial out. To understand the operation of shift registers consider the serial in/serial out 8 bit shift register shown in Figure 9.

As implied in the name of this device, the maximum number of bits that can be stored is 8. Information is entered into the shift register serially and recovered serially. As clock pulses occur, the data at the left most flip-flop is input and the stored data is shifted right 1 flip-flop.

The 8 bit shift register is built from 8 R-S flip-flops. While this particular shift register is able to shift data in only the right direction, devices are built which allow information to be transferred either left or right. For example, the parallel in/parallel out 4 bit shift right/shift left shift register shown in Figure 10. Controlled by the mode input, this device can load all 4 flip-flops at one time (in parallel) and shift that data right or left with each clock pulse it receives. When required, the data can be recovered from the shift register as 4 bits in parallel.

While many more sequential devices exist, the flip-flops, counters, and shift registers are the basic building blocks. As mentioned in the Part One, manufacturer's data sheets and the text of John D. Lenk, **Handbook Of Logic Circuits** and of H. V. Malmstadt and C. G. Enke, **Digital Electronics For Scientists** provide a deeper presentation of sequential logic. □

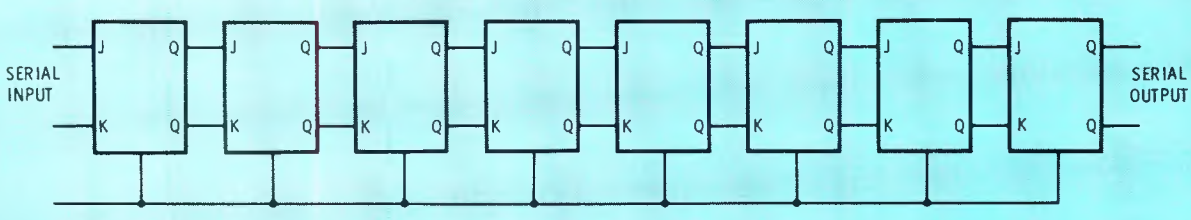


Fig. 9 An 8 Bit serial in/serial out shift register. As clock pulses occur, data is entered from the left and all stored data is shifted right 1 bit.

bookreview

CCTV Production Techniques

Until the last decade, the high price of equipment necessitated that television be used primarily as an entertainment medium. Recently, because of the introduction of television equipment that is priced far below that used in the commercial broadcast industry, closed-circuit television has found numerous applications in Cable TV, education, medicine, sports, business, and industry.

Closed-Circuit Television Production Techniques, written by Larry G. Goodwin and Thomas Koehring, is concerned with the production principles that are involved in closed-circuit television presentations. It covers the technical aspects, studio layout, camera operations, audio, lighting, graphics and sets, scripts, and presentation techniques of the field.

This book offers closed-circuit television users simple, but thorough, production principles that can be used in day-to-day operations. It is available through the Howard W. Sams & Co., Inc., Indianapolis, Ind.

For More Details Circle (90) *on Reply Card*

Solid State Guide

Today, the technician is expected to assume technical responsibilities that formerly were controlled by engineers. As a consequence, the valuable electronics technician must have more than a superficial knowledge of the popular solid-state components now in use. The main objective of the **Comprehensive Guide To Solid-State Electronics,** written by George B. Ruthkowski, is to help technicians meet this challenge. The author not only discusses the fundamentals, but also develops the student's ability to select proper design components for solid-state electronic circuits.

The book begins by explaining common semiconductor materials. Other chapters discuss the Zener Diode, the junction transistor, the silicon-controlled rectifier, the field effect-transistor and integrated circuits.

A modified programmed style is used throughout the book.Each point discussed is followed by at least one example. The student is encouraged to work each sample problem before referring to its solution. The answers to the odd-numbered end-of-chapter problems are provided at the end of the book. These problems, with the examples, make this book a highly-recommended source for either self-study or classroom use.

This book is available through Howard W. Sams & Co., Inc., Indianapolis, Ind.

For More Details Circle (91) *on Reply Card*

(*Continued on page 44*)

The author (r) discusses transmitter distortion measurements with Jim Sharon, WLIF FM Operations Director.

More on IM testing

By Dennis Ciapura
WLIF, Baltimore, Md.

Since almost all broadcast systems are limited bandwidth animals, IM distortion testing procedures yield many advantages over the more usual harmonic distortion measurements. The futility of harmonic analysis of high frequency distortion in FM broadcast systems where the harmonics never reach the modulator is a phenomena well known to many engineers. In AM modulators it is sometimes as difficult to avoid audio intermod as it is to avoid traffic on the freeway.

There are, however, some less obvious uses for IM test gear, primarily in testing program source equipment, i.e., tape and disc gear. As is often the case, the best way to obtain the fullest service from a test technique or procedure is to fully understand the theory of operation of the test equipment and the test process.

How IM Distortion Occurs

IM distortion can be generated in many ways, but the most common cause is non-linearity of power transfer. Figure 1 shows how two tones are affected by a non-linear transfer curve. As you can see from the diagram, the higher amplitude lower tone has modulated the higher tone; a contest often lost by violins to bass. If the high tone is now looked upon as an AM RF carrier and detected, the amplitude modulation components are the actual distortion. These consist primarily of $F_1 + F_2$ and $F_1 - F_2$, but not entirely. We must remember that the same non-linearity that caused the intermodulation also caused harmonics to be generated. These harmonics also intermodulate and as you can see in the table of output components in Figure 2, things are not as simple as they seemed at first.

From a practical standpoint though, the rest of the IM products are usually of negligible level because of the relatively low level of the harmonics (unless we are talking about a really gross non-linearity), cancellation of some of the components and the rather narrow bandpass of the measuring equipment. Speaking of measuring equipment, this would be an ideal place to stop and examine the test circuitry and see how these instru-

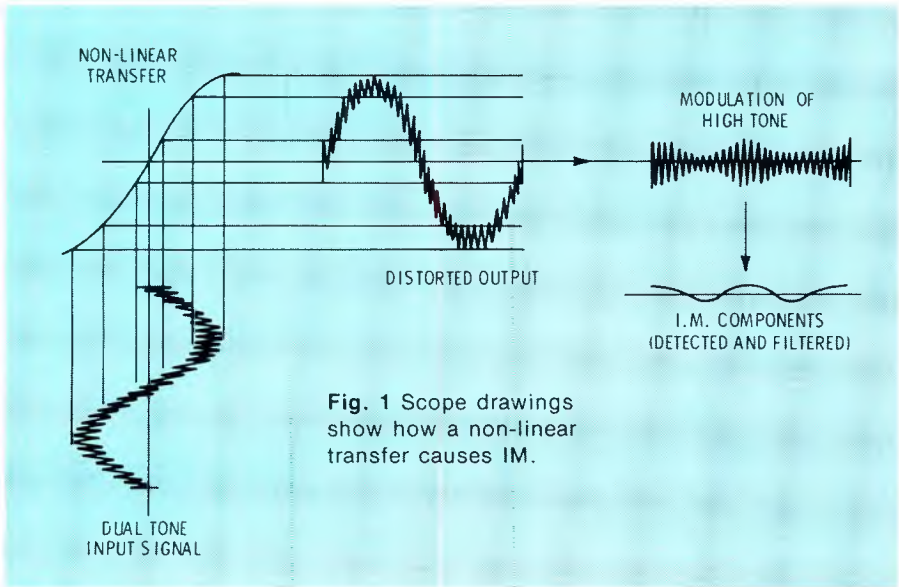


Fig. 1 Scope drawings show how a non-linear transfer causes IM.

Management Highlights

If your stations' decision making team is like most others, it sells against its sound and service. Here are expanded IM tests that can help interrogate your sound so that service is easier to guarantee.

Figure 2

Table of intermod components for distorted transfer of 60 & 5000 hz.

5k	60	10k	60	15k	60
5k	120	10k	120	15k	120
5k	180	10k	180	15k	180
5k	240	10k	240	15k	240
Etc.		Etc.		Etc.	

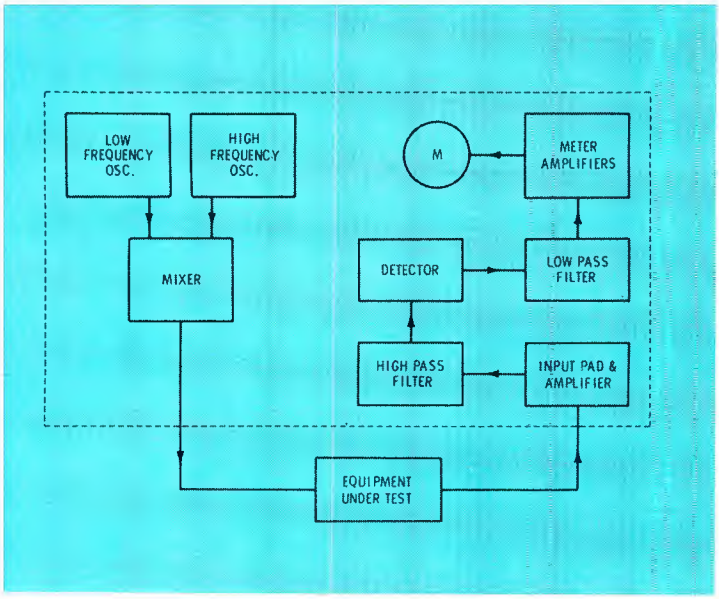


Fig. 3 Simplified block diagram of IM distortion meter.

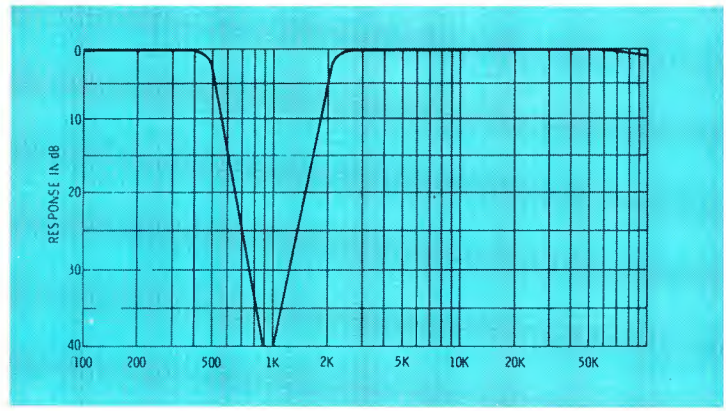


Fig. 4 Filter response curve of a high quality IM meter.

ments operate.

How The Test Gear Works

Figure 3 is a block diagram which describes in general terms how these units operate. Most IM distortion test equipment contains built-in low and high frequency tone sources. In the less expensive units, the 60 Hz low tone is tapped off of the power line for simplicity. In the more sophisticated units, internal tone generators are provided. The high frequency tone generator should, of course, be very amplitude stable to prevent any modulation of the test signal before it leaves the test equipment. The Crown I.M.A. analyzer actually employs two FET controlled oscillators for unusual stability.

The test tones are mixed linearly and with extreme isolation between generators to prevent any intermodulation of the test signals. The ratio of low to high tone levels is usually the SMPTE standard of 4:1 which is usually satisfactory. These levels usually can be easily varied, and it is sometimes desirable to use a higher ratio for increased sensitivity, particularly if you are tracing down a specific problem.

The test signal is fed into the equipment under test at the desired ratio and level, and the output fed back into the IM distortion analyzer for the distortion readout. The output of the device being tested first passes through an attenuator and input amplifier circuit. Next the signal goes to a high pass filter which removes the low frequency components and then on to an AM detector circuit to retrieve any modulation of the high tone. The output of this detector is then passed through a low pass filter to remove the high frequency carrier. This filter usually has a 500 - 1000 Hz cut-off frequency.

Figure 4 shows typical filter response curves for the Crown I.M.A. While these curves are extremely sharp (7 pole butterworth filters are employed in this unit), the corner frequencies are representative of those found in most IM distortion testing equipment. The distortion components that remain are then passed on to the metering circuitry. These same or additional metering circuits are employed for input and output level and calibration level measurements.

Probably the best way to understand how the IM meters work is to think of them as a fixed tuned AM radio receiver which demodulates the 4000 to 8000 Hz band. The

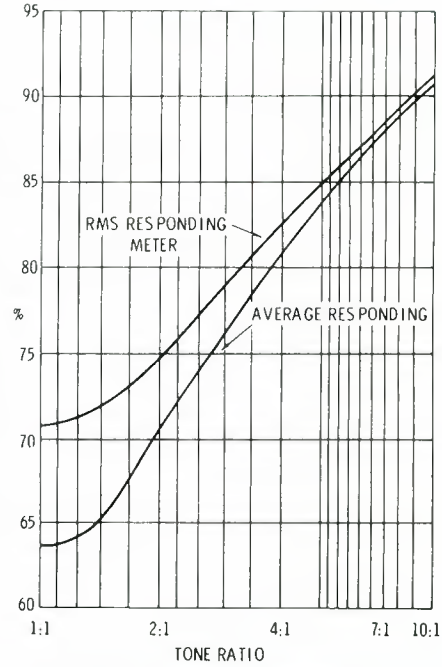


Fig. 5 Chart showing percent of normal meter indication required to achieve voltage level equivalent to single tone.

The author is shown here explaining IM tests methods for Station Manager Frank DeRose. This is the kind of communication that must exist within the station. Anyway, from the smiles, the results at WLIF must have been good.

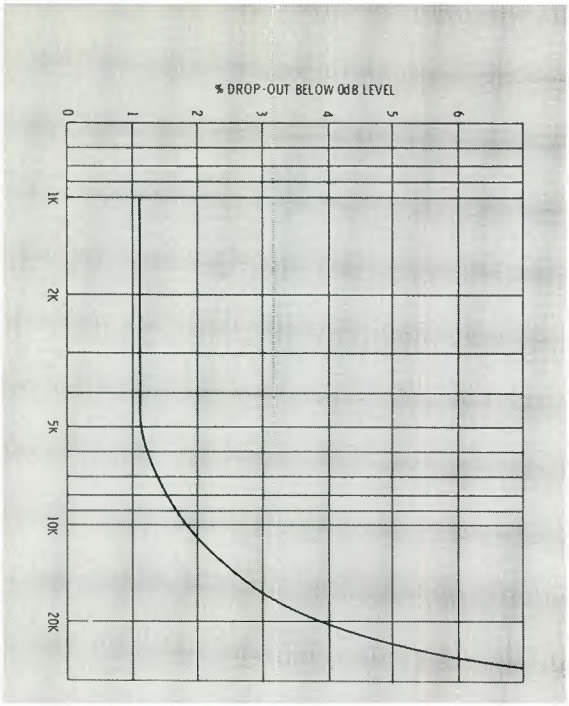


Fig. 6 Typical test of tape dropout versus frequency.

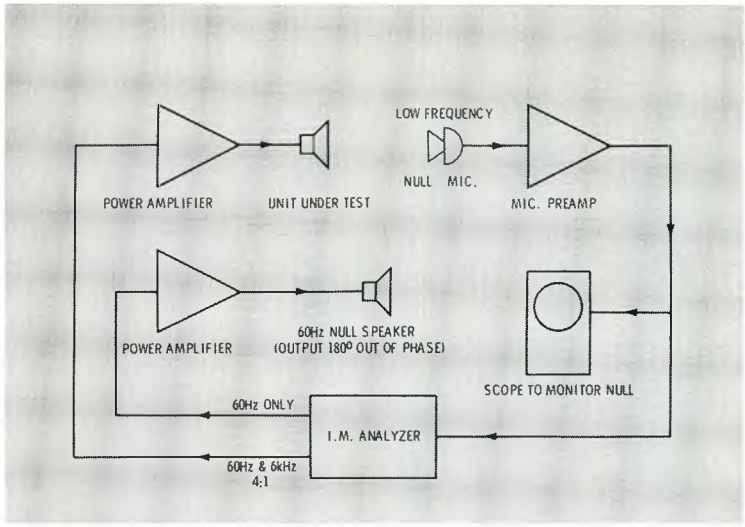


Fig. 7 A method of testing speakers for IM distortion. The low tone is acoustically nulled out for a cleaner mic pickup.

overall bandpass is usually about 1 kHz and the carrier is removed as in an AM radio.

Practical Applications and Methods

While a low tone of 60 Hz is usually employed for standard IM tests, other tones may be used if a higher resolution test would result. You may find, for example, that a console output transformer exhibits a core saturation problem at normal levels only below 50 Hz. In such a case, a 40 Hz low tone would be more appropo. A 6:1 ratio of low to high would also increase the sensitivity of our test to this particular defect.

Drifting bias balance in push-pull amplifiers and AGC amplifiers can cause unbalanced currents in their output transformers which make them run much closer to saturation at low frequencies than you might think. A 6:1 IM test will point out this problem before it becomes serious enough to be audible.

It's unfortunate that more equipment manufacturers don't give IM distortion specs in the manuals so that the equipment could be compared to its new performance standard periodically. The best way to solve this problem, however, is to run a standard SMPTE test on all new equipment purchased and record the results along with the harmonic distortion specs in the manual.

Good practice dictates the use of a high tone which is not an exact multiple of the low tone, but for most practical applications it really is not critical. Care must be taken not to use tones which fall out of the bandpass of the IM meter's filters! If the IM meter used employs inductors in its filters, be sure to make tests in an area relatively free of hum fields to avoid modulation of the high frequency tone as it passes through the high pass filter.

When testing equipment which has an IM specification pinned down by the manufacturer, be careful to make your comparative IM test with the same or nearly same test frequencies, the same test signal ratio, and at the same output level. The first two requirements are easily met, but the third takes some thought.

When measuring the dual tone IM test signal, we must remember that the manufacturer's specs will probably be for some RMS peak equivalent single tone sinusoidal level. More than likely our test meter will be an average responding audio voltmeter, or at best, a true RMS meter. We must convert our meter level to its corresponding RMS peak equivalent single tone value. Actually, it's easier to do things the other way around. Figure 5 gives the conversion factors required. If, for example, an IM spec is given for an output level of +10dBm with a 4:1 test signal ratio, our voltmeter should read only about 81 percent of that value to be equivalent.

Tape Equipment Test

The IM meter can also be a very effective tool for tape recorder set-up and maintenance. To understand why, it is helpful to review the theory of an IM meter's internal operation. The high frequency test tone is demodulated and the modulation components metered as distortion. If the low tone is removed entirely, all that will remain is noise in a narrow band around the high tone and any amplitude instability of the high tone.

Tape dropout is one of the most critical aspects of magnetic tape recording and is very easily measured with an IM meter; the low frequency tone is simply removed. The noise for 1kHz bandwidth is usually negligible but the dropout, particularly at the very high end of the audio spectrum, is appreciable.

Figure 6 shows the results of a typical dropout test run. Note that the dropout increases as the frequency of the test tone increases due to the difficulty in maintaining intimate tape to head contact at the shorter wavelengths.

A simple and rapid procedure for tape and tape recorder performance checks would be to set up for recording at 0 dB with a low to high ratio of 4:1 (SMPTE standard) using the IM meter's internal 60 Hz generator and an external variable frequency audio generator for the

high tone. The range of frequencies used for the high tone can extend from the lower limit of the meter's high pass filter to the upper limit of the instrument's frequency response, which is usually several octaves past the audible spectrum. A tape can be generated with the high tone covering the entire treble range and then run again but with the low tone shut off for a dropout test. When played back through the IM meter, a very good indication of system treble distortion can be obtained very quickly as no nulling adjustments are required.

When the second series of tones recorded without the low test tone appears, dropout can be measured. Harmonic distortion tests would be much more time consuming and less valid due to the restricted bandwidth of a tape system. Probably the best quantative study of a tape system would be harmonic distortion tests at the lower frequencies and IM analysis for the upper half of the band including the dropout test just described. The IM test procedure is also useful for bias optimization as it allows a rapid frequency vs. distortion measurement without the need for nulling type adjustments. The playback amplifier can be monitored with the IM meter while the bias is adjusted for minimum distortion in the audible band.

One of the best disc tracking measurement methods is an IM distortion test employing a test record as the signal source. The Cook Labs "Stereo IM Distortion Test Series 300" and CBS Labs "Square Wave Testing and IM Test Record STR 110" are available.

If 600 Hz low tones are used on the record you have, remember that this high a tone may fall on the skirt of your IM meter's low pass filter characteristic, thus reducing the distortion indication. As a maintenance tool, however, the test would still be just as useful as we are not interested in the absolute values of the distortion but in how the distortion level compares with a previously recorded value or how low we can get it compared to how

(*Continued on page 53*)

Book Review

(Continued from page 39)

Pulse, Switching Circuits

Pulse & Switching Circuits, written by Harvey F. Swearer is a complete, one-stop source of practical pulse and switching circuit operation and application data.

TV, computers, radar, telemetry, automation devices —practically every phase of electronics use pulse and switching circuits in one way or another. And as technology continues to advance, it is increasingly important that every individual in electronics has a thorough understanding of the principles and operation of pulse and switching circuitry. Whether the reader is a technician, an engineer, a designer, a serious hobbyist or experimenter, he can update his knowledge with this book.

For those totally unfamiliar with pulse and switching circuitry, and for those who need to brush up, Chapter 1 defines pulses-the basic definitions, nomenclature, harmonics, resonance, and the relationship between transistor switching and pulses. Pulse generator design and operation are covered in Chapter 2 - all basic circuits: multivibrators, blocking oscillators, time-base generators, relaxation oscillators, Miller integrator, boot-strap generator, a unijunction transistor generator, saw-tooth generator, IC pulse generators, plus details on sync, timing, time delays, etc. In Chapter 3, response characteristics are explained in regard to non-sine waves, transients, and non-rectangular waves. Also included are differentiation and integration, magnetic amplificiation, time-constant curves, and disertations on a variety of related subjects.

The book contains 256 pages, 11 chapters and over 200 illustrations.

It is available through Tab Books, Blue Ridge Summit, Pa.

For More Details Circle (92) *on Reply Card*

Solid State Workbook

Workshop In Solid State was written by Harold E. Ennes. The purpose of this book is to provide a rapid, practical, and effective transition from vacuum-tube circuitry to solid-state circuitry. It is assumed that the student already has received basic electronics training. The material was originally developed for use in training broadcast technicians. Therefore, broadcast circuits and applications have been emphasized. However, the training is just as useful to students of commercial and industrial applications as to broadcast personnel.

The 382 page book contains 17 Chapters.

This book is available through Howard W. Sams & Co., Inc., Indianapolis, Ind.

For More Details Circle (93) *on Reply Card*

PEOPLE IN THE NEWS

Broadcast

Steven J. Sharp has been named manager of the "D-MOST" Products department, Signetics Corp.... **Michael L. Ayers** is the new director of public relations for Ampex Corp....Western Union International, Inc. announced that **Seth D. Blumenfeld** has been elected assistant vice president for international relations....**P. Kim Packard** has been appointed Operations Manager - Cathode Ray Tubes for the Electronic Tube Division of GTE Sylvania Inc.

Charles Carl Conn has been named Video Cassette Recorder sales specialist, Philips Broadcast Equipment Corp....3M Company has announced the appointment of **Daniel E. Denham** as vice president of the newly formed Recording Materials Group....**Sheldon L. "Don" Kader** has joined Molnar & Associates, Inc. as vice president....Paradyne Corporation announced the appointment of **John William Malamphy** as sales manager for their Washington, D.C. region....**Joseph A. Kjar** has been appointed Executive Vice President for Bonneville International Corp....**Clyde W. Price,** president and general manager, WACT, Tuscaloosa, Ala., has replaced James W. Wesley, Jr., vice president and general manager, WIOD/WAIA, Miami, Fla., on the Radio Board of Directors of the National Association of Broadcasters.

Philip D. Costin has been named general manager of WIOD-AM and **Herbert R. Hirsch** has been appointed general manager of WAIA-FM, Cox Broadcasting Corp stations in Miami....**James W. Wesley, Jr.** has been named vice president and general manager of AM Radio Station KFI, Los Angeles, recently acquired by Cox Broadcasting Corp....**Roger D. Rice** has been named West Coast Broadcast Vice President of Cox Broadcasting Corp., in addition to his responsibilities as vice president and general manager of KTVU (TV), San Francisco-Oakland....**Joseph P. Dwyer** has been named controller and **Elliot Nevins** has been appointed program manager of AM Radio Station KFI, Los Angeles, Cox Broadcasting Corp.

Richard T. Seifert has been named to the newly created position of Manager of Applications Engineering for Western Digital Corp....Koss Corp. (OTC), has formed Koss Ltd., Canada, and named **Greg Cornehls** president of the wholly-owned subsidiary...**G. Curtis Kline** has been appointed Director of Marketing, Norelco Sound Systems, at Philips Broadcast Equipment Corp.,...Harris-Intertype Corp. has combined three divisions with eight plants in the U.S. and England into a new operating group, and appointed **William J. Stolze** to head it in the newly created post of vice president-group executive....**John J. Navin** has been elected a vice president of International Telephone and Telegraph Corp....ITT World Communi-

(Continued on page 46)

cations announced the promotion of two of its staff members—**Aina Liden** and **May Gilhooly**—to key managerial positions in the International Telephone and Telegraph Corp. subsidiary.

Michael L. Nystrom and **Kenneth M. Manke** have been appointed sales engineers for Nortronics Co., Inc....**Ivan D. Barton** is now Southwest Regional Manager for Philips Broadcast Equipment Corp....The appointment of **Charles W. Thierfelder** as Division Vice President, Manufacturing was announced by RCA....**William G. Hartzell** was appointed Division Vice President, Engineering by RCA....Communications Technology Corp., Los Angeles, has appointed **Fred Miller** as Regional Representative....**Henry J. Cauthen,** president and general manager of the South Carolina ETV Network in Columbia, has been elected chairman of the Southern Educational Communications Assoc. (SECA)....Utah Electronics recently presented **William Doyle** the outstanding Rep Of The Year Award during Utah's national sales meeting.... **Howard D. Holst,** managing director of WKNO-TV/FM, was awarded a plaque of appreciation and a Belgium crystal trophy in a special presentation at the 6th annual Southern Educational Communications Assoc. (SECA) Conference.

CATV

Anixter Bros., Inc., has named **Robert E. McLlvane** to the new corporate position of vice president - sales....TeleMation, Inc., announced the appointment of four new executives to its staff. Named Vice President of Finance was **Walter Gnemi,** with **Jay Hubbell** appointed to Manager of CATV Sales, **Vern Pearson** Manager of Broadcast Sales and **William T. "Bill" Blackwell** as District Manager of TeleMation Midwest's Indianapolis branch office.

Justo Caffi has been named general manager of American Cable Television, Inc.,'s Napa Valley, Calif. CATV system....**John R. Dillon** has joined the Cable Communications Division of Scientific-Atlanta, Inc. as Marketing Director....**Thomas P. Willett** has been named director of marketing for Continental Cablevision, Inc....**E. C. Oldfield, Jr.** has been appointed Treasurer for TeleCable Corp....**Royce R. Busey** has been named manager of Anixter-Pruzan's Southern office in Atlanta, Ga....C-Cor Electronics, Inc. has appointed **George A. Livergood** Sales Engineer and **J. Joseph Howe** Controller and Treasurer....**Robert T. Sample,** formerly director of the Boulder County Cable Communications Project in Colorado, has joined the staff of the Cable Television Information Center.

NEW PRODUCTS

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

FM Exciter-Xmtr

Complementing its FCC Type Approved AM/FM/TV monitors and broadcast audio console lines, **McMartin** has introduced its B-910 FM Exciter and B-910T 10-Watt Educational FM Broadcast Transmitter.

Frequency stability is insured by utilization of phase lock techniques to establish the center frequency of a direct-FM modulated oscillator operating at one-half the assigned frequency. Low FM noise, -68 dB or better; AF distortion at 0.3 percent and 0.5 dB frequency response reflect the design excellence incorporated in the new B-900 series.

With front panel access to fully-shielded, individual plug-in modules comprising the basic system, the exciter/transmitter permits immediate conversion to stereo and/or SCA multiplex operating modes by simply inserting optional modules: The B-110 Stereo Generator or B-113 SCA Generator.

Automatic protective circuitry provides indication of the phase lock condition, plus carrier interruption if the center frequency should shift 100 kHz or more from the assigned operating frequency.

Metering of all supply and phase lock control voltages, relative RF output and semipeak audio input voltages is provided.

For More Details Circle (50) *on Reply Card*

Gated Compressor

Shure Brothers Inc., has announced the first professional broadcast component combining a three input mixer with 600-Ohm line output and a true "hands-free" gain riding compressor in one, self-contained, portable unit.

Called the SE30 Gated Compressor/Mixer, the new Shure product is designed especially for broadcasting and sound recording applications both in the studio and on location.

The SE30 compressor is adjust-

(*Continued on page 48*)

NEW PRODUCTS

(Continued from page 47)

able to input requirements within a 40 dB range. Once the compressor is set, it virtually rides gain automatically. A unique Gated Memory Circuit "holds" compression level when input signals stop or drop below a certain threshold, thereby eliminating the "pumping effect" normally associated with conventional audio compressors. When desired program material returns, the "hold" is automatically released and the compressor goes back into action. This feature is especially useful during live broadcasting of news and sports events to eliminate crowd noise build-up when the announcer stops talking.

Compression is accomplished "in the field" before the signal enters telephone lines or voice couplers, the signal-to-noise ratio is optimized and, as a result, offering improved phone line transmission and program quality.

In studio use, the SE30 rides gain on any type of program material, freeing the operator for other duties. The Gated Memory Circuit eliminates the rush of noise during pauses in speech and at the end of records and tapes.

For More Details Circle (51) on Reply Card

50kW FM Transmitter

A new high power FM broadcast transmitter providing a high degree of redundancy and solid state reliability has been introduced by **American Electronic Laboratories, Inc. (AEL).**

The new model FM-25/25KD consists of two AEL FM-25KD (25kW) FM transmitter and a hybrid combiner, providing a standard operational output of 40kW and total capability of 50kW with plenty of power reserve.

The basic configuration is comprised of a control and interface cabinet placed between the two transmitter cabinets. The hybrid combiner, available in 3-1/8", 4-3/8" or 6-1/8" line depending on output power requirements, can be externally mounted when station layout permits. Customized patching and switching functions are available.

The unit's hybrid combiner accepts, combines and delivers the outputs of both transmitters to the antenna. When one transmitter is shut down, the combiner operates as a power divider, delivering half of the operating transmitter's power to the antenna and dissipating the rest to the reject load connected to the combiner. Since a high degree of isolation is maintained between the transmitters, service may be performed on the off unit.

The center cabinet of Model 25/25KD houses metering and control functions, as well as the interface for connection to remote control and monitoring. The exciter, buffer and phasing controls, in addition to meters for combiner

functions, for power readings and individual transmitter start, stop and plate voltage control are placed here.

AEL's Model 2202A Exciter provides drive to a solid state dual buffer amplifier, the outputs of which provide excitation to the 25kW amplifiers. Each amplifier is connected through its harmonic filter to the inputs of the hybrid combiner. Featuring a very high degree of phase stability and providing conservative operation, each amplifier contains a 4CX1000K driver stage and 3CX15000A7 grounded grid power amplifier.

For More Details Circle (52) *on Reply Card*

Dropout Compensator

3M Company now has available their new color dropout compensator (they call it the DOC). The new unit works with any quad VTR and it replaces lost video information, in color or monochrome, with correct video.

The unit is designed to eliminate color flashing. And servo lock and color lock are automatically maintained, allowing full color interlace and VTR stability even through multi-generation dubs.

Luminance and color are processed through separate delay lines, with color phase-inverted to achieve color interlace with the stored signal. Comes with adjustable dropout replacement threshold, RF AGC to maintain level set, and a built-in dropout simulator for alignment without a test tape.

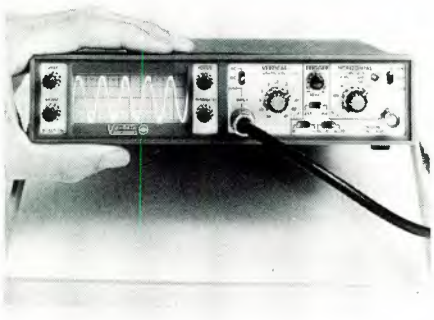
For More Details Circle (53) *on Reply Card*

Mini-Portable Scope

Introduction of the **Vu-data** Model PS910 has extended the feasibility of on-site field service and maintenance by providing DC-20MHz wide-band operation in a miniature, line- or battery-operated, portable oscilloscope. Truly a "mini-portable" because of its unusually small size and weight (1¾ H x 8½ W x 12 D, seven pounds) the PS910A can go in a tool case or in the slimmest attache case.

Designed mainly for the engineer who travels the PS910A also operates from the AC line and mounts directly in existing equipment to provide full-scale monitoring capability in minimum panel space. All controls are located on the front panel.

Batteries are entirely internal and may be nickel-cadmium, alkaline or even flashlight cells. Recharging circuitry is integral and batteries are electronically protected against over-discharge. Up to five hours operation can be obtained from nickel-cadmium cells.



For More Details Circle (54) *on Reply Card*

Audio Consoles

Broadcast Electronics now has available four new audio consoles. These consoles offer high and low level pre amps for each channel and electronic switching of input channels via FET's.

Offered in stereo and mono models, these consoles provide individual program, audition, monitor, cue and headphone amplifiers, plus mono mixdown amps (stereo models). They give identical program and audition output channels for dual console capability. Ladder attenuators are used, and carbon pots are available at lower cost in mono models.

Construction is solid state throughout, with modular, plug-in circuitry. Broadcast Electronics suggests that all requests for further information be sent to: Broadcast Electronics, 8810 Brookville Road, Silver Spring, Maryland, 20910.

(*Continued on page 50*)

NEW PRODUCTS

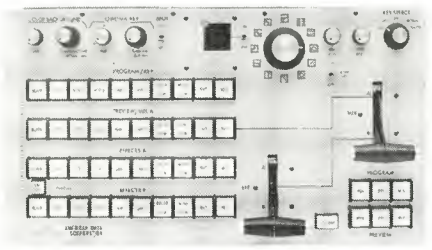
(Continued from page 49)

Production Switching System

American Data Corporation, an AIRPAX Company, has recently released their all new Model 556 Production Switching System. The system is a real "mini" but boasts "maxi" features.

The standard 556 has ten composite or non-composite inputs, which includes blackburst, and four busses. The special effects system incorporates the twelve "most used" wipe patterns, including a circle. A "joystick" positioner with a spotlight effect and a three input downstream keyer are also standard.

Downstream keying enables the operator to key **without** defeating the pattern generator so that special effects can be done behind any key including a chroma key. The keyer also includes both "Wipe" and "Blink" Key features and color



matting of monochrome keys. Reentry of Effects-Key into Mix allows the operator to Mix into or from an Effect or Key, or Key on top of an Effect.

Other standard features of the 556 system are Program and Preview output switching, a Color Background - Blackburst - Color Matte generator, a processing amplifier on the program output channel, momentary illuminated barrier switches, and provisions for an RGB chroma keyer.

For More Details Circle (55) *on Reply Card*

6 kW Dimmer System

Berkey Colortran Inc., a division of Berkey Photo, Inc., has announced their new 6kW Dimmer Pack System. The "Big Brother" of the 2.4kW and 3.6kW Dimmer Pack Systems, features 6-6kW Dimmers in a housing 20" wide x 14" high and 21.5" in depth.

The Control Pack is a two-scene preset with individual channel mode selections of independent, preset and off. A master of each scene is provided, along with tracking L.E.D.'s. The Master Pack provides mastering control for up to 20 control packs. It features A-B faders, an Independent Master and Grandmaster.

The Dimmer Pack weighs only 140 lbs. and may be stacked on a castered base for portable usage. The 6kW Dimmer Pack features plug-in circuitry, unique phase change block, fully magnetic circuit breakers, and high quality filtering. Systems may be combined as building blocks up to 120 dimmers, and may be mixed with 2.4kW and/or 3.6kW Dimmer Packs. Available with a wide choice of output receptacles or a terminal input/output

versions.

Portable models utilize color coded Camlok connectors for power handling. All controls cables are equiped with positive, cannon type connectors.

For More Details Circle (56) *on Reply Card*

Extended Play Reproducer

A new, second generation, **Scully** extended play reproducer designed to meet the demanding requirements of the broadcast industry is now available. Built to exacting specifications the LJ-10 offers unique features designed to improve performance and simplify maintenance.

Tone sensing circuitry and end-of-music overlap control are built into the LJ-10. No longer is a peripheral unit required to accomplish these functions. This reduces a broadcaster's overall costs, saves space and increases reliability.

A closed-loop tape drive significantly affects wow and flutter (3¾ ips). Tape is now pulled, rather than pushed and pulled, enhancing reproduction quality. While the computer industry has used a similar drive unit for many years, it is new to the broadcast industry.

For More Details Circle (57) *on Reply Card*

Solid State Color Camera

The Philips LDK 5 is the first of a completely new generation of color cameras. Integrated circuitry and a new design approach mean that all video processing is done right in the camera itself. Many of the usual C.C.U. functions have been incorporated in the camera-head.

The operating controls in the base station send their command signals in a digital code form, requiring only a simple two-way link such as a telephone connection or radio transceiver. In fact up to four cameras can be controlled over one telephone line. An 8 mm. tri-axial cable is all that is required to connect camera and base station. If the power supply is moved next to the camera the link need only be a co-axial cable. This all adds up the most flexible camera system ever produced.

Many other factors also contribute to the operational flexibility. Camera control settings are automatically retained in the camera head by the built-in digital memory, even when disconnected they are maintained by a rechargeable cell providing sufficient output for several days. This now allows camera sharing to become a practical reality; so long as there is an available base station in each studio, or O.B. van, any LDK 5 camera can be ready in just the time it takes to reconnect.

The base station consists of three independent and self-contained units which can be positioned wherever preferred. As the wiring between these units is also very much simplified, the result is that new studios will require far less wiring than previously and will be more flexible in operation.

For More Details Circle (58) *on Reply Card*

Character Generator

Datavision's Model D-2400 character generator offers broadcasters exceptional versatility since it allows users to present two different page displays simultaneously, with only one machine. This makes it possible to use one title on-air while preparing, changing or previewing three additional titles on the unit's keyboard.

Standard D-2400 features include: large, easily read characters, 32 scan lines high; four-page, two-

(*Continued on page 52*)

NEW PRODUCTS

(Continued from page 51)

channel display capability; one-row horizontal crawl; full cursor editing; 8 rows of display (16 characters each) per page; and external title storage, using **standard** audio recording equipment.

The D-2400 provides up to 32 one-row title storage, with random retrieval and display, one row at a time, in the lower one-third of the picture area. The D-2400 also permits single or multi-row title display anywhere in the picture area, and single line horizontal crawl display at the bottom of the picture. The Datavision D-2400 can interface with both teletype and computer systems to provide instant display capability of fast breaking events.

For More Details Circle (59) *on Reply Card*

Portable TV Cassette System

An economical and portable TV cassette system that can be easily operated by people totally unfamiliar with cassette equipment has just been introduced by **Videodetics Corp.**

Called the VIDEOSETTE™ Communications System, Portable Model, the lightweight unit consists of a color video cassette player and a 12-inch color receiver. The player accommodates standard 3/4-inch tapes and utilizes the popular U-MATIC format.

Unlike other cassette systems, no manual adjustments are required. The operator just inserts a prerecorded tape into the player, and the player and monitor turn on automatically. At the conclusion of the tape, or a predetermined position, the tape rewinds to the START position and turns itself off. Monitor fine tuning is also automatic.

Totally automatic operation enables the instructor to train a student without supervision and without being present; thus he can greatly increase his productivity.

The new Portable VIDEOSETTE unit also features automatic reset of the tape counter, built-in stereo amplifier, automatic repeat for continuous programming, built-in volume control, and internal phone jacks for headphones to accomodate individual viewing.

For More Details Circle (60) *on Reply Card*

Digital Multimeter

A new multimeter designed to meet the needs of users throughout science, technology, and industry has been introduced by the **John Fluke Company,** Seattle, Washington.

Featuring a basic accuracy of 0.1%. The new Fluke 8000A measures, in 26 ranges, AC and DC voltages from 100 microvolts to 1200 volts, AC and DC currents from 100 nanoamps to 2 amperes and resistance from 100 milliohms to 20 megohms. All instruments are guaranteed to meet specifications for one year.

According to the manufacturer, the Fluke 8000A is the first instrument to use both analog and digital large scale integration. The two chips used, equivalent to over 3,000 circuit elements, help reduce the parts count to about one-third that of typical 3-1/2 digit voltmeters. Because of the low parts count and LSI design the company says that it expects high reliability.

For More Details Circle (61) *on Reply Card*

Portable TV Production Center

A portable television production center designed for video-tape operations for smaller studios has been introduced by **GBC Closed Circuit TV Corp.,** 74 Fifth Avenue, New York City.

The GBC "Mini Console" is a complete television production center in one portable unit. Included is a special effects generator which makes it possible to switch or fade from one camera to the other; to super-impose to six different wipes (horizontal, vertical and the four corners); and to do lapses and dissolves.

The GBC "Mini Console" accepts inputs from three different cameras and a video-tape recorder. The unit also features a high quality four input audio mixer and three 5" monitors. It is delivered complete and ready to plug in.

For More Details Circle (62) *on Reply Card*

IM Testing

(Continued from page 43)

high it was. And boy can it be high!

You can imagine the effect of a low tone on a stylus attempting to track 6 or 7 kHz at the same time. A defective stylus, pickup or tone arm tracking error will quickly generate 10 percent distortion. Stylus pressure can also be set as a function of IM, thus insuring maximum tracking performance with no more than necessary record wear.

Monitor Speaker Analysis

One of the more sophisticated and interesting applications of IM testing is monitor speaker analysis. Harmonic distortion data is usually contained in the manufacturer's specs., but IM data frequently is not. Multi-driver systems usually are less prone to IM for obvious reasons. The most likely offender is a single driver of small diameter because of the large cone excursions and the fact that the higher frequencies must suffer from the non-linearity that the voice coil encounters while attempting to follow a large low note.

This is a generality. Small single driver systems with very large magnetic circuits can be quite good. Conversely a three-driver stystem doesn't guarantee low IM, but, as a general case it does hold true.

Measuring this distortion is not difficult, but the limitation of the electro-acoustical link must be taken into account. A typical test setup is shown in Figure 7. Care should be taken to choose a microphone that exhibits inherently low IM like a good pressure sensitive condenser mic.

Room reflection can both assist and confuse. Reflections causing cancellations near the high frequency test tone should be avoided by sweeping the frequency of the high test tone to 500 Hz each side of center to be sure that the microphone is not in a null for one of those frequencies. If, however, the microphone can be placed in a null for the low frequency test tone,then the probability of microphone induced IM in your readings is all but eliminated.

If an on-axis reflection cannot be arranged, an additional speaker may be used to produce a null spot at the low tone frequency. If the low tone cannot be acoustically nulled and the microphone must handle both tones, move the mic further from the speaker and remeasure the distortion. If it does not decrease, the test is still valid because the distortion measured is in the speaker, its drive level having remained constant. While measuring monitor speaker distortion may at first seem a bit far out; who would purchase a console with a monitor amplifier that has 8 percent distortion?

One of the biggest surprises to a broadcast engineer making IM distortion measurements for the first time is the higher percent level of IM than harmonic distortion that usually exists in the same system. If your FM rig is good for 0.5 percent harmonic distortion at 400 Hz, don't be too surprised if the IM is over 1 percent. There is no direct relationship between the numerical values of IM and harmonic distortion in the same system, but IM seems to relate more to listening fatigue than harmonic distortion. Being harmonically related to a musical note seems to endear a

distortion component to the listener's ear, where the closely jumbled IM "no goods" cause an irritating fuzziness. Since the IM figures for a piece of equipment don't usually look as good as the harmonic data, some manufacturers don't print such test results even if they have run them, no matter how important or informative they may be.

Perhaps if more engineers would inquire about IM performance of new or existing equipment, manufacturers would be more inclined to publish this spec. We wish to thank Crown International for their assistance in obtaining technical materials for this article. □

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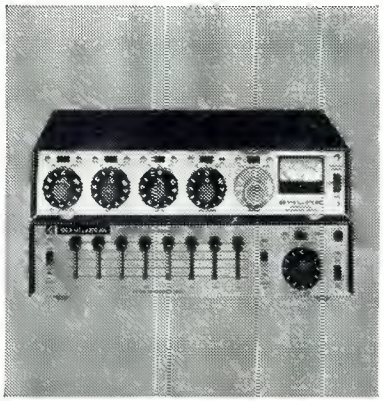

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