

ham radio

magazine

W6NRW

●●● ●● ■■■● ●●●● ■
 ●■ ■● ■●●
 ●●● ■■■■ ●●■ ■● ■●●
 ■●■● ●■■■

Sight and Sound CW



ICOM VERSATILITY

ICOM's versatile family of handhelds provides superb performance and reliability to keep you talking. With an incomparable full line of interchangeable accessories and options, they're suited to fit your every radio need.

2 METERS

ICOM's advanced IC-02AT, compact IC- μ 2AT Micro, and rugged IC-2AT dominate the 2-meter bands from 139.0-163.0MHz.

220MHz

ICOM's deluxe IC-03AT and dependable IC-3AT are the perfect choices for 220.00-224.995MHz.

440MHz

ICOM's outstanding IC-04AT, IC- μ 4AT, and Micro IC-4AT, have you covered to 440.00-449.995MHz.

1.2GHz

Exclusively ICOM, the 1260.0-1299.990MHz band is owned by the unique, full-featured IC-12AT.

ACCESSORIES

With headsets complete with Vox or PTT control box, a large variety of interchangeable battery packs, leather cases and rapid desktop chargers—the versatile

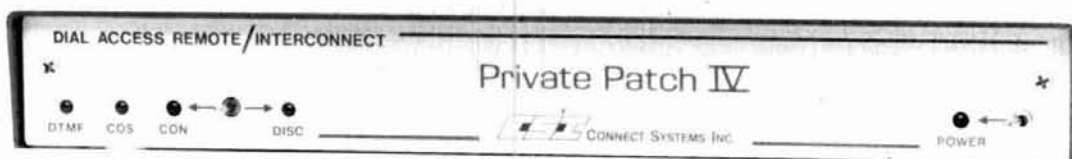
ICOM handhelds will keep you talking. Meet the full family at your local, quality ICOM dealer.

103


ICOM America, Inc.
 2380-116th Ave. N.E., Bellevue, WA 98004
Customer Service Hotline (206) 454-7619
 3150 Premier Drive, Suite 126, Irving, TX 75063
 1777 Phoenix Parkway, Suite 201, Atlanta, GA 30349
 ICOM CANADA, A Division of ICOM America, Inc.,
 3071 - #5 Road, Unit 9, Richmond, B.C. V6X 2T4
 Canada
 All stated specifications are approximate and subject to change without notice or obligation.
 All ICOM radios significantly exceed FCC regulations limiting spurious emissions. HANDHELDS1187.

THE ALL NEW PRIVATE PATCH IV BY CSI HAS MORE COMMUNICATIONS POWER THAN EVER BEFORE

- Initiate phone calls from your HT or mobile
- Receive incoming phone calls
- NEW! • Telephone initiated control . . .
 - ✓ Operate your base station with complete control from any telephone
 - ✓ Change frequencies from the controlling telephone
 - ✓ Selectively call mobiles using regenerated DTMF from any telephone
 - ✓ Eavesdrop the channel from any telephone
 - ✓ Use as a wire remote using ordinary dial up lines and a speaker phone as a control head.



The new telephone initiated control capabilities are awesome. Imagine having full use and full control of your base station radio operating straight simplex or through any repeater *from any telephone!* From your desk at the office, from a pay phone, from a hotel room, etc. You can even change the operating channel from the touchpad!

Our digital VOX processor flips your conversation back and forth fully automatically. There are no buttons to press as in phone remote devices. And you are in full control 100% of the time!

The new digital dialtone detector will automatically disconnect Private Patch IV if you forget to send # (to remotely disconnect) before hanging up. This powerful feature will prevent embarrassing lock-ups.

The importance of telephone initiated control for emergency or disaster communications cannot be overstated. Private Patch IV gives you full use of the radio system from any telephone. And of course you have full use of the telephone system from any mobile or HT!

To get the complete story on the powerful new Private Patch IV contact your dealer or CSI to receive your free four page brochure.

Private Patch IV will be your most important investment in communications.

✓ = NEW FEATURE

- ✓ * /# or multi-digit connect/disconnect
- ✓ Fully regenerated tone dialing
- Pulse dialing
- Toll protection
- Secret toll override code
- Busy signal disconnect
- ✓ Dialtone disconnect
- CW identification
- Activity timer
- Timeout timer
- ✓ Telephone initiated control
- ✓ Regenerated DTMF selective calling
- Ringout
- ✓ Ringout or Auto Answer on 1-8 rings
- Busy channel ringout inhibit
- ✓ Status messages
- ✓ Internally squelched audio
- MOV lightning protection
- ✓ Front panel status led's
- ✓ Separate CW ID level control
- ✓ 24 dip switches make all features user programmable/selectable.

- Connects to MIC and ext. speaker jack on *any* radio. Or connect internally if desired.
- Can be connected to any HT. (Even those with a two wire interface.)
- Can be operated simplex, through a repeater from a base station or connected directly to a repeater for semi-duplex operation.
- 20 minutes typical connect time
- Made in U.S.A.

OPTIONS

1. 1/2 second electronic voice delay
2. FCC registered coupler
3. CW ID chip



CONNECT SYSTEMS INC.
23731 Madison St.
Torrance CA 90505
Phone: (213) 373-6803

AMATEUR ELECTRONIC SUPPLY
Milwaukee WI, Wickliffe OH,
Orlando FL, Clearwater FL,
Las Vegas NV

BARRY ELECTRONICS CORP.
New York NY

EGE, Inc.
Woodbridge VA

ERICKSON COMMUNICATIONS
Chicago IL

HAM RADIO OUTLET
Anaheim CA, Burlingame CA,
Oakland CA, Phoenix AZ,
San Diego CA, Van Nuys CA,
Atlanta GA

HENRY RADIO
Los Angeles CA

INTERNATIONAL RADIO SYSTEMS
Miami FL

JUNS ELECTRONICS
Culver City CA

MADISON ELECTRONICS SUPPLY
Houston TX

MIAMI RADIO CENTER CORP.
Miami FL

MIKES ELECTRONICS
Ft. Lauderdale, Miami FL

N&G DISTRIBUTING CORP.
Miami FL

OMNI ELECTRONICS
Laredo TX

PACE ENGINEERING
Tucson AZ

THE HAM STATION
Evansville IN

WESTCOM
San Marcos CA

CANADA:
CARTEL ELECTRONIC DISTRIBUTORS
Surrey B.C.

COM-WEST RADIO SYSTEMS, LTD.
Vancouver B.C.

KENWOOD

...pacesetter in Amateur Radio

NEW!

Affordable DX-ing!

TS-140S

HF transceiver with general coverage receiver.

Compact, easy-to-use, full of operating enhancements, and feature packed. These words describe the new TS-140S HF transceiver. Setting the pace once again, Kenwood introduces new innovations in the world of "look-alike" transceivers!

- Covers all HF Amateur bands with 100 W output. General coverage receiver tunes from 50 kHz to 35 MHz. (Receiver specifications guaranteed from 500 kHz to 30 MHz.) Modifiable for HF MARS operation. (Permit required)
- All modes built-in. LSB, USB, CW, FM and AM.
- Superior receiver dynamic range Kenwood DynaMix™ high sensitivity direct mixing system ensures true 102 dB receiver dynamic range.



- New Feature! Programmable band marker. Useful for staying within the limits of your ham license. For contesters, program in the suggested frequencies to prevent QRM to non-participants.
- Famous Kenwood interference reducing circuits. IF shift, dual noise blankers, RIT, RF attenuator, selectable AGC, and FM squelch.

- M. CH/VFO CH sub-dial. 10 kHz step tuning for quick QSY at VFO mode, and UP/DOWN memory channel for easy operation.
- Selectable full (QSK) or semi break-in CW.
- 31 memory channels. Store frequency, mode and CW wide/narrow selection. Split frequencies may be stored in 10 channels for repeater operation.
- RF power output control.
- AMTOR/PACKET compatible!
- Built-in VOX circuit.
- MC-43S UP/DOWN mic. included.

Optional Accessories:

- AT-130 compact antenna tuner • AT-250 automatic antenna tuner • HS-5/HS-6/HS-7 headphones • IF-232C/IF-10C computer interface
- MA-5/VP-1 HF mobile antenna (5 bands)
- MB-430 mobile bracket • MC-43S extra UP/DOWN hand mic. • MC-55 (8-pin) goose neck mobile mic. • MC-60A/MC-80/MC-85 disk mics.
- PG-2S extra DC cable • PS-430 power supply
- SP-40/SP-50B mobile speakers • SP-430 external speaker • SW-100A/SW-200A/SW-2000 SWR/power meters • TL-922A 2 kW PEP linear amplifier (not for CW QSK) • TU-8 CTCSS tone unit
- YG-455C-1 500 Hz deluxe CW filter, YK-455C-1 New 500 Hz CW filter.



TS-680S

All-mode multi-bander

- 6m (50-54 MHz) 10 W output plus all HF Amateur bands (100 W output).
- Extended 6m receiver frequency range 45 MHz to 60 MHz. Specs. guaranteed from 50 to 54 MHz.
- Same functions of the TS-140S except optional VOX (VOX-4 required for VOX operation).
- Pre-amplifier for 6 and 10 meter band.



Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications, features, and prices are subject to change without notice or obligation.

KENWOOD

KENWOOD U.S.A. CORPORATION
2201 E. Dominguez St., Long Beach, CA 90810
P.O. Box 22745, Long Beach, CA 90801-5745

ham radio

magazine

JANUARY 1988

volume 21, number 1

T. H. Tenney, Jr., W1NLB
publisher

Rich Rosen, K2RR
editor-in-chief
and associate publisher

Terry Northup
assistant editor

Tom McMullen, W1SL
Joseph J. Schroeder, W9JUV
Alfred Wilson, W6NIF
associate editors
Susan Shorrock
editorial production

editorial review board

Peter Bertini, K1ZJH
Forrest Gehrke, K2BT
Michael Gruchalla, P.E.
Bob Lewis, W2EBS
Mason Logan, K4MT
Vern Riportella, WA2LQQ
Ed Wetherhold, W3NQN

publishing staff

J. Craig Clark, Jr., N1ACH
assistant publisher

Rally Dennis, KA1JWF
director of advertising sales

Dorothy Sargent, KA1ZK
advertising production manager

Susan Shorrock
circulation manager

Therese Bourgault
circulation

Farm Color
cover

ham radio magazine is published monthly by
Communications Technology, Inc.
Greenville, New Hampshire 03048-0498
Telephone: 603-878-1441

subscription rates

United States:

one year, \$22.95; two years, \$38.95; three years, \$49.95

Europe (via KLM air mail), \$40.00

Canada, Japan, South Africa and other countries (via surface mail),
one year, \$31.00; two years, \$55.00; three years, \$74.00

All subscription orders payable in U.S. funds, via international
postal money order or check drawn on U.S. bank

international subscription agents: page 111

Microfilm copies are available from
University Microfilms, International
Ann Arbor, Michigan 48106
Order publication number 3076

Cassette tapes of selected articles from ham radio
are available to the blind and physically handicapped
from Recorded Periodicals,
919 Walnut Street, Philadelphia, Pennsylvania 19107

Copyright 1987 by Communications Technology, Inc.
Title registered at U.S. Patent Office

Second-class postage paid
at Greenville, New Hampshire 03048-0498
and at additional mailing offices
ISSN 0148-5989

Send change of address to ham radio
Greenville, New Hampshire 03048-0498



contents

10 sight and sound CW

Don E. Hildreth, W6NRW

17 a battery-backed master power system

Eric L. Smitt, K9ES

25 new uses for old tuners

Hugh Wells, W6WTU

35 morse code teaching tools for the C-64 and 128

Dennis L. Green, KB8CS

38 build a QSO "beeper"

Richard L. Erhardt, KF6CU

52 radio addition: case history of an enthusiast

Robert J. Zarvel, Jr., W7SX

54 the technology of commercial television part 2: hardware

Eric Nichols, KL7AJ

69 ode to older oscilloscopes

W. Clem Small, KR6A

75 practically speaking: drift and shift

Joe Carr, K4IPV

83 the weekender: power speaker enhances mobile operation

Peter Bertini, K1ZJH

89 ham radio techniques: the year was 1923...

Bill Orr, W6SAI

100 Elmer's notebook: power measurements

Tom McMullen, W1SL

Joe Reisert's column returns next month.

114 advertisers index
and reader service

9 comments

96 DX forecaster

112 flea market

87 grid locator

110 ham mart

107 new products

4 reflections



REFLECTIONS



Hello Terry, Good Luck Dorothy

Meet Terry Northup, our latest addition to the Ham Radio magazine staff. She has handily started taking over the responsibilities once enjoyed by Dorothy Rosa and will be working with our authors to communicate the quality technical information that you expect from us. If one is allowed to judge by first impressions Terry brings to HR, besides her obviously finely-

tuned editorial skills, a vitality and spirit that is synonymous with what we perceive is needed in Amateur Radio in general.

Dorothy, prior to leaving for her new job as Senior Editor of 80 MICRO (International Data Group's monthly magazine for users of Tandy's MS-DOS) shared with us her feelings about Terry and about her own 5 years on the staff at HR.

"Terry, a skilled journalist and former publicist for the American Trucking Association brings relevant experience and strong writing, editorial and 'people' skills to a position that's as personally rewarding as it is professionally demanding. She also brings a resilient sense of humor and what a former employer described as a 'fine sense of the ridiculous'. That's good because she'll need both qualities in considerable quantity."

If you consider that magazine, newspaper or any periodical production can be likened to a smooth running machine, a treadmill really, that relies on all the participants contributions to maintain demanding schedules then you get to appreciate everyone's efforts. Dorothy recognized this when she tried to sum up her 5 years at the magazine.

"It's difficult to say goodbye to my colleagues at ham radio- not just to those whose names appear on the masthead, but to those whose names you never see: Beth McCormack, editorial department secretary; Teresa Leger, bookstore manager; and Phil Alix, chief of shipping, inventory and logistics. For ability, patience, and tireless goodwill, these folks are tops."

Dorothy, never really at a loss for words had one last message for the authors and columnists: "Goodbye, guys...73,88—and get those proofs back on time, darn it.!"

The voice will be different and the methods as well but the message will still be the same ... Ham Radio magazine—how may we help? Get in touch with Terry and see what we've already discovered and I'm sure you'll enjoy working with her.

Rich Rosen, K2RR
Editor-in-Chief

KENWOOD

...pacesetter in Amateur Radio

New
220 MHz

220: FM for All!



Kenwood brings you a wide range of 220 MHz gear designed for every need. Choose from two types of mobile and two types of HT. The TH-315A is a

TH-315A
Full-featured HT

full-featured HT covering 220–225 MHz. Ten memory channels and 2.5 watts of power. (5 W with PB-1 or 12 V DC.) Uses the same accessories as the TH-215A for 2 meters or TH-415A 440 MHz. For truly "pocket portability," choose the TH-31BT, a thumb-wheel programmable, 1 watt unit. For mobile use, select the TM-321A or TM-3530A.

The TM-321A is the 25 W, 220 MHz, 14-channel version of the super popular, super compact TM-221A. The 25-watt TM-3530A has 23 channels, a 15 telephone number memory and auto dialer. Direct keyboard frequency entry and front panel DTMF pad enhances operating convenience. Novice to Amateur Extra, these transceivers will put everyone on the air "Kenwood Style"!

TM-321A
Compact mobile transceiver

TH-31BT/31A
Pocket-held HT



TH-315A



New



New

TM-3530A
Full-featured mobile transceiver

KENWOOD

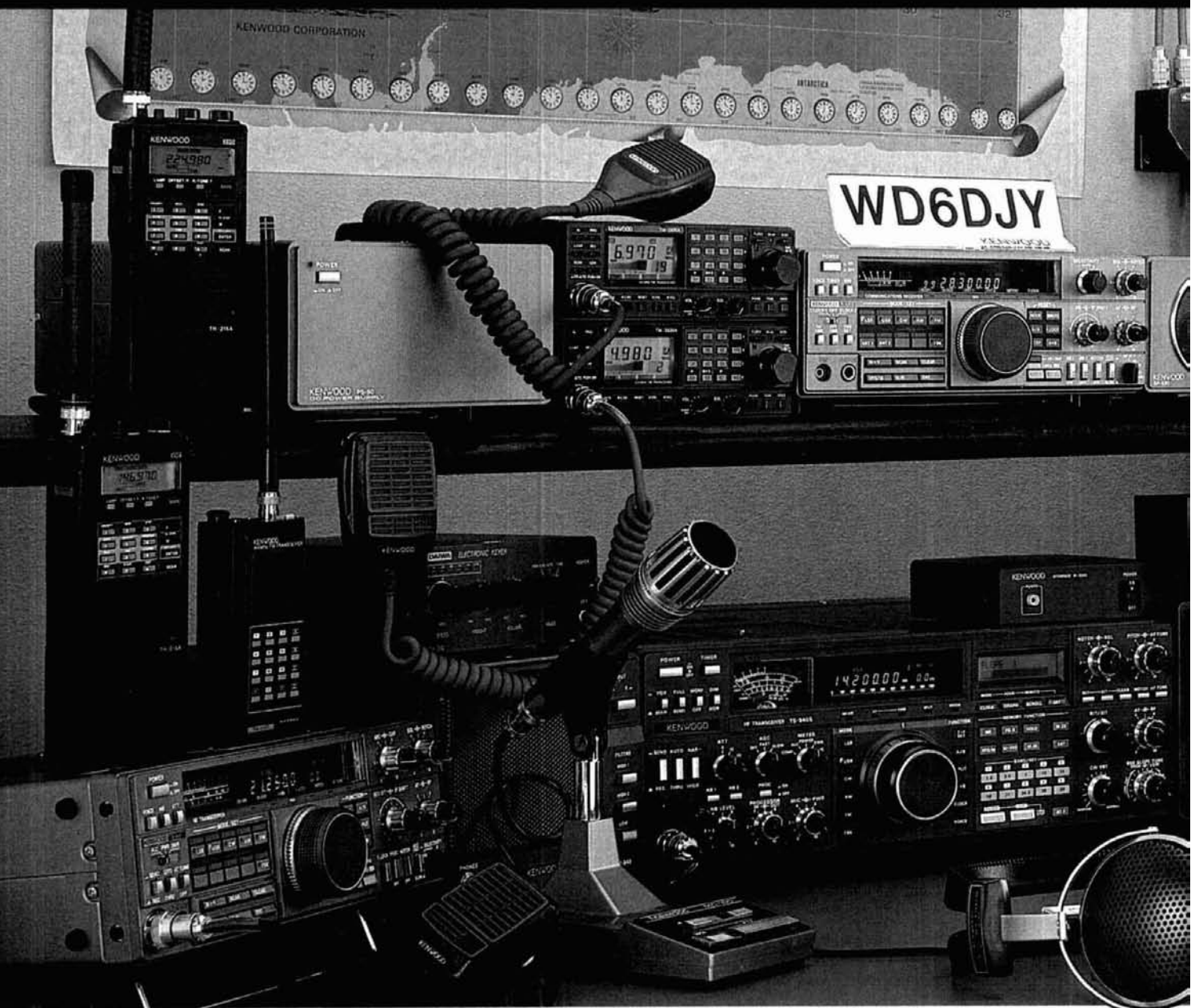
A complete line of accessories is available for all models.

Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications and prices are subject to change without notice or obligation.

KENWOOD U.S.A. CORPORATION
2201 E. Dominguez St., Long Beach, CA 90810
P.O. Box 22745, Long Beach, CA 90801-5745

KENWOOD

...pacesetter in Amateur Radio



Kenwood: from Novice

Kenwood has been producing the finest communications equipment for over three decades. Kenwood is the name recognized the world over as the number one manufacturer of Amateur Radio equipment.

Being number one means that we are committed to offer you the finest selection of equipment available. It's all here—everything for a truly "top notch" station. Commercial grade receivers for the Short Wave Listener. The latest in 220 MHz

transceivers for the enhanced Novice. The finest selection of VHF and UHF rigs. Our legendary HF line continues to earn top billing in Product Reviews, winning contest stations, and DXCC Honor Roll. All in your choice of base, mobile, or portable packages. All designed with the latest innovations in communications technology.

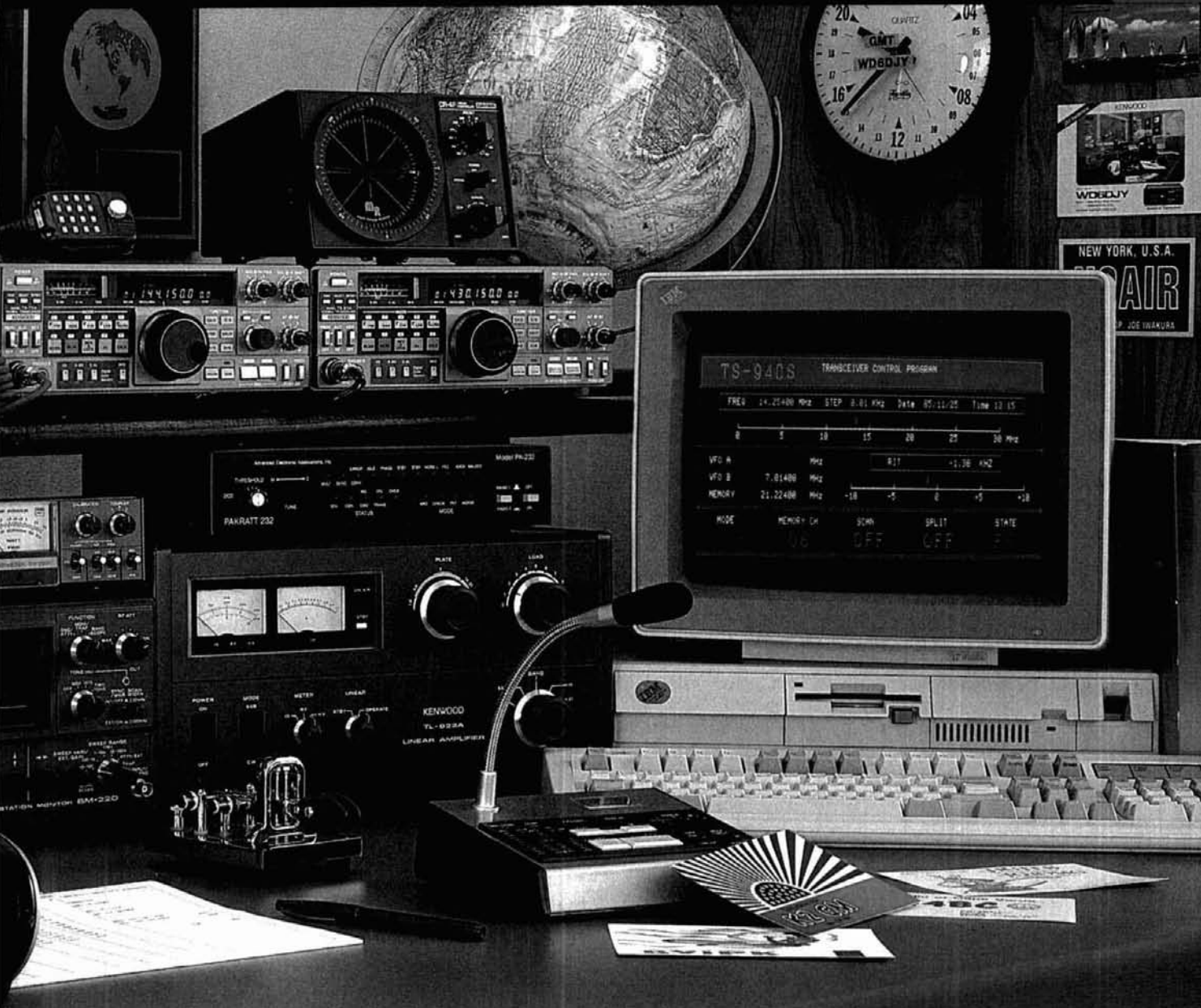
When you are on the air with a Kenwood rig, fellow Amateurs recognize that "Kenwood Sound"—it separates you from

the pack and lets everyone know that you are serious about communications, whether it's traffic handling, contesting, DX chasing, or just plain rag chewing.

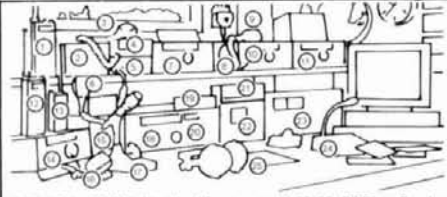
Leading edge technology, and superior field-proven performance—that's the Kenwood Experience!

Contact your nearest Authorized Kenwood Amateur Radio Dealer for more details on the hottest ham gear in the world!

Listen for
WD6DJY
Kenwood's Club
Station



to Amateur Extra Class!



1) TH-315A: 220 MHz Hand held Transceiver, 2) PS-50: DC Power Supply, (3) MC-43S: UP/DWN Microphone, included with (4) TM-2530A: Deluxe 25 W 2m FM Transceiver, (5) TM-3530A: Deluxe 25W 220 MHz Transceiver (also comes with MC-43S mic.), (6) MC-48B: 16 key DTMF Microphone,

(7) R-5000: High Performance Receiver, (8) SP-430: Matching External Speaker for TS-430S/TS-440S, (9) MC-48B, (10) TS-711A: 2m, 25 W All Mode Base Transceiver, (11) TS-B11A: 70cm, 25W All Mode Base Transceiver, (12) TH-215A: 2m, Full featured HT, (13) TH-21BT: Pocket-sized, 2m FM Transceiver, (14) TS-440S: HF Transceiver (with AT-440 installed), (15) SP-940: Matching External Speaker for TS-940S, (16) MC-48B, (17) MC-60A: Base Station Microphone with UP/DWN controls, (18) TS-940S: Competition Class HF Transceiver with General Coverage Receiver (AT-940 installed), (19) IF-232C: Computer Interface Level translator, (20) IF-10B: Computer Interface Module (installed inside TS-940S), (21) SW-2000: SWR/Power Meter, (22) SM-220: Station Monitor with pan display option BS-8 installed, (23) TL-922A: HF Linear Amplifier, (24) MC-85: Multi-function Desk Microphone with Graphic Equalization and three outputs, (25) HS-5: Deluxe Headphones

Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications, features, and prices are subject to change without notice or obligation.

KENWOOD

KENWOOD U.S.A. CORPORATION
2201E. Dominguez St., Long Beach, CA 90810
P.O. Box 22745, Long Beach, CA 90801-5745

MFJ-931 creates artificial RF ground with random wire also, electrically places far away ground directly at your rig



MFJ-931
\$79⁹⁵

- **Creates artificial RF ground with random length wire**
- **Electrically places a far away ground directly at your rig**
- **RF ammeter makes tuning for maximum RF ground current easy**
- **Eliminates "RF bites", RF feedback, TVI/RFI and other problems due to inadequate RF ground**
- **Improves radiation pattern distorted by poor RF ground**

Don't we all sometimes have problems getting a good RF ground?

Unpleasant problems. Problems like RF "hot spots" that "bite" our lips or fingers when we transmit; like RF feedback that causes our rigs to quit working on certain bands; like excessive RF coupling to AC lines that causes everything to quit working; like our neighbors screaming about TVI and RFI; like our computers computing jibberish; or like being unable to talk across town because of extreme ground losses or radiation pattern distortion.

"Hey, my rig is on the second floor. There's no way I can get a good ground," you're thinking, or "I already have an excellent ground but the long ground connection wire causes reactance and acts like a high impedance circuit, isolating my rig from true RF ground."

What to do

Use the new MFJ-931 to create an artificial RF ground! It resonates a random length of wire thrown along the floor and

produces a tuned counterpoise. This artificial ground effectively places your rig near actual earth ground potential even if your rig is on the second floor or higher with no earth ground possible.

Also, the MFJ-931 electrically places a far away RF ground directly at your rig -- no matter how far away it is. The MFJ-931 reduces the electrical length of the ground connection wire to virtually zero by tuning out its reactance.

How it works

The MFJ-931 connects between the ground connection of your transmitter or antenna tuner and a random length of wire thrown along the floor. Two knobs are adjusted for maximum RF ground current using its built-in RF ammeter. This resonates the random wire, converts it into a tuned counterpoise and presents an effective low impedance near ground potential to your rig, thus creating an artificial RF ground.

To electrically place a far away ground directly at your radio equipment simply connect the

MFJ-931 between your rig and the connecting ground wire and adjust its two knobs for maximum RF current using its RF ammeter. This tunes out the reactance of the connecting wire, reduces the electrical ground lead length to virtually zero and electrically places your far away ground directly at your rig.

Get an effective RF ground

Get an effective RF ground. Eliminate "RF bites", RF feedback TVI, RFI and many other annoying problems due to inadequate RF ground, *and* -- at the same time -- improve your radiation and radiation pattern for more DX.

The MFJ-931 covers 1.8 to 30 MHz and has a built-in RF ammeter for indicating RF ground current. It's ruggedly built in an all aluminum cabinet with a brushed aluminum front panel and measures 7 1/2 x 3 1/2 x 7 inches. It comes with a one year unconditional guarantee.

It's available only from MFJ. MFJ-931, \$79.95.

Order any product from MFJ and try it -- no obligation. If not satisfied return within 30 days for prompt refund (less shipping).
• One year unconditional guarantee • Add \$5.00 each shipping/handling • Call or write for free catalog, over 100 products.

MFJ

MFJ ENTERPRISES, INC.
Box 494, Miss. State, MS 39762

To Order or for Your Nearest Dealer
800-647-1800

Call 601-323-5869 in Miss. and outside continental USA.
Telex 53-4590 MFJ STKV





comments

the INUS system

Dear HR:

The INUS system can provide an answer for the "possessed" described in K2RR's editorial (October 1987), which I appreciated so much.

According to INUS, all actions and possessions are either Indispensable, Necessary, Useful, or Superfluous (INUS). The actions and possessions of DX-minded Hams can be categorized as follows:

Indispensable: an antenna (tubing or wire), a proper transmission line, a 12-VDC mobile rig and a battery (or whatever, as long as it's able to receive and transmit), a key, a headset, a log, and a clock — plus a lot of determination and careful listening.

Necessary: a steerable antenna with more bands, a mike, an SWR meter, an antenna tuner matched to a linear amplifier for low-band DXing, a place in the house for the station, an operating manual, a book on propagation, a subscription to a DX bulletin — as well as patience, spare time, and a world atlas.

Useful: a keyer, a grid-dip meter or antenna bridge, a 2-meter HT. Maybe get a new gray or black box, see what's inside and how it compares with my brave 15-year-old rig?

Superfluous: all things not classified above, including pieces and parts for homebrew projects never completed and other parts that were to be used for all those *Someday I'll build a . . .*'s. Maybe awards can be put here! (Heresy perhaps, but really, it's not the

paper that makes the fine DXer, the good friend, the helpful Elmer . . .)

Because junkboxes tend to grow out of control, it's best to go through them and keep only those items you really need. But selecting the useful goodies isn't so easy; there are many reasons we keep things. In such as case, apply the "time test": any item not used during the first year after purchase, should be assigned second-class status. If it hasn't been used after a second year passes, it's best to sell it, trade it, or give it away. Better yet, make a collection and offer the whole thing to a radio museum. When the SK hour rings, I'll bring nothing along

A station covering more than a normal sized desk — one layer high — is in danger of elephantitis. And the ham who chooses to get involved in more than one mode soon discovers that too much rig = too much money and too little time dedicated to each individual mode; results are poor.

People eat for hunger or appetite. If they eat for hunger only, they are able to maintain a good physical and mental form, and actively enjoy life. In the second case, the choice of diet is impulsive, not balanced. Fat accumulates, cholesterol levels go up, and sedentary diseases appear. (Being an M.D., I see that every day.) The same is true for ham stations

**Dr. Michel Christ, XE1MD
Mixcoac, Mexico 03900**

short circuits

dc-dc converters

In W3CZ's October, 1987 article, "Pulse Width Modulated dc-to-dc Converters," the artwork shown in **fig. 1** should be moved to **fig. 3**. The artwork shown in **fig. 3** should be moved to **fig. 1**. The captions should remain as shown.

In **fig. 5A**, the IC block diagram is of the SG3524, not the UG1524 — in fact, the text states this. In addition, the LH1605K is not available from Digi-Key as stated; the LM3524 is.

Are you radioACTIVE?



Dean LeMon, KR0V sure is! Dean got active in Amateur Radio when he was 16 years old and earned his Extra Class license in less than four years! "It's a fascinating hobby and a great way to meet all kinds of new people from all over the world."

Dean has cerebral palsy and got started in Amateur Radio with help from the Courage HANDI-HAM System. The HANDI-HAM System is an international organization of able-bodied and disabled hams who help people with physical disabilities expand their world through Amateur Radio. The System matches students with one to one helpers, provides instruction material and support, and loans radio equipment.

Isn't it time you got radioACTIVE with the Courage HANDI-HAM System?

Call or write the Courage HANDI-HAM System W0ZSW at Courage Center, 3915 Golden Valley Road, Golden Valley, Minnesota 55422, phone (612) 588-0811.

Are you radioACTIVE?

sight-and-sound CW

Visual and aural correlation
enhances capture,
protects ears

In my general search mode in our CW bands, I usually prefer to listen with a bandwidth of 500 Hz or more. This relatively wide bandwidth makes the mechanics of tuning easy, giving my "ear-brain" filter free rein. Only when the going gets rough in terms of noise or QRM do I switch in my very narrow, steep-skirted filter. In the past when I did this, I often lost and had to retune the very signal I was trying to isolate.

Fortunately, adding this small electronic device to your receiver can do wonders. By taking advantage of your brain's ability to correlate visual and sonic inputs, it helps you make the transition from wide to narrow bandwidths quickly, easily, and with precision.

hearing and seeing CW

Our ear-brain filter capability enables us to focus our attention on a bandwidth as narrow as 50 to 100 Hz (it varies with the individual), anywhere within the normal audio range. For example, if you're one of the lucky ones who can focus to a 50-Hz bandwidth, and your receiver has a 3-kHz noise bandwidth, you can generally hear a CW signal nearly 18 dB below the noise. This "focused" bandwidth is inferred from the power of a single tone that you're able to perceive in relation to, and in the presence of, a known power contained in an audio bandwidth of white noise. (It doesn't take into account the difference in antenna noise and copy error rates, however.)

In a practical sense, this means that even if no other signals are present and you increase the gain of your receiver to bring a very weak signal to a 70-dB sound pressure level,* you'll present your hearing mechanism with a sound pressure of nearly 90 dB from noise alone. If there are other signals within the 3-kHz bandwidth, the sound pressure total may exceed 90 dB.

Permanent hearing damage begins when sound pressures reach approximately 90 dB for extended periods, and the amount of exposure time necessary for damage to occur is said to decrease as the sound pressure level increases. These factors present a compelling argument for the use of a narrowband filter, even if you can copy that weak DX signal in the presence of noise and QRM and don't think you need one.

Admittedly, switching to a narrow filter can be awkward — and the better the filter, the worse it gets, because although our ear-brain filter is good at detecting incremental frequency changes, it's not nearly as adept at recalling or recognizing an absolute frequency. As a result, if you're listening to a signal using a relatively wide bandwidth and you shift to the narrow, steep-skirted filter, chances are you'll lose the signal and have to retune to find it. The odds are about 50 percent that you'll not only tune in the wrong direction but also have to retune very slowly, consuming precious time and feeling your frustration mount.

To overcome this problem, you can put the brain's ability to correlate sight with sound to work. Even though visual copy of CW is limited in speed, it can help compensate for the ear's weakness in absolute frequency recognition. To provide this capability, all you have to do is add an LED, with associated circuitry, that's driven by the output of a narrow filter. The block diagram in **fig. 1** shows a typical arrangement.

Using the blocks shown, the narrow filter, LED driver, and power amplifier are constantly ON. Input to the power amplifier is selected either from your receiver's output or from the filter. The inclusion of substantial voltage gain in the power amplifier ensures the ability to listen to a filtered weak signal at a moderate-to-low gain level from your receiver. This is desirable because the presence of strong signals outside the filter bandwidth, but inside your receiver's bandwidth,

* 0 dB is the threshold level of human hearing. 70 dB is the approximate sound pressure level of a one-on-one conversation.

By Don E. Hildreth, W6NRW, 936 Azalea Drive, Sunnyvale, California 94086

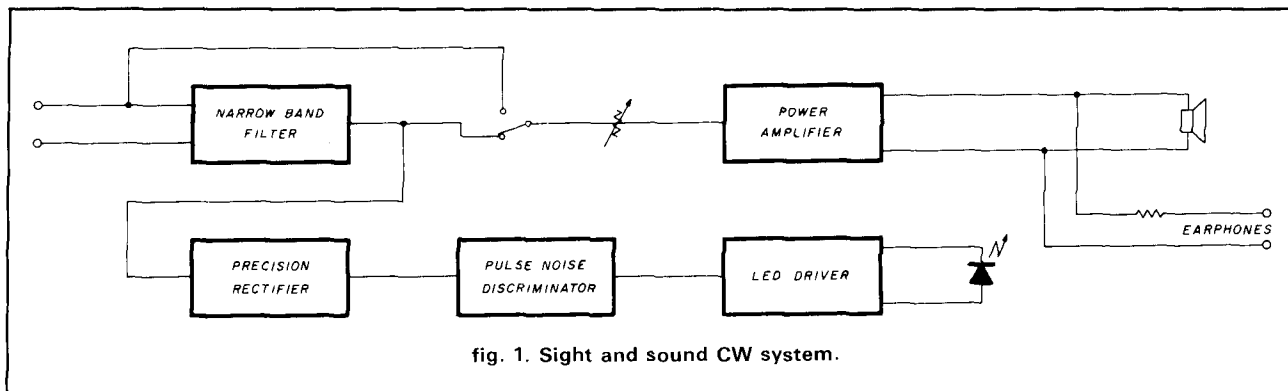


fig. 1. Sight and sound CW system.

could saturate some receiver stage if the receiver's gain is high.

system details and function

Figure 2 shows the circuit details of an eighth-order synchronous filter with a design bandwidth of approximately 40 Hz, a precision rectifier with a voltage gain of 10, a pulsewidth noise discriminator (PND), an LED driver transistor, and power amplifier.

In operation, a signal tuned to the filter's center frequency is fed to the input of the precision rectifier. The output from the rectifier is conditioned by an emitter-driven buffer to drive an emitter-coupled pair of transistors that serve as a PND. With the circuit values shown, the LED will respond to signal input amplitude levels from a receiver down to a nominal 0.1 volts RMS. The PND acts to ignore any signal until it has existed for a minimum length of time as determined by the installed value of R_t . As shown, this circuit doesn't recognize any signal voltage until it has existed for about 20 milliseconds. In addition, the circuit resets in less than one millisecond after an accepted signal stops. In this way, impulse noise, which usually lasts for less than 20 milliseconds, is rejected and 20 milliseconds is shaved from the leading edge of each coded "dit" and "dah." This provides the LED system with significant impulse noise rejection as well as an increased OFF time between the coded elements.

Modification of the code elements in this way can compensate, to some degree, for the eye's retentivity characteristic, which places the upper limit on visual code perception. Figure 3 shows a simplified representation of how this functions. A more detailed analysis of the PND was presented in a previous article.¹

general filter requirements

If you're concerned only about protecting your hearing from high noise pressure levels, steep skirts aren't required. A fourth-order bandpass filter designed for a nominal 50- to 100-Hz bandwidth, or a comparable

10- to 15-pole high-pass/low-pass combination adjusted to form a similar bandwidth, will do what is required. But if you wish simultaneous protection from high-level QRM that's very close in frequency to a desired signal and protection from wideband noise as well, an eighth-order bandpass — preferably in Butterworth or Chebychev configuration — is a minimum requirement.

The filter included in this article is an easy-to-build eighth-order Gaussian class design. An eighth-order Butterworth cascade was described in a prior article.²

Though the ringing performance of these narrow, steep-skirted filters can be a problem, they will allow comfortable copy to at least 25 WPM or so, depending on the individual. To mitigate the ringing and enable the use of filters that are still narrower, you can add a carrier-activated limiter between the output filter and power amplifier.² Clearly, as bandwidths narrow and as skirts fall more quickly, the visual tuning aid becomes more beneficial.

operating with sight and sound

To put this system into practice, turn your receiver's AGC off. Select a signal in the wideband position. As you tune through the beat note frequencies, you'll notice that the signal excites the LED only when it's in the narrow filter's bandwidth. Correlation between the LED and sonic outputs will be clearly recognized. As a corollary, if the wrong signal — that is, not the signal that you are focused on — is in the narrow filter's passband, the lack of correlation will be clearly perceived.

There isn't much question that copying code visually from a blinking LED is slower than copying by ear, but this system doesn't require that you copy with your eyes — only that you *sense* correlation. What's more, you don't have to actually watch the LED; peripheral vision is all you need. Of course, you'll probably look directly at the LED in the beginning, but you should be able to wean yourself from that habit reasonably quickly. Once you do this, you can put the LED anywhere it can be seen from the corner of your eye.

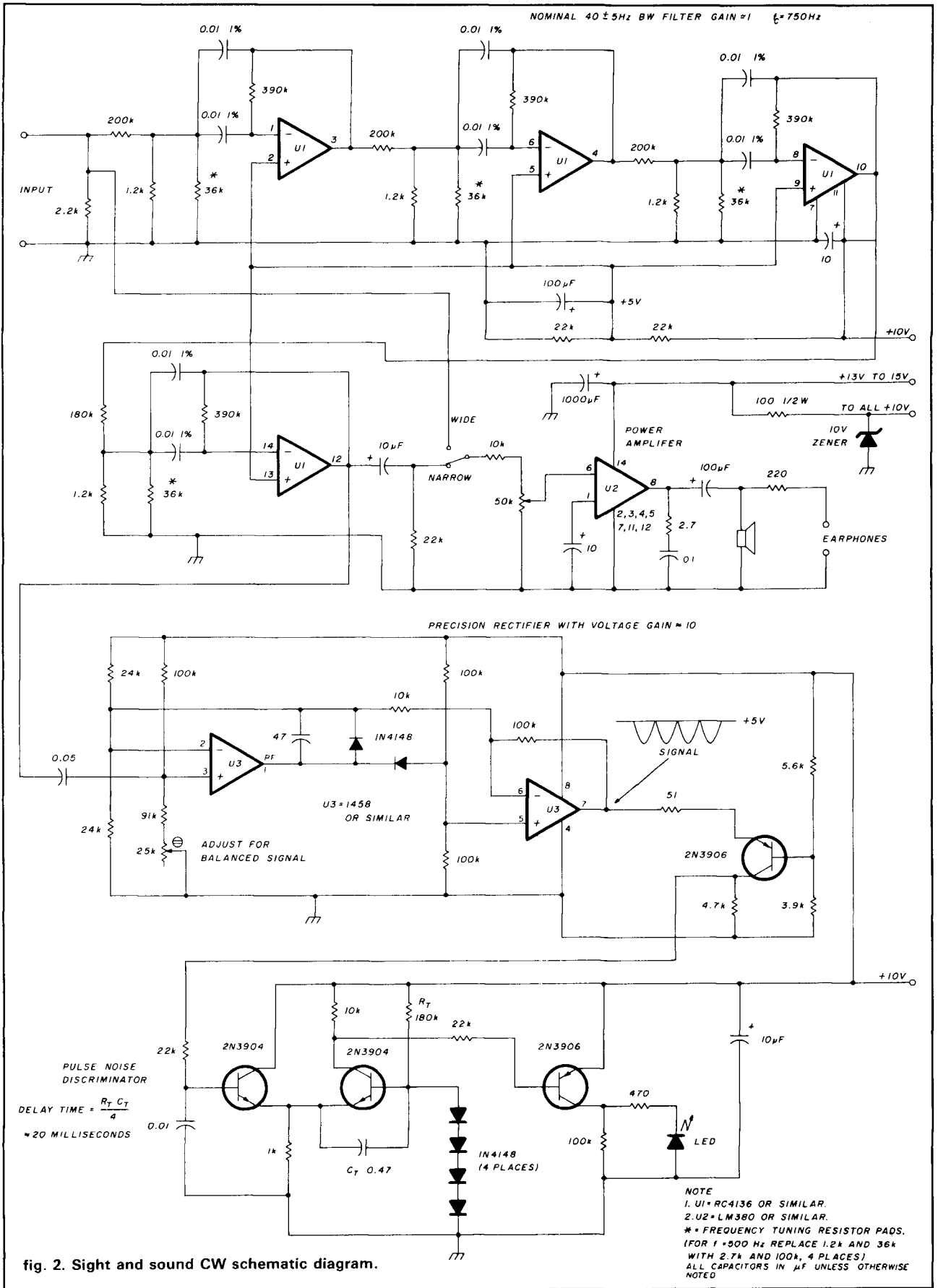


fig. 2. Sight and sound CW schematic diagram.

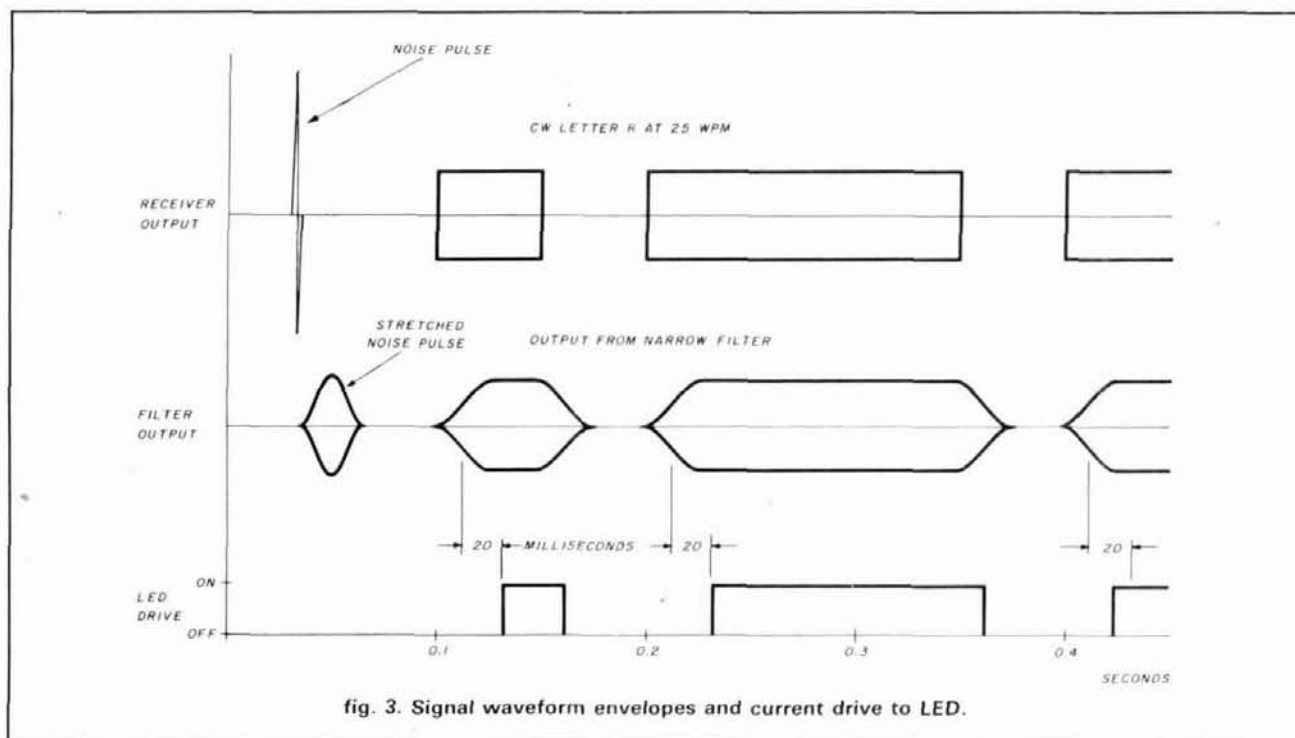


fig. 3. Signal waveform envelopes and current drive to LED.

When copying high-speed code, it may appear that the LED isn't keeping up to speed. This is an illusion. The problem isn't with the LED, but with our eyes, which just can't release light energy as fast as they can accept it. Under such circumstances, the OFF spaces tend to fill, making visual copy at high speeds extremely difficult. (This is what made 16 frame-per-second movies and TV possible.)

Besides the sonic benefit of the correlation function, there's a tuning "feel" assist. As you tune a signal while switched to the wider bandwidth, sonic feedback relative to knob control isn't lost. The end result is that the very critical knob control associated with very narrow filters is reduced. Once a signal is nicely in place, as indicated by the LED, you simply switch your audio to the narrow filter and you're right where you want to be.

In addition to these relatively mechanical improvements, there may also be some psychological benefits from parallel sensory excitation.³

Regardless of motivation, adding sight to sound in the detection of CW is relatively easy and inexpensive — and with your eyes, ears, and brain working together.

references

1. Don E. Hildreth, "A Pulsewidth Noise Discriminator," *ham radio*, November, 1984, page 23.
2. Don E. Hildreth, "Advanced CW Processor," *ham radio*, December, 1986, page 25.
3. Unpublished manuscript; send SASE to author for details.

ham radio

CONTINUOUS COVERAGE ANTENNAS FOR COMMERCIAL & AMATEUR SERVICE

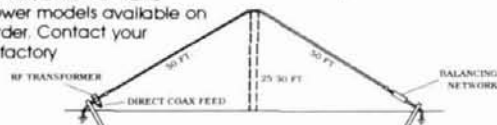
Model AC 1.8-30

1.8 to 30 MHz

- SWR Max 2:1, 1.4:1 average from 1.8 to 30 MHz
- Can be installed in approximately 80 ft. space
- Ideal for commercial services for multi frequency operation without the need for antenna tuners or additional antennas
- Handles 1 KW, 2 KW PEP ICAS
- Higher power models available on special order. Contact your dealer or factory

\$159.50

SHIPPING & HANDLING
ADD \$4.00



U.S. Patent No. 4,511,898

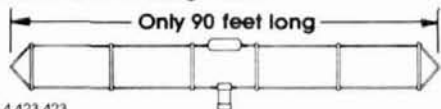
Model AC 3.5-30

3.5 to 30 MHz

- SWR less than 2:1 from 3.5 to 30 MHz
- Complete assembled. Balun terminated with standard SO-239 connector
- Power capability 1 KW - 2 KW PEP ICAS. Higher power model is available on special order.
- Designed for 50 ohm feedline
- Weather proof balun and balancing network

\$167.50

SHIPPING & HANDLING
ADD \$4.00



U.S. Patent No. 4,423,423

ALL OUR PRODUCTS MADE IN USA



BARKER & WILLIAMSON

Quality Communication Products Since 1932

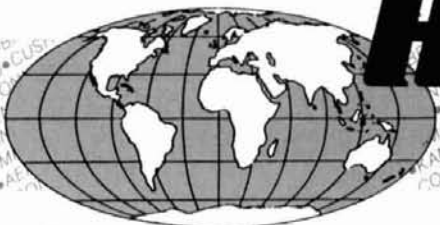
At your Distributors. Write or Call.

10 Canal Street, Bristol, PA 19007

(215) 788-5584



WORLDWIDE DISTRIBUTION



HAM RADIO OUTLET

LARGEST HAM OUTLET IN THE WORLD

**GUARANTEED
QUALITY
AT LOW OUTLET PRICES**

7 STORE BUYING POWER

KENWOOD TS-940S



TOP-OF-THE LINE
HF TRANSCEIVER



Contemporary design,
quality and a 5 year warranty
on parts and labor.
6 months on the RF Final transistors.
All amplifiers have GaAsFET receive
pre-amps and high SWR shutdown protection.

Gordon West's 21 DAY NOVICE

\$19.95



- CODE TAPES • 112 PAGE BOOK • BANDS CHART
ALL FCC FORMS • SAMPLE TESTS • PLUS MORE!
- \$70 in equipment certificates from ICOM, KENWOOD, & YAESU.
 - Ham radio equipment "Wish Books".
 - ARRL membership forms.
 - Hotline for student questions.
 - Course completion certificate.
- PLUS
ADDITIONAL
ITEMS



MA-40
40' TUBULAR TOWER
~~\$745~~ SALE! **\$549**

MA-550➔
55' TUBULAR TOWER
~~\$1245~~ SALE! **\$899**

- Handles 10 sq. ft. at 50 mph
- Pleases neighbors with tubular streamlined look

TX-455
55' FREESTANDING
CRANK-UP

- Handles 18 sq. ft. at 50 mph
- No guying required
- Extra-strength Construction
- Can add raising and motor drive accessories

Shown with optional
MARB rotor base

IN STOCK FOR QUICK DELIVERY
OTHER MODELS AT GREAT PRICES

GEOCHRON GLOBAL TIME INDICATOR



- Detailed illuminated map shows time, time zone, sun position and day of the week at a glance for any place in the world.
- Continuously moving - areas of day and night change as you watch.
- Mounts easily on a wall. Size: 34 1/2" x 22 1/2"

\$1295 DELIVERED IN U.S.

INDUSTRIAL LINE LUNAR

30w in, 160w out,
with low-noise
preamp!
MODEL
2M30-160P
for 2 meters
SALE!



\$219.95

From the Originator of the
QUALITY VHF AMP/PREAMP COMBO!

Alpha Delta Model DELTA-4

Lightning Surge Protected
4-Position RF Coax Switch

- Exclusive center "off" (ground) position.
- Uses ceramic Arc-Plug™ protector.
- Micro-strip circuitry—no wafer switch.



Model DELTA-4
(UHF Connectors) \$69.95

Model DELTA-4/N
(N-type Connectors) \$89.95

FREE SHIPMENT
MOST ITEMS UPS SURFACE

A3 DX THAT STANDS OUT FROM THE CROWD

**10, 15, 20
Meters**

Whether busting pileups,
rag chewing or hunting
rare DX, the A3 stands
out from the crowd with
the perfect combination
of easy assembly, the
right size, rugged durabil-
ity and great
performance.

- Boom Length 14 ft.,
Weight 27 lbs.
- Wind Surface Area
4.36 ft.

Mast
not
included

REG.
319.95

SALE
219.95
Plus Shipping

**FREE
SHIPMENT**
Most items UPS
surface

All Major Brands in Stock Now!

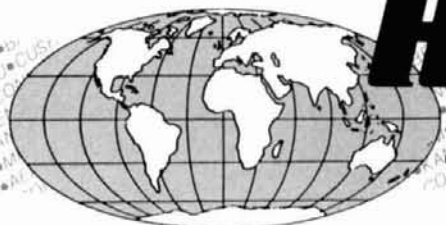
CALL TOLL FREE (800) 854-6046



Toll free including Hawaii. Phone Hrs: 7:00 am to 5:30 p.m. Pacific Time. California, Arizona and Georgia customers call or visit nearest store. California, Arizona and Georgia residents please add sales tax. Prices, specifications, descriptions subject to change without notice.



WORLDWIDE DISTRIBUTION



HAM RADIO OUTLET

LARGEST HAM OUTLET IN THE WORLD

FREE SHIPMENT
MOST ITEMS UPS SURFACE

7 STORE BUYING POWER

ICOM IC-761



HF SUPERIOR GRADE
TRANSCEIVER

SALE! CALL FOR PRICE

ICOM IC-275A/275H



138 - 174 MHz
IC-275A (25w) IC-275H (100w)
GREAT PRICE!

ICOM IC-900 MULTI-BAND MOBILE



YOU CAN OPERATE SIX BANDS
WITH ONE CONTROLLER!
2 MTR 25/45W, 440 MHz 10 MTR, 6 MTR,
220 MHz & 1.2 GHz 10 MEMORIES
ARE YOU READY FOR
1.2 GHz OPERATION?

ICOM IC-28A/28H



2-METER MOBILES
IC-28A (25w) IC-28H (45w)
LOW PRICE!

NOW!
IC-38A
220 MHz

NOW! RAPID DELIVERIES



FROM STORE NEAREST YOU

ICOM HAND-HELD VHF/UHF



IC-02AT IC-2AT 2MTR
IC-03AT IC-3AT 220 MHz
IC-04AT IC-4AT 440 MHz

ICOM IC-735



The Latest in ICOM's Long
Line of HF Transceivers

CALL FOR LOW, LOW PRICE

ICOM IC-R7000



25 MHz-1300 MHz

IN STOCK FOR
IMMEDIATE DELIVERY

ICOM IC-u4AT/u2AT 440 MHz, 2MTR

Mini
Hand-Held
AT Model
w/ TT Pad
GREAT
PRICE!



All Major Brands in Stock Now!



Bob Ferrero W6RJ
President
Jim Rafferty N6RJ
VP So. Calif Div.
Anaheim Mgr.

ANAHEIM, CA 92801
2620 W. La Palma
(714) 761-3033 (213) 860-2040
Between Disneyland &
Knott's Berry Farm

ATLANTA, GA 30340
6071 Buford Hwy
(404) 263-0700
Neil Mgr KC4MJ
Doraville, 1 mi north of I-285

BURLINGAME, CA 94010
999 Howard Ave.
(415) 342-5757
George Mgr WB6DSV
5 miles south on 101 from SFO

OAKLAND, CA 94606
2210 Livingston St
(415) 534-5757
Al Mgr WA6SYK
17N-5th Ave / 17S-16th Ave

PHOENIX, AZ 85015
1702 W. Camelback Rd
(602) 242-3515
Bob Mgr K7RDH
East of Hwy 17

SAN DIEGO, CA 92123
5375 Kearny Villa Rd
(619) 560-4900
Tom Mgr KM6K
Hwy 163 & Claremont Mesa Blvd

VAN NUYS, CA 91411
6265 Sepulveda Blvd
(818) 988-2212
Al Mgr K6YRA
San Diego Fwy
at Victory Blvd

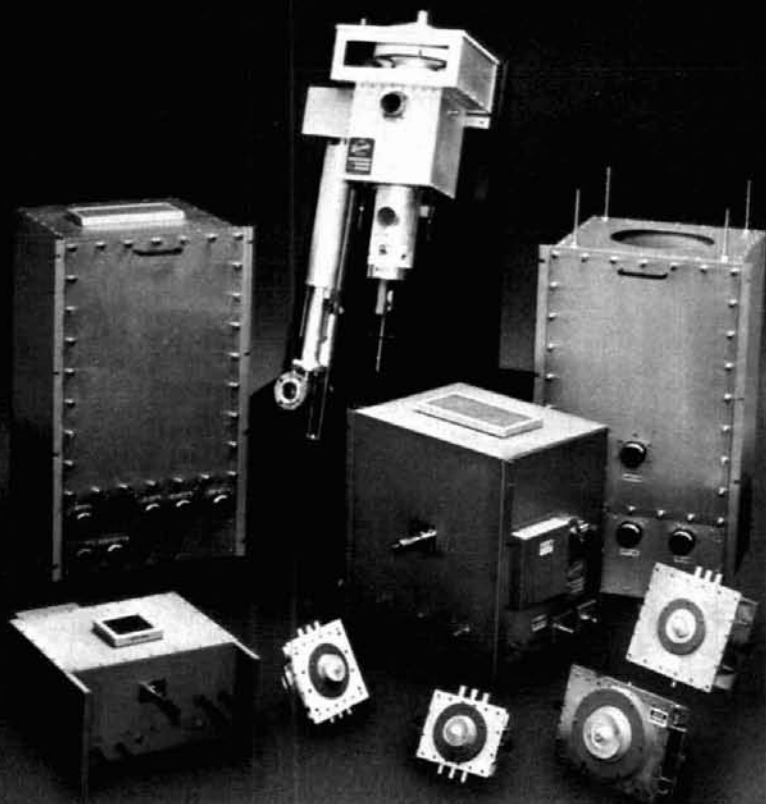
STORE HOURS
10 AM-5:30 PM
CLOSED SUNDAYS



CALL TOLL FREE (800) 854-6046

Toll free including Hawaii. Phone Hrs: 7:00 am to 5:30 p.m. Pacific Time. California, Arizona and Georgia customers call or visit nearest store.
California, Arizona and Georgia residents please add sales tax. Prices, specifications, descriptions subject to change without notice.





EIMAC cavities cover 54 to 970 MHz at power levels to 30 kW —our design or yours

Varian EIMAC has complete cavity design and production capability. We make sure that tube and cavity are compatible. If it isn't an off-the-shelf-item, we have the designers and engineers for any specific job.

EIMAC has expertise in all disciplines including pulse, CW, FM, and TV. We match tube, power,

bandwidth and operating mode to achieve optimum performance.

More information on EIMAC cavities and tubes is available in our Cavity Capability brochure from Varian EIMAC. Or for prompt consideration of your special design requirements, contact Product Manager, Var-

ian EIMAC, or the nearest Varian Electron Device Group sales office. Call or write today.

Electron Device Group
Varian EIMAC
301 Industrial Way
San Carlos, California 94070
415-592-1221

Varian A.G.
Steinhauserstrasse
CH-6300 Zug, Switzerland
Tel: (042) 23 25 75
Telex: 78 841

EIMAC Cavity	Matching EIMAC Tube	Tuning Range (MHz)	Power Output
CV-2200	4CX20,000A	86-108	30 kW
CV-2220	3CX1500A7	86-108	1.5 kW
CV-2225	4CX3500A	86-108	5 kW
CV-2240	3CX10,000U7	54-88	10 kW†
CV-2250	3CX10,000U7	170-227	10 kW†
CV-2400	8874	420-450	300/1250 W*
CV-2800	3CX400U7	850-970	225 W
CV-2810	3CX400U7	910-970	190 W

*pulsed power

†peak sync, or 2.5 kW combined in translator service



varian

a battery-backed master power system

Dependable dc power
for normal and
emergency operation

An ac power supply — whether it's just a simple series-regulated supply or a more complicated switching power supply — may add as much as 20 percent to the price of a single piece of today's solid-state equipment. A typical 20-amp power supply, for example, costs over \$100. It also takes up space and generates heat. If it fails, your expensive equipment can suffer serious damage.

My station consists of four solid-state transceivers, a few solid-state linear amplifiers, a packet radio TNC, a memory keyer, and a 220-MHz transverter. All but the larger amplifiers, the packet CRT, and the rotor controls require 12 volts; if I were to purchase a power supply for each of the remaining items, the cost would exceed \$400. Consequently, I've developed a power system that exceeds the ratings of any commercial supply, is totally backed up by a battery, and operates the station during total power failures for several hours. The system is safe, and its stability is very good.

The basic system, shown in **fig. 1.**, involves four blocks: the battery system, the battery charging system, the monitoring system, and the 12-volt distribution system.

• **The battery** is a "maintenance free" car battery purchased from a discount store for \$29.95. I use standard battery clamps with a compression fitting to connect the large cables to the terminals. The terminals are protected with chemical pads to reduce corrosion. Mounted on a wooden surface — not directly on the cement floor — the battery is positioned away from anything that might come in contact with, and thereby short out, the terminals.

• **The battery charging system** is a homebrewed regulated power supply that I built using surplus computer power supply parts. Capable of providing up to +16 volts or currents of up to 75 amps continuous,

it weighs over 100 pounds but costs very little to build. Though it could easily supply the radios by itself, I decided not to run it directly into them. The output voltage is fed to the battery through a large series diode that provides isolation from the battery when the ac power fails — whether because of a blown fuse or a general power failure. Mounted on a large heat sink and wrapped in insulation tape, this diode is rated at 100 amps and 100 PIV. Also in series with the battery and battery charger are a 25-amp quick-blow fuse and a current-measuring shunt that allows monitoring of the charging currents to the battery.

• **The battery monitoring circuitry** measures three parameters of the electrical system: the battery's terminal voltage (10 to 15 volts), the battery's input charge current (0 to 20 amps), and the battery's output current to the system (0 to 50 amps).

The battery terminal voltage monitor shown in **fig. 2** is composed of circuitry that provides metering from +10 to +15 volts. This allows me to use a 500- μ A movement meter, on which each major graduation is equal to 1 volt. A 500- μ A meter has an ohms-per-volt rating of 2000. This means that the amp meter is converted to a voltmeter by placing a series resistance of 2000 ohms per volt of desired range. Any internal resistance of the meter must be considered as part of this total resistance.

In order to get the meter to read from 10 through 15 volts, I biased the negative side of the meter to +10 volts by placing a three-terminal adjustable voltage regulator in series with the supply voltage and placing the output directly on the minus side of the meter. I could have used a precision voltage reference such as a temperature-compensated zener diode or a voltage reference. I chose values for setting the regulator to 10 volts to minimize voltage drift with aging and temperature.

Since I wanted to read from 10 volts up to 15 volts, the total range is 5 volts. Assuming 2000 ohms per volt, this translates into a total series resistance of 10,000 ohms. To ensure accuracy, I selected a 20-turn

By Eric L. Smitt, K9ES, 10 Bowling Green Lane, Worcester, Massachusetts 01602

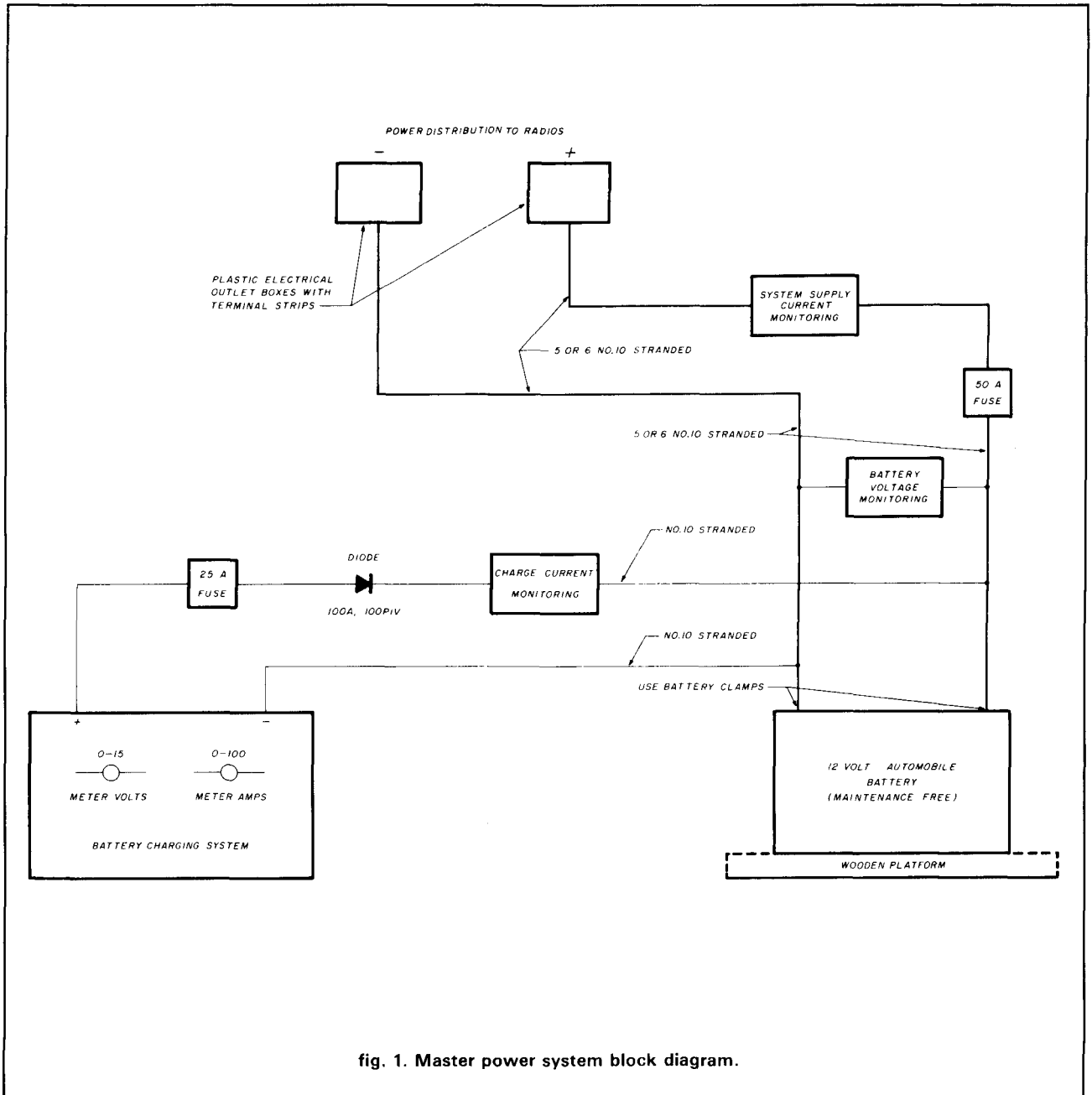


fig. 1. Master power system block diagram.

trim pot with a value of 10k and trimmed the resistance in series with the meter to make the meter agree with the reading of a digital voltmeter placed directly across the battery terminal. I routinely check measurement performance with my digital voltmeter, and find little, if any, voltage shift as time passes and temperatures change.

Current measuring of dc currents is done most easily with current shunts, or very small resistances, where series current produces a very small voltage drop, which is proportional to the amount of series current. I selected a criterion specifying that no shunt voltage drop would exceed 100 mV. To calculate the required

resistances for the shunt, use Ohm's Law:

$$R = 0.1V / \text{max amps}$$

5/1000 ohms for 20-amp shunt

2/1000 ohms for 50-amp shunt

These resistances are very small, but with more high-current supplies available, resistor manufacturers are producing wirewound resistors with very low values. I found several 0.01-ohm, 6-watt, 5-percent wirewound resistors at a hamfest. To produce a 20-amp shunt (fig. 2), I paralleled two of these resistors together, using braid from RG-8 coax. To produce the 50-amp shunt, I paralleled five of these resistors together. The monitoring meters are actually 500- μ A

Radio Shack Parts Place

Hams! Shop The Shack® for Parts and Accessories

Audio Connectors



- (1) **Eight-Pin Mike Plug.** Fits many popular Ham rigs. #274-025 ... 2.19
 (2) **Headphone Adapter.** Right angle 1/8" jack-1/4" plug. Mono. #274-371 ... 2.99
 (3) **HT Earphone.** Mono 1/8" jack-1/32" submini plug. #274-327 ... 1.29

Archer® Low-Loss Coax Cable



36¢ Per Foot

- 95% Shielding
- Made in USA by Radio Shack

The really good stuff, in demand by Amateur radio operators! Low-loss, all-copper conductors and polyethylene dielectric. RG 8/AU, velocity factor 66%. Loss per 100 ft. at 100 MHz: 2.5 dB. #278-1323

Antenna "Fixin's"

- (4) **Coax Cable Cutter.** Blades cut clean—preserve cable impedance. #278-244 Reg. 4.95 ... **Sale 2.95**
 (5) **Coax Cable Stripper.** Adjustable blades give perfect strips with RG6, 59, 58, 8M and 62 cables. #278-240 ... 11.95
 (6) **Heavy-Duty Antenna Wire.** For Ham, SWL antennas. Bare copper. 65 feet. #278-1329 ... 4.59
 (7) **Insulators.** For antenna center and end, or for guy wire installation. #278-1333 ... **Pkg. of 2/69¢**
 (8) **RF Connector-Sealant Tape.** Weatherproofs outdoor antenna connections. #278-1645 ... 2.49
 (9) **PL-259 Plug.** #278-205 ... **Pkg. of 2/1.99**



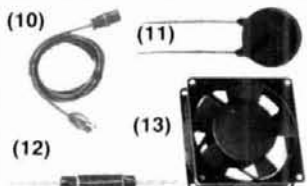
Spike Protector



Noise Filter Reduces RF Static

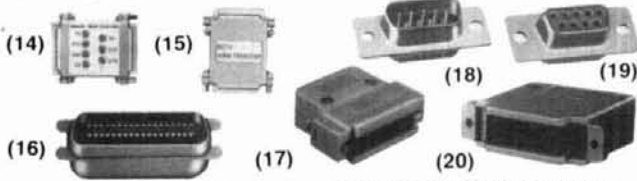
Protects electronic equipment from potentially damaging high-voltage spikes on AC line. Rated 15 amps. Six grounded-plug outlets, lighted on/off switch. Circuit breaker, 6-ft. cord. UL listed. #61-2780 ... 29.95

AC-Line Insurance



- (10) **AC Power Cord.** CEE-type. UL listed. #278-1257 ... 3.99
 (11) **Heavy-Duty MOV.** #276-568 ... 1.99
 (12) **100 µH RF Choke.** #273-102 ... 99¢
 (13) **Quiet 3" Fan.** 7-13.8 VDC. #273-243 ... 14.95

Computer Connectors & RS-232 Tester



- (14) **RS-232 Inline Tester.** Ends guesswork. #276-1401 ... 14.95
 (15) **RS-232 Transient Suppressor.** #276-1402 ... 16.95
 (16) **Parallel Printer Connector.** Centronics, 36-position. #276-1534 ... 4.99
 (17) **Shielded 25-Position Hood.** Protects against EM/RFI. #276-1536 ... 1.99

Solder-Type "D" Submini Connectors

Fig.	Type	Positions	Cat. No.	Each
18	Male	9	276-1537	1.49
19	Female	9	276-1538	2.49
20	Hood	9	276-1539	1.99
—	Male	25	276-1547	1.99
—	Female	25	276-1548	2.99
—	Hood	25	276-1549	1.99

Novice Exam Kit



Learn How to Become a Ham
 Prepares you for the new Voice Class FCC exam. Two cassette recordings for self-paced Morse code learning plus practice exam questions and answers to help you get ready for the test. #62-2402 ... 19.95

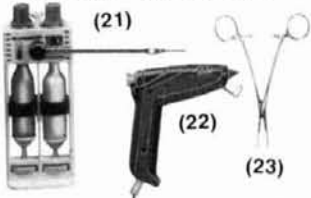
Amp/Speaker



A Workbench "Must"

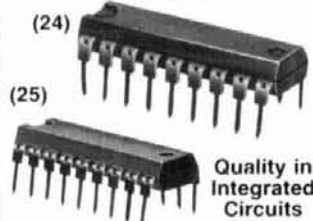
Makes the niftiest test amplifier! Also handy for computer voice synthesis, circuit tracers and dozens of other uses. High-gain IC design and 200-milliwatt output. Battery extra. #277-1008 ... 11.95

Shop "Helpers"



- (21) **Pocket Gas Torch.** 5000° F for brazing or soldering. #64-2165 ... 25.95
 (22) **Hot Melt Glue Gun.** Three glue sticks. UL listed AC. #64-2861 ... 8.99
 (23) **6" Locking Forceps.** Stainless steel, serrated tip. #64-1866 ... 4.95

Hard-to-Find ICs



- (24) **TDA7000, FM Receiver on a Chip.** The heart of a repeater monitor. 70 KHz IF. #276-1304 ... 5.95
 (25) **SSI202, Touch-Tone Decoder IC.** DTMF receiver! Requires color-burst crystal. #276-1303 ... 12.95

Dual-Track Supply



Delivers rock-steady voltage. Variable 0-15 VDC or in series up to 30 VDC. The two voltages can be adjusted simultaneously or separately. Switchable volt/amp meter for either output. UL listed AC. #22-121 ... 69.95

Bench Multimeter



- Memory With Min/Max Hold
 - Measures Transistor h_{fe}
- Our best! Features 31-segment analog bar-graph display, autoranging with manual override and buzzer continuity. Diode checker tests junctions. Measures AC/DC voltage/current and resistance. Batteries extra. #22-195 ... 99.95

Engineering Calc



37⁹⁵

- 110 Functions
- With Complex Numbers

Accepts input and displays output using popular engineering symbols! Alphanumeric display with contrast control. Gamma functions, engineering keys. With functions for trig, statistics, base-number math/logic and fractions. #65-983 ... 37.95

"Hotline" Service



- Fast Delivery
- No Postage Charges

Your Radio Shack store manager can special-order a wide variety of items not in our catalog—tubes, ICs, crystals and more. No minimum!

Over 1000 items in stock: Binding Posts, Books, Breadboards, Buzzers, Capacitors, Chokes, Clips, Coax, Connectors, Fuses, Hardware, ICs, Jacks, Knobs, Lamps, Multimeters, PC Boards, Plugs, Rectifiers, Resistors, Switches, Tools, Transformers, Wire, Zeners, More!

Radio Shack

A DIVISION OF TANDY CORPORATION

Prices apply at participating Radio Shack stores and dealers

meters, with series resistance to make them read from 0 to 100 mV.

The shunts must be mounted in the actual heavy wiring. The voltage pickup wiring can be a twisted pair going to the series resistance/meter units. The series resistance (including the meter resistance) for each meter is 200 ohms (remember 2000 ohms/volt). The actual series resistances were made using 20-turn, 100-ohm trim pots. Once the meter shunts and series elements were made, calibration was done with the DVM unit, connected to monitor large currents.

The power distribution circuitry is probably the most critical. All the best precautions taken to reduce voltage drop in shunts and maintain regulation of the system will be irrelevant if care isn't taken to use sufficient wire size. Stranded wire is a must in this application; solid copper wire is too difficult to work with in these sizes. Because of the currents that would result from a short, the wire must also be insulated.

I discovered that marine supply stores sell battery wiring for power distribution in boats. But because anything purchased through a marine supply store is likely to be very expensive, I decided to parallel six No. 10 stranded wires for each leg. I also placed a 25-amp series fuse between the isolation diode and the battery charging supply, and a 50-amp fuse (from a surplus dynamotor unit) between the battery and the radios. These fuses are very important, and must be included.

All wires in the positive and negative bundles are first soldered together and then to a large terminal strip mounted in a plastic electrical box. The positive plastic box and the negative box are separated by a distance of 5 inches in the hope of eliminating the possibility of short circuits. The terminal strips, also found at a hamfest, were selected to handle 25 amps per screw connection.

While all connections to the radios are made using compression-type screw lugs, I soldered the wires to the lugs and placed insulation over all exposed wire. I used the original wiring supplied by the manufacturer for each radio; these have in-line fuses to prevent damage to the system in case the radio fails.

A few words of caution are necessary. Do not omit the two fuses mentioned earlier. The 25- or 30-amp fuse will protect the battery if the charging fails, which would result in an overvoltage. The battery, which acts like a large capacitor, will consume as much current as you can supply; if you were to place a high voltage (above 15 volts) across its terminals, it would continue to accept charge until it exploded! Placing a fuse in series protects the battery and the radios if the charging supply fails (as it would, for example, if it were struck by lightning) and short out the regulator, leaving nonregulated voltage on the radios. Don't omit this fuse from your installation!

The 50-amp output fuse protects against a short circuit's delivering enough current to melt the wiring. Remember that the battery has a "cold cranking output" rating of several hundred amperes, which can

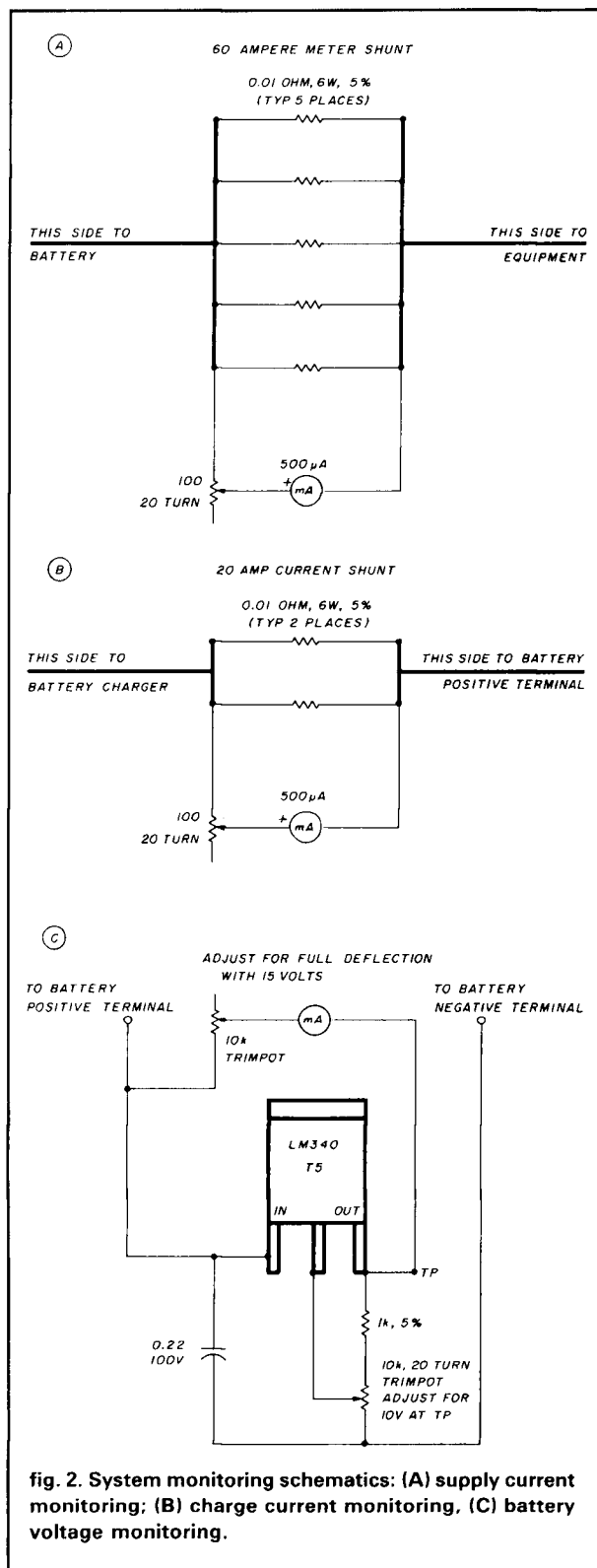


fig. 2. System monitoring schematics: (A) supply current monitoring; (B) charge current monitoring; (C) battery voltage monitoring.

Isn't it time for a new
computer weather
station ?

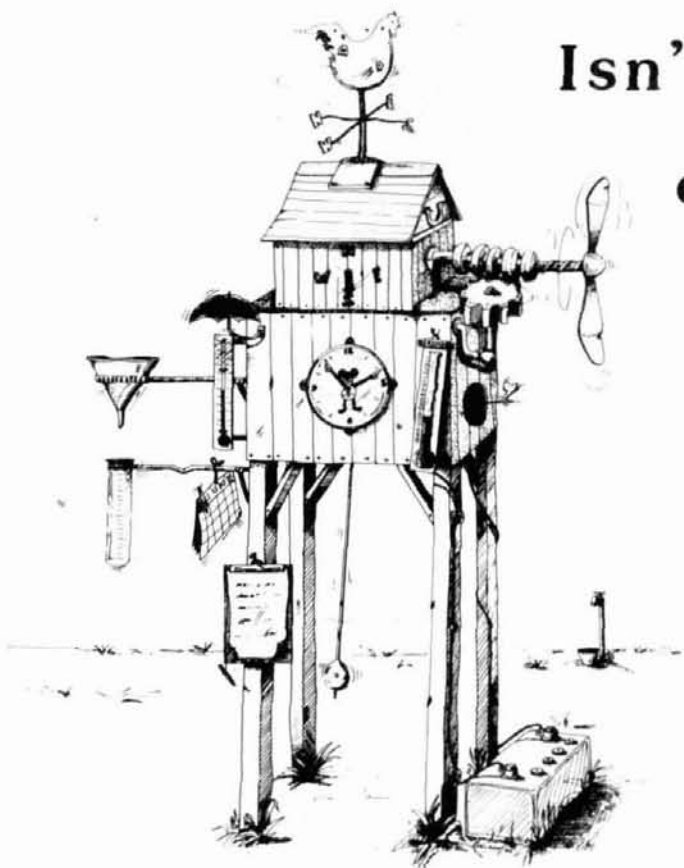
DIGITAR[®]



ALT-4
\$169.95

WEATHER
MASTER 

- Barometer
 - Barometer Store
 - Altimeter
 - Inside Temperature
 - Outside Temperature
 - Hi-Low Temp Record
 - Wind Speed *
 - Wind Direction *
 - Wind Chill *
 - Wind Gust Record *
 - Rainfall *
 - Time with Alarm
 - Elapsed Time
 - Date
 - Bidirectional Alarms
 - for Temp & Altitude
 - Programmable Scan
 - Standard & Metric
 - Backlit LCD
 - Built-in Recharger
- * With Optional AN-2 Anemometer & RG-2 Rain Collector.



NEW!

TW-2 MICRO WEATHER
\$139.95 STATION

- Wind Speed
- Wind Direction
- Wind Chill
- Wind Gust Record
- Anemometer Included
- Temperature
- Hi-Low Temp Record
- Standard & Metric
- Programmable Scan
- Built-in Recharger

* * OPTION ORDER FORM * *		
MODEL	DESCRIPTION	PRICE
BP-3	RECHARGEABLE BATTERIES	\$ 6.95
PS-12	AC POWER ADAPTER	7.95
MODEL ALT-4 ONLY		
AN-2	ANEMOMETER	109.95
RG-2	RAIN COLLECTOR	49.95
SHIPPING & INSURANCE		5.50
TOTAL WA RESIDENTS ADD 8.1% TAX		
* MADE IN U.S.A. * ONE YEAR WARRANTY *		

MAGNAPHASE INDUSTRIES, INC.
1502 Pike Street N.W., Auburn, WA 98001

Info & WA: (206) 735-0374 M/C &
Order Line: 1-800-322-1502 VISA

Join AMSAT...Today

Amateur Radio Satellite OSCAR 10 provides:

- **A New Worldwide DX Ham Band** open 10 hours a day.
- **Rag Chew With Rare DX Stations** in an uncrowded, gentlemanly fashion.
- **Popular Modes In Use:** SSB, CW, RTTY, SSTV, Packet
- **Full Operating Privileges** open to Technician Class licensee or higher.

Other AMSAT Membership Benefits:

Newsletter Subscription:

Dependable technical articles, satellite news, orbital elements, product reviews, DX news, and more.

Satellite Tracking Software

Available for most popular PCs.

QSL Bureau, AMSAT Nets, Area Coordinator Support, Forum Talks

Construction of Future Satellites For Your Enjoyment!

AMSAT Membership is \$24 a year, \$26 outside North America. VISA and MC accepted.

**AMSAT
P.O. Box 27
Washington, DC 20044
301 589-6062**

✓ 111

melt wire and start a fire. The battery will overheat, and perhaps explode. Don't omit this fuse, either.

Some of my friends are reluctant to use a lead acid battery in the ham shack because they worry about hydrogen gassing and the possibility of explosions resulting from gases mixing near an open flame. These problems are real! But you can avoid gassing by limiting the battery voltage to 13 volts (or less). Your transmitted output power will be slightly lower, but your radio will still work well, and the battery life will easily exceed several years.

Avoid charging the battery to a level at which you hear the sounds of gassing. This bubbling noise is the first indication that you're producing excess hydrogen gas. Keep the voltage below the point of gassing or replace the battery if gassing occurs with a battery terminal voltage near 13 volts.

Remember, too, that car batteries contain sulfuric acid. Every time you work near the battery, wash your hands and launder clothing that might have touched any liquid near the battery. Keep a barrier between you and the battery in case it explodes. Don't smoke or allow any open flame near the battery. Hydrogen gas will rise, but don't let it accumulate by covering the battery in an airtight enclosure. And don't place the battery on a cement surface; the calcium in the floor will cause the battery to die!

first aid

If acid contacts your skin, wash the affected area with a large volume of water immediately. Spread a mixture made of baking soda and water on the affected area and seek medical attention if the area is large or if the skin is burned. If acid gets into your eyes, rinse them thoroughly in the shower and get to a hospital *immediately*.

Should acid get on your clothing, remove all contaminated items and wash all exposed skin. Then soak the clothing in water mixed with baking soda. Sulfuric acid will destroy cotton clothing.

Remember that battery acid is very dangerous. Use all appropriate precautions whenever you work with batteries.

how well does it work?

During the 1987 VHF QSO Party we lost power in our neighborhood when a severe thunderstorm knocked out a transformer. I stayed on the air during the 2-hour blackout — in the dark! (My next investment, obviously, will be an automatic lighting system that turns on automatically whenever I lose ac power to the shack.

I've had my IC-751, IC-551D, IC-271A, IC-471A, KLM 160-watt 2-meter amplifier, and my MMT-220/28 on the air, all at once, without difficulty. It works!

ham radio



P.C. ELECTRONICS 2522 S. PAXSON LN. ARCADIA CA 91006 (818) 447-4565
 TOM W6QRG MARYANN WB6YSS
 Compuserve 72405,1207



AMATEUR TELEVISION

ATV MADE EASY WITH OUR SMALL ALL IN ONE BOX TC70-1 TRANSCEIVER AT A SUPER LOW \$299 DELIVERED PRICE!

CALL 1-818-4474565 AND YOURS WILL BE ON ITS WAY IN 24 HRS (VIA UPS SURFACE IN CONT. USA).

TC70-1 FEATURES:

- * Sensitive UHF GaAslet tuneable downconverter for receiving
- * Two frequency 1 watt p.e.p. transmitter, 1 crystal included
- * Crystal locked 4.5 mHz broadcast standard sound subcarrier
- * 10 pin VHS color camera and RCA phono jack video inputs
- * PTL (push to look) T/R switching
- * Transmit video monitor outputs to camera and phono jack
- * Small attractive shielded cabinet - 7 x 7 x 2.5"
- * Requires 13.8vdc @ 500 ma. + color camera current

Just plug in your camera or VCR composite video and audio, 70cm antenna, 12 to 14 vdc, and you are ready to transmit live action color or black and white pictures and sound to other amateurs. Sensitive downconverter tunes whole 420-450 mHz band down to channel 3. Specify 439.25, 434.0, or 426.25 mHz transmit frequency. Extra transmit crystal add \$15.

Transmitting equipment sold only to licensed radio amateurs verified in the Callbook for legal purposes. If recently licensed or upgraded, send copy of license. Receiving downconverters available to all starting at \$59 (TVC-2G).

WHAT ELSE DOES IT TAKE TO GET ON ATV?

Any Tech class or higher amateur can get on ATV. If you have a camera you used with a VCR or SSTV & a TV set, your cost will just be the TC70 and antenna system. If you are working the AMSAT satellites you can use the same 70cm antennas on ATV.

DX with TC70-1s and KLM 440-27 antennas line of sight and snow free is about 22 miles, 7 miles with the 440-6 normally used for portable uses like parades, races, search & rescue, damage assessment, etc. For greater DX or punching thru obstacles: 15 watt p.e.p. Mirage D15N or 50 watt p.e.p. D24N or D1010N-ATV.

The TC70-1 has full bandwidth for color, sound, like broadcast. You can show the shack, home video tapes, computer programs, repeat SSTV, weather radar, or even Space Shuttle video if you have a home satellite receiver. See the *ARRL Handbook* chapt. 20 & 7 for more info & *Repeater Directory* for local ATV repeaters.

**PURCHASE AN AMP WITH THE TC70-1 & SAVE!
 50 WATT WITH D24N-ATV...\$499**

All prices include UPS surface shipping in cont. USA

COMPLETE ATV STATION

 YOUR TV SET YOUR HOME TV CAMERA	 TC70-1...\$299 ATV Transceiver	 Mirage D15N....\$119 (optional) 15 watts RF out. Mirage D24N....\$219 (optional) 50 watts RF out.	 KLM 440-27 14dbd \$107 KLM 440-10X 11dbd \$65 KLM 440-6X 8.9dbd \$51
--	--	--	--

HAMS! Call or write for our full line ATV catalog...Downconverter boards start at only \$39

NEW!

REVEX

NEW!

Please see the complete REVEX line of laboratory instruments and accessories.

AVERAGE AND PEP RF MONITORING BUILT INTO ALL UNITS.
1.6 to 1300 MHz, 1 watt to 5kw**IN LINE TYPE SWR & POWER METERS****EXCLUSIVE!!! PATENTED WIDEBAND Z COUPLER, AVAILABLE IN NO OTHER UNIT AT ANY PRICE, PROVIDES LABORATORY ACCURACY AND QUALITY AT AMATEUR PRICES...**INTRODUCTORY PRICE **\$89** MODEL W510INTRODUCTORY PRICE **\$99** MODEL W560INTRODUCTORY PRICE **\$79** MODEL W540INTRODUCTORY PRICE **\$129** MODEL W570**REVEX IN LINE WATT METER**

	RF	144/220/430	HF/50/144/430	HF/144/430/1300
MODEL	W 5 1 0	W 5 4 0	W 5 6 0	W 5 7 0
FREQUENCY RANGE	1.6MHz ~ 30MHz	148 ~ 525MHz	1.6-525MHz	1.6 ~ 1300MHz
MEASURABLE POWER RANGE	5W/20W/200W	200W/20W/4W	200W/20W/3W	200W/20W/5W
SWR SENSITIVITY	8 W	4W	S1:2W S2:3W	S1:2W/S2:3-4W
MEASURABLE FUNCTIONS	FWD POWER REF POWER PEP MONITOR SWR	FWD POWER REF POWER PEP MONITOR SWR	FWD POWER REF POWER PEP MONITOR SWR	FWD POWER REF POWER PEP MONITOR SWR
IMPEDANCE	50 Ω	50 Ω	50 Ω	50 Ω
IN/OUT CONNECTOR	SO239	SO-239	S1:SO239/S2:K-R	S1:SO239/S2:K-R
METER	1	1	1	1
SENSOR	1-BUILT IN TROIDAL CORE	1-BUILT IN STRIP LINE	2-BUILT IN S1: TROIDAL CORE S2: CH	S1: BUILT IN S2: EXTERNAL CH S1: TROIDAL CORE
DIMENSIONS (w/h)	120 W x 72 (80) H x 85 (114) D	120 W x 72 (80) H x 85 (114) D	120 W x 72 (80) H x 85 (114) D	120 (W) x 75 (80) H x 85 (146) D EXTERNAL SENSOR
WEIGHT	APPROX. 700g	APPROX 540g	APPROX. 670g	APPROX. 900g

RF 1.8 ~ 54 MHz, AF 10 Hz ~ 40 kHz AM, CW, SSB, OSCILLOSCOPE, TRAPEZOID, RTTY**• WAVE MONITOR SCOPE****MS 1**
INTRODUCTORY PRICE
\$279

Wave Monitor Scope MS 1 directly monitors 1.8 ~ 54MHz band transmission signals (10 ~ 1000W PEP). Front panel operation makes it possible to monitor RF envelope patterns and RF trapezoid patterns. Also, since the MS 1 has two sets of input terminals (one on the front and one on the rear panel) for observing audio band patterns, an RTTY terminal unit can be connected to allow monitoring of RTTY (radio teletype) cross patterns.

FEATURES:

1. AM, CW, SSB transmission signals, amplifier linearity, drive, carrier, sideband and CW key click conditions can be observed.
2. Shift adjustments are easy to make as RTTY cross patterns can be displayed.
3. Receiver signals can be monitored as patterns in the 10Hz ~ 40kHz audio band can be observed.
4. Superior commercial quality.
5. 2 Separate sets of input terminals allow multi-rig connection, without changing cables, with simple front panel switch selection.

EXCLUSIVE DISTRIBUTOR:

AMATEUR-WHOLESALE ELECTRONICS

46 Greensboro Highway, Watkinsville, Georgia 30677

112

TO ORDER:

TOLL FREE..800-327-3102

Telephone (404) 769-8706 Telex: 4930709 ITT

CORDLESS PHONE - LINK??

FEELING TIED DOWN TO YOUR MICROPHONE??

American Lightwave introduces a fantastic kit that converts your cordless phone into a remote link!!

PHONE LINK

- * Use your rig from the kitchen, garden, garage
- * Easy to build...one evening assembly time
- * Easily connects to your rigs mic and speaker jacks
- * No mods to radio or telephone system...just plug in
- * MADE IN THE USA

KIT PL-A High quality glass epoxy board with doc... \$10
KIT PL-B Complete kit - board, parts, doc (less cabinet)... \$30

We don't nick you for extra money... NO SHIPPING CHARGES!!!

Check/Money Order/COO **AMERICAN-LIGHTWADE**
Or call 313-588-9007 P.O. BOX 71684
COO only...add \$3. Madison Heights, MI 48071-0684**MAKE CIRCUIT BOARDS
THE NEW, EASY WAY****WITH TEC-200 FILM****JUST 3 EASY STEPS:**

- Copy circuit on TEC-200 film using any plain paper copier
- Iron film on to copper clad board
- Peel off film and etch

SATISFACTION GUARANTEED
convenient 8½ x 11 size**5-Sheets for \$3.95**
10 sheets only \$5.95

add \$1.00 postage - NY res. add sales tax

The MEADOWLAKE Corp.DEPT. F, P.O. Box 497
Northport, New York 11768**BLACK DACRON® POLYESTER
ANTENNA ROPE**

- UV-PROTECTED
- HIGH ABRASION RESISTANCE
- REQUIRES NO EXPENSIVE POTTING HEADS
- EASY TO TIE & UNTIE KNOTS
- EASY TO CUT WITH OUR HOT KNIFE
- SIZES: 3/32" 3/16" 5/16"
- SATISFIED CUSTOMERS DECLARE EXCELLENCE THROUGHOUT U.S.A.

LET US INTRODUCE OUR DACRON® ROPE TO YOU • SEND YOUR NAME AND ADDRESS AND WE'LL SEND YOU FREE SAMPLES OF EACH SIZE AND COMPLETE ORDERING INFORMATION.

Dealer Inquiries Invited
In Australia contact
ATN Antennas, Birchip, Victoriasynthetic
textiles, inc. 2472 EASTMAN AVE., BUILDING 21
VENTURA, CALIFORNIA 93003
(805) 658-7903

new uses for old tv tuners

Don't throw them away
— put them to work
in a variety of
handy applications

Like any other tuner, the TV tuner is the front end of a receiver — and it's the front end, of course, that determines which frequencies a receiver will hear. Used ahead of a low-band receiver, the TV tuner becomes a VHF/UHF converter for that receiver.

Typical VHF TV tuners cover a frequency range of 54 to 216 MHz and UHF TV tuners cover 420 to 900 MHz. Think of the ham bands that are either covered by or adjacent to those ranges; some (220, 450, and 902 MHz, for example) are within the tuning range of stock tuners, and others (6 and 2 meters) are adjacent. Still other bands may be reached with some modification of the tuner.

It doesn't take much to get the tuner operating as it was designed, and it's always best to do this before beginning any modification. Getting the tuner working requires applying the appropriate voltages and feeding the i-f output to a receiver tuned to 47 MHz. A signal generator with a known signal or harmonic in the desired frequency band makes the retuning operation much easier. Once the unit is operating, check the frequency coverage to determine what you'll have to do to move its coverage to the desired band.

TV tuners come in many sizes and shapes, but fall into three basic categories: detent, variable, and varactor. Detent tuners have a band switch and a fine tuning adjuster. Variable tuners use a tuning capacitor to cover the entire tuning range. Varactor tuners use varactor diodes as tuning capacitors for band coverage. A voltage is applied to the varactor diode to change its capacitance; the higher the voltage, the lower the capacitance, and vice versa.

intermediate frequency

When a TV tuner is used as a converter, its i-f output is fed into a receiver's antenna input. The receiver then operates as the tuner's i-f amplifier and detector. The i-f frequencies vary according to the date of manufacture and the type of application for which the tuner was designed. Black-and-white tube TV sets

built from about 1947 through 1957 used an i-f of 21 to 27 MHz, while color sets have an i-f centered at about 47 MHz. Cable TV and VCR tuners have an i-f of 63 MHz (channel 3), with a bandwidth of approximately 6 MHz. If the tuner is solid-state, it will probably have an i-f of 47 MHz unless it's from a VCR tuner.

Many suitable receivers are available for operation in the 47-MHz region. Receivers for 30- to 50-MHz communications and scanning are quite common and work well with TV tuners. Some Amateur receivers also cover 47 MHz.

When using an Amateur receiver with a narrow passband, it will be necessary to tune the receiver across the i-f frequency after the tuner has been set to a desired frequency. *Note that frequencies tuned by the receiver will be reversed from the normal tuning scheme.* Most TV tuners have the local oscillator frequency set above the incoming RF. This means that a direct frequency translation does not occur, and the incoming frequency decreases as the receiver's dial frequency increases.

The tuning reversal is caused by the fact that the tuner's oscillator frequency is fixed above (i.e., higher than) the RF input frequency. With the i-f being tuned to a higher frequency, the frequency difference between the RF and the i-f decreases.

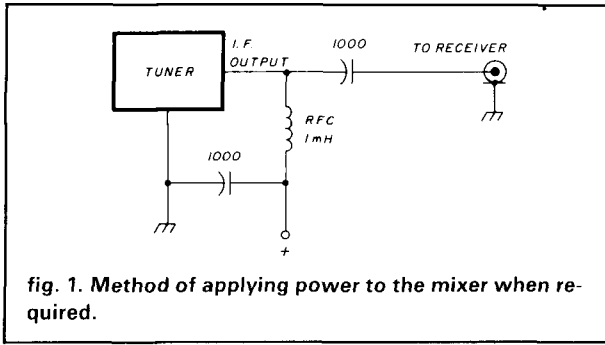
applying power

Before applying power, it's necessary to examine the tuner and identify all of the terminals. If possible, remove the cover(s) to expose the wiring; this will help in identifying the connections.

The antenna input terminal(s) will be obvious as either two pins or a phono connector. Some UHF varactor tuners use a single pin for an antenna input. When several other phono connectors appear in addition to the antenna input, one may be used as the i-f output and another may be used as the UHF tuner i-f input. The UHF tuner input provides a means of tying the UHF signal into the i-f through the channel selector switch. For ham converter purposes, the UHF input connector may be ignored.

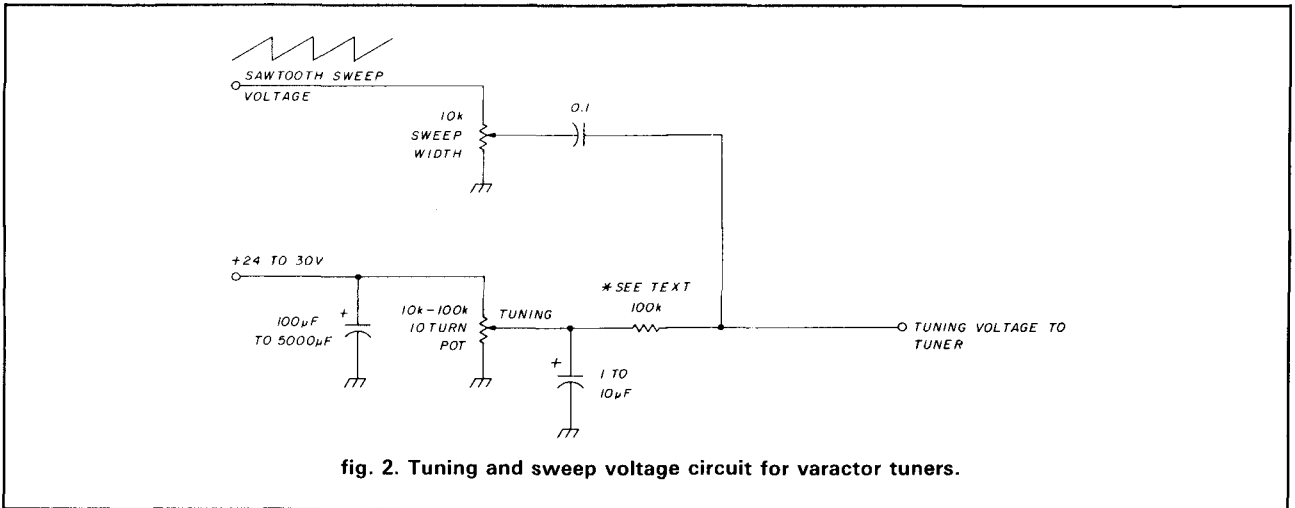
There are five important terminals on most tuners for voltage application: V_{CC} , (sometimes marked B +; AGC; AFC (found only on more recent models); band switch (discussed under "varactor tuners," below);

By Hugh Wells, W6WTU, 1411 18th Street, Manhattan Beach, California 90266



sensitivity. A 5- to 10-foot wire attached to the ungrounded antenna terminal should be adequate.

Voltage applied to the AGC terminal (normally positive with respect to the case) will control the tuner's sensitivity, and when varied with a potentiometer, will function as an RF gain control. A fixed voltage may be applied later on. With the tuner and receiver operating, tune to a known signal (TV or otherwise) and adjust the AGC voltage from (+)0 to 10 volts for maximum received signal (measure and record the AGC voltage value for future reference).



and i-f output. Tube TV tuners also have a tube heater terminal which is usually 6.3 volts, but it may be another voltage value if the tuner was designed for use in a series string heater circuit. For solid-state tuners, the voltage required for V_{CC} is (+)15 to 20 volts; for AGC, it's (+)0 to 5 volts. The i-f output terminal is either a wire or a phono connector. If the output is a wire, it will protrude through the tuner wall and may be attached to a terminal strip mounted on the tuner's case. For most tuners used as converters, this i-f wire may be connected directly to the center conductor of a coax feeding the antenna terminal of the receiver.

A few tuners require a voltage to be applied to the i-f wire to provide power to the transistor/tube mixer (see fig. 1). Determine the need to apply power before actually doing so to reduce the risk of circuit damage. Measure the resistance between the i-f wire and the transistor collector or tube plate. If the resistance value is below 50 ohms, power is probably required.

Attach an antenna to the tuner's antenna terminals to obtain an input signal from any source. Even though most tuners have a 300-ohm balanced antenna input, grounding one terminal and feeding the other with 52-ohm coax seems to have little effect on signal sen-

tuning aids

Make a set of tuning aids to assist in making coil adjustments during frequency modifications. Small metal rods (1/16 inch diameter x 1/4 inch long) attached to a plastic or wooden stick are useful tools for adjusting VHF and UHF coils. Brass, a diamagnetic material, will reduce the coil's inductance when inserted. Inserting the metal can also increase the circuit capacitance, but the net result will be an increase in the resonant frequency. Inserting an aluminum rod of similar size will lower the resonant frequency slightly. Aluminum, being nonmagnetic, won't affect the inductance value, but will increase the circuit capacitance, causing a lowering of the resonant frequency. An iron rod, being magnetic, will increase the inductance value and lower the resonant frequency; a powdered, rather than solid, iron rod would be preferable at VHF and lower RF frequencies. Brass and aluminum rods, however, have been found to be the most useful in working with VHF and UHF tuner modifications.

These tools are used to determine if any improvement is to be gained by coil adjustment *before* the adjustment is actually made. For example, if the signal strength of the incoming signal is improved as the

brass rod (as opposed to aluminum) approaches the coil, then the inductance value should be reduced slightly. A signal improvement with either aluminum or iron indicates that an *increase* in inductance is required.

detent tuners

Detent tuners for the VHF bands use either a drum or switch mechanism for changing channels. On this type of tuner, a fine-tuning adjustment is provided by either of two means: by oscillator slug adjustment or by a dielectric tuning capacitor that changes the oscillator circuit capacitance.

Putting the detent tuner into one of the ham bands may require modification of the coils. You'll need a signal generator of some kind to track the effects of retuning; it doesn't take much adjustment for most tuners to move over into adjacent ham bands.

As an example, let's assume that you want to modify a tuner for 6 meters. Select channel 2 (54 to 60 MHz) on the tuner. Adjust the fine tuning for the lowest frequency. Using a signal source, locate the tuner's input frequency. If it's already in the ham band, no modification is necessary. If it has to be lowered a bit, try increasing the tuner's oscillator trimmer capacitance, squeezing the oscillator coil wires together, or adding an additional turn of wire to the coil.

The channel 2 oscillator coil will be the easiest to identify because it has the greatest number of turns of those on the oscillator wafer switch. Increasing the inductance — either by squeezing the coil or adding a turn of wire — will lower the frequency sufficiently.

Retuning of the tuner's input circuits is usually necessary. However, the oscillator coil must be retuned and put on the desired frequency before the RF and mixer circuits are touched. It's important to tune and measure only one circuit at a time during the modification.

varactor tuners

Of the three types of tuners, varactor tuners provide the most flexibility for Amateur use because the tuning range is generally continuous and may overlap the ham bands without modification. Cable-ready VCR tuners, for example, cover about 39 to 290 MHz. Frequency coverage of 6, 2, and 1-1/4 meters is available without tuner modification. UHF varactor TV tuners cover the top part of the 450-MHz band and will require modification to cover the 902-MHz band. A signal source is necessary when modifying tuners for these bands.

Modifying the tuning frequency of a varactor tuner requires a change in the inductance value of the oscillator. But because space is tight, capacitor changes are difficult to make. To move a VHF tuner up to 220 MHz, it's necessary to decrease the induc-

HIGH PERFORMANCE PRESELECTOR-PREAMP

The solution to most interference, intermod, and desense problems in **AMATEUR** and **COMMERCIAL** systems.

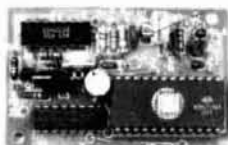


- 40 to 1000 Mhz - tuned to your frequency
- 5 large helical resonators
- Low noise - High overload resistance
- 8 dB gain - ultimate rejection > 80 dB
- 10 to 15 volts DC operation
- Size - 1.6 x 2.6 x 4.75" exc. connectors
- **FANTASTIC REJECTION!**

Typical rejection:
 ± 600 KHz@144 Mhz: -28dB
 ± 1.6 Mhz@220 Mhz: -40dB
 ± 5 Mhz@450 Mhz: -50dB

Price - CALL bipolar w/RCA jacks
 Connector options: BCN \$5, UHF \$6, N \$10
SUPER HOT! GaAs Fet option \$20

AUTOMATIC IDENTIFIERS



ID-1



ID-2

- For transceivers and repeaters - **AMATEUR** and **COMMERCIAL**
- Automatic operation - adjustable speed and amplitude
- Small size - easy installation - 7 to 15 volts DC
- 8 selectable, reprogrammable messages - each up to 2 min. long
- Wired, tested, and programmed with your message(s)

Model ID-1 - \$49.95 Model ID-2 w/2 to 10 minute timer - \$89.95

We offer a complete line of transmitter and receiver strips and synthesizers for amateur and commercial use.

Request our free catalog. Allow \$2 for UPS shipping - Mastercard and VISA welcome

GLB ELECTRONICS, INC.

Dept H, 151 Commerce Pkwy., Buffalo, NY 14224
 716-675-6740 9 to 4

116

The XP-706-US Multiband Antenna

In the final
analysis quality is
less expensive

The unique design of the XP-706-US antenna system gives you **MONOBAND PERFORMANCE** in a Multiband beam. The antenna **USES NO TRAPS** of loading coils that rob power and limit bandwidth. Sommer Antennas use the **FULL** surface area of the elements on **ALL** bands.

Our commitment to use only the finest materials insures that your investment will last for years. Our system uses a Double rectangular boom, **CAST** aluminum element mounting brackets, all stainless hardware and a high power balun.

Monoband performance on a Multiband beam is yours when you move up to Sommer, the last beam you'll have to buy. We believe Sommer is your best antenna value when compared to the construction and performance of other multi and monoband antenna systems.

H.J. Theller Corp.
 P.O. Box 5369
 Spartanburg, SC 29304
 (803) 576-5566



117

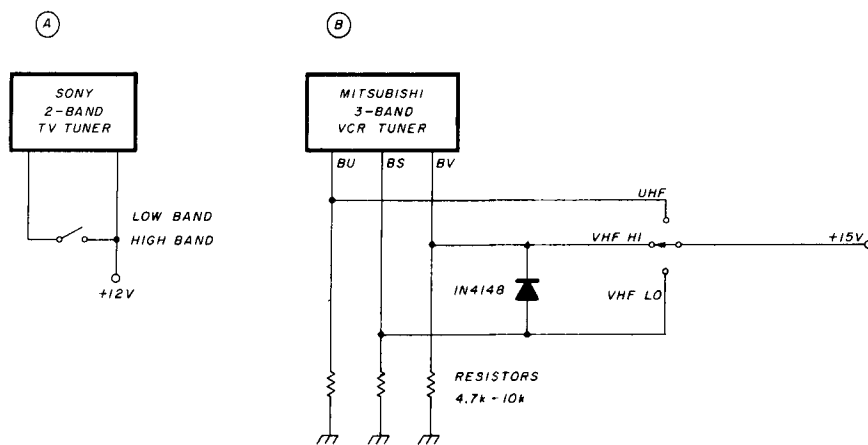


fig. 3. Band selection methods for varactor tuners: (A) Sony two-band tuner, (B) Mitsubishi three-band tuner.

tance of the oscillator coil by spreading the coil wires slightly. Once on frequency, the front end (RF and mixer) coils may be tweaked to improve the overall sensitivity. Be sure to use the brass or aluminum tuning aid before modifying the coils significantly.

Tuning is accomplished by providing a variable tuning voltage from 0 to 30 volts. The most satisfactory tuning resolution is obtained by using a ten-turn potentiometer to provide the vernier voltage adjustment (see fig. 2).

One of the greatest problems observed with the varactor tuner occurs when the oscillator frequency-modulates as a result of voltage fluctuation on the tuning voltage line and power supply bus. A fairly large capacitor (e.g., 1 to 10 μF) placed on the tuning voltage line will reduce this tendency. Shielding the line and regulating the power supply bus will help, too. Adding the large capacitor reduces the tuning slew rate. You'll overshoot the desired frequency if you turn the tuning knob too rapidly.

The 100-k resistor between the potentiometer and tuner is optional unless the circuit is to be used as a spectrum analyzer.

If the tuner has two or more bands, frequency selection is accomplished by diode switching within the tuner. Switch control is obtained by applying a voltage to the appropriate diode(s). For example, I tried the scheme shown in fig. 3A on a Sony two-band VHF TV tuner. When the high band was selected, a positive voltage was applied to both terminals; when the low band was chosen, voltage was applied to only one. The actual voltage required for switching didn't seem to be critical on the Sony tuner as long as it was kept between 8 and 14 volts. However, the greatest signal sensitivity occurred at +12 volts.

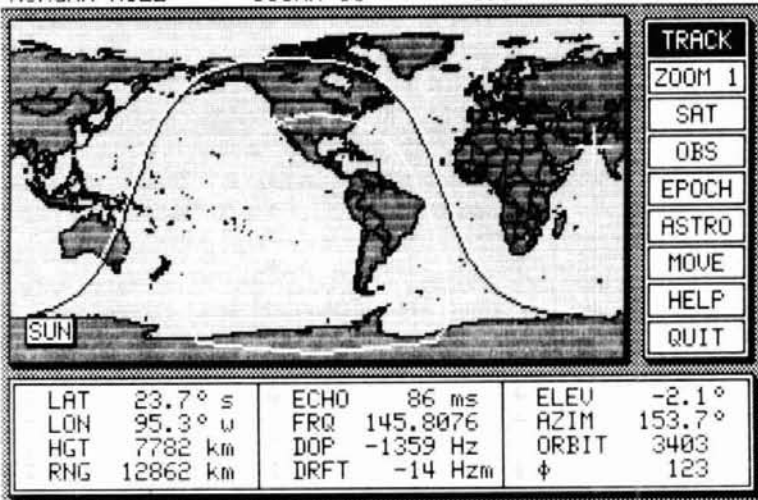
A Mitsubishi VCR tuner had three band switch terminals. Figure 3B shows the circuit developed for

selecting its bands. The selection voltage had to be +15 volts for maximum signal sensitivity, and when not used, the terminals had to be pulled to ground (a soft pull-down was sufficient, but floating the terminal failed to work). This particular tuner had independent AFC and tuning voltage terminals. Apparently fixed voltages were established for band selection and rough channel tuning. An AFC voltage was then applied for fine tuning.

variable tuners

In some tuners, a variable capacitor provides the means of tuning through the channels. Variable UHF tuners have been around the longest and are generally the most readily available. Mechanically, they're difficult to tune by rotating the shaft when they're used with narrowband receivers following them. Once tuned, however, they seem to be quite stable. Unfortunately, very few of these tuners have RF stages, and their sensitivity suffers for weak-signal activity. A good outside antenna and/or RF pre-amp is suggested as a means of improving performance.

The circuit of the tuner is very basic, with one or more passively tuned circuits ahead of a diode mixer. Each one of the tuning sections is a coaxial cavity with a capacitor at the top of the coaxial line. A transistor oscillator provides the injection signal for mixing. Power supply voltage stability for the oscillator is critical, although the actual voltage value is not. Most will operate very well on a 9-volt transistor battery. Some tuners of this type also have varactor diodes in their oscillator circuits to accommodate AFC. Examine the lead(s) attached to the diode for polarization; occasionally, both ends of the diode are brought out of the case. The cathode end (the end with a stripe) will be attached to the positive source and the anode end will be attached to ground. A tuning voltage applied to



MIRAGE/KLM

COMMUNICATIONS EQUIPMENT, INC.

P.O. BOX 1000 MORGAN HILL, CA 95037

MIRAGE TRACKING INTERFACE

"MTI" IS THE ONLY SMART INTERFACE BOX THAT WORKS WITH SILICONE SOLUTIONS™ SOFTWARE.

"MTI" OFFERS AUTOMATIC TRACKING OF ANY ORBITING BODY.

"MTI" KEEPS ANTENNAS AIMED CORRECTLY AT ALL TIMES.

"MTI" COMES WITH A ONE YEAR WARRANTY FROM MIRAGE/KLM.

"MTI" OFFERS ONE YEAR SOFTWARE SUPPORT TO REGISTERED OWNERS.

"MTI" IS AVAILABLE FROM MIRAGE/KLM ONLY. CALL FOR MORE DETAILS ...

(408) 779-7363 or outside CA,
(800) 538-2140

FEATURES INCLUDE:

- SWITCH SELECTABLE — ELEVATION FROM 0° - 90° AND 0° - 180°
- " — ELEVATION SCALING X1 OR X2
- " — NORTHERN OR SOUTHERN HEMISPHERE
- " — MANUAL OR AUTOMATIC MODE
- " — BAUD RATE (300 - 2400)
- 100 PAGE DETAILED MANUAL
- CABLE FOR KENPRO'S™ "A" SERIES CONTROLLER

MIRAGE/KLM

COMMUNICATIONS EQUIPMENT, INC.

P.O. BOX 1000 MORGAN HILL, CA 95037

(408) 779-7363

(800) 538-2140 (outside CA)

440-6X

ELECTRICAL:

BANDWIDTH.....	420-460 MHz
GAIN.....	8.9 dBd
VSWR.....	1.5:1
F/B.....	.20 dB
BEAMWIDTH.....	.60°
FEED IMP.....	50 ohm
BALUN.....	4:1 coax

MECHANICAL:

ELEMENT LENGTH.....	13½" max.
BOOM LENGTH.....	.28"
TURN RADIUS.....	.28"
WINDLOAD.....	.2 sq. ft.
WEIGHT.....	.1 lb.
MAST.....	1½" o.d.
MOUNT.....	Rear

440-10X

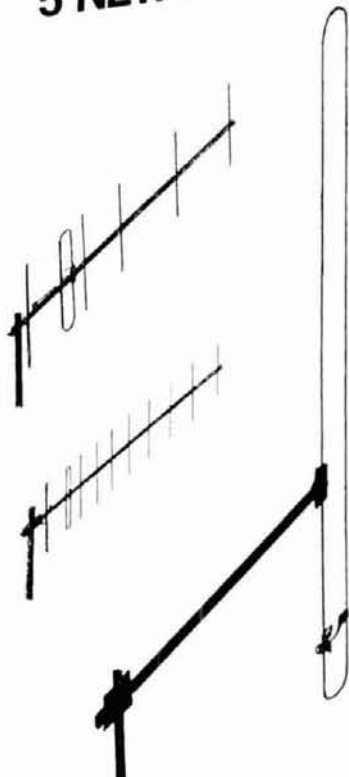
ELECTRICAL:

BANDWIDTH.....	420-460 MHz
GAIN.....	11.2 dBd
VSWR.....	1.5:1
F/B.....	.20 dB
BEAMWIDTH.....	.48°
FEED IMP.....	50 ohm
BALUN.....	4:1 coax

MECHANICAL:

ELEMENT LENGTH.....	13½" max.
BOOM LENGTH.....	.64"
TURN RADIUS.....	.64"
WINDLOAD.....	.4 sq. ft.
WEIGHT.....	1½ lbs.
MAST.....	1½" o.d.
MOUNT.....	Rear

PRESENTS 5 NEW ANTENNAS



ALL CJ ANTENNAS INCLUDE
INSULATED SUPPORT MAST

CALL YOUR DEALER
TO ORDER ONE NOW!

CJ2M

ELECTRICAL:

BANDWIDTH.....	144-148 MHz
GAIN.....	1.8 dBd
VSWR.....	1.5:1
FEED IMP.....	50 ohms

NO GROUND PLANE REQUIRED

MECHANICAL:

HEIGHT.....	.61"
WEIGHT.....	.2½ lbs.
MAST.....	1½" o.d.

CJ220

ELECTRICAL:

BANDWIDTH.....	220-224 MHz
GAIN.....	1.8 dBd
VSWR.....	1.5:1
FEED IMP.....	50 ohms

NO GROUND PLANE REQUIRED

MECHANICAL:

HEIGHT.....	.40"
WEIGHT.....	.2 lbs.
MAST.....	1½" o.d.

CJ440

ELECTRICAL:

BANDWIDTH.....	420-470 MHz
GAIN.....	1.8 dBd
VSWR.....	1.5:1
FEED IMP.....	50 ohms

NO GROUND PLANE REQUIRED

MECHANICAL:

HEIGHT.....	19¼"
WEIGHT.....	1 lb.
MAST.....	1½" o.d.

the diode provides fine-tuning control around the frequency selected by the tuning capacitor (see the technique used in **fig. 2**).

The tuning range of the UHF variable tuner generally covers the top end of the 450-MHz band up to 890 MHz. Modification of the tuner would be necessary if you wanted to reach the 902-MHz band, but this would take the tuner out of the 450-MHz band. The oscillator, for most tuners, is on the high side of the RF input. Therefore, before making any modification, be sure to verify the placement of the oscillator above or below the RF input. Verification is accomplished at the lowest frequency. Adjust the tuner to the lowest frequency possible and locate the RF input frequency with a signal source. Once you find it, increase the signal source frequency up 94 MHz (two times the i-f, 47 MHz), which is the detected RF frequency plus 94 MHz. If the signal is heard — even though it may be weak — the oscillator is probably above the input. Return to the previous RF input frequency and decrease the signal source frequency by 94 MHz (detected RF minus 94 MHz). If the signal isn't heard, then the oscillator is on the high side. Should the signal source be heard on both sides, shift the tuner to a new frequency and run the test again, since you're hearing generator harmonics or spurs on one side.

Another technique used for identifying the tuner's oscillator placement is varying the received i-f frequency. This technique works when a tunable receiver follows the tuner. Locate the RF input frequency with the signal source and adjust the frequency dial for peak signal into the receiver. Take note of the receiver's dial frequency. Then increase the signal source frequency by a few kHz. Re-tune the receiver dial to receive the signal again and note the new frequency indication. If the frequency is lower, the tuner's oscillator is *above* the incoming RF. If it's higher, the oscillator is *below* the incoming RF. Repeat the technique a few times for verification.

Assuming that the oscillator is on the high side of the RF, two choices are available for 902 MHz tuner modification. The first choice requires moving the oscillator up about 30 MHz, with modifications to the RF and mixer circuits made later. The second choice requires leaving the oscillator where it is and modifying the RF and mixer circuits by moving them up 94 MHz, placing them above the oscillator. The first choice is probably easier, although the oscillator may stall or become sluggish at the higher frequency (the oscillator transistor is approaching 1000 MHz).

The modification may be as simple as reducing the fixed capacitance in the oscillator circuit. The fixed capacitors are wires or metal tabs attached by one end to the walls near the top end of the cavity. Bending them against the wall, away from the tuned line, reduces the capacitance and may be the only tweak-

ing required. Check the new oscillator frequency before modifying the RF and mixer circuits. If the oscillator frequency is at the desired frequency, bend the mixer wire/tabs against the wall while monitoring for a peaked signal level transferred through the tuner. You can use a plastic or wooden stick to bend wires while the circuit is operating, but you'll have to remove it from the circuit to assess the effects of the adjustment. Then move on to the RF circuit and repeat the peaking process.

For the second choice, retuning the RF input and mixer circuits will put them above the oscillator by 47 MHz. Raising the frequency of the cavity requires shortening the cavity or reducing the capacitance at the top. One modification technique requires the removal of capacitor plates to raise the cavity frequency by 94 MHz. If possible, avoid removing the variable capacitor plate; once removed, the plates cannot be reinstalled.

The output of the diode mixer may be connected directly to the coax center conductor going to the receiver. But you'll have to determine if signal sensitivity improves when you shunt the coax with a 10- to 22-k resistor. The diode requires a dc current path for proper mixing action to take place. You can place a 10- to 22-k, 1/4- or 1/8-watt carbon resistor inside the mixer cavity near the i-f output. One end of the resistor is soldered to the i-f output connector wire from the diode. The other end of the resistor is soldered to the case ground. An alternate method is to place a coaxial "tee" in the i-f line going to the receiver. A resistor is shunted across the center lead and shield at one of the ports of the "tee."

tubed tuners

Tubed tuners will be either detent or variable types and will require a power supply voltage, B+, of 80 to 150 volts, with 100 to 105 volts preferred. The proper heater voltage will also be necessary. Tubed tuners frequently require that the mixer plate voltage be supplied through the i-f output circuit. In the absence of an output transformer, a 1-mH RF choke connected between the i-f output lead and B+ will provide the power (see **fig. 1**). Signal output can then be coupled from the lead through a 1000-pF capacitor to the center conductor of the coax going to the receiver.

Fortunately, tubed TV tuners don't require an AGC voltage for proper operation. But for maximum signal sensitivity, the AGC lead should be grounded, not left floating. The addition of a negative voltage variable from 0 to 10 volts will function as an RF gain control.

Because of their bulk, tubed tuners are fairly easy to modify. But because of their age, most tubed tuners cover 50 MHz, 146 MHz, and 220 MHz within the oscillator's tuning range for the selected band.

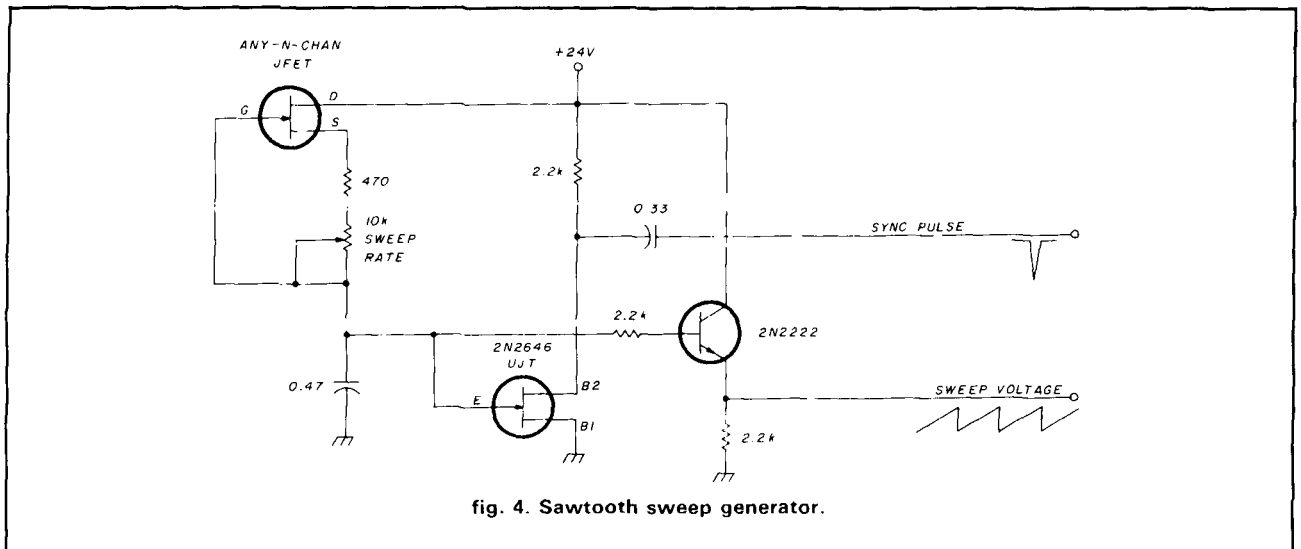


fig. 4. Sawtooth sweep generator.

In the past, the Amateur's favorite was the Mallory Inductuner (circa 1949), which used three spiral-wound inductors covering 50 to 220 MHz in two bands. By disabling the band switch that caused the tuner to jump over the 88- to 175-MHz band segment, you could modify the tuner to cover 2 meters.

A detent favorite was the Standard Coil drum tuner (circa 1952). All of its coils were mounted in clips to form a drum; removing all except the one being worked on provided ample room for modification. Later model tuners used a 6BQ7/6BZ7 cascode RF stage that provided excellent weak-signal sensitivity.

power supply

The power supply requirements are generally the same for all solid-state tuners. However, since voltage fluctuations and hum cause the local oscillator to frequency-modulate, a well-regulated and filtered power supply is an absolute *must*. Any of the popular three-lead, fixed-voltage regulators are quite satisfactory for use with TV tuners. Variable voltage regulators such as the LM723 and LM317 allow users to select voltage values.

The typical solid-state tuner V_{CC} voltage requirement is (+)15 to 20 volts (50 to 100 mA). Varactor tuners also require a 24- to 30-volt (5 to 10 mA) regulated source for tuning control, and possibly 12 to 15 volts (10 to 20 mA) for band switching. Some tuners, such as the UHF variable tuner, will operate satisfactorily on a 9-volt transistor battery. Battery life is determined by the amount of current drawn by the particular tuner.

Oscillator stability, the most important factor, depends on thermal heating and voltage variation. Regulation and low V_{CC} line impedance are key factors in reducing the oscillator's tendency to frequency-

modulate. Taking advantage of the oscillator's sensitivity to voltage variations, small adjustments in V_{CC} may be used to provide a fine-tuning capability. A V_{CC} tuning control can be implemented by placing a low-value potentiometer in the regulator voltage sense circuit of one of the variable voltage regulators. Small changes in potentiometer resistance will cause small changes in the V_{CC} value, which will result in an oscillator frequency shift.

applications

Low-band communications receivers (30 to 50 MHz) appear to be inexpensive items at ham swap meets, perhaps because of diminished interest in low-frequency activity. In general, the low-band receivers were well designed and continue to perform adequately. Adding a TV tuner as a front end converter can provide such receivers with new life.


Variable or varactor tuners are preferred for use with fixed-frequency receivers because of their tuning capability. Detent tuners would work well also, but would be limited to single-channel monitoring.


When used with scanning receivers, TV tuners function as converters to extend the received frequency coverage. One of the advantages of using a scanning receiver lies in the fact that the TV tuner i-f may be scanned from about 43 to 48 MHz, allowing the selected input frequency of the tuner to be scanned over a 5-MHz segment. The tuner's RF frequency is adjusted during the initial setup of a band and then left alone. Tuning occurs by scanning the i-f. Detent tuners work well in this application.


One of the better uses of wide-frequency range receivers is as a spectrum analyzer. Together in such an application, the varactor tuner, a 30- to 50-MHz communications receiver, and an oscilloscope functions as a spectrum analyzer. The receiver's first limiter


SEND FOR FREE 1987 CATALOG
OUR NEW MAILING ADDRESS IS:
 P.O. BOX 567
 VAN NUYS, CA 91408
 800-826-5432


QUALITY PARTS • DISCOUNT PRICES • FAST SHIPPING!
ALL ELECTRONICS CORP.
ALL ELECTRONICS CORP.


BLACKLIGHT ASSEMBLY

 Complete, functioning assembly includes ballast, on/off switch, power cord, sockets and F45 H.I. blacklight. Mounted on a 7 1/4" X 3 1/4" metal plate. Use for special effects lighting or erasing EPROMs.
 CAT# BLTA \$10.00 EACH


ELECTRET CONDENSER MIKE

 Model# Z5LM044 Highly sensitive mini microphone. 65 wire leads. 0.39" dia. X 0.25" high. Omni directional. Operates on 2-10 Vdc. 50 Ohm 2 mA. 1K impedance. 50 Hz to 15 K Hz range.
 CAT# MKE-1 \$1.00 EACH

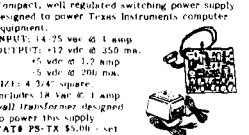
48 KEY ASSEMBLY

 NEW T.I. KEYBOARDS. Originally used on computers. These keyboards contain 48 K.B.S.T. mechanical switches. Terminates to 15 pin connector. Frame 4" X 3"
 CAT# KP-48 \$3.50 EACH


VIC 20 MOTHERBOARD

 26 IC's including 6502A and 6580. 2 ea. 6522. 2 ea. 8128. 2 ea. 801488. 3 ea. 2114. Not guaranteed but great for replacement parts or experimentation.
 CAT# VIC-20 \$15.00 EACH

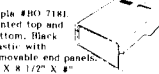
1mA METER

 Module. 0-1 mA signal strength meter with KLM logo. 1 1/4" X 1 1/4" X 7/8" deep.
 CAT# MEI-2 \$2.00 EACH

SLIM LINE FAN

 T0704 TERN115A New 115 Vdc cooling fan. 3 5/8" square X 1 1/2" deep. Metal housing. 1 blade impeller.
 CAT# SFE-115 \$8.50 EACH 10 for \$75.00

PUSHBUTTON PHONE

 Spectra-Phone Model# OP-1 1 piece telephone with rotary impulse output. Operates on most rotary touch tone systems. Features best button, dial and mute button. Includes coil cord with standard modular plug. WOVY
 CAT# PHN-1 \$15.00 EACH 2 for \$30.00

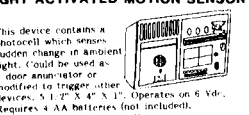
SWITCHING POWER SUPPLY

 Compact, well regulated switching power supply designed to power Texas Instruments computer equipment.
 INPUT: 115-230 Vdc @ 1 amp
 OUTPUT: 12 Vdc @ 250 ma.
 15 Vdc @ 1.2 amp
 5 Vdc @ 200 ma.
 SIZE: 4 3/4" square
 Includes 19 pin AT 1 amp wall transformer designed to power this supply.
 CAT# PS-X \$9.00 EACH 10 for \$45.00

NI-CAD CHARGER/TESTER

 DELUXE universal charger and tester. For almost every size Ni-Cad battery available.
 CAT# UNCC-N \$15.00 EACH

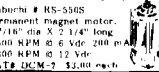
VENTED PROJECT CASE

 Hupis 480 7181 Vented top and bottom. Black plastic with removable end panels. 1 blade impeller.
 CAT# MB-71 \$17.50 EACH

RELAYS
12 VOLT-4PDT

 P.C. mount 5 amp contacts. 150 ohm coil. Size: 1 1/4" X 1 3/4" X 7/8"
 CAT# 4PDT-12PC \$3.50 10 for \$30.00

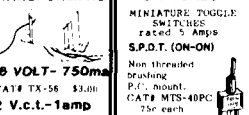
LIGHT ACTIVATED MOTION SENSOR

 This device contains a photo cell which senses sudden change in ambient light. Could be used as a door annunciator or modified to trigger other devices. 5 1/2" X 4" X 1". Operates on 6 Vdc. Requires 4 AA batteries (not included).
 CAT# LMSD \$3.25 PER UNIT

RECHARGEABLE NI-CAD BATTERIES
AAA SIZE 1.25V 180MAH \$2.25
AA SIZE 1.25V 500MAH \$2.00
AA with solder tabs \$2.20
C SIZE 1.2V 1200MAH \$4.25
SUB-C SIZE solder tab \$4.25
D SIZE 1.2V 1200MAH \$4.25

6-12 VDC MOTOR

 Mabuchi # MS-5505 Permanent magnet motor. 1 7/16" dia X 2 1/4" long. 2400 RPM @ 6 Vdc. 200 mA. 5300 RPM @ 12 Vdc.
 CAT# DCM-2 \$3.00 EACH

10AMP SOLID STATE

 Controls 3-32 Vdc Load: 10 AMPS. 130 Vdc. Size: 2 1/2" X 3/4" X 7/8"
 CAT# SSRLY-10A \$9.50 10 for \$85.00

TRANSFORMERS

5.6 VOLT-750MA
 CAT# TX-56 \$3.00
12 V.c.t.-1amp
 CAT# TX-121 \$4.00
12 V.c.t.-2amp
 CAT# TX-122 \$4.85
12 V.c.t.-4amp
 CAT# TX-124 \$7.00
18 VOLT-650ma
 CAT# TX-186 \$2.00 10 for \$18.00
24 V.c.t.-1amp
 CAT# TX-241 \$4.85
24 V.c.t.-2amp
 CAT# TX-242 \$6.75
24 V.c.t.-3amp
 CAT# TX-243 \$9.50
24 V.c.t.-4amp
 CAT# TX-244 \$11.00


COMPUTER GRADE CAPACITORS
1,400 MFD 200 VDC
 1" dia. X 2" high
 CAT# CG-1400 \$2.00
7,500 MFD 200 VDC
 3" dia. X 4 3/4" h.
 CAT# CG-75 \$4.00
22,000 MFD 25 VDC
 2" dia. X 4 3/4" h.
 CAT# CG-22 \$2.50
72,000 MFD 15 VDC
 2" dia. X 4 3/4" h.
 CAT# CG-130 \$3.50

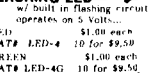
LED'S
 Standard Jumbo Diffused
 1" X 1/4" Size
 RED 100 for \$1.50
 CAT# LED-1 1000 for \$13.00
 GREEN 100 for \$2.00
 CAT# LED-2 1000 for \$17.00
 YELLOW 100 for \$2.00
 CAT# LED-3 1000 for \$17.00
FLASHING LED
 w/ built in flashing circuit operates on 5 Volts.
 RED \$1.00 EACH
 CAT# LED-4 10 for \$9.50
 GREEN \$1.00 EACH
 CAT# LED-4G 10 for \$9.50
BI-POLAR LED
 Lights RED one direction, GREEN the other. Two leads.
 CAT# LED-6 2 for \$1.70

25 AMP SOLID STATE

 PPTC 22A 240125 P.P.T.C. TTL compatible. INPUT: 3-32 VDC. OUTPUT: 25 AMPS @ 240 VAC. SIZE: 1 1/2" X 3/4" X 7/8"
 CAT# SSRLY-2524 \$35.00 EACH

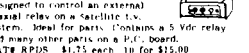
SWITCHES
MINIATURE TOGGLE
 S.P.D.T. (ON-ON) rated 5 Amp
 Non threaded. Pushing. 9/16" mount.
 CAT# MTS-40PC 75c each 10 for \$7.50
 S.P.D.T. (ON-ON) Solder lug terminals.
 CAT# MTS-4 10 for \$9.00
 D.P.D.T. (ON-ON) Solder lug terminals.
 CAT# MTS-8 \$2.00 each 10 for \$19.00
MINI PUSH BUTTON
 S.P.S.T. momentary. Push to make 1/4" brushing. Red button.
 CAT# MPB-1 35c each 10 for \$3.50

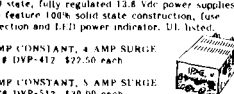
WALL TRANSFORMER

 115 Volts. 1.85 AMP. Input: 120 Vdc. Size: 3 3/4" X 2 7/8" X 2 5/8"
 CAT# DTX-11519 \$6.50 EACH


LED HOLDERS

 Two power holder. CAT# HLED 10 for 65c
CLIPLEAD LED HOLDER
 Takes 1.1 L.H. look like a fancy indicator.
 CLEAR CAT# HLDC-L-C
 RED CAT# HLDC-L-R
 GREEN CAT# HLDC-L-G
 YELLOW CAT# HLDC-L-Y
 1 of one color \$1.00

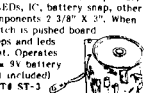
THIRD TAIL LIGHT

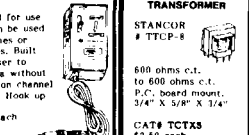
 Sleek high-tech lamp assembly. Red lens is 3 3/4" X 5 1/2" mounted on a 4" high pedestal with up/down swivel adjustment. Has 2V replaceable bulb.
 CAT# TLB \$3.95 EACH

POLARITY SWITCH

 Designed to control an external external relay on a satellite T.V. system. Ideal for parts. Contains a 5 Vdc relay and many other parts on a P.C. board.
 CAT# RPSD \$1.75 EACH 10 for \$15.00

13.8 VDC REGULATED POWER SUPPLY

 Solid state, fully regulated 13.8 Vdc power supplies. Both feature 100% solid state construction, fuse protection and LED power indicator. UL listed.
 2 AMP CONSTANT, 4 AMP SURGE CAT# DVP-412 \$27.50 EACH
 3 AMP CONSTANT, 5 AMP SURGE CAT# DVP-512 \$30.00 EACH

A/B SWITCH

 JVC# PUS5593 2 High quality A/B switch. Measures: 3 3/4" X 1 7/16" X 1". 75 OHMS INPUT
 CAT# DSS-2 \$3.50 EACH

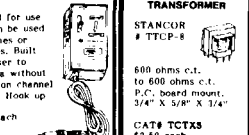
SOUND EFFECTS BOARD

 P.C. board with 2 1/4" speaker. 2 LEDs. 6V battery snap, other components 2 3/8" X 2 1/2". When switch is pushed board beeps and leads light. Operates on a 9V battery (not included).
 CAT# SF-3 \$1.75 EACH

TELEPHONE COUPLING TRANSFORMER

 STANCOB # TTPC-8
 600 ohms c.t. to 600 ohms c.t. P.C. board mount. 3/4" X 3/8" X 3/4".
 CAT# TCTX \$2.50 EACH

STORES:
 LOS ANGELES
 905 S. VERMONT AVE.
 LOS ANGELES, CA 90006
 (213)380-8000
 VAN NUYS
 6228 SEPULVEDA BLVD.
 VAN NUYS, CA 91411
 (818)997-1808

MAIL ORDERS TO:
 ALL ELECTRONICS
 P.O. BOX 567
 VAN NUYS, CA 91408
 TWX-511010163
 ALL ELECTRONICS
 Foreign Customers
 Send \$1.50 postage
 for FREE Catalog!!

TOLL FREE
 800-826-5432
 INFO:(818)904-0524
 FAX:(818)781-2653
 QUANTITIES LIMITED
 MINIMUM ORDER \$10.00
 CALIF. ADD SALES TAX
 USA \$3.00 SHIPPING
 NO C.O.D.
 FOREIGN ORDERS
 INCLUDE SUFFICIENT
 SHIPPING

SOUND AND VIDEO MODULATOR

 T18 UM381-1. Designed for use with T.V. computers. Can be used with video cameras, games or other audio/video sources. Built in A/B switch enables user to switch from T.V. antenna without disconnection. Operates on channel 3 or 4. Requires 12 Vdc. Hook up diagram included.
 CAT# AVMOD \$5.00 EACH

Christmas Special I
\$999*
COMPLETE SYSTEM
 Incl. Monitor & Printer
 w/20 meg Hard Drive

- 4.77-8 mhz
- 360K DD
- Monitor/Printer Card
- AT/XT Keyboard
- Samsung TTL Amber Monitor w/Tilt & Swivel
- 150 Watt P/S
- Star NP-10 Printer
- 1 Yr. Limited Warranty
- 640K Ram
- Floppy Cont.
- 20 meg H/D

"See us at the Tropical Hamboree February 6 & 7, 1988."
WORLD DATA ENTERPRISES
1-800-634-3547
(305) 551-4023
 P.O. BOX 652737 MIAMI, FL 33265
 *PLUS S/H, Assembled in USA

Christmas Special II
\$799*
COMPLETE SYSTEM
 Incl. Monitor & Printer

- 4.77-8 mhz
- 2 - 360K DD
- Monitor/Printer Card
- AT/XT Keyboard
- Samsung TTL Amber Monitor w/Tilt & Swivel
- 150 Watt P/S
- Star NP-10 Printer
- 1 Yr. Limited Warranty
- 256K
- Floppy Cont.

"See us at the Tropical Hamboree February 6 & 7, 1988."
WORLD DATA ENTERPRISES
1-800-634-3547
(305) 551-4023
 P.O. BOX 652737 MIAMI, FL 33265
 *PLUS S/H, Assembled in USA

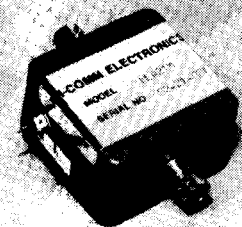
Iron Powder and Ferrite TOROIDAL CORES
 Shielding Beads, Shielded Coil Forms
 Ferrite Rods, Pot Cores, Baluns, Etc.

Small Orders Welcome
 Free 'Tech-Data' Flyer

AMIDON Associates Since 1963
 12033 Otsego Street, North Hollywood, Calif. 91607

In Germany: Elektronkladen, Wilhelm — Melles Str. 88, 4930 Detmold 18, West Germany
 In Japan: Toyomura Electronics Company, Ltd. 7-9, 2-Chome Sota-Kanda, Chiyoda-Ku, Tokyo, Japan

LINEARITY is our SPECIALTY
 10 - 900 MHz Preamp
 G=13dB NF=3dB IP=20dBm



WI-COMM ELECTRONICS INC.
 P.O. Box 5174, MASSENA, N.Y. 13662
 (315) 769-8334

dc output (or last i-f, if sufficient scope gain is available) is connected to the vertical input of the scope, providing a voltage amplitude display as a function of signal strength. The limiter output of a tube-type receiver swings negative, causing the scope display to swing downward unless the scope input can be switched to negative. A negative swing, as opposed to a positive swing, on the scope is of little consequence unless one's eye cannot adjust to the downward display of the signal.

To provide a frequency display on the horizontal axis, the varactor tuner must be swept over a range of frequencies with a sawtooth waveform. This may be accomplished in one of two ways: by obtaining the sawtooth sweep voltage from the scope or by generating a sawtooth voltage external to the scope. Older model Tektronix scopes had a sweep output terminal on the front panel that provided ready access to the internal sawtooth sweep voltage. The voltage output from the scope terminal was quite high, however — usually up to 100 volts. Approximately 0 to 3 volts is all that's required for adequate tuner sweeping. A resistor in series with a potentiometer will ratio the sweep voltage to the desired amount.

Should the user's scope not provide a sawtooth output voltage, an external sweep generator (fig. 4) may be used. A sync pulse is provided by the circuit to trigger the scope so that the trace will sweep and track along with the tuning voltage to the tuner. Some horizontal nonlinearity will be observed in the analyzer display. However, the amount is tolerable. The effect is caused by the difference in sawtooth linearity characteristics between the scope sweep and the external generator. Obtaining the sweep from the scope masks most of the effects of sweep nonlinearity. The remaining nonlinearity in the display is caused by the non-uniform voltage-to-frequency conversion of the varactor diode.

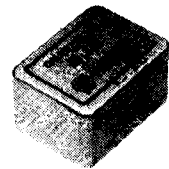
The sawtooth voltage is used to drive the tuning voltage line (see fig. 2) of the tuner in sync with the scope sweep, resulting in a signal voltage versus frequency display on the scope. Controlling the tuner frequency and sweep width separately allows the tuner to "look" at single or multiple signals near the center of the tuner's frequency setting.

The narrow passband of the typical 30- to 50-MHz receiver makes the tuning of the TV tuner critical but still satisfactory for analyzer work. However, a wider passband receiver makes the spectrum analyzer easier to handle. Readers who want to build a wider passband receiver, are referred to K4IPV's article, "Poor Man's Spectrum Analyzer," which appeared in the September 1986 issue of *ham radio*.

TV tuners are available from Science Workshop, P.O. Box 393, Bethpage, New York 11714. — Ed.

ham radio

K.V.G. CRYSTAL PRODUCTS



9 MHz CRYSTAL FILTERS

MODEL	Applic- ation	Band- width	Poles	Price
XF-9A	SSB	2.4 kHz	5	\$61.00
XF-9B	SSB	2.4 kHz	8	83.00
XF-9B-01	LSB	2.4 kHz	8	110.00
XF-9B-02	USB	2.4 kHz	8	110.00
XF-9B-10	SSB	2.4 kHz	10	145.00
XF-9C	AM	3.75 kHz	8	89.00
XF-9D	AM	5.0 kHz	8	89.00
XF-9E	FM	12.0 kHz	8	89.00
XF-9M	CW	500 Hz	4	62.00
XF-9NB	CW	500 Hz	8	127.00
XF-9P	CW	250 Hz	8	175.00
XF-910	IF noise	15 kHz	2	21.00

10.7 MHz CRYSTAL FILTERS

WRITE FOR FULL DETAILS OF CRYSTALS AND FILTERS
Export inquiries invited.

Shipping: \$3.75

ANTENNAS

2M:			
10XY-2M	\$80.00	LOOP YAGIS	
70cm:		1268-LY	\$80.00
70/MBM28	60.00	1296-LY	\$60.00
70/MBM48	90.00	1691-LY	\$75.00
70/MBM88	120.00	order loop yagi connector extra	
DY20-900 MHz	80.00		

Send 66¢ (3 stamps) for full details of all our VHF & UHF equipments and KVG crystal products.

Shipping: FOB Concord, Mass.

Prices subject to change without notice.



si

(617) 263-2145

SPECTRUM

INTERNATIONAL, INC.

Post Office Box 1084

Concord, MA 01742, U.S.A.

✓ 123



INTERNATIONAL MONTHLY MAGAZINE BY AND FOR ACTIVE RADIOAMATEURS

Radiosporting

THIS IS IT! — FOR BIG GUNS & LITTLE PISTOLS

A magazine dedicated to quality and sportsmanship in amateur radio operating. Fresh, timely, practical and down to earth reading for little pistols and big guns. Written by the world's best in their fields: ON4UN, SMØAGD, LZ2CJ, VE3BMV, KH6BZF, DJ9ZB, ZS6BRZ, W1WY, N2AU, K7GCO, K4ZN, W4GF, VE3JTQ, WB4ZNH, WB9TBU, KQ2M, NS6X, W3FG, KA3B, K1PLR, N7CKD, VE3XN, ABØX, JE1CKA and others.

Includes DX News, QSL Info, 160m, 80m, 10m, 6m columns, DXpeditioning, Propagation, Awards, Contest rules and results, Traffic — Emergency, FCC News, New Products, Antennas, Technical news and articles, equipment reviews and modifications, computer programs, Radio Funnies, Club Life, RTTY, VHF/UHF, Mail Box, Classified Ads and much more in a magazine format with the speed of a bulletin.

RADIOSPORTING sponsors DX Century Award, Contest Hall of Fame and World Radio Championship contest.

"Your publication is superb! Keep it up!" Joe Reisert, W1JR

"Your W2PV articles are priceless. Your magazine is super!"
Rush Drake, W7RM

"Let me congratulate you on a very impressive magazine. Just what I've been looking for as a DXer and Contester!"

Dick Moen, N7RO

"RADIOSPORTING, once received, cannot be tossed aside until it is read from cover to cover. Then reviewed again and again."
Chas Browning, W4PKA

Subscription rates: 1 year USA \$18, Canada CDNS\$26, Overseas US\$23; 2 years \$33, \$48, \$42 respectively. Single issue \$2. USA First Class Mail add \$8/year, DX Air Mail add \$15/year.

TRY US! SUBSCRIBE OR SEND \$1 FOR YOUR SAMPLE COPY.

RADIOSPORTING Magazine

PO Box 282, Pine Brook, NJ 07058, USA



✓ 124

January 1988  33

Introducing...

The AR 2002

The Professional Monitor Receiver



Now! In America

For the first time, the AR2002 is available in the U.S.A.! Acclaimed worldwide for its full spectrum coverage, its superior sensitivity, excellent selectivity and convenient, compact design; it has all the features a sophisticated and discerning public service band radio user desires. Experts in Europe, and around the world report excellent performance in independent lab tests. For example: sensitivity across all bands will typically exceed .3 microvolts in NFM. And now the AR2002 is available to you exclusively through this offer.

Performance Above and Beyond

You'll hear signals from 25 through 550 MHz, plus 800 MHz through 1.3 GHz. In any mode: narrow band FM, wide band FM, or AM. Search through entire bands, or enter selected frequencies into any of 20 memory channels. The sidelighted LCD gives full information on status and programming. Profession quality hinged keys and a digitized front

panel control knob make tuning easier than ever before. There's even a real time clock with backup, a signal strength meter and a front panel head phone jack. Plus, programmable search increments, a laboratory quality BNC antenna connector with switchable attenuator, full memory backup, and power cords for AC or DC operation. A professional quality swivel mount telescoping antenna is also supplied.

...And More!

Every AR2002 has a special connector on the rear panel. It interfaces to our custom RC-pack. A little device that makes the AR2002 controllable by ANY computer with an RS-232C port. The possibilities that result from this option are nearly limitless. In effect, virtually your only monitoring constraint will be your imagination.

Yet Convenient to Own

The AR2002 is available exclusively through us — so call us direct, TOLL FREE. We'll be happy to answer any questions you may have. And if you

respond like thousands of other monitor users the world over, we'll be shipping you an AR2002 within 48 hours by surface UPS for only \$455. Plus we pay all freight and handling charges. Remember to ask about our custom test and triple extended buyer protection warranty plans, and our express shipping option. If you're not satisfied within 25 days, return your AR2002. We'll refund your purchase and return shipping costs. There are no catches, no hidden charges.

The AR 2002

The Professional Monitor Receiver



10707 East 106th Street, Indianapolis, IN 46256

Call Toll Free 800-445-7717

Visa and MasterCard

COD slightly higher

In IN 317-842-7115 Collect

Warehouse: 22511 Aspan Street, Lake Forest, CA 92630

(7 $\frac{1}{8}$ "D × 5 $\frac{1}{8}$ "W × 3 $\frac{1}{8}$ "H Wt. 2 lbs., 10 oz.)

morse code teaching tools for the C-64 and 128

You control
between-character timing
for increased proficiency
and greater speed

Suppose you've decided to learn a new language — French, for example. You could choose to study with a teacher in a classroom or on your own, using cassette tapes or records. In either case, you'd notice that the instructor would begin by pronouncing each word normally at the appropriate speed, but would lengthen the pauses between the words or syllables to give students time to recognize individual sounds.

Let's assume you've opted to learn French from records or tapes. What would happen if, instead of playing them at their proper speed, you played them at a slower speed? You'd probably have great difficulty recognizing any words at all.

Learning Morse Code is like learning a new language, and listening to code at five wpm is just like listening to language records or tapes played at the wrong speed.

At five wpm it's easy to fall into the trap of counting dots and dashes. Most people can't reach 13 wpm this way, so when they switch to learning to hear the rhythm patterns (i.e., *sounds*— Ed.) instead of individual dots and dashes, they're essentially learning a new code.

Unfortunately, this experience is often accompanied by a discouraging loss of speed, just when they need encouragement to upgrade. Too many would-be Generals give up at the Technician level because of the difficulty of breaking the dot and dash counting habit to relearn code at 13 words per minute.

The fastest way to a General Class license is to start at 13 wpm, with generous pauses between characters for an overall speed of five words per minute. This way, you'll learn code characters by recognizing rhythm patterns rather than by counting dots and dashes. Once you've learned to recognize the patterns, all you have to do is concentrate on reducing your

reaction time. Just as on the language records, you'll find the time between the characters helpful for recognizing them and writing them down.

To skeptics who insist that they can't learn code, I like to introduce the letters V and B. I simply suggest that they think of the V as the Roman numeral \bar{V} . I ask them to recall Beethoven's Fifth Symphony, noting that the sound of the Morse V sounds just like the opening phrase: *di-di-di-dah*. For the Morse letter B (as in "Beethoven"), you just play it backwards: *dah-di-di-dit*. After a short demonstration, they can pick these letters out of small code groups, even though they may have to pause to figure out how many dots and dashes are used for each letter. This trick often provides the confidence they need to continue studying code.

code practice from the computer

When I started preparing for the Extra Class code test, I wasn't sure whether I was really improving my copying or merely remembering the material on the recordings. I bought one of those code practice keyers that generates random code, with an adjustable delay between characters. But without a printout of answers against which I could check my work, I was still unsure of my progress. When I finally got around to looking at computers, I was surprised to find how difficult it is to find a code program that includes the continuously variable spacing my keyer provides. Most programs offer only the choice of standard spacing or standard spacing plus one full space. This is too big a jump; a better method would allow for gradual reduction of the length of the pauses between characters, with character speed remaining constant.

Hearing of my problem, a friend offered me the use of his Commodore 64 computer and challenged me to write a code program that provides the variable spacing I believe is essential for learning the code. *Morse Code Teaching Tools*, the result of that effort, allows you to set the character speed and overall word speed to any logical combination of speeds between five and 50 wpm. It also performs the following functions:

- **Random practice.** Choose letters, numbers, punc-

By Dennis L. Green, KB8CS, 20039 Murray Hill,
Detroit, Michigan 48235

tuation, mixed letters and numbers, or all characters. Select groups of one to nine characters or random lengths.

- **Keyboard Mode.** Send the characters as you type them on the screen. You can type up to 920 characters ahead; the character being sent will be highlighted with a brighter color.
- **Message Entry.** Enter your own text, such as a sample code test.
- **Disk Access.** Format a new disk, save the current message, load a message, delete messages, or validate a disk.
- **Sending.** Send the current message or send random practice. Pause, resume sending, or return to the menu at any time. Select a blank screen or print each character on the screen after it's sent.
- **Printing.** Print the current message or random practice answers on the screen or printer.

The program is menu-driven to make it easy to use with minimal knowledge of the computer. Out-of-range or blank entries are ignored, and you're sent back to the menu. Most disk errors — such as bad file names or no disk in the drive — won't crash the program. For those who prefer single-key operations, the CRSR-right key will move the selection highlighted on the menu, but will work normally when you select a message from the disk directory. This program will run on the Commodore 128 computer in the "64" mode.

getting the timing right

The program timing is based on words of five characters and one space, for a total of 50 time elements. Dots and the time between dots and dashes are each one time element in length. Dashes and the time between characters are three elements long. A space character has the same timing as a silent "e" in a spoken word — that is, one element without the sound plus the usual three elements of time between characters. The word "PARIS" fits this description. When you set the word speed slower than the character speed, the three time elements between characters are lengthened. If you try a speed test, remember to put two spaces before the last word instead of the trailing space, since it's rather difficult to hear when a "space" has ended.

After filling my trash can with a number of early versions of this program, I discovered why it's so hard to generate accurate code on the Commodore 64 computer. A signal from the Complex Interface Adapter (CIA) chip's timer causes the computer to stop whatever it's doing sixty times per second to run a built-in machine language program that updates the clock registers and scans the keyboard and stores the value of any depressed key in memory. These interruptions in the execution of the program make the code inaccurate (and sloppy sounding) if a program loop is used to control the code timing. Using the clock registers in a loop to control the code timing won't work any better because they're updated too infrequently and the keyboard routine must finish before the BASIC program resumes execution and can respond to the change in the clock register.

To generate accurate code, it's necessary to use the CIA chip's timer interrupts to control the sound chip and give it priority over the keyboard and clock functions. The effect on the keyboard response shouldn't be noticeable to the average typist, and the clock isn't used by this program. The modified interrupt handler machine language is POKed in from DATA written in BASIC to avoid the need for an assembler to enter the program. If you're familiar with machine language, you may wish to use the data to create a binary file, which will load faster.

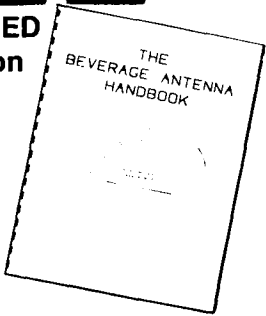
how to get a copy of the program

Because of its considerable length (7 pages, 315 lines of coding) the program listing cannot be reproduced here; a free printout is available from *ham radio* for a No. 10 SASE with two units of first-class postage. If you'd like to have a ready-to-use copy of the program on a disk, send a certified check or money order for \$8.00 to Robert A. Evans, N8GFE, 23540 Manistee, Oak Park, Michigan 48237.

ham radio

NEW

FULLY REVISED
Second Edition




**BEVERAGE
ANTENNA
HANDBOOK**
by Vic Misek, W1WCR

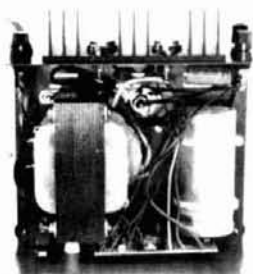
Recognized around the world as the definitive work on Beverage Antennas, W1WCR has spent countless hours developing new antenna ideas and optimizing the SWA (Steerable wave antenna.) Misek delves deep into the secrets of the single wire Beverage with helpful hints and tips on how to maximize performance based upon wire size, height above ground, overall length and impedance matching. Also includes information on center fed Beverages constructed out of several wire types. **CITY LOT OWNERS** Note: Misek has developed a Beverage for you too! Called the Micro-SWA, it is just 60 ft long. You get excellent directivity and null steering capabilities. Transformer design information for both termination and feedline matching is completely revised. © 1987 80 pages 2nd Edition

VM-BAH **Softbound \$14.95**

Please enclose \$3.50 for shipping and handling

ham radio BOOKSTORE 

GREENVILLE, NH 03048 603-878-1441



INSIDE VIEW — RS-12A

ASTRON POWER SUPPLIES

• HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE •

SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-3A, RS-4A, RS-5A.
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC ± 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- Also available with 220 VAC input voltage



MODEL RS-50A



MODEL RS-50M



MODEL VS-50M

RM SERIES



MODEL RM-35M

19" × 5 1/4" RACK MOUNT POWER SUPPLIES

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RM-12A	9	12	5 1/4 × 19 × 8 1/4	16
RM-35A	25	35	5 1/4 × 19 × 12 1/2	38
RM-50A	37	50	5 1/4 × 19 × 12 1/2	50
• Separate Volt and Amp Meters				
RM-12M	9	12	5 1/4 × 19 × 8 1/4	16
RM-35M	25	35	5 1/4 × 19 × 12 1/2	38
RM-50M	37	50	5 1/4 × 19 × 12 1/2	50

RS-A SERIES



MODEL RS-7A

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-3A	2.5	3	3 × 4 1/2 × 5 1/4	4
RS-4A	3	4	3 1/4 × 6 1/2 × 9	5
RS-5A	4	5	3 1/2 × 6 1/2 × 7 1/4	7
RS-7A	5	7	3 3/4 × 6 1/2 × 9	9
RS-7B	5	7	4 × 7 1/2 × 10 3/4	10
RS-10A	7.5	10	4 × 7 1/2 × 10 3/4	11
RS-12A	9	12	4 1/2 × 8 × 9	13
RS-12B	9	12	4 × 7 1/2 × 10 3/4	13
RS-20A	16	20	5 × 9 × 10 1/2	18
RS-35A	25	35	5 × 11 × 11	27
RS-50A	37	50	6 × 13 3/4 × 11	46

RS-M SERIES



MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-12M	9	12	4 1/2 × 8 × 9	13
• Switchable volt and Amp meter				
RS-20M	16	20	5 × 9 × 10 1/2	18
• Separate volt and Amp meters				
RS-35M	25	35	5 × 11 × 11	27
RS-50M	37	50	6 × 13 3/4 × 11	46

VS-M AND VRM-M SERIES



MODEL VS-35M

- Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps)			ICS* (Amps) @13.8V	Size (IN) H × W × D	Shipping Wt. (lbs.)
	@13.8VDC	@10VDC	@5VDC			
VS-12M	9	5	2	12	4 1/2 × 8 × 9	13
VS-20M	16	9	4	20	5 × 9 × 10 1/2	20
VS-35M	25	15	7	35	5 × 11 × 11	29
VS-50M	37	22	10	50	6 × 13 3/4 × 11	46
• Variable rack mount power supplies						
VRM-35M	25	15	7	35	5 1/4 × 19 × 12 1/2	38
VRM-50M	37	22	10	50	5 1/4 × 19 × 12 1/2	50

RS-S SERIES



MODEL RS-12S

- Built in speaker

MODEL	Continuous Duty (Amps)	ICS* Amps	Size (IN) H × W × D	Shipping Wt. (lbs.)
RS-7S	5	7	4 × 7 1/2 × 10 3/4	10
RS-10S	7.5	10	4 × 7 1/2 × 10 3/4	12
RS-12S	9	12	4 1/2 × 8 × 9	13
RS-20S	16	20	5 × 9 × 10 1/2	18

build a QSO “beeper”

End-of-transmission tone becoming more common

As an Amateur, you're no doubt familiar with the courtesy tones heard over repeaters, indicating the end of each transmission. You may have also heard end-of-transmission tones in SSB communications during contesting or poor conditions. This article describes several different circuits for producing these tones, along with some discussion of how they operate. I like to refer to these circuits as "QSO Beepers."

operation timing

The Beeper (fig. 1) transmits one or more short tone bursts after you're finished talking. This indicates to other stations that your station has finished transmitting and is now in the receive mode.

In many radios the PTT line from the microphone immediately unkeys the transmitter when you're through talking. However, if this were allowed to happen with a QSO Beeper in place, these trailing courtesy tones would be cut off. Therefore, after you unkey, the Beeper keeps the PTT line keyed (active) for the short interval of burst tone activity (see fig. 1).

The interval WAIT1 provides a delay-before-burst or "DBB" period. Without this short interval, the following beep tone (BEEP1) would "ride" the audio of the quick-fingered operator who unkeys instantaneously after talking. A duration of 0.1 seconds usually works well, but isn't critical.

BEEP1 is the desired tone burst, usually around 1 kHz and about 0.1 second or so in length. The pitch and duration are selected to provide a comfortable sound.

The other DBB intervals (WAIT2, etc.) provide the same spacing effect as WAIT1. The next desired tone bursts — designated BEEP2, etc. — have characteristics similar to the first.

Simple circuits can be used to produce these DBB intervals and the tone bursts. A single-burst Beeper cascades the DBB and burst generators. A multiburst Beeper can be made by cascading several single-burst Beepers. When the burst tones are set to different pitches (BEEP1, BEEP2, etc.), a melody distinctive to each station can be produced.

Figure 2 illustrates the general circuit of the Beeper. The Beeper is connected between the microphone output plug and the microphone input jack to the radio. Audio from the microphone connects directly through the Beeper to the radio. The Beeper's courtesy tones are injected into this line at the proper time.

A level transition detector senses when the PTT line from the microphone changes state as you unkey at the end of a transmission. This transition triggers the time interval generator to produce a pulse of fixed duration. This gating pulse in turn gates both the PTT electronic switch (controlling the radio) and the audio oscillator, producing the tone burst.

Since many PTT microphones operate by grounding a control line normally "pulled high," the circuits described here "pull" the radio PTT line to ground during transmit (see fig. 1). This can be achieved with an open-collector NPN transistor placed in conduction at the proper time. For improved circuit operation, a very low-resistance VMOS (TMOS, etc.) FET could be used in place of the bipolar device.

An extra line from the radio (via the microphone

By Richard L. Erhardt, KF6CU, 2200 Agnew Road #309, Santa Clara, California 95054-1502

**TE
SYSTEMS****RF POWER AMPLIFIERS**

- Lowest NF GaAs FET Preamp
- Finest Quality Military Construction
- Off-The-Shelf Dealer Delivery



For the past five years, Amateurs worldwide have sought quality amplifier products from TE Systems. Renowned for the incorporation of high quality, low-noise GaAs FET preamplifiers in RF power amplifiers, TE Systems offers our fine line of products through select national distributors.

- All amplifiers are linear (all-mode), automatic T/R switching with adjustable delay and usable with drive levels as low as 1/2 Watt. We incorporate thermal shutdown protection and have remote control capability. All units are designed to ICAS ratings and meet FCC part 97 regulations. Approx. size is 2.8 x 5.8 x 10.5" and weight is 5 lbs.

Consult your local dealer or send directly for further product information.

**TE
SYSTEMS****TE SYSTEMS**

P.O. Box 25845
Los Angeles, CA 90025
(213) 478-0591

SPECIFICATIONS

Model	Freq. MHz	Power		Preamp		DC +Vdc	Power A	RF Conn.
		Input	Output	NF-dB	Gain-dB			
0508G	50-54	1	170	.6	15	13.6	28	UHF
0510G	50-54	10	170	.6	15	13.6	25	UHF
NEW 1409G	144-148	2	160	.6	15	13.6	25	UHF
1410G	144-148	10	160	.6	15	13.6	25	UHF
1412G	144-148	30	160	.6	15	13.6	20	UHF
2210G	220-225	10	130	.7	12	13.6	21	UHF
2212G	220-225	30	130	.7	12	13.6	16	UHF
4410G	420-450	10	100	1.1	12	13.6	19	N
4412G	420-450	30	100	1.1	12	13.6	19	N

Models also available without GaAs FET preamp (delete G suffix on model #). All units cover full amateur band - specify 10 MHz bandwidth for 420-450 MHz amplifier.

Amplifier capabilities: 100-200 MHz, 225-400 MHz, 1-2 GHz, Military (28V), Commercial, etc. also available - consult factory.

127

**SECURITY
SYSTEMS****ALARM &
CLOSED CIRCUIT TV****DISCOUNT PRICING**

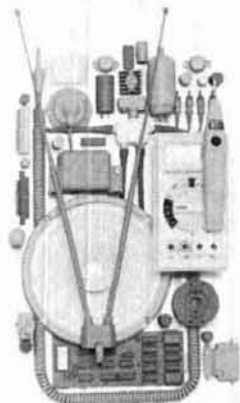
- Panasonic CCTV
- Wireless & Hardwired Alarm Systems
- Experienced
- State Licensed

For More Information

7:30 AM-6 PM CST M-F
**DETECTION
DYNAMICS**

4700 LOYOLA LANE, #119
AUSTIN, TX 78723 (512) 345-8401

128

**CONSOLIDATED
ELECTRONICS**

CONSUMER & INDUSTRIAL ELECTRONICS CATALOG • 17TH EDITION
22.00

**THE ULTIMATE
ELECTRONICS CATALOG.**

Order your 260 page catalogue packed with over 10,000 money saving electronic parts and equipment. Send \$3.00 check or money order, or call 1-800-543-3568 today and use your Mastercard or Visa.
Consolidated Electronics, Incorporated
705 Watervliet Ave., Dayton, Ohio 45420-2599

NAME _____
ADDRESS _____
CITY _____
STATE _____ ZIP _____

129

**BIGGER
AND BETTER**

By popular demand, we are extending our end-of-year sale* of genuine top-rated 8-pole FOX TANGO filters for Kenwood, Yaesu, Drake, Heath, and Collins indefinitely. Buy at discounts of 10%, 20%, and even 30% or more at a time when these Japanese-made units should be getting more expensive. Our secret? Fine products, low overhead, high sales volume. Filters are our prime specialty!

We are not just bragging when we say FOX TANGO filters are top-rated. We are proud that they have been favorably rated twice in impartial QST Product Reviews, selected for use in a major construction article in the ARRL Handbook, praised in two major articles in 73 magazine, and recommended for contesters in Radiosporting magazine. Reprints of all articles are available. Convince yourself! Use your next ten QSO's to learn what hams think about FOX TANGO: its products, its reputation. Since no rig is better than its filters, why risk disappointment with unproven imitations?

**GO FOX TANGO—TO BE SURE!
SUPER SPECIALS!**

TS-830S 400 Hz (CW) 455.7 kHz—Reg. \$110, **Now \$77**.
Note: Suitable for '830 only. Easy drop-in installation.

14-year Fox Tango Newsletter Index—Reg. \$5, **Now FREE**. (With purchase of a filter for any Yaesu rig.)

*Phone for Sale prices, or see any Nov. 1987 ham magazine. ORDER by mail or phone. SHIPPING \$5, Overseas Air \$13.

FOX TANGO CORPORATION
Box 15944, W. Palm Beach, FL 33416
Telephone: (305) 683-9587

PRESENTING

MIRAGE /KLM

Another Great Power Amplifier
with "Made in the U.S.A."-Quality
the D15N

The MIRAGE D15N represents the latest in 440 MHz Power Amplifiers. It incorporates features that make it the most useful and versatile amplifier available today. The D15N will amplify both FM, SSB, and ATV signals. It has variable SSB delay.

SPECIFICATIONS:

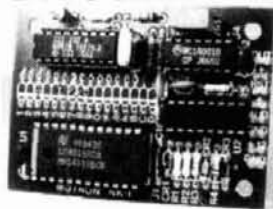
Frequency Range:	420 to 450 MHz				
Power:	INPUT 0.1-2 Watts (2 Watts maximum) OUTPUT 18 Watts or more for 2 Watts input-intermittent duty cycle.				
Modes:	FM, SSB, CW and ATV				
Performance:					
Power In:	1.5	1.0	.75	5	.25
Power Out:	18.0	15.0	13.00	10.0	6.00
	Insertion Loss Typical 1.5 dB				
DC Power:	13.6 VDC at 3 amps nominal				
Fuse:	5 amps				
Impedance:	50 Ohm input and output				
Size:	7.25" x 3.5" x 2"				
Weight:	1.5 lbs.				

Contact your
local ham dealer
for prices and
availability

130



P.O. Box 1000 • Morgan Hill, CA 95037
(408) 779-7363

NET-KALL NK-1
DTMF ALERT DECODER



From
Only
\$34.95!

- Momentary or latched output
- Multiple Group-Call response
- High stability xtal controlled SSI-202
- Ideal for an economical alert system

 NK-1K (kit) **\$34.95**
 NK-1W (Wired/Tested) **\$44.95**
 (Add \$2.00 Shipping/Handling in U.S.A.)

MoTron Electronics Call Toll-Free
695 W. 21st Ave. **1-800-338-9058**
Eugene, OR 97405 or (503) 687-2118

131

FREE CATALOG!

Features Hard-to-Find Tools
and Test Equipment



Jensen's new catalog features hard-to-find precision tools, tool kits, tool cases and test equipment used by ham radio operators, hobbyists, scientists, engineers, laboratories and government agencies. Call or write for your free copy today.

JENSEN®
TOOLS INC. Dept. HR
7815 S. 46th Street
Phoenix, AZ 85044
(602) 968-6231

132

KENNEDY ASSOCIATES

Stocking all major lines. San Antonio's
Ham Store. Great Prices—Great Service.
Factory authorized sales and service.
Hours: M-F 10-6; SAT 9-3

KENWOOD

YAESU



ICOM

Amateur Radio Division
5707A Mobud
San Antonio, TX 78238
Telephone: 512-680-6110



133

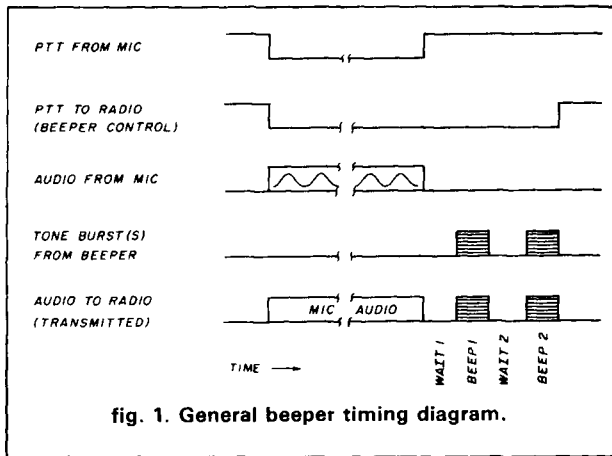


fig. 1. General beeper timing diagram.

defining the gate's digital state. The output of the gate follows this input spike with a pulse of width directly proportional to the resistor and capacitor values. Values of $R_p = 470\text{ k}$ and $C_p = 0.22\mu\text{F}$ provide a pulse of about 0.1 seconds, yielding an effective delay-before-burst interval. (Triggering on the negative-to-positive transition instead can be accomplished by connecting the resistor to ground instead of the positive supply line. Note that the output in this case is also the inverse of the previous case, providing a negative-going pulse.)

audio oscillator

Figure 4 shows one way of implementing the tone

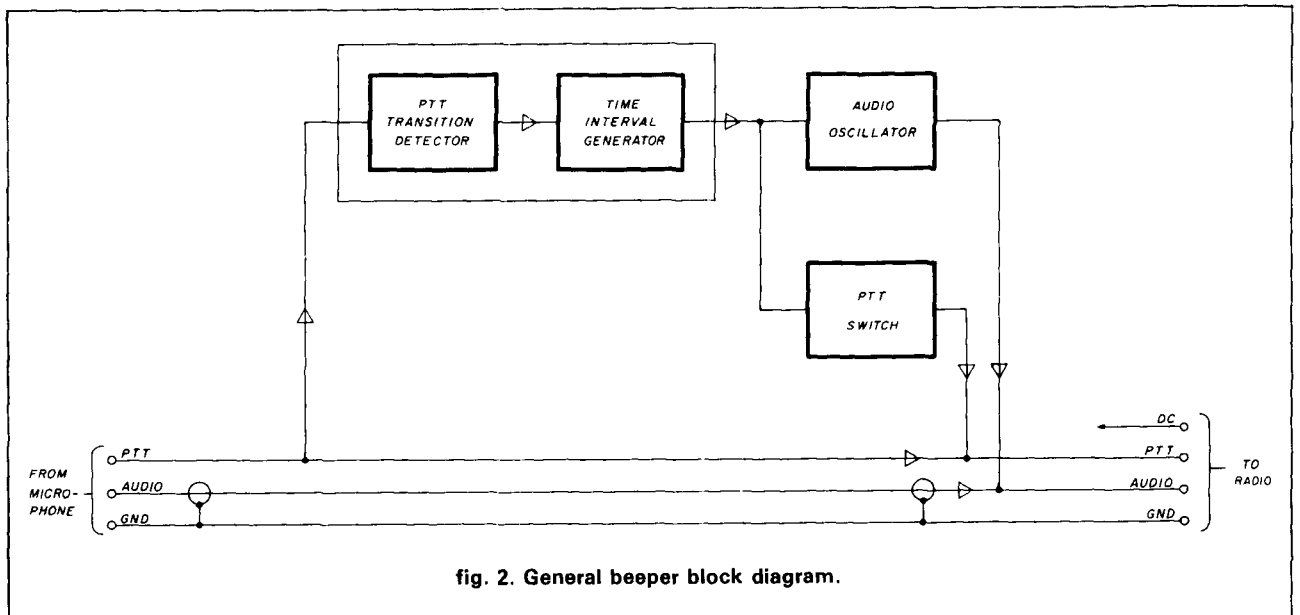


fig. 2. General beeper block diagram.

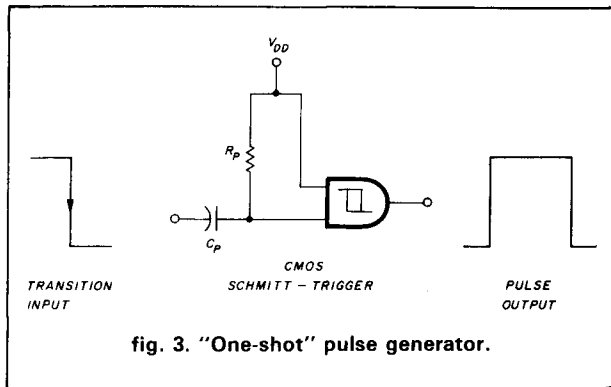
cable, for example) or an internal battery can supply dc input power. The use of CMOS circuitry keeps the dc input power requirement low, allows wide supply-voltage operation (+3 to +18 dc), and provides high noise immunity. The high input impedance of the CMOS gates allows realizable component values to be used in generating the desired time constants. Low power consumption and small size make the Beeper perfect for QRP outings (such as Field Day), net operation, and contesting.

time delay circuit

Figure 3 illustrates one way of implementing the time interval (pulse) generator, which is also referred to as a monostable multivibrator or "one-shot." Upon a positive-to-negative edge transition capacitor C_p produces a single spike at the input of the gate, charging through resistor R_p . This spike causes the gate input voltage to momentarily cross the threshold level

burst circuit, also referred to as a gated astable oscillator. Upon application of the burst-control signal, the gate is enabled and the output changes state. Resistor R_o feeds this output signal back to the gate input and capacitor C_o . As C_o discharges, the gate input voltage crosses the threshold level defining the gate's state and the output follows this input change. This out-of-phase feedback mechanism causes C_o to charge and discharge at a determinable rate, with the gate input voltage rising and falling accordingly. An output oscillation will be produced at a rate inversely proportional to the values of R_o and C_o . Notice that the tone burst has the same duration as the input burst-control signal because the gate is active only during this time.

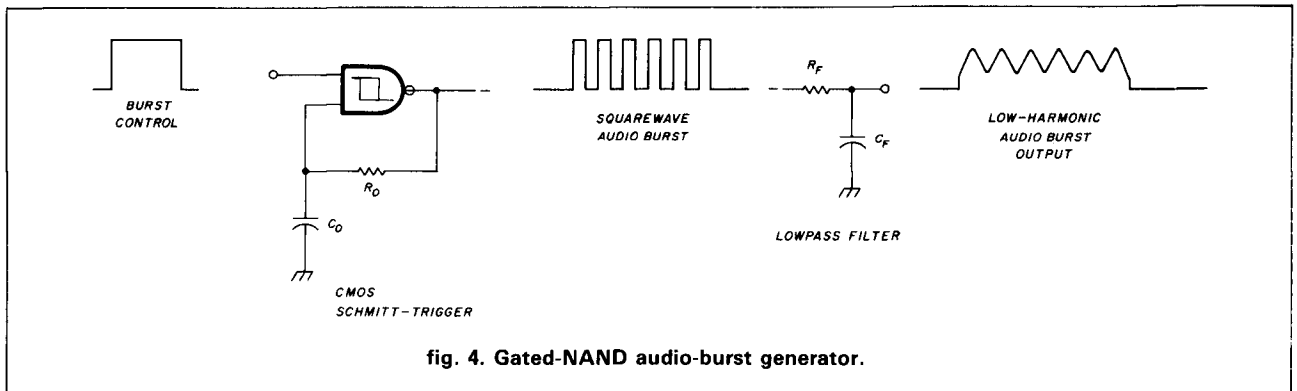
Values of $R_o = 10\text{ k}$ and $C_o = 0.1\mu\text{F}$ provide a frequency of about 1 kHz, producing a pleasing beep tone. A low-pass filter composed of R_f and C_f remove the high-frequency components of the gate's square



single-tone QSO beeper

The circuit shown in fig. 5 illustrates a Beeper that produces a single beep. The first section, U1A, makes the necessary waveform inversion of the PTT negative-to-positive transition to that of positive-to-negative required by the "one-shots" (as in fig. 1 and fig. 3). R1 provides the necessary voltage pull-up for the microphone PTT switch that connects to ground when keyed.

Two "one-shots" have been cascaded to provide the necessary time delays. The first interval at U1B (by C1 and R3) is the DBB interval described previ-



wave, leaving a lower-harmonic sawtooth-type waveform.

potentiometer or fixed resistor?

Both the monostable and astable circuits could use a potentiometer in place of the fixed resistor to allow flexibility in setting the interval or pitch. However, these two parameters usually don't have to be changed after the initial setting, so a fixed component works well. Potentiometers usually need more real estate than small fixed resistors anyway!

In both the one-shot and oscillator circuits the very high input impedance of the CMOS gate provides minimal loading of the RC circuit, meaning the time constant is effectively only a function of (realizable) values for the resistor and capacitor. At much shorter timing intervals, or higher oscillation frequencies, the input capacitance of the CMOS gate must be taken into account. At longer intervals (or lower frequencies) capacitor leakage must be considered. The Schmitt trigger hysteresis and the CMOS gate transfer function are also important for proper operation.

Keep these effects in mind when modifying or adapting either the one-shot or tone burst generators. More information about monostable and astable generators can be found in various application notes on CMOS gates such as the 4093 or 74C132 Schmitt-trigger NAND gate IC, or the 4069 Schmitt-trigger inverter IC.

ously. The second interval of U1C (by C2 and R4) sets the length of the beep tone. The resistor and capacitor values shown provide about 0.1 seconds of delay through each one-shot stage.

The output of U1C controls or gates the audio oscillator of U1D (set by C3 and R7), yielding the output tone burst. Low-pass filtering is provided by R8 and C4. Potentiometer R9 allows the amplitude of the tone burst to be set. Capacitor C5 simply blocks dc between U1D and the audio line; many active microphones receive dc power from the radio via this line, which must not be interfered with by the dc present at the potentiometer output.

Transmitter keying (PTT) is provided by the open-collector NPN transistor, which is turned on during both one-shot intervals by "wired OR-ing" through diodes CR2 and CR3. U1A is also ORed via CR1 to key the radio PTT line while the operator is keying the microphone. Without CR1 the radio PTT line would be active only during the DBB and tone burst periods via CR2 and CR3 (fig. 1). As previously mentioned, a very low-resistance FET could be used at Q1 in place of the bipolar device for improved performance. The collector current and open circuit voltage present on the radio PTT line must be considered when selecting Q1. Most solid-state rigs with PTT keying via the microphone operate this control line with relatively low voltage and current that are easily handled by the 2N2222 or its equivalent.

ICOM MICRO
Available in 2-meter
and 440MHz versions!



ICOM MICRO THE WINNING HAND

Deal yourself a winning hand in modern technology with ICOM's new micro-size 2-meter FM transceiver. The IC- μ 2AT combines maximum performance, reliability and easy operation in a thin-styled handheld that's perfectly suited for today's active lifestyles.

The IC- μ 2AT. A breakthrough that ends every amateur radio operator's quest for that one true, go-anywhere 2-meter handheld.

Miniaturization. The MICRO gives you all the advantages and performance of a larger handheld, in a package so small, so refined, so well-built that only ICOM could build it.

Measuring only 4.6" high by 2.3" wide by 1.1" deep, the MICRO fits in your pocket or purse as easily as a cassette tape.

This miniaturization doesn't compromise ICOM quality. It's exactly what

you'd expect from ICOM: high performance in a micro package.

Full Featured. And ICOM hasn't compromised features for size. The IC- μ 2AT DTMF version includes ten



programmable memories, transmit offset capability from the back panel including odd offsets, an LCD readout on the top panel for easy readability, up to three watts of output (optional), 32 built-in subaudible tones AND wide-band receive coverage from 138 to 162.995MHz in 5kHz steps for MARS

and CAP operation plus weather broadcasts.

There's also a simple-to-use digital **TouchStep Tuning System** for fast shirt-pocket frequency adjustments. The MICRO also includes a band or memory manual scan function. An A version is also available without DTMF and PL tones.

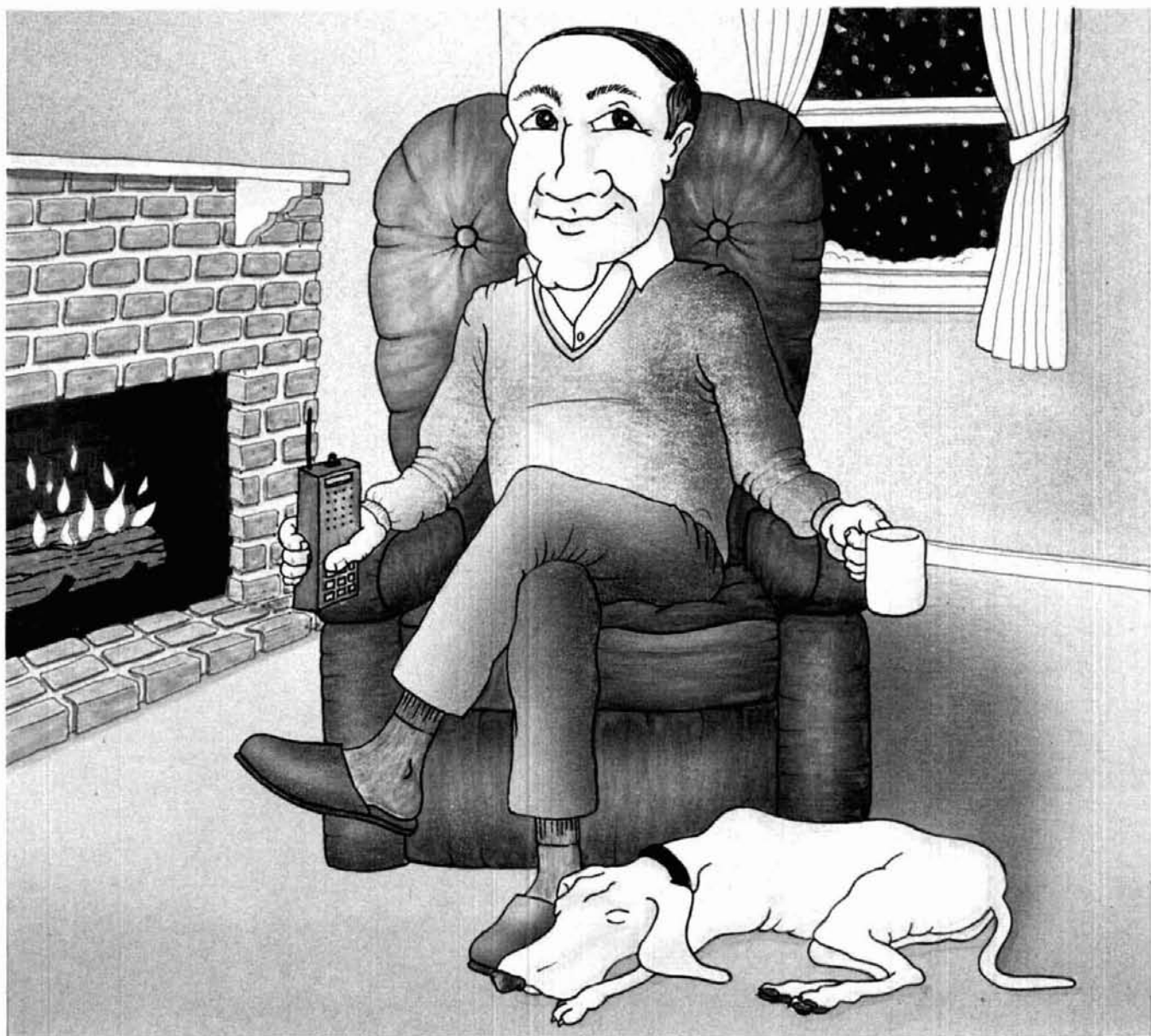
Personalize your ICOM MICRO. The MICRO utilizes most existing ICOM handheld accessories, plus it hosts a new line of versatile accessories including the BP-24 2.6 watt high-power battery pack, BP-23 long-life 1.6 watt battery pack, BC-50 desktop rapid charger, and a variety of carrying cases.

See the ICOM MICRO at your local ICOM dealer. Play your cards right with ICOM!

 **ICOM**
First in Communications

ICOM America, Inc., 2380-116th Ave. N.E., Bellevue, WA 98004 **Customer Service Hotline (206) 454-7619**
3150 Premier Drive, Suite 126, Irving, TX 75063 / 1777 Phoenix Parkway, Suite 201, Atlanta, GA 30349
ICOM CANADA, A Division of ICOM America, Inc., 3071 - #5 Road, Unit 9, Richmond, B.C. V6X 2T4 Canada

All stated specifications are approximate and subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions. μ 2AT387.



“I convinced my club to buy an ACC repeater controller, and I’m glad I did”

Our group decided to upgrade our repeater system and I was the one asked to investigate.

We’ve always tried to have the best system around so it was time to make some changes. We needed a control system that was reliable, easy to hook up, cost-effective, and something that would free the technical guys for more interesting projects than just keeping the equipment running.

Everyone in the club put a few bucks into the pot and it was ours!

We’ve found the voice messages and telemetry make using the repeater more fun. The convenience of remote programming and automatic scheduled

operation is remarkable. Not to mention the most sophisticated autopatch ever designed for amateur use. Later we added the Digital Voice Recorder for personalized IDs, bulletin boards, and voice mail.

ACC’s products are state-of-the-art commercial quality and built to last. Workmanship so solid even the military uses them.

What impresses me even more, though, is the support we get from the staff at ACC – both before and after the sale. And they protect our investment through simple plug-in software and hardware upgrades . . . new features and capabilities that keep our club on top.

I feel good about recommending Advanced Computer Controls’ repeater controllers. After all, it’s *my* club’s money that was spent and *my* reputation that was on the line.

ACC

advanced
computer
controls, inc.

2356 Walsh Avenue • Santa Clara, California (408) 727-3330

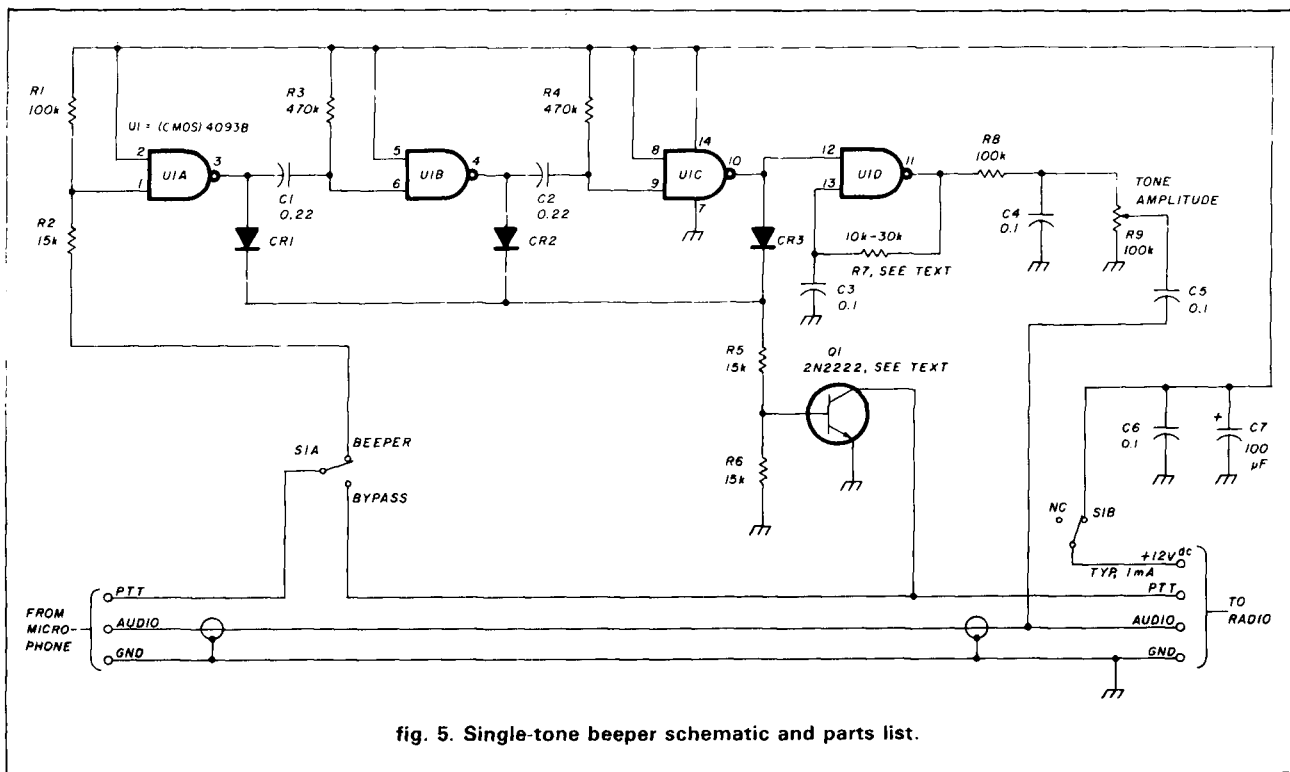


fig. 5. Single-tone beeper schematic and parts list.

Single-tone Beeper parts list

C1,2	0.22µF, 50 volts	nonpolarized, low-leakage	(RS 272-1070)
C3,4,5,6	0.1µF, 50 volts	nonpolarized, film	(RS 272-1069)
C7	100µF, 35 volts	electrolytic (or tantalum)	(RS 272-1028)
CR1,2,3	1N914	general signal diode	(RS 276-1620)
Q1	2N2222A	general purpose NPN	(RS 276-1617)
R1,8	100 k	1/4 watt	(RS 271-1347)
R2,5,6	15 k	1/4 watt	(RS 271-1337)
R3,4	470 k	1/4 watt	(RS 271-1354)
R7	10-30 k	1/4 watt (set for tone pitch)	(RS 271-13xx)
R9	100 k	potentiometer	(RS 271-338)
S1	DPDT	toggle (or slide)	(RS 275-663)
			(RS 276-1999)
			(RS 276-168)
socket	14-pin DIP		
U1	CD4093B	CMOS quad NAND Schmitt	
		(74C132)	
	perfboard with solder pads, 0.1-inch centers		

DPDT switch S1 allows the Beeper to be switched in or out of the circuit as desired. Note that in the "bypass" mode, dc power to the Beeper doesn't have to be applied for the radio to be keyed by the microphone; thus, normal radio operation is restored. The base-to-ground resistor at Q1 ensures that Q1 won't conduct while the Beeper is in the bypass mode.

a dual-tone QSO beeper

The circuit shown in fig. 6 describes a Beeper that

produces either a single tone or two tones in sequence. Here the single-tone Beeper described above is cascaded for sequential operation. For simplicity, a single panel switch is used to select either the bypass mode, or the one- or two-beep mode. However, two trade-offs must be made in the bypass mode when using only the single switch: first, dc power to the Beeper is always connected, which will probably not pose a power consumption problem; and second, input to the Beeper is always connected (even though it will be

TURBO PC/XT COMPATIBLE

\$649.00

PRICE INCLUDES

PHOENIX BIOS

HI-RES SAMSUNG MONITOR

2 DISK DRIVES DS/DD 360K

DELUXE KEYBOARD

MS DOS 3.1 WITH MANUAL

PRINTER PORT

SERIAL PORT

GAME PORT

CLOCK CALENDER

256K MEMORY

4.77 OR 8MHZ OPERATION

EXPANDABLE TO 640K

8 SLOT MOTHER BOARD

FREE SOFTWARE

AZOTIC INDUSTRIES INC.

2026 W BELMONT

CHICAGO ILL 60618

(312)-975-1288

COMING SOON

BBS SERVICE &

FAX SERVICE



WE STOCK

FLOPPY DISK DRIVES

HARD DISK DRIVES

MONITORS CABLES

I/O CARDS MODEMS

OCR PC-FAX EGA

SERVICE & REPAIRS

1 YEAR WARRENTY ON DRIVES MONITORS
KEYBOARD POWER SUPPLIES.
90 DAY WARRENTY ON MOTHER BOARDS
AND I/O CARDS. EXTENDED WARRENTY
AND MAINTANCE AVAILABLE.

✓ 136

CADDELL COIL CORP.

35 Main Street
Poultney, VT 05764
802-287-4055

BALUNS

Get POWER to your antenna! Our Baluns are already wound and ready for installation in your transmatch or you may enclose them in a weatherproof box and connect them directly at the antenna. They are designed for 3-30 MHz operation. (See ARRL Handbook pages 19-9 or 6-20 for construction details.)

100 Watt (4:1, 6:1, 9:1, or 1:1 impedance—select one)	\$10.50
Universal Transmatch 1 KW (4:1 impedance)	14.50
Universal Transmatch 2 KW (4:1 impedance)	17.00
Universal Transmatch 1 KW (6:1, 9:1, or 1:1—select one)	16.00
Universal Transmatch 2 KW (6:1, 9:1, or 1:1—select one)	18.50

Please send large SASE for info.

VACUUM CAPACITORS

Jennings Vacuum Variable Capacitors removed from equipment:

#UCSXF-1500-10 Vacuum Variable Capacitor, 20-1500 pf 10 KV max; 10" L x 5.1" dia, 6 lbs. Used.....\$175

#UCS-300-10, 10-300 pf 10 KV max; 8.8" L x 2.6" dia, 4 lbs. Used.....\$110

#UCSL-465-5, 5-465 pf 5 KV max; 5.5" L x 2.3" dia, 2 lbs. sh. Used.....\$75

HIGH VOLTAGE TRANSFORMER for your power amp! Primary 115 VAC 50-60 Hz; Secondary 6336 VCT 500 ma, 8300 V insulation; 110 lb sh. #T9/5368, Used.....\$85

CHOKO for above, 11 Hy 500 ma; 42 lbs. #L8/T368 Used.....\$17.50

Prices F.O.B. Lima, O. - VISA, MASTERCARD Accepted.
Allow for Shipping - Write for latest Catalog Supplement
Address Dept. HR - Phone 419/227-6573

FAIR RADIO SALES

1016 E. EUREKA • Box 1105 • LIMA, OHIO • 45802

✓ 138

HI-PERFORMANCE DIPOLES

ANTENNAS THAT WILL! CUSTOM ASSEMBLED TO YOUR CENTER FREQUENCY RANGE - ADVISE MT. OF CENTER AND EACH END - HANG AS INVERTED "Y", HORIZONTAL, VERT DIPOLE, SLOPING DIPOLE - COMMERCIAL QUALITY - STAINLESS HARDWARE - LEGAL POWER - NO TRAF. HIGH EFFICIENCY DESIGN. PERSONAL CHECK, MO, OR C.O.D. 1833

MFD-1 80-40-20-15-10M MAX-PERFORMANCE DIPOLE 87' LONG.....\$39ppd

MFD-2 80-40M MAX-PERFORMANCE DIPOLE (specify 85, 95, 114' L).....\$55ppd

MFD-3 160-80-40M HI-PERFORMANCE DIPOLE 137' LONG.....\$71ppd

MFD-4 160-80-40-20-15-10M SPACE-SAVING DIPOLE 71' LONG.....\$114ppd

MFD-5 80-40-20-15-10M SPACE-SAVING DIPOLE (SPECIFY 42' OR 52' LONG).....\$77ppd

MFD-6 80-40-20-15M SPACE-SAVING DIPOLE (SPECIFY 44' OR 60' LONG).....\$89ppd

*3-BAND WITH WIDE-RANGING-RANGE TUNER.

BASE FOR CATALOGS OF 10 DIPOLES, SLOPERS, AND OTHER UNIQUE ANTENNAS.

WJHN ANTENNAS 312-394-3414

BOX 393 MT. PROSPECT, IL 60056

✓ 139

INTERFERENCE?

★ Interference Location

★ Stuck Microphones

★ Cable TV Leaks

★ Security Monitoring



★ VHF and UHF Coverage

★ Computer Interface

★ Speech Synthesizer

★ 12 VDC Operation

New Technology (patent pending) converts any VHF or UHF FM receiver into an advanced Doppler shift radio direction finder. Simply plug into receiver's antenna and external speaker jacks. Uses four omnidirectional antennas. Low noise, high sensitivity for weak signal detection. Call or write for full details and prices.

DOPPLER SYSTEMS, INC. P.O. Box 31819 (602) 488-9755
Phoenix, AZ 85046

Want to
Advertise in
HAM RADIO?
Call Rally Dennis
(603) 878-1441
today for more
information

functionally inhibited). More on this second tradeoff follows.

As in the single Beeper, U1A provides the necessary signal inversion of the PTT line, with R1 providing the pull-up function. Notice here that when switch S1 is in the bypass mode, the input via R2 is still connected to the radio. If the radio uses a relatively high voltage for the PTT "pull-up," the IC can be damaged if this voltage exceeds the IC supply voltage. Optional diode CR6 limits the input voltage at U1A from exceeding the supply voltage, with resistor R2 providing current limiting. Alternatively, a zener diode of appropriate value could be used between the input of U1A and ground. In rigs where the PTT pull-up voltage is the same or less than the Beeper supply voltage, no problem should exist, so CR6 can be omitted. U1B sets the first DBB period (by C1 and R3) and U1C provides the necessary gating (by C2 and R4) for the first tone burst oscillator U1D. U2B sets the second DBB period (C3 and R5) and U2C (with C4 and R6) gates the second tone burst oscillator U2D. Gate U2A diphxes the tone burst signals from U1D and U2D and buffers them for output to the low-pass filter of R11 and C7 and level setting potentiometer R12. The radio PTT line must remain active throughout the intervals (WAIT1 + BEEP1 + WAIT2 + BEEP2 + ...). This is achieved by OR-ing the control gating lines together. As with the single Beeper, PTT operation is provided by the open-collector NPN transistor, which is held active during all one-shot intervals by "wired-ORing" through diodes CR1 through CR5. Again, CR1 is required to key the radio while the microphone PTT line is activated by the operator (see fig. 1).

The DPDT-center-off switch allows selection of single or dual beeps, or of bypassing the unit. In the dual-beep mode, all the "one-shots" are cascaded. Notice that in the single-beep mode, U2B is inhibited by tying the input to the supply line. This allows only the first DBB period and the first tone burst to be transmitted. The radio PTT line is immediately unkeyed after this first tone burst.

Two switches could be implemented to disconnect dc input power and the Beeper input while in the bypass mode. Switch section S1B of fig. 6 could still be used, while a DPDT switch identical to S1 (A and B) in the single Beeper of fig. 5 could be added. This would alleviate the problems of the single DPDT-center-off switch previously discussed. A DIP header with 1/8-watt resistors that plugs into an IC socket can be used for the interval- and pitch-setting resistors of R3, 4, 5, 6, 9, and 10. This allows flexibility for changing values later, but doesn't take up as much room as potentiometers.

a multi-tone QSO beeper

It's also possible to make a Beeper capable of

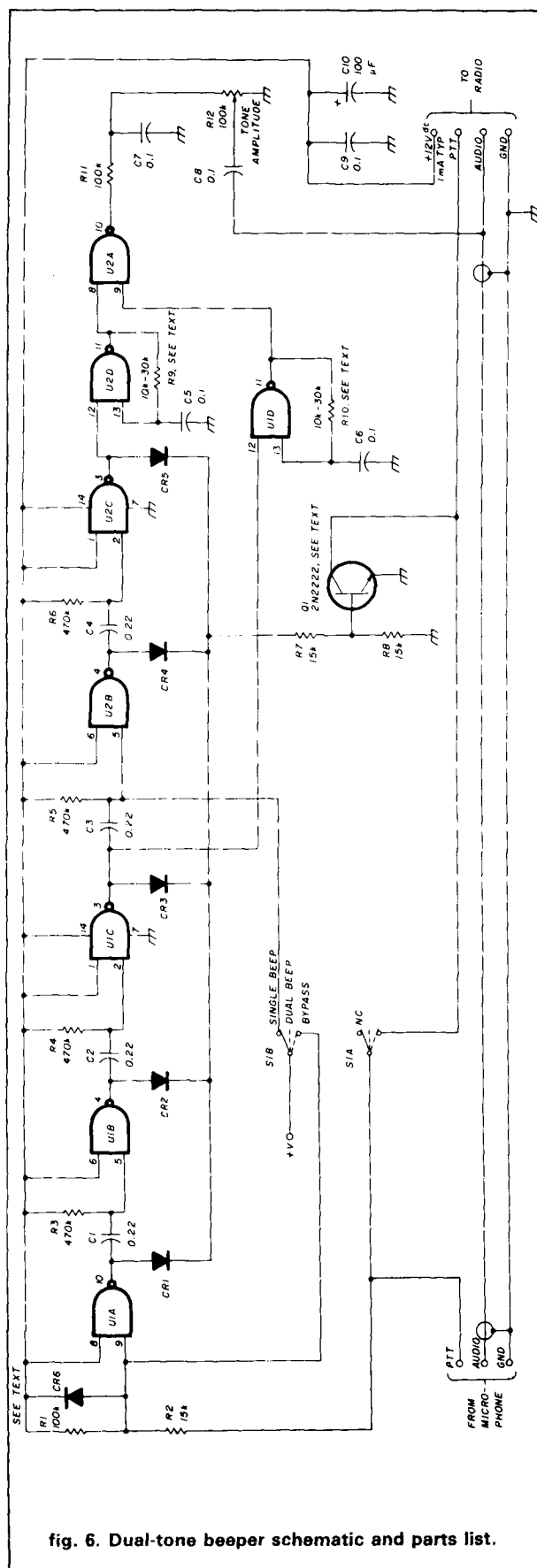


fig. 6. Dual-tone beeper schematic and parts list.

Dual-tone Beeper parts list:

C1,2,3,4	0.22 μ F, 50 volts	nonpolarized, low leakage	(RS 272-1070)
C5,6,7,8,9	0.1 μ F, 50 volts	nonpolarized	(RS 272-1069)
C10	100 μ F, 35 volts	electrolytic (or tantalum)	(RS 272-1028)
CR1,2,3,4, 5, and CR6 (if used)	1N914	general signal diode	(RS 276-1620)
Q1	2N2222A	general pupose NPN	(RS 276-1617)
R1,11	100 k	1/4 watt	(RS 271-1347)
R2,7,8	15 k	1/4 watt	(RS 271-1337)
R3,4,5,6	470 k	1/4 watt	(RS 271-1354)
R9,10	10-30 k	1/4 watt (set for tone pitch)	(RS 271-13xx)
R12	100 k	potentiometer	(RS 271-338)
S1	DPDT center-off toggle or slide		(RS 275-664)
sockets	14-pin DIP		(RS 276-1999)
U1,2	CD4093B	CMOS quad NAND Schmitt (74C132)	
perfboard with solder pads, 0.1-inch centers			(RS 276-168)

producing many tones in sequence. The one-shot intervals could conceivably be cascaded indefinitely, producing many DBB and burst intervals. However, component count would increase accordingly.

A less complex circuit — operating on a slightly different principle than that previously described — could be produced. The end-of-transmission on the microphone PTT line could still be detected as a state transition. However, instead of using discrete time interval “one-shots,” a clock (gated astable circuit) and a serial shift-register could be used to create alternate intervals for DBB and burst gating. The various audio burst lines would be diplexed into a multi-input NAND gate, as in the dual Beeper. The shift-register outputs could be ORed to control the (NPN) PTT switch. The last register output desired should be fed back to disable the clock and reset (i.e., clear) the register.

Similarly a (gated astable) clock could drive a multi-bit binary (or BCD) counter chip (e.g., a 74C161). The counter's binary output could be decoded into many single lines by a demultiplexer chip (e.g., 74C154) to create the DBB and burst gating intervals. Again the astable burst outputs would be diplexed by a multi-input NAND gate.

Note that in both these methods the length of each interval cannot be different because each clock pulse has identical width. Also keep in mind that each additional beep tone increases the length of the transmission; the operator on the receiving end may not need to hear an entire melody to know that you've finished transmitting (some repeaters sport three courtesy tones, but these tones are wisely kept very brief).

alignment

Tune-up of the QSO Beeper's interval, tone pitch, and tone amplitude can be done with an oscilloscope; a two-channel scope works nicely. By monitoring the audio and PTT lines at the radio microphone port, the signals can be verified against those of **fig. 1**. Beeper amplitude is best set by relative comparison with the microphone audio level. (The microphone level may be reduced if the potentiometer is set at too low an impedance.)

Checking the tone(s) can be done without continuously keying and unkeying the transmitter. While keying the radio with the microphone PTT switch, monitor the Beeper audio line to the radio. Flip the mode switch between the dual-beep (center) position and the bypass position. The Beeper will inject its tone(s) onto the audio line every time this is done, alleviating the need to switch from transmit to receive and back again just to produce the tone(s).

The true and final check should, of course, be on the air. Comments from a receiving station should be helpful. An auxiliary receiver also is very convenient for monitoring the QSO Beeper.

If you choose to modify the Beeper, avoid connecting the radio PTT line (and the PTT switch) directly to the input of the Beeper; a feedback loop would be set up when the radio PTT line is keyed (pulled low), preventing the negative-to-positive transition via the microphone PTT line.

I'm looking forward to hearing your Beeper during our next contest QSO.

ham radio

Yaesu's mini HTs. The smallest, smartest, toughest radios. Anywhere.

Whether you're a Novice or Extra class operator, you're sure to appreciate the high power, durability and size of Yaesu's FT-23R Series mini-HTs.

To begin with, you'll find a model that's right on your wavelength. The 2-meter FT-23R. The 220-MHz FT-33R. Or the 440-MHz FT-73R.

Whichever you choose, you benefit from incredibly small packaging. (Take a look at the actual size photo.) Aluminum-alloy cases that prove themselves reliable in a one-meter drop test onto solid concrete. And moisture-resistant seals that really help keep the rain out.

But perhaps best of all, each radio blends sophisticated, micro-processor-controlled performance with surprisingly simple operation. In fact, it takes only minutes to master all these features:

Ten memories that store frequency, offset and PL tone. Memory scan at 2 frequencies per second. Tx offset storage. Priority channel scan. Channel selection via tuning knob or up/down buttons. PL tone board (optional). PL display. Independent PL memory per channel. PL encode and decode. LCD power output and "S" meter display. Battery-saver circuit. Push-button squelch override. Eight-key control pad. Keypad lock. High/low power switch.

The FT-23R comes with a 7.2-volt, 2.5-watt battery pack. The FT-73R with a 7.2-volt, 2-watt pack. And the FT-33R with a powerful 12-volt, 5-watt pack.



You can choose the miniature 7.2-volt, 2-watt pack shown in the photo below. And all battery packs are interchangeable, too.

And consider these options: Dry cell battery case for 6 AAA-size cells. Dry cell battery case for 6 AA-size cells. DC car adapter/charger. Programmable CTCSS (PL tone) encoder/decoder. DTMF keypad encoder. Mobile hanger bracket. External speaker/microphone. And more.

Check out the FT-23R Series at your Yaesu dealer today. Because although we can tell you about their incredible performance, toughness and small size, seeing is really believing.



YAESU

Yaesu USA 17210 Edwards Road, Cerritos, CA 90701 (213) 404-2700. Repair Service: (213) 404-4884. Parts: (213) 404-4847.
Yaesu Cincinnati Service Center 9070 Gold Park Drive, Hamilton, OH 45011 (513) 874-3100.

Prices and specifications subject to change without notice. PL is a registered trademark of Motorola, Inc. FT-33R shown with optional FNB-9 battery pack.

here is the next generation Repeater
2 meters - 220 - 440

MARK 4CR

No other repeaters or controllers match Mark 4 in capability and features. That's why Mark 4 is the performance leader at amateur and commercial repeater sites around the world. Only Mark 4 gives you Message Master™ real speech • voice readout of received signal strength, deviation, and frequency error • 4-channel receiver voting • clock time announcements and function control • 7-helical filter receiver • extensive phone patch functions. Unlike others, Mark 4 even includes power supply and a handsome cabinet.

Call or write for specifications on the repeater, controller, and receiver winners.



MICRO CONTROL SPECIALTIES

Division of Kendecom Inc.

23 Elm Park, Groveland, MA 01834 (617) 372-3442

The **only** repeaters and controllers
with REAL SPEECH!

Create messages just by talking. Speak any phrases or words in any languages or dialect and *your own voice* is stored instantly in solid-state memory. Perfect for emergency warnings, club news bulletins, and DX alerts. Create unique ID and tail messages, and the ultimate in a real speech user mailbox — only with a Mark 4.



TELEX 4932256 Kendecom

FAX 617-373-7304

141

THROW AWAY YOUR FALCON CATALOGS

Falcon Communications, THE source for quality, American made, MOS-FET and bipolar repeater, base station and mobile power amplifiers announces a major re-design of our line.

Send for information on our models 8151, 8152, 8153, 8182, 8183, 8171, 8172, 8181, 8182, 8183, 8184, 8251, 8252, 8253, 8261, 8262, 8271, 8272 and 8282.



P.O. Box 8979 • Newport Beach, CA 92658
(714) 760-3622

Please send all reader inquiries directly.

CONFERENCE PROCEEDINGS

21st Central States VHF Society Conference held in Arlington, Texas, July 23-26, 1987. 28 papers covering everything from use of TVRO dishes for moonbounce to a solid state amplifier for 5.7 GHz. 166 pages.

6th ARRL Computer Networking Conference held in Redondo Beach, California, August 29, 1987. 29 papers (approximately 150 pages) will appear in the proceedings booklet. Copies will be available at the conference or from ARRL after September 1.

MICROWAVE UPDATE 1987 held in Estes Park, Colorado, September 10-13, 1987. 15 papers (approximately 100 pages) appear in the proceedings booklet. Copies will be available at the conference or from ARRL after September 14.

Proceedings booklets are \$10.00 each plus \$2.50 per order for postage and handling (\$3.50 for UPS.)

142

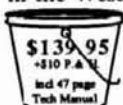
Multiband QRV 160-10 Emergency Pack

Field Day Winner

The Emergency Pack contains QRV 160-10 All Band kink-proof weather sealed antenna, Quick Launch kit, 70' RG-8x feedline, 160 meter adapter, all band counterpoise, 200' rotproof line. Complete and QRV. One person installs in 15 minutes!

1971 N. Oak Lane 1300 E.
Provo, UT 84604-2138

Fastest Antenna in the West



Info: 56c S.A.R.R.O.

AntennasWest
(801) 374-1084

144

1986-87 CALL DIRECTORY

(on microfiche)

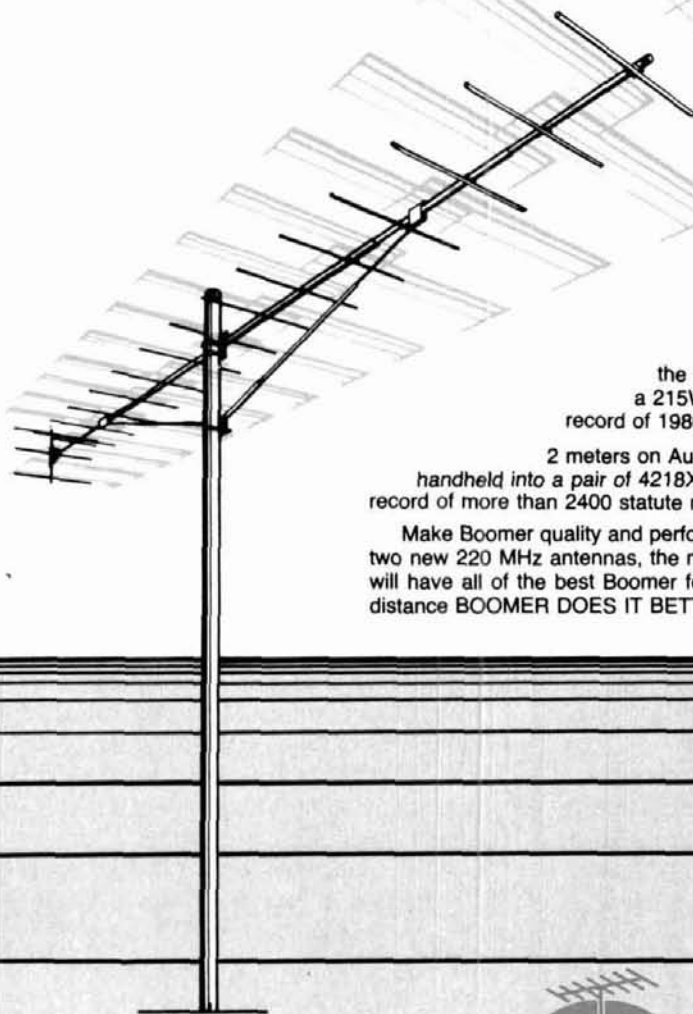
Call Directory \$8
Name Index \$8
Geographic Index \$8

All three — \$20
Shipping per order \$3

BUCKMASTER PUBLISHING
Mineral, Virginia 23117
703-894-5777

143

NEW BOOMER DISTANCE RECORDS



220 MHz on June 14, 1987 Bill Duval, K5UGM of Irving, Texas using the 220B Boomer made the first ever 220 MHz sporadic E contact with W5HUQ/4 in Florida.

2 meters on June 14, 1987 Jim Frye, NW70 using the 4218XL Boomer contacted Jim Poore, KD4WF using a 215WB Boomer to set a new 144 MHz overland distance record of 1980 Statute miles.

2 meters on August 3, 1987 Gordon West WB6N0A, using a 1/2 watt handheld into a pair of 4218XL Boomers contacted KH6HME in Hawaii a distance record of more than 2400 statute miles.

Make Boomer quality and performance work for you. Whether you choose one of our two new 220 MHz antennas, the most popular 215 WB or the world class 4218XL, you will have all of the best Boomer features. Whatever your choice of operating mode or distance BOOMER DOES IT BETTER.

145

AVAILABLE THROUGH
DEALERS WORLDWIDE



THE ANTENNA COMPANY

48 PERIMETER ROAD, MANCHESTER, NH 03108 USA
603-627-7877 • TELEX 4949472 • FAX 603-627-1764

radio addiction: case history of an enthusiast

I recently bought a house in Tucson. When I first confronted the real estate agent, I advised her of its necessary attributes: four bedrooms, two baths, a large lot, underground utilities, and no antenna restrictions. I chose northwest Tucson over the more scenic southern foothills, where the Catalina Mountains blocked the great circle route to my favorite radio target: Europe. Northwest Tucson has a nice clear horizon in that direction.

That night, after signing away my life savings, I thought about the purchase. "My God," I thought to myself, "how much simpler life would be without this radio addiction!"

As the agent showed me the house, I imagined where the main tower would be placed, the orientation of the zepps, and how I could actually place a full-sized 160-meter dipole on the lot. Thoughts about how the rugs really didn't match my furniture, the amount of work required for redecorating, and the like, were secondary. It was obvious that a serious metamorphosis had transpired: I had finally asked — and answered — the question, "Why is Amateur Radio so important?"

The answers lie deep inside all of us. But this time I dared to quantify them, to analyze my own addiction's history — and then, in a moment of impudence, actually write everything down! Prejudice, bias, love, hate; all surfaced. But it really began long ago and far away

It was 1957 in South Chicago. I think it was my mother's hi-fi set that did it. The power amp didn't have a cabinet, so the transformers and tubes were naked to youth's curiosity. And what tubes they were! A 5U4 rectifier and those noble push-pull 6L6s. I was only six, but somehow I knew that the tubes were the components of consequence. Turn the switch on, and they made a crinkling sound as the red filaments lit up. As the rectifiers kicked in and the filter capacitors inhaled their charges, jumping blue lights danced around the glass envelopes. Music would then emerge from the speaker cabinet.

It was as if this curious assemblage were alive, waking up to perform its miraculous functions. If those had been the last tubes I'd ever seen, I'm sure I'd swear they were over a foot tall. First conclusion: *It's OK to like tubes.*

For six-year-olds, particularly those who grow up to be engineers, curiosity eventually leads to more direct involvement. (If observation is interesting, manipulation must be bliss!) I remember grabbing one of the 6L6s — I think it was the righthand one — and yelling out as the heat singed my inquisitiveness. The next thing I remember was my mother telling me, with great urgency and unusual directness, *never* to play with tubes, hi-fi's, or electricity again. "Wow," I decided, "this stuff must be better than I thought!"

My parents loved music. I inherited that affection, but with some twists: when I hear "The Blue Danube," for example, I don't conjure up images of a placid river scene reminiscent of the Hapsburg dynasty; I envision a pair of 6L6s!

I had to be content with just watching those tubes until we added another piece of equipment to the hi-fi: a radio tuner. By this time — age eight or nine, perhaps — I was actually operating the hi-fi, but under strict instructions not to "play" with it. I began DXing the a-m broadcast band. My mother asked me why I preferred to listen to fading noisy signals rather than clear, clean local stations. That was a good question. In retrospect, I've reached a second conclusion: *It's OK to listen to noise.*

A few years later I began reading radio books written for young people. The Chicago Heights Public Library had three. Then I read about Amateur Radio and found that these guys didn't just listen, they transmitted — even farther than WLS!

One night as I was listening to Petula Clark sing "Downtown" on the old 6L6s, I heard "CQ CQ CQ 40 THIS IS W8MAE PORTABLE 9 OVER." A few days later I found out that it was a guy down the street who had just moved in. I rang his doorbell and told him I could hear him on my hi-fi.

"Well then," he said, "I'll stop transmitting."

"No!" I said, "I've read about Amateur Radio and I'm very interested in it!"

He invited me down into his basement. I'll never forget that station: an SX-25, Viking II, with matching matchbox and a myriad of accessories, all on an old

**By Robert J. Zavrel Jr., W7SX, P.O. Box 23447,
Tucson, Arizona 85734**

beat-up wooden desk. A partially rusted Ohio license plate — W8MAE — hung on the wall. QSL cards were strewn about, and there were tubes everywhere — on the desk (these were the important ones) and in boxes on the floor. There was even a “dead” one hanging from a noose strung from a nail in the wall.

Marty was the first guy to tell me he liked tubes. “So do I,” I said. He turned up the volume on the SX-25. 40 meters was filled with a-m signals. We heard a CQ, and he responded. A switch was thrown, the receiver went mute, a red light came on, and we were on the air. The room lights that were on dimmed, and those that were off came on. This, of course, was precisely the type of electrical chaos that appealed to southside juveniles!

Marty was bald. He was dressed in his work clothes: soiled green coveralls. A steelworker, he’d been transferred from Cleveland to Chicago Heights. This coarse-looking character, this man of blast furnaces and hot rolls, threw that switch — and with all the eloquence and reverence of a Shakespearean master, clutched the D-104 microphone and made the QSO. Meters moved, lights dimmed, and high-modulating iron vibrated to this rich, deep Midwestern voice, a voice heard across the continent. I was spellbound with the magic of radio.

With an Elmer only three doors down, I got my Novice license (WN9RAT) within a year. Soon I was putting up antennas and trying to work DX.

Back then, Novices could run 75 watts input. The transmitter had to be crystal controlled. Crystals cost \$3 each, a goodly sum for 14-year-olds in 1965; spending all I had on radios, I was always broke.

My friends, who thought I was weird, were the first to ask the recurring question, “What do you talk about on the air, anyway?”

“Signal report, name, location,” I replied, “and then anything that I think of.”

“Sounds boring,” they said.

Remarks like these always left me feeling disappointed, as if I’d somehow failed to convey my enthusiasm effectively. Examining this disappointment years later, I thought about other hobbies. What good is a pilot’s license, for example, if no passengers or cargo are transported? The pilot flies from Point A to Point A. How silly! Obviously, if you have to ask the question, you’ve missed the point. Just as pleasure flying is flying for the sake of flying, Amateur Radio operation is operating a radio for the pleasure of operating a radio. It doesn’t have to be more, it doesn’t have to be practical, because it’s the practice of an art. My third conclusion, then, is that it’s not what you say, but how you say it — and *Amateur Radio is a very subtle way of saying who and what you are.*

Then there was Tri-Town, our local radio club — a whole room full of guys who liked tubes. (Some of

the guys even liked transistors, but they were just too weird for me.) Most of the guys liked 2 meters and were talking about repeaters. Their single-channel 2-meter rigs were big . . . bigger, even, than my NC-300. The rigs had plenty of tubes inside them, and the tubes had something to do with “limiting,” though I didn’t know what that meant. My dismay peaked when I heard how much DX could be worked with these rigs; it seemed like an awful lot of tubes for just talking across town. I remember thinking that “limiting” meant “limited DX.” Looking back on that experience, I came to my fourth conclusion: *It’s OK not to get excited about fm.*

Ted, K9YOE, was a member of the club. A DXer, he lived at home while attending college. He had an NC-300, a Ranger, and a three-element tri-band quad atop his parents’ roof. Ted was — and is — the finest operator in my recollection. His ears had the precision of a 10,000-point, real-time Fast Fourier Transform processor. With his 60-watt output, he managed nearly 300 countries confirmed, all on CW and a-m.

QST includes transmitter power class in their listings of ARRL DX Contest results. In 1967 or 1968, the top three in Illinois were “Class C” kilowatts; Ted placed fourth with a “Class A” 60 watts, followed by any number of high-power entrants. Ted was “cool”; even my sister, who thought all my friends were nerds, asked who he was after he came over to visit. My fifth conclusion? *You can be a ham and still be “cool.”*

Another member of Tri-Town was Oak, a friend of Ted’s. Now W9RX, Oak had a massive station in his basement built into a large homemade cabinet. In his back yard, there was situated a 120-foot tower with a TH6DXX on top and a prop pitch motor at the base. A full-sized 40-meter dipole was attached to the boom of the TH6DXX, and a sloping dipole for 80 rounded off this five-band monster. Oak taught me an important lesson: *It’s OK to be extravagant with hardware.*

Most addicts end up pushing the stuff they need, eking out a living and subsidizing their habits in the process. Amateurs are no exception — in fact, they’re licensed by the authorities, with special spectral places set aside for their habitual indulgences.

My case is typical. Mom warned me about the habit, and then Marty, a casual user, turned me on. My need for DX led to harder stuff; I wanted higher and higher antennas. I went to work in radio broadcasting. Finally, I graduated to the Big Leagues with a degree in Physics. Now, through my work, I’m an international dealer.

Sometimes the question arises, “Do you want to kick the habit? Go straight? Drink beer with the guys at the local bar every night and watch football on TV?” My seventh conclusion: *No way!*

ham radio

the technology of commercial television part 2: hardware

Our ham's-eye tour
continues — with a
close-up look at
the technology

In part 1 of this article I described the evolution of and standards for TV signals. In this installment, I'll describe how these signals are actually generated.

If you were to walk into a typical TV control room (and I'd suggest that you do), you'd find a dark inner sanctum glowing with the light of TV monitors and green oscilloscopes. You'd also be greeted with several — possibly several *dozen* — equipment racks loaded with apparently unidentifiable equipment, which is in fact, likely to consist of sync-related devices.

Although the actual sync generator is really rather small, every piece of video equipment must be timed with, or "locked into" it. If the sync generator is the heart of a TV station, the sync distribution system is the arteries and capillaries. Each branch of the arterial system is called a DA, or distribution amplifier. **Figure 1** shows a typical sync DA system. As you can see, this scheme allows any number of sources to be driven. In preparing **fig. 1**, I stopped drawing at 16 video sources; I could have easily gone to 64 sources with just one more generation of DAs.

These video sources can be just about anything including cameras, VCRs, electronic digital effects, film chains, or test signal generators. Regardless of what they are, station sync must be fed to all of them. Obviously, the sync generator is critical to the system; if it dies, you go off the air. If you go off the air, you lose money. If you lose money, you lose. And if you

lose, you wish you had a spare sync generator. Consequently, most stations have a spare sync generator ready to go on line at a moment's notice.

If you didn't read part 1 of this article, this part may make little sense. If you did read part 1, you already know all about the sync signal and why it's so important in TV. You may recall that I omitted satellite receivers from the list of possible video sources at the conclusion of part 1; this is because it's difficult to plug your DA into a satellite and lock it up to your TV station. So what do we do if we want to use a satellite image in our TV station without recording it? We lock our sync generator to the satellite instead. This technique is known as "gen-lock" in TV circles. A station that's gen-locked to a satellite will exhibit extreme stability and frequency accuracy. All satellite uplinks are already gen-locked to atomic clocks, so if you're in turn locked onto the satellite, you'll have atomic accuracy, too. We can gen-lock a station to satellite sync even if we don't want to use the video programming from that satellite; in this case, we're really using the "bird" as a cosmic timer.

how it works

So, how does a sync generator work? Actually, the generator is nothing more than a digital clock with a few steps added. All begin with a 3.58-MHz crystal oscillator. This oscillator is useful in certain studio equipment needing a subcarrier (SC) input. Although the example shown in **fig. 2** is now usually built on a single IC, it's important to understand its function.

The 3.579545 signal, being a wave, isn't of a suitable shape for the subsequent digital dividers. So it first goes through a comparator, which is a device used to convert sine waves to square waves. (Back in the old days we would have used a Schmitt trig-

By Eric Nichols, KL7AJ, Box 0, North Pole, Alaska 99705

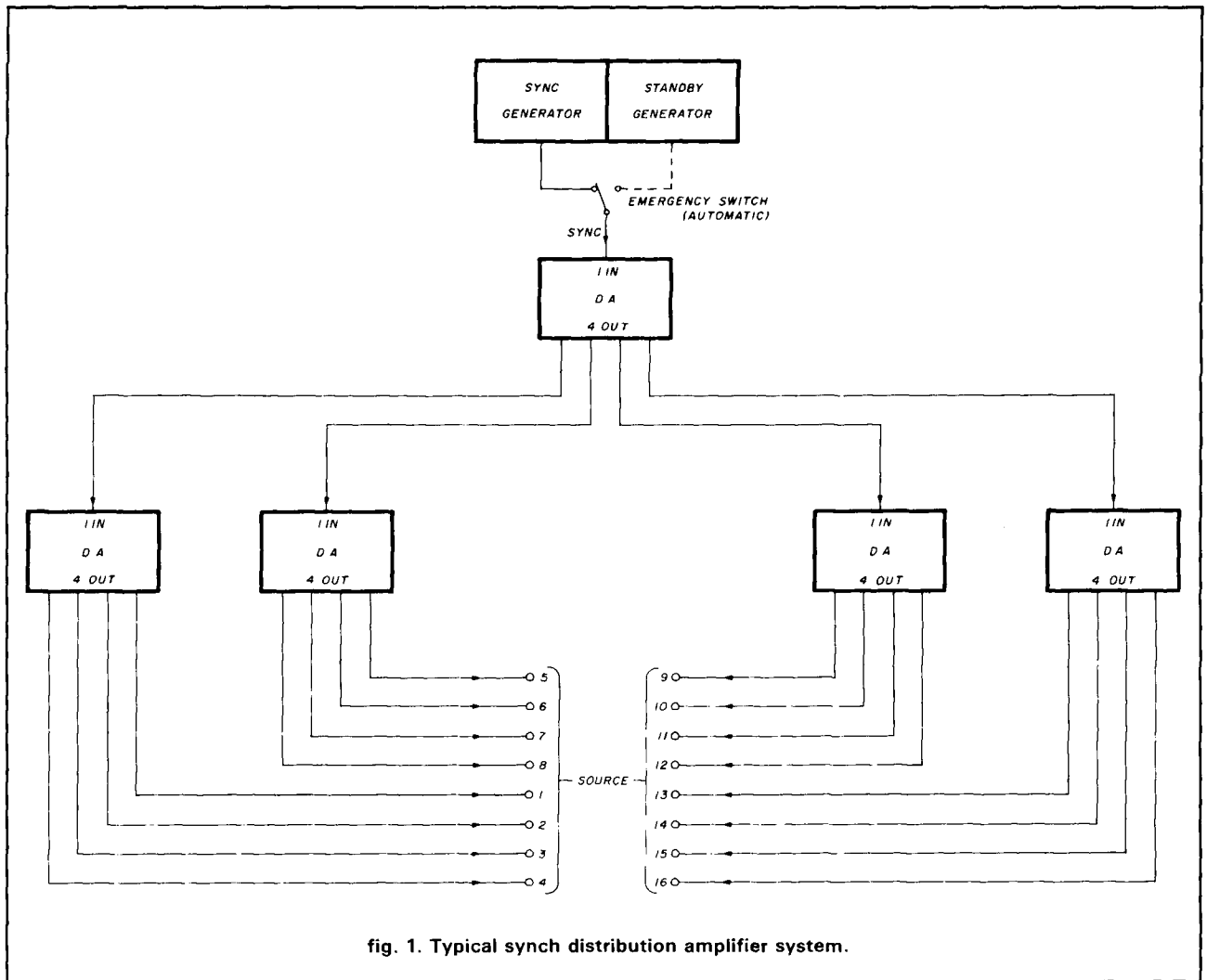


fig. 1. Typical sync distribution amplifier system.

ger, the electronic equivalent of a toggle switch, to do the job.) Now that we have nice square waves, we can use them to drive our digital dividers and multipliers. (As an extra credit project for you digital folks, try to figure out how to divide by 455 using JK flip-flops. That should keep you going for a while!)

A careful look at **fig. 2** will reveal that all the important frequency relationships necessary for TV are right there. And you can see that the relationships allow for quite a simple circuit, logically speaking. Remember, this was all developed before microprocessors or even transistors were available! Certain experimental HDTV systems rely on the ability to shift these numerical relationships at will, which is an easy job with microchips. But we'll skip that discussion because this article deals with NTSC (see part 1, December 1987, page 57).

transmission line review

Before I can discuss sync distribution further, I need to talk about transmission line theory. (This may be

painful for some of you, but this subject is essential). A transmission line is a device for carrying signals from a generator to a load. These signals can be video, audio, sync pulses, or subcarriers. In NTSC television, the transmission lines for video and sync pulses are coaxial cables with a characteristic impedance of 75 ohms. The characteristic impedance of a coaxial transmission line is a function of the ratio of the inside and outside conductor diameters. **Figure 3** shows the cross section of a high-impedance line and a low-impedance line. Notice that even though the outside diameters of each are the same, the impedances are different.

So, what does this all have to do with video transmission? Well, if video travelled through coax cable infinitely fast, there would be no significance. But electrical signals travel through cables at a finite speed, typically around 66 percent of the speed of light in free space. Because of this, we have the possibility of the signal being reflected from the receiving end of the line, if corrective measures are not taken to prevent

OnSat

"America's Weekly Guide to Satellite TV"



The best in satellite programming! Featuring: ★ Over 120 Channels listed ★ Weekly, Updated Listings ★ Magazine Format ★ Complete Alphabetical Movie Listings ★ Sports Specials ★ Prime Time Grids ★ Specials ★ Programming Updates!

- Only \$45.00 per year (52 weekly issues)
- 2 Years \$79.00 (104 weekly issues)
- \$1.00 for sample copy

*NC Residents must add 5% Sales Tax

Subscribe Today!

call toll free 1-800-234-0021
 Visa® and MasterCard® accepted

OnSat PO Box 2347 Shelby, NC 28151-2347



STV GUIDE

The new **STV Guide** contains valuable information on zoning regulations, scrambling, plus technical tips for installing or updating a satellite system—and now a precise monthly guide to satellite TV with the latest program listings for over **90 channels!**



All this in each complete issue of **STV Guide!**

- Only \$48.00 per year (12 monthly issues)
- \$2.00 for a sample copy

*NC Residents must add 5% sales tax

Subscribe Today!

Call toll free 1-800-234-0021
 Visa® and MasterCard® accepted

STV Guide PO Box 2384 Shelby, NC 28151-2384

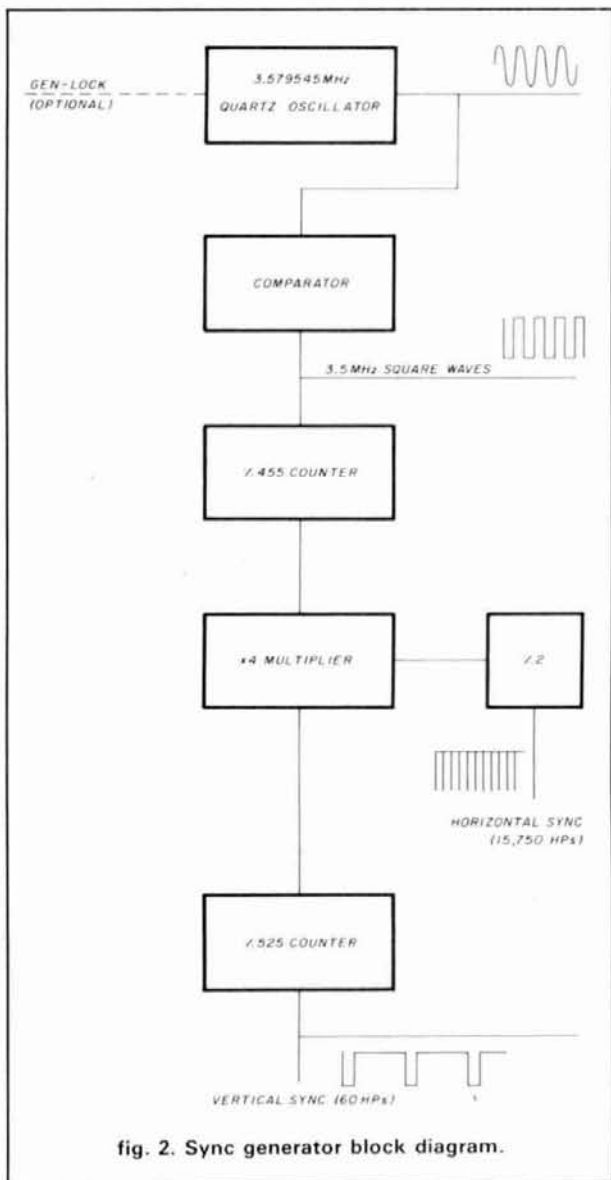


fig. 2. Sync generator block diagram.

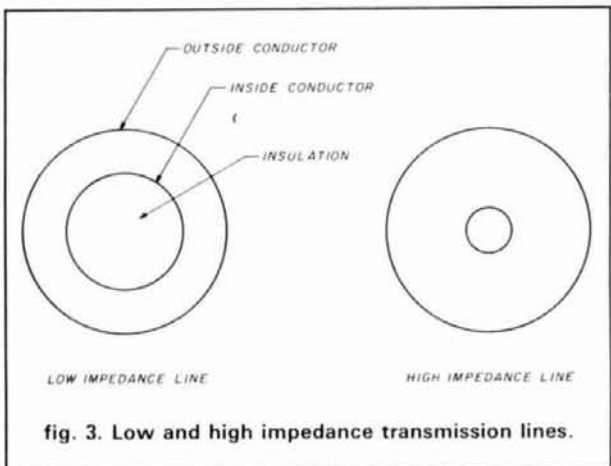


fig. 3. Low and high impedance transmission lines.

**FIVE Watt
IC-02ATHP
(High Power)
now available!**

ICOM IC-02AT

Full Size, High Power

If you want a 2-meter handheld with exceptional features, quality built to last, and a wide variety of interchangeable accessories, take a look at the ICOM IC-02AT and IC-2AT handhelds.

Frequency Coverage. The IC-02AT covers 140.000 through 151.995MHz and the IC-2AT, 141.500 through 149.995MHz...both include frequencies for MARS operation.

IC-02AT Features. ICOM's versatile IC-02AT handheld has the following outstanding features:

- DTMF/direct keyboard entry
LCD readout
- 3 watts (IC-BP3 battery pack) standard, or 5 watts (IC-BP7 battery pack)
- 10 memories which store duplex offset and PL tone (odd offset can be stored in last 4 memories)
- Frequency dial lock
- Three scanning systems: priority, memory and programmable band scan (selectable increments of 5, 10, 15, 20, or 25kHz)

IC-2AT Features. The IC-2AT is ICOM's most popular handheld on the market. The IC-2AT features a DTMF pad, 1.5 watts output, and thumbwheel frequency se-

lection. The IC-2A is also available and has the same features as the IC-2AT except DTMF.

Accessories. A variety of slide-on battery packs are available for the IC-02AT and IC-2AT, including the new long-life 800mah IC-BP8 which can be used with both handhelds.



Other accessories include the HS-10 boom headset, HS-10SB PTT switchbox, HS-10SA VOX unit (for IC-02AT), and an assortment of battery pack chargers.

The IC-02AT and IC-2AT come standard with an IC-BP3 NiCd battery pack (IC-02ATHP comes with IC-BP7 battery pack), flexible antenna, AC wall charger, belt clip, wrist strap, and ear plug. See the IC-02AT and IC-2AT 2-meter handhelds at your local ICOM dealer.

**Often imitated,
never duplicated.**



First in Communications

ICOM America, Inc., 2380-116th Ave. N.E., Bellevue, WA 98004 **Customer Service Hotline (206) 454-7619**
3150 Premier Drive, Suite 126, Irving, TX 75063 / 1777 Phoenix Parkway, Suite 201, Atlanta, GA 30349
ICOM CANADA, A Division of ICOM America, Inc., 3071 - #5 Road, Unit 9, Richmond, B.C. V6X 2T4 Canada

All stated specifications are approximate and subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions. 02AT587.



HAMTRONICS, INC.

KENWOOD — ICOM — YAESU — AEA — ASTRON — CUSHCRAFT

YAESU 

YAESU HT

FT-23RTT
FT-33RTT
FT-73RTT

ON SALE

KENWOOD



TH-215AT
TH-315AT
TH-415AT

ON SALE

ICOM 



μ 2AT
 μ 4AT
NEW

ON SALE

YAESU 



FT-109RH
FT-209RH

ON SALE

NC29	84.95
FNB9	39.95
FNB10	41.95
FNB11	67.95
FNB12	59.95
FTT4	54.95
FTS12	61.95
MH12A2B	41.95
MH18A2B	41.95
LCC-28	39.95
LCC-28 S/M	59.95
MMB32	18.95
NC18B	12.95
NC27B	12.95
NC28B	12.95


BC-7	99.95
BC-8	44.95
LH4	46.95
LH5	49.94
MB-4	12.95
PB-1	76.95
PB-2	44.95
PB-3	54.95
PB-4	79.95
PG3D	21.95
SC-12	26.95
SC-13	26.95
SMC-30	42.95
TSU-4	39.95

BC 50	74.50
BC 16U	20.25
BP-20 (AA)	15.25
BP-21	33.95
BP-22	37.50
BP-23	47.00
BP-24	49.00
IC-CP1	13.00
DC-25	23.25
AD10	12.99
UT-37	42.50
UT-38	25.99
ICHM9	47.00

ASTRON CORPORATION 

RS7A	34.95
RS12A	89.95
RS20A	115.95
RS35A	174.95
RS50A	253.95
RS50m	288.95
VS50m	162.95


KENWOOD



TM2570A
TM3570A

PS 50	224.95
PS 430	189.95
CD10	109.95
TU-7	36.95
MO-1 MU-1	44.95
VS-1	54.95
SW100A/B	64.95
SWT-1	44.95
MC-60A	119.95
MB-10	24.95
SP50B	35.95

KENWOOD



TM 221A 2M 45W
TM 321A 220 MHZ 25W
TM 421A 440 MHZ 35W

RC-10	219.95
PG-4G	18.95
PS20	77.95
TSU-5	39.95
SW1 DO/AB	64.95
SWT1/SWT2	44.95
SP40	35.95
MC60A	119.95
MC55	59.95
MC85	129.95
MB201	14.95

ICOM 



28A/H — 2M 25/45
38A — 220 MHz
48A — 440 MHz



SP-4	31.00
SP-8	35.99
IC-HM14	55.50
PS45	139.00
SM10	136.25
PG-35	95.00
AH-32	37.00
AHB-32	34.00

KENPRO

CALL FOR  SALE PRICE

Model KR400 RC
Model KR600 RC

STORE HOURS

MT & W 9 AM-6 PM
TH & F 9 AM-8 PM
SAT 9 AM-3 PM

Factory Authorized Service

CALL FOR SPECIAL HOLIDAY PRICES
(215) 357-1400

ARRL—AMECO—PUBLICATION—EXAM GUIDES

AMECO — BENCHER — MIRAGE — ROHN — KENPRO

HAMTRONICS, INC.

KENWOOD — ICOM — YAESU — AEA — ASTRON — CUSHCRAFT

KENWOOD
940 S/AT



100% DUTY CYCLE
40 MEMORIES
160-10
ON SALE

YAESU FT 757 GX/II



CAT System
All model HF Transceiver
Dual VFO
Full Break-in CW
100/Duty Cycle
ON SALE

ICOM IC-761



HF All Ham Band
General Coverage Rec.
Built-in antenna tuner
and power supply
ON SALE

KENWOOD



100/ Duty Cycle
100 memories
Direct keyboard entry
Call for Price
ON SALE

KENWOOD TL922A



160-15M
Linear Amplifier
2 KW PEP
Call for
Holiday
Pricing

KENWOOD R2000



100 kHz-30 MHz
Gen. Cov. Receiver
Call for
Price

NYE VIKING

MB-IV-1A
MB-V-A

Call for
Special Price

ICOM R-7000



25-1300 + MHz
Receiver CALL
Special
Pricing

Complete Line of
Keyers and Electronic
Keyers in Stock

BENCHER MFJ
NYE VIKING VIBROPLEX

PK-232 299.00



Both for
\$349.00

ComPakRatt Software 59.95
IN STOCK — ORDER NOW

ICOM IC-1271A



1.2 GHz
All Mode
Transceiver

KENWOOD DUAL BAND TW4100A



45W VHF
25W UHF
10 memories

PS-50	224.94
CD-10	109.95
MV-1	44.95
TU-7	36.95
VS-2	54.95
SW100B	64.95
SWT-1/SWT-2	44.95
SP50B	35.95
MC60A	119.95
MC43S	39.95
MA4000	14.95

Alpha Delta Model DELTA-4



Lightning Surge Protected
4-Position RF Coax Switch

- Exclusive center "off" (ground) position.
- Uses ceramic Arc-Plug protector.
- Micro-strip circuitry—no wafer switch

Model DELTA-4
(UHF Connectors) \$69.95

Model DELTA-4/N
(N-type Connectors) \$89.95

ICOM Dualbander IC-3200A



10 memories
Scanning
Compact
38 Built in tones
25W output
MARS/CAP Operation

AH-32	37.00
AHB-32	34.00
SP10	35.99
PS45	139.00
ICHM16	34.00
HS15	31.50
UT-23	34.99

MIRAGE

Model	Band	Pre-amp	Input	Output	Sale Price
A1015	6M	Yes	10W	150W	\$288
B23A	2M	Yes	2W	30W	\$128
B10B	2M	Yes	10W	80W	\$158
B10E	2M	Yes	10W	160W	\$258
B3016	2M	Yes	30W	160W	\$228
D1010N	440	No	10W	100W	\$318

SMART PATCH



CES 510-SA

BIRD



IN STOCK TODAY

148

Wattmeters Elements

HAMTRONICS, INC.

A DIVISION OF TREVOSE ELECTRONICS
4033 BROWNSVILLE RD., TREVOSE, PA 19047
(215) 357-1400

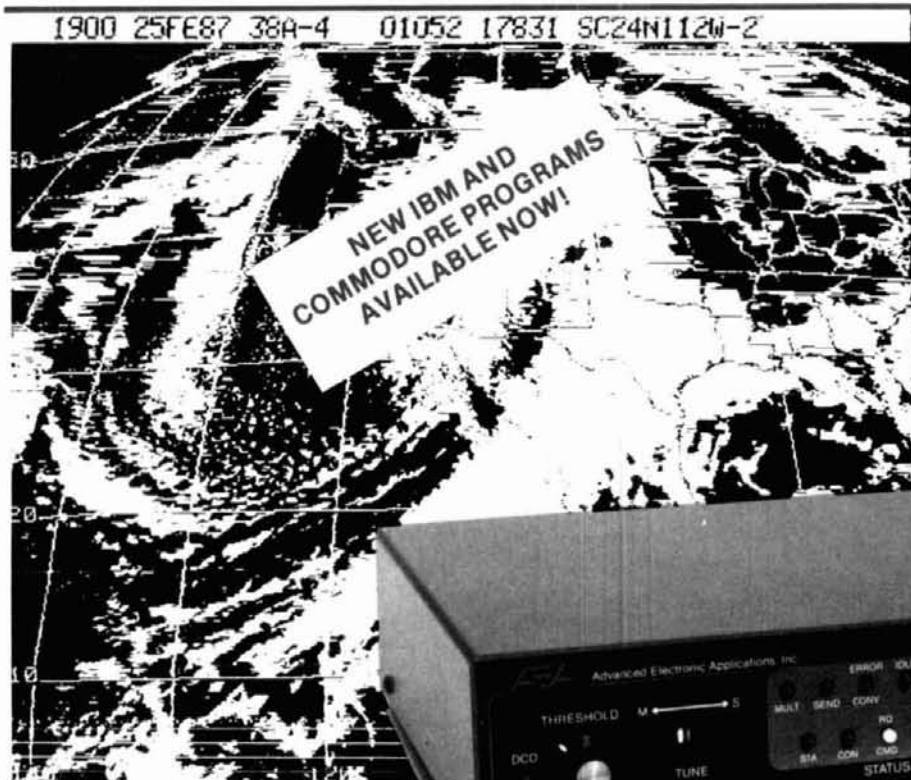


Prices are subject to change without notice.

AMECO — BENCHER — MIRAGE — ROHN — KENPRO

New PK-232 Breakthrough

Six Digital Modes - Including Weather FAX



A new software enhancement makes the AEA PK-232 the only amateur data controller to offer six transmit/receive modes in a single unit.

- * Morse Code
- * Baudot (RTTY)
- * ASCII
- * AMTOR
- * Packet
- * Weather FAX



\$ **319**⁹⁵
AMATEUR NET
\$379.95 AEA RETAIL

Your home computer (or even a simple terminal) can be used for radio data communication in six different modes. Any RS-232 compatible computer or terminal can be connected directly to the PK-232, which interfaces with your transceiver. The only program needed is a simple terminal program, like those used with telephone modems, allowing the computer to be used as a data terminal. All signal processing, protocol, and decoding software is in ROM in the PK-232.

The PK-232 also includes a no compromise VHF/HF/CW modem with an eight pole bandpass filter, four pole discriminator, and 5 pole post detection low pass filter. Experienced HF Packeteers are reporting the PK-232 to have the best Packet modem available.

Operation of the PK-232 is a breeze, with twenty-one front panel indicators for constant

status and mode indication. The 240 page manual includes a "quick start" section for easy connection and complete documentation including schematics. Two identical back panel radio ports mean either your VHF or HF radio can be selected with a front panel switch. Other back panel connections include external modem disconnect, FSK and Scope Outputs, CW keying jacks, and RS-232 terminal interface.

The RS-232 connector is also used for attaching any Epson graphics compatible parallel printer for printing Weather Fax. Weather maps and satellite photos, like the one in this ad, can be printed in your shack.

Contact your local AEA dealer today for more information about the one unit that gives you six modes for one low price, the PK-232.

AEA Brings you the Breakthrough

2006-196th St. SW
Lynnwood, WA 98036
(206) 775-7373

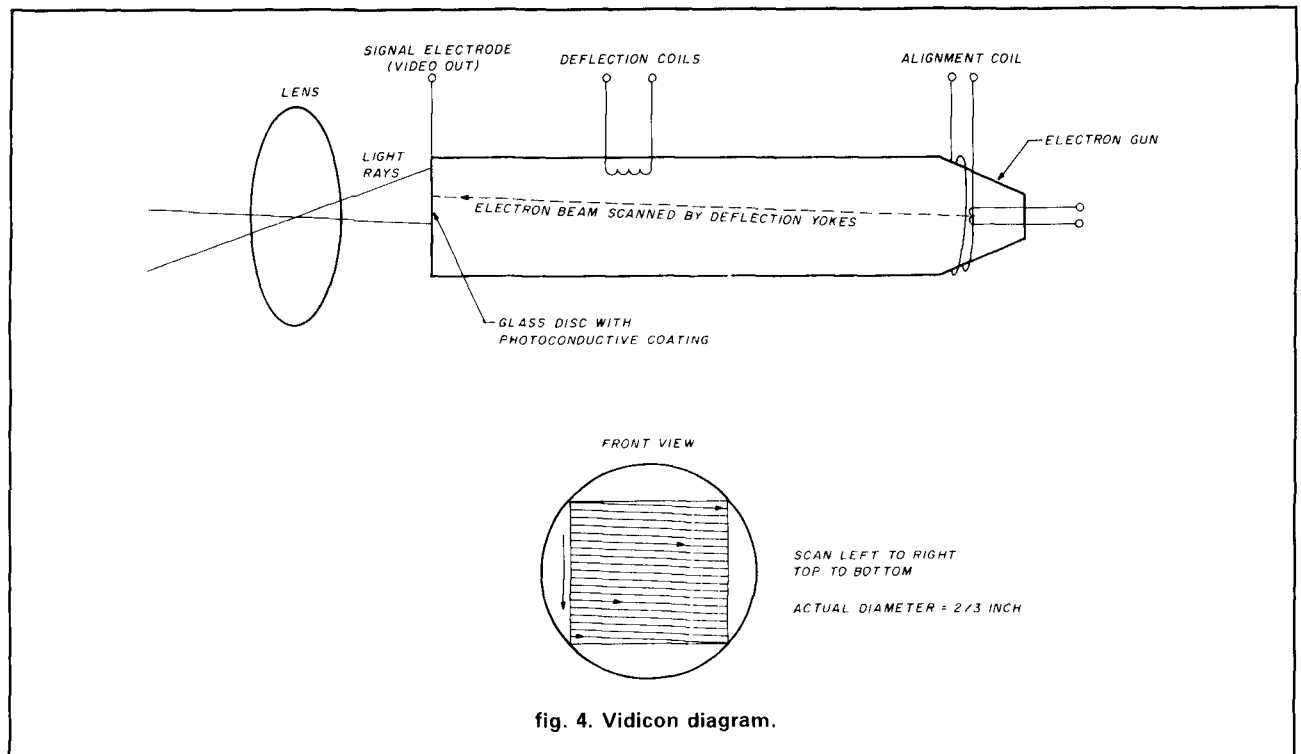


fig. 4. Vidicon diagram.

this. We prevent reflections by terminating the transmission line with a resistor equal to the characteristic impedance of the line. In video, we terminate the end of every coax cable with a precision 75-ohm resistor.

We could reverse the definition and say that the characteristic impedance of a transmission line is that which experiences no reflections when terminated with a known resistance. In other words, we can send a signal down a piece of transmission line which is unknown and change the value of terminating resistor until no reflections are experienced. Under these conditions we can then measure the value of our terminator, and then know that the characteristic impedance of our line is the same value. Fortunately we don't have to do all this in real TV, because we use only cables known to have a 75-ohm impedance, but we can still terminate a cable improperly by either using too many terminations or terminating the cable somewhere other than the end (non-terminal termination!)

What does an improperly terminated signal do? Depending on the nature of the original signal, reflections can manifest themselves in different ways. If the signal is continuous, such as an RF carrier, the signal reflected from the unterminated end recombines with the power going the "right" direction to form standing waves. These standing waves are voltage lumps and valleys which repeat at periodic intervals from the end of the cable. Also the input impedance will no longer be equal to the characteristic impedance of the

line at every point on the line. Instead, we'll have a high SWR. If the generator is an RF transmitter, retuning of the "finals" may be necessary to deliver full power into the line. Also, under certain conditions, a high SWR may cause undue stress on marginal coax cable.

Video and sync signals, by their very nature, are not continuous, and therefore reflections do different things to these signals. Since pulses from sync generators are of very short duration, it's unlikely that a forward-going pulse and reflected sync pulse would ever overlap each other. So "standing waves," as most radio people know them, aren't the real problem. Instead, a sync pulse reflected from the end will be re-reflected from the sync generator and will reappear at the load end in a more or less random time, depending on the length for the cable. This causes "ghosting" or double-syncing. Unfortunately, these ghosts can't be removed by reorienting the receiving antenna or twiddling the fine tuning knob on the receiver; instead these ghosts will be built into the transmitted signal!

The point of this is to say that it's a good idea to terminate the cables in a TV plant properly. But proper termination of the cables hasn't solved all our problems. You'd think that at 66 percent of the speed of light you wouldn't have to worry about the time it takes for a video signal to get from point A to point B in a studio. Unfortunately, nothing could be further from the truth. One of the big headaches in TV engi-

neering is trying to insure that all the video sources arrive at the switcher (more on switchers later) at the same time.

Small mis-timings usually result in tiny color phase (hue) shifts between sources. This can usually be corrected electronically at the receiving end. Longer mis-timings result in a visible left-right shift of the picture. The only way to correct this is to make sure that all the video cables are the same length. This, of course, means that every cable is as long as the longest cable, regardless of whether you need that much stretch or not. That is why the first thing most people ask when they see a control room is, "Why do you have all that extra cable lying around?" I'd love to cut all the cables to just the right length and neatly bundle them somewhere, but I've never seen a TV control room where it worked out that way. TV is one place where you first make it work, and then you try to make it pretty. When you finally do find a place to put all the cable, someone wants to add a new video source, and then you go through it all over again.

video sources

Now that we've temporarily exhausted the subject of coax cables, let's talk about video sources. The first and most basic video source is, of course, the camera. I could trace the history of camera tube development, but I'll stick with the most common type of "eyeball," the vidicon. (There are several varieties of vidicons known as saticons, plumbicons, and Ledicons, but these are only chemically different; the actual wiring is about the same.)

A vidicon is essentially a backwards TV picture tube. Instead of using an electron beam to control the emission of light, we use a property known as photoconductivity to control an electric current. The main difference is that the screen of a vidicon is very small and perfectly flat. The screen of the vidicon is coated with a photoconductive layer of antimony sulfide. If we were to focus a visual image on the surface, we would, of course, have light and dark areas. The light areas are highly conductive, while the dark areas are resistive. As in any other tube, an electron beam emitted from a hot filament is focused to a very thin beam with magnetic yokes (coils). This electron beam is scanned across the glass disk by magnetic yokes much as it is in a TV receiver. The vertical deflection yoke does the same thing at a 60-Hz field rate. When a beam hits a light spot, it flows out of the signal electrode with ease. When it hits a darker spot, less electron current flows out the signal electrode. This signal fluctuates in accordance with the scan and illumination of the vidicon surface. Obviously, the narrower the electron beam, the better the resolution of the vidicon. Keep in mind that a full-size raster must be concentrated on a vidicon with a 0.66 inch face diameter.

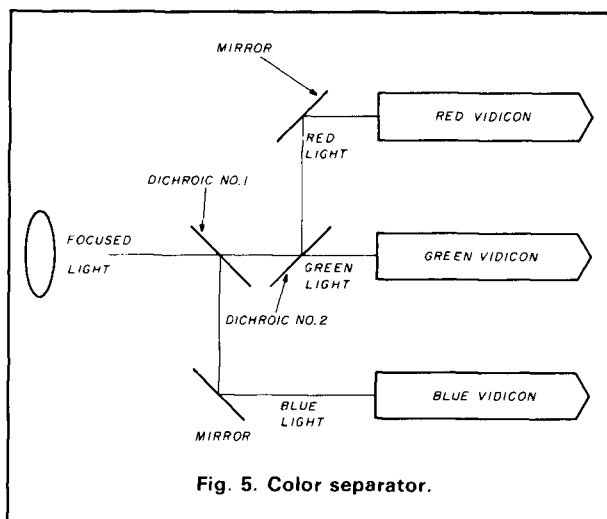


Fig. 5. Color separator.

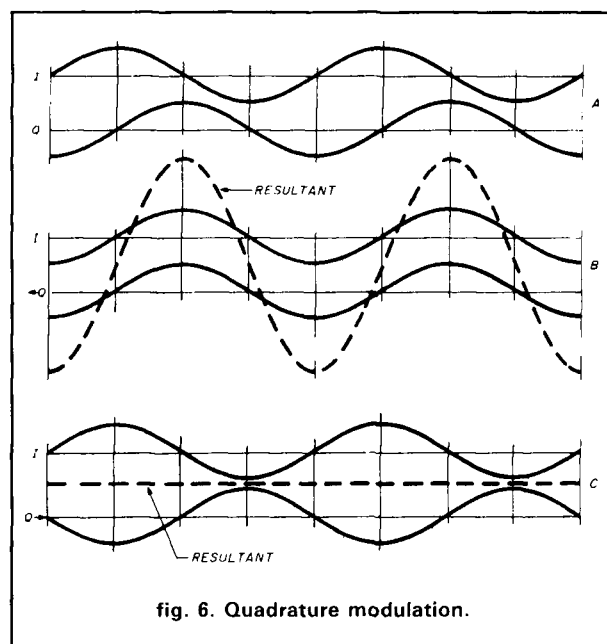


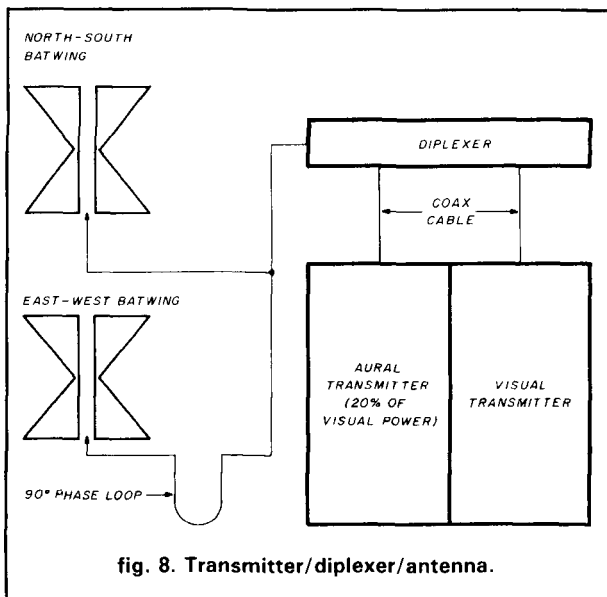
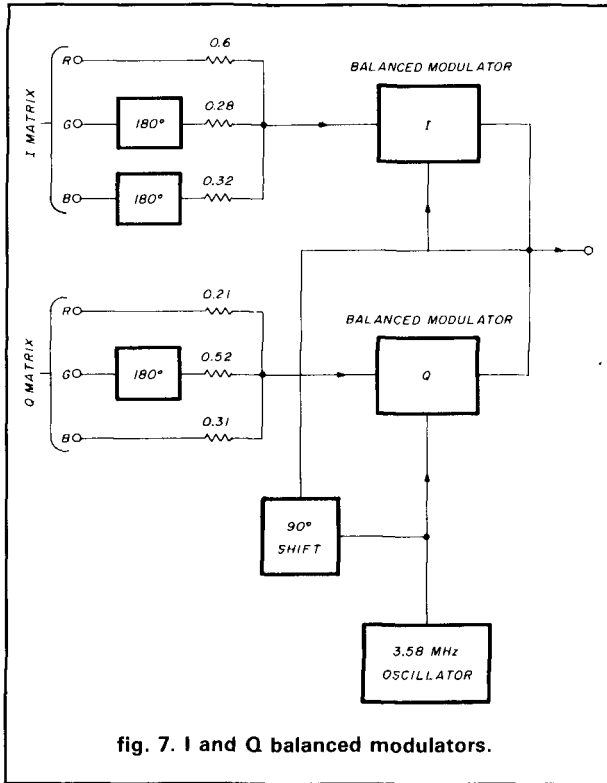
fig. 6. Quadrature modulation.

The output of a vidicon is extremely weak and is not linear (i.e., in direct proportion) to the light falling upon it. The weak signal is accommodated by using a low noise field effect transistor. (This used to be done with low-noise triode tubes such as those in the famous Nuvistor series.) This preamplified signal then goes into a gamma corrector. Gamma is the mathematical name for the non-linear voltage characteristics of a vidicon. A gamma corrector is just an amplifier that has an amplification characteristic that is equal but opposite to that of the vidicon. What we get out of our gamma-corrected preamplifier is a video signal of a voltage directly proportional to the light level. Without gamma correction, we have contrast that looks washed at medium gray levels — not very pleasant to watch.

the sync adder

Now all we have to do is take our video signal and add it to our station sync. The device that does this is called a sync adder; its product is called composite video, or video + sync. Most cameras have internal sync adders.

Now we can take our composite video signal and



feed it to a monitor by means of a properly terminated 75-ohm coaxial cable transmission line. Voilà! A picture appears.

it's all done with mirrors

If we want a color picture, we just have to do the above three times; once for red, once for blue, and once for green. **Figure 5** shows a color separator for a three-gun color camera. As you can see, it's all done with mirrors. There's actually no difference in the actual vidicons; the only difference is in the color light that's fed to them. A vidicon doesn't know anything about the color of light hitting it. It simply knows how much is there. You can't tell blue video from red video from green video, either.

A dichroic is a mirror that transmits one color light and reflects another. I don't know how it's done, but expensive as they are, I'm not surprised that they do it so well!

The dichroic/mirror system separates all visible light into one of three vidicons. Now, what about colors that are neither red, green, nor blue? Are there any colors that never get transmitted at all? Yes! This is where all that psycho-visual testing (see part 1) came in: to determine which color frequencies we could do without. As it turns out, by combining the primary colors (red, green, and blue) colors, not enough gets left out to be easily noticeable. This is fortunate because we have only three colors to work with when we play the whole thing back. Fortunately, with only three colors, we can fake just about any color necessary. White is a combination of all three colors — but not in equal parts; 30 percent red, 59 percent green, and 11 percent blue gives you white. Now do you see why TV is such fun?

As I said in part 1, when no color information is present on a video signal, we have no 3.58-MHz subcarrier. Our video signal contains only luminance or brightness information. This occurs when the output from all three vidicons is in the 30:59:11 ratio. We achieve this by means of quadrature modulation or "IQ" modulation. "IQ" stands for "in phase and quadrature." (Quadrature simply means 90 degrees out of phase.) Although some knowledge of trigonometry is helpful in understanding quadrature modulation, it's not essential. Basically, it consists of adding two carriers at 90 degrees and allowing them to add or subtract from each other by shifting their relative phases. **Figure 6** shows this action. The top drawing shows the normal 90-degree phase between I and Q. The middle shows the Q shifted to the left so that the two signals are in phase (0 degrees shift) and add. The bottom shows the shift to the right of Q and how the signals cancel out, leaving no amplitude on the resultant. In every case, though, the individual I and Q amplitudes are the same.

CTM

The Magazine

For Amateur Radio and Computerists
Why You Should Subscribe!
Read what our subscribers say!

It's in the fine print!

•Your magazine is the finest innovation that I have seen in ham radio since 1953—except... maybe the all-solid state transceiver. **Carl Soltesz, W8PFT** • ...have most certainly received my money's worth in software... **Michael Regan, K8WRB** • ...you have found a nice niche for CTM in packet... you have me getting interested... **Charlie Curle, AD4F Chattanooga, TN** • The packet computer info convinced me to subscribe. **John Skubick, K8JS** • Enclosed is my check for renewal of my subscription. I enjoy the down to earth and homey style of your magazine and the many fine computer articles... **Andy Kosiorek, Lakewood, OH** • I was both pleased and dismayed upon becoming acquainted with your magazine at HAM-COM. Pleased that I discovered your magazine—dismayed that I didn't long before now. **Bill Lathan, AK5K** • ...CTM gives the finest coverage to packet radio that I have seen in any of the computer or amateur radio magazines. It would appear that CTM has just the right blend of packet amateur radio articles and computer articles. **Barry Siegfried, K2MF** • Of the three HAM magazines I received each month CTM is the only one I read from cover to cover and carry with me during my travels abroad. Most of the time it remains in that country. **Buck Rogers, K4ABT**

U.S.A. \$18.00 1 Yr—\$10.00 6 Months (Limited Offer) \$33.00 2 Yr

Mexico & Canada \$32.00 1 Yr (Surface)

Other Countries (Air) \$68.00 (Surface) \$43.00 1 Yr

U.S. FUNDS ONLY

Sample Copy & Back Issues—\$3.50

Mail to:
Circulation Manager
1704 Sam Drive
Birmingham, AL 35235
(205) 854-0271

Name _____

Call Sign _____

Address _____

City _____ ST _____ ZIP _____

Date _____

Signature _____

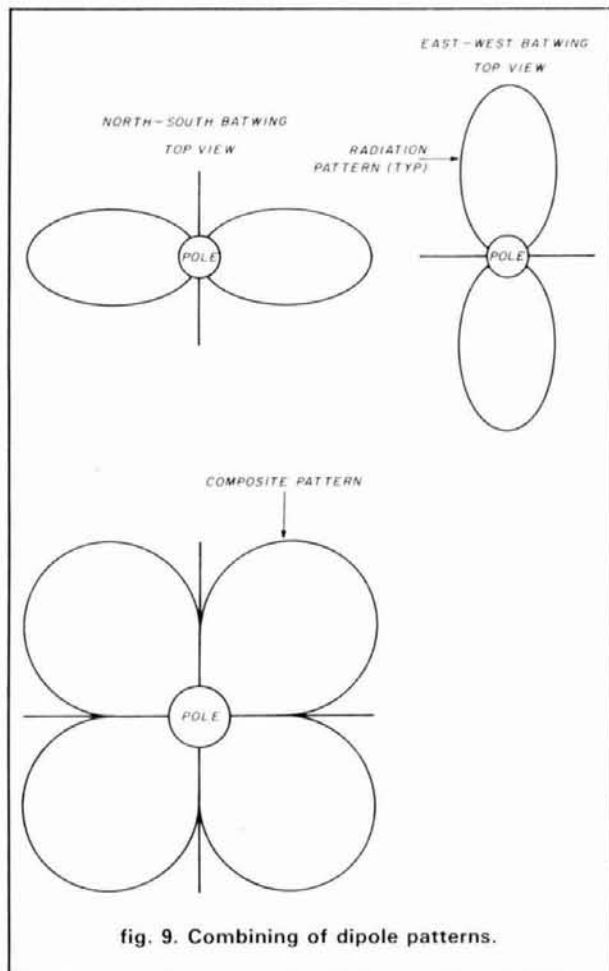


fig. 9. Combining of dipole patterns.

balanced modulators

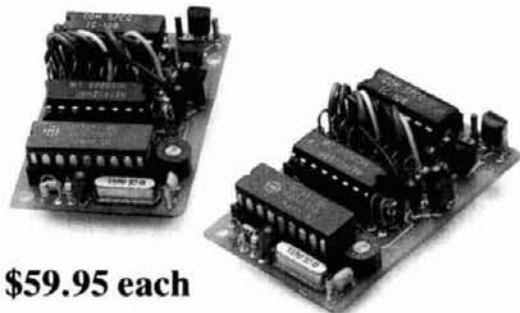
The actual phase shifting is accomplished with balanced modulators, the inner workings of which are beyond the scope of this article. Also in real life, the I and Q are both shifted, but in opposite directions. Now the only trick is to arrange things so that the condition of fig. 6C prevails when no color is present. In other words, we have to put the information from three cameras onto only two axes. This process consists of what's known as matrixing, and a matrix is nothing more than a bunch of precision resistors. The sum of I and Q modulator outputs will be 0 (no carrier) when the output from each of the matrices is equal and opposite in polarity. Keeping in mind that magical 30:59:11 ratio, we find that with the given resistor values, this will occur when the output from each gun is equal. (I'm not going to do all the addition here, so take my word for it!) All that's left is for us to do a couple of 180's and our signals will cancel rather than add. (Notice the 180-degree phase shifters in the I and Q matrix.) The point here is that we have combined three guns into two modulators. Now if anything changes to upset the balance of our guns, such as when the input includes color, our balanced modu-



Eureka!

We just struck gold with a miniature, high quality and very reliable DTMF decoder at a rock bottom price of \$59.95. Our DTD-1 will decode 5040, 4 digit codes with the security of wrong digit reset. It contains a crystal controlled, single chip DTMF decoder that works great in bad signal to noise environments and provides latched and momentary outputs. Why carry that heavy gear when its size is only 1.25 x 2.0 x .4 inches and it comes with our etched in stone, legendary, one year warranty.

Instead of sifting through the field...searching, use our super quick one day delivery and cash in on a rare find.



\$59.95 each

**COMMUNICATIONS
SPECIALISTS**

426 W. Taft Ave., Orange, CA 92665-4296
Local (714) 998-3021 • FAX (714) 974-3420
Entire U.S.A. 1-800-854-0547



lators will be unbalanced, allowing some 3.58-MHz carrier to leak out. This carrier will be compared in phase to the color burst in our receiver (see part 1) and decoded to give the right color.

the switcher

Now that we've generated a color signal with our camera, we need to run it to the switcher, the brains of the TV station. A TV switcher is just a switchboard that selects video sources. However, it must do so without introducing any visible glitches. It does this by switching during the vertical interval, that period of time between the frames when nothing is showing. How does the switcher know to do this? That's right; it's fed sync from the DA system.

When you push a button to select another camera or, for example, a VCR, the switcher waits a 30th of a second or so until it sees a vertical sync pulse and then throws the switch. In actuality, the switches in the video path are saturated FETs, which make almost ideal video gates.

Switchers can do other things besides selecting sources. They can do fades, wipes, and synthetic coloring. Switchers that do this are called SEGs, or special effects generators. A vertical wipe is easy; all the switcher does is wait a precise amount of time after the vertical interval to switch from one source to the next. This timing is selected by a joystick or fade/wipe bar. As the bar is moved down, it merely increases the delay time between the vertical interval and switch-over time. For those of you familiar with test equipment, this is identical in function to the "delayed sweep" mode on an oscilloscope.

After we do our switching, we need to run our signal to our transmitter. If our transmitter is on a distant hill, we send our video to a studio transmitter link (STL), which is no more than an fm microwave transmitter operating at 2, 7, or 13 GHz. STLs are extremely wideband; this allows us to get video from point A to point B with no measurable distortion.

Before we feed our STL or transmitter, we usually run our video through a processing amplifier or "proc amp." This device cleans up any garbage our sync pulses have accumulated in their course through the switcher. Also, unless you're using 2-inch quadruplex videotape equipment, the sync level is going to be pretty lame even before it gets to the switcher. For some reason, 3/4-inch and 1/2-inch helical VCRs can't reproduce a decent sync pulse. The proc amp also allows us to adjust color burst amplitude and phase, and to set overall video modulation and setup level. It's sort of a final inspection before the signal hits the airwaves.

The first thing our video sees when it reaches a transmitter is a receiver equalizer or "predistorter" that compensates for delay time errors all TV receivers ex-

perience because of the intercarrier sound system mentioned in part 1. Rather than require that receivers fix their own problems, the FCC makes the broadcaster compensate for poor receiver design by introducing the opposite problem at the transmitter; hence the name "predistorter." Without receiver equalization, a color receiver has a comic effect; this is caused by the color information taking longer to get through the receiver circuitry than the luminance information. So the receiver equalizer introduces an equal but opposite frequency vs. time delay before it even gets to the transmitter. The receiver equalizer uses circuits known as all-pass filters to do this.

After we've butchered our perfectly good video with our receiver equalizer, we run it into an optional differential gain corrector. This is similar to a gamma corrector except in that it compensates for nonlinear responses in the power amplifier of the visual transmitter. Usually this circuit is bypassed when the tubes are new. As they get "soft," we can start adding gain correction. When the gain corrector can no longer do the job, we change the tubes. (Not a pleasant task at a minimum of \$5000 for a moderate-power VHF transmitter. The price rises to \$35,000 for a typical UHF transmitter.)

From here, it goes into an endless variety of modulators. The trend these days is to use a low-level modulator so we can use the same exciter to run any power level of transmitter. Our output power is then determined by how many stages of linear amplifiers (afterburners) we want to use. Our Harris BT5L transmitter uses a diode ring modulator, similar to the type used in many Amateur SSB transmitters. This system is very linear and broadbanded — i.e., high fidelity. Next we eliminate the lower sideband with a novel type of filter called a SAW (surface acoustic wave) filter, which is actually an electromechanical device that uses the properties of shock waves rippling across a piezoelectric crystal to achieve very precise frequency filtering. It requires no adjustments or tuning.

All this is done at about 37 MHz. From here, it's converted to the channel of operation. Almost all TV transmitters are hybrid — i.e., they use both tubes and solid-state devices. Vacuum tubes still offer clear advantages at high power levels.

Next we take our high power output signal and run it through a diplexer. Doing this allows us to use the same antenna for both transmitters. Both the diplexer and antenna are designed for optimum bandwidth. The system must exhibit less than 1.05:1 SWR over a 6-MHz wide channel. The shape of the batwing antenna is the key to this bandwidth. By using two batwings positioned at right angles and fed 90 degrees out of phase electrically, we can achieve a nearly circular radiation pattern (see fig. 9).

Figure 10 gives a crude explanation of how a bat-

Magnetic Attraction

Tired of paying higher and higher prices for V.H.F. magnetic mount antennas? Hustler has the solution. Two new series of antennas at surprisingly affordable prices. Built with the same quality and performance you expect from a Hustler product. Designed to offer you years of trouble-free operation. Priced to save you money.

FX SERIES (pictured mounted)

- 3.4 db gain | 5/8 wave
- 200 watt rating
- 15 foot coax
- PL-259 connector installed
- Magnetic mount holds to 100 mph

Model FX-2 — 2 Meter, black & chrome

Model FX-220 — 220 MHz, black and chrome

24.95 ea.

Also Available in Black

Model FX-2B, 2 Meter

Model FX-220B, 220 MHz **29.95** ea.

RX SERIES (pictured lying down)

- 3.4 db gain | 5/8 wave
- 100 watt rating
- 15 foot coax
- PL-259 connector installed
- Magnetic mount holds to 75 mph

Model RX-2, 2 meter black and chrome

Model RX-220, 220 MHz, black & chrome

19.95 ea.

Also Available in Black

Model RX-2B, 2 meter

Model RX-220B, 220 MHz **24.95** ea.



Model FX-2
(Also Available in Black)

Model RX-2
(Also Available in Black)

HUSTLER[®]

One Newtronics Place
Mineral Wells, Texas 76067
(817) 325-1386

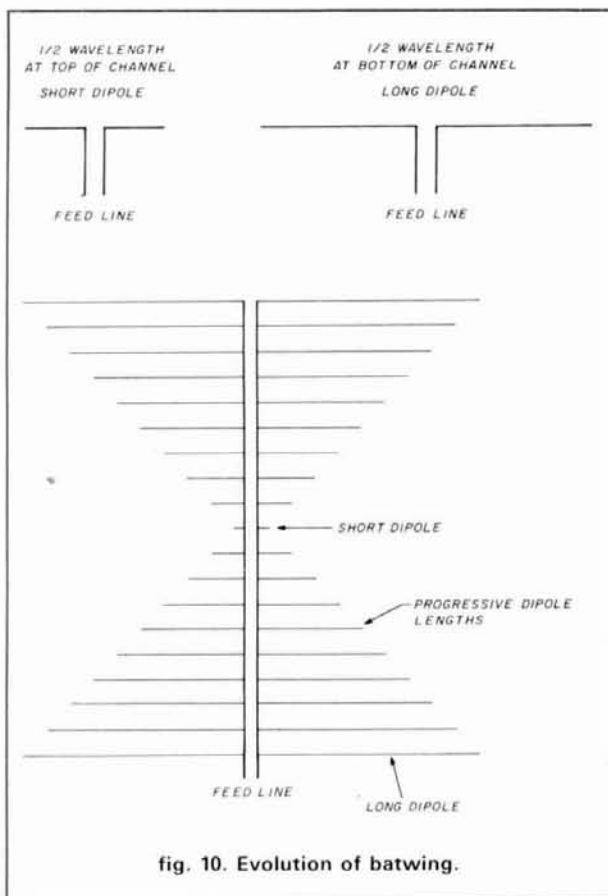


fig. 10. Evolution of batwing.

wing shape ensures broad bandwidth. The short dipole is resonant and works well at the top end of the channel. The long dipole is resonant at the bottom of the channel. By making a batwing sheet, we actually have an infinite number of dipoles of different length.

Any frequency signal falling within the 6-MHz limit will find a dipole of the correct length. This scheme has no effect on the directional characteristics of the system. Batwing antennas are all horizontally polarized. Circularly polarized TV antennas follow configurations other than the batwing, but that's a different subject altogether.

One major refinement of the batwing that makes this description a little too simple is that these things are firmly bolted to a solid steel pole. A few tricks are necessary to make the pole look like it isn't there, electrically speaking. Because the use of insulators is prohibited mechanically, the problem becomes even more amusing; actually, it isn't as difficult as it may seem, though it does require some understanding of advanced transmission line theory. We use the principal of shorted stubs, sometimes facetiously called "conductive insulators."

Speaking of transmission lines, these antennas are fed with 50-ohm transmission line, which is standard practice for RF power applications. Unlike flexible coax, 50-ohm TV transmission line measures 1-1/2 inches in diameter, contains solid copper pipes for both inside and outside conductors, and is very expensive . . . but then again, so is most of the materials and equipment that are used in TV.

Though I've now described a TV station from video to antenna, I've obviously left many questions unanswered. But by now you should at least know what those questions are. As I mentioned at the beginning of part 1, NTSC isn't the perfect system, but it works.

If you think you could do the job better, you're probably right — and there's probably a TV station somewhere that could use your ideas.

ham radio

ENHANCE PERFORMANCE

The Ultimate Upgrades!

Drake R-4B/C, TR-7, R-7, TR-4/C, SPR-4, SW-4A
First & Second IF Filters, P. C. Board Retrofits
JRC NRD 515 Filters + Motherboard Modifications
Speech Processing + IF Filters: T-4XC, TR-7, CX-11A
Front-End Antenna Filters: 160, 80, 40, 20, & 15 M
High-Performance SSB & Phase-Locked AM Detector
Improved HF Mobile Antennas: 80-10 or 40-10 M
Atlas and Signal/One Filter Improvements

Receiver / Transmitter Modification Services
Alignments, Receiver Testing, Filter Plots

Sherwood Engineering, Inc.

1268 South Ogden Street, Denver, CO 80210
(303) 722-2257 8:30 A.M. - 5:30 P.M., Mountain Time
Visa, MasterCard, Choice cards welcome

153

SSB ELECTRONIC TRANSVERTERS & PREAMPLIFIERS

LT 2S	144/28 XVRTR 20W GaAsfet DBM	.....\$549
LT33S	902/144 Xvrtr 20W GaAsfet	.....\$599
LT23S	1296/144 Xvrtr 10W GaAsfet	.....\$549
MICRO-13	2304/144 XVRTR 0.5W GaAsfet	.....\$429
MICRO-X	10368/144 Xvrtr 0.1W GaAsfet	.....\$599
DX	series low noise GaAsfet preamps	\$129
MV	series mass mounted GaAsfet preamps	\$199
K	series rx cnvtrs GaAsfet DBM from	.....\$129

TRANSVERTERS UNLIMITED

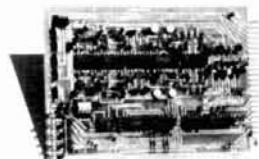
T220/28	220 MHz Xvrtr 28 or 50 IF, 20 W	.....\$220
T144/28	144 MHz Xvrtr 28 or 50 IF, 25 W	.....\$199
PA33200	902 MHz 2 tube PA, 200W +	.....\$499
PA23150	1296 2tube PA, 150 + W	.....\$449
PA1325	2304 1tube PA, 25 + W	.....\$429
HF400	High power relay 2Kw at 144 MHz	.....\$129
RK500	Medium power relay 1KW at 144 MHz	.....\$ 69

Factory Authorized Dealer for SSB Electronics for North America

TRANSVERTERS UNLIMITED BOX 6286 STATION A TORONTO, ONTARIO CANADA M5W 1P3 (416) 759-5562	TRANSVERTERS UNLIMITED (US) P. O. BOX 178 NEW BOSTON, NH 03070 (603) 547-2213
---	---

154

THE MULTIPLE RECEIVER SOLUTION



4 Channel Signal-to-Noise Voter

- Expandable to 32 Channel by Just Adding Cards
- Continuous Voting
- LED Indicators of COR and Voted Signals
- Built-in Calibrator
- Remote Voted Indicators Pinned Out
- 4 1/2 x 6 Double Sided Gold Plated 44 Pin Card
- Remote Disable Inputs
- MORE

Built, tested and calibrated with manual

\$350.00

Telephone interface now available
For more information call or write:

HALL ELECTRONICS
Voter Department
815 E. Hudson Street
Columbus, Ohio 43211
(614) 261-8871

155

ode to older oscilloscopes

handy boat anchor
monitors i-f,
tunes RTTY signals

Old tube-type oscilloscopes are often available at flea markets at very little cost. Until the 1940s and 50s or so, oscilloscopes produced for most technical work were "recurrent sweep" models. This meant that the spot of light on the tube face swept continuously across the tube face, whether there was a signal to monitor or not.

Shortly thereafter the design of general purpose scopes underwent several dramatic changes. Older scope designs were inadequate for the tasks demanded of them by technicians and engineers. As newer designs evolved, the recurrent sweep type was replaced by the "triggered" sweep, in which the spot of light on the tube face swept across only when there was a signal present. By allowing the signal to control the sweep, a much more stable visual display was obtained. Better response at higher frequencies was another welcome improvement.

The newer scopes were easier to use, and would do things that the older models would not: for example, they would provide more accurate traces of higher frequency signals than the older ones. The sometimes jumping, jittery trace of the older recurrent-sweep scope was now replaced with the rock-solid, easily controllable, triggered trace.

The newer scopes were such a pleasure to operate that, by comparison, the ones they had replaced came to be viewed as relatively worthless relics.

Although the really worn-out older scopes are probably better left on the scrap heap, many of them are still in fair shape, and remain good performers for some

uses. Note that I say "some uses." I don't mean to suggest that the older models are at all comparable to today's scopes in performance; they are not. On the other hand, the older scopes can perform several tasks that are of considerable interest to many hams and radio buffs, and do them quite well. Let's take a look at some of these applications.

rf applications

One useful application is the viewing of signals tapped from your receiver's i-f section. Some receivers and transceivers have an output jack for this function. When used in this application, your scope trace will show you such things as the modulation characteristics of received signals in phone work, or the keying characteristics of CW signals (see **fig. 1A** and **1B**).

Once I was given an older scope when I bought some other items at a flea market. Sometimes these old scopes work without repair; others may need minor repair. Luckily I found that all mine needed was the replacement of two tubes. *If you tinker with the innards of an oscilloscope, remember that there are very high voltages in most of these units.* Reduce the chances of sending an electrical current through your heart by following the slogan, "One hand in the circuit, one in a pocket." My "free" scope now sits alongside my operating table (see **fig. 2**). Using it to view signals from my transceiver's i-f, I find it's a pleasure to be able to check the received signals by just glancing at the CRT. Such an accessory provides an education in judging signal characteristics.

Other rf applications for some of these scopes stem from the fact that, on various models, there was a means of connecting the test leads from rf signal sources directly to the deflection plates of the CRT itself! To locate the connections to these plates, look for a small porthole on the side of the case, near the neck of the CRT. The direct connections were neces-

By **W. Clem Small, KR6A**, R.R. 1, Box 181, Salisbury, Vermont 05769

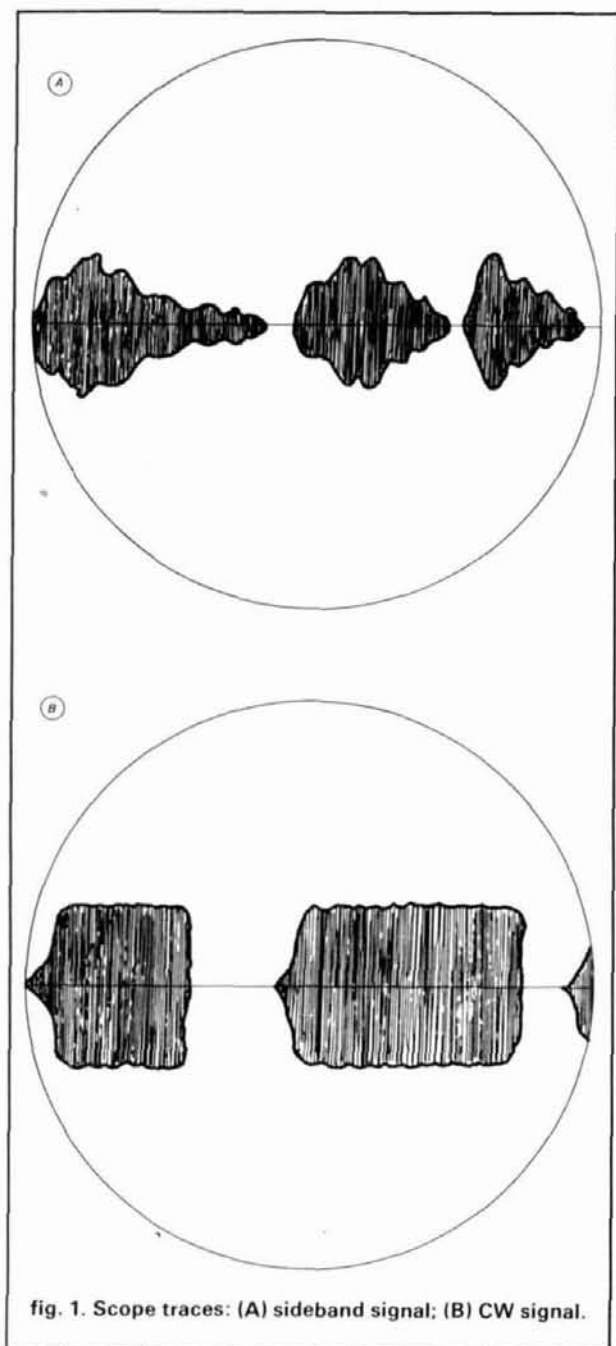


fig. 1. Scope traces: (A) sideband signal; (B) CW signal.

sary for rf work because the amplifiers used in these scopes had a much lower frequency response than those used in modern scopes. So by going directly to the CRT tube elements and bypassing the amplifiers, the amplifier-response problems were solved! By this direct-connection method, the older scopes could be used to view rf signals in the hf region and beyond.

Most radio handbooks include examples of other applications appropriate for these older scopes.

tuning indicators

RTTY, AMTOR, and other popular modes of com-



fig. 2. Two recurrent-sweep scopes are used; larger to monitor receiver i-f, smaller as RTTY tuning indicator.

munication perform only when the received signals are properly tuned in. Many of the interfaces in use for these modes of communication have outputs that can be connected directly to the inputs of the older scopes. The ease of tuning in a reluctant RTTY or AMTOR signal with a scope indicator can be appreciated only by one who has experienced it (see fig. 3). The new LED tuning indicators do work to a degree, but when it comes to tuning in a difficult signal, they don't hold a candle to an oscilloscope of any vintage. The older scopes are superb for this application. (I have a small, old Heathkit scope that's great for this job. That scope is located above, and to the right of the transceiver — see fig. 2.)

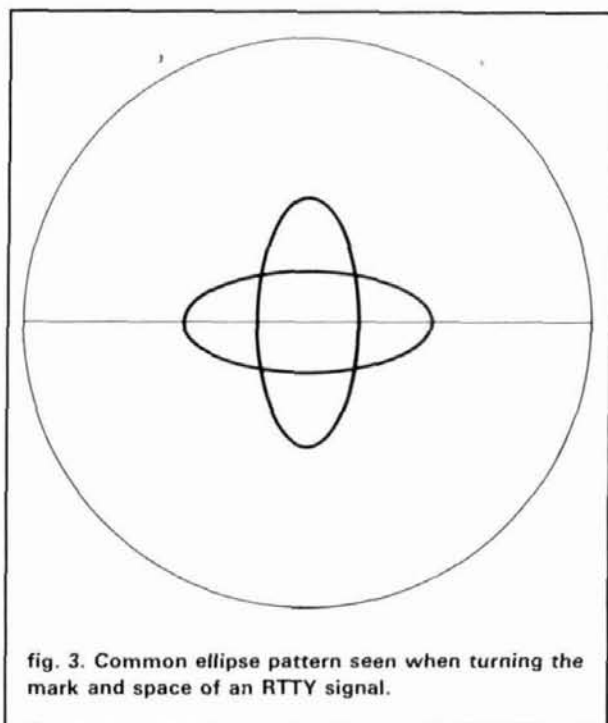


fig. 3. Common ellipse pattern seen when turning the mark and space of an RTTY signal.



28th ANNUAL TROPICAL HAMBOREE ARRL HAMFEST OF THE AMERICAS FEBRUARY 6-7, 1988



DADE COUNTY YOUTH FAIR GROUNDS
Tamiami Park, 10901 S.W. 24 Street (Coral Way), Miami, Florida

- | | |
|--|---|
| <ul style="list-style-type: none"> • FREE PARKING 15,000 VEHICLES • • 1,000 INDOOR SWAP TABLES • • 300 CAMPSITES WITH FULL HOOKUPS • • 200 COMMERCIAL EXHIBIT BOOTHS • • COMPUTERS & SOFTWARE • • HAMBOREE DEALER SPECIALS • | <ul style="list-style-type: none"> • LICENSE EXAMS • PACKET RADIO PROGRAMS • DX FORUM • RCA FLORIDA SECTION LUNCHEON • TECH TALKS • ACTIVITIES FOR NON-HAMS |
|--|---|

Registration: \$5.00 Advance — \$6.00 Door. Valid both days. (advance deadline Jan. 30th)
Swap Tables, 2 days: \$16.00 each. Power: \$10.00 per user.
All swap table holders must have registration ticket.

Campsites: \$12.00 per day, includes water, power, sanitary hook-ups, showers.
(All RV vehicles, tent campers, vans, trailers welcome — no ground tents, please.)

Headquarters Hotel: Miami Airport Hilton, 5101 Blue Lagoon Drive.

Special Hamboree Rates: \$55.00 Single or Double.

Reservation forms available through Dade Radio Club December 1st.

Exhibit Booth Information:
Evelyn D. Gauzens,
W4WYR, Chairman
2780 N.W. 3rd St.
Miami, FL 33125
Telephone:
(305) 642-4139

**Make checks for Registration, Swap Tables & Campsites payable to:
DADE RADIO CLUB, P.O. BOX 350045, MIAMI, FL 33135**

4-Page Brochure
Available . . .
December 1st

VHF COMMUNICATIONS

915 North Main Street
Jamestown, New York 14701

INTRODUCING
W2DRZ VHF/UHF MODULES.
NOW AVAILABLE.

ICOM, AEA, LARSEN, VAN GORDEN,
VIBROPLEX, NYE-VIKING, FALCON
COMM, LEADING EDGE, ARRL PUBLI-
CATIONS, KAGLO, HAMTRONICS,
PROWRITER, ELEPHANT DISKS,
DEBCO, TRIONYX

✓ 156

Western New York's finest... amateur radio dealer!
PH. (716) 664-6345

VHF-UHF POWER DIVIDERS

RF power dividers provides the best way to feed in-phase 2 and 4 antenna arrays to maximize system gain and at the same time reduce losses to a minimum. Covering 144 thru 1296 MHz, this series of VHF/UHF power dividers are premier RF devices designed for a long service life with low SWR and broad operating bandwidth.

Extruded aluminum body with a durable enamel finish in addition to silicon sealing at connector flanges results in a ruggedized unit for all array installations. Available with N-type connectors only, these units are unconditionally guaranteed for 2 years.

MODEL	CONFIG.	PRICE
144-2P	(2 ports)	\$51.00
144-4P	(4 ports)	\$58.00
220-2P	(2 ports)	\$50.00
220-4P	(4 ports)	\$57.00
430-2P	(2 ports)	\$48.00
430-4P	(4 ports)	\$56.00
902-2P	(2 ports)	\$48.00
902-4P	(4 ports)	\$56.00
1296-2P	(2 ports)	\$49.00
1296-4P	(4 ports)	\$57.00

SHIPPING NOT INCLUDED

STRIDSBERG ENGINEERING, CO.
P.O. Box 7973 • Shreveport, LA 71107 • USA
Phone: (318) 865-0523

✓ 177

**NO TUNERS!
NO RADIALS!
NO RESISTORS!
NO COMPROMISE!**

**THREE EXCELLENT REVIEWS JUST DON'T HAPPEN BY CHANCE.
CALL US FOR A FREE CATALOGUE.**

*See review in Oct 73, 1984
*Sept 73, 1985 *March 73, 1986

NEW LOCATION!
BILAL COMPANY
137 Manchester Dr.
Florissant, Colo. 80816
(303) 687-0650

✓ 157

IIX Equipment Ltd.

Say EYE-EYE-X

#1
In Mounts

FREE! ALL NEW 1988
Y-6 CATALOG
OF COMMUNICATION ACCESSORIES

Immediate Shipping On All Items. Call/Write

IIX EQUIPMENT
PO BOX 9
OAKLAWN, IL 60454
(312) 423-0605

✓ 158

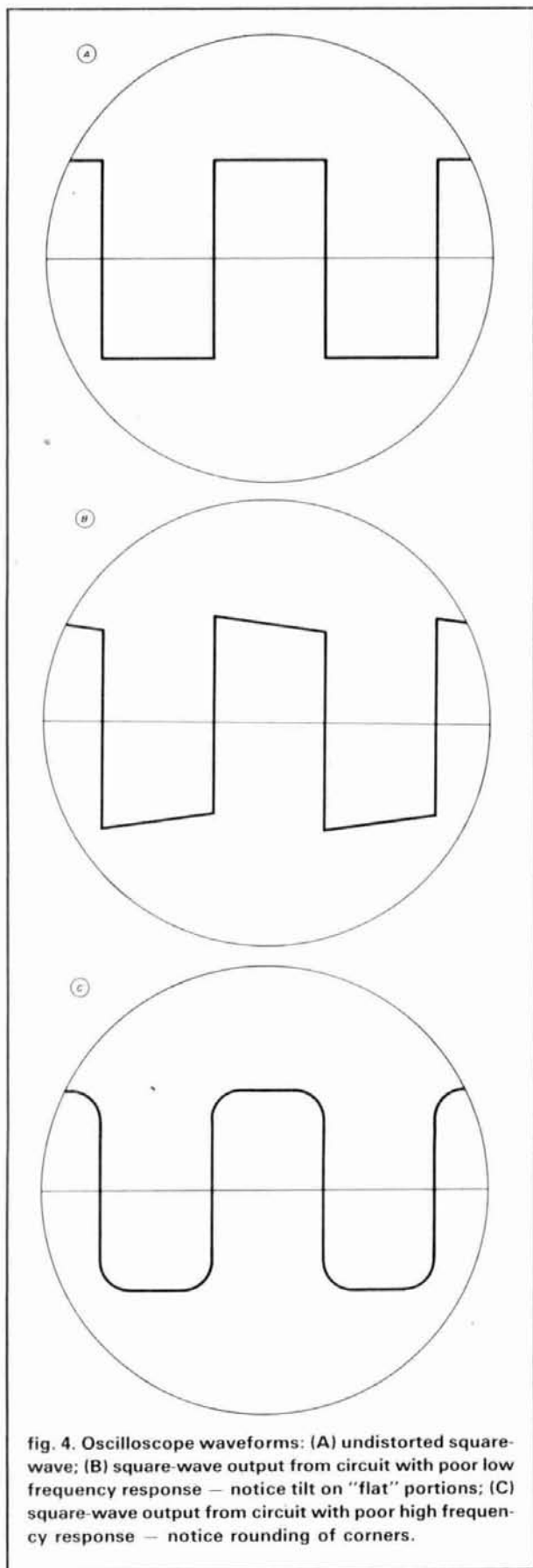


fig. 4. Oscilloscope waveforms: (A) undistorted square-wave; (B) square-wave output from circuit with poor low frequency response — notice tilt on "flat" portions; (C) square-wave output from circuit with poor high frequency response — notice rounding of corners.

audio too!

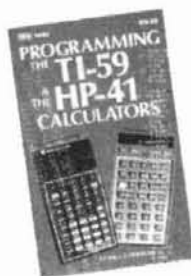
We mustn't forget that the old scopes did a pretty fair job in audio work. Looking for distortion, clipping, and the like is a simple matter with a scope. **Figure 4** gives an idea of how easy it is to see distortion present in audio signals.

Next time you come across one of yesterday's oscilloscopes, think of all the fun — and even education — that you can get by applying one or more of the ideas covered above. With the price range of contemporary scopes in the hundreds and even thousands of dollars, using yesterday's scopes today isn't such a bad idea after all.

ham radio



SPECIAL PURCHASE FROM THE PUBLISHER ALLOWS US TO SLASH THE PRICES ON THESE BOOKS



PROGRAMMING FOR THE TI-59 AND HP-41 CALCULATORS

by Paul Garrison

To take full advantage of your hand-held calculator's power, you need to learn how to program it. Clear easy-to-understand instructions make programming a snap! Over half the book has practical programming applications that will solve some very complex problems. © 1982, 294 pages.

T-1442 Was \$12.95 SAVE \$8 Softbound \$4.95

MICROCOMPUTERS IN AMATEUR RADIO

by Joe Kasser, G3ZCZ

Computers can be used in a number of different ways in your Ham shack. They can be used to control your rig, predict propagation, control antennas and hundreds of other applications. Kasser explores the possibilities in this book. Includes interface I/O devices, system categories, programming the micro-computer and much more. Great reading. © 1981, 307 pages.

T-1305 Was \$15.95 SAVE \$11.00 Softbound \$4.95



SOFTWARE FOR AMATEUR RADIO

BY JOE KASSER, G3ZCZ



SOFTWARE FOR AMATEUR RADIO

by Joe Kasser, G3ZCZ

Packed with practical computer applications and tested and de-bugged programs that can be simply adapted to almost any microcomputer. Includes BASIC programming concepts as well as how to interface your computer to your radio, digital communications and more. © 1984, 284 pages.

T-1560 Was \$15.95 Softbound \$4.95 SAVE \$11.00

BUY ALL 3 SPECIAL \$44.85 VALUE at retail

T-SPB **\$10.95**

SAVE \$33.90

WOW What a Deal!!!!!!

ham radio magazine **BOOKSTORE**

GREENVILLE, NH 03048

603-878-1441

ORDER DESK HOURS (Eastern):
MONDAY-FRIDAY 10 A.M. to 5 P.M.
SATURDAY 10 A.M. to 4 P.M.
 Technical and VA orders call (703) 938-3350

Electronic Equipment Bank
 516 Mill Street N.E., Vienna, VA 22180
 Telephone (703) 938-3350

STORE HOURS (Eastern):
 Same as Order Desk Hours
Closed Mondays
Thursday 10 A.M. to 9 P.M.

Electronic Equipment Bank—Order Toll Free 800-368-3270

MOBILE HANDSET

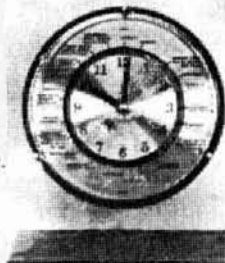


NEW!

- * Handset w/PPT switch.
- * Bracket w/DTMF, speaker & volume controls.
- * Upgrade your 'mobile' image! Specify YAESU, ICOM or KENWOOD. HSC701Y, I or K...\$79.95 + \$4. UPS

DESK CLOCK

NEW!



- * 12/24 hour display.
- * Quartz movement.
- Gold or silver dial:

E4111G or E4111S...\$34.95 + \$4. UPS

DOCKING BOOSTERS



NEW!

- * GaAs FET preamp.
- * Compact solid state POWER Amplifier in 30 or 50 watt models
- * ICOM, KENWOOD or YAESU from: \$169.95 and up! CALL FOR DETAILS.

* Turn your HANDHELD into a Mobile Giant!

WP230 or WP250; Y, I, K + \$4. UPS

SPEAKER/MIKE

NEW!

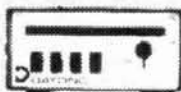


- * Finally a speaker/mike we can all afford!
- * For ICOM, KENWOOD or YAESU. Specify YAESU, ICOM or KENWOOD.

DMC537Y, I or K...\$19.95 + \$4. UPS

DATONG AUTOMATIC NOTCH FILTER

- * Automatically notch out heterodynes, whistles.
- * Get rid of 'tuner-uppers' on NET frequencies.
- * 1 second is typical lock time/covers 270 Hz to 3.5 KHz.
- * Auto/Manual operation in Notch or Peak modes.



NEW!

ANF...\$119.95 + \$4. UPS

DATONG MULTIMODE AUDIO FILTER



- * SSB, SSB & PEAK, SSB & NOTCH, CW & RTTY!
- * If you need an audio filter this is it! FL2...\$159.95 + \$4. UPS
- * The ultimate audio filter: same as FL2 but with AUTO NOTCH! FL3...\$229.95 + \$4. UPS

DATONG DIRECTION FINDER



- * Doppler DF system for FM receivers.
- * User attaches his own coax, antennas & speaker.
- * Normal transceive operation even while DFing!
- * 20 - 200 MHz, dependant on users equipment.

DF...\$329.95 + S&H.

COMPUTER INTERFACE AEA PK 232



- * Attach to any RS232 compatible computer for CW, RTTY, ASCII, AMTOR, PACKET and WEATHER FAX (Epson MS-80/RX-80 for Fascimile).
- * The PK 232 is THE UNIT to buy! EEB includes the AC Adapter #571512 with purchase! PK232...\$299.95 + \$6. UPS

FREE 1988 CATALOG SHORTWAVE!

CALL OR WRITE TODAY!

36 Pages over 300 items for the SWLer!

HANDHELD SCANNER

NEW!



- * Covers NOVICE 220 MHz band!
- * 16 Memories/Scanning.
- * Delay/Lockout/Priority.
- * 26-30, 60-80, 115-178, 210-260, 410-520 MHz. NICAD power.

BJ200...\$229.95 + \$4. UPS.

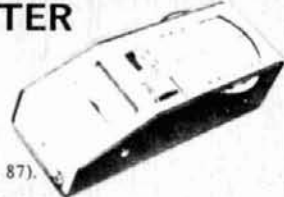
NEW!



- * Enjoy SHORTWAVE or EXTEND frequency for YAESU FRG9600 and ICOM R7000 radios.
- * The following have PL259 connectors for YAESU FRG9600:
 - * FC965DX...\$149.95, 20 kHz - 60 MHz.
 - * FC1300...\$199.95, 800 MHz - 1300 MHz.
 - * WA965...\$109.95, 30 MHz - 1.5 GHz.
- * Control console for ease of operation switches converters and antennas in/out. CC965...\$119.95.
- * FC7000 for ICOM R7000 with type 'N' connectors. 20 kHz-60 Mhz...\$159.95
- * FC965DX, FC1300, WA965 & FC7000 can be used without Control console and are powered from: FRG9600 or R7000.

DIPMETER

- * 1.5 to 250 MHz.
- * 6 plug-in coils.
- * Use as OSC for receiver alignment.
- * See the review in '73' Magazine (nov, 87).



DM-4061...\$79.95 + \$4. UPS

RF SIGNAL GENERATOR

- * 100 KHz - 150 MHz; 450 MHz on harmonics.
- * RF output: 100 mV.



SG-4160...\$149.95 + \$4. UPS

SWR/RF ANTENNA METER



- * Read SWR, RF power and field strength
- * 10 or 100 watt range.
- * 1.7 to 150 MHz.

SWR3P...\$19.95 + \$4. UPS



- * We ship world-wide
- * Shipping charges not included
- * Prices & specifications subject to change without notice

10 miles west of Washington, D.C.
 Sorry—No COD's
 10-5 Tues., Wed., Fri. 10-9 Thursday
 10-4 Saturday Closed Sunday and Monday



ELECTRONIC EQUIPMENT BANK
 516 Mill Street, N.E. 159
 Vienna, VA 22180
 Order Toll Free: 800-368-3270
 Technical and VA Orders (703) 938-3350

Now You Can Have the Best of Both . . .

Radio Data Communications and PC-Compatibility!

DS-3200



Now you can have the BEST in a radio data communications terminal with the NEW DS-3200.

Recognizing the chief weakness of previously available computer-based terminals is RFI generation and susceptibility, HAL has designed the fully-shielded DS-3200 for operation in the radio data communications environment. No longer do you have to QRT when that rare DX station's signal dips near the noise level!

The DS-3200 is provided with an extensive RTTY software package which emulates the operation of our MPT3100/DSK3100 combination for message processing and handling. Continuous save to disk of all received text, direct transmission of selected files from disk, and full editing capability are just a few of the features of this "user-friendly" software package. Plus, we have included the latest release of MS-DOS with GW BASIC!

The built-in RS-232C serial port allows the use of the DS-3200 with an external demodulator such as the HAL ST-5000, ST-6000, or ST-8000. Or, add the HAL PCI-2000 for a completely self-contained RTTY/CW terminal and demodulator. Also, with the use of a second RS-232C serial port the DS-3200 can be used with your favorite TNC on Packet!

The DS-3200 with its IBM PC XT-style architecture gives you virtually unlimited flexibility for future expansion. Here is a list of just some of its hardware features: 8088 CPU, 640KB RAM, RS-232C Serial Port, Parallel Printer Port, Clock/Calendar with Battery Back-Up, Two 360KB Floppy Disk Drives OR One 360KB Floppy and One 20MB Hard Disk Drive, HERCULES-compatible Monochrome Graphics Adapter with High-Resolution 12 Inch Monochrome Video Monitor.

The DS-3200 is THE choice for modern radio data communications.

Write or call for complete specifications on the NEW DS-3200.



HAL Communications Corp.
Government Products Division
Post Office Box 365
Urbana, IL 61801
(217) 367-7373 TWX 910-245-0784

Trademarks: IBM, International Business Machines Corporation
MS-DOS, Microsoft Corporation
GW BASIC, Microsoft Corporation
HERCULES, Hercules Computer Technology

drift and shift

Few circuit problems are less welcome than frequency drift — a gradual change of frequency, usually as a function of temperature — and shift, an abrupt change of frequency. Although the causes of these two related phenomena are different, they're often confused with each other.

There's also a difference between problems with new projects and drift in old equipment that once worked well. In a newly constructed project, or in new equipment from less reputable sources, the problem may well be an inherent error in the design. Some of these errors are easily corrected, while others are not. In equipment that once worked well, however, it's more likely a matter of a failed component.

frequency shift problems

Resonant circuits in modern electronic equipment might be LC tuned by a combination of inductance and capacitance, or tuned by a piezoelectric resonator element ("crystal"). In either case, the cause of a sudden unwanted shift of operating frequency is usually related to some form of mechanical trauma somewhere in the circuit. In other words, some component has either broken down or suffered an intermittent connection.

Figure 1 shows a partial circuit of an oscillator. The resonance of this circuit is determined by the combination of C1, C2, C3, and L1. If any of these

components fails, changes value, or becomes disconnected, then the resonant frequency of the circuit will shift. If coil L1 fails, the circuit will probably cease oscillating, so the fault will be obvious. But what if one of the capacitors fails? In that case, the circuit may well continue oscillating, but at a different frequency than before.

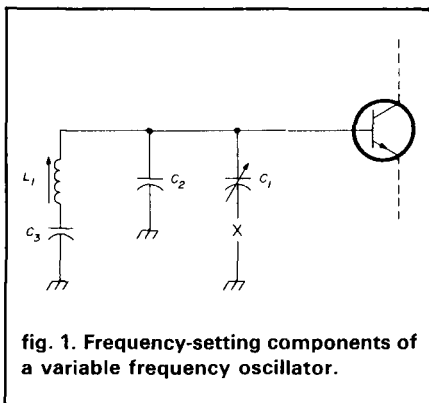


fig. 1. Frequency-setting components of a variable frequency oscillator.

The trimmer capacitor was selected for our example in fig. 1 because those components seem especially at fault. After many years of experience, I can attest that trimmers seem to have a high casualty rate. Perhaps the worst offenders are the half-turn type that use silver deposited on a pair of ceramic surfaces. The mica compression types also fail, but at a lower rate than the other types. The failure mechanism seems to be looseness in the adjustment screw. Tap the capacitor gently with an insulated probe, and

note whether or not the shift occurs.

Don't make the mistake of assuming that the other forms are fault-free — far from it. Every form of fixed capacitor has at least a small failure rate, with failure usually attributable to disconnected leads inside the body of the capacitor.

Also, don't overlook the possibility that the problem is due to the solder connections on the capacitor, especially where the capacitor is mounted on a printed circuit board that flexes easily. Although some bad joints slip past the eye of the factory Quality Assurance (QA) inspector — and subsequently last for years before failing — others die an early death because of trauma or flexure of the board. In addition to solder joint breaks, it's also possible that the printed wiring track is cracked. In both cases, a little solder and a hot iron will solve the problem.

One of my colleagues is a ham who has a receiver-transmitter pair that was once the top of the line in Amateur circles. He noticed that the formerly very good receiver dial calibration was now about 25 kHz off. On inspecting the local oscillator VFO circuit, he found that the LO VFO contained a number of small fixed capacitors in addition to the frequency-setting trimmer and the main tuning variable capacitor. He made a few quick calculations of resonance to see which, if any, would result in about 25-kHz shift if it were open. He quickly identified a 27-pF unit that was part of the tem-

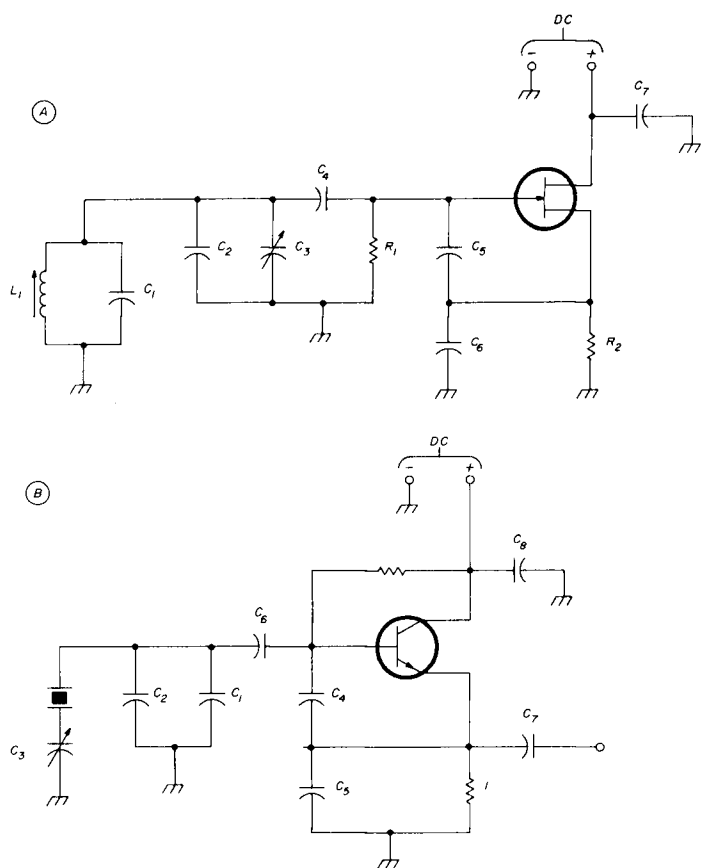


fig. 2. (A) LC-tuned VFO showing resonant tank circuit; (B) Piezoelectric crystal oscillator.

perature compensation circuit. A new 27-pF N1500 unit solved the problem.

When you find a disk ceramic capacitor with a specified temperature coefficient, please don't make the mistake of thinking that a low-temperature coefficient type is a better replacement. And don't use another disk with a different temperature coefficient!

On older receivers, be sure to examine the main tuning capacitor for problems. I once had a terrible problem with a piece of equipment that exhibited both shift and drift in magnificent proportions. Although employed in a communications shop at the time, I didn't get around to fixing the receiver for several months (the cobbler's kids go-without-shoes syndrome). When I looked into the problem, it turned out to be dirty grease under the rotor grounding spring on the main tuning

capacitor. That capacitor rotor is normally grounded to the chassis through its own frame. But because the rotor must move, a brass or steel grounding leaf spring or "spider clip" is usually placed around the rotor at the front bearing. The spring or clip grounds the rotor to the frame. But in that case, dirty grease had built up under the spring. Rather than causing operation to cease, however, the grease caused massive frequency shifts, drift when it wasn't shifting, and a sad tendency towards microphonics.

Another problem in older receivers is poor grounding. I've seen frequency shift problems in many car radios, in two-way radios, and in other rf equipment caused by poor grounding or cracked ground tracks on the printed circuit board. In one infamous fm model, the fm front end was ground-

ed at only two points on the printed circuit. If that wasn't bad enough, the ground ran around the edge of the card, and was stressed at one point. . . where cracks tended to develop. Although the circuit wouldn't cease oscillating, the extra several inches of ground line on a flexing board caused operating frequency shifts. I suspect that the cause of the frequency shift was the added inductance of the printed circuit ground path.

At VHF frequencies the effect of distributed inductance and/or capacitance is more profound than at low frequencies. Again, judicious use of a soldering iron not only repaired the break but also added strength to the weak point.

frequency drift problems

Unfortunately, most electronic components exhibit some temperature sensitivity. This sensitivity is usually measured in terms of a temperature coefficient which specifies a certain shift of value in parts per million (PPM) per degree Celsius of temperature change. The temperature coefficient (or, casually, "tempco") can be either positive or negative. A positive temperature coefficient (PTC) indicates that the component value will increase as temperature rises and decrease as temperature falls. A negative temperature coefficient (NTC) indicates that the value will decrease as temperature rises and increase as temperature falls.

Most inductors used in oscillator circuits have a PTC problem. The value of inductance (in microhenrys) is determined by the coil dimensions and the number of turns of wire. While the turns count remains constant, the diameter, length, and size of the wire used in the inductor are temperature-related.

The temperature coefficient of inductors can be minimized by design. If the inductor uses Litz wire (or some other low-tempco wire) and a low-tempco coil form, then the temperature coefficient is reduced tremendously. Old-fashioned cardboard forms are terrible sources of drift. According to

TINY-2 PACKET CONTROLLER

\$119.95
READY TO USE - NOT A KIT

- * USES TNC-2 EPROMS INCLUDING NET/ROM. FIRMWARE VERSION 1.1.5 PROVIDED
- * 32K RAM AND 32K EPROM STANDARD
- * SUPPORTS BOTH RS-232 AND TTL COMPUTERS, 300-19,200 BAUDS
- * EXTRUDED ALUMINUM CABINET WITH OVEN-BAKED WRINKLE FINISH. ONLY 5" x 7"
- * WATCHDOG TIMER, MODEM DISCONNECT HEADER, 12V DC OPERATION.

SALE

THE BEST VALUE IN A VHF/HF TNC
PAC-COMM TNC-220 \$149.95
WITH TUNING INDICATOR \$179.95

- NOW WITH 32K RAM STANDARD, FIRMWARE VERSION 1.1.5
- SELECT EITHER HF OR VHF RADIOS FROM THE KEYBOARD.
- SUPPORTS RS-232 AND TTL COMPUTERS
- IN KIT FORM -- \$129.95
- INTERNAL TUNING INDICATOR -- \$44.95

SALE

PACKET TERMINAL PROGRAMS

PAC-PRO (PC)	\$29.95
DIGIPACK II (PC)	\$49.95
MACPACKET (MAC)	\$49.95
MACKET (MAC)	\$39.95
COMMODORE 64	\$19.95

TNC-200, TNC-220 VERSION 1.1.5 EPROMS
\$10.00

ACCESSORIES:

12v WALL MOUNT POWER SUPPLY \$9.95
RS-232 CABLE \$9.95, C-64 CABLE \$12.95

WRITE OR CALL FOR OUR NEW CATALOG OF PACKET EQUIPMENT, SOFTWARE AND ACCESSORIES.

TOLL FREE
(ORDERS ONLY)
800-223-3511
EXCEPT FLORIDA



Pac-Comm, 3652 West Cypress St., Tampa, FL 33607

FLORIDA ADDRESSES ADD 5%. \$3.00 SHIPPING/HANDLING PER ORDER.

TECHNICAL INFORMATION
7:30 AM - 11 PM EASTERN
(813) 874-2980

TELEX: 650-268-1526 MCI
FAX: (813) 872-8696

✓ 161



SAY
YOU SAW **ham**
IT IN **radio** magazine



AMATEUR RADIO MAIL LISTS

Self-stick 1x3 labels

- *** NEWLY LICENCED HAMS ***
- *** ALL NEW UPGRADES ***
- *** UPDATED EACH WEEK ***

Total List = 462,728 (ZIP sorted)
Price is 2.5 cents each (4-up Cheshire)

BUCKMASTER PUBLISHING
Mineral, Virginia 23117
703:894-5777

✓ 162

Half-Square QRV-DX Monobanders

Work DX with No Tower and No Amplifier.
Cut noise, cut near sigs, build DX sigs, kill QRM.

10 Meters 15 Meters 20 Meters 30 Meters

\$29.95 \$39.95 \$49.95 \$59.95

Broadside Pattern, Low Profile, Coax Feed, Ready to Use

Highest DX Gain per Dollar

5c. When ordering add \$5 Postage & Handling

1971 North Oak Lane Antennas West
Provo, UT 84604-2138 (801) 374-1084

✓ 144

**Factory-less,
jumper-less,
ROM-less programming.**



With the new S-COM 5K Repeater Controller, you'll be able to configure your repeater remotely — using DTMF commands. Only the 5K offers this capability for just \$189, wired and tested.



S-COM Industries
P.O. Box 8921
Fort Collins, CO 80525
(303) 493-8316

✓ 163



**CONTACT YOUR DEALER
FOR MORE INFORMATION**

Amateur Radio Baluns-
Traps-Remote Coaxial Switches

Or Write To:

UNADILLA DIV. of ANTENNA'S ETC.
P.O. Box 215 BV ANDOVER, MA. 01810
617-475-7831

✓ 164

standard wisdom, the best forms are ceramic, but that that's not true any longer. Fiberglass and other synthetic materials now provide better tempco characteristics.

Capacitors are also sources of temperature coefficient problems. Ceramic capacitors are available in either PTC, NTC or no-TC versions. Markings of "Nxxx" and "Pxxx" indicate the direction and value of the temperature coefficient. For example, an "N750" is an NTC device with a tempco of 750 PPM. The capacitor marked "NPO" has a low tempco, but it isn't precisely zero — as some people find out to their chagrin when they try to substitute really low-tempco caps with NPO ceramic units. In general, silver mica and polystyrene capacitors are the lowest-tempco units available.

So why not make all capacitors with low or nearly zero tempcos? Because they're sometimes used in temperature compensation circuits. **Figure 2** shows two forms of oscillator, one LC tuned and the other crystal tuned. Both of these oscillators seem to have "extra" capacitors in the circuit (for example, C2 in **fig. 2A** and C1 and C2 in **fig. 2B**). In these cases, the extra capacitors are used for temperature compensation. They typically have small values compared with other circuit capacitors, but have precalculated temperature coefficients that will cause the capacitance to change a predictable amount with changes in temperature. Both circuits, even the crystal oscillator, will change frequency with changes in circuit capacitance, so the tempco of the compensation capacitors forces the frequency to change in a predictable manner. The idea is to counter the positive temperature coefficient of the inductor with an equal and opposite direction temperature coefficient of the capacitors.

Unfortunately, even some manufacturers don't understand drift. Several years ago, in my column for *World-radio*, I passed along a request for information sent in by an Amateur working in the jungles of central America. He had a low-cost transceiver that had made a brief splash on the Ama-

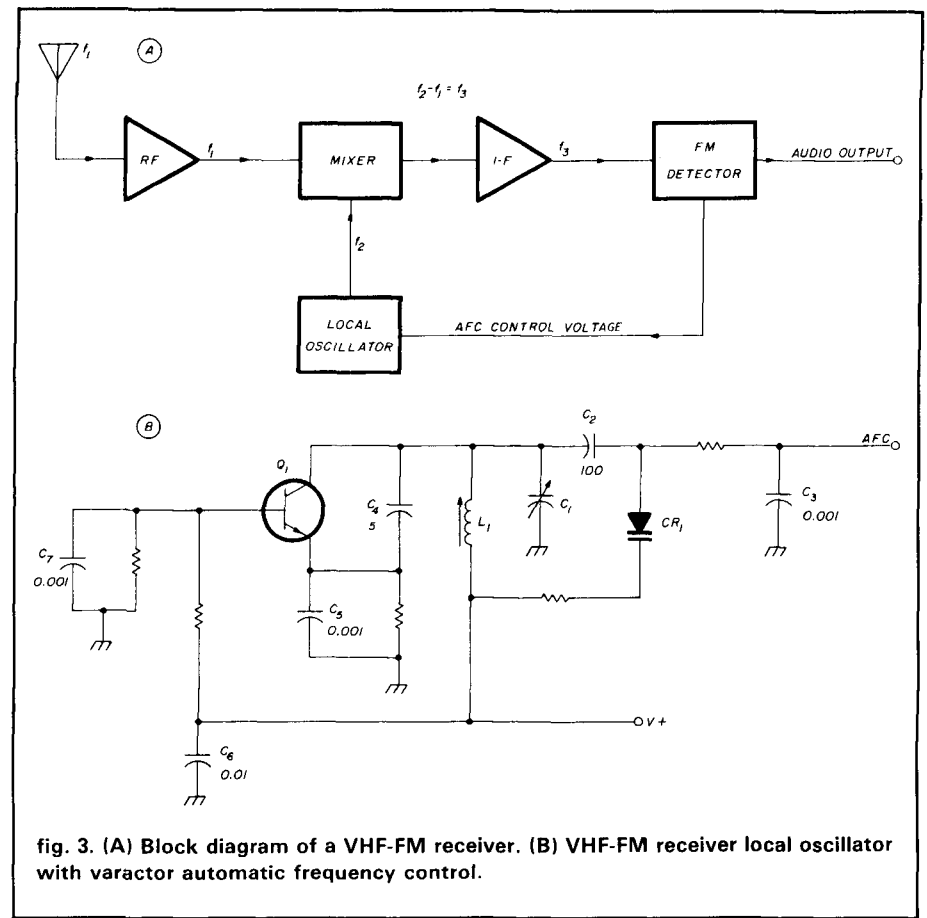


fig. 3. (A) Block diagram of a VHF-FM receiver. (B) VHF-FM receiver local oscillator with varactor automatic frequency control.

teur market. His problem was that it drifted badly, and, in fact, had always drifted, even when it was new. My request was answered by an engineer at Stoner Communications who passed along the information that the rig had been designed by a consulting design engineer whose reputation is spotless. His name is well known to technically oriented Amateurs, but in this case I suspect he would prefer to remain anonymous.

The designer reported that the original prototypes and first production units had a drift spec of 100 Hz in the first 15 minutes, and 50 Hz per hour thereafter . . . not terrific, but good enough for an inexpensive rig. The early rigs actually met the specification. So what happened?

According to the designer, the original design used Litz wire in the VFO inductor and a special low-tempco fiberglass form. The VFO also used DM-25 silver mica capacitors, except

for a couple of ceramics used for temperature compensation. The inexperienced manufacturer, however, had employed a "kid technician" to redesign the rig to make it cheaper to produce. He replaced the Litz wire with enameled wire, the coil form with an off-the-shelf ceramic type, and the DM-25 SM capacitors with NPO disk ceramics. The result was a disaster.

Figure 3A shows the block diagram of an fm receiver. The local oscillator (**fig. 3B**) is kept on-channel by a dc control voltage from the automatic frequency control (AFC) output of the fm detector stage. The actual mechanism of frequency control is the variable capacitance (varactor) diode in the oscillator circuit (CR_1 in **fig. 3B**). This type of diode is used in both LC-tuned circuits, as it's used in broadcast receivers as well as in crystal-controlled units used in communications equipment. If the varactor becomes defective, it will cause a frequency

TOWERS by ALUMA

HIGHEST QUALITY ALUMINUM

- TELESCOPING (CRANK-UP)
- BUYED (STACK-UP)
- TILT-OVER MODELS

Easy to install. Low Prices. Crank-ups to 100 feet.

EXCELLENT FOR AMATEUR COMMUNICATIONS

Over 36 types aluminum towers made — specials designed and made — Write for details.



Mobile Trailer Type



Mobile Truck Type

SPECIAL Four Section 50 Ft. Van Mounted Crank-up Aluma Tower



Fixed Base

ALUMA TOWER CO.

BOX 2806HR

VERO BEACH, FL 32961-2806

(305) 567-3423 803405 MAIN-VERO

✓ 365

SPECIALIZED COMMUNICATIONS

FOR TODAY'S RADIO AMATEUR!



Our 20th Year!

Since 1967, covering all modes of Amateur Radio "specialty" communications; Fast Scan TV, SSTV, FAX, Packet Radio, Computers, RTTY, AMTOR, Satellites, TVRO, Microwave, Lasers and more! 10 issues per year. Back issues available, SASE brings TRS80C, C64, IBM software catalog. U.S. subscribers \$20/year. Foreign slightly higher. Add \$2.00 for Index Issue.

SPEC-COM Communications & Publishing Group

P.O. Box H
Lowden, Iowa
52255-0408



5% Added

BLUE CHIP

PERSONAL COMPUTER



BIG on Power ... 512K RAM Memory At Huge Savings To You!

Factory New! First Quality!

Command the Power... of the highly versatile Blue Chip Computer System that boasts 512K of RAM for productivity plus! Ideal for home and business applications, it consists of the CPU with 2 disk drives, keyboard, monitor, and software. The bottom line—it gives you all the advantages of the industry leader, the IBM PC/XT, yet it takes up about 25% less space. Check our LOW price. Order **huge savings!**

- 512K RAM Memory on Main CPU Board. Can be Expanded to 640K. Has 4.77 MHz Clock.
- An 8088 Based 16-Bit Microprocessor.
- Two 360KB Floppy Disk Drives Included.
- 130 Watt Power Supply. Enough Power to Support a 20 Megabyte Hard Disk.
- Six, 62-pin, Full-Size Expansion Slots Included.
- One Parallel Printer Port and One RS-232C Serial Input/Output Port for the Printer (not included).
- High Resolution 12" Monochrome Monitor. Displays 720 x 348 Dots in Graphics Mode. Green with Non-Glare Treatment. 80 Characters x 25 Rows.
- Monitor Has a 9-Pin D-Sub Connector for Input Terminal. IBM Compatible Cable Included.
- Blue Chip Authorized Service Centers Nationwide. Full List Provided, Plus Toll-Free "Help" Number.

Complete Software Package Includes:

- GS BASIC 3.2, MS-DOS, Software Documentation and Manual.
- Get-Ready-To-Go-Kit Provided. Contains Paper, Spray Cleaner, Screen Wipe, Rolodex, a Computing Magazine, Trial Program Diskette from Finance to Games, and 4-\$50 Money-Saving Coupons.

One-Year Limited Factory Warranty on Parts and Labor.

IBM and IBM-PC/XT are registered trademarks of International Business Machine Corp.

List: **\$1125.00** **\$799**

Liquidation Price
Item H-3157-7304-181 Shipping, handling: \$49.00/set
Plus 50¢ Insurance Charge Per Order.

To Order Call Toll-Free: 1-800-328-0609

Credit card customers can order by phone, 24 hrs. a day, 7 days a week.

SEND TO:

COMB Authorized Liquidator
1405 Xenium Lane N/Minneapolis, MN 55441-4494
Send Blue Chip Personal Computer System(s) Item H-3157-7304-181 at \$799 each, plus \$49 each for ship. handling. Plus 50¢ ins. charge per order. (Minnesota residents add 6% sales tax. Sorry, no C.O.D. orders.)

PLEASE CHECK VISA MasterCard Discover American Express
 My check or money order is enclosed (No delays in processing orders paid by check.)

Acct. No. _____ Exp. _____

PLEASE PRINT CLEARLY

Name _____

Address _____ Apt. # _____

City _____

State _____ ZIP _____

Phone (____) _____

Sign Here _____

**A LIVE
DREAM...
Winter in Florida
ORLANDO
HAMCATION
AND COMPUTER SHOW**



★ REGISTRATION ★

**\$6 Advance • \$8 At Door
Banquet \$12.50**

**Air-Conditioned Swap Table Area
Tables \$25.00 ea.**

**Swap Table Area Open
Friday at Noon**

**Get your Suntan as you Tailgate.
Four Hundred Positions
Tailgating: \$20.00**

*Build your
next vacation
around the south-
land's most popular
Hamfest, at the hub of
the greatest entertainment
and activity center in the east.*

**WHILE HAMCATIONING
TAKE IN THE SIGHTS AT:**

- ★ Disney World ★ Sea World
- ★ Kennedy Space Center ★ Epcot
- ★ Daytona Beach ★ Church Street
Station ★ Busch Gardens
- ★ Cypress Gardens ★ Silver Spgs

ALL MAJOR EXHIBITORS EXPECTED

**ARRL
FLORIDA STATE
CONVENTION
MARCH 11-13, 1988
at ORLANDO'S
EXPO-CENTRE**

**UPGRADE! Volunteer Examinations
by CAVEC • SUNDAY (March 13)**

Send completed Form 610, photocopy of
present license and \$4.00 fee to:
R.V. Mackey, CVE, P.O. Box 1598,
Maitland, Florida 32751
(WALK-INS ACCEPTED)

**PLANNING AHEAD! Here's your Ham-
Cation dates for the next four years:**

MAR. 10-12, 1989 ★ MAR. 9-11, 1990
MAR. 8-10, 1991 ★ MAR. 14-16, 1992

Y'all C'mon Down and Enjoy Our Southern Hospitality

For Tickets, Swap Table and Tailgate reservations
send Check or Money Order and SASE to:

ORLANDO HAMCATION & COMPUTER SHOW
Dept. QST, P.O. Box 547811 • Orlando, Florida 32854-7811

Reservations accepted until 2/15/88. Tickets held at Information Booth after that date.

**73 & 88 for '88
from all the hams at**

ONEARC™

K1BVS-Tom	W900-John	KA9ZNO-Bill
N9GYA-Chuck	WB8RFB-John	KA9ZNP-Steve
N9GZE-Chuck	KA9ZLT-Chuck	KA9ZNU-Duke
W9JUV-Joe	KA9ZLU-Ann	KA9ZNV-Steve
KA9JXU-Bruce	KA9ZLV-Laura	KA9ZOM-Kevin
	KA9ZMW-Jeff	

ONEARC CORPORATION 27944 N. Bradley Rd.
Libertyville, IL 60048
(312) 680-4680

**GENERATE YOUR OWN
AMATEUR RADIO
EXAM**

ALL ELEMENTS

Novice through Extra with the
latest Exam syllabus questions.

Use MS-DOS, IBM compatible,
computers

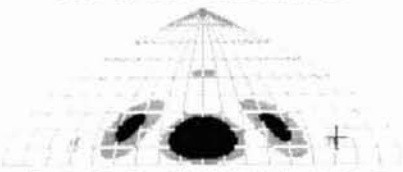
\$19.95 per element post-paid

contact:

**DeVRY AMATEUR
RADIO SOCIETY**

3300 N. Campbell
Chicago, ILL 60618
(312) 929-8500 ex 2221

**A better way to design
and analyze Long wires,
Vee's, and Rhombics.**



LONG WIRE PRO

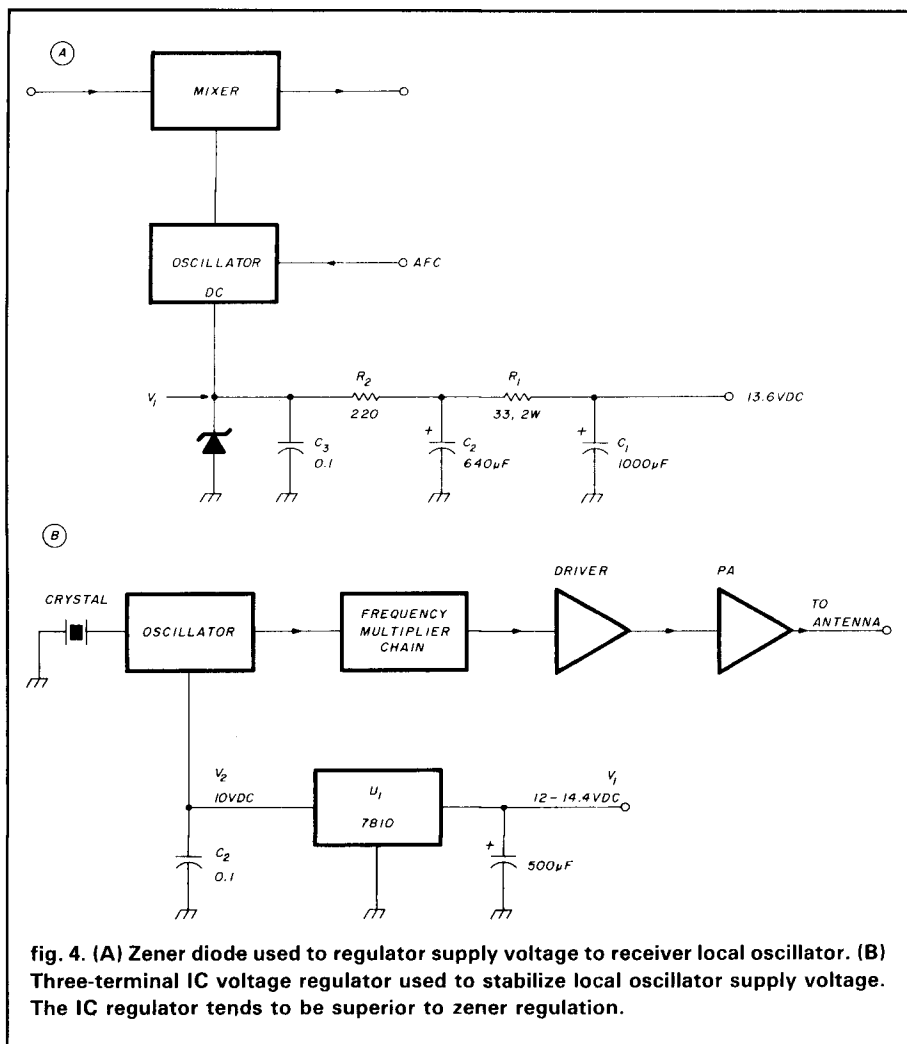
Easy to use, menu driven, select wire length,
height, frequency, ground type, and get a color
coded sinusoidal projection of your HF antenna.

For the IBM PC and compatibles,
DOS 2.0 or higher, 256K, color required.

Price \$35.00

EPSILON CO

Box 715, Trumbull CT, 06611, (203) 261 7694



shift; on the other hand, if the diode is intermittent, the circuit will jump on and off the channel as the diode opens and closes the circuit. Over the years, I've seen, however, quite a number of sets in which a newly developed (as opposed to inherent) drift problem was caused by a defective diode. For some reason, the diode capacitance was a function of temperature. I once measured — more casually than scientifically — about five diodes that showed this effect, and found that all had excessive leakage resistance in the reverse-bias direction.

Don't overlook the dc power supply as a potential source of drift problems! Oscillators typically require fixed, well-regulated dc operating potentials for best stability. That dictum applies equally well to both LC-tuned and crystal oscillators. If the dc voltage, or

bias voltages, change, you can expect the oscillator frequency to shift.

The problem with dc voltage is especially acute in mobile equipment, whether designed for communications or broadcasting. In the early 1960s I worked in a car radio shop that dealt with Blaupunkt receivers, the German-made radios found in Porsches, for example. One customer came in with an odd problem: his radio changed frequency with changes of engine speed. That set, which used vacuum tubes, had a germanium diode across the resonant circuit to limit oscillation amplitude. A gas-regulator tube that was supposed to keep the potentials applied to the circuit was defective. Because the power supplied to the radio varies markedly with engine speed, the now-unregulated power supply voltage applied to the oscillator also

varied. Although I frequently chuckled at customers' diagnoses, I never again doubted this customer's description of the symptom: "... it changes stations when I pull away from a light!")

Modern mobile electronic equipment is probably more subject to this type of fault than some of the older equipment. In communications equipment and fm broadcast receivers, the oscillator voltage is typically regulated. In **fig. 4A** we see the zener diode regulator generally used in many car radio circuits; in **fig. 4B**, we see the three-terminal IC voltage regulator that keeps the oscillator voltage to +10 volts in a certain mobile transmitter master oscillator. If any of these components fail, shift or drift will result.

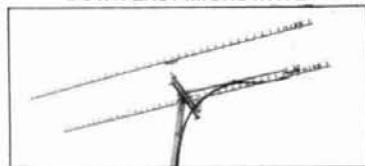
The nominal "12-volt" vehicle power supply is actually quite variable. With the engine off, my own car measured 11.8 VDC on one meter, and 12.05 VDC on my DMM. When the engine is started, however, the voltage varies from 12.3 VDC at an idle to 14.5 VDC as the engine speed is increased. To an oscillator inside electronic equipment, that range might be intolerable.

Crystal oscillators aren't immune to drift problems, even when they previously worked well. In addition to the problems with dc power supplies mentioned above, it's also possible for the crystal to become defective. Over the years, I've seen several sets in which a terrible drift problem resulted from defective crystal elements. Replacing the crystal solved the problem.

problems peculiar to older equipment

Certain older Amateur equipment exhibits a problem in frequency shift that's due to the use of ferrite cores in the VFO and i-f coils. Ferrite cores age with time and heat, and as a result have a different permeability than when the equipment was first calibrated. I've seen that problem even on the legendary Collins Permeability Tuned Oscillator (PTO) used in their Amateur and commercial communications equipment. In some cases, a simple realignment will suffice to bring the coil back to the correct resonant frequency. In

DOWN EAST MICROWAVE



MICROWAVE ANTENNAS AND EQUIPMENT

• Loop Yagis • Power Dividers • Linear Amplifiers • Complete Arrays • Microwave Transverters • GaAsFET Preamps
• TROPO • EME • Weak Signal • OSCAR • 902 • 1269 • 1296 • 2304 • 2400 • 3456 MHz

2345 LY 45el loop Yagi 1296 MHz 20dBI \$93
1345 LY 45el loop Yagi 2304 MHz 20dBI \$80
3333 LY 33el loop Yagi 902 MHz 18.5dBI \$93

Above antennas assembled and tested. Kits also available.

All Aluminum and Stainless Construction.

Add \$6 UPS S/H, \$11 West of the Mississippi.

2316 PA Linear Amp 1W in 18W out 1296 MHz 13.5V. \$245 ppd.

2335 PA Linear Amp 10W in 35W out 1296 MHz 12.5V. \$295 ppd.

NEW! MICROWAVE TRANSVERTERS

BY LMW ELECTRONICS

1296TRV6D 6W GaAsFET, T/R Sequencer, Output Meter \$569

2304TRV2D 2W GaAsFET, T/R Sequencer, Output Meter \$649

Add \$6 for shipping UPS/48

Stripped down version, kits also available

Write For FREE Catalog



DOWN EAST MICROWAVE

Bill Olson, W3HQT

Box 2310, RR 1, Troy, ME 04987

(207) 948-3741



175

QSO PRO

A Easy-To-Use Logbook

Program For Your

MS-DOS® Compatible Computer

- ★ Complete Cursor Control
- ★ Room to store complete address information
- ★ A Real-Time Log
- ★ Total QSL's by State
- ★ 900 QSO's on floppy, hard disk limited by space available



~~\$39.95~~

Introductory Offer

\$34.95*

*Ohio resident must add 5% sales tax.

Make Checks Payable To:

MORLAN SOFTWARE

P.O. Box 2400

East Liverpool, Ohio 43920-0400

176

A RACE ON THE EDGE OF TIME

Radar — The Decisive Weapon of WW II

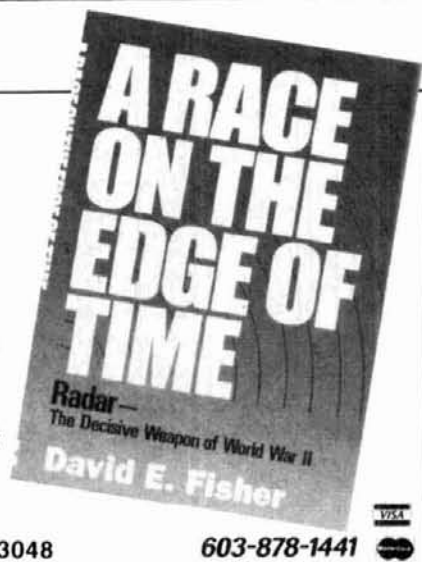
by David E. Fisher

A Race On The Edge Of Time reads like a thriller but is based upon painstaking and comprehensive research by the author. In fact, Fisher argues rather convincingly that radar was the crucial factor that allowed the allies to win the war and that radar has played the same important role in our current military and political environment. Filled with fascinating twists and turns of history that could have changed the war's outcome, anecdotes about the personalities involved in the development of radar and other military insights. Also includes radar development post WW II and how it will influence future battles. Illustrated with rare vintage photographs and diagrams.

MH-21088

Hardbound \$19.95

Please enclose \$3.50 shipping and handling.



ham
radio
magazine

BOOKSTORE

GREENVILLE, NH 03048

603-878-1441



other cases, replacement of the coil, or at least the ferrite core, is required.

Several years ago I had the opportunity to help a Novice on the air with a 20-year-old Heath DX-60B he bought for a song at the Gaithersburg Hamfest. He complained that keying was erratic: sometimes it keyed, other times it didn't. It rapidly became apparent by looking at the grid and plate meter readings that the oscillator wasn't running all the time. It turned out that the DX-60B crystal oscillator circuit uses a tuned plate circuit. The ferrite core of the coil had dried out over the years and mistuned the oscillator. Readjusting the coil made the oscillator run properly.

heat problems

Because the source of many drift problems is the temperature coefficient of capacitors and inductors, it seems obvious that temperature needs to be controlled in radio equipment. In the past, several otherwise well-regarded pieces of equipment suffered drift because of the tremendous heat buildup inside the cabinet. In some cases, ventilation and a blower might help; in other cases, using a little insulation in and around the offending oscillator is also helpful. In certain crystal oscillator circuits we can make progress by designing in a crystal oven to keep the crystal temperature constant.

equipment modification

Amateurs have a long tradition of

modifying commercial equipment. Although many mods are ill advised, some are certainly worthwhile and well engineered. The process is a lot less dangerous, incidentally, if you make good notes so that the rig can be restored to original condition if the mod doesn't work out as expected. For most equipment, the first place to start is to make sure that the power supply voltage to the oscillator is stable. Check to confirm that the printed circuit board, its mounting, and individual components, are solidly anchored. Finally, make sure the circuit isn't overheating.

If those methods fail to solve the problem, then and only then dive into the circuit to attempt temperature compensation. We'll look into the subject in a future column. If you have any insight on procedures or techniques, please communicate them to me so that they can be shared with others.

conclusion

In many cases, the sources of frequency shift and drift problems may be difficult to detect. Understanding the causes and potential solutions of these problems goes a long way toward finding and correcting the fault.

I'd be happy to receive your comments, questions, and suggestions for future columns. My 1987 (and earlier) Callbook address is incorrect, so please contact me at P.O. Box 1099, Falls Church, Virginia 22041.

ham radio



power speaker enhances mobile operation

Asked to name a problem that universally impairs the pleasure of operating most mobile stations, regardless of mode or band, most hams will say, "a serious lack of adequate receiver audio." This isn't surprising, considering the micro-sized speakers that are now standard in new radios.

Miniaturization isn't a problem in the average Amateur home station, where the sound produced by a 2-inch speaker is more than adequate, but it does present a problem when a radio is mounted under the dashboard of a car. Typically, the speaker ends up directing its puny audio towards the floor, away from the driver, and into heavy carpeting — with dismal results.

This weekender shows how to overcome that problem. My external speaker, combined with an integral amplifier, provides enough audio for any situation. Used with a radio equipped with an external speaker or earphone jack, it will produce several watts of loud, crisp audio. A few milliwatts of audio will drive it to full output.

You can also add this amplified speaker to any of the popular hand-held VHF transceivers. By doing so, you'll improve your audio and dramatically extend the life of your hand-held's battery. You may also find that other small portable radios, scanners, televisions, cassette recorders and similar items can also make good use of this project.

the circuit

The amplifier circuit is built around the LM383 IC, which I chose because it's stocked by Radio Shack and is carried by RCA SK replacement-device dealers. Actually, almost any audio IC intended for 12-volt operation and capable of delivering 4 or 5 watts of

audio will work, providing the necessary circuit changes are made. **Figure 1** shows the schematic for the LM383 amplifier.

An input attenuator composed of resistors R1 and R2 reduces the audio level and prevents overdriving the amplifier. The 22-ohm resistor provides a low-impedance termination for the receiver audio stage. These three resistors weren't included on the pc board layout, but instead were mounted on a phenolic tie-strip to allow quick empirical substitutions to be made.

Negative feedback is used in this amplifier to improve its linearity and bandwidth and to set the closed-loop gain. The 2.7-ohm resistor sets the feedback level. (This value was optimum for this application. Values from 1 to 4.7 ohms may better suit other applications requiring more or less gain.) Capacitors C2 and C3, which help prevent rf detection, are mounted on the foil side of the board using short leads. Shielded audio cable, or even RG-174, should be used for audio connections between the speaker and radio.

how much audio is enough?

This amplifier will drive speakers between 2 and 16 ohms impedance. However, the load impedance sets the maximum audio power. Assuming a 13.8-volt supply, a 4-ohm speaker will allow about 5 watts of audio, while with a 2-ohm speaker the amplifier will deliver nearly 8 watts. Four watts of audio into an efficient speaker system is one heck of a lot of noise; a 4-ohm speaker will do well here.

putting it together

The amplifier is built on a small section of copper-clad PC material. Although this amplifier is intended for audio, a-f ICs will often perform well into the rf frequencies, so good hf practices — a wide, low-impedance ground plane, adequate bypassing, and short leads — must be followed if instability is to be avoided.

Stability is further enhanced by the use of inverse feedback and by the presence of the 0.22- μ F capacitor swamping the amplifier output.

To reduce failures caused by mechanical vibration, larger parts, such as electrolytics, may be fastened to the board with a strip of silicone adhesive. The tab of the IC must be heatsunk; either the metal speaker enclosure or a piece of aluminum should be used. Use thermal compound between the LM383 tab and the heatsink.

selecting parts

Don't worry if the exact capacitor values aren't available; considerable leeway is permissible here. But choose the enclosure and speaker carefully. This isn't the place to cut corners. Select a rugged speaker with

By Peter Bertini, K1ZJH, 20 Patsun Rd., Somers, Connecticut 06071



new

LOW BAND DX-ING COMPUTER PROGRAMS

by John Devoldere, ON4UN, for
Apple IIe/c, MS-DOS, Commodore
C-128 Apple Macintosh and Kaypro
CPM Computers

Here's a collection of 30 super programs written by ON4UN. Just about every interest or need is covered—from antenna design and optimization to general operating programs. Antenna programs include: shunt and series input L network design, feedline transformer, shunt network design, SWR calculation, plus 11 more! General Ham programs include: sunrise/sunset, great circle distances, grayline, vertical antenna design program, sunrise calendar plus 9 more! Phew. When you sit down to use these programs you'll be amazed at what you have. The best value in computer software available today. © 1986.

- | | |
|---|-------------|
| <input type="checkbox"/> UN-Apple IIe/IIc | \$39.95 ea. |
| <input type="checkbox"/> UN-MS (MS-DOS) | \$39.95 ea. |
| <input type="checkbox"/> UN-CPM/Kaypro | \$39.95 ea. |
| <input type="checkbox"/> UN-C-128 (COMMODORE) | \$39.95 ea. |
| <input type="checkbox"/> UN-MAC (MACINTOSH) | \$49.95 |

LOW BAND DX'ING

by John Devoldere ON4UN

Now Available! The new, 2nd edition of the definitive book on Low Band DX'ing. Based upon years of practical on-the-air experience, learn the secrets of how ON4UN has been so successful on the low bands. Extensive coverage is given to transmit and receive antennas with clear concise explanations and plenty of illustrations—dipoles, inverted Y's, slopers, phased arrays and Beverages—they're all in this book. Also covered: propagation, transmitters, receivers, operating, software and an extensive Low Band bibliography. Going to be a best seller! Get yours today. © 1987 2nd Edition 200 pages

- AR-UN Softbound \$9.95

BUY'EM BOTH SPECIAL OFFER

Book & Software Reg. \$49.90
(\$59.90 for Mac)

Just \$44.90 (\$54.90 for Mac)

- UN-SO (specify computer) \$44.90
 UN-MSO Macintosh Special \$54.90

SAVE \$5

Please enclose \$3.50 shipping & handling

ham radio BOOKSTORE

GREENVILLE, NH 03048 603-878-1441

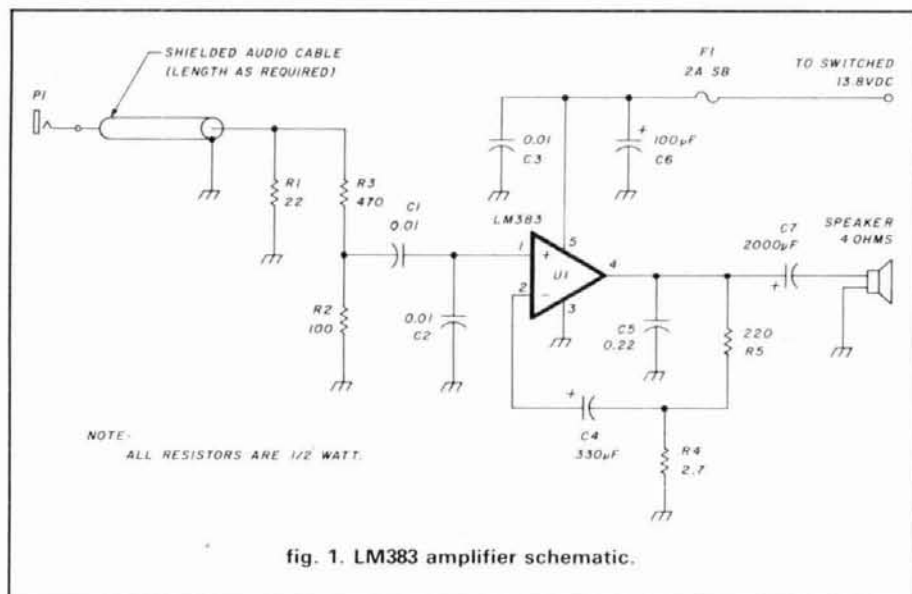


fig. 1. LM383 amplifier schematic.

a stiff cone and a large magnet. The enclosure can be a home-crafted affair, as long as it's structurally sound and free of rattles.

A good source of speakers and companion enclosures is mobile-radio repair shops or dealers who are willing to sell directly to Amateurs. They often have used speakers for sale at reasonable prices. You may have to select an off-brand if the dealer's selection is limited; their priority is to sell accessories as complete packages from inventory. Speakers available from mobile-radio dealers and repair shops are generally of better quality than the general-replacement lines sold by radio and TV repair shops. Be sure to check out your purchase in advance. Years of on-the-job wear and tear take their toll: watch for torn or otherwise damaged cones. Auto-sound stores also carry suitable speakers and matching enclosures.

I mounted the amplifier assembly inside the speaker enclosure. This is largely a personal choice; a separate box housing the amplifier will do as well. My unit is built around an early Motorola mobile speaker. Although its dated styling and large size led to its premature retirement from commercial service, its robust and roomy steel enclosure was well suited for this project.

installation

Once the amplifier is built and tested (and, I hope, working) it's time to install it in the vehicle. Mount the speaker in a clear, unobstructed spot from which the audio can be directed at the driver. Power may be taken from the fuse block; look for a point labeled "accessory" or "ignition." Usually a female or male spade connector is needed to make the power connection. Most automotive stores carry an assortment of these crimp-on connectors. Be sure to fuse the power lead near the power take-off point. Some cars may not have points available to take the power off the fuse block. For these rare instances it's possible to purchase special "piggy-back" connectors that allow additional connections to be made to existing fuses. If alternator whine or other automotive electrical noise is objectionable, try taking power from a different point. Going directly to the battery often works well, but then a power switch will be needed on the speaker. A brute-force filter, consisting of a choke and filter capacitor, is available from Radio Shack.

I hope this speaker will increase your mobile operating pleasure as much as it has mine.

ham radio



Rob, WA3QLS



Katherine, KA3IYO



Paul, WA3QPX

Delaware Amateur Supply

71 Meadow Road, New Castle, Del. 19720 302-328-7728

Factory Authorized Dealer

9-5 Daily, 9-8 Friday, 9-3 Saturday

AEA • ALINCO • AMERITRON • CUSHCRAFT • ICOM
KANTRONICS • KENWOOD • MOSLEY • SANTEC
TELEX HY-GAIN • TENTEC • YAESU • AND MORE!

800-441-7008

New Equipment Order & Pricing

Large Inventory



Prices are subject to
change without notice
or obligation.
Products are not sold
for evaluation.

**NO Sales Tax
in Delaware!**
one mile off I-95

**SERVICE,
USED GEAR INFO:
302-328-7728**

Daily UPS Service



The HF4B "Butterfly"™
A Compact Beam
for 20-15-12-10 Meters



- Unique design reduces size but not performance.
- No lossy traps, full element radiates on all bands.
- Retrofit kit for 17 meters coming soon
- Turns with TV rotor
- Only 17 lbs.

HF ANTENNAS FROM BUTTERNUT

Butternut Verticals

Butternut's HF verticals use highest-Q tuning circuits (not lossy traps!) to outperform all multiband designs of comparable size!

Model HF6V

- 80, 40, 30, 20, 15 and 10 meters automatic bandswitching
- Add-on kit for 17 and 12 meters available now
- 26 ft tall

Model HF2V

- Designed for the low band DXer
- Automatic bandswitching on 80 and 40 meters
- Add-on units for 160 and 30 or 20 meters
- 32 feet tall - may be top loaded for additional bandwidth

For more information see your dealer or write for a free brochure



BUTTERNUT ELECTRONICS CO

405 East Market Lockhart, Texas 78644



Wideband Preamp 10-1000 Mhz

Dual GasFet low noise preamplifier for HF, UHF or VHF systems. Just perfect for the R-7000. Excellent for Spec Analyzers, Scanners, etc. Gain 20 Db +/- 1 DB, -3 Db at 2 & 1100 Mhz. 1 Db compression of >10 Dbm. Intercept points >45 Dbm. New shipped price of only \$124.95. Pa. residents please add 6% state tax.

GTI Electronics

RD 1 BOX 272
Lehighton, Pa. 18235
717-386-4032

✓ 172

INDUSTRIAL QUALITY REPLACEMENT BATTERIES FOR COMMUNICATIONS

Nickel-Cadmium, Alkaline, Lithium, etc.

Repair Packs For
ICOM®, KENWOOD, YAESU,
SANTEC, AZDEN, TEMPO,
CORDLESS PHONES... AND MORE!

NEW! I.C.E. PACK \$49⁹⁵



E.H. YOST & CO.

EVERETT H. YOST KB9XI
7344 TETIVA RD.
SAUK CITY, WI 53583
ASK FOR OUR CATALOG
(608) 643-3194

✓ 173

NEMAL ELECTRONICS

- *Complete Cable Assembly facilities MIL-STD-45208
- *Commercial Accounts welcome- Quantity pricing * Same day shipping most orders
- *Factory authorized distributor for Alpha, Amphenol, Belden, Kings, Times Fiber

Call NEMAL for computer cable, CATV cable, Flat cable, semi-rigid cable, telephone cable, crimping tools, D-sub connectors, heat shrink, cable ties, high voltage connectors.

HARDLINE 50 OHM

FXA12 1/2" Aluminum Black Jacket.....	89/ft
FLC12 1/2" Cablewave corr. copper blk jkt	1.59/ft
FLC78 7/8" Cablewave corr.copper blk jkt	3.92/ft
NM12CC N conn 1/2" corr copper m/ft	23.00
NM78CC N conn 7/8" corr copper m/ft	54.00

COAXIAL CABLES (per ft)

1180 BELDEN 9913 very low loss	48
1102 RG8/U 95% shield low loss foam 11ga.....	32
1110 RG8X 95% shield (mini 8)	15
1130 RG213/U 95% shield mil spec NCV jkt.....	36
1140 RG214/U dbl silver shld mil spec.....	1.65
1705 RG142B/U dbl silver shld, teflon ins	1.50
1310 RG217/U 50 ohm 5000 watt dbl shld	85
1450 RG174/U 50 ohm .100" od mil spec	14

ROTOR CABLE-8 CONDUCTOR

8C1822 2-18ga and 6-22ga	19/ft
8C1820 2-18ga and 6-20ga	36/ft

CONNECTORS-MADE IN USA

NE720 Type N plug for Belden 9913	\$3.95
NE723 Type N jack for Belden 9913.....	4.95
PL259 standard UHF plug for RG8,213.....	65
PL259AM Amphenol PL259	89
PL258TS PL259 teflon ins/silver plated.....	1.59
PL258AM Amphenol female-female (barrel).....	1.45
UG175/UG176 reducer for RG58/59 (specify).....	22
UG210S N plug for RG8,213,214 Silver.....	3.35
UG83B N jack to PL259 adapter, teflon	6.50
UG146A SO239 to N plug adapter, teflon	6.50
UG255 SO239 to BNC plug adapter, Amphenol.....	3.29
SO239AM UHF chassis mt receptacle,Amphenol.....	89

GROUND STRAP-GROUND WIRE

GS38 3/8" tinned copper braid	30/ft
GS12 1/2" tinned copper braid	40/ft
GS200 1-1/2" heavy tinned copper braid	2.00/ft
HW06 6ga insulated stranded wire	35/ft
AW14 14ga stranded Antenna wire CCS	12/ft

*Shipping: Cable \$3/100, Connectors \$3.00, Visa/Mastercard \$30 min, COD add \$2.00
Call or write for complete price list. NEMAL's new 36 page CABLE AND CONNECTOR SELECTION GUIDE is available at no charge with orders of \$50 or more, or at a cost of \$4 with credit against next qualifying order.

NEMAL ELECTRONICS, INC. 12240 NE 14th Ave. N. Miami, FL 33161
(305) 893-3924 Telex 6975377 24hr FAX (305)895-8178

✓ 171

Electronic Repair Center

Servicing

Amateur Commercial Radio

The most complete repair facility on the East Coast.

Large parts inventory and factory authorized warranty service for Kenwood, Icom and Yaesu.

SEND US YOUR PROBLEMS

Servicing "Hams" for 30 years, no rig too old or new for us.

HAMTRONICS, INC.

4033 Brownsville Road

Treose, Pa. 19047

215-357-1400



locator field list

Do you like challenges? If the widespread acceptance of the DXCC, WAZ, and sundry other operating awards proudly displayed by Amateurs throughout the world is any indication, I'm sure you do.

Folke Rosvall, SM5AGM, has taken it upon himself to compile, on a per-band basis, the total number of fields worked by individuals. His list appears in *ham radio* four times a year (see page 75 of the July issue for the first list published in these pages).

"But," you ask, "What's a field?" Glad you asked. According to the Maidenhead locator system, the world is divided into 324 fields or areas, each 20 degrees wide in longitude and 10 degrees wide in latitude. Though most encompass land masses, quite a few do not; this means no countries, no islands, no reefs—just water. So even if you've worked every country in the world and your name is at the top of the honor roll, you still probably haven't worked all the fields. For example, I'm very active on 80 meters, yet I've been able to snag only 148 out of 324 fields. I can think of a number of other 80-meter operators who are even more active than I am.

Have I tickled your competitive spirit? Think of the ultimate challenge: *work all fields on all 19 bands on one specific mode*. Some quick calculating shows that to be...uh...6156 contacts. That'll keep you off the streets (but probably get you into trouble with your family, your employer, etc.). Seriously, it's all for fun, and you'll learn a little more geography in the process.

All the necessary details are included on the accompanying chart. Folke would be very glad to hear from you. Please send your tabulations directly to him (his address at the bottom of the chart)—not to *ham radio*.

See you on 80!

Rich Rosen, K2RR

LOCATOR FIELD LIST										OJ	PJ	QJ	RJ				
AJ	BJ	CJ	DJ	1987-09-30, COMPILED BY SM5AGM (JO99DK). WHO WILL BE THE FIRST RADIO AMATEUR TO WORK ALL 324 FIELDS ON THE SAME BAND?										OI	PI	QI	RI
AI	BI	CI	DI														
1.8 MHZ	1 W1JR 2 SM3CWE	FN JP	70 870920 54 870630	3 SM6CTQ 4 OK1DKS	JO JO	33 850127 11 870929	5 SM0LH 6 SM4JXG	JO JO	5 860322 3 861231	7 SM0NZB 8 SK6AW	JO JO	2 870630 1 870630					
3.5 MHZ	1 K2RR 2 SM3CWE 3 W1JR	FN JP FN	150 870923 130 870630 102 870920	4 SM0CCE 5 SM7WT 6 SM0HTO	JO JO JO	79 850122 68 850129 64 851230	7 SK6AW 8 SM5CAK 9 SM6INC	JO JO JO	58 870630 56 860921 29 870630	10 OK1DKS 11 SM3CVM 12 KC9RG	JO JP EN	24 870929 23 870930 10 870630	13 SM0LH 14 SM4JXG	JO JO	8 860322 7 861231		
7 MHZ	1 SM3CWE 2 SM0CCE 3 W1JR 4 SM7WT	JP FN FN JO	142 870630 138 850122 119 870920 97 850129	5 SM7PKK 6 SM6INC 7 SK6AW 8 SM3CVM	JO JO JP JP	86 870322 76 870630 67 870630 59 870930	9 SM0HTO 10 OK1DKS 11 SM0LH 12 9V1RH	JO JO JO OJ	47 851230 21 870929 15 860209 14 870610	13 SM5CAK SM4JXG KC9RG 16 SM0NZB	JO JO EN JO	11 860921 11 861231 11 870630 5 870630					
10 MHZ	1 W1JR 2 SM2FP 3 SM6INC	FN OJ JO	43 870920 31 861220 23 870630	4 SM5FUG 5 SM5ACO 6 SM3CWE	JO JO JP	21 860912 17 870625 13 870630	7 SM6MSG 8 SM0LH 9 SM4JXG	JO JO JO	10 850930 9 860322 9 861231	10 SM0HTO 11 SM7BDB 12 SM5PAX	JO JO JO	7 851230 5 850922 4 850930	13 SM5CAK SM0NZB 15 KC9RG	JO JO EN	3 860921 3 870630 1 870630		
14 MHZ	1 SM3CWE 2 SM7WT 3 SM0HTO W1JR	JP JO JO FN	222 870630 201 850331 192 851231 192 870920	5 SM0CCE 6 SK6AW 7 W6DU 8 SM6INC	JO JO CM JO	186 850122 157 870630 147 860526 131 870630	9 SM5ACO 10 OK1DKS 11 SM5CAK 12 SM0LH	JO JO JO JO	122 850930 90 870929 73 860921 57 860212	13 SM3CVM 14 SM5FBL 15 KC9RG 16 SM4JXG	JP JO EN JO	50 870930 44 850126 40 870630 37 861231					
18 MHZ	1 SM6INC 2 SM5ACQ	JO JO	18 870630 12 870331	3 SM7BDB 4 SM4JXG	JO JO	8 850922 7 861231	5 SM0LH 6 SM5PAX	JO JO	5 860322 3 850930	SM0HTO 8 SM3CWE	JO JP	3 851230 2 870630	9 9V1RH	OJ	1 870610		
21 MHZ	1 SM3CWE 2 SM0CCE 3 SM7WT	JP JO JO	158 870630 153 850122 131 850129	4 SK6AW 5 SM6INC 6 SM5DUT	JO JO JO	116 870630 109 870630 97 870910	7 SM5ACO 8 OK1DKS 9 SM0HTO	JO JO JO	95 850930 72 870929 52 851230	10 SM0LH 11 SM4JXG 12 SM3CVM	JO JO JP	44 860209 38 861231 31 870930	13 KC9RG 14 W1JR 15 SM5CAK	EN FN JO	26 870630 3 870630 10 860921		
24 MHZ	1 W1JR 2 SM7AST/CTI 3 SM6INC	FN IM JO	27 870920 15 870911 12 870630	4 SM0HTO SM4JXG SM5ACO	JO JO JO	5 851230 5 861231 5 870506	7 KC9RG 8 SM7BDB 9 SM0LH	EN JO JO	3 870630 2 850922 1 860209	9V1RH SM3CWE	OJ JP	1 870610 1 870630					
28 MHZ	1 DF2NJ 2 SM6LF 3 SM0HTO 4 SM7LXV	JO JO JO JO	159 851111 143 850909 139 851230 127 850630	5 SM0CCE 6 SM3CWE 7 SM6INC 8 SM7WT	JO JP JO JO	126 850122 123 870630 111 870630 108 850129	9 SM0HJV 10 SK6AW 11 SM5DUT 12 SM5ACQ	JO JO JO JO	93 860917 90 870630 69 870910 53 850930	13 SM0LH 14 W1JR 15 OK1DKS 16 SM0JXA	JO FN JO JO	32 860212 29 870920 22 870929 21 861101	17 KC9RG 18 SM4JXG 19 SM5CAK 20 SM3CVM	EN JO JO JP	17 870630 12 861231 9 860921 7 870930		
50 MHZ	1 WA1OUB 2 NOLL W1JR	FN EM FN	46 860901 41 861106 41 870920	4 K0TLM 5 W3VFM 6 KA9MGR	EM FM EN	40 870614 33 870901 16 860331	7 W6RXQ 8 K13W 9 NFDS	CM FN EN	15 870630 14 870630 12 870928	10 JQ1GTC KC9RG	OM EN	5 861212 5 870630					
144 MHZ	1 SM7BAE 2 VE7BOH 3 DL8DAT 4 K1WHS	JO CN JO FN	45 870214 42 870113 41 870620 38 840930	5 SM2GGF 6 Y22ME 7 YU3WV 8 SM4GVF	KP JO JN JN	37 850622 36 861231 35 870331 34 860930	9 YU3ZV 10 WA1JXN F6CJG 12 F6BSJ	JN DN JN JN	32 831231 32 840608 32 840110 31 840903	OZ1EME SM4IVE WA4NJP HB9CRQ	JO JO EM JN	31 841224 30 840609 30 840903 30 870818	17 KB7Q 18 OH7PI W5UN KD8SI	DN KP DM EM	29 851231 28 831231 28 840428 28 850118		
220 MHZ	1 W1JR	FN	10 870920	2 KA9MGR	EN	4 860331	3 W6RXQ	CM	3 870630								
432 MHZ	1 K2UYH DL9KR 3 YU1AW W1JR	FN JO KN FN	33 850331 33 861001 30 860407 30 870920	5 WB5LUA OK1KIR 7 W7GBI 8 SM3AKW	EM JN DM JP	28 840428 28 870623 27 840505 26 861231	9 VE4MA 10 SM6CKU SO1MN 12 OH6NU	EN JO JO KP	23 830331 21 821231 21 860617 20 821231	13 K1FO Y22ME 15 SM0DJW 16 HB9CRQ	FN JO JO JN	19 850318 18 861231 18 851231 13 870818	17 W7HAH 18 OH7CY 19 OZ3ZW SM6FYU	JO DN JO JO	12 860314 10 830627 7 850630 7 860330		
902 MHZ	1 W1JR	FN	2 870920														
1.3 GHZ	1 K2UYH 2 OK1KIR 3 OE9XXI 4 WB5LUA	FN JN JN EM	20 850331 18 870623 16 850331 13 840428	W7GBI 6 SM6CKU 7 YU1AW 8 W6YFK	DM JO KN CM	13 840505 12 821231 11 860407 7 840506	OE9FKI OZ3ZV DL7YC 12 SM6HYG	JN JO JO JO	7 850331 7 850630 6 840411 5 821231	SM0DJW SM3AKW 15 SM0PYP SM4AXY	JO JO JO JO	5 851231 5 861231 4 830331 4 831231	HB9CRQ W1JR OK1DKS 20 K1FO	JN FN JO FN	4 870818 4 870920 4 870929 3 860318		
2.3 GHZ	1 W4HHK OE9XXI OK1KIR	EM JN JN	4 850304 4 850331 4 870623	4 SM6HYG W6YFK 6 W1JR	JO CM FN	3 830331 3 840506 2 870920	OK1DKS 8 PA0SSB WB5LUA	JO JO EM	2 870929 1 821231 1 840428	WA4HGN OZ1CFO W6RXQ	EM JO CM	1 840505 1 850826 1 870630					
3.4 GHZ	1 SM6HYG	JO	1 850914														
5.7 GHZ	1 SM6HYG	JO	1 850914	OZ1CFO	JO	1 850930											
10 GHZ	1 SM5QA 2 SM0DJW	JO JO	4 870930 2 850630	YU1AW W6RXQ	KN CM	2 860205 2 870630	W2TTM 6 SM6HYG	FN JO	2 870927 1 850914	SM7ECM W1JR	JO FN	1 860930 1 870920					

This list shows the number of fields worked according to the Maidenhead Locator system. A field is a block of 20° (longitude) × 10° (latitude). Rules: 1. All fields must have been worked via passive reflectors. 2. All stations involved must be on the earth's surface. 3. QSL cards are not required if you are sure that the other station considers the QSO complete. 4. All QSO's must have been worked from points within a circle of 1000 km radius. 5. There is no starting time for contacts to be eligible. A world map showing the 324 fields can be found in "The Radio Amateur's World (Locator) Atlas", that normally should be available at your national amateur radio society.

Compiled quarterly since 1982, the list shows the situation on March 31, June 30, September 30 and December 31 at 2400 UT. Please send your info as soon as possible after each date to SM5AGM, Folke Rosvall, Vasterstarsringen 50, S-184 00 Akersberga, Sweden. Tel. 0764-27638.



Ham Radio
Computer Hardware
Computer Software
Plans-Kits
Schematics
Test Equipment
CB Gear
Satellite TV
Video
Components
Antique Electronics
Cable TV
Publications
Repairs-Services
New Products
Events Calendar

IF YOU ARE INTO ELECTRONICS AND SAVING MONEY IS IMPORTANT TO YOU, THEN YOU OWE IT TO YOURSELF TO TRY NUTS & VOLTS MAGAZINE. DISCOVER WHY THOUSANDS OF SMART PEOPLE NATIONWIDE TURN TO NUTS & VOLTS EACH MONTH TO MEET THEIR ELECTRONIC NEEDS. WHETHER YOU'RE BUYING, SELLING, OR JUST TRYING TO LOCATE THOSE UNIQUE OR HARD-TO-FIND ITEMS, FIND OUT HOW NUTS & VOLTS CAN HELP!

SUBSCRIBE TODAY!

CHECK MONEY ORDER VISA MC

Name _____

Address _____

City _____

State _____ Zip _____

Card No. _____ Exp. Date _____

CALL FOR ADVERTISING INFORMATION
DISTRIBUTOR INQUIRIES INVITED

Subscription Rates

U.S. FUNDS REQUIRED

3rd Class Mail - USA

One Year \$10.00
Two Years \$18.00
Lifetime \$50.00

1st Class Mail

One Year - USA ... \$18.00
Canada & Mexico .. \$20.00

Air Mail

Foreign - 1 Year ... \$50.00

Includes one FREE 40-word
Classified Ad ✓ 174

A National Publication For The Buying And Selling Of Electronic Equipment

***** Super Comshack 64 *****
Programmable Repeater Controller/HF & VHF Remotes/Autopatch
Engineering Consulting 583 Candlewood St. Brea, Ca. 92621 Tel 714-671-2009

REMOTE #1 CS64S *HMI* CART* C58 *BASE TX/RX
FT-757/767/980
TS-440/940/10735

REMOTE #2
FT-727R/767, TS-711/811

REPEATER CONTROLLER
*Change all access codes remotely
*Synthesized male/female voice
*Program mail box or ID tail with touchtones from HT
*Alarm clock & auto excite mode
*Macro commands, 22 digits max
*32 CTCSS manual & auto paging
*Code practice & voice readback
*Multifunction voice alarm clock
H.F. REMOTE #1
*10 Memories/auto mode sel.
*Scan up/down sel. rate or step
*Voice ack. all control commands

AUTOPATCH
*300 Auto/quick dial mem. recall
*300 call signs paged/32 sub tone
*50 enable/disable tel. #'s
*Hi/Low priority access codes
*Directed/general & reverse page
*Full or Half duplex (level cont.)
*Securely mode/TT readback on/off
*Store MCI/Sprint tel. #'s
*Reverse Patch active all modes
*Call waiting/quick dial & reset
Y.H.E. REMOTE #2
*Dual VFO's/Rev/Split/COR detect
*Set Scan inc. & offset/ver. resume

Super Comshack CS64S \$349.95
+ \$4.00 ship USA; incl. computer interface, disk, cables & manual (simplex version inc. on request)

SYSTEM OPTIONS
*External Relay Control 3 DPDT relays + 5 open collector outputs. **CS-8 \$79.95**
*EPROM Auto boot Cartridge customized with your system **CART \$99.95**
*Beam control, speaks bearing and rotates beam, 1 degree incre. **HMI \$49.95**
*Manual (Refunded) **HMI \$15.00**
*Row & col. freq. control. **RAP \$149.95**
*C64 D.C. Switcher P.S. **DCPS \$119.95**

12v C64 SWITCHER
*Draws 1.1A @12v.
*70khz 75% efficient
*Outputs 5v @2 amps and 9 vac 60Hz
*Crystal time base
*Plugs into C64 power
MODEL DCPS..... \$119.95 NEW

MINI (BEAR CAT) COMPUTER CONTROL FT-727R
Programs and Scans 100 ch. in Ham/General cover age. Converts HT into a power/ul 100 ch. scanner & programs all for field use!
Vesu FT727R
*Digital "S" meter; stops scan from S(1-9); Auto resume
*Loads & programs all FT-727R parameters in less than 15 secs.
*Includes hardware & disk for C64 or IBM PC. **MODEL 727S \$39.95**

12 YDC. AUDIO. 300 BALD RS232 123456 789ABC BHI,C64 APPLE
Touchtone to RS-232 (300 baud interface)
Program your computer in basic to decode multi-digit "strings", sound alarm, observe codes, includes basic program for C64 VIC20/C128, works on all computers!
MODEL DAP \$89.95

"Audio Blaster" IC-02/04 AT, 2AT, U16, FT209, FT727R
Module installs inside the radio in 15 Min. Boost audio to 1 watt! Low standby drain/Corrects low audio/1000's of happy users. Miniature audio amplifier -->
Used by Police, fire, Emergency, when it needs to be HEARD!
WOW! (hats loud now!!! you can hear everything!)
FOR ALL H.T.'S
MODEL AB1 \$19.95

Touchtone 4 Digit Decoder & on/off latch with all 16 Digits
Expandable Repeater on/off control
*Low power CMOS +5 to +12 Volts
*User programmable 50,000, 4 digit codes
*Send code once to turn on, again to turn off
*Momentary & Latch output drives relay
*Wrong digit reset; no falsing; 2 to 4 digits
*Mute speaker audio until call is received
*LED displays latch state; Optional 4 digit extra custom latch. (7225) IC's \$6.95 ea
*Model TSD \$59.95

ENGINEERING CONSULTING *** 583 CANDLEWOOD ST. BREA, CA. 92621
MASTERCARD ** VISA ** CHECK ** M.O. ** CA. RES. ADD 8% TEL: 714-671-2009

W6SAI BOOKS

published by Bill Orr, W6SAI and Stu Cowan, W2LX

BEAM ANTENNA HANDBOOK

Completely revised and updated with the latest computer generated information on BEAM Antenna design. Covers HF and VHF Yagis and 10, 18 and 24 MHz WARC bands. Everything you need to know. 204 illustrations. 268 pages. ©1985. Revised 1st edition.

IRP-BA Softbound \$9.95

SIMPLE LOW-COST WIRE ANTENNAS

Primer on how-to-build simple low cost wire antennas. Includes invisible designs for apartment dwellers. Full of diagrams and schematics. 192 pages. ©1972 2nd edition

IRP-WA Softbound \$9.95

ALL ABOUT CUBICAL QUAD ANTENNAS

Simple to build, lightweight, and high performance make the Quad at DX'ers delight. Everything from the single element to a multi-element monster. A wealth of information on construction, feeding, tuning and installing the quad antenna. 112 pages. ©1982. 3rd edition.

IRP-CQ Softbound \$7.95

THE RADIO AMATEUR ANTENNA HANDBOOK

A wealth of projects that covers verticals, long wires, beams as well as plenty of other interesting designs. It includes an honest judgement of gain figures, how to site your antenna for the best performance, a look at the Yagi-Quad controversy, baluns, slopers, and delta loops. Practical antenna projects that work! 190 pages. ©1978. 1st edition.

IRP-AH Softbound \$9.95

Please enclose \$3.50 for shipping and handling.

ham radio magazine **BOOKSTORE**
GREENVILLE, NH 03048 (603) 878-1441

ham radio

TECHNIQUES

Bill Over
W6SAI

the year was 1923 . . .

It all happened about 65 years ago. There were only a few thousand Radio Amateurs in the world. Many of them dreamed that they would someday converse across oceans. But though Americans had indeed heard a few European ham signals and hundreds of United States signals had been heard in Europe, it seemed that a two-way transatlantic QSO was virtually impossible.

However, on the night of November 27, 1923, the impossible happened. Leon Deloy, 8AB, of Nice, France worked Fred Schnell, 1MO, and John Reinartz, 1XAM. Four thousand miles of distance had been conquered in just a few hours. As 8AB said to 1MO, "This is a fine day."

I had known John Reinartz for some years. He never tired of telling the thrilling story of that first contact. Deloy, 8AB, worked many American stations after the record-setting QSO, but it wasn't until December 8 of that year that contact was established between u1MO (Kenneth Warner) and g2KF (J. Partridge), and the radio barrier between America and England was broken.

When I asked John why the first QSO was between USA and France rather than the United States and England — especially since 8MO was located on the Mediterranean coast of France, a good 700 miles further from the east coast of the United States than the British hams, who were centered around London — John had no answer, but explained that 8AB was always consistently louder than the

British signals. I asked myself whether it was a matter of power, a better antenna, or a better location at 8AB. I thought I'd never know.

a visit to 8AB

The whole story passed from my mind until 1976, when I was living in Monaco and operating 3A0AF. Conditions from Monaco to the United States were spotty. Good openings were possible in the afternoon around 1600 UTC, but propagation was via the long path. That was a beautiful shot — downhill a short distance, then across the Mediterranean to the United States. Signals from California and other west-coast stations were strong and consistent. But working the United States from Monaco, the short path was a different story. Directly behind the principality, the French Alps towered thousands of feet in the air. The short path to the United States was a tough one, and only the stations on the easternmost coast of the United States could be worked. It was very difficult to work into the Midwest.

Observing this problem first-hand, I began to wonder how Leon Deloy had managed to work the Americans with such a robust signal. After all, Nice was only a few miles from Monte Carlo. How had 8AB conquered the French Alps with his primitive radio equipment?

I knew Leon was retired and living in Monaco. After much hesitation, I looked up his number and called him on the telephone. John Reinartz, who had met him years before, had told me that Leon spoke excellent English. So

when he answered the phone, I wasn't surprised to find that I had no difficulty explaining who I was and asking if he would consent to a short visit and an interview. Delighted, he invited me over for tea. Since he lived just a few blocks away, I walked to his home, where he greeted me at the door. As we sat sipping tea in his library, lined with books and decorations he had received from the French government for his work in communications, he told me the story of his record-breaking transatlantic radio work.

Hard work, good equipment, good operating technique, and a good antenna were the answer. The year before the great achievement, Leon had visited several prominent stations in the United States, observing their equipment, listening to band conditions carefully, and noting operating habits. He purchased some of the latest radio equipment to take home with him and spoke at length to Reinartz, examining his station carefully. Returning to his home in Nice, he put into practice what he had learned. When his station was assembled, he cabled the ARRL and told them he would transmit on the exceptionally short wavelength of 100 meters during the evening hours, starting on November 25th. The first night he was on the air, he was heard by Amateurs in the United States! Being appraised by cable that his signals were "crossing the pond," he set up a schedule the next night with Schnell and Reinartz, who had just gotten special permission to use the 100-meter wavelength.

8AB's signal was heard again. The

WE SHIP WORLDWIDE

Barry Electronics Corp.

WORLD WIDE AMATEUR RADIO SINCE 1950
Your one source for all Radio Equipment!

For the best buys in town call:
212-925-7000
Los Precios Mas Bajos en
Nueva York

KITTY SAYS: WE ARE NOW OPEN 7 DAYS A WEEK.
Saturday & Sunday 10 to 5 P.M.
Monday-Friday 9 to 6:30 PM Thurs. to 8 PM
Come to Barry's for the best buys in town.



ICOM
IC-7E1A 7.0-14.2MHz 200W 40A 4000Hz
R 7000W IC-7E1 10.1-17.5MHz 1200W
4700A 135 IC-9001



Ring in the New Year
With the best of Barry's New Gear
Antennas



154405-AT R 5000 R 2000 15 940 S RT
1M 221A-421A 1M 2570A-50A 30A TR 751A
Kenwood Service: Repairs 1M 2133 41 B1
15 171418A 1M 1168A 1M 1168B 1M 1168C
1M 1168D 1M 1168E 1M 1168F



YAESU
FT-767GX, FT-757GXII,
FRG-8800, FT-736, FRG-9600,
FT-211/711RH, FT-2700RH

VAESU ICOM Land Mobile HT
IC-2AT/12AT ICOM Maxon
IC-03/04AT Taurus FT-112 FT-114
IC-A20/16 ICOM (M) M150
Tempo M-1



SMART PATCH
1 1/2" x 3" x 1/2" Antenna for 5/8 Wave Patch 1/4
1 1/2" x 3" x 1/2" Antenna for 5/8 Wave Patch 1/4
1 1/2" x 3" x 1/2" Antenna for 5/8 Wave Patch 1/4
1 1/2" x 3" x 1/2" Antenna for 5/8 Wave Patch 1/4

Budwig ANT Products
NEL-TECH DWR-100 Digital Voice Keyer
FLUKE 77 Multimeter
Mitsumi Modems
Sanyo Handheld Laser Stylus

VoCom/Mirage/Alinco
Tokyo Hy-Power/TE SYSTEMS
Amplifiers &
5/8 HT Gain
Antennas IN STOCK

Soldering
Station,
48 Watts, \$68
MICROLOG ART 1, Air Disk,
SWL, Morse Coach

KANTRONICS
UTU KAM UTU XT
KPC 2400, KPC IV

EIMAC
3-500Z
572B 6J56C
12B17A &
6146B

BIRD
Wattmeters &
Elements
In Stock

AEA 144 MHz
AEA 220 MHz
AEA 440 MHz
ANTENNAS



AMERITRON AMPLIFIER AUTHORIZED DEALER

Yaesu FTR-2410, Wilson
ICOM IC-RP 3010 (440 MHz)
ICOM IC-RP 1210 (1.2 GHz)
ICOM IC-RP 2210 (220 MHz)

Computer Interfaces,
Stocked MFJ-1270B,
MFJ-1272, MFJ-1224,
AEA PK-87, PM-1,
PK-232 W/FAX

**Complete Butternut Antenna
Inventory in Stock!**

DIGITAL FREQUENCY COUNTERS
Tronix, Model TR-1000, 0-600 MHz

AMP SUPPLY STOCKED
Long Range Wireless
Telephones for export in stock

**BENCHER PADDLES
BALUNS, LOW PASS FILTERS
IN STOCK**

MIRAGE AMPLIFIERS
ASTRON POWER SUPPLIES
Saxton Wire & Cable, Int'l Wire

PRIVATE PATCH IV, Duplex 8000



NYE MBV-A 3 Kilowatt Tuner



MFJ-989B

Ten Tec
Tuner 2298

**HEIL EQUIPMENT
IN STOCK**

SANGEAN Portable Shortwave Radios

New TEN-TEC
Corsair II, PARAGON, Century 22, Argosy II

MAIL ALL ORDERS TO: BARRY ELECTRONICS CORP., 512 BROADWAY, NEW YORK CITY, NY 10012 (FOUR BLOCKS NORTH OF CANAL ST.)

**New York City's LARGEST STOCKING HAM DEALER
COMPLETE REPAIR LAB ON PREMISES**

"Aquí Se Habla Español"
BARRY INTERNATIONAL TELEX 12-7670
MERCHANDISE TAKEN ON CONSIGNMENT
FOR TOP PRICES
Monday-Friday 9 AM to 6:30 PM Thursday to 8 PM
Saturday & Sunday 10 AM to 5 PM (Free Parking)
AUTHORIZED DIST. MCKAY DYMEK FOR
SHORTWAVE ANTENNAS & RECEIVERS
IRITILEX - Spring St. Station
Subways: BMT - Prince St. Station
IND - F Train Bwy. Station
Bus: Broadway #6 to Spring St.
Path - 9th St. 6th Ave. Station

We Stock: AEA, ARRL, Alpha, Ameco, Antenna Specialists, Astatic, Astron, B & K, B & W, Bencher, Bird, Butternut, CDE, CES, Collins, Communications Spec, Connectors, Covercraft, Cushcraft, Daiwa, Dentron, Digimax, Drake, ETO (Alpha), Emac, Encomm, HeilSound, Henry, Hustler (Electronics), Hy-Gain, Icom, KLM, Kantronics, Larsen, MCM (Daiwa), MFJ, J.W. Miller, Mini-Products, Mirage, Newtronics, Nye Viking, Palomar, RF Products, Radio Amateur Callbook, Rockwell Collins, Saxton, Shure, Telex, Tempo, Ten Tec, Tokyo Hi-Power, Tronix TUBES, W2AU, Waber, Wilson, Yaesu Ham and Commercial Radios, Vocom, Vibroplex, Curtis, Tri-Ex, Wacom Duplexers, Repeaters, Phelps Dodge, Fanon Intercoms, Scanners, Crystals, Radio Publications

WE NOW STOCK COMMERCIAL COMMUNICATIONS SYSTEMS
HAM DEALER INQUIRES INVITED. PHONE IN YOUR ORDER & BE REBURSED
COMMERCIAL RADIOS stocked & serviced on premises.
Amateur Radio Courses Given On Our Premises, Call
Export Orders Shipped Immediately. TELEX 12-7670

AntennaBooks

ALL ABOUT CUBICAL QUAD ANTENNAS

by Bill Orr, W6SAI and Stu Cowan, W2LX
The cubical quad antenna is considered by many to be the best DX antenna because of its simple, lightweight design and high performance. You'll find quad designs for everything from the single element to the multi-element monster quad. There's a wealth of data on construction, feeding, tuning, and mounting quad antennas. 112 pages. ©1982. 3rd edition. Includes data for WARC bands
RP-CQ Softbound \$7.95

THE AMATEUR RADIO VERTICAL HANDBOOK

by Cpt. Paul H. Lee, USN (Ret.), N6PL
Based upon the author's years of work with a number of different vertical antenna designs, you'll get plenty of theory and design information along with a number of practical construction ideas. Included are designs for simple 1/4 and 5/8-wave antennas as well as broadband and multi-element directional antennas. Paul Lee is an engineer and avid ham and is Amateur Radio's resident expert on the vertical antenna. ©1984. 2nd edition.
CQ-VAH Softbound \$9.95

THE RADIO AMATEUR ANTENNA HANDBOOK

by Bill Orr, W6SAI and Stu Cowan, W2LX
Contains lots of well illustrated construction projects for vertical, long wire, and HF/VHF beam antennas. There is an honest judgment of antenna gain figures, information on the best and worst antenna locations and heights, a long look at the quad vs. the yagi antenna, information on baluns and how to use them, and new information on the popular Sloper and Delta Loop antennas. The text is based on proven data plus practical, on-the-air experience. 190 pages. ©1978. 1st edition.
RP-AH Softbound \$9.95

HF ANTENNAS — The Easy Way

by John Haerle, WB5IIR
This tutorial is an excellent source book on antenna theory and applications. Examples of areas covered are: Fundamentals, antenna and feedline terminology, baluns, ground systems, lightning protection, The Basic Antenna, the dipole, the zepp, 6SRV, Windom, Special Antennas, the sloper, DORR, Beverage, folded unipole, Beams, W8JK, Yagi, two element quad, and the 160 meter band story. John's writing is in an easy-to-understand conversational style and is full of examples and handy tips and hints. There are no drawings or illustrations but John's prose paints pictures for clear and complete understanding of the information being presented. ©1984 1st Edition.
JH-AT Softbound \$11.95

BEAM ANTENNA HANDBOOK

by W6SAI and W2LX
Completely revised and updated the Beam Antenna Handbook includes the very latest state-of-the-art antenna design. Computer generated beam dimensions for the 40, 30, 20, 17, 15, 12, 10 and VHF bands are included eliminating the need for time consuming math calculations. Also covered are: Beam height and optimum apex of radiation, how element types and hardware effect performance, effect of nearby objects on radiation patterns, feedlines, baluns and matching systems and much more. Ham Radio VHF columnist W1JR, and noted European VHF'er DL6WO's VHF antenna designs are covered extensively as well as NBS VHF long Yagis. 268 clearly written pages — 204 easy-to-understand illustrations, make this the book to buy for beam construction. ©1985. 1st edition.
RP-BA Softbound \$9.95

SIMPLE LOW-COST WIRE ANTENNAS

by Bill Orr, W6SAI and Stu Cowan, W2LX
Learn how to build simple, economical wire antennas. Apartment dwellers take note! Fool your landlord and your neighbors with some of the "invisible" antennas found here. Well diagrammed. 192 pages. ©1972.
RP-WA Softbound \$9.95

ARRL ANTENNA BOOK

14th Edition
The Amateur Antenna bible. Includes just about every bit of information you'd ever want to know about antenna design, construction and theory. Starts with wave propagation, antenna fundamentals and transmission line theory, progresses through coupling the transmitter and antenna to the feedline to 9 big, inclusive chapters on how to build different antennas. ©1982, 14th edition, 200 pages.
AR-AM Softbound \$8.00

ham radio BOOKSTORE
GREENVILLE, NH 03048 603-878-1441

Barry Electronics Commercial Radio Dept. offers the Best in two-way communications for Businesses, Municipalities, Civil Defense, Broadcasting Companies, Hospitals, etc. Sales and Service for all brands: Maxon, Yaesu, Icom, Tad, Octagon, Regency/Wilson, Midland, Standard, Uniden, Shinway, Fujitus, Seas, Spillsbury, Neutec, etc. Call or write for information. 212-925-7000.

8-POLE CRYSTAL FILTER SALE - 10 - 20% OFF

For Kenwood, ICOM and Yaesu products. We will match any competition prices. FREE one year subscription for ICOM, Kenwood or Yaesu Newsletter (\$10.00 value) with filter purchase. USA only. For latest prices, call (305) 879-6868 or send SASE for latest catalog!! Sale ends December 31, 1987. We also offer expert repair service on Kenwood, ICOM, Yaesu, Azden and Atlas equipment. 15 years experience, 5 days average turnaround time. Call for more info!!

INTERNATIONAL RADIO, INC.
751 S. Macedo Blvd.
Port St. Lucie, FL 34983
(305) 879-6868



Photo A. "Mr. DX," Leon Deloy, F8AB, at his home in Monte Carlo in 1976.

town of Nice had a 25-cycle power source and the signal from France had a distinctive gargle on it as Leon applied high-voltage ac directly to his transmitter tube. This time, Schnell and Reinartz were ready. In no time at all, the Atlantic barrier was breached!

I had known the story before I met Leon Deloy, but to hear it from him personally was thrilling. I asked him exactly where he had lived in Nice. What was his QTH like? And what about the French Alps that effectively blocked the path? We discussed these things at length, and the day after the conversation I drove the few miles to Nice to the house from which Leon had made his record-breaking QSOs. The address was 54 Boulevard du Mont-Boron. The street was on the ocean side of the Lower Corniche, one of the main boulevards that ran from Monte Carlo to Nice. The home was a large, pleasant house in the French style. It had a small back yard, but the hills rose sharply behind the location, seemingly blocking it from a direct radio path to the United States.

After surveying the location, I drove to the top of the hills behind Nice and looked down on Boulevard du Mont-Boron. Yes, it was possible. The French Alps dropped in height as they approached the valley of the Var river. The coastline curved around and the mountains were to the north of 8AB, but the shot to the northwest — towards North America, that is — was reasonably clear. 8AB's signals must

have grazed the edge of the Alps, then had a clean shot up the Var valley.

Although 8AB was no longer active, he still had a keen interest in Amateur Radio. With his permission, I took a photograph of him (**Photo A**), and one of an oil painting of him as a young man in his dapper French military uniform **Photo B**.

What a grand gentleman! Although he expressed hopes of coming to America again, his health prevented such a journey. He later told me that he had bought a shortwave receiver and listened to the ham bands on occasion, marveling at the ease of voice contacts with sideband signals.

When I heard of his passing, it was as if an era had ended. The Americans at the other end of the great contact



Photo B. An oil painting made in 1920, hung in the entry hall of his apartment, depicted F8AB at the time he was awarded the Legion of Honor.

had passed away earlier. And now Leon Deloy! It was the end of a fabulous era in Amateur Radio. I always regret that I hadn't seen him again in his library, sipping tea, surrounded by his paintings and awards and honors.

We will not see the likes of him again.

To Amateurs who talk across the Atlantic daily, the adventure of 8AB and the American Amateurs may seem like no big deal. But to the Amateurs of yesterday, all of whom operated in the region of 150 to 200 meters, his DX work on 100 meters opened the short-wave spectrum. Shorter was better, and Amateur activity began a downward trek towards the 100- to 80-meter region.

Amateur regulations were vague at the time. The Radio Laws of 1912 were still in effect, and while Amateurs could operate between 200 and 150 meters, they weren't allowed above 200 meters. The waves below 150 — obviously useless — were not strictly regulated. Finally, in July, 1924, after much prodding by the ARRL, the Department of Commerce authorized the issuance of new licenses for Radio Amateurs permitting the use of wavelengths in the vicinity of the present bands, up to 20 meters. A maverick assignment at 5 meters was tossed into the pot, too. Amateurs applying for new licenses could operate in the new short wave bands. The downward march in wavelength began.

10-meter RFI and all that

First, the good news. The sunspot cycle is climbing rapidly and 10 meters is coming back to life. Many newer Amateurs have never experienced this band when it's fully alive. Plenty of DX can be worked with low power, and there's lots of room for pleasant contacts and rag-chewing.

And now the bad news. The second harmonic of a 10-meter transmitter falls right into TV channel 2, the third harmonic falls into TV channel 6, and the fourth harmonic falls into the channels assigned to air-to-ground communications.

Most Amateurs have no problem with the fourth harmonic, but the second and third harmonics (of even a 100-watt transceiver) can cause problems with nearby television receivers.

In addition, a 10-meter transmitter can overload the input circuits of a nearby TV set, even though the trans-

MADISON SHOPPER

CALL FOR ORDERS
1 (800) 231-3057
1-713-520-7300 OR 1-713-520-0550
TEXAS ORDERS CALL COLLECT
ALL ITEMS ARE GUARANTEED OR
SALES PRICE REFUNDED

New Icom IC 761
Kenwood TH215A

Trades wanted
Trade in your old HT



Kenwood TS140S — Call

Kenwood TS 140S
New Kenwood TM-221A, 45W. mobile
Lunar 2M4-40P
ICOM 28H/TM

Call for trade
Call
109.00
399.00



Icom 761 2095.00

Shure 444D 54.95
Astatic MC321 Cartridge D104 12.00
Astatic D104C/TUP-9 72.00

Isopole 144 MHz 44.95
Cushcraft 124 WB (146 MHz) 33.00
Butternut HF6V, 80-10 vertical 125.00
Hustler G7 144 119.95
KLM HF World Class Series Antennas Call Don
KLM KT-34A 399.00
NEW KLM 1.2-44LBX 129.00
G5-RV 44.00

Avanti AP151 3G on Glass Antenna 36.00
Anteco 2M, 5/8, Mag. Mount, Comp 25.00

Thousands of panel meters 3.95 up CALL
Aerovox 1000 pF/500 V feedthrough caps 1.95
100 mld/450V Axial Cap 2.00

831SP PL259 Silverplate 1.25
82-61 N Male 3.00

GE 6146B 13.95
3-500Z 119.95
GE 12BY7A 7.00
6JEGC/6LO6 10.95
6KD6 12.95

AEA PK-232 with new WX FAX 299.00
Kantronics KPC II 149.00
New Kantronics KAM 299.00

USED EQUIPMENT

All equipment, used, clean, with 90 day warranty and 30 day trial. Six months full trade against new equipment. Sale price refunded if not satisfied.

Call for latest used gear
(800) 231-3057

TS-430S, TS-830S, TS-520S, FT101E, and Collins.

Porcelain 502 Guy Insulators (1/4) 3.39

POLICIES

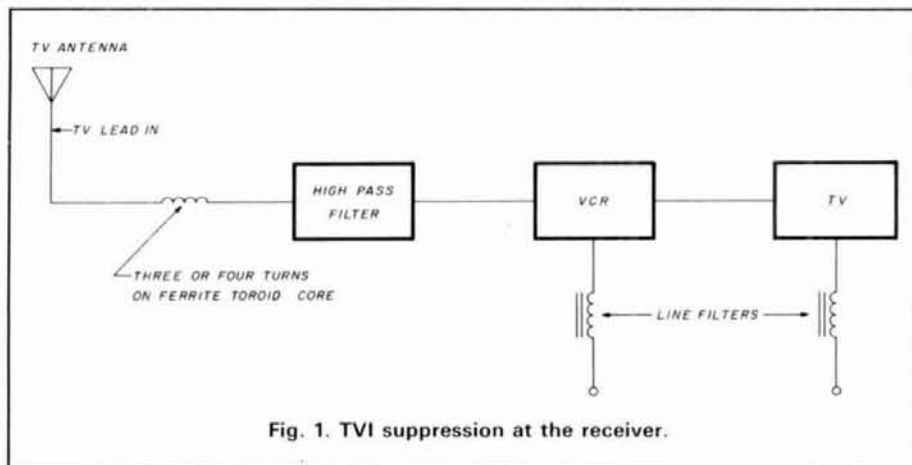
Minimum order \$10.00. Mastercard, VISA, or C.O.D. All prices FOB Houston, except as noted. Prices subject to change without notice. Items subject to prior sale. Call anytime to check the status of your order. Texas residents add sales tax. All items full factory warranty plus Madison warranty.

Bird and Belden products in stock. Call today.

MADISON

Electronics Supply

3621 FANNIN
HOUSTON, TEXAS 77004



mitter may be "clean," as far as harmonic emission goes.

Television interference presents a delicate public relations problem because viewers always assume TVI is the hams' fault and blame them accordingly. In short, TVI isn't a big problem if you don't have it, but it's hell if you do!

Fortunately, many of the TVI problems associated with 10-meter operation can be solved. Your own TV receiver can serve as a guinea pig. If you have no interference problems with it, you might be in good shape with your neighbors. Alas, the ability of TV receivers to reject strong nearby signals varies from manufacturer to manufacturer and from model to model. Your set may be interference-free, but the one next door may not.

where to start

The first step in resolving TVI problems is to place a high-pass filter in the lead-in of the TV set, right at the receiver terminals. Available for either 300-ohm ribbon line or 75-ohm coax, these filters will reject your signals and pass those of the television stations. Unless you're running with a linear, a high-pass filter will knock your fundamental signal down sufficiently to protect the TV receiver.

Your next step is to place a low-pass filter in the coax lead to your antenna. For best results, the filter should be mounted directly on the back of your transmitter and securely grounded to

the transmitter ground point. This will substantially reduce any harmonic energy.

You'll find out that when you don't permit the transmitter harmonics to run up your coax to the antenna, they'll seek another avenue of escape. This will be via the interconnecting control leads, the microphone cable, and the power leads of your transmitter.

The next thing to do is wrap the power lead of your transmitter around a ferrite core or rod. Use a high-permeability ferrite*; it will be lossy at 28 MHz and higher frequencies, and any rf current flowing in the lead will be converted into heat in the core material. This simple fix will prevent rf power from flowing into your electrical system.

You can wrap control leads around a smaller ferrite. Either a core or rod

* A suitable ferrite rod around which you can wrap a line cord is the AMIDON R-33-050-750. With a permeability of 800 (33 material), it measures 7.5 inches long. A longer rod of similar material is the R-33-075-1200, which is 0.75 inches in diameter and 12 inches long — just right for the linear amplifier!

If a ferrite toroid is desired, the AMIDON FT-240-72, 2.4 inches (O.D.) and 1.4 inches (I.D.) is satisfactory. RG-8A/U or RG-59/ CU cable can be wrapped loosely around this core, as can 300-ohm ribbon line.

A split core to place over a coax line is the AMIDON 2X-43-151, which is suitable for RG-8A/U coax. Place the two halves of the ferrite over the line and tape them together.

In case of computer interference, AMIDON supplies split bars that fit over flat cables. The 2X-43-951 is for 2-inch wide cable and the 2X-43-051 is for 2.5-inch cable.

These devices are available from AMIDON, 12033 Otsego Street, North Hollywood, California 91607.

THE MOST AFFORDABLE REPEATER

ALSO HAS THE MOST IMPRESSIVE PERFORMANCE FEATURES

(AND GIVES THEM TO YOU AS STANDARD EQUIPMENT!)

BAND	WIRED	KIT
6M, 2M, 220 UHF	\$988	\$636

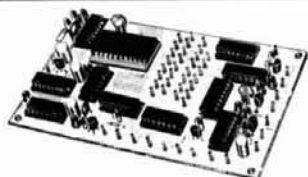
(Also available for commercial bands!)



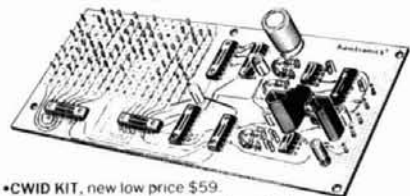
FEATURES:

- **SENSITIVITY SECOND TO NONE!** 0.15uV Typ.
- **SELECTIVITY THAT CAN'T BE BEAT!** Both 8 pole xtal filter & ceramic filter for > 100dB at ±12kHz. Helical resonator front end to combat dense & intermod.
- **Flutter-proof squelch**, Automatic frequency control, separate spkr amplifier.
- **CLEAN, EASY-TUNE TRANSMITTER**, up to 20W output. 50W with additional PA.

ACCESSORIES



- **TD-2 DTMF DECODER/CONTROLLER** kit only \$79. Full 16 digits, 5 functions, toll call restrictor, programmable. Much more. Great for selective calling tool!
- **AP-1 AUTOPATCH** kit only \$79. Reverse patch & phone line remote control std.
- **AP-2 Simplex Autopatch**. Use with above.



- **CWID KIT**, new low price \$59. Field programmable, timers, the works!
- **COR-2 kit**, \$38. Audio mixer, local spkr amplifier, tail & time-out timers.
- **COR-3 kit**, \$49, with courtesy beep.



- **MO-202 FSK DATA MODULATOR** kit \$39. Run up to 1200 baud digital or packet radio signals through any FM transmitter.
- **DE-202 FSK DATA DEMODULATOR** kit \$39.

GaAs FET PREAMPS at a fraction of the cost of comparable units!

LNG-(*) GaAs FET PREAMP

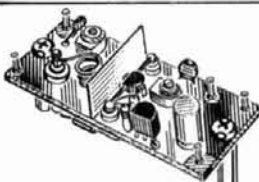
ONLY \$59!

WIRED/TESTED



FEATURES:

- **Very Low Noise:** 0.7dB VHF, 0.8dB UHF
 - **High Gain:** 13-20dB, depending on freq
 - **Wide Dynamic Range:** to resist overload
 - **Stable:** new-type dual-gate GaAs FET
- * Specify tuning range desired: 26-30, 46-56, 137-150, 150-172, 210-230, 400-470, or 800-960 MHz.



LNW-(*) MINIATURE GaAs FET PREAMP

Unbelievably Low Price ---

ONLY \$24/kit, \$39 Wired/tested

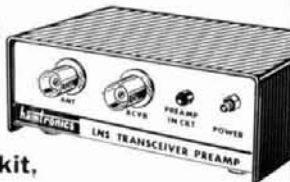
GaAs FET Preamp similar to LNG, except designed for **low cost & small size**. Only 5/8" W x 1-5/8" L x 3/4" H. Easily mounts in many radios.

- * Specify tuning range desired: 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, or 400-500 MHz.

LNS-(*)

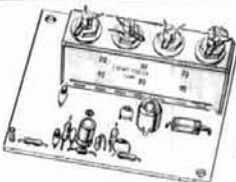
IN-LINE PREAMP

ONLY \$79/kit, \$99



GaAs FET Preamp with features similar to LNG series, except **automatically switches out of line during transmit**. Use with base or mobile transceivers up to 25W. **Tower mtg. hardware supplied.**

- * Specify tuning range desired: 120-175, 200-240, or 400-500 MHz.



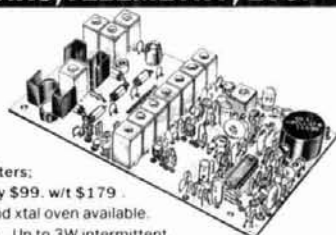
HRA-(*) HELICAL RESONATOR PREAMP

ONLY \$49 VHF or \$84 UHF

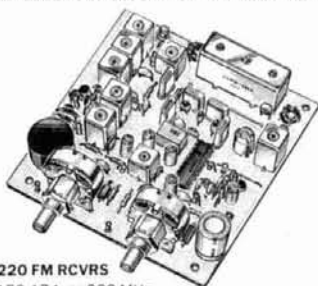
Low-noise preamps with helical resonators **reduce intermod & cross-band** interference in critical applications.

- * Specify tuning range desired: 143-150, 150-158, 158-162, 162-174, 213-233, 420-450, 450-465, or 465-475 MHz.

HIGH QUALITY XMTR & RCVR MODULES FOR REPEATERS, LINKS, TELEMETRY, ETC.



- **FM exciters:** kits only \$99. w/t \$179. TCXO and xtal oven available. 2W cont. Up to 3W intermittent.
 - **TA51** for 10M, 6M, 2M, 150-174, 220 MHz.
 - **TA451** for uhf.
- FCC TYPE ACCEPTED FOR COMMERCIAL BANDS.
- **VHF & UHF LINEAR AMPLIFIERS.** For FM or SSB. Power levels from 10 to 45 Watts. Several models, kits starting at \$99.



- **R144/R220 FM RCVRs** for 2M, 150-174, or 220 MHz. 0.15uV sens, 8-pole xtal & 10 pole ceramic i-f filters, helical resonator front end for exceptional selectivity, > 100dB at ±12kHz (best available anywhere!) Flutter-proof squelch. AFC tracks drifting xmtrs. Xtal oven avail. Kit \$149, w/t \$229.
- **R451 FM RCVR.** Same as above but UHF. Tuned line front end. 0.2uV sensitivity. Kit only \$149, w/t \$229.
- **R76 VHF FM RCVR** for 10M, 6M, 2M, 220. As above, but w/o AFC or hel res. Kits only \$129.
- **R110 VHF AM RCVR** for VHF aircraft or ham bands or UHF. Kit only \$149.

NOW—FCC TYPE ACCEPTED TRANSMITTERS, RECEIVERS, AND REPEATERS AVAILABLE FOR HIGH-BAND AND UHF. CALL FOR DETAILS.

RECEIVING CONVERTERS

VHF MODELS	Antenna Input Range	Receiver Output
	28-32	144-148
	50-52	28-30
	50-54	144-148
	144-146	28-30
	145-147	28-30
	144-144.4	27-27.4
	146-148	28-30
	220-222	28-30
	220-224	50-54
	222-224	28-30
UHF MODELS	432-434	28-30
	435-437	28-30
	432-436	144-148
	432-436	50-54
	439-25	61-25
	902-928	422-448
	902-922	430-450

TRANSMIT CONVERTERS

For SSB, CW, ATV, FM, etc. Can be linked with receive conv for transceive. 1 to 2 W out. Linear PA's available up to 50W.	For VHF Model XV2 Kit \$79 (specify band)	Exciter Input Range	Antenna Output
		28-30	144-146
		28-29	145-146
		28-30	50-52
		27-27.4	144-144.4
		28-30	220-222
		50-54	220-224
		141-146	50-52
		144-146	28-30
	For UHF Model XV4 Kit \$79	28-30	432-434
	Wired \$159	28-30	435-437
		61-25	439-25
		144-148	432-436

HAMTRONICS, INC.

65-E Moul Rd.; Hilton NY 14468-9535

High quality equipment at reasonable prices surely appeals to me; but I want more details before I buy! Rush my copy of the 40-page Hamtronics catalog by return first class mail. I enclose \$1 (\$2 for overseas air mail).

Name _____
Address _____
City _____ State/ZIP _____

- Order by phone or mail • Add \$3 S&H per order (Electronic answering service evenings & weekends)
- Use VISA, MASTERCARD, Check, or UPS COD.

hamtronics, inc.

65-E MOUL ROAD • HILTON NY 14468-9535

Phone: 716-392-9430

Hamtronics® is a registered trademark

800-882-1343



	List	Juns
IC-761 New Top of Line	2499.00	Call \$
IC-735 Gen. Cvg. Xcvr	\$999.00	Call \$
IC-751A Gen. Cvg. Xcvr	1649.00	Call \$
R7000 Gen. Cvg. Rcvr.	1099.00	Call \$
R71A Gen. Cvg. Rcvr.	949.00	Call \$
IC-28A/H FM Mobile 25w/45w	429/459	Call \$
IC-37A FM Mobile 25w	499.00	Call \$
IC-900 Super Multi-Band Mobile	589.00	Call \$
IC-04AT UHF HT	449.00	Call \$
IC-48A UHF 45w	459.00	Call \$
IC-38A FM Mobile 25w	459.00	Call \$
IC-02AT FM HT	399.00	Call \$
IC- μ 2AT Micro HT	329.00	Call \$



	List	Juns
TS-940SAT Gen. Cvg. Xcvr.	\$2249.95	Call \$
TS-430S Gen. Cvg. Xcvr.	819.95	Call \$
TS-711A All Mode Base 25w	899.95	Call \$
TR-751A All Mode Mobile 25w	599.95	Call \$
TS-440S/AT Gen. Cvg. Xcvr	1199.95	Call \$
TM-2530A FM Mobile 25w	429.95	Call \$
TM-2550A FM Mobile 45w	469.95	Call \$
TM-2570A FM Mobile 70w	559.95	Call \$
TH-205 AT, NEW 2m HT	259.95	Call \$
TH-215A, 2m HT Has It All	349.95	Call \$
TH21BT 2M HT	259.95	Call \$
TH31BT 220 HT	269.95	Call \$
TM-3530A FM 220 MHz 25w	449.95	Call \$



	List	Juns
FT-757 GX Gen. Cvg. Xcvr.	\$995.00	Call \$
FT-767 4 Band New	1895.00	Call \$
FT-211 RH	459.95	Call \$
FT-290R All Mode Portable	579.95	Call \$
FT-23 R/TT Mini HT	299.95	Call \$
FT-209RH RM Handheld 5w	359.95	Call \$
FT-726R All Mode Xcvr.	1095.95	Call \$
FT-727R 2M/70CM HT	479.95	Call \$
FT2700RH 2M/70CM 25w	599.95	Call \$



3919 Sepulveda Blvd.
Culver City, CA 90230
213-390-8003

will do the job. You may even have to place a ferrite in the microphone lead as close to the mic jack as you can get.

But what if you've done all this and still get TVI on channel 2 when you operate 10 meters?

the final cleanup

As I said, a nearby TV receiver will help you determine the interference relationship between your transmitter and your neighbor's TV set. For my checks, I used the family TV set, which is about 30 feet away from my equipment. The TV antenna is about 40 feet away, and just below it is my 10-meter antenna. Two CB hand-helds provide communication between the transmitter operator and the TV checker. Using these techniques, and running 100 watts, I was completely clean on all channels. But when I turned on my kW linear amplifier, I knocked out channel 2 and cross-hatched channel 6.

All the cures applied to the exciter were then applied to the amplifier: a ferrite choke was placed in the power line, ferrite chokes were installed in the interconnecting leads, and a low-pass filter was added to the coax to the antenna. That made two low-pass filters — one after the exciter and one after


the linear amplifier. Channel 6 was now clean, with only mild problems on channel 2.


The last step was placing a ferrite line choke on the TV receiver. The line cord was wrapped around a ferrite toroid, where the power cord left the back of the cabinet. Attention was then directed to the lead-in, which happened to be 300-ohm ribbon.

It's possible for the TV lead-in to act as an antenna for hf signals or harmonics. These pass down the lead-in, with the two lead-in wires acting in phase as a common-pickup antenna. The unwanted signal just flows around the high-pass filter with little attenuation. To prevent this, I loosely wrapped the ribbon line through a 2-inch (O.D.) ferrite toroid. I passed three turns through the core and held them in place with a plastic wire-wrap, then placed this little filter just before the high-pass filter as shown in the illustration (fig. 1).

All in all, the ferrite filters seem to do a much better job in TVI suppression than do bypass capacitors. They're also much easier to install. (More on interference reduction in a forthcoming column.)

ham radio





EQUIP-tips

Tips from the expert on boosting the performance of your radio equipment.

Boost the Range of Hand-Helds

Today's hand-held VHF/UHF scanners and handie-talkies from Bearcat, Regency, Cobra, and Radio Shack, ICOM, Yaesu, and Kenwood have excellent sensitivity and talk power, but their range is reduced by their short flex antennas.

Tip: To increase the range of your hand-held scanner or transceiver, connect a Grove ANT-8 extendable whip antenna, equipped with standard BNC base.

Only \$12⁹⁵ plus \$1.50 UPS Shipping (US)

Grove Enterprises
140 Dog Branch Road Brasstown, N.C. 28902
(704) 837-9200 or (MC, Visa & COD only) 1-800-438-8155

Uncle Bill's Commodore C-64 Computer Software by Bill Clarke WA4BLC

CODE COURSE

This computer program is broken into three user friendly parts. Part one introduces to the beginner the different morse characters. The student simply presses a key and the character is sent and displayed on the screen. Part two generates the morse character and the student is required to press the correct key on the computer. If the student answers incorrectly, the character is automatically resent. Part three sends morse characters in random groups of five. The student can tailor what is sent to their particular needs; numbers only, letters only or a combination of both. Speeds are from 5 to 20 groups per minute. The computer can also be configured to send the Farnsworth method (high speed/ slow spacing code.) V 2.2

UB-CC (For C-64) \$9.95

KODE MASTER (for Novice, General or Extra Class students)

Prepare for your next code exam using computer generated QSOs. Each QSO contains call signs, names, QTH's equipment info plus many of the other exchanges commonly found in Ham QSO's. QSO's can be displayed on the screen by one character at a time, by each sentence or after the completion of the QSO for checking. With a printer you can print out a hard copy. Available in 5 wpm for Novices, 13 wpm for Generals and 20 wpm for Extra class students.

UB-KN Novice Class (for C-64) \$14.95
UB-KG (for C-64) \$14.95
UB-KE Extra Class (for C-64) \$14.95

ANTENNA SYSTEM

This nifty antenna modeling and development program will help you get the most from your antenna projects while eliminating much of the drudgery of antenna calculations. Part one covers standard design antennas—dipoles, verticals and Yagi designs. Part two designs shortened dipole antennas for space limited hams. Great for shortened 160/80 meter antennas. All dimensions are listed. At this price it's not an engineering program but a neat program to have around.

UB-AS (for C-64) \$9.95

RADIO AMATEUR CALLBOOK SUPPLEMENT

(both NA and International calls)

Invaluable operating aid to all classes of Radio Amateur. Includes all calls issued since publication of the 1987 edition of the North American and International editions. The ONLY way to be fully up-to-date is to have the Callbook supplement in your shack. 296 pages © 1987

CB-SUP 87 Softbound \$9.95

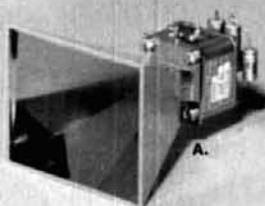
Please enclose \$3.50 shipping & handling

ham radio magazine
BOOKSTORE
GREENVILLE, NH 03048
603-878-1441



Gunnplexers & accessories

10 & 24 GHz



A.



D.



C.



B.

A. Microwave Associates 10 GHz Gunnplexer. Two of these transceivers can form the heart of a 10 GHz communication system for voice, mcw, video or data transmission, not to mention mountaintop DXing! MA87141-1 (pair of 10 mW transceivers) \$251.95. Higher power units (up to 200 mW) available. B. Microwave Associates 24 GHz Gunnplexer. Similar characteristics to 10 GHz unit. MA87820-4 (pair of 20 mW transceivers) \$739.20. C. This support module is designed for use with the MA87141 and MA87820 and provides all of the circuitry for a full duplex audio transceiver system. The board contains a low-noise, 30-MHz fm receiver, modulators for voice and mcw operation, Gunn diode regulator and varactor supply. Meter outputs are provided for monitoring received signal levels, discriminator output and varactor tuning voltage. RXMR30VD assembled and tested \$119.95. D. Complete, ready to use communication system for voice or mcw operation. Ideal for repeater linking. A power supply capable of delivering 13 volts dc at 250 mA (for a 10 mW version), microphone, and headphone and/or loudspeaker are the only additional items needed for operation. The Gunnplexer can be removed for remote mounting to a tower or 2 or 4 foot parabolic antenna. TR18GA (10 GHz, 10 mW) \$399.95. Higher power units available. TR24GA (24 GHz, 20 mW) \$639.95. Also available: horn, 2 and 4 foot parabolic antennas, Gunn, varactor and detector diodes, search and lock systems, oscillator modules, waveguide, flanges, etc. Call or write for additional information. Let ARR take you higher with quality 10 and 24 GHz equipment!

Advanced Receiver Research

Box 1242 • Burlington CT 06013 • 203 582-9409



183

L INDUSTRIES, INC.
LUNAR



The **ORIGINATOR** of the VHF AMP/PREAMP COMBO!
YOU KNOW THE LUNAR NAME...NOW OWN THE BEST.

• Solid State Amplifiers for 50, 144, 220, 440 MHz •

NEW! GaAs FET Receive Preamp Built-In!

NEW! UHF Models of Latest Design!

NEW! Model V2-500 for Two Meters...
500 Watts Output in a Deluxe Package!

See your
dealer or call

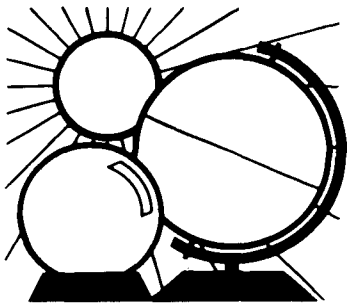
L INDUSTRIES, INC.
LUNAR

COMMUNICATIONS & SYSTEMS DIVISION

Full line of
separate preamps
available

7930 Arjons Drive • San Diego, CA 92126 • Telephone (619) 549-9555 • Telex 181747

184



DX FORECASTER

Garth Stonehocker, KØRYW

solar cycle update

Enough time has passed to take the guesswork out of determining the sunspot number (SSN) minimum. Since the official value, is, by definition, a 12-month running average, it takes a year's worth of values to define the SSN centered on a date six months ago. The upward SSN trend also takes time to determine: from six months to a year, to be precise. The minimum for Cycle 21 could have occurred in September 1986 at a relatively high value of 12.3, although official international numbers are still being evaluated and things may change a little. This would make Cycle 21's duration equal to 10.25 years, which is closer to the short end of the solar cycle range of 9.0 to 13.6 years.

Scientists at the Space Environment Center (SEC) at Boulder have been reviewing predictions made by several methods to see what Cycle 22's maximum value, and the date of its occurrence, might be. A summary of their findings indicates 145 as the maximum value — a little lower than Cycle 21's maximum. However, the values for Cycle 22 range from 118 to 185. Most of the scientists agree, however, that whatever the maximum might be, it will probably occur in 1990 (i.e., dur-

ing the period from December 1989 to 1991). These predictions will be refined as the cycle starts its sharp ascent over the next six months.

The solar flux measured at Ottawa, Canada, on 2800 MHz (10.7 cm) indicates a slightly different Cycle 21 minimum than that obtained from sunspot records. The minimum solar flux, a measured quantity, occurred during the period from June 24 to June 30, 1986. This raw data was corrected to one A.U. (Astronomical Unit, or the distance between the sun and the Earth at equinox) in order to extrapolate solar flux values measured at the earth's surface to those which occurred *at the sun*. The corrected minimum (at the sun) occurred in September 1986. However, the ionosphere "recognizes" only the measured values (at the earth's surface), of course. Consequently, the period of the solar flux cycle was from June 1975* to June 1986, for a total length of 11.05 years. The lowest value of daily flux was 66 — a high minimum, indeed. This reinforces the prediction of a lower SSN maximum for Cycle 22. If this is accurate, expect a Cycle 22 SSN between 110 and 125 (160-180 flux), spread over the 1990 to 1992 time-

* Note: this represents a correction to November 1986 "DX Forecaster" — Ed.

frame. In any case, a rapid rise in flux should be noticed *this* winter. The geomagnetic field will become stable, and recurrent-type geomagnetic disturbances will subside until the 27-day flux peaks reach a value of approximately 150, after which time flares will become more potent and cause more intense geomagnetic disturbances of shorter duration.

We can look forward to more frequent 10- and 12-meter openings by the end of 1988. A steady increase in solar flux is occurring already. This increase is about 3 SSNs, or 2 flux units, per month, which is equivalent to a 0.13 MHz (or 13 percent) increase per month. This will soon increase to 5 SSNs or 3.8 flux units, which is about 0.17 MHz (15 percent) per month for noontime mid-latitude MUFs. Of course the normal 27-day flux variation period of the sun's rotation is superimposed upon this steady increase. Flaring regions of sunspots will augment longer term solar flux values. On a daily basis, if there's only a 2 to 3 flux unit change per day, the MUF will change by one-half percent per flux unit, with no delay. If, however, there is a change of 10 to 20 flux units in a day, the MUF will change by 30 percent of the flux unit (change), with a 2- to 3-day lag. Consequently, it's possible to utilize the solar flux data transmitted by WWV, or available from the computer billboard at SEC, to determine 10- and 12- meter band conditions next year.

last-minute forecast

The higher frequency bands should be very good the first five days of the month and after the 21st. Look for good transequatorial openings to the southern countries. Openings may be enhanced during geomagnetic disturbances around January 8, 18, and 28. The lower bands are expected to be their best this winter around the 5th

WESTERN USA

QNT	WESTERN USA											
	PST	N	NE	E	SE	S	SW	W	NW	1200	1100	1000
0000	40	40	40	20	15	15	10	12	20	40	40	40
0100	30	40	40	20	15	15	12	12	20	40	40	40
0200	30	40	40	20	20	15	15	15	20	40	40	40
0300	40*	40	40	20	20	15	15	15	20	40	40	40
0400	40	40	40	30	20	20	20	20	30	40	40	40
0500	40	40	40	30	20	20	20	20	40	40	40	40
0600	40	40	40	30	20	20	20	20	40	40	40	40
0700	40	40	40	30	30	30	20	20	40	40	40	40
0800	40	40	40	30	30	30	20	30	40	40	40	40
0900	40	40	40	30	30	30	30	30	40	40	40	40
1000	40	40	40	30	30	30	30	30	40	40	40	40
1100	40	40	40	30	30	30	30	30	40	40	40	40
1200	40	40	40	30	30	30	30	30	40	40	40	40
1300	40	40	40	20	20	30	30	30	40	40	40	40
1400	40	40	30	15	15	30	30	30	40	40	40	40
1500	40	40	20	15	15	30	30	30	40	40	40	40
1600	40	40	20	12	12	15	30	20	40	40	40	40
1700	40	20	20	12	12	15	20	20	40	40	40	40
1800	40	30	12	12	12	15	20	20	40	40	40	40
1900	40	40	12	10	15	15	15	20	40	40	40	40
2000	40	40	12	10	15	15	15	20	40	40	40	40
2100	40	40	15	10	15	15	12	15	40	40	40	40
2200	40	40	15	12	15	15	12	15	40	40	40	40
2300	40	40	15	12	15	15	10	15	40	40	40	40
2400	40	40	15	12	15	15	10	15	40	40	40	40

MID USA

QNT	MID USA											
	MST	N	NE	E	SE	S	SW	W	NW	1200	1100	1000
0000	40	40	20	15	15	12	12	12	20	40	40	40
0100	40	40	20	20	15	15	15	15	20	40	40	40
0200	40	40	20	20	20	15	15	15	20	40	40	40
0300	40	40	20	20	20	15	15	15	20	40	40	40
0400	40	40	30	20	20	20	20	20	30	40	40	40
0500	40	40	30	20	20	20	20	20	40	40	40	40
0600	40	40	30	20	20	20	20	20	40	40	40	40
0700	40	40	30	20	20	20	20	20	40	40	40	40
0800	40	40	30	20	20	20	20	20	40	40	40	40
0900	40	40	30	20	20	20	20	20	40	40	40	40
1000	40	40	30	20	20	20	20	20	40	40	40	40
1100	40	40	30	20	20	20	20	20	40	40	40	40
1200	40	40	30	20	20	20	20	20	40	40	40	40
1300	40	40	30	15	15	30	30	30	40	40	40	40
1400	40	40	30	15	15	20	20	20	40	40	40	40
1500	40	40	20	15	15	20	20	20	40	40	40	40
1600	40	40	20	12	12	15	20	20	40	40	40	40
1700	40	40	12	12	12	15	20	20	40	40	40	40
1800	40	40	12	10	15	15	20	20	40	40	40	40
1900	40	40	12	10	15	15	20	20	40	40	40	40
2000	40	40	12	10	15	15	20	20	40	40	40	40
2100	40	40	12	12	15	15	15	15	40	40	40	40
2200	40	40	15	12	15	15	12	15	40	40	40	40
2300	40	40	15	12	15	15	12	15	40	40	40	40
2400	40	40	15	12	15	15	10	15	40	40	40	40

EASTERN USA

QNT	EASTERN USA											
	EST	N	NE	E	SE	S	SW	W	NW	1200	1100	1000
0000	40	40	20	20	20	15	15	15	30	40	40	40
0100	40	40	20	20	20	20	20	20	40	40	40	40
0200	40	40	20	20	20	20	20	20	40	40	40	40
0300	40	40	30	20	20	20	20	20	40	40	40	40
0400	40	40	30	20	20	20	20	20	40	40	40	40
0500	40	40	30	20	20	20	20	20	40	40	40	40
0600	40	40	30	20	20	20	20	20	40	40	40	40
0700	40	40	30	20	20	20	20	20	40	40	40	40
0800	40	40	30	20	20	20	20	20	40	40	40	40
0900	40	40	30	20	20	20	20	20	40	40	40	40
1000	40	40	30	20	20	20	20	20	40	40	40	40
1100	40	40	30	20	20	20	20	20	40	40	40	40
1200	40	40	30	20	20	20	20	20	40	40	40	40
1300	40	40	30	20	20	20	20	20	40	40	40	40
1400	40	40	30	20	20	20	20	20	40	40	40	40
1500	40	40	30	20	20	20	20	20	40	40	40	40
1600	40	40	30	20	20	20	20	20	40	40	40	40
1700	40	40	30	20	20	20	20	20	40	40	40	40
1800	40	40	30	20	20	20	20	20	40	40	40	40
1900	40	40	30	20	20	20	20	20	40	40	40	40
2000	40	40	30	20	20	20	20	20	40	40	40	40
2100	40	40	30	20	20	20	20	20	40	40	40	40
2200	40	40	30	20	20	20	20	20	40	40	40	40
2300	40	40	30	20	20	20	20	20	40	40	40	40
2400	40	40	30	20	20	20	20	20	40	40	40	40

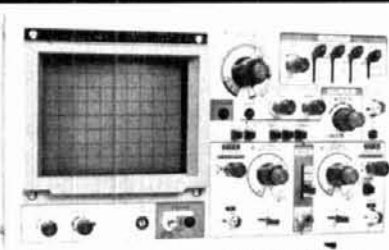
The italicized numbers signify the bands to try during the transition and early morning hours, while the standard type provides MUF during "normal" hours.

*Look at next higher band for possible openings.



\$369.95*
20 MHz DUAL TRACE

Includes 2 hook-on probes
 Features component testing circuit for resistors, capacitors, digital circuits and diodes—TV sync filter—high sensitivity—Z axis—XY mode—built-in calibrator—5X horizontal magnifier



\$499.95*
35 MHz DUAL TRACE

Includes 2 hook-on probes
 wide frequency bandwidth—optimal sensitivity—delayed triggering sweep—hold off—ALT trigger—single sweep TV sync—5X magnification—XY or XYZ operation—HF, LF noise reduction



\$2495.00* THE COMMUNICATIONS SERVICE MONITOR THAT WORKS HARDER FOR LESS.

Introducing COM-3... the new service monitor designed by service technicians for service technicians. It works harder for less... giving you advanced testing capabilities at a very affordable price.
FEATURES • Direct entry keyboard with programmable memory • Audio & transmitter frequency counter • LED bar graph frequency/error deviation display • 0.1-10,000 µV output levels • High receive sensitivity, less than 5 µV • 100 KHz to 999.9995 MHz Continuous frequency coverage • Transmit protection, up to 100 watts • CTS tone encoder, 1 KHz and external modulation

UNSURPASSED QUALITY • SUITABLE FOR HOBBY, SERVICE & PRODUCTION

MODEL	BAND WIDTH	# TRACES	CRT SIZE	VERTICAL SENSITIVITY	MAXIMUM TRIG FREQ	USEABLE MAXIMUM BANDWIDTH
2200	20 MHz	(2)	8x10CM	5 mV per div	35 MHz	30 MHz
3500	35 MHz	(2)	8x10CM	1 mV per div	50 MHz	60 MHz

All include high quality 1:1, 10:1 hook on probes, instruction/service manual with schematic and component layout, 1 year warranty.

*Add an additional \$10.00 for each unit for shipping.

MINI-100 COUNTER



\$119.95 CHARGER, NICAD BATTERIES, AC ADAPTER INCLUDED

CT-70 7 DIGIT 525 MHz



\$139.95 WIRED, INCLUDES AC ADAPTER

CT-90 9 DIGIT 600 MHz



\$169.95 WIRED INCLUDES AC ADAPTER

CT-50 8 DIGIT 600 MHz



\$189.95 WIRED INCLUDES AC ADAPTER

CT-125 9 DIGIT 1.2 GHz



\$189.95 WIRED INCLUDES AC ADAPTER

MODEL	FREQ RANGE	SENSITIVITY	ACCURACY	DIGITS	RESOLUTION	PRICE
MINI-100	1-500 MHz	Less than 250mv	1 PPM	7	100 Hz, 1 KHz	119.95
CT-70	20 Hz-550 MHz	< 50mv to 150 MHz	1 PPM	7	1Hz, 10Hz, 100Hz	139.95
CT-90	10 Hz-600 MHz	< 10mv to 150 MHz < 150mv to 600 MHz	1 PPM	9	0.1Hz, 1Hz, 10Hz	169.95
CT-50	5 Hz-600 MHz	LESS THAN 25 mv	1 PPM	8	1Hz, 10Hz	189.95
CT-125	10 Hz-1.25 GHz	< 25mv @ 50 MHz < 15mv @ 500 MHz < 100 mv @ 800 MHz	1 PPM	9	0.1Hz, 1Hz, 10Hz	189.95
CT-90 WITH OV-1 OPTION	10 Hz-600 MHz	< 10mv to 150 MHz < 150mv to 600 MHz	0.1 PPM	9	0.1Hz, 1Hz, 10Hz	229.90

RAMSEY FREQUENCY COUNTERS

Ramsey Electronics has been manufacturing electronic test gear for over 10 years and is recognized for lab quality products at breakthrough prices. Our frequency counters have features and capabilities of counters costing twice as much.



RAMSEY D-4100 COMPACT DIGITAL MULTITESTER
\$2495
 test leads and battery included

NEW

Compact sized reliability and accuracy. This LCD digital multimeter easily fits in your pocket, you can take it anywhere. It features full overload protection • 3 1/2 digit LCD readout • recessed input jacks • safety probes • diode check function • 2000 hours battery life



RAMSEY D-5100 HANDHELD DIGITAL AUTORANGING METER
\$49.95
 Includes Probes 1 Year Warranty

Provides distinctive audible chirp after contact has been made and meter reading has stabilized. Has TOUCH-HOLD feature to allow readings to be logged or referred to before making the next reading. Up to 10 AMP current capability and a continuity function which beeps on zero Ohms.



\$4995
 wired includes AC adapter
 PR-2 kit \$39.95

PR-2 COUNTER PREAMP

The PR-2 is ideal for measuring weak signals from 10 to 1,000 MHz • flat 25 db gain • BNC connectors • great for sniffing RF • ideal receiver/TV preamp



\$6995
 wired
 PS-2 kit \$49.95

PS-2 AUDIO MULTIPLIER

The PS-2 is handy for high resolution audio resolution measurements, multiplies up in frequency • great for PL tone measurements • multiplies by 10 or 100 • 0.01 Hz resolution & built-in signal preamp/conditioner



\$8995
 wired includes AC adapter

PS-10B 1 GHz PRESCALER

Extends the range of your present counter to 1 GHz • 2 stage preamp • divide by 1000 circuitry • super sensitive (50 mV typical) • BNC connectors • 1 GHz in, 1 MHz out • drives any counter

MINI KITS—EASY TO ASSEMBLE—FUN TO USE—FOR BEGINNERS, STUDENTS AND PROS

<p>TONE DECODER A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20 turn pot. voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts. Complete kit, 1D-1 \$5.95</p>	<p>COLOR ORGAN See music come alive! 3 different lights flicker with music. One light each for high, mid-range and low. Each individually adjustable and drives up to 300 W runs on 120VAC. ML-1 kit \$8.95</p>	<p>VIDEO MODULATOR Converts any TV to video monitor. Super-stable, tunable over ch 4-6. Runs on 5-15V accepts std. video signal. Best unit on the market! Complete kit, VD-1 \$7.95</p>	<p>FM WIRELESS MIKE Transmits up to 300 ft to any FM broadcast radio uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage. FM-1 kit \$3.95 FM-2 kit \$4.95</p>	<p>SUPER SLEUTH A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or a general all-purpose amplifier. Full 2W rms output runs on 6 to 15 volts, uses 8-45 ohm speaker. SN-9 kit \$5.95</p>	<p>TELEPHONE TRANSMITTER Low cost with professional performance. Features include: self phone line powered, tunable from 76 to 100 MHz, polarity and sensitive compact size (1 1/2" x 1 1/2") easily installs anywhere on the phone line or inside the instrument itself. PB-1 kit \$14.95</p>	<p>FM MINI MIKE A super high performance FM wireless mike kit. Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built-in electret mike. Kit includes case, mike, on/off switch, antenna, battery and super instructions. This is the finest unit available. FM-1 kit \$14.95 FM-3 Wired and tested 19.95</p>
<p>40 WATT 2 mtr PWR AMP Simple Class C power amp features 8 times power gain 1 W in for 8 out, 2 W in for 15 out, 5 W in for 40 W out. Max output of 50 W into 8 ohm load. Complete with all parts, less case and T-R relay. PA-1 40 W pwr amp kit \$22.95 TR-1 RF sensed T-R relay kit 6.95</p>	<p>VOICE ACTIVATED SWITCH Voice-activated switch kit provides switched output with current capability up to 300 mA. Can drive relays, lights, LED or even a tape recorder motor. Runs on 5 VDC. VS-1 kit \$6.95</p>	<p>LED BLINKY KIT Alternately flashes 2 numbers LEDs. Use for name badges, buttons, warning panel lights. Runs on 3 to 15 volts. BL-1 kit \$2.95</p>	<p>MAD BLASTER Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC. MB-1 kit \$4.95</p>	<p>60 Hz TIME BASE Low current (25ma) 1 min/month accuracy. TB-6 kit \$5.50 TB-6 Ass'y \$9.95</p>	<p>UNIVERSAL TIMER Provides the basic parts and PC board required to provide a source of precision timing and pulse generation. Uses 355 timer IC and includes a range of parts for most timing needs. UT-5 kit \$5.95</p>	<p>WHISPER LIGHT An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Includes mike, controls up to 300 W runs on 120 VAC. WL-1 kit \$6.95</p>

ACCESSORIES FOR RAMSEY COUNTERS

- Telescopic whip antenna—BNC plug \$ 8.95
- High impedance probe, light loading 16.95
- Low pass probe, audio use 16.95
- Direct probe, general purpose use 13.95
- Tilt bail, for CT-70, 90, 125 3.95

PHONE ORDERS CALL

716-586-3950

TELEX 466735 RAMSEY CI

FAX 716-586-4754



TERMS: • satisfaction guaranteed • examine for 10 days, if not pleased, return in original form for refund • add 6% for shipping and insurance to a maximum of \$10.00 • foreign add 15% for surface mail • CDD add \$2.50 (CDD in USA only) • orders under \$15.00 add \$1.50 • NY residents add 7% sales tax • 90 day parts warranty on all kits • 1 year parts & labor warranty on all wired units.

RAMSEY ELECTRONICS, INC.
 2575 Baird Rd.
 Penfield, N.Y. 14526

through the 8th. However, during disturbances, expect lower MUFs and signal strengths and QSB on the auroral paths — i.e., long east-west and northern routes. Approximately one week later, after the beginning of these disturbances, look out for the winter absorption anomaly to occur, especially from the 18th on (listen for a STRATWARN from WWV).

Lunar perigee will occur on the 8th, with a full moon on the 20th. An intense but short-duration meteor shower, the Quadrantids, will occur between January 2 and 4, and last a few hours.

band-by-band summary

Ten, twelve, fifteen, and twenty meters will be open from morning till early evening almost every day and to most areas of the world. The openings on the higher of these bands will be shorter and will occur closer to local noon. Transequatorial propagation on these bands will more likely occur toward evening during conditions of high solar flux and disturbed geomagnetic field conditions.

Thirty and forty meters will be useful almost 24 hours a day. Daytime conditions will resemble those on 20 meters. Skip distances and signal strengths may decrease during midday on days that coincide with these higher solar flux values. Nighttime DX will be good except after days of high MUF conditions and during geomagnetic disturbances. Look for DX from unusual places on east, north, and west paths during this time. The usable distance is expected to be somewhat less than on 20 in the daytime and greater than on 80 at night.

Eighty and one-sixty meters will exhibit short-skip propagation during daylight hours and lengthen for DX at dusk. These bands follow the darkness regions opening to the east just before your sunset, swinging more to the south around midnight, and ending up in the Pacific areas an hour or so before dawn. The 160-meter band opens later and ends earlier than 80.

ham radio

THE 1988 ARRL HANDBOOK

FOR THE RADIO AMATEUR



NEW EDITION

The 1988 ARRL Handbook For The Radio Amateur carries on the tradition of the previous editions by presenting 1200 pages of comprehensive information for the radio amateur, engineer, technician and student. Clothbound only. \$21 in the U.S., \$23 in Canada and elsewhere.

THE AMERICAN RADIO RELAY LEAGUE
225 MAIN STREET
NEWINGTON, CT 06111

This publication is
available in microform
from University
Microfilms
International.



Please send information about these titles:

Name _____

Company/Institution _____

Address _____

City _____

State _____ Zip _____

Phone () _____

Call toll-free 800-521-3044. In Michigan, Alaska and Hawaii call collect 313-761-4700. Or mail inquiry to: University Microfilms International, 300 North Zeeb Road, Ann Arbor, MI 48106.

2x4Z BASE REPEATER ANTENNA

THE HIGHEST GAIN DUAL BAND
BASE/REPEATER ANTENNA

HIGH POWER 200 WATTS

CENTER FREQUENCY

146.500 MHz

446.500 MHz

GAIN:

VHF - 8.2dB

UHF - 11.5dB

VSWR - 1.-1.2 or less

CONNECTOR:

N TYPE FEMALE

LIGHTNING PROTECTION
GROUNDED DIRECT

LENGTH: 16 FT.

WEIGHT: 5 LBS. 3 OZ.

WIND LOAD: 90 MPH

MOUNTING: UP TO 2 IN.

MAST

CAN SIMULCAST ON

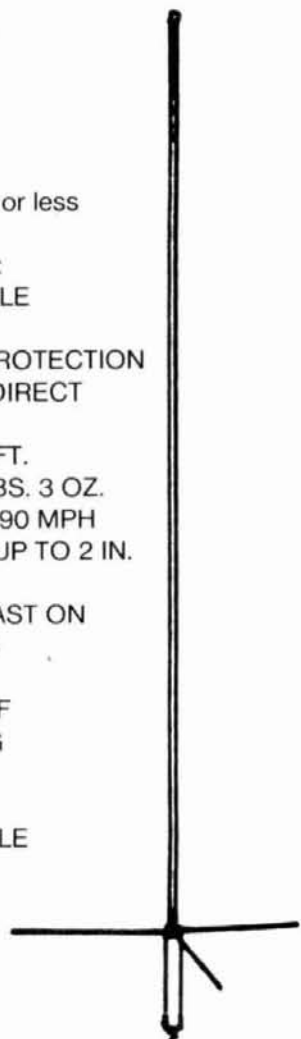
BOTH BANDS

WATERPROOF

CONNECTING

JOINTS

UPS SHIPPABLE

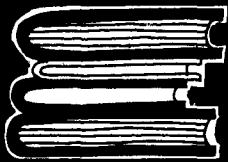


AMATEUR SPECIAL



1275 NORTH GROVE ST.
ANAHEIM, CALIF. 92806
(714) 630-4541

CABLE: NATCOLGLZ
FAX (714) 630-7024



ELMER'S NOTEBOOK

Tom McMullen, W1SL

power measurements

The subject for this month's notebook — power measurements — popped into mind while I was writing last month's column. Rather than append a lengthy footnote to that dissertation (on 1200 MHz equipment — see December 1987, page 113), I decided that the topic deserved more thorough treatment.

The trigger word was "PEP," or peak-envelope power. Because power measurements have always been one of the elements of electronics that require some study, I'll use this month's column to explain what they're all about.

dc measurements

There's not a lot that's exciting about dc power measurements, or about measuring equipment, for that matter. But it helps to know something about them so you'll have some basis for what's to follow.

You can learn all you need to know about dc with the aid of a voltmeter, an ammeter, and a couple of simple formulas. It's all very straightforward: voltage times current equals power ($E \times I = P$). If you don't have an ammeter, you can measure the voltage drop across a resistor and obtain the power by using the formula $P = E^2/R$. If you use an oscilloscope to look at a dc waveform, you'll see a straight line across the screen, at a level that's displaced from the zero-voltage line of the trace (see fig. 1A). By carefully calibrating the oscilloscope screen,

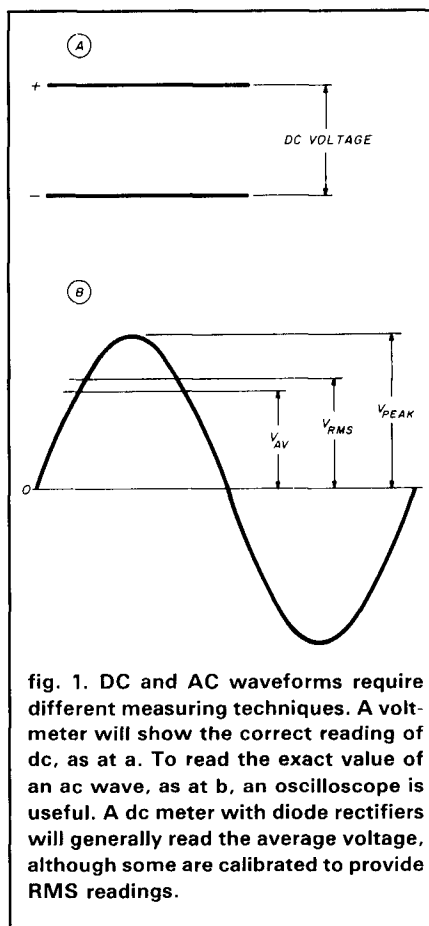


fig. 1. DC and AC waveforms require different measuring techniques. A voltmeter will show the correct reading of dc, as at a. To read the exact value of an ac wave, as at b, an oscilloscope is useful. A dc meter with diode rectifiers will generally read the average voltage, although some are calibrated to provide RMS readings.

you can read the voltage with precision. With dc, what you see is what you get — the peak voltage and average voltage are the same.

ac measurements

When you turn your efforts to measuring ac voltages, things get more complex. The meter you used for dc

is no longer useful. If you connect the probes from a dc voltmeter across a source of ac, you might see no pointer movement at all, or perhaps just a blur as the pointer tries to keep up with the rapidly changing waveform. The common way to obtain an ac-reading voltmeter is to insert a rectifier diode in series with one lead (or sometimes a bridge rectifier, which will provide a higher resultant dc reading on the meter). This type of meter provides a reading that generally represents the average voltage of the ac waveform, shown in fig. 1B, although some read RMS and are marked accordingly on their scales.

An oscilloscope will show you the true value of the ac waveform, including the negative-going and positive-going peaks. With a calibrated oscilloscope, you can measure the peak voltage accurately.

The average voltage (of a rectified sine wave) bears a direct relationship to the peak voltage by the formula $V_{av} = 0.637 \times V_{peak}$.^{*} Knowing this relationship, you can turn the formula around to use the average reading (from a voltmeter with a rectifier) as a means of finding the peak voltage: $V_{peak} = 1.571 \times V_{av}$.

Though this relationship of average to peak holds true for any undistorted sinusoidal waveform, a distorted waveform doesn't follow the same rules.

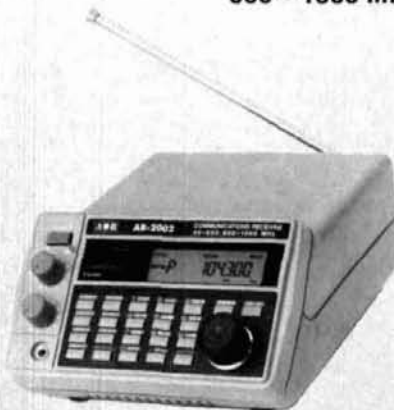
^{*} Note that this value isn't the same as the RMS voltage, which is obtained by $V_{RMS} = 0.707 \times V_{peak}$, and $V_{peak} = 1.414 \times V_{RMS}$.

Above and Beyond AR2002

PROFESSIONAL MONITOR RECEIVER

25 - 550 MHz

800 - 1300 MHz



Specifications:

Receiving mode - Narrow band FM, Wide band FM & AM

Receiver circuit - Microprocessor controlled PLL
Frequency synthesized superheterodyne type
with high-level doubled balanced mixer

Receiver IF - 750MHz, 45.03MHz, 5.5 MHz (WFM)
and 455kHz (NFM & AM)

Sensitivity - NFM - 0.35 μ V (12dB SINAD)
WFM - 1.00 μ V (12dB SINAD)
AM - 1.00 μ V (10dB S/N)

Selectivity - NFM - \pm 7.5kHz @ 6dB
 \pm 20kHz @ 70dB
WFM - \pm 50kHz @ 6dB
 \pm 250kHz @ 60dB
AM - \pm 5.0kHz @ 6dB
 \pm 10kHz @ 70dB

Number of memory channel - 20 channels
Scan rate - 5 channels per second
Search rate - 6 seconds per MHz

Antenna connector - Standard BNC type, 50-ohm
Audio output power - 1 watt at less than 10% THD
Power requirement - 12 to 14Vdc at 300 to 500mA
Size and weight - 5.4" W x 3.15" H x 7.88" D, 2.6 lbs.

Options:

Cradled mobile mounting bracket
Trunk lid mobile antenna with 12 ft cable
Discone base antenna with 30 ft cable
RS-232C Interface unit

Please: No Dealer Inquiries

AR2002

Professional Monitor Receiver

\$455.00

(California res. add \$27.30 tax)

Visa and MasterCard accepted

Prices includes shipping & handling
C.O.D. slightly higher

22511 Aspan Street, Lake Forest, CA 92630-6321

Calif/Alaska (714) 581-4900

Facsimile (714) 768-4410 (not a phone)

TOLL FREE 1-800-523-6366

ACE communications, inc.



Now that you can speak, talk to Larsen.

Novice Enhancement opens up a whole new way for novices to communicate. To make the most of it, talk to Larsen Electronics.

We'll tell you how Larsen antennas can greatly improve your powers of communication. We'll also explain how Larsen 220 and 1296 MHz antennas are designed to give you the best performance.

Talk to your Larsen amateur dealer today, and see if Larsen performance doesn't speak for itself.

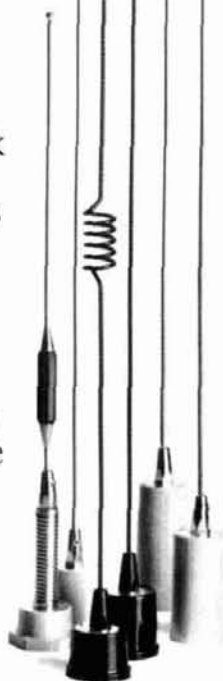


Larsen Antennas The Amateur's Professional™

See your favorite amateur dealer or write for a free amateur catalog.

IN USA: Larsen Electronics, Inc., 11611 N.E. 50th Ave., P.O. Box 1799, Vancouver, WA 98668. 206-573-2722.

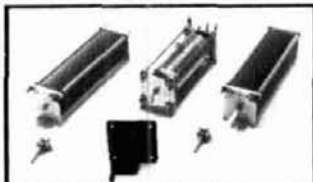
IN CANADA: Canadian Larsen Electronics, Ltd., 149 West 6th Avenue, Vancouver, B.C. V5Y 1K3. 604-872-8517.



✓ 188

1500 + WATT TRANSMATCH KIT \$164.95

OTHER KITS



BASIC KIT: INDIVIDUAL ITEMS

- 1 - rotary inductor 28 μ H \$59.00
- 2 - 6:1 ball drives \$7.50 ea.
- 1 - 0-100 turns counter \$62.50
- 2 - variable capacitors
25-245 pF 4500 v \$37.00 ea.

OPTIONS—

- enclosure (pictured in Sept. 86 CQ) \$64.00
- 4:1 balun kit \$22.50

dials, terminals, chassis, ceramic standoffs, hardware, toroids, amp components, B&W coil stock, etc.

- Article Reprints (refundable)..... \$1.50
- G3RUH, PSK Packet Modem, Satl./Terrestrial \$99.00
- PC Board for above only, delivered \$27.99
- Ten-Tec Designer Cabinet for above \$12.00
- K9CW Memory Contest Keyer \$109.00
- Yaesu FRG-9600, .1 to 60 MHz Converter \$94.95
- 20m CW, 15w Transceiver (H.R. 6/87) \$159.95
- 50W 75M SSB XCVR \$199.95

Factory Wired

- Nel-Tech DVK-100 \$259.00
- B&W PT-2500A Amp \$1,670.00
- B&W VS1500A Tuner \$384.00
- Amp Supply Monobanders \$299.00

Shipping Extra Unless Noted
Catalog \$1.00

RADIOKIT • P.O. Box 973-H
Pelham, NH 03076 • (603) 635-2235



✓ 189

THE RF CONNECTION

"SPECIALIST IN RF CONNECTORS AND COAX"

Part No.	Description	Price
321-11064-3	BNC 2 PST 28 volt coaxial relay, Amphenol Insertion loss: 0 to 0.75GHz, 0.10dB Power rating: 0 to 0.5GHz, 100 watts CW, 2 kw peak Isolation: 0.1 GHz/45db, 0.2 GHz/40db, 0.4 GHz/35db	\$25 used 1.45 tested
83-822	PL-259 Teflon, Amphenol	1.45
PL-259-ST	UHF Male Silver Teflon, USA	1.30
UG-21D-U	N Male RG-8, 213, 214, Amphenol	2.95
UG-21B-U	N Male RG-8, 213, 214, Kings	3.75
9913-PIN	N Male Pin for 9913, 9086, 8214 fits UG-21D-U & UG-21B-U N's	1.50
UG-21D-9913	N Male for RG-8 with 9913 Pin	3.95
UG-21B-9913	N Male for RG-8 with 9913 Pin	4.75
UG-146-U	N Male to SO-239, Teflon USA	5.00
UG-83-U	Female to SO-239, Teflon USA	5.00

"THIS LIST REPRESENTS ONLY A FRACTION OF OUR HUGE INVENTORY"

THE R.F. CONNECTION
213 North Frederick Ave. #11
Gaithersburg, MD 20877

(301) 840-5477

CASH PRICES

191

SYNTHESIZED SIGNAL GENERATOR

MADE IN USA



MODEL SG-100F
\$429.95 delivered

- Covers 100 MHz to 199.999 MHz in 1 kHz steps with thumbwheel dial
- Accuracy +/- 1 part per 10 million at all frequencies
- Internal FM adjustable from 0 to 100 kHz at a 1 kHz rate
- External FM input accepts tones or voice
- Spurs and noise at least 60 dB below carrier
- Output adjustable from 5-500 mV at 50 Ohms
- Operates on 12 Vdc @ 1/2 Amp
- Available for immediate delivery
- \$429.95 delivered
- Add-on accessories available to extend freq range, add infinite resolution, AM, and a precision 120 dB attenuator
- Call or write for details
- Phone in your order for fast COD shipment.

VANGUARD LABS

196-23 Jamaica Ave., Hollis, NY 11423
Phone: (718) 468-2720 Mon. thru Thu.

192

ALL BAND TRAP "SLOPER" ANTENNAS!



FULL COVERAGE! ALL BANDS! AUTOMATIC SELECTION WITH PROVEN Weatherproof sealed Traps - 16 Ga. Copperweld Wire! GROUND MOUNT SLOPERS - No Radials needed! Ground to rad. or house water faucet! Connect Top to Trees, Buildings, Poles, etc at ANY angle from Straightup to 60 degrees for excellent "SLOPER" DX Antenna Gain or bend it anywhere you need to! 2000 Watt PEP input, max! Permanent or portable! Use instantly in 10 minutes - SMALL - NEAT - ALMOST INVISIBLE - No one will know you have a Hi-Power DX Antenna. Ideal For COND'Os APARTMENTS - RESTRICTED AREAS - Pre-tuned for 2-1 or less SWR over ALL bands (except 80-160-300kc) No adjustments needed - EVER, COMPLETELY ASSEMBLED, with 50 ft RG-50U Coax feedline and PL-259 connector - Built in lightning arrester - ready to hookup! FULL INSTRUCTIONS!

No. 1080S - 80-40-20-15-10 - 1 trap 49 ft. - \$59.95
No. 1040S - 40-20-15-10 - 1 trap 26 ft. - \$59.95
No. 1020S - 20-15-10 - 1 trap 13 ft. - \$57.95
No. 1016S - 160-80-40-20-15-10 - 2 traps 83 ft. - \$89.95
SEND FULL PRICE FOR PPDEL IN USA (Canada is \$5.00 extra for postage etc) or order using VISA, MASCARD - AMER EXP. Give Number Ex Date. Ph 1-308-238-5333 weekdays. We ship in 2-3 days (P&R Cks 14 days) Guaranteed 1 yr - 10 day money back trial.

WESTERN ELECTRONICS
Kearney, Nebraska 68847

193

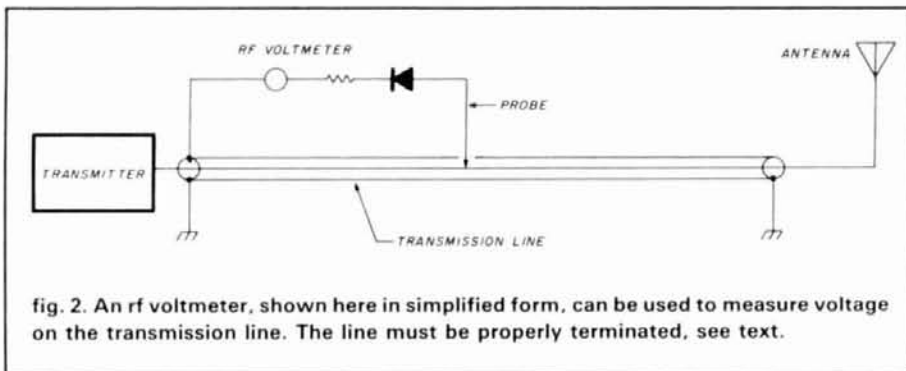


fig. 2. An rf voltmeter, shown here in simplified form, can be used to measure voltage on the transmission line. The line must be properly terminated, see text.

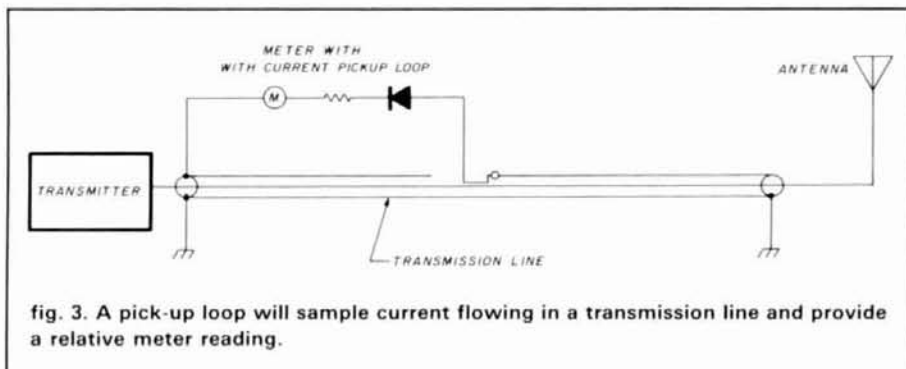


fig. 3. A pick-up loop will sample current flowing in a transmission line and provide a relative meter reading.

rf meters

Meters that measure RF are basically the same as those used to measure lower-frequency ac; a dc meter with diode(s) will provide a reading that represents some percentage of the waveform that's applied to it. The percentage for RF won't be the same as for lower-frequency ac such as 60 Hz, however. Variables such as the efficiency of the diode, the amount of resistance and capacitance in the meter/diode circuit, and the frequency of the RF being measured will all affect the reading.

You can check RF output power by measuring the voltage across a known resistor. The "known resistor" can be your 50- or 75-ohm transmission line (fig. 2). The formula is $P = E^2/R$, where R is the impedance of the transmission line. If the diode/meter combination is accurately calibrated, the results of such measurements are reliable.

Another common method of checking RF output power is to use a coupling loop inserted in the field of a

transmission line. The loop samples the current flowing in the line, and can be thought of as a transformer working at radio frequencies. The RF energy picked up by the loop is passed through a diode and applied to a meter (fig. 3). The Bird (or similar) type of in-line wattmeter uses this technique.

For either of these methods, the meter and pickup circuitry must be calibrated and used in a properly terminated transmission line.

PEP

After that review of measurement techniques and instruments, let's look at some applications, such as measuring PEP. We all know that PEP stands for peak envelope power. But what's an envelope?

To follow this, look at fig. 4. If you have access to an oscilloscope and a signal generator with built-in modulation, you can see a waveform like this by connecting the output of the generator to the input of the 'scope, and then turning on the modulation. By experimenting a bit with the scan rate of

Running Back for More Is a Snap



ege inc™

DISCOUNTS FOR AMATEURS

EGE VIRGINIA

14803 Build America Drive, Bldg. B
Woodbridge, Virginia 22191
Information: (703) 643-1063
Service Dept: (703) 494-8750

Store Hours: M-F: 10-6
Sat: 10-4

Order Hours: M-F 9-7
Sat: 10-4

EGE NEW ENGLAND

8 Stiles Road
Salem, New Hampshire 03079
New Hampshire Orders,*
Info & Service: (603) 898-3750

Store Hours: MTuWTF: 10-5
Th: 12-8
Sat: 10-4

*Order & we'll credit you \$1 for the call.



Our associate store
Davis & Jackson Road, P.O. Box 293
Lacombe, Louisiana 70445
Info & Service: (504) 882-5355



Terms: No personal checks accepted. Prices do not include shipping. UPS COD fee: \$2.35 per package. Prices are subject to change without notice or obligation. Products are not sold for evaluation. Authorized returns are subject to a 15% restocking and handling fee and credit will be issued for use on your next purchase. EGE supports the manufacturer's warranties. To get a copy of a warranty prior to purchase, call customer service at 703-643-1063 and it will be furnished at no cost.

ege inc™

Winter Buyer's Guide/Catalog Available - Send \$1.

Antennas

Amateur HF Bands

Cushcraft, Butternut, KLM, Mosley, Hy-Gain, B&W, Van Gorden, Hustler, Larsen, Antenna Specialists, Centurion, Smiley

Antennas in Stock for Mobiles, Base Stations, and Handhelds

Everything from mini rubber duckies to huge monobanders

ASK FOR PACKAGE DEALS ON ANTENNAS AND ACCESSORIES

Also...

Antennas for Scanners, CBs, Marine, Commercial, and Short Wave Listening

YAESU



FT 23/33/73
Mini HTs for 2m, 220/440 MHz



FT 727R
2m/440 MHz Dual Band HT



FT 767GX
All Mode Transceiver with CAT System



NEW FT 757GX Mark II
HF Transceiver with General Coverage Receiver



FRG 9600
Scanning Receiver for 60-905 MHz FM/AM/SSB

Towers

UNARCO-ROHN TRI-EX HY-GAIN

Ask for package quotes on complete tower assemblies including Phillystran, guy wire, antennas, rotators, etc.

ROTATORS

Kenpro, Alliance, Daiwa, Telex Hy-Gain

ICOM



IC 751A
HF Transceiver with General Coverage Receiver



IC 3200
Dual 2m/440 MHz Mobile



IC 275A
All-mode Transceiver



R 7000
General Coverage Receiver



Micro 2AT/4AT
Mini Handhelds for 2m or 440 MHz



IC 02AT/03AT/04AT
Handhelds for 2m/220/440

Computer Stuff

Packet Controllers

Kantronics and MFJ

Amateur Software

Ham Data Software for Commodore Computers
Ask for Descriptions

RTTY/Morse/Amtor

Hardware and Software and packages by Kantronics, Microlog, HAL, MFJ, & more

KENWOOD



TS-140S
HF Transceiver with General Coverage Receiver



TS-940S
HF Transceiver with General Coverage Receiver



TM 221A/321A/421A
2m/220/440 MHz Mobiles



TH-25AT/45AT
Tiny HTs for 2m/440 MHz



R 5000
General Coverage Receiver

Accessories

AMPLIFIERS

Vocom, Daiwa, TE Systems, Amp Supply, Mirage, Alinco, Ameritron, Tokyo Hy-Power, RF Concepts

ANTENNA TUNERS

Amp Supply, Ameritron, MFJ

Switches, Couplers, Filters, Connectors, Mikes, Keys, Paddles, Headsets, Clocks, Books, Power Supplies

Now Available Heathkit

Selected Products at Discount Prices
Call for More Info



Corsair II Model 561
HF Transceiver



Paragon
Amateur Transceiver with General Coverage Receiver



ALR-22T
Compact 2m Mobile



ALD-24T
Compact Dual-band Mobile for 2m & 440 MHz

More Radios

SONY Receivers

REGENCY BEARCAT Scanners

CB RADIOS
Midland, Cobra, Uniden

For Orders & Quotes Call Toll Free: 800-336-4799
In New England (except NH): 800-237-0047 In Virginia: 800-572-4201

ege inc™

DAYTON

Hamvention

April 29, 30, May 1, 1988

Early Reservation Information

- Giant 3 day flea market • Exhibits
- License exams • Free bus service
- CW proficiency test • Door prizes

Flea market tickets and grand banquet tickets are limited. Place your reservations early, please.

Flea Market Tickets

A maximum of 3 spaces per person (non-transferable). Tickets (valid all 3 days) will be sold IN ADVANCE ONLY. No spaces sold at gate. Vendors MUST order registration ticket when ordering flea market spaces.

Special Awards

Nominations are requested for "Radio Amateur of the Year", "Special Achievement" and "Technical Achievement" awards. Contact: Hamvention Awards Chairman, Box 964, Dayton, OH 45401.

License Exams

Novice thru Extra exams scheduled Saturday and Sunday by appointment only. Send FCC form 610 (Aug. 1985 or later) - with requested elements indicated at top of form, copy of present license and check for \$4.35 (payable to ARRL/VEC) to: Exam Registration, 8830 Windbluff Point, Dayton, OH 45458

Hamvention Video

VHS video presentation about the HAMVENTION is available for loan. Contact Dick Miller, 2853 La Cresta, Beavercreek, OH 45324

1988 Deadlines

Award Nominations: March 15

Lodging: April 2

License Exams: March 26

Advance Registration and banquet:

USA - April 4 Canada - March 31

Flea Market Space:

Orders will not be processed **before** January 1

Information

General Information: (513) 433-7720
or, Box 2205, Dayton, OH 45401

Flea Market Information: (513) 898-8871

Lodging Information: (513) 223-2612

(No Reservations By Phone)

Lodging

Reservations received after Housing Bureau room blocks are filled will be returned along with a list of hotel/motels located in the surrounding areas of Dayton. The reservation will then become the responsibility of the individual.

HAMVENTION is sponsored by the Dayton Amateur Radio Association Inc.

Lodging Reservation Form

Dayton Hamvention - April 29, 30, May 1, 1988
Reservation Deadline - April 2, 1988

Name _____

Address _____

City _____ State _____ Zip _____

Phone _____

Arrival Date _____

Before 6 pm After 6 pm

Departure Date _____

Rooms: Single Double (1 bed, 2 persons)

Double Double (2 beds, 2 persons)

Deposit required - Room deposit must be paid directly to the hotel or motel by date shown on the confirmation form sent to you. Use canceled check for confirmation.

Mail to - Lodging, Dayton Hamvention, 1880 Kettering Tower, Dayton, OH 45423-1880

PLEASE SEPARATE

Advance Registration Form

Dayton Hamvention 1988

Reservation Deadline - USA-April 4, Canada-March 31

Name _____

Address _____

City _____ State _____ Zip _____

How Many

Admission _____ @ \$8.00* \$ _____
(valid all 3 days)

Grand Banquet _____ @ \$16.00** \$ _____

Women's Luncheon (Saturday) _____ @ \$6.75 \$ _____

(Sunday) _____ @ \$6.75 \$ _____

Flea Market _____ \$23/1 space
(Max. 3 spaces) \$50/2 adjacent

Admission ticket must \$150/3 adjacent \$ _____
be ordered with flea market tickets **Total** \$ _____

* \$10.00 at door ** \$18.00 at door, if available

Make checks payable and mail S.A.S.E. to -
Dayton Hamvention, Box 2205, Dayton, OH 45401

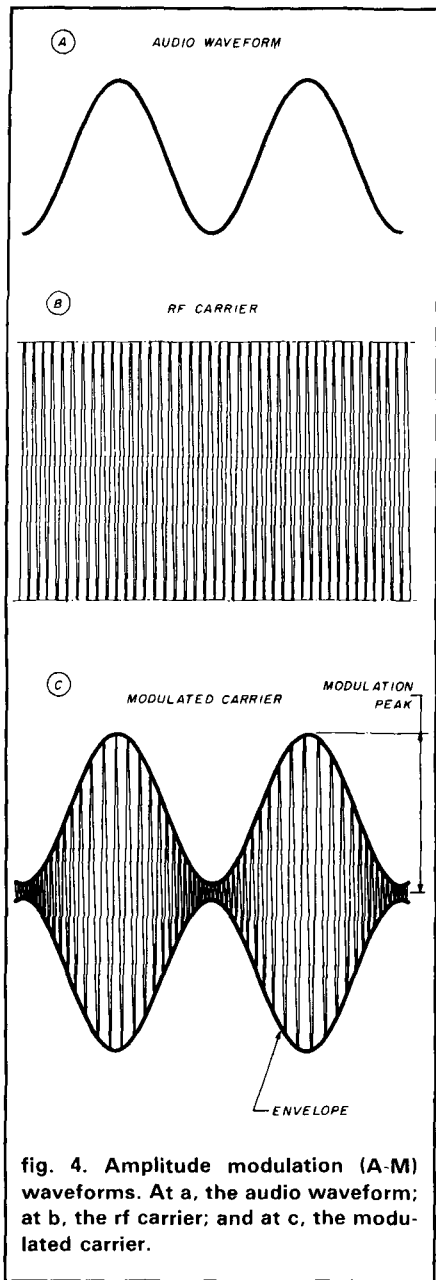


fig. 4. Amplitude modulation (A-M) waveforms. At a, the audio waveform; at b, the rf carrier; and at c, the modulated carrier.

the 'scope trace and with the level settings of the generator, you can produce a picture that appears very much like that which is shown in fig. 4C.

The modulation shown in fig. 4A and the RF carrier displayed in fig. 4B combine to produce the modulated carrier shown in fig. 4C. You'll note that the larger waveform (the modulation) has what appears to be a mirror image of itself, with some parts that almost touch at the center of the vertical screen trace. If you increase the modulation level enough, these

parts that touch will become flattened. This is *overmodulation*; if it's done on the air, it will cause splatter that will interfere with other stations.

Inside the larger waveform are sweep traces that are of a much higher frequency. This is the RF carrier. It follows the modulation to its highest peaks and decreases to practically nothing on the negative-going parts of the waveform. The larger waveform with the RF carrier inside it is called the *modulation envelope*. That's where the "envelope" part of PEP comes from, and the peak power is measured (or calculated) by using the voltage measured from the reference (zero) line to the tip of the modulation peak.

Here's another bit of theory applicable to a-m transmitters: because every positive-going modulation peak is matched by a negative-going one, the average power input is always the same. Because of *that*, the plate current to the final amplifier doesn't vary. (If it does, there's something wrong — perhaps low RF drive, incorrect bias, a power supply that has a poor output filter, a weak p-a tube, etc.) This is true for both voice-modulation and sine-wave modulation because voice waveforms have positive- and negative-going peaks too. Your antenna (or feedline) current will, however, increase with modulation peaks because the output contains sidebands that add their power to the carrier.

the SSB problem

Single-sideband voice transmission doesn't provide a steady RF-carrier output or a steady p-a power input that can be easily measured by common meters. A p-a plate-current meter will attempt to follow the modulation peaks when you speak, but because of the slow response time of the meter pointer, it will never quite catch up.* When you apply a steady tone (a test

* This lag in response time in meter movements is called *inertia*, and is created by the mass of the pointer and any parts, such as the moving coil (armature), attached to it. The reluctance of the coil moving in a magnetic field also affects the inertia of the meter. External circuitry, such as a very low resistance across the meter terminals can also slow the response time of the meter, but this is called *damping*.

signal), the meter will show a steady value that's useful for tune-up purposes, but voice modulation will produce a meter reading that's only a fraction of that value. The ratio is very unpredictable; each person's voice has

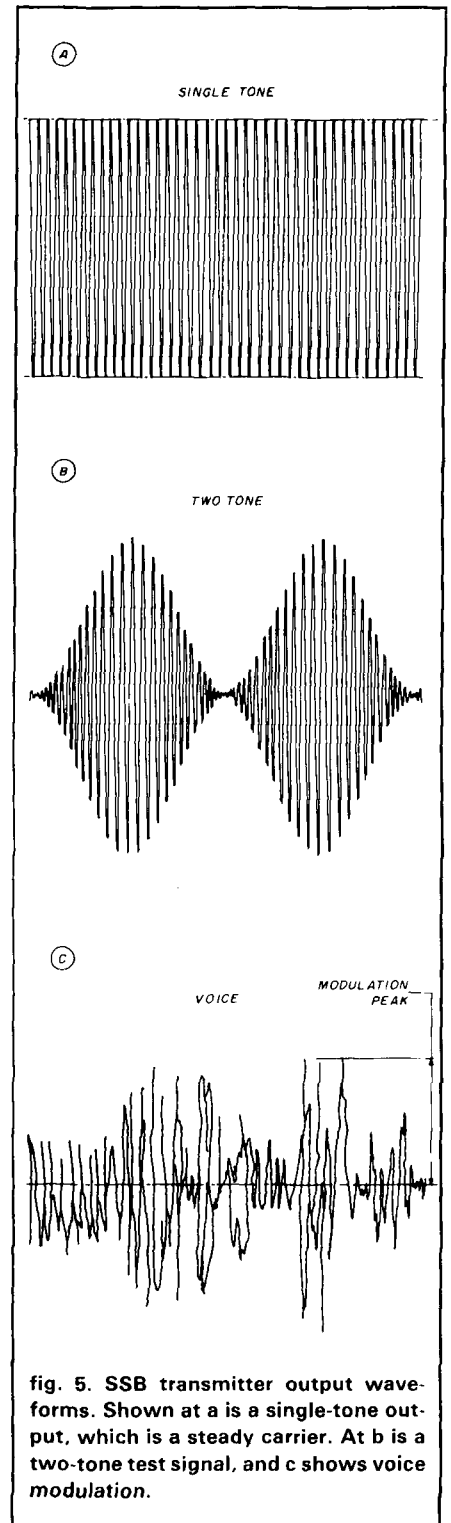


fig. 5. SSB transmitter output waveforms. Shown at a is a single-tone output, which is a steady carrier. At b is a two-tone test signal, and c shows voice modulation.

different peak-to-valley characteristics and different frequency content, and not all meters respond the same way. The meter reading for voice could be as low as 25 to 30 percent of that for steady-carrier conditions, for equivalent peak power.

Figure 5A shows a typical SSB output waveform with a steady one-tone test signal, and fig. 5B shows the output for a two-tone test signal. Figure 5C shows a voice-modulated SSB signal.

An oscilloscope can be used to monitor a voice-modulated SSB signal, and the peak voltage reading noted and used to compute the power at that instant. Oscilloscopes haven't found great favor among the Amateur community, however. Many of them are larger than the other components of the station, and most have an appearance more appropriate to a laboratory setting than an operating position.

Some manufacturers such as Heath, Kenwood, and Icom have produced "station monitors" designed to fit neatly into an equipment lineup. These dressed-up oscilloscopes will show the

audio peaks and valleys, and if calibrated for the transmission line and frequency of operation, will provide a reliable means of checking peak power output.

There are RF-output meters that provide peak readings. Some are manufactured by the major suppliers of Amateur transceivers, and provide a choice of either RMS or peak reading. I've seen Bird wattmeters advertised as "peak reading," and there may be others I'm not aware of.

For you builders, there's a digital PEP wattmeter described in Chapter 34 of the ARRL's 1987 *Radio Amateur's Handbook*. It uses peak-detectors to sample the voltage on a transmission line, and a holding circuit to hold the value long enough for the digital readout to provide an indication.

The thing to remember about any meter that samples either the current or voltage in a transmission line is that they're accurate only if the feedline is properly matched. If you use 50-ohm coaxial cable, but your antenna appears as 30 ohms, the SWR will quite thoroughly mess things up so that the readings you get are meaningless. (This brings up the subject of SWR

and VSWR, which I'll cover in next month's column).

which measurement?

So what does the FCC want you to measure? There's a "grandfather clause" in the regulations that permits General-class and higher licensees to use p-a plate input power as a measurement until 1990 — with a limit of 1000 watts.

Otherwise, all Amateur power levels are stated as PEP output, with a maximum for General-class and higher of 1500 watts.* (Note: when a higher-class licensee is operating in the Novice segment of any band, the higher-class licensee must observe the same power limits as the Novice).

Novices are allowed 200 watts PEP output on their segments of the 80, 40, 15, and 10-meter bands. On 220 MHz, the limit is 25 watts PEP output. On 1270 MHz, it's 5 watts.

You already have a yardstick that ignores the usually poor efficiency of the transmitter. With tube-type transmitters, efficiency depends upon correct drive, age of the tube, how hot the filament (or cathode) is, the *Q* of the output circuit, and how well the circuit is adjusted, among other things. All of these variables combine to make the actual output a rather uncertain figure. With solid-state transmitters, efficiency is often poor to begin with, and it changes with applied voltage as well as circuit adjustment, matching to the load, and even operating temperature. So, although it's not as easy to obtain as p-a input, PEP output is a more universally "fair" measurement.

In case your transceiver has an internal RF power metering circuit (and many solid-state units do have such circuits), it can be used for a-m, CW, or fm after being properly calibrated by checking against a decent-quality output wattmeter and dummy load. For SSB, this type of meter won't provide an accurate indication of PEP output unless the manufacturer has specifically designed it to do so.

* Except on the 30-meter band, where the limit is 200 watts PEP output.

ham radio

✓ 194

DEALER
INQUIRES
INVITED

ANTENNES
TONNA

The Shack

52 Stonewyck Drive
Belle Mead, New Jersey 08502
IVARS - KC2PX
MARA - SALES

MICROWAVE MODULES LTD.



FOFT TONNA

MON-SAT (201) 874-6013
10AM - 3PM ORDERS
7PM - 10PM ORDERS/TECHNICAL

CALL FOR CATALOG VISA/MASTERCARD



book and product

REVIEWS

KPC-4 packet TNC

The Kantronics KPC-4 Packet TNC features dual 1200-baud ports allowing simultaneous connections and conversations through each port. This TNC is excellent for VHF to HF gateway operations, packet bulletin board connections through different VHF frequencies or bands, and also VHF to VHF gateways. 2400 baud operation is possible on port 2 with the addition of the Kantronics 2400 Modem. Independent watchdog timers on each TNC port and a unique power brownout supervisory circuit permit unattended digipeater service. Operating parameters are retained via a 512 byte EEPROM eliminating the need for battery backup. Mobile, digipeater or portable operation is enhanced by the low-current single 12-VDC power supply requirements for the KPC-4. Home station power for the TNC is supplied by a wallplug type powerpack.

The KPC-4 includes the Kantronics Personal Mailbox feature. This remarkable mailbox was reviewed in detail in the October 1987 issue of Ham Radio. The mailbox operation is transparent — that is the TNC is still fully usable for digipeating, gateways or carrying on a packet QSO while the mailbox is being used. The operator may access the mailbox while the TNC is in a connected state. The KPC-4 has 32K of RAM, expandable to 64K, as compared to the 16K supplied with the earlier versions of the KPC-2, greatly increasing the mailbox capacity. The mailbox is not intended to serve a large user base — it is, as its name implies, a personal type mailbox intended to receive and store messages to and from the TNC's owner. But certainly some limited club applications are possible, such as posting meeting notices or similar limited-size general information bulletins. The mailbox is capable of receiving autoforwarding messages from its files. The command structure is basically the same as for the KPC-2 TNC using the mailbox firmware, except for several new commands for controlling the dual-port feature and gateway functions. The manual is nearly 90 pages long with in-depth coverage of the packet commands and parameters used by the KPC-4.

Nine LED front panel indicators continuously monitor TNC operations. The MAIL LED lights when a station is connected to the PBBS, or plinks continuously to indicate when mail addressed to you is present. Two LEDs indicate transmitter ptt keying for each port, two others indicate when either port is receiving data. The

RPT LED indicates when gateway or digipeater functions are actively in use. Unacknowledged packets cause the STA LED to illuminate. The remaining LED is the power indicator.

The KPC-4 will easily interface with most popular computers. All that is needed is a simple modem program to allow communications between the TNC and computer. The computer port uses true RS-232 levels for interfacing, or alternatively the levels may be converted to TTL by simply moving a jumper — permitting use with the popular Commodore 64 computers. For those few modem programs that use it, the KPC-4 supports TRS/CTS handshaking. The AFSK levels to the radio transmitter may be set at 10-mV or 50-mV via an internal jumper; or, alternatively, by changing internal resistors audio levels up to 1 volt are possible. Prewired cable assemblies are supplied for both radio ports and for the computer port — no connector is supplied for the computer end of the cable. The manual provides detailed information and examples for interfacing the KPC-4 with your computer and radio.

Since the KPC-4 is capable of operating as a fully automatic independent gateway you can provide access for your local VHF/UHF area network to a mailbox or gateway system. Two principle commands control gateway operations — MYGate and Gateway. MYGate is used to program the gateway identification; this call must be different than that used for MYcall or MYAlias. This is easily done by changing the ssid extender, for example if K1ZJH were used for MYcall, K1ZJH-1 would serve for MYGate. The Gateway command is used to turn the gateway off or on from the computer keyboard. When this command is on, packets addressed through the KPC-4 digipeater from either port will be automatically transmitted through the other port and visa-versa. Obvious uses would include cross-connecting area LANS operating on different frequencies and/or bands, multiple band and/or frequency operation for a packet PBBS, or for providing secular non-Amateur "wormhole" communication paths between distant LANS.

As with the other Kantronics products I've owned and used the KPC-4 uses highgrade components and is solidly built. For more information contact Kantronics, Inc., 1202 East 23rd Street, Lawrence, Kansas 66046.

by K1ZJH

Circle #308 on Reader Service Card.

Communications Receivers Principles and Design

The art of designing communication receivers incorporating the various analog and new digital techniques is frequently kept a well guarded trade secret. The new book, *Communications Receivers Principles & Design* (McGraw-Hill Book Company, ISBN 0-07-053570-1) by Ulrich

L. Rohde (DJ2LR/KA2WEU) and T. T. Nelson Bucher makes this information available to the interested community. The original manuscript was developed from courses given at the University of Gainesville, Florida and George Washington University in Washington by Dr. Rohde, where he was appointed adjunct professor of electrical and computer sciences. Both authors have a successful career in the field. Dr. Rohde, while at RCA, had directed the Military communication business area which had major government contracts in this field, and Dr. Bucher was responsible for many of the modern signal processing technologies and hardware designs and implementation at RCA. The reader, therefore, can expect a wealth of useful information to be found within the book as a result of the authors considerable background.

The book, divided into 10 chapters, considers the following subjects:

1. Basic Radio Considerations
2. Radio Receiver Characteristics
3. Receiver System Planning
4. Antennas and Antenna Coupling
5. Amplifiers and Gain Control
6. Mixers
7. Frequency Control and Local Oscillators
8. Demodulation and Demodulators
9. Other Receiver Circuits
10. Receiver Design Trends

The authors have provided a nice mix of theoretical and practical information. Many useful detailed circuits are shown and systems analyses and trade-off studies are included. The intense use of special modulation methods by the Services to provide reliable communication even under poor propagation has prompted the authors to provide a good theoretical introduction into this field as well as detailed practical performance examples.

"Communications Receivers Principles and Design" will, with its cogent mix of theory and practical information appeal to radio amateurs, students in the field of radio communications and engineering managers who need a comprehensive overview of all the techniques.

Available from Ham Radio Bookstore for \$69.95 postpaid.

K2RR

**SAY
YOU SAW
IT IN
ham radio!**



new accessories from ICOM

Instant satellite communications are now possible with ICOM's CT-16 Satellite Interface Unit when used with an ICOM CI-V System Transceiver. The CT-16 features an uplink switch to control the downlink and uplink transceivers, and a switch to select either normal or reverse tracking. The CT-16 may also be used in coordination with the UX-14 CI-IV/CI-5 converter. The suggested list price is \$97.50.

The UX-14 Converter enables you to adapt a CI-IV system to a CI-V system. This allows the transceiver to be computer controlled, or for satellite operations using the CT-16 Satellite Interface Unit. The following radios are equipped with a CI-IV port and can be converted for CI-V use with the UX-14: IC-R71A, IC-271A, IC-271H, IC471A, IC-471H, IC-751, IC-751A and IC-1271A. The converter is priced at \$72.50.

Radio operations can now be externally controlled by a RS-232C I/O port equipped personal computer by using ICOM's CT-17 Communication Interface-V (CI-V) Level Converter. Up to four ICOM CI-V radios can be used for controlling frequency, mode and memory information. Suggested List Price is \$97.50.

To complement the growing activity on 220MHz, ICOM now has a 220MHz repeater available, the RP-2210. With frequency coverage from 216-236 MHz, selectable CTCSS/Carrier squelch operating system, and 25 watts RF output power, DTMF control and continuous duty cycle. The RP-2210 is a great way to get out of the mainstream activity. The Suggested List Price of the repeater is \$1499.00.

Now ICOM offers the HM-46 and HM-46L Handheld Speaker Mic. The mini-sized speaker mic, HM-46 is big on audio for top panel connections on the IC-2AT, IC-02AT, IC-3AT, IC-03AT, IC-4AT and IC-04AT and the HM46L right angle connection speaker mic for the Micro series. Both the HM-46 and HM-46L have a swivel clip on the back to easily clip on your lapel or collar. The Suggested List Price of each mic is \$29.99.

Circle #307 on Reader Service Card.

morse code tutor program

MFJ Enterprises, Inc. has released its new MFJ-1266 and MFJ-1267 Morse Code Tutor Program/Iambic Keyer/Keyboard. This new program for the Commodore C-64 and C-128 not only teaches Morse code, but also functions as an iambic keyer and Morse keyboard. With the optional MFJ-76 interface board (\$19.95), you can plug in an external keyer paddle and key a transmitter or transceiver.

The disk version, MFJ-1266, retails for \$19.95 and the cartridge version, MFJ-1267, retails for \$29.95.

The program follows the format of the ARRL's *Tune in the World* and can be used with that course with MFJ's own code learning course.

The MFJ Morse Code Tutor such features as Select Random, which lets you choose the letters you wish to study; Complete Random, which sends all letters, numbers and punctuation randomly; Random Message, which sends a plain English message exactly as given on an FCC test or received on the air; Message Store, which lets you enter a message from the keyboard and store it for sending.

Each mode can use normal CW spacing or the special Farnsworth spacing that sends characters at a fast pace, but lengthens spaces between characters.

A copy of a test similar to a FCC Novice license test is included in the manual.

For additional information, contact MFJ Enterprises, Inc., P.O. Box 494, Mississippi State, Mississippi 39762.

Circle #306 on Reader Service Card.

dual-band amplifier

A dual-band amplifier?

Yes.

The HL-725D is a dual-band power amplifier for the 144 and 440 MHz bands, with low noise GaAs FET RX pre-amps. The HL-725D uses a large heat sink and the circuits of THL's stable, reliable HL-62V and HL-60U models. Because IN/OUT connectors are installed for both amplifiers, various combinations of dual TX and RX amplifiers can be used. Priced at \$329.95, the HL-725D's are available from Encomm dealers.

For details, contact Encomm, Inc., 1506 Capital Avenue, Plano, Texas 75074.

Circle #304 on Reader Service Card.

700 series towers

Microflect's new 12-page catalog describes the light-duty 700 Series tower, designed for cellular, UHF, VHF, and small microwave antenna applications. The standard three-legged tower configuration is available in 10-foot increments up to 160 feet.

The 700 Series easily adapts to Microflect's 800 Series towers to provide greater heights when required.

The accessories section in the catalog includes pipe mounts, beacon light mounts, and grounding kits for the 700 Series. A price list is also included.

Complimentary copies will be sent on request. Contact Microflect Company, Inc., P.O. Box 12985, Salem, Oregon 97309-0985.

Circle #303 on Reader Service Card.

firm grip

Fix-O-Fix is a vacuum suction pad that holds virtually any object firmly in any position — horizontally, vertically, sloping, or upside down

— on almost any flat surface. Attachment is easy; to disengage the vacuum, simply turn the pad to the left.

Fix-O-Fix is available for just \$5.00 plus \$1.00 shipping and handling directly from LWC Enterprises, 38 West Center, Logan, Utah 84321.

Circle #305 on Reader Service Card.

new rotor control option

Engineering Consulting has announced several new features for the Super Com Shack 64 remote base and repeater controller.

The advanced beam rotator control option (model HM-1) allows your system to control the Ham "M," Ham 4 or similar (i.e., CDR) rotators, complete with voice-announced bearings. The rotor option works in conjunction with the CS-8 relay card and the new HM-1 voltage-to-frequency converter, which plugs into the cassette port. The HM-1 samples a voltage from the rotor control box meter, which provides beam headings accurate to 1 degree. The control box switches (left, right, and brake on/off) are controlled via an interface cable that connects to the CS-8 relays No. 1, 2, and 3. An easy-to-install interconnect cable is used to parallel the control switches of the rotor control box, thereby allowing both manual and remote control of the rotor.

The HM-1 option (\$49.95) operates in conjunction with the model CS-8 relay control board and CS64S Version 3.0 software. Program enhancements include provisions to allow using the remaining five open collector outputs on the CS-8 to activate external relays or controlling the CS-8 for programming the dip switch of a CTCSS (sub-tone) Encoder or Decoder. While in the directed page mode or from a mobile, it's possible to access up to 32 tones to individuals or groups. Whenever a station is being voice-paged, the selected tone is sent to enable the receiver audio to open the receiver squelch. Additional Version 3.0 software enhancements include the ability to quick dial (two digits) all 300 stored telephone numbers. Version 3.0 allows users to assign 32 CTCSS (subtones) to groups or individuals, for automatic paging.

Version 3.0 is available to all Super Comshack 64 users who purchased the Model CS64S system since May 1, 1987 as part of Engineering Consulting's free upgrade policy.

For information, contact Engineering Consulting, 583 Candlewood Street, Brea, California 92621.

new HAMRAD publication

HAMRAD Press now publishes a directory of DX station operating information — *The W1TQS DX Locator*, a monthly compilation of data relating to the operating times and frequencies of DX stations heard and worked during the current month contained in major DX newsletters, magazines, club bulletins, logs, and other sources.

Over 2500 reports of DX station activity are separately listed by time, frequency and call, providing a rapid reference of potential DX con-

AEA
PK-232
PAKRATT
\$309
CASH PRICE

MA.

TEL-COM

Electronic Communications

NEW ENGLAND'S FACTORY-
AUTHORIZED SALES & SERVICE
FOR

KENWOOD ICOM

Also displaying the popular accessories needed to complete a HAM STATION . . .

- ARRL PUBLICATIONS • AEA PRODUCTS • AMPHENOL
- ALPHA DELTA • ASTRON • AUSTIN ANTENNAS • AVANTI
- BELDEN • BENCHER • B & W • DAIWA • ALINCO
- HUSTLER • KLM • LARSEN • MIRAGE • ROHN
- TELEX/HY-GAIN • TOKYO HY-POWER LABS
- TRAC KEYERS • VIBROPLEX • WELZ • ETC.

✓ 195

KENWOOD
SEE THE NEW
POCKET PORTABLE

TH-25AT
FOR THE HAM
WHO MISSED OUT
AT CHRISTMAS

OPEN SIX DAYS A WEEK

Telephone 617/486-3400, 3040

675 Great Rd., (Rte. 119) Littleton, MA 01460

1³/₄ miles from Rte. 495 (Exit 31) toward Groton, Mass.

tacts available during any time of day, and on any band from 160 to 10 meters. Bar and pie chart graphics also characterize DX station operating habits by band and time period, to highlight optimum operating conditions.

The W1TQS DX Locator is intended to supplement — not replace — the many fine DX newsletters currently available. Subscriptions are available from HAMRAD Press, P.O. Box 2458, Springfield, Virginia 22152. A one-year subscription (via first class mail) is \$35; foreign airmail rates are available upon request.

LCFIL filter design program

LCFIL, a stand-alone CAD program for IBM-compatible and Apple Macintosh computers, provides design solutions for lowpass, highpass, and bandpass filters having up to 21 poles. You can specify input impedance, inductor *Q*, and other parameters. Arbitrary component values may be entered into a general-purpose building block, which allows analysis of many other L-C filter topologies.

LCFIL computes filter magnitude, phase, and delay characteristics and provides normalized and actual component values. Both linear and logarithmic frequency steps are selectable. Optional modules provide for CGA, EGA, and Hercules-compatible graphical representation and drive 30 different popular pen plotters. An

optional signal processing module works with LCFIL to provide transient analysis capability. Inputs are free-format with liberal error trapping.

The retail price of this program is \$95. For details, contact BV Engineering, 2200 Business Way, Suite 207, Riverside, California 92501.

Circle #302 on Reader Service Card.

world time clock

The Azimuth Communications Corporation has announced a new World Time Clock, Model WT-80A, that features digital readouts with both local time and world time in 24-hour Zulu notation.



Designed around a special microprocessor, the quartz clock operates on a single oscillator. A slide switch selects display of the time in 24 cities around the world. (Universal/GMT time is shown when switch is set to London.)

Outside the shack, a press-on light and snooze alarm allow its use as a travel alarm clock. Two AAA penlight batteries are required.

As a special introductory offer, Azimuth is offering these world time clocks — a \$29.95 value — at \$19.95 plus \$1.95 for postage and handling (California residents add state sales tax.) To order, or for more information, contact Azimuth Clock, 11845 West Olympic Boulevard, Suite 1100, Los Angeles, California 90064.

Circle #301 on Reader Service Card.

new tool kit

Jensen Tools has introduced a new tool kit for advanced students of electronics and skilled hobbyists. Also appropriate for small service shops and skilled home repair, the Deluxe Tech School Kit (No. 23B002) includes screwdrivers, nutdrivers, a wire stripper/cutter, pliers, scissors, wrenches, a hemostat, a mirror, a holding tweezer, soldering equipment and more. A total of 28 quality tools are furnished in a 13-7/8 x 6-7/8 x 7 plastic tool box with lift-out tray, positive latch, and carrying handle. The kit is priced at \$79.00.

For more information and free catalog, contact Jensen Tools, Inc., 7815 South 46th Street, Phoenix, Arizona 85044.

Circle #309 on Reader Service Card.



Ham Radio's guide to help you find your local

California

A-TECH ELECTRONICS
1033 HOLLYWOOD WAY
BURBANK, CA 91505
(818) 845-9203
New Ham Store and Ready to Make a Deal!

JUN'S ELECTRONICS
3919 SEPULVEDA BLVD.
CULVER CITY, CA 90230
213-390-8003
800-882-1343 Trades
Habla Espanol

Colorado

COLORADO COMM CENTER
525 EAST 70th AVE.
SUITE ONE WEST
DENVER, CO 80229
(303) 288-7373
(800) 227-7373
Stocking all major lines
Kenwood Yaesu, Encomm, ICOM

Connecticut

HATRY ELECTRONICS
500 LEDYARD ST. (SOUTH)
HARTFORD, CT 06114
203-527-1881
Call today. Friendly one-stop shopping at prices you can afford.

Delaware

AMATEUR & ADVANCED COMMUNICATIONS
3208 CONCORD PIKE
WILMINGTON, DE 19803
(302) 478-2757
Delaware's Friendliest Ham Store.

DELAWARE AMATEUR SUPPLY
71 MEADOW ROAD
NEW CASTLE, DE 19720
302-328-7728
800-441-7008
Icom, Ten-Tec, Microlog, Yaesu, Kenwood, Santec, KDK, and more.
One mile off I-95, no sales tax.

Florida

AMATEUR ELECTRONIC SUPPLY
1898 DREW STREET
CLEARWATER, FL 33575
813-461-4267
Clearwater Branch
West Coast's only full service Amateur Radio Store.
Hours M-F 9-5:30, Sat. 9-3

AMATEUR ELECTRONIC SUPPLY
621 COMMONWEALTH AVE.
ORLANDO, FL 32803
305-894-3238
Fla. Wats: 1 (800) 432-9424
Outside Fla: 1 (800) 327-1917
Hours M-F 9-5:30, Sat. 9-3

Georgia

DOC'S COMMUNICATIONS
702 CHICKAMAUGA AVENUE
ROSSVILLE, GA 30741
(404) 866-2302 / 861-5610
ICOM, Yaesu, Kenwood, Bird...
9AM-5:30PM
We service what we sell.

Hawaii

HONOLULU ELECTRONICS
819 KEEAUMOKU STREET
HONOLULU, HI 96814
(808) 949-5564
Kenwood, ICOM, Yaesu, Hy-Gain, Cushcraft, AEA, KLM, Tri-Ex Towers, Fluke, Belden, Astron, etc.

Idaho

ROSS DISTRIBUTING COMPANY
78 SOUTH STATE STREET
PRESTON, ID 83263
(208) 852-0830
M 9-2; T-F 9-6; S 9-2
Stock All Major Brands
Over 7000 Ham Related Items on Hand

Illinois

ERICKSON COMMUNICATIONS, INC.
5456 N. MILWAUKEE AVE.
CHICAGO, IL 60630
312-631-5181
Hours: 9:30-5:30 Mon, Tu, Wed & Fri;
9:30-8:00 Thurs; 9:00-3:00 Sat.

Indiana

THE HAM STATION
220 N. FULTON AVE.
EVANSVILLE, IN 47710
(800) 523-7731
(812) 422-0231
ICOM, Yaesu, Ten-Tec, Cushcraft, Hy-Gain, AEA & others.

Maryland

MARYLAND RADIO CENTER
8576 LAURELDALE DRIVE
LAUREL, MD 20707
301-725-1212
Kenwood, Ten-Tec, Alinco, Azden. Full service dealer.
M-F 10-7 SAT 9-5

Massachusetts

TEL-COM, INC.
675 GREAT ROAD, RTE. 119
LITTLETON, MA 01460
617-486-3400
617-486-3040
The Ham Store of New England
You Can Rely On.

Michigan

ATLANTIC SOLAR POWER/ENCON
(SINCE 1979)
37279 W. SIX MILE RD.
LIVONIA, MI 48152
(313) 591-7745
Solar Electric Power for Repeaters, Ham Shacks, Packet Radio.
Call Paul, WD8AHO

Missouri

MISSOURI RADIO CENTER
102 NW BUSINESS PARK LANE
KANSAS CITY, MO 64150
(800) 821-7323
Missouri: (816) 741-8118
ICOM, Kenwood, Yaesu
Same day service, low prices.

Nevada

AMATEUR ELECTRONIC SUPPLY
1072 N. RANCHO DRIVE
LAS VEGAS, NV 89106
702-647-3114
Dale Porray "Squeak," AD7K
Outside Nev: 1 (800) 634-6227
Hours M-F 9-5:30, Sat. 9-3

New Hampshire

RIVENDELL ELECTRONICS
8 LONDONDERRY ROAD
DERRY, N. H. 03038
603-434-5371
Hours M-S 10-5; THURS 10-7
Closed Sun/Holidays

Dealers: YOU SHOULD BE HERE TOO!
Contact Ham Radio now for complete details.

New Jersey

ABARIS SYSTEMS

276 ORIENTAL PLACE
LYNDHURST, NJ 07071
201-939-0015
Don WB2GPU

Astatic, Azden, B&W, Butternut, Larsen,
Mirage/KLM, Kenpro, Nye, Santec,
THL, and many others.

M-F 10 am-9 pm
SAT 9 am-7 pm
VISA/MC

KJI ELECTRONICS

66 SKYTOP ROAD
CEDAR GROVE, NJ 07009
(201) 239-4389
Gene K2KJL

Maryann K2RVH
Distributor of: KLM, Mirage, ICOM, Lar-
sen, Lunar, Astron. Wholesale - retail.

New York

BARRY ELECTRONICS

512 BROADWAY
NEW YORK, NY 10012
212-925-7000

New York City's Largest Full Service
Ham and Commercial Radio Store.

VHF COMMUNICATIONS

915 NORTH MAIN STREET
JAMESTOWN, NY 14701
716-664-6345

Call after 7 PM and save! Supplying all
of your Amateur needs. Featuring ICOM
"The World System." Western New
York's finest Amateur dealer.

Ohio

AMATEUR ELECTRONIC SUPPLY

28940 EUCLID AVE.
WICKLIFFE, OH 44092 (Cleveland Area)
216-585-7388

Ohio Wats: 1 (800) 362-0290
Outside Ohio: 1 (800) 321-3594
Hours M-F 9-5:30, Sat. 9-3

DEBCO ELECTRONICS, INC.

3931 EDWARDS RD.
CINCINNATI, OHIO 45209
(513) 531-4499

Mon-Sat 10AM-9PM
Sun 12-6PM

We buy and sell all types of electronic
parts.

UNIVERSAL AMATEUR RADIO, INC.
1280 AIDA DRIVE
REYNOLDSBURG (COLUMBUS), OH
43068

614-866-4267

Featuring Kenwood, Yaesu, Icom,
and other fine gear. Factory author-
ized sales and service. Shortwave
specialists. Near I-270 and airport.

Pennsylvania

HAMTRONICS, DIV. OF TREVOSE ELECTRONICS

4033 BROWNSVILLE ROAD
TREVOSE, PA 19047
215-357-1400

Same Location for over 30 Years

Tennessee

MEMPHIS AMATEUR ELECTRONICS

1465 WELLS STATION ROAD
MEMPHIS, TN 38108

Call Toll Free: 1-800-238-6168

M-F 9-5; Sat 9-12

Kenwood, ICOM, Ten-Tec, Cushcraft,
Hy-Gain, Hustler, Larsen, AEA,
Mirage, Ameritron, etc.

Texas

MADISON ELECTRONICS SUPPLY

3621 FANNIN
HOUSTON, TX 77004

713-520-7300

Christmas?? Now??

KENNEDY ASSOCIATES

AMATEUR RADIO DIVISION
5707A MOBUD

SAN ANTONIO, TX 78238

512-680-6110

Stocking all major lines. San Antonio's
Ham Store. Great Prices — Great
Service. Factory authorized sales and
service.

Hours: M-F 10-6; SAT 9-3

MISSION COMMUNICATIONS

11903 ALEIF CLODINE
SUITE 500 (CORNER HARWIN &
KIRKWOOD)

HOUSTON, TEXAS 77082

(713) 879-7764

Now in Southwest Houston—full line
of equipment. All the essentials and
extras for the "ham."

Wisconsin

AMATEUR ELECTRONIC SUPPLY

4828 W. FOND DU LAC AVE.
MILWAUKEE, WI 53216

414-442-4200

Wisc. Wats: 1 (800) 242-5195

Outside Wisc: 1 (800) 558-0411

M-F 9-5:30 Sat 9-3

Foreign Subscription Agents for Ham Radio Magazine

Ham Radio Austria
Karin Ueber
Postfach 2454
D-7850 Loerach
West Germany

Ham Radio Belgium
Sterehouse
Brusselssteenweg 416
B-9218 Gent
Belgium

Ham Radio Holland
Postbus 413
NL-7800 Ar Emmen
Holland

Ham Radio Europe
Box 2084
S-194 02 Upplands Vaxby
Sweden

Ham Radio France
SM Electronic
20 bis, Ave des Clarons
F-89300 Auxerre
France

Ham Radio Germany
Karin Ueber
Postfach 2454
D-7850 Loerach
West Germany

Canada
Send orders to
Ham Radio Magazine
Greenville, NH 03048 USA
Prices in Canadian funds
1 yr. \$41.85, 2 yrs. \$74.25,
3 yrs. \$99.90

Ham Radio Italy
Via Maniago 15
I-20134 Milano
Italy

Ham Radio Switzerland
Karin Ueber
Postfach 2454
D-7850 Loerach
West Germany

Ham Radio England
c/o R S G B
Lambda House
Crabtree Road
Potters Bar
Herts EN6 3JW
England



R-7000 Widespan Panadaptor

Panadaptor especially designed
for the R-7000 receiver. For use
with a standard scope. Variable
span width from 1 to 10 Mhz.
Uncover unknown elusive signals.
Complete with all cables, & 90 day
warranty. \$349.95 Shipped. Pa.
res. add 6%.

GTI Electronics

RD 1 BOX 272
Leighton, Pa. 18235
717-386-4032

flea market



RATES Noncommercial ads 10¢ per word; commercial ads 60¢ per word both payable in advance. No cash discounts or agency commissions allowed.

HAMFESTS Sponsored by non-profit organizations receive one free Flea Market ad (subject to our editing) on a space available basis only. Repeat insertions of hamfest ads pay the non-commercial rate.

COPY No special layout or arrangements available. Material should be typewritten or clearly printed (not all capitals) and must include full name and address. We reserve the right to reject unsuitable copy. **Ham Radio cannot check each advertiser and thus cannot be held responsible for claims made. Liability for correctness of material limited to corrected ad in next available issue.**

DEADLINE 15th of second preceding month.

SEND MATERIAL TO: Flea Market, Ham Radio, Greenville, N. H. 03048.

TEST EQUIPMENT WANTED. Don't wait we'll pay cash for LATE MODEL HP, Tek, etc. Call Glenn, N7EPK, at Skagitrronics Co. (800) 356-TRON.

HAMLOG COMPUTER PROGRAMS. 17 modules auto-logs, sorts 7-band WA5/DXCC. Full features. Apple \$19.95, IBM or CP/M \$24.95. KA1AWH, POB 2015, Peabody, MA 01960.

TEKTRONIX 7000 scope plug in's wanted: 7A, 7B, 7D, 7S, 7L series. Doug Rygalo, 13117 - 132 St, Edmonton, Alberta T5L 1R6 Phone (403) 453-1008.

I PAY CASH for new and used vacuum tubes, especially vintage and transmitting types. I also buy vintage audio equipment by Western Electric, Atec, McIntosh, Marantz, Westrex, etc. Randy Nachtrieb, WA6GJA, 6392 Park Avenue, Garden Grove, CA 92626/5 (714) 897-9351.

WANTED ATLAS 350-XL. N5NM, Box 2169, Santa Fe, NM 87504 (505) 988-2305.

CLEANING HAMSHACK. Ham equipment, test equipment, manuals, radio parts, optics and antique radios/parts. Send business SASE for list. W6IEG, PO Box 1244, Oakhurst, CA 93644. (209) 683-8430.

WANTED: Swan 250, 6 meter (tube) SSB/CW transceiver and power supply. Richard McMahon, PO Box 316, FPO New York 09518.

R-390A Receiver: \$115, electronically complete, repairable (government removed meters, operation unaffected). R-390A parts; info SASE. Professional quality TS-352 Voltohm/Multimeter, AC DC, with leads, manual: \$12.50. Mint military-spec pull-out 12AT7, 6BA6, 6AG5, 6AL5: \$10/six. CPRC-26 Infantry Manpack Radio, 6 meter FM, receiver transmitter sections, cabinet, antenna, crystal, handset: \$22.50, \$42.50/pair. H-251 Military Communications Headphones: \$7.50. Add \$4.50/piece shipping (\$9 maximum), except R 390A shipped collect. Baytronics, Box 591, Sandusky, OH 44870.

TEST EQUIPMENT FOR SALE. Many useful, quality items. General Radio 1001-A signal generator, lab grade, \$100. GR-1650A RCL Impedance bridge, \$135. Tektronix 50 MHz plug-in units, Exc. 1A1 \$100; 1A4, 4-trace \$150. HP-130B audio scope, \$50. HP 412A DC VTVM, Exc. \$40. Microwave Equipment: HP-618B generator, 3.8-7.6 GHz, \$150. FXR C772A, 3.9-8.2G, \$75. Alfred 650 Sweep Gen. \$200. HP-851B Spectrum Analyzer Display, \$100. Boonton 260-A O Meter, \$250. Most have manuals. Large Variac, 22 amps, new, cased, boxed, retails \$296, sell \$75. UTC commercial grade swinging chokes, 5-25H, 5000V, Exc f/linear, \$25/ea. Micamold capacitors, 2Mf, 4KV, \$8/ea. Giant Tektronix service manuals, 465B, 475A \$20/ea. List of Test Equipment manuals, SASE. Thermocouple wire, Type-J, .18 ft. Joseph Cohen, 200 Woodside, Winthrop, MA 02152. (617) 846-6312.

SOLDERING STATION AND TOOLS. European and American. Free catalog. Robert Mink Import-Export, Box 6437R, Fair Haven, NJ 07704. (201) 758-8388.

WANTED TEN-TEC ARGONAUT. N5NM, Box 2169, Santa Fe, NM 87504. (505) 988-2305.

COMMODORE CUSTOM CHIPS FOR C64/128 Computer/Peripherals at low prices, 24 hour delivery: #6510-\$9.95, #6526-\$9.95, #6567-\$14.75, #6581-\$12.85, PLA-\$12.50, 901

ROMS at \$10.95 each and many others. "THE COMMODORE DIAGNOSTICIAN": A complete diagnostic reference chart for fixing Commodore computers, etc. An absolute must for those who want to fix their own computers and save money and down time. \$6.95 plus postage. HD Power Supply for C64-\$27.95... Send for complete chips/parts catalog. VISA/MC... Kasara Inc., 36 Murray Hill Drive, Spring Valley, NY 10977. 1-800-642-7634, 800-248-2983 (outside NY) or 914-356-3131.

SUPERFAST MORSE CODE SUPEREASY. Subliminal cassette. \$10. Learn Morse Code in 1 hour. Amazing new supereasy technique. \$10. Both \$17. Moneyback guarantee. Free catalog: SASE. Bahr, 2549-H Temple, Palmbay, FL 32905.

UHF PARTS. GaAs fets, mimics, chip caps, trimmer caps, and other builder parts. MGF 1402 @\$14.00. MFG 1302 @\$10.00. .8 10pf Trimmer trimer @\$3.75. Porcelain chip caps @\$1.75. Orders add \$1.00 p/h. SASE for complete list. MICRO-WAVE COMPONENTS, 12126 Cape Cod, Taylor, MI 48180.

2.4 kHz AM Demodulator with 8 bit A-D and buffer. Copy WEFAX from GOES SATELLITES or APT from NOAA POLAR ORBITING SATELLITES. Created for use with Elmer Schwitek's Multifax 2.0 program. Order #206 KIT \$49.95 or assembled and tested board Order #206: ASY \$69.95. Add \$2.50 shipping per order. For info on all our WEFAX products send SASE to: A & E Engineering, 2521 W. LaPalma, Unit K, Anaheim, CA 92801. (714) 952-2114.

NJ-NJ-NJ-NJ-NJ-NJ-NJ A Full Service Ham SWL CB Scanner store in NJ. Discount Grand Opening Prices. Top performing radio systems for every budget. New 10 meter and VHF/UHF rigs. ARRL, Amphenol, Astatic, Astron, Ardton, B&W, Bital Belden 9913, Butternut, Clear Channel, KLM, Larsen, MFJ, Mirage, Mil Spec Cables, much more. Open M-F 10 AM-9PM. Sat 10 AM-7 PM. Buy and sell used gear and have qualified repair facility. ABARIS SYSTEMS, 276 Oriental Pl, Lyndhurst, NJ 07071 (201) 939-0015.

WAGFR COMMUNICATIONS SOFTWARE. \$15.00 disk contains HF/VHF/UHF/FM band propagation programs to predict range in miles based on transmitter power, receiver sensitivity, and antenna height & gain. A "must" for designing repeater installations. Also includes Smith Chart impedance matching programs. Commodore 64 or IBM. Lynn Gerig, RR1, Monroeville, IN 46773.

SMART BATTERY CHARGER for gell cells or lead acid batteries, by Warren Dion, W1BBH. See June '87OST Magazine for circuit details. Complete kit, nothing else to buy, only \$49.95 plus \$3.50 s/h. Order #150-KIT. A & E Engineering, 2521 W. LaPalma, Unit K, Anaheim, CA 92801.

IBM-PC RTTY/CW. New CompRtty II is the complete RTTY/CW program for IBM-PC's and compatibles. Now with larger buffers, better support for packet units, pictures, much more. Virtually any speed ASCII, BAUDOT, CW. Text entry via built-in screen editor! Adjustable split screen display. Instant mode/speed change. Hardcopy, diskcopy, break-in buffer, select calling, text file transfer, customizable full screen logging, 24 programmable 1000 character messages. Ideal for MARS and traffic handling. Requires 256k PC or AT compatible, serial port, RS-232C TU. \$65. Send call letters (including MARS) with order. David A. Rice, KC2HO, 25 Village View Bluff, Ballston Lake, NY 12019.

CHASSIS, CABINET KITS. SASE. K31WVK, 5120 Harmony Grove Road, Dover, PA 17315.

TELEVISION SETS made before 1946, early TV parts, literature wanted for substantial cash. Specially interested in "mirror in the lid" and spinning disc tv's. Finder's fee paid for leads. Arnold Chase, 9 Rushleigh Road, West Hartford, Conn. 06117. (203) 521-5280.

ENGINEERS request free catalog of Electronics Software. Circuit analysis, filter design, graphics, etc. BV Engineering, 2200 Business Way, Suite 207, Riverside, CA 92501 (714) 781-0252.

SUBCONTRACTORS WANTED by electronics manufacturer to wire small pc boards. Box 498, Greenville, NH 03048.

CODE PROGRAMS. Apple/C-64 128. 37 modes/graphics/lessons. LARESCO, POB 2018-HR, Calumet City, IL 60409. (312) 891-3279.

RADIO BROADCASTING EQUIPMENT WANTED for parts and rebuilding. Jon Hall, 98 Woodlake Drive, Charlottesville, VA 22901. (804) 978-1220 or (804) 973-8697.

RTTY JOURNAL—Now in our 35th year. Join the circle of RTTY friends from all over the world. Year's subscription to RTTY JOURNAL, \$10.00, foreign \$15.00. Send to: RTTY JOURNAL, 9085 La Casita Ave., Fountain Valley, CA 92708.

IMRA International Mission Radio Association helps missionaries. Equipment loaned. Weekday net, 14,280 MHz, 1-3 PM Eastern. Nine hundred Amateurs in 40 countries. Rev. Thomas Sable, S.J., University of Scranton, Scranton, PA 18510.

MARCO Medical Amateur Radio Council, Ltd. operates daily and Sunday nets. Medically oriented Amateurs (physicians, dentists, veterinarians, nurses, physiotherapists, lab technicians, etc.) invited to join. Presently over 550 members. For information write MARCO, Box 73's, Acme, PA 15610.

COMMODORE REPAIR. We are the largest/oldest Authorized Service Center in the country. (eg. C64 \$39.95). Fast turnaround. Call Toll Free 1-800-642-7634, 800-248-2983. (outside NY) or 914-356-3131. Kasara Inc., 36 Murray Hill Drive, Spring Valley, NY 10977.

FOR SALE: 1 RACAL Model RA6778 0.30 MHz receiver. Excellent condition, \$4200.00 US. Barrie Greenwood, VE3ADA, 248-30th Street, Etobicoke, Ont. Canada M8W 3E1. (416) 253-0708.

ANTENNAS ANTENNAS Austin VHF/UHF Tri-Banders, Yagis HF antenna experimenters kit, books. SASE brings lists. Ed Noll, W3FQJ, POB 75, Chalfont, PA 18914.

HAM LAB PROJECT. Want several pieces HP G-382A variable attenuator. Will consider any repairable condition. K6GOX, PO Box 10, O'Neals, CA 93645 (209) 868-3548 Collect.

30 YEARS PROVIDING QSL's. Full color Old Glory, Cartoon, Also Parchment, Golden Eagle and others. Free samples. SASE appreciated. Rusprint, Rt 1, Box 363-HR, Spring Hill, KS 66083.

YAESU FT-727-R COMPUTER INTERFACE. For info write Gerald Hogsett Consulting, 1581 Woodland, Palo Alto, CA 94303.

RUBBER STAMPS: 3 lines \$5.00 PPD. Send check or MO to G.L. Pierce, 5521 Birkdale Way, San Diego, CA 92117 SASE brings information.

ELECTRON TUBES: Receiving, transmitting, microwave... all types available. Large stock. Next day delivery, most in stock. DAILY ELECTRONICS, PO Box 5029, Compton, CA 90224 (213) 774-1255

CUSTOM MADE EMBROIDERED PATCHES. Any size, shape, colors. Five patch minimum. Free sample, prices and ordering information. HEIN SPECIALTIES, Inc., Dept 301, 4202 N. Drake, Chicago, IL 60618

RECONDITIONED TEST EQUIPMENT \$1.25 for catalog. Walter, 2697 Nickel, San Pablo, CA 94806.

COMING EVENTS

Activities — "Places to go . . ."

SPECIAL REQUEST TO ALL AMATEUR RADIO PUBLICITY COORDINATORS: PLEASE INDICATE IN YOUR ANNOUNCEMENTS WHETHER OR NOT YOUR HAMFEST LOCATION, CLASSES, EXAMS, MEETINGS, FLEA MARKETS, ETC. ARE WHEELCHAIR ACCESSIBLE. THIS INFORMATION WOULD BE GREATLY APPRECIATED BY OUR BROTHER/SISTER HAMS WITH LIMITED PHYSICAL ABILITY.

FLORIDA: January 30. The 8th annual Citrus County Hamfest sponsored by the Sky High Amateur Radio Club, County Fair grounds Auditorium, 4 miles south of Inverness, Rt 41. Open to vendors 7 AM. General public 9 AM. Admission \$3/advance; \$4/door. Talk in on 146.355/955. For more information or tickets call Bob Gordon at (904) 628-5045 or write SHARC Hamfest, PO Box 572, Lecanto, FL 32661.

NEW YORK: January 31. The Yonkers ARC is sponsoring their Winter Electronics Fair, Lincoln High School, Kneeland Avenue, Yonkers. Admission \$3.00. Children under 12 free. Sellers tables \$10.00 or \$1.00/ft. Advance registration for club provided tables. One person admitted free with every rented table. Sellers admitted 8 AM. Buyers 9 AM. Flea Market 9 AM to 3 PM. No tail gating. Free coffee all day. Talk in on 146.865 or 440.150. For information contact Otto Supliksi, WB2SDQ (914) 969-1053 after 5 PM.

MICHIGAN: February 7. The 18th annual Livonia Amateur Radio Club's Swap 'n Shop, Dearborn Civic Center, Dearborn, 8 AM to 4 PM. ARRL/VEC exams given by the Motor City Radio Club. Plenty of tables, refreshments and free parking. Talk in on LARC Repeater 144.75/5.35 and 146.52 simplex. For further information SASE to Neil Coffin, WA8GWL, Livonia ARC, POB 2111, Livonia, MI 48151.

MASSACHUSETTS: February 14. Electronics Flea Market sponsored by the Algonquin ARC, Marlboro Middle School Cafeteria, Union Street off Rt 85, Marlboro, 10 AM to 2 PM. Sellers 8 AM. Admission \$2.00. Tables \$8/advance; \$10/door. WHEELCHAIR ACCESSIBLE. For more information Dan, KB1WVW, (617) 481-1587 or write AARC, Box 258, Marlboro, MA 01752.

MICHIGAN: January 24. The Southfield High School ARC's 20th annual Swap & Shop, Southfield HS, 24657 Lahser, Southfield. Exhibitors admitted 6 AM. Public 8 AM to 3 PM. Admission \$3.00. Reserved tables \$20.00 for 2' 8" tables paid in advance. Addit. reserved tables \$10.00 each. All profits go to Electronic Scholarships and to support the Southfield HS Amateur Radio Club. For more information/reservations write Robert Younker, Southfield HS, 24675 Lahser, Southfield, MI 48034.

LOUISIANA: January 16. Southeastern Louisiana University ARC & SELARC's annual Hamfest, S.E. Louisiana University, 9 AM to 3 PM. Free admission. One free tables. Addit. tables \$5.00 each. VE exams. Talk in on 146.4/147.0. For information Joe Magro, W05R, 534 Iverstone Lane, Hammond, LA 70401.

INDIANA: SOUTH BEND. January 3. Hamfest Swap & Shop, first Sunday after New Year's Day at CENTURY CENTER downtown on US 33 Oneaway North between St. Joseph Bank Building and river. Four lane highways to door from all directions. Tables: \$5/5 ft. round; \$15 8x2.5 rectangular; \$20/8 ft. Wall locations. Talk in freq: 52.52, 99.39, 69.09, 34.94, 145.29. K9IXU (219) 233-5307.

OPERATING EVENTS

"Things to do . . ."

January 30: The University of Idaho Amateur Radio Club, W7UQ, will hold its third annual "Alumni Reunion on the Air", 2100 UTC, Saturday, to 0300 UTC, Sunday. The goal is to make 100 contacts to celebrate the U of I centennial. Listen for "CO Reunion" on phone and "CO R" on CW. Color QSL available for SASE to Callbook address.

February 5-14. NORAC, the North Okanagan Radio Amateur Club, will operate a special event station daily during the Vernon Winter Carnival, Canada's largest winter carnival. Listen for VE7NOR. For a special commemorative certificate send QSL and 2 IRC's or \$1.00 to NORAC, Box 1706, Vernon, BC V1T 8C3.

HAM EXAMS: The MIT UHF Repeater Association and the MIT Radio Society offer monthly Ham Exams. All classes Novice to Extra. Wednesday January 20, 7 PM, MIT Room 1-150, 77 Mass Ave, Cambridge, MA. Reservations requested 2 days in advance. Contact Ron Hoffmann at (617) 646-1641. Exam fee \$4.25. Bring a copy of your current license (if any), two forms of picture ID, and a completed form 610 available from the FCC in Quincy, MA (617) 770-4023.

CHARGE
YOUR CLASSIFIED ADS
 to your MC or VISA, write or call
HAM RADIO MAGAZINE
 Greenville, NH 03048
 (603) 878-1441

America's Best Kept Secret!

TEN-TEC

*For the serious
radio operator!*



PARAGON HF TRANSCEIVER, MODEL 585

MEET AMERICA'S NEWEST FULL FEATURED, SYNTHESIZED TRANSCEIVER. GENERAL COVERAGE ALL MODE RECEIVER TUNES FROM 100 KHZ TO 29,999,999 MHZ. TRANSMIT AT 100 WATTS OUTPUT ON ALL AUTHORIZED FREQUENCIES FROM 1.8 TO 29,999,999 MHZ. SSB, CW, FSK AND OPTIONAL FM. NOISE BLANKER AND SPEECH PROCESSOR ARE STANDARD EQUIPMENT. DUAL VFO'S, RX OFFSET.

LIST PRICE \$2245.00
 SALE PRICE \$1995.00 !!!
 (LIMITED TIME ONLY)

MISSION COMMUNICATIONS
 11903 Alief-Clodine Suite 500
 HOUSTON, TEXAS 77082

(713) 879-7764
 Telex 166872 MCON UT

MADE IN USA!

196

SPECIALISTS IN FAST TURN P.C. BOARDS

PROTO TYPE P.C. BOARDS
AS LOW AS \$25.00

- SINGLE & DOUBLE SIDED
- PLATE THROUGH HOLES
- TEFLON AVAILABLE
- P.C. DESIGN SERVICES

FOR MORE INFORMATION

Midland Technologies

34374 EAST FRONTAGE ROAD
 BOZEMAN, MT 59715 (406) 586-1190

197

Multiband QRV Dipole/V/Slopers

Ready to Use		Full Legal Power
Fastest Install	Tough	No Lossy Traps
Coax Feed	Flexible	Low Noise
2500 V Insul	Kink-Proof	Never Corrodes

QRV - \$49.95 **QRV - \$59.95**
 80-10 51 ft. long 160-10 102 ft. long

Prices include 47 page Tech Manual To order add \$5 Post & Handling
 1971 N. Oak Ln. Info: Sec
 Provo, UT 84604 (801) 374-1084

144

SUBSCRIBE

—AND RENEW—
TOLL-FREE

**ham
radio**
 magazine



1 YR - \$22.95 2 YRS - \$38.95

3 YRS - \$49.95

Prices U.S. only



MASTERCARD

VISA BILL ME

Please have your charge card ready.



DATATEL 800™

800-341-1522

Weekdays 8 AM - 9 PM EST • Saturdays 9 AM - 5 PM EST
 IN MAINE CALL COLLECT (207) 236-2896

OUR 800 NUMBER IS FOR SUBSCRIPTION ORDERS ONLY!

For Errors or Change of Address CALL *ham radio*
 direct at (603) 878-1441 8-5 EST

ADVERTISER'S INDEX AND READER SERVICE NUMBERS

Listed below are the page and reader service number for each advertiser in this issue. For more information on their products, select the appropriate reader service number make a check mark in the space provided. Mail this form to ham radio Reader Service, I.C.A., P.O. Box 2558, Woburn, MA 01801.

Name _____ Call _____

Address _____

City _____ State _____ Zip _____

*Please contact this advertiser directly.

Please use before February 29, 1988.

READER SERVICE #	PAGE #	READER SERVICE #	PAGE #
202 - Ace Communications, Inc	101	109 - Magnaphase Industries Inc	21
125 - Ace Communications	34	114 - The Meadowlake Corp	24
135 - Advanced Computer Controls, Inc	44	105 - MFJ Enterprises	8
183 - Advanced Receiver Research	95	141 - Micro Control Specialties	50
149 - AEA	60	197 - Midland Technologies	113
119 - All Electronics Corp	32	118 - Mirage Communications	29
165 - Aluma Tower Co	79	130 - Mirage Communications	40
112 - Amateur Wholesale Electronics	24	196 - Mission Communications	113
113 - American-Lightwave	24	198 - Missouri Radio Center	115
120 - Amidon Associates	32	176 - Morlan Software	82
111 - AMSAT	22	131 - Motron Electronics	40
144 - Antennas West	50, 77, 113	186 - NCG	99
142 - ARRL	50	171 - Nema Electronics	86
185 - ARRL	99	174 - Nuts & Volts	88
126 - Astron Corp	37	* Oneac Corporation	80
137 - Azotic Industries	46	200 - OPToelectronics	116
* Barker & Williamson	13	* Orlando Hamcation	80
* Barry Electronics	90	110 - P.C. Electronics	23
157 - Bilal Company	71	161 - Pac-Comm Packet Radio Systems, Inc	77
143 - Buckmaster Publishing	50	194 - The PX Shack	106
162 - Buckmaster Publishing	77	199 - Radio Amateur Callbook	114
* Butternut Electronics	86	108 - Radio Shack	19
* Caddell Coil Corp	46	189 - Radiokit	101
* C.O.M.B.	79	124 - Radiosporting	33
150 - Communications Specialists	65	187 - Ramsey Electronics, Inc	98
104 - Connect Systems Inc	1	191 - The RF Connection	102
129 - Consolidated Electronics	39	163 - S-Com Industries	77
151 - CTM	64	- Sherwood Engineering, Inc	68
145 - Cushcraft Corp	51	117 - Sommer	27
* Dayton Hamvention	104	* Spec-Com	79
170 - Delaware Amateur Supply	85	123 - Spectrum International	33
128 - Detection Dynamics	39	177 - Stridsburg Engineering Co	71
167 - DeVry VEC	80	169 - STV/OnSat	56
137 - Doppler Systems	46	115 - Synthetic Textiles, Inc	24
175 - Down East Microwave	82	127 - TE Systems	39
159 - EEB	73	195 - Tel-Com	109
190 - EGE, Inc	103	154 - Transverters Unlimited	68
* Engineering Consulting	88	* Tropical Hamboree	71
168 - Epsilon Co	80	164 - Unadilla/Antennas Etc	77
138 - Fair Radio/Sales	46	* University Microfilm Int	99
* Falcon Communications	50	192 - Vanguard Labs	102
* Fox Tango Corp	39	107 - Varian EIMAC	16
116 - GLB Electronics	27	156 - VHF Communications	71
182 - Grove Enterprises	94	139 - W9INN Antennas	46
172 - GTI	86	193 - Western Electronics	102
203 - GTI	111	122 - Wi-Comm Electronics Inc	32
160 - HAL Communications Corp	74	121 - World Data Enterprises	32
155 - Hall Electronics	68	140 - Yaesu USA	49
106 - Ham Radio Outlet	14, 15	201 - Yaesu USA	CIII
* Ham Radio's Bookstore	36, 72, 82, 84, 88, 90, 95	173 - E.H. Yost Co	86
* Hamtronics, NY	93		
148 - Hamtronics, PA	58, 59		
* Hamtronics, PA	86		
152 - Hustler, Inc	67		
103 - ICOM America, Inc	CII		
134 - ICOM America, Inc	43		
146 - ICOM America, Inc	57		
158 - IIX Equipment Ltd	71		
178 - International Radio, Inc	90		
132 - Jensen Tools, Inc	40		
181 - Jun's Electronics	94		
133 - Kennedy Associates	40		
* Kenwood U.S.A. Corp	2, 5, 6, 7, CIV		
188 - Larsen Electronics	101		
184 - Lunar Electronics	95		
180 - Madison Electronics Supply	92		

PRODUCT REVIEW/NEW PRODUCTS

301 - Azimuth Clock	109
302 - BV Engineering	109
304 - Encomm, Inc	108
* Engineering Consulting	108
* HAMRAD	109
* Ham Radio's Bookstore	107
307 - ICOM America, Inc	108
309 - Jensen Tools, Inc	109
308 - Kantronics	107
305 - LWC Enterprises	108
306 - MFJ Enterprises	108
303 - Microlect Company, Inc	108

1988 CALLBOOKS



The "Flying Horse" sets the standards

Continuing a 67 year tradition, we bring you three new Callbooks for 1988.

The North American Callbook lists the calls, names, and address information for 478,000 licensed radio amateurs in all countries of North America, from Canada to Panama including Greenland, Bermuda, and the Caribbean islands plus Hawaii and the U.S. possessions.

The International Callbook lists 481,000 licensed radio amateurs in countries outside North America. Its coverage includes South America, Europe, Africa, Asia, and the Pacific area (exclusive of Hawaii and the U.S. possessions).

The 1988 Callbook Supplement is a new idea in Callbook updates, listing the activity in both the North American and International Callbooks. Published June 1, 1988, this Supplement will include thousands of new licenses, address changes, and call sign changes for the preceding 6 months.

The 1988 Callbooks will be published December 1, 1987. See your dealer or order now directly from the publisher.

- North American Callbook
incl. shipping within USA \$28.00
incl. shipping to foreign countries 30.00
- International Callbook
incl. shipping within USA \$30.00
incl. shipping to foreign countries 32.00
- Callbook Supplement, published June 1st
incl. shipping within USA \$13.00
incl. shipping to foreign countries 14.00

SPECIAL OFFER

- Both N.A. & International Callbooks
incl. shipping within USA \$55.00
incl. shipping to foreign countries 60.00

Illinois residents please add 6 1/2% tax.
All payments must be in U.S. funds.

RADIO AMATEUR
callbook INC.
Dept. F
925 Sherwood Dr., Box 247
Lake Bluff, IL 60044, USA

Tel: (312) 234-6600



MISSOURI RADIO CENTER

102 N.W. Business Park Lane, Kansas City, MO 64150 816-741-8118

Call Toll Free — 9am - 6pm Mon. - Fri., 9am - 2pm Sat.
In Missouri Call — 816-741-8118

1-800-821-7323

TRADE INS ACCEPTED
MasterCard — VISA — COD Welcome

KENWOOD



TS940S "DX-celence"

- Programmable Scanning
- High Stability, Dual Digital VFO's
- 40 Channel Memory
- General Coverage Receiver

KENWOOD



TS440S "DX-CITING"

- 100% Duty Cycle
- 100 memories
- Direct Keyboard Entry
- Optional Built-in AT
- On Sale Now, Call For Price!

KENWOOD



TM-3530A

- 220 MHZ MOBILE FM TRANSCEIVER
- 220-225 MHz with 25 Watts
 - 7-Digit Telephone No. Memory
 - Direct Frequency Entry
 - 23-Channel Memory

KENWOOD



TH-215A

"FULL FEATURED 2m HT"

- 141-163 MHz Receive
- 144-148 MHz Transmit
- 2.5w Output (5w Optional)
- 10 Memories
- Built-in CTCSS Encoder
- Nine Types of Scanning

YAESU



FT-757GX "CAT SYSTEM"

- All Mode Transceiver
 - Dual VFO's
 - Full Break-in CW
 - 100% Duty Cycle
- CALL FOR BEST PRICE!

YAESU



FT-767GX HF/VHF/UHF BASE STATION

- Add Optional 6m, 2m & 70cm Modules
- Dual VFO's
- Full CW Break-in
- Lots More Features

YAESU



FT23/73R

- Zinc-Aluminum Alloy Case
- 10 Memories
- 140-164 MHz, 440-450 MHz
- 600 MAh Standard Opt. 5w New "super handie"

YAESU



FT-109RH

220 MHz H.T.

- 5 Watts Output
- Battery Saver
- 10 Memories
- Multiple Scanning Routines
- Power Meter

ICOM



IC-735 "NEW"

Can you put a price tag on reliability? Now ICOM offers a ONE YEAR WARRANTY on its HF Transceivers & Receivers purchased after August 1, 1986.

ICOM



IC-751A "NEW"

- 100 KHz - 30 MHz
- FM Standard
- 32 Memories
- QSK (Nominal Speed 40 WPM)

ICOM



IC-38A

- Full 25W, 5W low
- 21 memories
- Subtones built in RX 215-230 MHz
- CALL FOR BEST PRICE

ICOM



IC-μ2AT

- 140-163 MHz
- 10 Memories
- 1W, 1.5W optional
- 32 tones built-in

Kantronics



KAM

Kantronics All Mode

- CW, RTTY, ASCII, AMTOR, HF & VHF Packet
- RS-232/TTL, Universal Compatibility
- Transmit and Receive CW 6-99 wpm, RTTY/ASCII 45-300 Baud, ARQ, FEC, SELFC, Listen ARQ, VHF and HF Packet



MFJ-1274

TNC 2 PACKET RADIO

- VHF and HF Packet
- Precision Tuning Indicator
- AX 25 Level 2 Version 2 Software
- TTL Serial Port
- More!



IC-03AT

- 220 to 224.995 MHz
- 2.5W, 5W Optional
- Built in subtone
- 10 Memories

ASTRON CORPORATION



Power Supply

- RS7A\$48
- RS12A\$68
- RS20A\$88
- RS20M\$105
- VS20M\$125
- RS35A\$133
- RS35M\$149
- VS35M\$165
- RS50A\$189
- RS50M\$215
- RM50A\$219
- VS50M\$229

NOVICES

ARE YOU CONFUSED ABOUT YOUR NEW PRIVILEGES? CALL US FOR THE UP-TO-THE-MINUTE INFORMATION AND ASSISTANCE WITH YOUR GEAR.

✓ 198



PK 232

- Make any RS-232 compatible computer or terminal a complete digital operating position.
- Morse, Baudot, ASCII, AMTOR, Packet
- Loaded with features.

**NEW
POCKET SIZE**

**SIZE: 4" H x 3.5" W x 1" D
MADE IN USA**

\$99⁹⁵ - \$150⁰⁰

#TA-100S

OPTOelectronics inc
**FREQUENCY
COUNTERS
TO 1.3 GHz**

**8 LED DIGITS • 2 GATE TIMES
ANODIZED ALUMINUM CABINET
INTERNAL NI-CAD BATTERIES INCLUDED
AC ADAPTER/CHARGER INCLUDED**

**EXCELLENT SENSITIVITY
& ACCURACY**

**AC-DC • PORTABLE
OPERATION**



#P-100

#1200H 1.2 GHz



#AC-1200
AC ADAPTER
CHARGER

Small enough to fit into a shirt pocket, our new 1.2 GHz and 1.3 GHz, 8 digit frequency counters are not toys! They can actually out perform units many times their size and price! Included are rechargeable Ni-Cad batteries installed inside the unit for hours of portable, cordless operation. The batteries are easily recharged using the AC adapter/charger supplied with the unit.

The excellent sensitivity of the 1200H makes it ideal for use with the telescoping RF pick-up antenna; accurately and easily measure transmit frequencies from handheld, fixed, or mobile radios such as: Police, firefighters, Ham, taxi, car telephone, aircraft, marine, etc. May be used for counter surveillance, locating hidden "bug" transmitters. Use with grid dip oscillator when designing and tuning antennas. May be used with a probe for measuring clock frequencies in computers, various digital circuitry or oscillators. Can be built into transmitters, signal generators and other devices to accurately monitor frequency.

The size, price and performance of these new instruments make them indispensable for technicians, engineers, schools, Hams, CBers, electronic hobbyists, short wave listeners, law enforcement personnel and many others.

STOCK NO:

#1200HKC	Model 1200H in kit form, 1-1200 MHz counter complete including all parts, cabinet, Ni-Cad batteries, AC adapter-battery charger and instructions	\$ 99.95
#1200HC	Model 1200H factory assembled 1-1200 MHz counter, tested and calibrated, complete including Ni-Cad batteries and AC adapter/battery charger	\$137.50
#1300HC	Model 1300H factory assembled 1-1300 MHz counter, tested and calibrated, complete including Ni-Cad batteries and AC adapter/battery charger	\$150.00

ACCESSORIES:

#TA-100S	Telescoping RF pick-up antenna with BNC connector	\$12.00
#P-100	Probe, direct connection 50 ohm, BNC connector	\$18.00
#CC-70	Carrying case, black vinyl with zipper opening. Will hold a counter and accessories	\$10.00

✓ 200

FLA (305) 771-2050

**ORDER FACTORY DIRECT
1-800-327-5912**



OPTOelectronics inc
5821 N.E. 14th Avenue
Ft. Lauderdale, Florida 33334



AVAILABLE NOW!

Orders to US and Canada add 5% of total (\$2 min., \$10 max)
Florida residents add 5% sales tax. COD fee \$2.



1.3 GHz
#1300H

Introducing the next logical step.

Yaesu's Dual Band Handie.

Two affordable radios in one—that's exciting.

Yaesu's dual-band FT727R packs our best HT know-how into one compact design. At a price that's in step with your ham budget.

Hit hard-to-reach repeaters with a powerful 5 watts on both 2 meters and 440 MHz.

Work the bands quickly and easily with a wealth of microprocessor-controlled commands:

Jump between the separate VHF and UHF VFO registers. Program each of the ten memories for instant recall of repeater input and output frequencies, odd splits, and tone encode/decode.

Scan the memory channels, the entire band, or a band segment. And return to any special frequency with the priority feature.

Use link repeaters by programming TX on one band and RX on another.

Conserve power with the battery saver. It lets you monitor silently



while drawing negligible current. And measure your battery level with the digital battery voltmeter. There's even a "Low Battery" LED.

Finally, your operation is rounded out with features like VOX capability. A one-touch repeater reverse switch. An LCD readout with illumination lamp. A high/low power switch. Remote computer control capability. An optional CTCSS module. And Yaesu's full line of optional accessories.

So step up your operating capability now with the logical choice in HT operation.

Yaesu's dual-band FT727R.

YAESU

Yaesu USA

17210 Edwards Road, Cerritos, CA 90701
(213) 404-2700
Repair Service: (213) 404-4884
Parts: (213) 404-4847

Yaesu Cincinnati Service Center

9070 Gold Park Drive, Hamilton, OH 45011
(513) 874-3100

Prices and specifications subject to change without notice.

KENWOOD

...pacesetter in Amateur Radio

NEW!

Compact Breakthrough!



TH-25AT/45AT New Pocket Portable Transceivers

The all-new TH-25 Series of pocket transceivers is here! Wide-band frequency coverage, LCD display, 5 watt option, plus...

- Frequency coverage: **TH-25AT:** 141-163 MHz (Rx); 144-148 MHz (Tx). (Modifiable for MARS/CAP Permits required.)
TH-45AT: 438-450 MHz.
- Automatic Power Control (APC) circuit for reliable RF output and final protection.
- 14 memories; two for **any** "odd split" (5 kHz steps).
- Automatic offset selection (TH-25AT).
- 5 Watts from 12 VDC or PB-8 battery pack.
- Large multi-function LCD display.
- Rotary dial selects memory, frequency, CTCSS and scan direction.
- T-ALERT for quiet monitoring. Tone Alert beeps when squelch is opened.
- Band scan and memory scan.
- Automatic "power off" circuit.
- Water resistant.
- CTCSS encoder built-in (TSU-6 decoder optional).
- **Supplied accessories:** StubbyDuk, PB-5 battery pack for 2.5 watts output, wall charger, belt hook, wrist strap, water resistant dust cap.



Optional accessories:

- **PB-5** 7.2 V, 200 mAh NiCd pack for 2.5 W output • **PB-6** 7.2 V, 600 mAh NiCd pack • **PB-7** 7.2 V, 1100 mAh NiCd pack
- **PB-8** 12 V, 600 mAh NiCd for 5 W output • **PB-9** 7.2 V, 600 mAh NiCd with built-in charger • **BC-10** Compact charger
- **BC-11** Rapid charger • **BT-6** AAA battery case • **DC-1/PB-2V** DC adapter • **HMC-2** Headset with VOX and PTT • **SC-14, 15, 16** Soft cases • **SMC-30/31** Speaker mics • **TSU-6** CTCSS decode unit • **WR-1** Water resistant bag

KENWOOD

KENWOOD U.S.A. CORPORATION
2201 E. Dominguez St., Long Beach, CA 90810
P.O. Box 22745, Long Beach, CA 90801-5745

Complete service manuals are available for all Kenwood transceivers and most accessories. Specifications, features, and prices are subject to change without notice or obligation.

