International Edition

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Amateur Radio's Technical Journal

A CWC/I Publication

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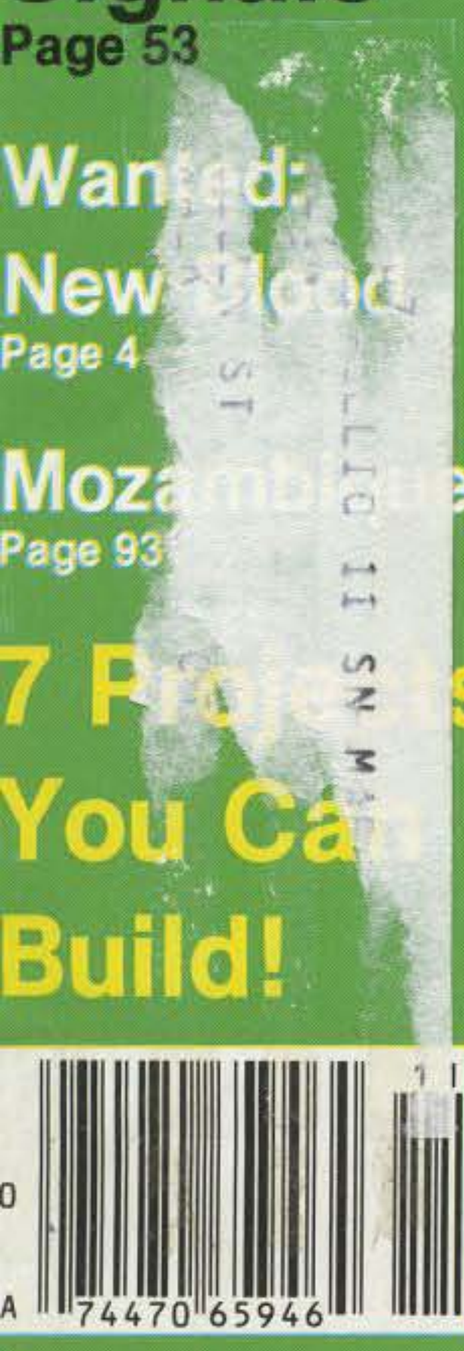

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ICOM Handhelds

2 Meter, 220 or 440 MHz

Battery Pack	Nominal Transceiver Power (watts)
BP2	1.0
BP3	1.5
BP5	2.3
BP8	1.5

*Requires BC-35 Charger

†Will charge from BC-35, BC-25U, stet CP1 or 12 VDC Direct (internally regulated)

††Accept 6 AA size batteries – Alkaline or NiCd (Do not attempt to charge Alkaline batteries)

ICOM's reliable, field proven, handhelds have been the most popular handheld on the market. Here's a few reasons why:

The Transceivers. The IC-2AT features full coverage of the 2 meter ham band. The IC-3AT covers 220 to 224.99 MHz, and the IC-4AT has 440 to 449.995 MHz. Each radio is only 2.6in x 1.4in x 6.5in in size. Excellent audio quality is provided by a quality speaker and an electret condenser microphone. All have 1.5 watt output and battery saving 0.15 watt low power. Touch Tone® pad is included (on "T" models).

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The System. Accessories for the handheld series are interchangeable between transceivers. Slide in removable battery packs allow quick changing of batteries. Batteries may be charged when removed from the transceiver.

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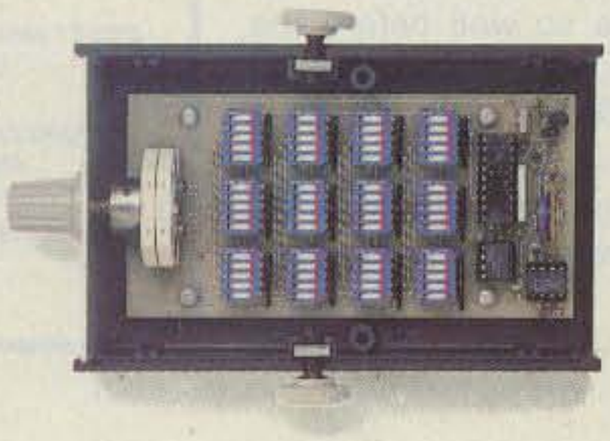

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editorial by Wayne Green

OUR WORST ENEMY

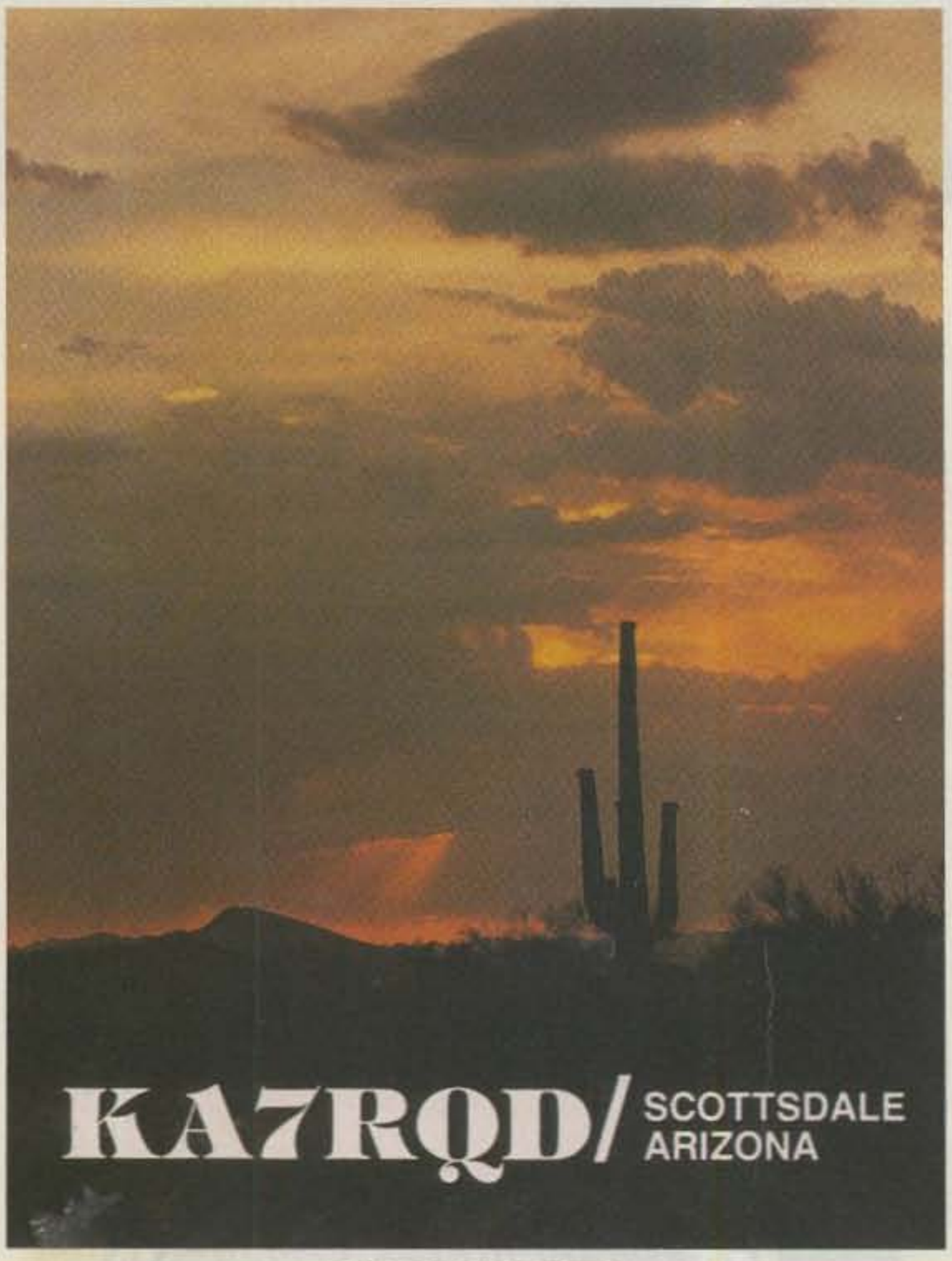
It was back around 1976, shortly after the Carter revamping of the Commissioners, when we hams had our first serious problem with the FCC. In case you are new to amateur radio or are short of memory, here's what happened.

The first problem facing the new Commission had to do with a proposal to eliminate ten-meter linears. This was in response to enormous interference problems from cheap and dirty linears made for CB use on 11 meters, which were proliferating. CB was in its heyday and television sets everywhere were driving their owners crazy as CBers drove by or worked DX from their home locations with their kilowatts.

The FCC had no way of knowing that in a few months their actions would solve the problems in an unexpected way when they expanded the service to 40 channels, almost killing CB entirely.

The situation was severely aggravated when the previous Commission outlawed 11-meter linear amplifiers. This forced the legitimate manufacturers out of business and left it open to underground manufacturers. Clean-emission standards were henceforth ignored and "ham 10-meter" amplifiers flooded in from truckstops and from under CB-dealers' shelves.

The new Carter FCC held a hearing on whether to outlaw 10-meter linears entirely. The main speaker was the ARRL legal counsel, who proceeded to lecture them like school kids. I watched in mounting horror as Booth went on endlessly while the Commissioners fumed and then walked out on him. That day we lost not only that rule-making, but all sympathy from the FCC for four years. We were fortunate that they did not follow up on their plan to make a new personal-radio service with CB and ham radio combined.



QSL OF THE MONTH

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A Fresh Start

The Reagan FCC gave us a new change in 1981. I went down to Washington and talked with each of the Commissioners personally, giving them some background on the past, present, and potential future of amateur radio. They were eager to help our service get back into a strong growth mode so it could again attract teenagers and thus bring the country desperately needed engineers and technicians—as it had done so well before the ARRL's incentive-licensing disaster of 1963.

Since no-code had been the breakthrough for growth in Japan, they were eager to try it out

Continued on page 82

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TS-711A

TS-711A Multi-function all-mode 2 m transceiver.

The TS-711A 2 m all-mode transceiver is the perfect base station unit. It features Kenwood's innovative D.C.S. circuitry that allows your TS-711A to respond only to signals that include a pre-selected digital code. The system recognizes 100,000 different 5-digit codes, making it possible for each station to have its own "private call," "group call," or "common call" code. Built-in dual digital VFO's provide commercial-grade frequency stability through the use of a TCXO (Temperature Compensated Crystal Oscillator). The new fluorescent multi-function display shows frequency, RIT shift, VFO A/B, SPLIT, ALERT, repeater offset, digital code, call sign code, and memory channel. 40 multi-function memories store frequency, mode, repeater offset and tone. It has programmable scan, memory scan, and mode scan. The Auto-mode function automatically selects the correct mode for the frequency being used. When a mode key is depressed, an audible "beeper" announces mode identification in International Morse Code.

The TS-711A has all-mode squelch, noise blanker, speech processor (SSB, FM), IF shift, RF power control, alert, and a unique channel Quick-Step tuning that varies tuning characteristics from conventional VFO feel, to stepping action when CH.Q switch is depressed.

Optional accessories:

- CD-10 Call Sign Display
- TU-5 CTCSS Tone Unit
- VS-1 Voice Synthesizer
- MC-60A Deluxe Desk Mic
- MC-80 Desk Mic
- MC-85 Desk Mic
- SP-430 External Speakers
- MB-430 Mobile Mount
- PG-2J DC Cable

TS-670

TS-670 All-mode "Quad Bander."

The TS-670 "Quad Bander" is a unique all-mode transceiver that covers the 6 meter VHF band and the 10, 15 and 40 meter HF bands. FM operation may be added with the optional FM-430. Key features include dual digital VFO's, 80 memory channels, memory scan, and programmable band scan. Direct keyboard frequency selection allows you to enter a frequency to either VFO or to a memory channel using the 10-button key-pad on the front panel. The 2-color fluorescent tube display indicates frequency to the nearest 100 Hz (10 Hz modifiable) and includes LED indicators that signal the specific functions in use. The optional GC-10 general coverage receiver unit allows continuous tuning from 500 kHz to 30 MHz. The VS-1 voice synthesizer unit is another popular option available. All this plus IF shift, all-mode squelch, CW semi-break-in with side tone, narrow-wide filter selection, noise blanker, and R.F. attenuator make the TS-670 "Quad Bander" the next transceiver you should own!

Optional accessories:

- GC-10 General Coverage Unit, 500 kHz to 30 MHz
- VS-1 Voice Synthesizer
- FM-430 FM Unit
- YK-88C 500 Hz CW Filter
- YK-88CN 270 Hz CW Filter
- YK-88A 6 kHz AM Filter
- PS-430 DC Power Supply
- KPS-7A DC Power Supply
- MC-60A Deluxe Desk Mic
- MC-80 Desk Mic
- MC-85 Multi-Function Desk Mic
- VOX-4 VOX Unit

More information on the TS-711A and TS-670 is available from authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, CA 90220.

Specifications and prices are subject to change without notice or obligation.

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Transmits on both 170 Hz and 850 Hz shift.

Built-in RS-232 interface, no extra cost.

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Has front panel sensitivity control.

Normal/Reverse switch eliminates retuning while checking for inverted RTTY. Speaker jack. +250 VDC loop output.

Exar 2206 sine wave generator gives phase continuous AFSK tones. Standard 2125 Hz mark and 2295/2975 Hz space. Microphone lines: AFSK out, AFSK ground, PTT out and PTT ground.

FSK keying for transceivers with FSK input.

Has sharp 800 Hz CW filter, plus and minus CW keying and external CW key jack.

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4. Sharp Mark and Space Filters. Greatly improves copy under crowded, fading and weak signal conditions. For 170, 425, 850 Hz shifts.

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RTTY/ASCII/CW COMPUTER INTERFACE

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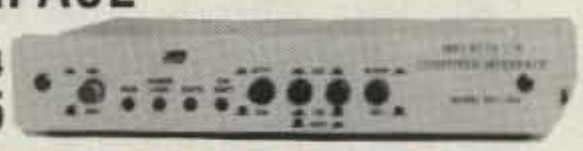

Free MFJ RTTY/ASCII/CW software on tape and cable for VIC-20 or C-64. Send and receive computerized RTTY/ASCII/CW with nearly any personal computer (VIC-20, Apple, TRS-80C, Atari, TI-99, Commodore 64, etc.). Use Kantronics or most other RTTY/CW software. Copies both mark and space, any shift (including 170, 425, 850 Hz) and any speed (5-100 WPM RTTY/CW, 300 baud ASCII). Sharp 8 pole active filter for CW and 170 Hz shift. Sends 170, 850 Hz shift. Normal/reverse switch eliminates retuning. Automatic noise limiter. Kantronics compatible socket plus exclusive general purpose socket. 8x1¼x6 in. 12-15 VDC or 110 VAC with adapter, MFJ-1312, $9.95.

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EDITED BY PERRY DONHAM KK2Y

PUBLISHED REPORTS that *73* had been put up for sale by its parent company, CW Communications, Inc., were absolutely true. CWCI felt that *73*, as an amateur-radio magazine, did not fit in with its 50 or so other computer publications. Pro-*73* forces, however, suggested that modern ham techniques, such as packet radio, are indeed high tech and also that selling a successful property might not be a sound idea. CWCI subsequently *withdrew* its offer to sell and committed its *full backing and support* to *73*. As a result, we believe our readers and advertisers will be seeing some exciting improvements in *73* as we enter our 25th-anniversary year!

SOFTWARE PIRATES are looking over their shoulders after Kantronics successfully prosecuted Cindy Gladwell of Cindy's Computer Software. Cindy sold a pirated copy of Kantronics' Hamtext computer program, along with a full set of documentation, to Mike Forsyth at the Michigan State ARRL Convention in Detroit. Mike happens to be Marketing Director of Kantronics. Ms. Gladwell was served an injunction to halt all software-reproduction activities and directed to forfeit $2000 in damages to Kantronics.

THE BID FOR 220 MHZ by several commercial interests has been stalled at press time. The petition by Sideband Technology, Inc., RM-4831, has been put on hold while the FCC investigates charges of conflict-of-interest filed by the Inland Waterway Communications System. Art Reis K9XI, editor of *220 Notes*, has asked for a congressional investigation into the activities of the FCC Office of Science and Technology, which seems to be behind the bid for 220.

THE MOUNT GREYLOCK REPEATER was saved from an untimely demise recently when Governor Dukakis of Massachusetts signed into law a bill giving the Northern Berkshire Amateur Radio Club a twenty-year lease on the repeater site. Overwhelming support from amateurs across the country in the form of cards and letters was instrumental in preserving this heavily-used machine.

A SPREAD-SPECTRUM BEACON is now on the air near Falls Church VA. According to Chuck Phillips N4EZV, the system operates from 144.5 to 147.7 MHz, with a hop rate of 10 per second. Output power is 25 Watts, and the beacon transmits a series of Vs after an identification that is simulcast on the AMRAD repeater, 147.21/.81. After normal business hours, the beacon may be turned on by sending the touchtone™ digits 4-3-2-1 on 144.5 MHz. Chuck has plans for HF spread-spectrum beacons on the 10- and 15-meter bands. If you are interested in the application of this fascinating technique to amateur radio, contact Chuck Phillips at Tactical Communications, Inc., 5711 B Center Lane, Falls Church VA 22041.

PACKET RADIO will be the subject of the next North American Teleconference Radio Net (TRN), heard through over 150 gateway stations across the United States. Two of packet radio's pioneers, Lyle Johnson WA7GXD and Harold Price NK6K, will be the featured speakers. Lyle is president of the Tucson Amateur Packet Radio Society (TAPR) and was the primary influence behind the development of the TAPR terminal-node-controller (TNC) hardware. Harold is a director of TAPR and worked on the software end of the TAPR TNC. For a complete list of TRN gateway stations, send an SASE to TRN Manager, c/o Midway Amateur Radio Club, PO Box 1231, Kearney NE 68847-1231, or check CompuServe's Hamnet XA4 database.

Massachusetts Governor Michael Dukakis chatted with nearly 125 hams after signing legislation saving the Mt. Greylock repeater. That's Warner W1YBT on the right.

SEVERAL ARRL QSL BUREAUS have new addresses.
Third call area: CCARS, PO Box 448, New Kingston PA 17072-0448.
Fourth call area, two-letter prefixes (AA4, KB4, etc.): Sterling Park ARC, Call Box 599, Sterling Park VA 22170.
Fifth call area: ARRL W5 QSL Bureau, PO Box 44246, Oklahoma City OK 73144.
US Virgin Islands: Virgin Islands ARC, GPO Box 11360, Charlotte Amalie, St. Thomas, Virgin Islands 00801.
VE5: VE5 QSL Bureau, B. J. Madsen VE5ADA, 739 Washington Drive, Weyburn, Saskatchewan, Canada S4H 2S4.
VE6: CRRL Incoming Bureau, N. F. Waltho VE6VW, General Delivery, 9714 94th Street, Morinville, Alberta, Canada T0G 1P0.
SWL: Mike Witkoski, 4206 Nebel Street, Stevens Point WI 54481.

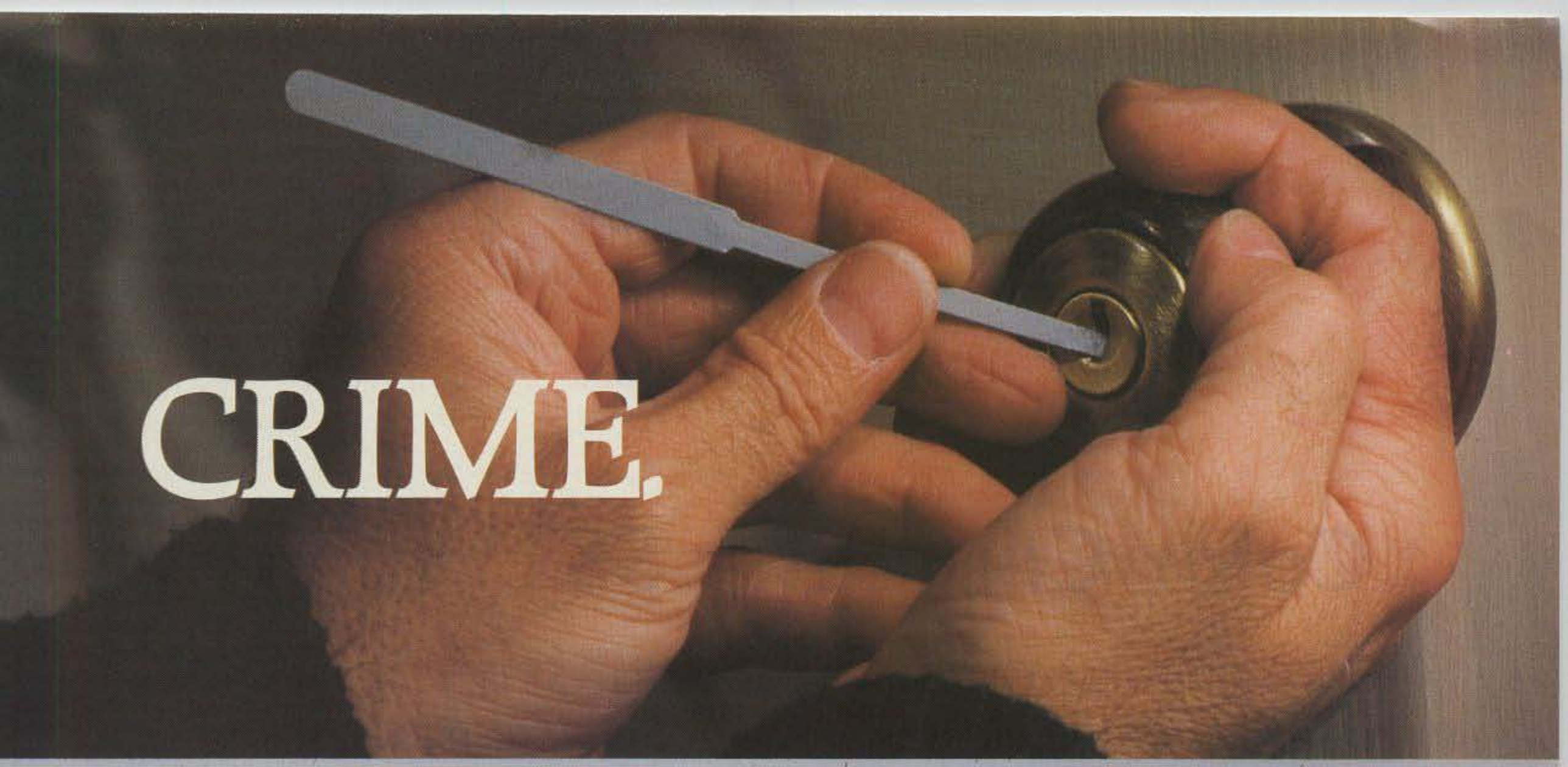
THE FAILURE RATE of the new volunteer-given amateur exams is exceptionally high. Most groups report that only 25% of their applicants are upgrading. There's a good deal of confusion regarding who is actually running things—although the *W5YI Report* and the ARRL are both Volunteer-Examiner Coordinators (VECs) for all 13 districts, many districts have up to *seven separate groups* acting as VECs. In some areas, the district VECs are bowing out in favor of the League, which is still trying to bully its way into control of the program. In any case, the FCC will be out of the testing business at the end of the year. For a complete list of VECs, send an SASE to *73*, Pine Street, Peterborough NH 03458, Attn: VEC LIST.

FCC HAS NAILED another jammer. Dave Meehan W7IVK has had his Advanced-class amateur license suspended for one year for willfully interfering with communications on the 40-meter band. After the year is up, Meehan will be permanently barred from operating in the 7235-to-7280-kHz segment of the band.

$140,000 WORTH OF ILLEGAL CB GEAR was seized by US Marshals recently in one of the nation's largest radio-related raids. Most of the equipment consisted of linear amplifiers and subassemblies destined for use in the CB service. The distributor, D&D, Inc., of Shelby NC, faces fines of up to $10,000 and prison sentences for its violation of the Communications Act of 1934.

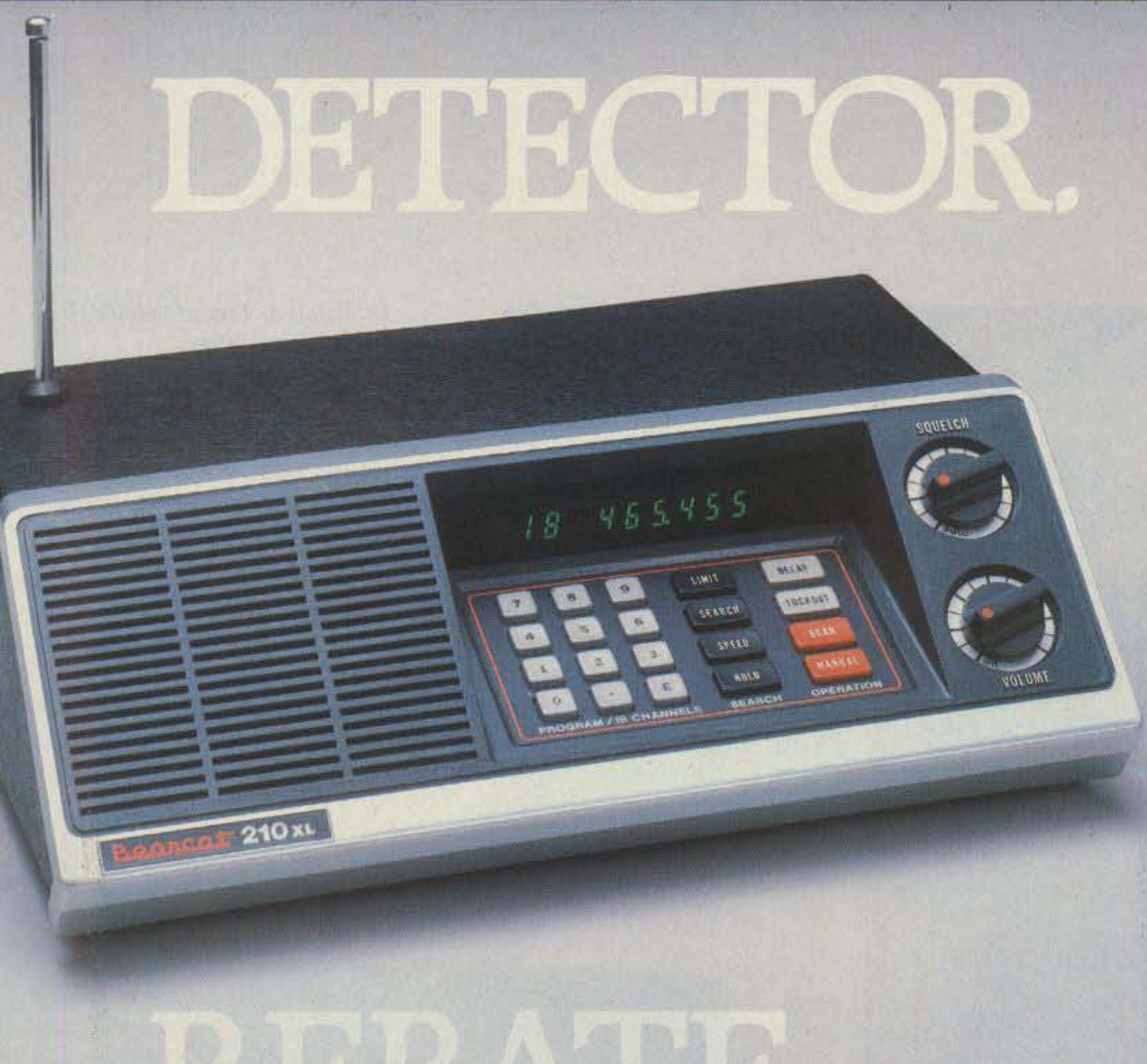
CONGRATULATIONS TO ROY NEAL K6DUE on his new duties as Deputy Bureau Chief for News Operations for NBC. Roy had previously served as the science correspondent for the network, giving live on-the-air commentary during most of NASA's space shots. Good luck, Roy!

THIS MONTH'S NEWS was courtesy of the *W5YI Report*, *Westlink*, and WA1HXQ.



CRIME.

DETECTOR.



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Color Computer SSTV: Part I

Turn your CoCo into a complete SSTV terminal!
How? First, build this high-resolution display system.

Clayton W. Abrams K6AEP
1758 Comstock Lane
San Jose CA 95124

Dr. Ralph A. Taggart WB8DQT
602 Jefferson Street
Mason MI 48854

This two-part article describes a high-resolution display system for the Radio Shack Color Computer® (CoCo). This system provides the CoCo computer with more display capability than any low-cost computer. You might ask why you should use your CoCo to display and generate television images. One answer is, for communications.

Imagine taking your CoCo with a hardware-software interface and connecting it to amateur-radio equipment and transferring a picture to

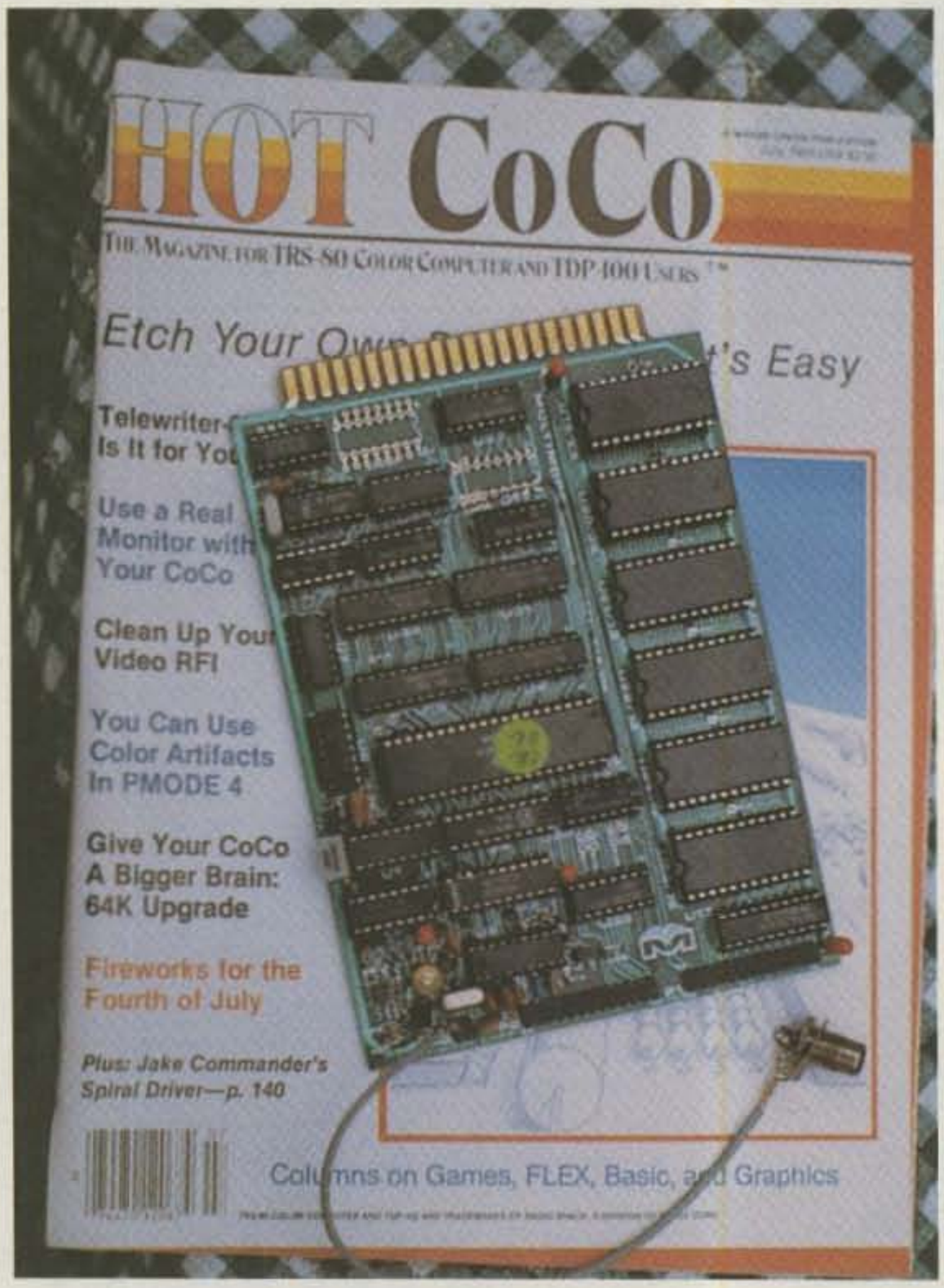

Photo A. Multimode display board, showing the physical size of a production display interface. The board has 16K of display memory.

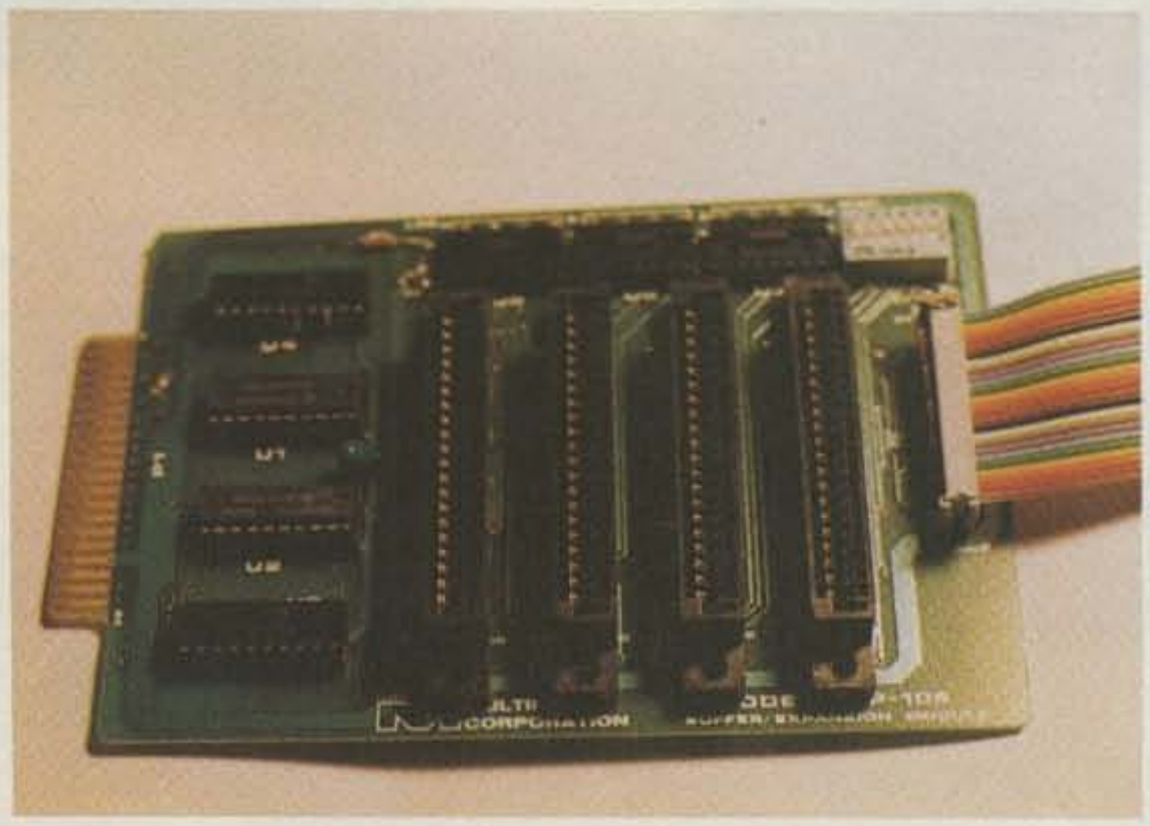

Photo B. Multimode CoCo interface board, which plugs into the expansion interface of the CoCo. A 26-pin flat cable interconnects the interface board and the display board.

someone miles away, or receiving weather-satellite pictures. The digital-television-display field is one which has not been explored by the amateur-computing community, and only a small amount of commercial equipment exists for such applications. In this article, instructions will be provided to construct a card to display high-resolution images and provide interfaces to receive weather-satellite pictures or amateur-radio SSTV.

Before plowing ahead with a lot of technical jargon and confusing terms, some definitions are in order.

Background

In display terminology two terms are particularly important. These terms are used also in television. The first is pixel, and it relates to the smallest element of a picture which can be seen on the TV screen. In normal TV, the pixels are so small that they tend to blend together to form a contiguous image. In digital TV, a pixel is a unit in the picture which can be seen by the unaided eye. Each pixel in digital TV has an intensity or discrete color. The main goal in digital TV is to place the most pixels on a line to form the smoothest image. To do this as well as standard TV does takes a lot of complex and costly circuitry.

The second term is number of lines per picture. In the USA, standard TV has 262 lines per frame or 525 lines per interlaced picture. In digital TV, the number of lines is often reduced from normal TV for cost and simplicity reasons.

If a digital-display system could be developed around a standard microprocessor system, the system would be very versatile. The few commercial display systems which have been developed to date have some disadvantages.

Expandability. Microprocessors have been installed in some of the new display-system designs. All of these units are not user-programmable. Most vendors would rather provide users with new units when their function is to be expanded. If a system were to be based on a commercial microprocessor with a good software base, the system could be expanded as technology progresses.

Fixed Architecture. Most commercial systems are built around a large planar board with lots of ICs and discrete components. These units are designed for a specific application and a limited life span. Adding interfaces like FAX and other applications is difficult. For this reason, the modular approach of functional units connected to a microprocessor makes good sense.

Up to a few years ago, digital TV was not possible. With the explosion of the semiconductor industry, the price of ICs has fallen to a level which makes this economically possible. Most of the early digital TV scan converters used were hardware-only devices. These units were very dumb and could only generate and display images. The explosion of digital computers and the incorporation of digital displays in computers makes the whole concept very exciting. Once an image is placed in the computer, almost anything is possible: communications, image analysis by computer for manufacturing inspection, medical applications, or art forms for their own sake.

Two applications will be described in this article. The first application is amateur-radio slow-scan television; the second is weather-satellite reception. While the applications are similar in that they require some means of picture displaying and a

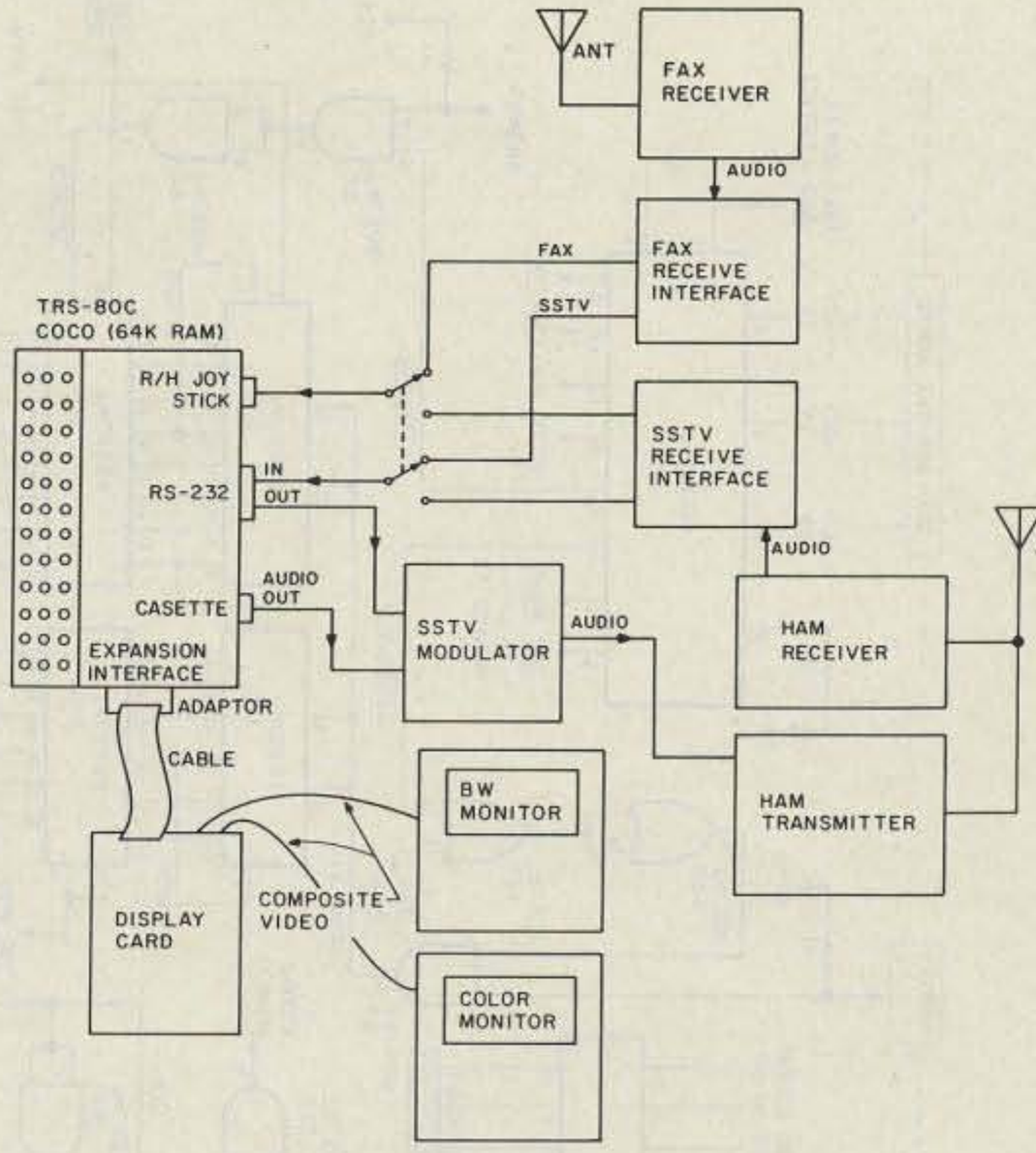

Fig. 1. System block diagram, showing the interconnection of the computer and all the interfaces.

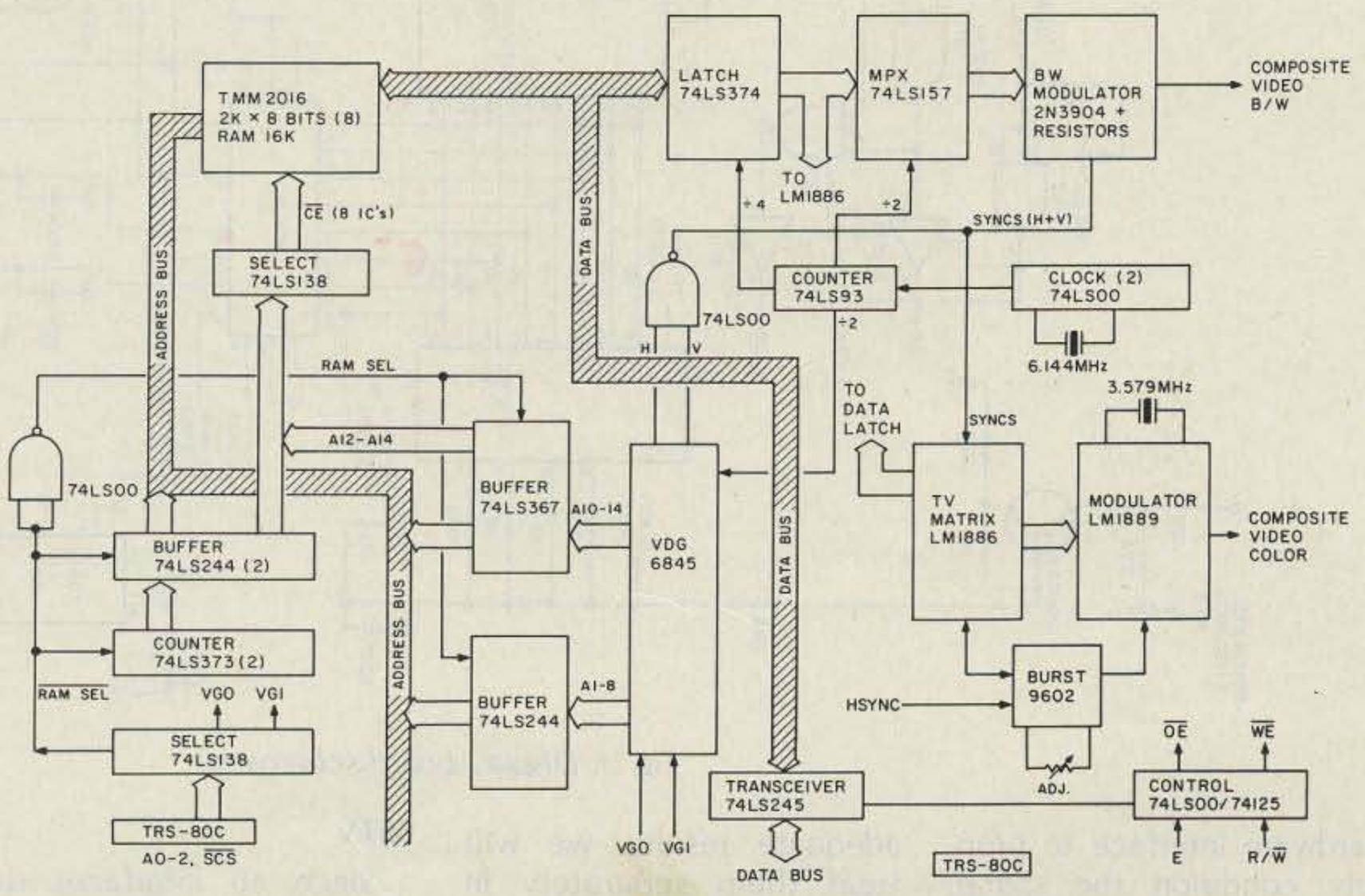

Fig. 2. Display block diagram, showing how the display interface functions. Only the important ICs are shown.

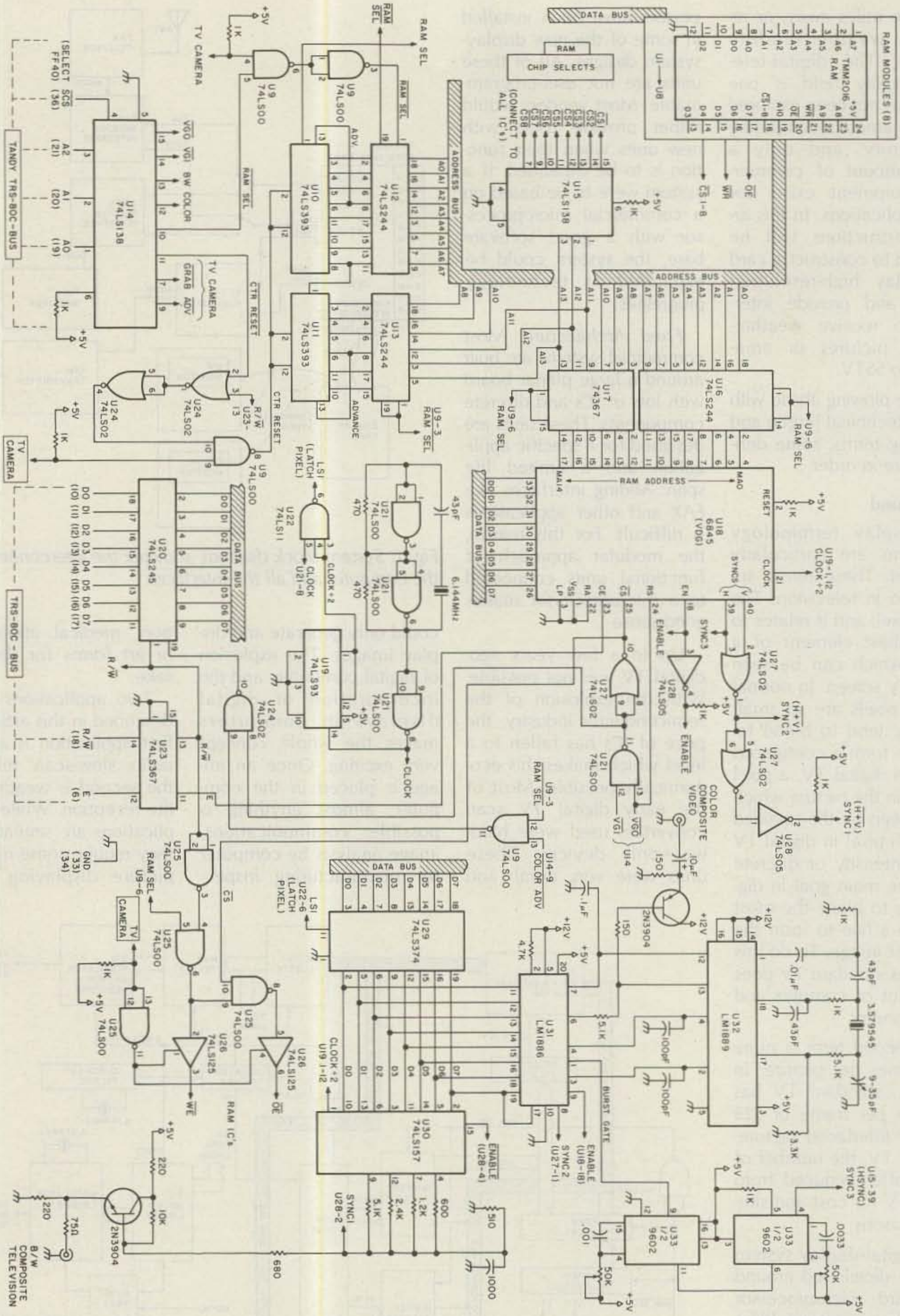

Fig. 3. Display board schematic.

hardware interface to properly condition the signal, and each requires trade-offs and compromises to achieve adequate results, we will treat them separately in order to do an adequate job on each.

SSTV

Since all interfaces use simple hardware, the heart of the system is software. It would be impossible to publish an entire software package in an article of this type. To date, thousands of lines

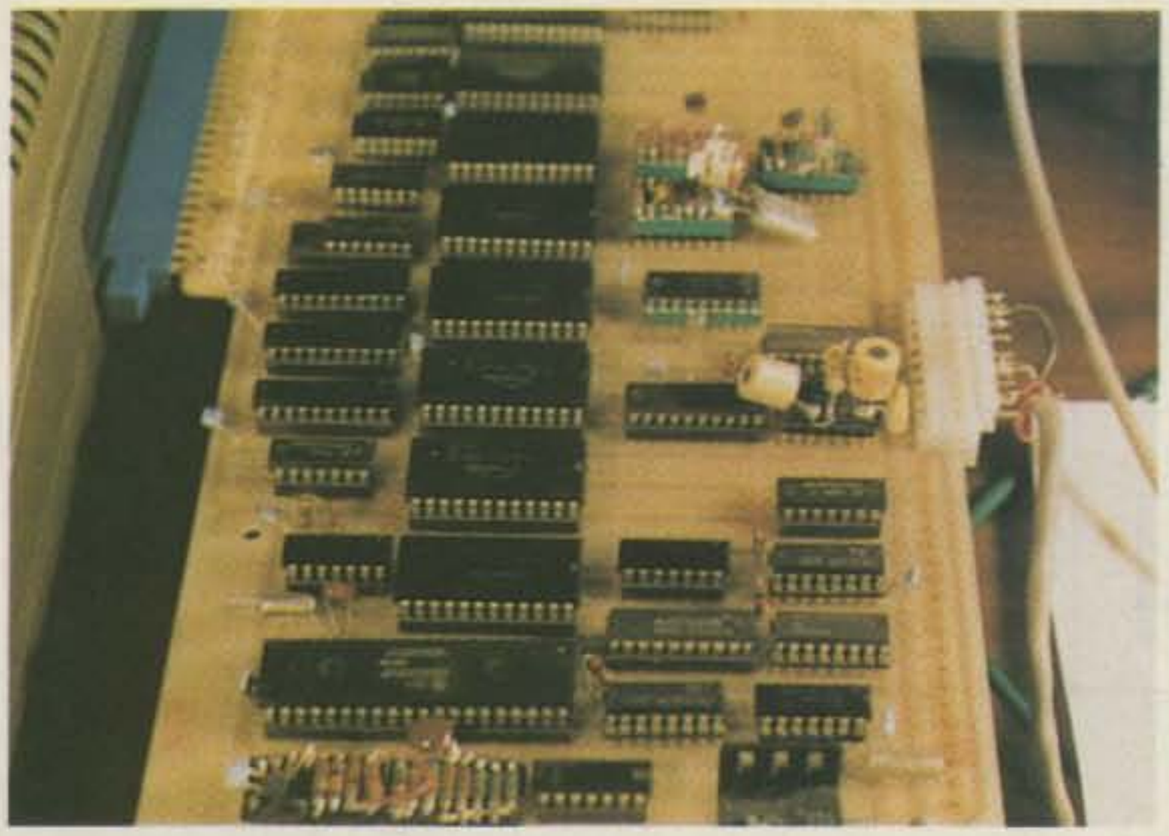

Photo C. The prototype board by K6AEP was one of the first display boards constructed. The board is plugged into a CoCo. The board was point-to-point wired and is exactly like the schematic in Fig. 3. All of these photos in part I of this article were generated by this board. The same results can be achieved by the commercial display boards.

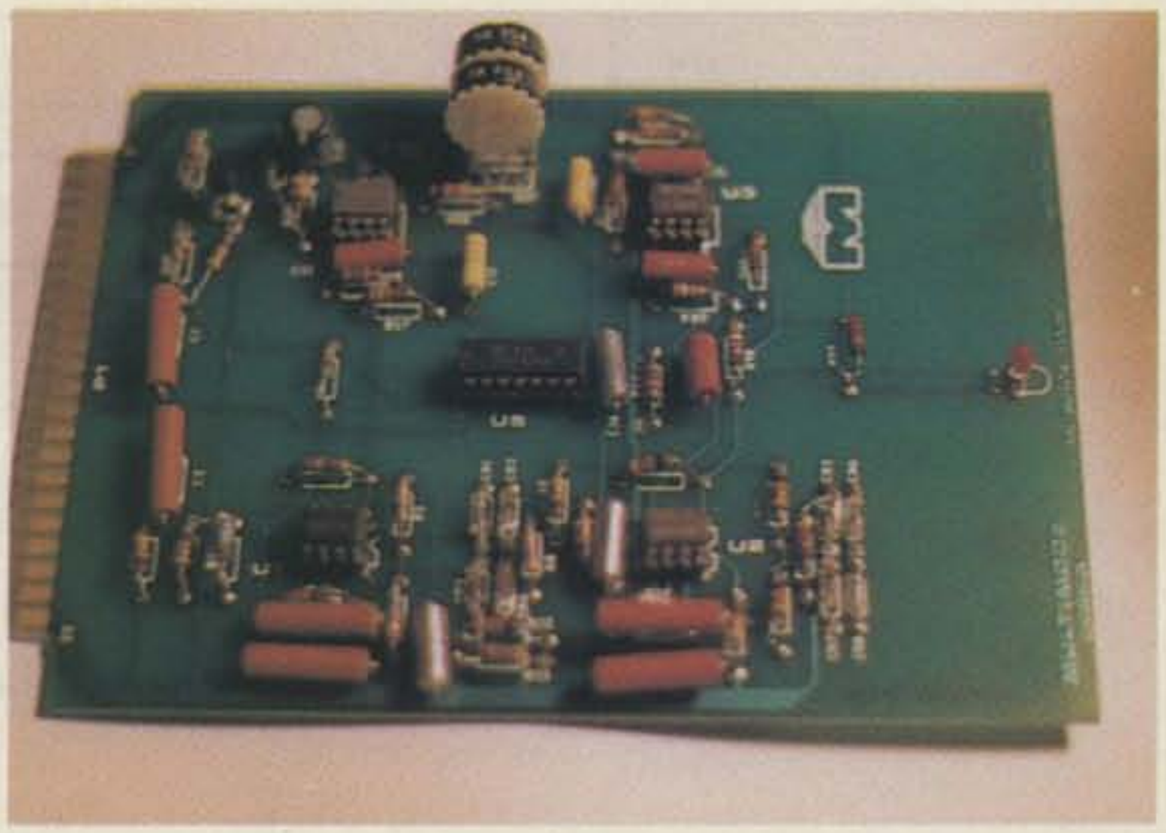

Photo D. A multimode SSTV receive interface. This board is a commercial version of the SSTV receive interface. The physical size is the same as the display board.

of code have been developed. What will be provided here is a technical description of how the software and hardware interfaces function and the steps necessary to develop code. You will find it possible to modify the concepts we present for interfacing with any microprocessor system.

The Display Criteria

Since the main goal of the display card is to produce quality images, it is important to make the picture density as high as possible. This requires the addition of RAM memory in which the image will be saved and displayed. Experimentation by many people over a period of years has determined that a minimum of 128 pixels per line is required for low-resolution images, with at least 16 gray levels. Some experimentation which I conducted in mid-1982 indicated that a minimum of 256 colors per pixel is required to display low-resolution color-TV images.

Armed with this information, a design criteria of 256 pixels per line, 16 gray levels, on 128 lines was defined for black and white displays. This equates to a display size of 16K of display RAM. With a little clever programming and slight reconfiguration of data bits, a total of 256 colors can be displayed for each pixel with 128 pixels per line on 128 lines.

Obviously, a system can be constructed with higher resolution, but as the digital-display density increases so do the cost and complexity. Since this project was created for the average hobbyist with a limited budget, the above criteria seem adequate for today's technolgy.

Hardware Design

It is unfortunate that no off-the-shelf module or design provides the necessary ingredient to display TV-type images. Many manufacturers have developed display-controller ICs for computer terminals, but in most cases they are unusable in TV applications. One of the few ICs which make the job easier is the Motorola 6845. This IC is the heart of the display board and causes the image to be displayed.

The card is designed to attach to the Radio Shack TRS-80C Color Computer, but the design concept is so basic that it can be altered to attach to any microcomputer. The card functions by first generating or placing an image in the main memory of the computer. The TV image can be received through a slow-scan demodulator attached to the receiving equipment then connected to the joystick input of the computer.

Another method of image generation is to attach a special hardware interface to the display card and frame-grab the image into the display card from a TV camera. At this time the TV-camera interface has not been developed. When using the TV camera, the image will be loaded into the video card first and then transferred by computer software to main memory.

System Description

Fig. 1 provides a block diagram of the entire system. The TRS-80C in this application acts as an intelligent controller. All interfaces are very primitive and cannot function without intensive control from the computer. When an image is to be displayed from the receiver, the audio tones are first detected by the display demodulator and converted to two types of signals: sync pulses and a dc voltage which changes as a function of the input audio frequency. These signals are connected to the CoCo's RS-232 input and the joystick input.

The joystick input is actually an analog-to-digital converter which can be used to digitize slow-scan TV video into picture information. All of the operation is controlled by software in the CoCo. When digitized, the pixels are transferred to the display card and immediately displayed. For transmission, the image is first created by software and placed in the CoCo's memory. To transfer the image to a transmitter, the sync pulses are controlled by the RS-232 output line and the video is controlled by the computer's cassette output, which is a digital-to-analog converter.

The above process is true only for black and white television. Color digital TV is more complex. Color TV is developed or transferred from three image planes. Each plane consists of the three prime colors (red, green, and blue). When the three frames are mixed together, a color image is formed. The image can then be transferred to the display card. The transmission method of colored television is either by frame-sequential or by a colored line-sequential multiplexed method.

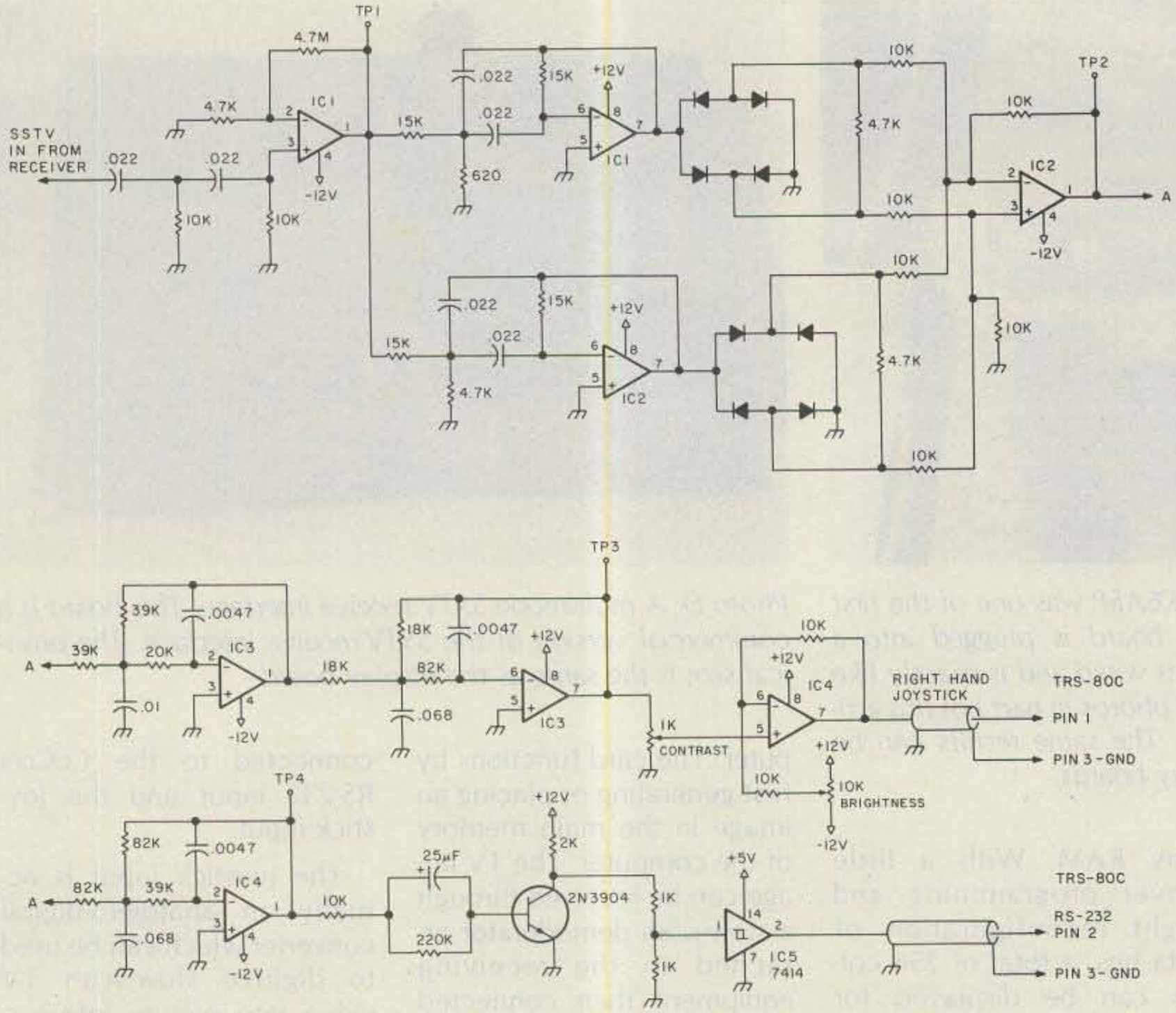

Fig. 4. SSTV/FAX receive demodulator schematic showing a front end which can be used with the computer to display both SSTV and FAX images. The FAX application can be used only on the HF bands.

The block diagram of the display card is shown in Fig. 2 and the schematic is shown in Fig. 3. The following sections describe the major functional parts of the display board.

Display Board

The display board is attached to the expansion port on the side of the CoCo. This port provides connection to the address, data, and control signals of the 6809E MPU. Wiring to the CoCo must be as short as possible; less than one-half-inch leads are a must. The data lines are connected to both the eight RAM ICs and the VDG U18 (6845) display-controller IC through a data bus transceiver (U20). The R-W line determines if the CPU is reading or writing to the board.

In order for the display-controller IC to function, you must first write data to its 18 internal registers. Only three address bits of the 6809 CPU IC are connected to the card. These low-order address bits select the mode which you are performing. The SCS line on the TRS-80C connector is used to select address FF40. The interface E line is the enable signal from the 6809 CPU. This line is used to synchronize the 6845 to the CPU IC for writing to its internal registers.

1. *Functional Selection.* All internal functions of the card are software-selected by a U14 (74LS138). The functions are shown in Table 1 and are described in more detail in the programming section of this article.

2. *Random Access Memory.* This card contains 16K of display RAM (U1 to U8) in eight 2K-by-8-bit ICs. Static RAM was used so as to make the design as simple as possible. Dynamic RAM has the advantage of lower cost but requires extra circuitry to develop RAS and CAS signals, and it is difficult to correct and diagnose problems when they occur. Simple changes can be made to the circuit to add more display memory. Modifications have been made to add 32K RAM. The board can then display 256 pixels on 256 lines, black and white. Television pictures in this mode are starting to approach standard US TV quality pictures.

Control of read or write to the RAM is determined by U25 and U26. During most of the time, RAM is in the read mode. This causes the video data to be valid on the internal data bus. When data is written, it is transferred to and from the CoCo through bus transceiver U20 to the RAM ICs.

3. *Video Display Generator.* The VDG U18 is the heart of the display board. This integrated circuit has 18 registers. In order to make the board operational, the registers must be preloaded before a picture can be displayed on the card. This IC is used to develop the video refresh timings of the RAM. By simply changing the initialization values, either 50-Hz or 60-Hz video can be displayed.

An example of CRT initial-

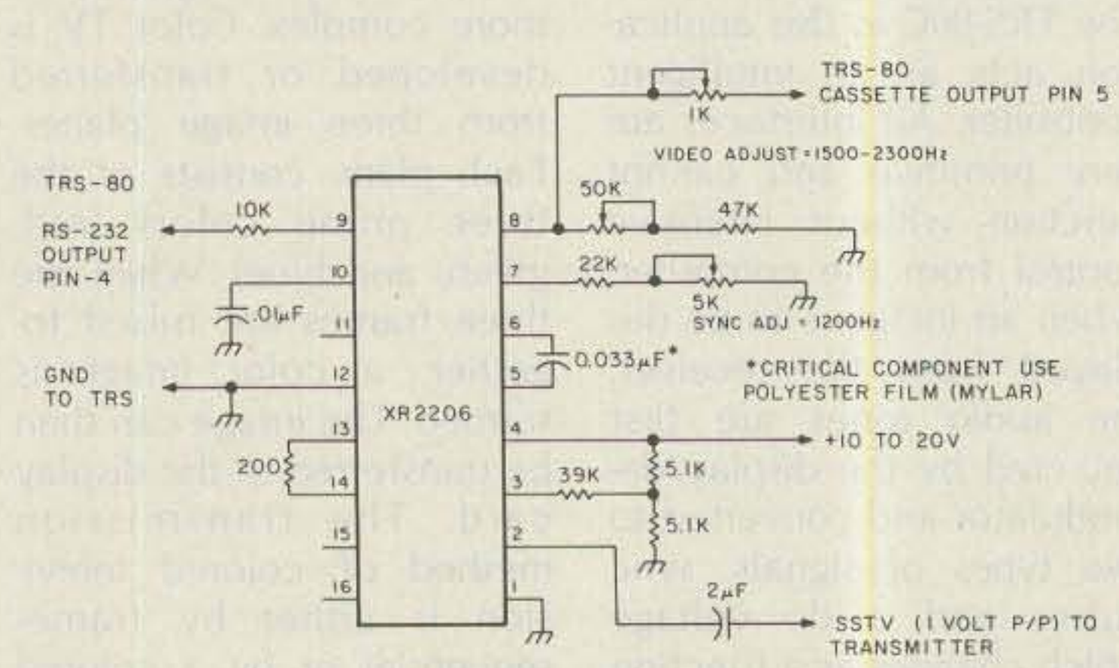

Fig. 5. SSTV modulator, used to transmit SSTV pictures on the HF amateur bands.

ADDRESS	SIGNAL
FF40	VG0 VDG controller address register
FF41	VG1 VDG controller data register
FF42	Spare
FF43	Spare
FF44	Reset—reset RAM address counter
FF45	Select—send picture data to card
FF46	Frame Grab—TV camera—reserved
FF47	Color—TV camera—reserved

Table 1.

```
                        * ASSEMBLER EXAMPLE FOR CODING A PROGRAM
                        * TO RECEIVE SSTV OF FAX WITH A TRS-80C
                        * COLOR COMPUTER
                        *
                              OPT PAG
0600                          ORG $0600
                        * EQUATES
                   FF45 PORT2 EQU $FF45     DISPLAY A PIXEL
                   FF44 PORT3 EQU $FF44     RESET HARDWARE COUNTER
                   1000 START EQU $1000     DUMMY START ADDRESS FOR PICTURE INFO

0600 8E   1000     RECV  LDX #START    START OF PICTURE IN RAM
0603 BD   49             BSR INIT      INITALIZE MPX IN TRS-80C
0605 86   80             LDA #128      256 PIXELS PER LINE
0607 B7   0651           STA PIXC      PIXEL COUNTER
060A B7   0652           STA LINE      LINE COUNTER
060D B7   FF44           STA PORT3     RESET COUNTER ON DISPLAY CARD
                        *
0610 8D   3B             BSR VSYNC     WAIT FOR VERT SYNC
0612 8D   37       RECV1 BSR ADC       GET A READING FROM COCO ADC
0614 12                  NOP           EQUALIZE CYCLES TO KEEP
0615 12                  NOP           SOFWARE JITTER TO A
0616 12                  NOP           MINIMUM
0617 12                  NOP
0618 12                  NOP
0619 12                  NOP
061A 34   02             PSHS A        SAVE ADC ON THE STACK
061C 10BE 064F           LDY DELAY     PLACE DELAY CONSTANT IN Y
0620 31   3F       RECV2 LEAY -1,Y     DELAY LOOP BETWEEN PIXELS
0622 26   FC             BNE RECV2
0624 44                  LSRA          FORMAT PIXEL INTO RIGHT
0625 44                  LSRA          NIBBLE (4 BITS)
0626 44                  LSRA
0627 44                  LSRA
0628 AA   E0             ORA 0,S+      ADD PIXELS
062A 10BE 064F           LDY DELAY     DELAY CONSTANT
062E B7   FF45           STA PORT2     DISPLAY TWO PIXELS
0631 A7   80             STA 0,X+      PLACE A COPY IN RAM
0633 31   3F       RECV3 LEAY -1,Y     DELAY LOOP
0635 26   E9             BNE RECV2
0637 7A   0651           DEC PIXC      DECREMENT PIXEL COUNTER
063A 86   80             LDA #128      RE-INT PIXEL COUNTER
063C B7   0651           STA PIXC
063F 26   D1             BNE RECV1     DO IT TILL LAST PIXEL
0641 7A   0652           DEC LINE      IS IT LAST LINE ?
0644 27   04             BEQ END       DO IT TILL LAST LINE
0646 8D   04             BSR HSYNC     WAIT FOR HORIZONTAL SYNC
0648 20   CB             BRA RECV1     DO IT ALL OVER AGAIN
                        *
                        * END THE WHOLE PROCESS
                        *
064A 39                 END   RTS           RETURN TO MAIN LINE CALL
                        *   ADC ROUTINE- RECEIVE A PIXEL THROUGH ADC PORT
                        *   JOYSTICKS - PERSERVE THE X AND A REGISTERS
                        *   RETURN WITH ADC VALUE IN A
                        *
064B 39                 ADC   RTS           DUMMY RETURN
                        *
                        *    SYNC ROUTINES- SAMPLE RS-232 INPUT PORT AND WAIT FOR
                        *    THE INPUT TO RISE THAN FALL. VERTICAL SYNC SHOULD
                        *    LOOK ONLY FOR PULSES GREATER THAN APPROXIMATELY 30
                        *    MILLISECONDS. IF THE PULSE WIDTH IS LESS THAN APPROX.
                        *    3 MILLISECONDS THEN IT IS A HORIZONTAL SYNC PULSE.
                        *
064C 39                 HSYNC RTS           DUMMY H SYNC
064D 39                 VSYNC RTS           DUMMY V SYNC
                        *
                        * INITALIZE MULTIPLEXER IN COCO TO CONNECT JOYSTICK
                        * INPUT TO THE CORRECT PIN ON THE CONNECTOR. JOYSTICK
                        * INPUTS CAN BE A POSSIBILITY OF 4 PINS
                        *
064E 39                 INIT  RTS           DUMMY MPX SELECTION
                        *
                        *  DELAY- CONSTANT TO ALLOW FOR DELAY BETWEEN PIXELS
                        *  VARIABLE TO COVER ALL MODES OF RECEPTION
                        *
064F 0010               DELAY FDB $0010     SAMPLE DELAY
                        *
                        * GENERAL STORAGE FOR PROGRAM CONSTANTS
0651 00                 PIXC  FCB 0         PIXEL COUNTER DELAY
0652 00                 LINE  FCB 0         LINE COUNTER DELAY
                        *
                              END RECV
```

Fig. 6. Program example for SSTV/FAX receive, written in 6809 assembler language, to demonstrate how easily a receive routine can be written. The routine cannot be executed without software additions.

```
                        * ASSEMBLER CODE EXAMPLE OF TRANSMISSION OF
                        * A SSTV PICTURE OVER AMATEUR RADIO USING A
                        * TRS-80C COLOR COMPUTER
                        *
                              OPT PAG
0600                          ORG $0600
                        * EQUATES
                   FF45 PORT2 EQU $FF45     DISPLAY A PIXEL
                   FF44 PORT3 EQU $FF44     RESET HARDWARE COUNTER
                   1000 START EQU $1000     DUMMY START ADDRESS OF PICTURE INFO
                   FF20 PIA   EQU $FF20     DAC PORT (CASSETTE OUTPUT)

0600 8E   1000     XMIT  LDX #START    START ADDRESS TO XMIT
                        * FIRST DISPLAY PICTURE ON THE SCREEN
0603 B7   FF44           STA PORT3     RESET HARDWARE COUNTER
0606 A6   80       XMIT1 LDA 0,X+      GET A PIXEL
0608 B7   FF45           STA PORT2     DISPLAY IT ON CARD
0609 8C   5000           CMPX #START+$4000 LAST BYTE OF DISPLAY ?
060E 26   F6             BNE XMIT1
0610 10BE 0655           LDY #TABLE    ADDRESS OF PIXEL TABLE
0614 7F   0666           CLR LINE      CLEAR LINE COUNTER
0617 7F   0665           CLR PIXC      CLEAR PIXEL COUNTER
061A 8E   1000           LDX #START    START OF PICTURE RAM
061D 8D   33             BSR XVERT     XMIT A VERTICAL SYNC PULSE
061F A6   80       XMIT2 LDA 0,X+      GET A PIXEL
0621 34   02             PSHS A        SAVE IT ON THE STACK
0623 44                  LSRA          FORMAT PIXELS FOR TRANSMISSION
0624 44                  LSRA
0625 44                  LSRA
0626 44                  LSRA
0627 A6   A6             LDA A,Y
0629 B7   FF20           STA PIA       XMIT A PIXEL
062C 35   02             PULS A        GET BACK ORIGINAL TWO PIXELS
062E 84   0F             ANDA #$0F     MASK OUT HIGH ORDER NIBBLE
0630 8D   22             BSR DELAY     DELAY LOOP BETWEEN PIXELS
0632 A6   A6             LDA A,Y
0634 B7   FF20           STA PIA       XMIT NEXT PIXEL
0637 8D   18             BSR DELAY     DELAY A PIXEL
0639 7C   0665           INC PIXC
063C B6   0665           LDA PIXC
063F 4D                  TSTA          IS IT THE LAST PIXEL ?
0640 26   C4             BNE XMIT1
0642 7F   0665           CLR PIXC      RESET PIXEL COUNTER
0645 8D   0C             BSR XHORIZ    XMIT A HORIZONTAL SYNC
0647 7C   0666           INC LINE
064A B6   0666           LDA LINE      GET NEW LINE COUNT
064D 81   80             CMPA #128     LAST LINE ?
064F 26   B5             BNE XMIT1     NOT LAST LINE
0651 39                  RTS           RETURN TO MAIN LINE CALL
                        *
                        * XMIT SYNC PULSES - VERTICAL SYNC WILL BE
                        * 50 MILLISECONDS IN DURATION, THE HORIZONTAL
                        * SYNC PULSE WILL BE 5 MILLISECONDS IN DURATION
                        *
0652 39                 XVERT  RTS          DUMMY ROUTINE
0653 39                 XHORIZ RTS          DUMMY ROUTINE
                        *
                        * PIXEL DELAY ROUTINE DELAY A SUFFICIENT AMOUNT
                        * OF TIME BETWEEN PIXELS TO XMIT THE CORRECT
                        * HORIZONTAL SYNC FREQUENCY
                        *
0654 39                 DELAY  RTS          DUMMY ROUTINE
                        *
                        * PIXEL LOOK UP TABLE. CORRECT PIXEL BIT PATTERNS
                        * WILL BE ACCESSED IN THIS ROUTINE TO PLACE A
                        * A VOLTAGE ON THE SSTV MODULATOR TO PROVIDE THE
                        * APPROPRIATE VOLTAGE F=WHITE 2300 HZ.
                        * 0=BLACK 1500 HZ
                        *
0655                    TABLE  RMB 16       16 BYTES OF DATA
                        *
                        * COUNTERS IN RAM
0665 00                 PIXC   FCB 0
0666 00                 LINE   FCB 0
                        *
                              END XMIT
```

Fig. 7. Program example for SSTV transmission.

ization is contained in the programming section. The initialization constants were chosen to display an image with the minimum amount of tearing and proper centering on a 9-inch RCA Color Trak TV set. The TV set was interfaced to the video card by a Radio Shack rf modulator.

4. *The Master Clock.* The master clock is a crystal oscillator operating at 6.144 MHz and is generated by a 74LS00 U21 IC. This crystal frequency was chosen to display an active picture time of 42 microseconds. The initialization software of the 6845 is used to fine-tune this display time. A counter is used to divide the clock frequency by 2 and 4.

5. *The Internal Data and Address Bus.* The entire card is designed to display an SSTV picture continuously. Since the card must be powered by an external source different from the computer, power can be dropped on the computer and the display will still be active.

When a picture is to be displayed on the card, the refresh process is interrupted for a few microseconds. This causes a small white line to appear on the display. The direct memory access (DMA) scheme used on the card is very simple in principle. Normally the addressing of RAM is from the VDG through two tri-state buffers, U16 and U17. When the CPU writes to RAM, not-RAM select is brought low and the RAM address is generated by two counters, U10 and U11. At this time, VDG buffers U12 and U13 are floated on the address bus and the counter buffers drive the bus. After the RAM has been written, the counter advances to the next address.

6. *Display Data.* The digital display data is latched from the data bus at the correct time by the 74LS374 U24; the black and white is twice the rate of the color. The 74LS374 U39 is latched from the data bus every 650 nanoseconds. This data is fed to both the black and white and color modulators. A multiplexer is used to feed the black and white modulator. The multiplexer 74LS157 U30 is clocked at a rate of 325 nanoseconds, which is 256 pixels per line of SSTV.

7. *Black and White Modulator.* The black and white modulator is fed from the multiplexer, U30, which feeds first the 4 low-order bits (nibbles) then the high-order nibble. The output of the multiplexer is connected to a simple digital-to-analog converter (D/A) which consists of a transistor and 10 resistors.

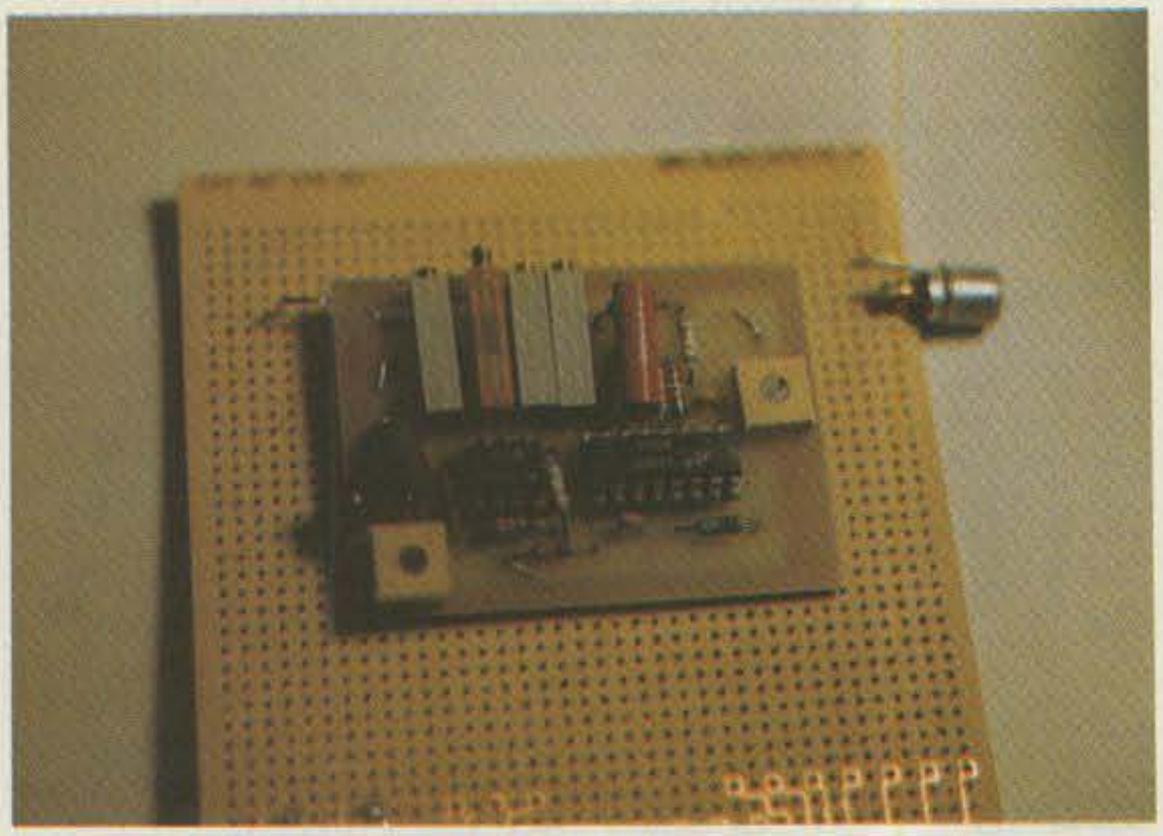

Photo E. RTM Circuit Board's SSTV transmit interface placed on a Tandy prototype card. The card can be plugged into a card cage or a socket for ease of removal and repair.

Sync pulses are generated by the VDG U13, are ORed together by U27, then mixed with video data in the single-transistor D/A converter. Since 4 bits are used, the modulator is restricted to 16 possible gray levels per pixel.

A picture-smoothing capacitor (1000 pF) was placed across the 510-Ohm resistor to ground at the D/A summing point. The value of this capacitor can be optimized to produce the picture most desirable. The absence of the capacitor produces a more digitized picture.

8. *Color-SSTV Modulator.* The color-SSTV modulator consists of three ICs, LM1889 U32, LM1886 U31, and a 9602 U33. The SSTV modulator functions by clocking the picture data on the latch. The data is next transferred to the LM1886 which converts the digital pixels to difference and luminance signals. These signals are internally connected to the color modulator which provides composite color video.

Three additional signals are provided to the LM1886, blanking, sync pulse, and a burst gate. The burst gate is developed from a 9602 which is a dual single shot. The burst gate serves as a reference signal. The location of the burst gate must be adjusted to the correct position on the horizontal-blanking back porch. This is the only adjustment on the board.

The digital data to the LM1886 (U32) is in the format of 3-by-3-by-2 bits of red-, green-, blue-frame information. For example, the lower three bits of the byte are the red-frame information, the next three bits are for the green frame, and the most significant bits are for the blue frame.

This configuration allows for a possible 256 combinations which are unique colors. Since the LM1886 allows for nine bits of digital data to be inputted, the LSB is tied to the MSB of the blue-frame input of the IC to make the bit pattern compatible with the eight-bit display-data bus. This trick allows for black and white images to be displayed. Without this modification, the black and white images would have a blue hue.

9. *TV-Camera Interface.* A number of points are identified in the logic of the display-board interface for the inclusion of a TV camera at a later date. The camera interface will function as follows: When the 74LS00 U9-5 is brought low, the counter will drive the address bus. The TV-camera pixel counter will be incremented by the input U9-9. The RAM read/write is controlled by U26, and the TV-camera input at U25-12/13 will cause the RAM to switch to the write mode. Pixels can next be written to the RAM from the data bus.

```
                    * ASSEMBLER CODE EXAMPLE TO INITALIZE THE CRT
                    * CONTROLLER TO THE APPROPRIATE RATES OF STANDARD
                    * USA 525 LINE TV AND NTSC COLOR TV
                    * SLIGHT MODIFICATIONS WILL ALLOW FOR 50 HZ
                    * 625 LINE AND PAL COLOR
                    *
                          OPT PAG
0600                      ORG $0600

0600 5F             INCRT CLRB
0601 30  8D 000E          LEAX CONCRT,PCR CRT INITALIZATION CONSTANTS
0605 F7  FF40       INCRT1 STB PORT       SELECT REGISTER ADDRESS IN 6845
0608 A6  80               LDA 0,X+      GET FIRST CONSTANT
060A B7  FF41             STA PORT1     PUT DATA INTO REGISTER
060D 5C                   INCB          POINT TO NEXT REGISTER
060E C1  10               CMPB #16      LAST BYTE ?
0610 26  F3               BNE INCRT1    DO IT AGAIN
0612 39                   RTS
                    *
                FF40 PORT   EQU $FF40     CRT CONTROLLER ADDRESS PORT
                FF41 PORT1  EQU $FF41     CRT CONTROLLER DATA PORT
                    *
                    * CRT CONTROLLER IC EQUATES
0613 C0             CONCRT FCB $C0        REG 1  HORIZ TOTAL
0614 80                    FCB 128        REG 2  CHAR/ROW
0615 92                    FCB $92        REG 3  HSYNC POSITION
0616 1E                    FCB $1E        REG 4  HSYNC WIDTH
0617 78                    FCB $78        REG 5  VERT TOTAL
0618 35                    FCB $35        REG 6  VERTSYNC ADJ
0619 7F                    FCB $7F        REG 7  CHAR ROWS/FRAME
061A 01                    FCB $01        REG 8  VSYNC POS
061B 00                    FCB 0          REG 9  INTERLACE MODE
061C 01                    FCB 1          REG 10  SCAN LINES/ROW
061D 00                    FCB 0          REG 11  CURSOR START
061E 00                    FCB 0          REG 12  CURSOR END
061F 02                    FCB 02         REG 13  MSB START VIDEO
0620 00                    FCB 0          REG 14  LSB STOP VIDEO
0621 00                    FCB 0          REG 15  MSB L/P
0622 00                    FCB 0          REG 16  LSB L/P
                    *
                           END
```

Fig. 8. Initialization of the display board; this is an example of how the display board 6845 can be initialized.

Receive Demodulator

The receive demodulator is a device which decodes the SSTV tones into a dc voltage proportional to input frequency and digital sync pulses. This circuit converts video tones of 1500 Hz and 2300 Hz to 0 volts and 5 volts, respectively. A frequency of 1200 Hz converts to a positive digital pulse.

The circuit consists of four stages of filtering and one stage of pulse shaping. Its schematic is shown in Fig. 4.

The decode by this circuit is not only compatible with SSTV but can also be used to decode FAX pictures transmitted commercially on the HF frequencies.

The SSTV video enters the demodulator through the limiter circuit, U1. The limiter is connected to two bandpass filters, U1 and U2, which have bandpasses of approximately 1100 to 2400 Hz. These filters are connected to two diode-discriminator circuits which are combined into a differential amplifier. The signal at TP2 is the carrier frequency of the audio signal with amplitude modulation. The signal in this path with TP3 (U3 and U4) is a series of bandpass amplifiers which allow only the video components of 1500 and 2300 Hz to be passed.

The path of TP4 and U4 is used for the detection and waveshaping of the sync signals. The Schmitt trigger, 7414, is used to develop fast rise times of the sync signals and to produce TTL-level voltages. The sync output from the circuit contains both horizontal and vertical sync pulses.

Modulator Circuit

The modulator interfaces to the CoCo and is the circuit which produces the SSTV audio tones for the transfer of video information in computer memory. The interface, shown in Fig. 5, connects to the CoCo through the RS-232 and cassette-output ports. The cassette-output port is a 6-bit digital-to-analog converter.

The circuit functions as follows. When the RS-232 output is raised, the modulator outputs a sync frequency of 1200 Hz. To generate video tones, a ground

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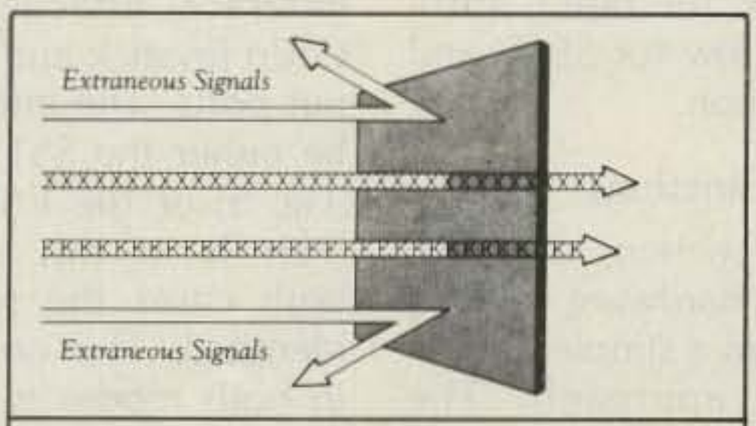

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Photo F. A color-SSTV picture displayed on a TI color monitor attached to the K6AEP prototype display board. The picture was received over amateur radio on 28.680 MHz by the TRS-80C and saved on tape. The picture was generated by WBØUNB in St. Louis, Missouri.

Photo G. A color-SSTV picture generated by WØLMD and placed on audio cassette tape and loaded into the TRS-80C. This picture shows the effect of color contouring. Since the display has only 256 possible colors, the shading in the flesh-tone regions are noticeable.

potential is applied to both the RS-232 output and the video input. This causes a video frequency of black 1500 Hz to be outputted. When the video level is increased to approximately 1.1 volts by outputting a digital F to the cassette-output port, a frequency of 2300 Hz is generated. By the use of software, an SSTV picture can be generated by software and transmitted.

The Software

The preceding section provides you with a complete description of the hardware requirements for SSTV applications. Obviously, the hardware performs few useful functions without the software. The intent of the hardware design is to place the burden of all timings and control on the software. This allows for the maximum utilization of all hardware interfaces. There are the following limiting factors.

Microprocessor Speed. The reception or transmission of images is limited by the rate at which the instructions can be executed by the CPU. Fortunately, the 6809 microprocessor is very fast due to its rich instruction set and its ability to process 16-bit data even though the processor is on an 8-bit data bus.

Internal Analog-to-Digital Converter. All of the preceding interfaces are based upon the use of the internal analog-to-digital converter in the TRS-80C. This feature is used to process joystick inputs when playing games. The A/D converter uses a simple successive-approximation technique and is driven by the microprocessor. When this technique is used, the conversion rate is quite slow. The tightest loop which can be written to utilize this feature allows for the conversion of 4 bits of data in approximately 75 microseconds. Even though this is slow, the rate is sufficient to allow for SSTV and FAX reception.

Software Functions

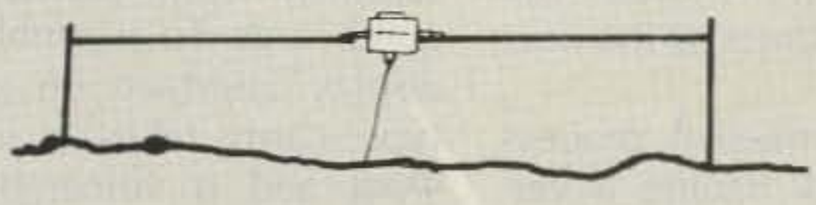
In this section, the software and hardware will be described in a simple, broad, overview approach. The principles described can apply to SSTV, FAX, or any other communications mode which uses a slow rate of transmission or reception. Normally this type of software is called firmware or microcode. Since the software is extremely time-dependent, care must be taken with each instruction written to make the time as short as possible. The description of the software routines will be general enough so that they can be recoded for any general-purpose microprocessor. One important point is that all software must be written in the microprocessor's native assembler language. High-level languages are too slow. Even the most efficient compilers are too slow for SSTV applications.

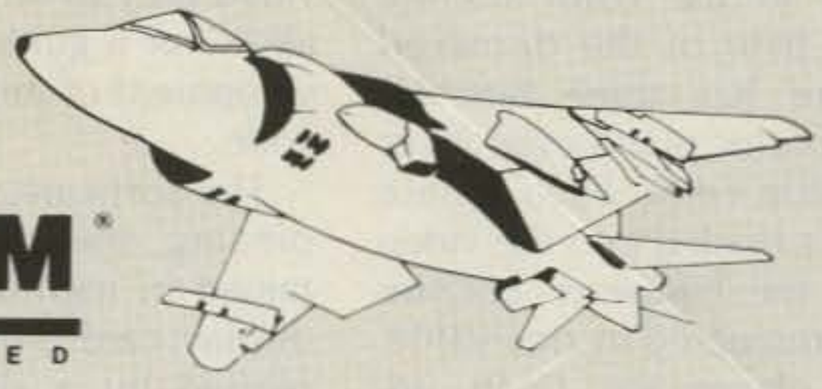
Receive Software. In Fig. 6 is a simple routine which will receive a picture through an interface attached to the CoCo joystick and RS-232 input ports. The interface can be either the SSTV receiver (Fig. 5) or the FAX receiver (Part II of this article). In both cases the software is identical. The only change in both modes is the delay between pixel reception. The software routines provided are not complete but they do provide an example to readers ambitious enough to learn assembler-language programming. The program functions as follows.

The first six lines of code initialize program constants for the correct number of lines and place the CoCo multiplexer to the correct joystick-input-connector pin. The hardware counter PORT3 is reset to the upper left-hand corner of the picture area. As soon as a vertical sync signal is received on the interface, the program starts to digitize the picture.

The A/D routine converts the analog input voltage to four digital bits and places this information into the lower nibble of a byte. The byte is next placed on the stack, and a software delay is executed. Upon completion of this delay, the next A/D reading is converted. These two values are next added together on the stack, then placed into RAM, and simultaneously displayed on the video card.

The byte in RAM is the same format as the byte on the video card. In the black and white format, the byte





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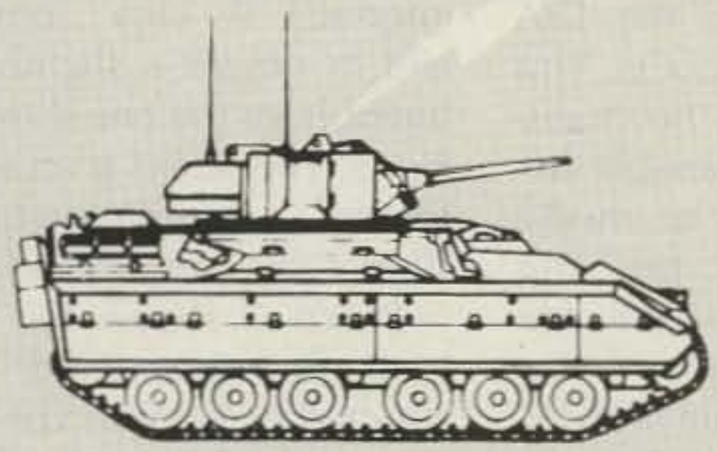

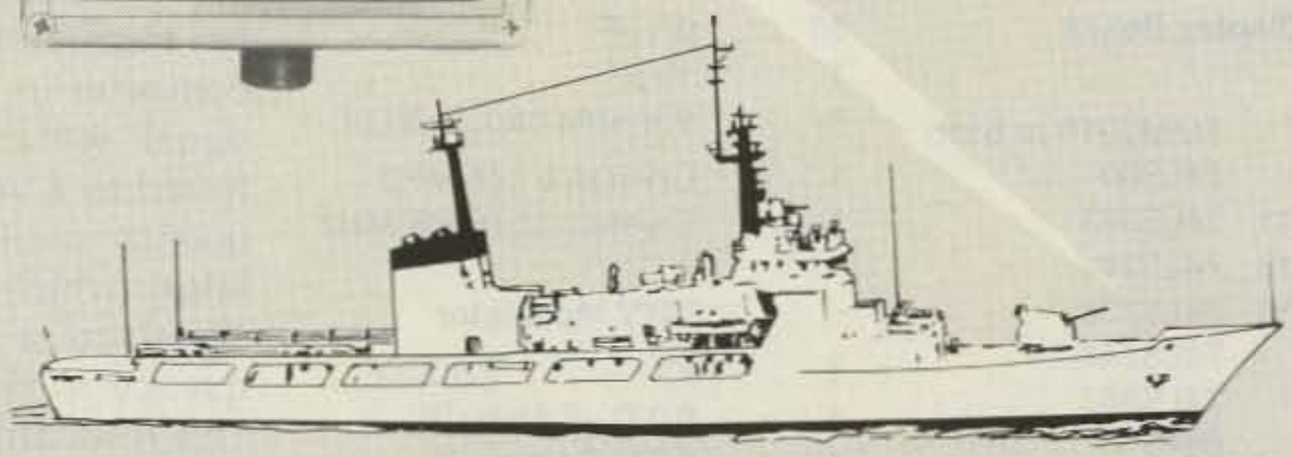

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contains two pixels of 4 bits each. In the color format, each byte of the displayed picture has three bits for each color plane except for the blue color. Each time a byte is loaded into the video port, the hardware counter is incremented by one value. This places the DMA address counter to the next location in RAM where the next pixel will be written.

Transmit Software. Fig. 7 contains a simplified example of how an SSTV transmit routine can be written. This example, like SSTV receive, is very general and is provided only as an example to allow for a guideline for development of more complex code.

The software starts off by placing the picture contained in memory onto the display card. This is accomplished by a simple block move of data to the display card. Prior to the block move, the card hardware counter is reset to zero and 16K bytes are taken from RAM and transferred to the video card. Each time the byte is stored at the video-card address, the hardware automatically increments the RAM address to the next location.

The transmission process starts off by issuing a vertical sync pulse. This pulse allows for the receiver on the other end of the transmission path to reset the picture to the top of the screen. In the following steps, a picture byte in memory is loaded into the A accumulator. Each nibble is formatted into the lower nibble of a byte. This byte is next used as an offset to a lookup table in memory which will convert the address to an appropriate digital signal which can be transferred to the D/A converter in the CoCo. This signal will then be transferred to a vco (variable frequency oscillator or modulator) which converts this signal to a sinusoidal frequency in the audio range. This resultant signal is SSTV.

The program continues to transmit pixels until 256 pixels are transmitted. At this time a horizontal sync pulse is transmitted. The program next checks if 128 lines have been transmitted. If so the whole process is terminated. If not, the program continues to transmit pixels.

CRT Controller Initialization. Fig. 8 contains a software routine which will initialize the 6845. The routine takes 16 bytes of data in the table CONCRT and stuffs them into the controller registers. This process is accomplished by first presenting the controller register number to the IC. Next the data byte is loaded into the accumulator then transferred to the card.

The display constants in CONCRT are for a standard 60-Hz display system. To revise the formats to 50 Hz, 625 lines, registers 1 and 5 must be changed. The values should be selected by trial and error.

Hardware Construction

The hardware mentioned above can be constructed on prototype cards or assembled from printed circuit boards. To assemble the display interface on prototype cards takes a lot of work and is vulnerable to errors. Problems experienced with prototyping the card have included: grounds conductors were too small, too few bypass capacitors on power lines, and hardware counters U10 and U11 required a small capacitor on the counter-reset line. Despite these problems, about 5 boards have been constructed to date with excellent results.

Photo A shows the multimode display board.[1] This interface is very compact and its design is slightly different from the one shown in Fig. 3. The board is attached to the computer through a short cable (see Photo B).

Photo C shows the original prototype card constructed by K6AEP. The card was point-to-point solder-wired on a prototype SS-50 computer interface card. A small adapter card was constructed to plug into the CoCo expansion interface. (An etched PC board or completely assembled version of this card is available from L. W. InterFace.[3]

The SSTV receive and transmit interfaces are available in a number of forms. Photo D shows the multimode receive-board interface card; Photo E is a transmit interface from RTM Circuit Boards.[2]

All boards can be placed in a cabinet with the appropriate power supplies of 5 volts (1 Amp) and ±12 volts (100 mA). Cables can be made to attach to the computer and receivers.

Part II of this article will describe the FAX hardware.

Conclusions

The computer approach to displaying images is a very cost-effective method. Most alternative methods available are limited in function and are considerably more costly. The commer-

Parts List

Display Board

ICs

8	U1–U8	TMM2016 or 6116
1	U9	74LS00
2	U10, U11	74LS393
2	U12, U13	74LS244
2	U14, U15	74LS138
1	U16	74LS244
1	U17	74LS367
1	U18	6845
1	U19	744LS93
1	U20	74LS245
1	U21	74LS00
1	U22	74LS11
1	U23	74LS367
1	U24	74LS02
1	U25	74LS00
1	U26	74125
1	U27	74LS02
1	U28	74LS05
1	U29	74LS374
1	U30	74LS157
1	U31	LM1886
1	U32	LM1889
1	U33	9602

Transistors

2	2N3904

Resistors

1	75 Ohms	¼ W, 5%
2	150	¼ W, 5%
2	220	¼ W, 5%
2	470	¼ W, 5%
1	510	¼ W, 5%
1	600	1/10 W, 1%
1	680	¼ W, 5%
8	1k	¼ W, 5%
1	1.2k	1/10 W, 1%
1	2.4k	1/10 W, 1%
1	4.7k	¼ W, 5%
1	5.1k	1/10 W, 1%
2	5.1k	¼ W, 5%
1	10k	¼ W, 5%
2	50k Trimpot	

Capacitors

3	43 pF	Mica
2	100 pF	Mica
1	1000 pF	Mica
1	0.001 µF	
1	0.01 µF	
20	0.1 µF	
1	10 µF	
1	Variable cap, 9–35 pF	
1	Crystal, 6.144 MHz	
1	Crystal, 3.579545 MHz	

SSTV Modulator

1	IC	XR 2206
1	0.033 µF Mylar™	
1	0.01 µF Ceramic	

Resistors

2	200 Ohms	¼ W, 5%
2	5.1k	¼ W, 5%
1	10k	¼ W, 5%
1	22k	¼ W, 5%
1	39k	¼ W, 5%
1	47k	¼ W, 5%
1	1k	Trimpot
1	5k	Trimpot
1	50k	Trimpot

SSTV Receive Interface

4	IC 1–4	MC1458
1	IC5	7414

Resistors

1	620 Ohms	¼ W, 5%
2	1.0k	¼ W, 5%
1	2k	¼ W, 5%
4	4.7k	¼ W, 5%
11	10k	¼ W, 5%
3	15k	¼ W, 5%
2	18k	¼ W, 5%
1	20k	¼ W, 5%
3	39k	¼ W, 5%
3	82k	¼ W, 5%
1	220k	¼ W, 5%
1	4.7 M	¼ W, 5%
1	1k	Trimpot
1	10k	Trimpot

Capacitors

3	*0.0047 µF Mylar™
1	*0.01 µF Mylar
6	*0.022 µF Mylar
2	*0.068 µF Mylar
1	*25 µF Mylar

Small Signal Diodes

8	*1N914

* Or equivalent.

cial units have one advantage in that they can be purchased and plugged into the wall and they are operational. The computerized system described takes a little more work, but it is extremely flexible and not subject to obsolescence as are its commercial counterparts. The results achieved with the system described here rivaled those of commercial counterparts.

Photo F is a typical color image, 128 pixels per line on 128 lines, 256 colors per pixel. Photo G is another color-SSTV image which shows the resolution of the display board on facial flesh tones. This type of image is the hardest type to display. This picture shows color contouring due to the 256 colors per pixel. Photo H is another color picture with computer-graphics overlays generated by software. The picture is the same as Photo G but reduced in size by one half. The colored image was moved to the center of the display screen and graphical characters of various colors were distributed around the picture.

Photo H. A color-SSTV picture with graphics. This picture is the same as Photo G, but reduced in size by software and placed in the center of the image area. The graphics were generated by software and placed around the picture. The graphics and picture were all generated by the K6AEP SSTV 7.6 Revision 2 program.

Better results can be achieved with 32K of display memory, but photos were not presented in this article for this mode. The black and white images developed by this display density approach fast-scan TV quality.

More photos will be presented in Part II of the article, on the FAX application.

Obviously a project of this magnitude is not a one-person effort. Some of the people who contributed were Ron Adair K5HFT of Multimode Corporation, Bob Blackstock WB5MRG who helped with the display-board design, Larry Fritz AG8O of L. W. InterFace, and Bob Wilson WBØRTM of RTM Circuit Boards. ■

References

[1] Multimode Corp., PO Box 171171, Arlington TX 76016; (817)-572-3996.

[2] RTM Circuit Boards, 205 Elm Street, Van Horne IA 52346-0400.

[3] L. W. InterFace, 9570 Kinsman Road, Novelty OH 44072.

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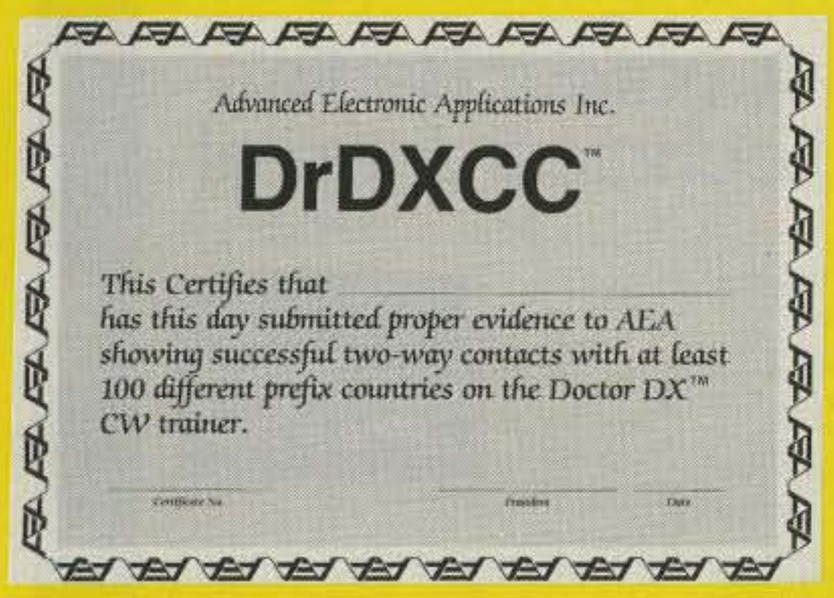

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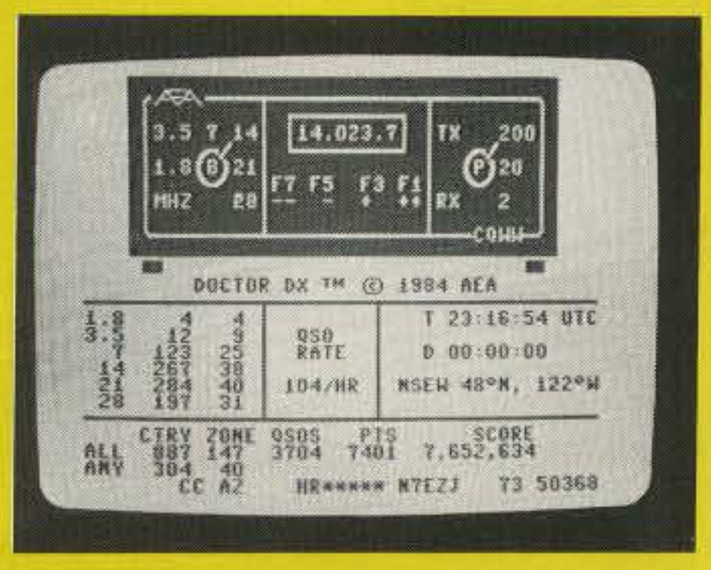

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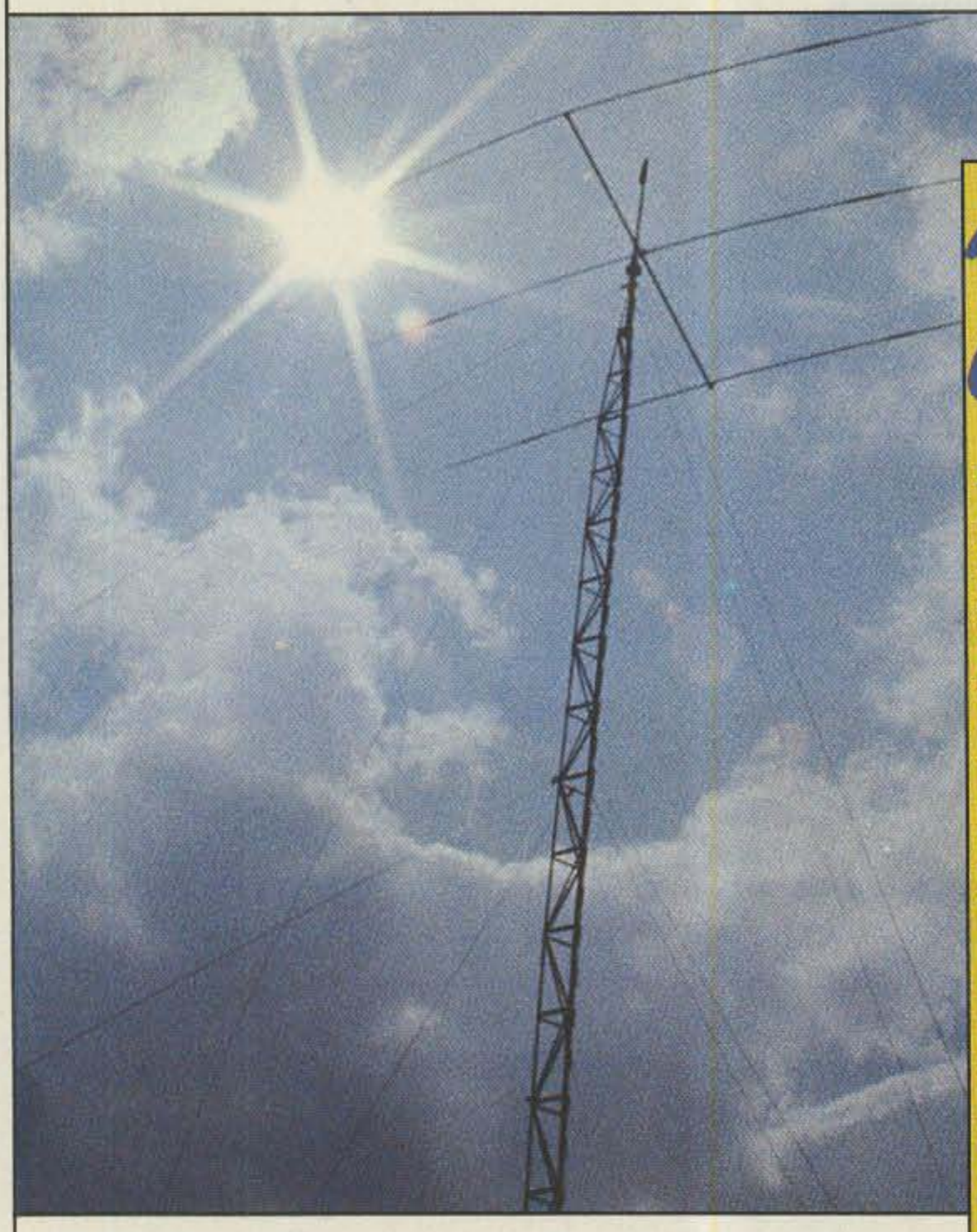

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One of the most perplexing problems for the amateur can be TVI complaints. It seems that no matter how clean your rig, how little power you radiate, or what operating hours you choose, it is only a matter of time before a TVI problem comes home. The best defense against these complaints is the ability to prove you are not ruining your own TV reception. The unfortunate fact of this defense is that few of us can boast of "clean" TV reception while running our transmitters.

After collecting some TVI complaints, most from my own household, a solution to the problem was sought. The original attempt to cure our own TVI problem was the installation of cable TV. This failed miserably and, in fact, enhanced the sensitivity of both television sets to my transmissions. Now, with the capability of jamming every channel day or night, an ultimatum was issued: cure the problem or find another hobby.

Several solutions were tried. The addition of high-pass filters seemed to have little effect on the interference. A new grounding system was installed utilizing multiple copper rods with a braided-copper ground strap run to the rig. This lessened the TVI but did not cure the problem.

Since my efforts were proving less than effective, current literature on TVI prevention was avidly read during my nonoperating time. Despite being hooked up to cable TV, the symptoms appeared to be the result of front-end overloading of the TV receivers. Further reading indicated the probability of inductive coupling between the TV coax and the transmitter. In this case, rf currents are induced to flow in the shield of a coaxial cable situated near a transmitter or antenna. A high-pass filter

Photo A. The TVI cure in place. The antenna coax and TV power cord are wound in opposite directions through the core to minimize coupling effects.

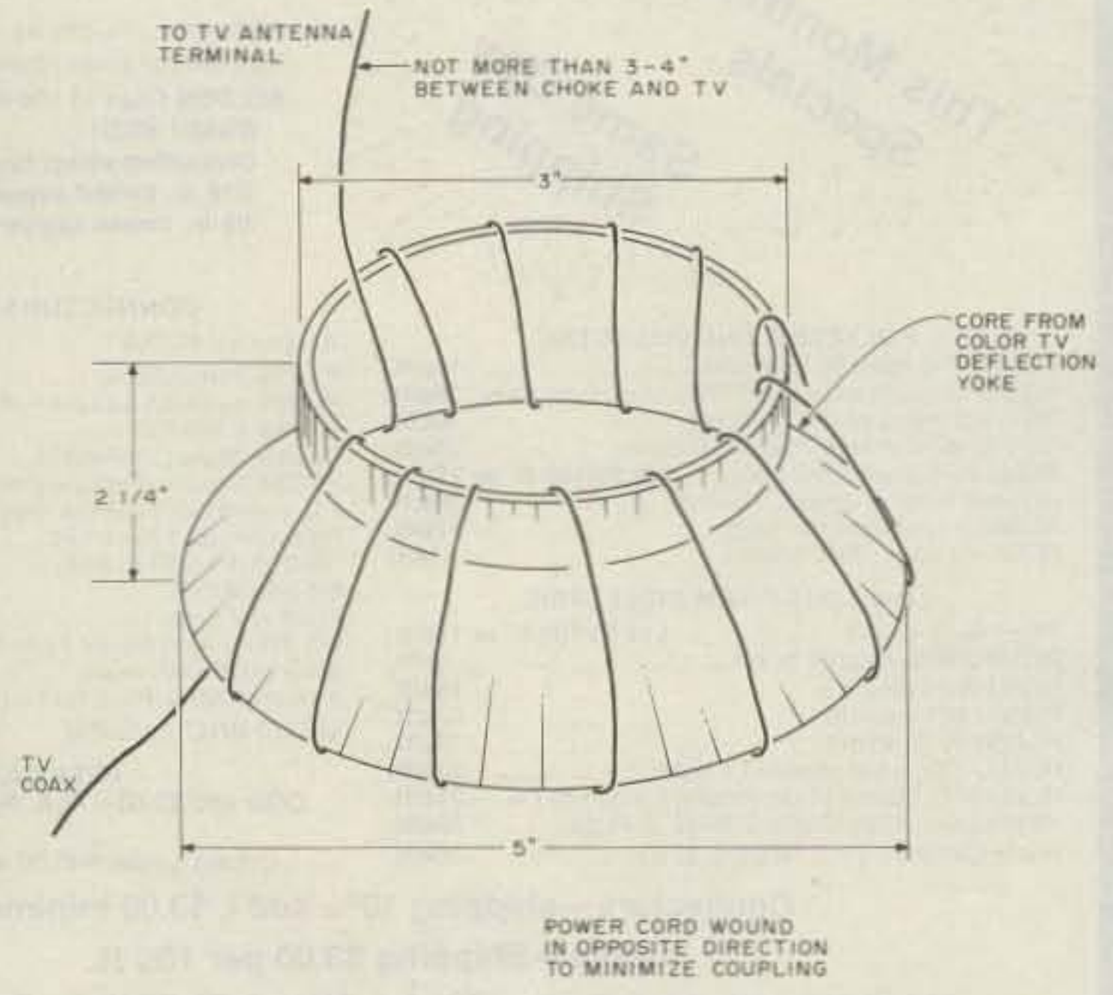

Fig. 1.

is of no use in this situation since the rf current flows down the shield of the coax, through the filter casing, and into the TV.

There are several possible solutions. One is to install a quarter-wave stub at the antenna terminals of the TV, but this is effective for only one operating frequency. A better method is to use a large ferrite toroidal core and wind the coax around it. This functions as a shield choke, preventing rf currents from flowing into the TV, and is effective at all operating frequencies. The only problem with this arrangement is the cost of a suitable ferrite core. They are typically $10.00 to $15.00 apiece.

A less-expensive alternative was sought. Remembering that picture-tube deflection yokes have a toroidal core, several were picked up from a local TV repair shop. They were obtained free of charge, being defective units that had been replaced. The copper windings were stripped off revealing a large, bell-shaped split core bound together with a metal strap. The TV coax was coiled around this core in the same manner as winding a toroidal transformer (Fig. 1). Three inches of cable was left free for attachment to the television. This placed the homemade choke as close as possible to the TV antenna terminals to minimize unwanted rf pickup.

The results were truly gratifying. With the transmitter running at full power, only a faint cross-hatching could be discerned on the picture. Next, the television power cord was wound around the ferrite core in the same manner as the coaxial cable. At this point, all symptoms of interference vanished. Even with one television operating a mere four feet from the transmitter, the picture and sound remained crystal clear.

The same setup was tried with the stereo system in an attempt to achieve the same spectacular results. The speaker leads and the power cord were wrapped around the core in the same manner as with the television. Again it worked beyond all expectations. "CQ CQ from KR7L" was never heard on it again.

This system will not cure every TVI or RFI problem you might have. If your transmitter is spewing out harmonics or other spurious radiation, you need to go to work on the rig, not the television. On the other hand, this method will cure simple overload problems and the cost can't be beat. The TV repair shops in my area were more than happy to give away all their old, defective deflection yokes.

Now when the neighbor comes over to announce that I'm pulverizing his TV, I set him down in front of mine while I fire up the rig. A short demonstration results in profuse apologies and a willingness to listen to some solutions. In addition, I can rest assured that I am free to operate when and where I choose without disrupting the family's favorite TV programs. ■

Photo B. The ferrite core is removed from the deflection yoke by releasing the metal restraining band or by cutting the masking tape that holds it in place.

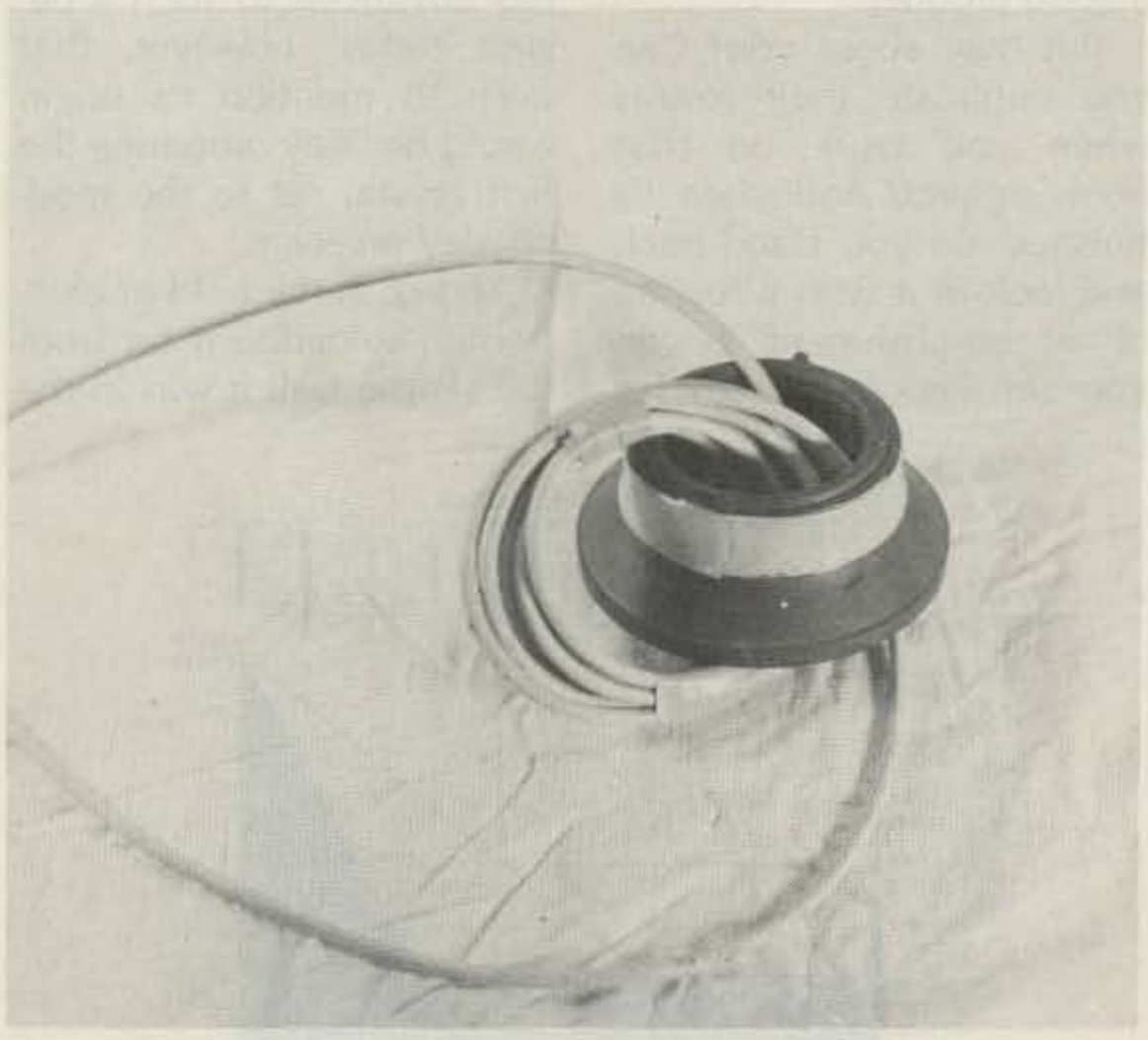

Photo C. The correct method of coiling the TV coax through the ferrite core.

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But how about you? Can you duplicate their results when you work on that home project? And when it's finished, do you stand back and look at it with a feeling of accomplishment or do you say "good enough for government work," as long as it works?

Then and Now

Let's look at this process of joining two pieces of metal together by the use of a solder alloy. It's one of the oldest known joining techniques and probably the least understood by most hams. Believe it or not, it was first developed in ancient Egypt; the technology has advanced to such a degree today, however, that even to mention its origin would be like comparing the first crystal set to the modern-day receiver.

Today, in the field of electronics, soldering is far from the simple task it was in the early days of radio. It could be considered a fine art and one that requires experience, a thorough knowledge of fundamentals, and great care. Faulty solder joints still remain the chief cause of equipment failure.

What is presented here will cover *basic* soldering for electronics and certainly does not represent the details which should be covered for one to become skilled. It should provide you with the fundamental knowledge needed to perform soldering operations with a fair degree of reliability. It will cover the fundamentals of solder action, the selection and proper use of the soldering iron, and some clarifying definitions. It will not cover the accepted procedures for soldering wires and components to single-sided, double-sided, and multi-layer circuit boards.

All aerospace contractors have in-house training programs that are a certification requirement imposed on them by NASA. These go into great detail and are quite lengthy. To cover these related requirements would fill a book, but the average amateur has no use for information on a "PWB lapped termination, a PWB stud termination, PWB clinched termination, turret terminal termination, or a bifurcated terminal termination." This subject can get very dry after about a week, and just a little bit goes a long way.

So, the key word here is *reliability*. High-reliability soldering has been an answer to early failures in space equipment and the

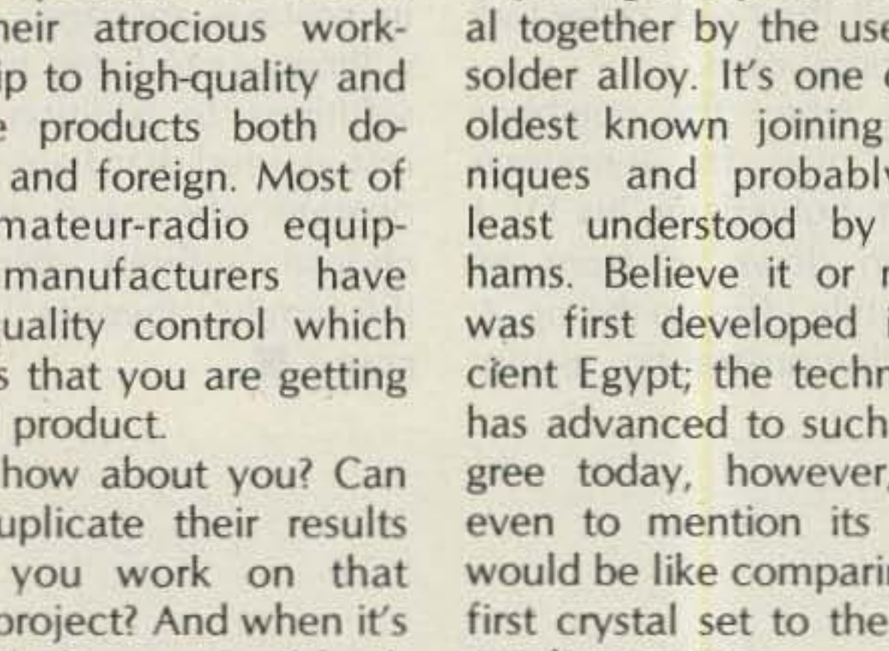

Fig. 1. Fusion characteristics of tin/lead solders.

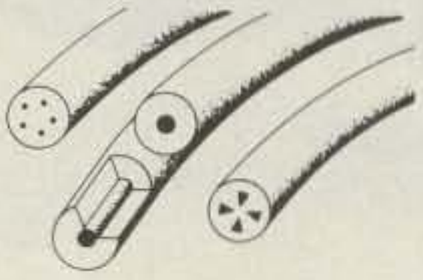

Fig. 2. Types of cored solder, with varying solder-flux percentages.

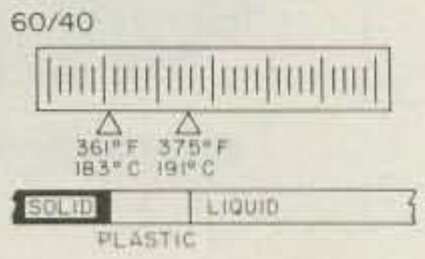

Fig. 3. Plastic range of 60/40 solder: Melt begins at 361° F and is complete at 375° F.

concept has spread to include aviation, weapons, and medical equipment. Today, we expect this reliability in every-day electronics as well, from your hand-held to receivers with complicated bells and whistles.

General Considerations

In order to form a continuous electrical path that will ensure a good contact, one that vibration and mechanical shock won't loosen and will not be subject to oxidation or corrosion, we must solder it according to accepted standards. Look at Fig. 1; it details the fusion characteristics of tin/lead solders. Notice the melting point of lead and tin and their different alloys. These will be discussed later in more detail.

The term "soldering" generally means "soft soldering," which simply means a method of joining two metals together with an alloy of relatively low melting point, usually composed of tin and lead.

Common soft solder used by all of us at one time or another comes in ribbon, wire, and bar form. Wire solder may be either solid or tubular with a core (or cores) of either acid or rosin soldering flux. Bar solder is always used with heavy irons or with blow torches, plumbing, and large sheet-metal work. Ribbon and wire solder are used with light irons on electrical wiring and other small jobs, as shown in Fig. 2.

Solder is designated by numbers; the first number represents the proportion of tin and the second number the proportion of lead. 60/40 solder means a solder that is composed of 60% by weight of tin and 40% by weight of lead. A common solder for all-around use is 50/50 or "half and half." There are others for a more specialized use. Soft solders for gold and silver and for copper and brass sheet generally contain more tin than lead and melt at a low temperature.

So-called liquid solders, or "cold solders," usually are not solders at all but are cements or glues fortified with aluminum or other metallic powder. Avoid trying to make a metal-to-metal bond with these products. They are not electrically conductive and they may disintegrate in the presence of organic solvents or at temperatures considerably below the softening point of tin and lead solders.

The Need for Fluxes

What does the application of flux do? Why do we need to apply flux to a surface to be soldered? In order for the solder to adhere to the metals to be joined, the surfaces must be completely free of oxide. Oxides are present on most metals; they form at room temperatures but almost immediately when heated. A coating or some material must be used that will remove the film already present and protect the solder and the metal from further oxidation. Such a material is flux. It is a Latin word, and it means "to flow."

Except for electrical work, the fluxes most commonly used for soft soldering are solutions of pastes that contain zinc chloride or a mixture of zinc and ammonium chlorides. The heat of the soldering operation evaporates the medium containing the chloride flux. The flux then melts and partially decomposes with the liberation of hydrochloric acid which dissolves the oxides from metal surfaces. The fused flux also forms a protective film that prevents further oxidation. These fluxes are called "acid fluxes" and come in both liquid and paste form.

It goes without saying that acid fluxes have a corrosive action and most certainly should not be used to solder electrical connections. On printed circuit boards—and if it is necessary to wipe the surface with flux prior to soldering—it would certainly be wise to use a good grade of flux and one that can be removed completely.

Some assembly procedures recommend that all solder pads be wiped with a coat of flux. This is a bad practice. It is hard enough to remove the last traces of excessive flux and its residue without damaging the printed circuit board or the installed components. If there is adjacent wiring attached, there is always the danger of rosin flux wicking into the wire between the conductor and the insulation, which would not be removed when the board is cleaned.

Always use a good grade of solvent to remove the unwanted flux and its residue. Ethyl alcohol, isopropyl alcohol, trichorotrifluoroethane, or tricholoethane can be used. A mixture of about 90% isopropyl alcohol and 10% naphtha is excellent for most work.

An acid brush with about half of the bristles cut away makes an effective tool to remove the flux and residue. Rub gently but firmly, taking care not to press too hard, until all traces of the flux are removed. In some cases the joint can be polished using several thicknesses of Kleenex.

Solder

Rosin core solder, when heated to its melting point, undergoes several changes which should be noted in order to make a good joint. It is solid to begin with, changes to a plastic, and then changes to a liquid form. Pure tin melts at about 450° F and lead at 621° F. It would seem that a 50/50 alloy would therefore become liquid at about 535° F. Not so. 50/50 is a solid until it reaches a temperature of about 361° F. At this point it

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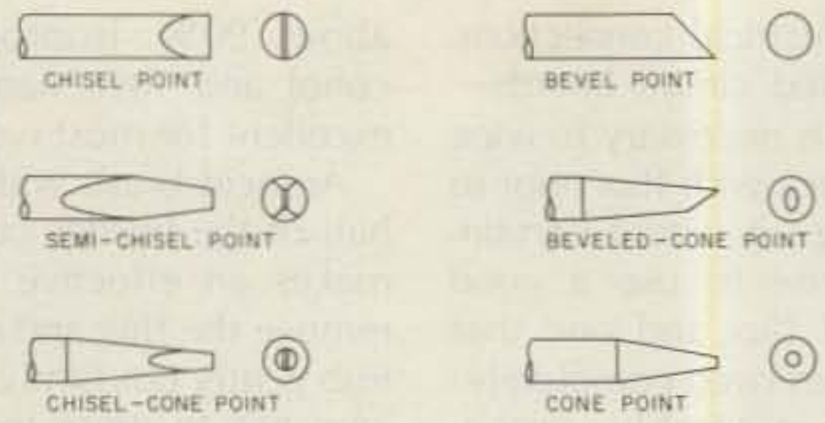


Fig. 4. Tip types.

becomes plastic and remains in this condition until it reaches 415° F when it becomes liquid.

Let's take 60/40 (see Fig. 3). At 361° F, 60/40 changes from a solid to a plastic and remains in that state until 375° F when it turns into a liquid. The time that 60/40 remains in a plastic form is considerably less than the 50/50. If the joint is moved while the solder is in a plastic state, it could well be described as a disturbed joint. It might check out with your meter, but when an electrical load was applied, it could fail to conduct.

Let's take another case: 63/37 alloy. This is what is called an eutectic (low melt) composition. It is 63% tin and 37% lead. It has no plastic state and is transformed from a solid to a liquid at 361° F. 63/37 is most generally used on printed circuit boards. It can be seen that this would have an advantage since the plastic state does not occur. Also, the importance of the soldering-iron tip temperature suddenly takes on a new meaning.

Heat Sources and Tinning

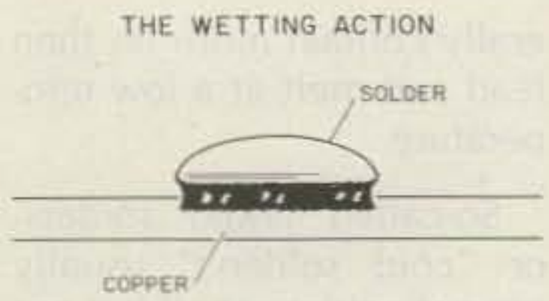
A temperature-regulated soldering iron is a must when soldering printed circuit boards. A 50-Watt iron can easily be regulated with a variac or a homemade voltage regulator using a light-dimming rheostat. The temperature can be adjusted to suit the need of the joint to be soldered. The larger the mass, the more temperature will be required. Start with a low temperature and gradually increase it until the desired result is achieved.

The geometric shape of the soldering tip controls the rate of heat flow to the extreme point of the soldering tip. Two main considerations should be made in choosing a proper tip point: access to the solder joint and maximum *wetted* contact of the tip point with the joint members to be soldered. Because of high component density, one often is restricted to just one or two shapes. The standard soldering tips are shown in Fig. 4.

Let's look at Fig. 5 and consider that word "wetted." Wetting is the flow and adhesion of a liquid to a solid surface. It is characterized by smooth, even edges. In other words, a tip that is hot and tinned and ready to do its job. Conversely, de-wetting is a condition in a soldered area in which the liquid solder has not adhered intimately to the joint or, in this case, the solder tip.

Selected tinning (Fig. 6) is an important consideration in certain soldering operations and the point should be tinned on one side only. There is a good reason for this: There is less chance of disturbing an adjacent joint with the immunized side of the tip's point. When a soldering iron is removed from its holder, the soldering tip should be cleaned on a wet, sulfur-free cellulose sponge. The wet sponge will provide a thermal shock to break free and remove secondary oxides from the surface of the tip.

A tip will de-tin or de-wet, and degradation (or the start



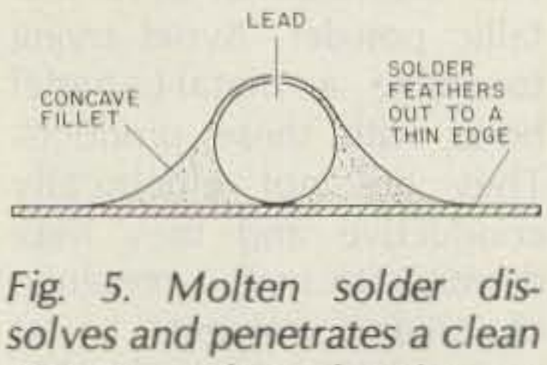


Fig. 5. Molten solder dissolves and penetrates a clean copper surface forming an intermetallic bond.

of oxidation) of the tinned areas will start when the solder begins to ball up on the tip. Once this action has started, it usually will continue until the tip will no longer wet with fresh solder and makes a dry contact with the work. Then the operator will believe the iron is not hot enough. This can all be avoided if the tip is tinned after each soldering operation and prior to placing the iron in its holder.

Another cause of de-tinning is an excessively high tip-idling temperature at which the solder oxidizes faster than you are able to replenish the tip with fresh solder. At high temperatures the flux usually burns and carbonizes, further adding to the de-tinning of the tip. Two simple axioms should be remembered:

1) Solder at the lowest practical temperature, and

2) Keep your soldering tip tinned.

Stranded wires may be tinned very simply if you keep in mind the mass they present to the soldering iron. In other words, the larger the wire, the larger the soldering iron. For example, suppose we wanted to tin a 22-gauge wire and a 14-gauge wire. Both could be handled the same way, with a couple of exceptions. A small, 25-Watt iron with a tip temperature of about 500° F would be sufficient for the smaller wire. How-

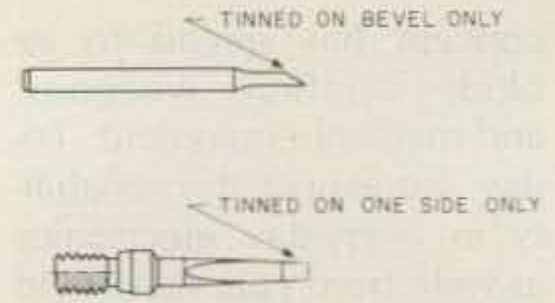


Fig. 6. Selected tinning.

ever, in order to tin the larger wire, an iron of at least 100 Watts should be used but with the *same* tip temperature.

To tin, place a drop of solder on the tip, place the wire in the solder, and add solder to the top of the wire so that it sweats completely and through the strands. Move the wire slowly along the length to be tinned while adding solder constantly until the strands are thoroughly wet with solder.

Another way to tin wires is called the "reflow" method. Tin your wire in the usual way and note if it has surplus of solder on the wire and separate strands cannot be distinguished. Reflow can be accomplished by raising the iron temperature considerably, then dipping the soldered portion of the wire into flux (a good grade of rosin flux) while wiping the tip rapidly on a wet sponge to shock off the oxides. Very quickly hold the wire in a vertical position and place the tip of the wire on the soldering-iron tip. The excess solder will be removed and will flow to the soldering-iron tip, and the wire strands will be visible. The wire will be thoroughly tinned and will not "birdcage" when bent.

A Word to the Wise

Use a thermal shunt or a heat sink whenever installing heat-sensitive components like transistors, flat paks, or integrated circuits. It is very easy to damage these items with excessive heat. When trimming transistor leads for installation on your favorite PC boards, grip the lead to be cut with needle-nose pliers between the transistor case and the

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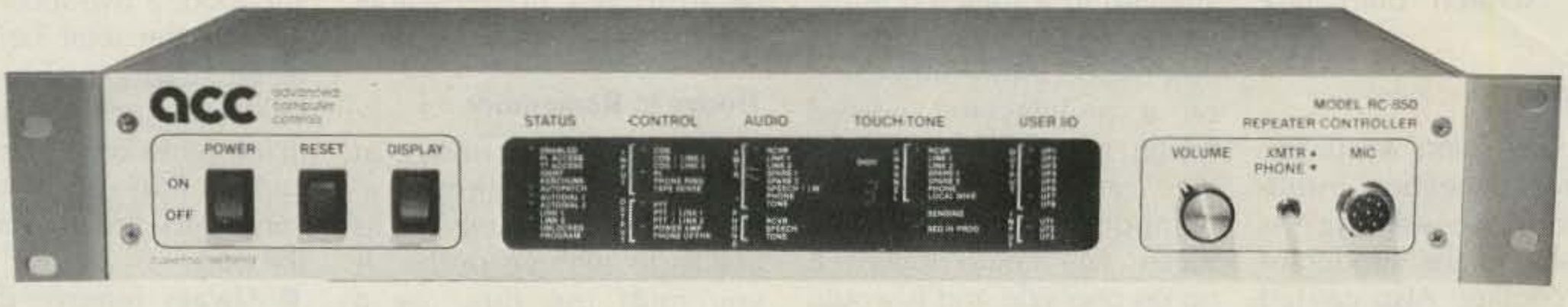

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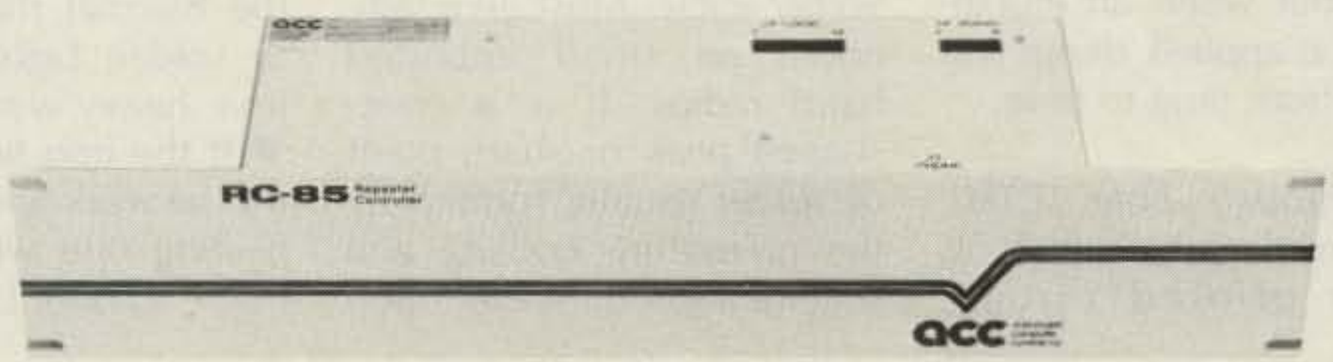

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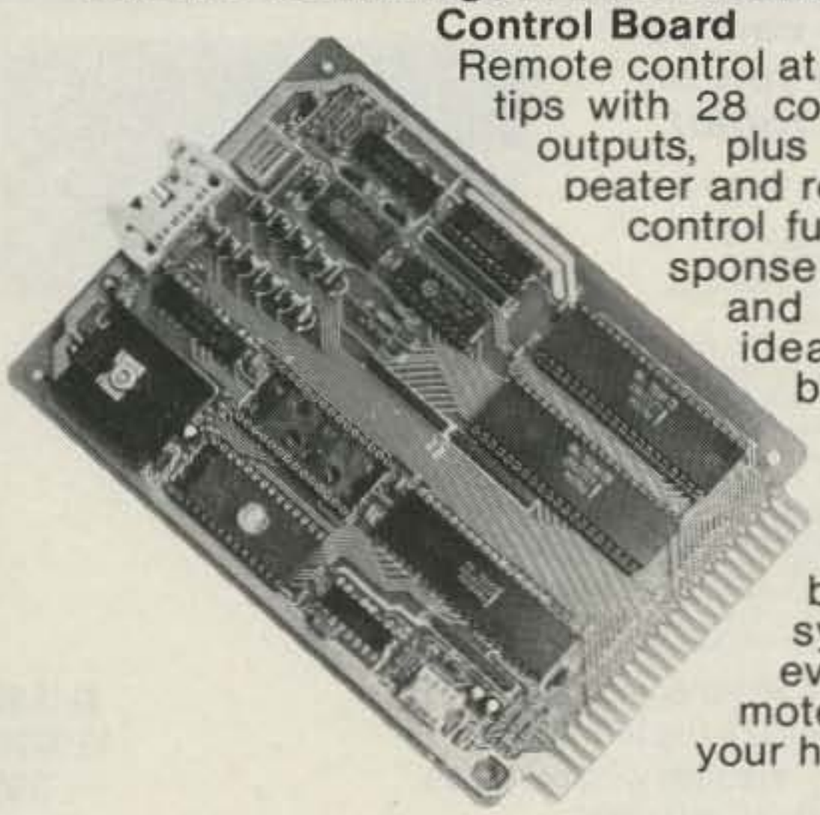

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point where you cut. The energy that makes the unused end go flying across the room can also be expanded in the opposite direction and can fracture the connection inside the housing easily...scratch one transistor.

Definitions

Cold solder joint: An unsatisfactory connection resulting from de-wetting or movement of the conductor during cooling. Also caused by too rapid cooling (like dousing it in water). These joints usually appear frosty and granular. They will show up as an intermittent when you least expect it and will drive you up the wall. When checked with your trusty meter, they show good continuity, but when an electrical load is applied, things will change from time to time.

Plated-through hole (PTH): An interesting thing to look for on printed circuit boards. This is a plated-through hole formed by the deposition of metal on the inside surface of the hole. (Also known as a supported hole.) It is used to provide additional mechanical strength to a soldered termination and/or to provide an electrical interconnection on a multilayered printed wiring board. Use extreme care whenever removing a component from one of these. You could loosen it up on one side and it would still be solid on the other side. It is best to use solder wick here or a solder sucker and remove all the solder.

Rosin solder joint: A connection with entrapped rosin flux. The only recourse is to re-solder—carefully.

Solder icicle: Most generally noted on small imported hand radios. It is a cone-shaped peak or sharp point of solder usually formed by the premature cooling and solidification of solder upon removal of the heat source. High-speed production causes this unsatisfactory condition. If the operator worked that fast, it makes one wonder what other bad practices he was guilty of. Be suspicious of the whole unit if this is noted.

Things to Remember

- Flux is very corrosive at solder-melting temperatures, which accounts for its ability to remove oxides. If you must use flux, use a good grade. Kester No. 1544 is a good grade for almost all electrical and electronic soldering.
- Vary the voltage input to your soldering iron and thereby control the tip temperature. Also choose a soldering iron that is matched to the thermal mass you wish to solder. Light work, light iron; heavy work, large iron.
- If the iron tip is too large for the work and too hot, the heating rate will be so fast that it cannot be controlled. If the tip is too small, the heating rate will be too slow. A good rule to prevent overheating is to *get in and out as fast as you can*. This simply means using the hottest iron you can react to, or one giving about a two-second contact on the joint being soldered. Caution: Too much heat, too much pressure, too many times on a printed circuit board—even on the very best board—will lift the pad.
- Always remove the flux and other impurities. Keep it clean...clean...clean!
- Finally, some soldering irons are simply not compatible with transistors and integrated circuits. They are not isolated from ground and can easily zap everything you solder. Choose well.

I would like to acknowledge the encouragement and help of Merv Holmberg KQ1G. His constructive comments and enthusiasm made research a pleasure. ■

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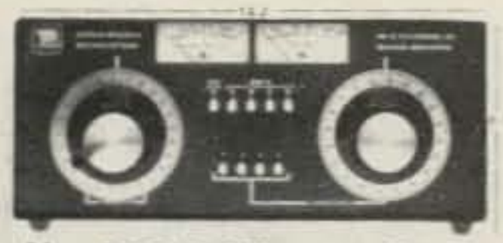

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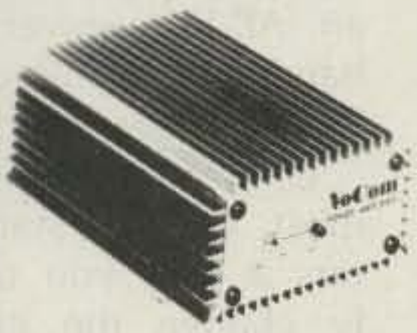

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Many hams use filters to block interfering signals so that CW, phone, and RTTY transmissions can be copied better. Crystal filters are used in many modern transceivers in i-f stages, and add-on audio filters are available from many manufacturers. Most audio filters don't vary much in their design, using operational amplifiers (op amps), resistors, and capacitors to put together active-filter building blocks. These have been described in many publications, and a typical filter is shown in Fig. 1. Common audio filters are low-pass, high-pass, bandpass, and notch. See Fig. 2 for typical frequency response curves.

Circuits are available if you want to build your own filter. Articles in *73*, *QST*, and other ham magazines as well as sections in *The Radio Amateur's Handbook* provide circuit details.[1,2,3,4,5] Most of the parts are inexpensive and readily available, but if you want to look at off-the-shelf filters, they are available from many manufacturers. The MFJ-720 is a typical bandpass filter, centered at about 750–800 Hz. Standard filter circuits can be duplicated, and by using several filter stages in series, you can get a fairly narrow bandwidth. You also can buy a filter such as the M and M Electronics MSB-1, which contains all of the filter types. Even more complex and expensive filters, such as the Datong frequency-agile audio filter, are available.

Integrated-Circuit Filters

If you decide to build your own filter circuits, you might consider using the AF-100 integrated circuit from National Semiconductor. This "chip" contains three op amps preset in a basic filter circuit. By adding a few external components, bandpass, low-pass, and high-pass filters can be built. A "spare" op amp in the chip is used if you want to build a notch filter. Filters are easy to set up; a few calculations are needed to select the right combination of resistors and capacitors, but the math is simple. There is a 20-page data sheet available that explains the types of filter functions that can be obtained, and several examples show how to use this filter chip. There is also an AF-150 universal wideband active filter and an AF-151 dual universal filter.

One of the limitations of most of the standard filters is that you can't easily change the cutoff frequency once the filter has been built. For example, in a filter with four op amps, you would need to carefully vary at least four resistors to change the cutoff frequency.

By the way, the term cutoff frequency is used a bit loosely, since low-pass and high-pass filters have a cutoff frequency, while notch and bandpass filters have a center frequency. Since it's cumbersome to say both,

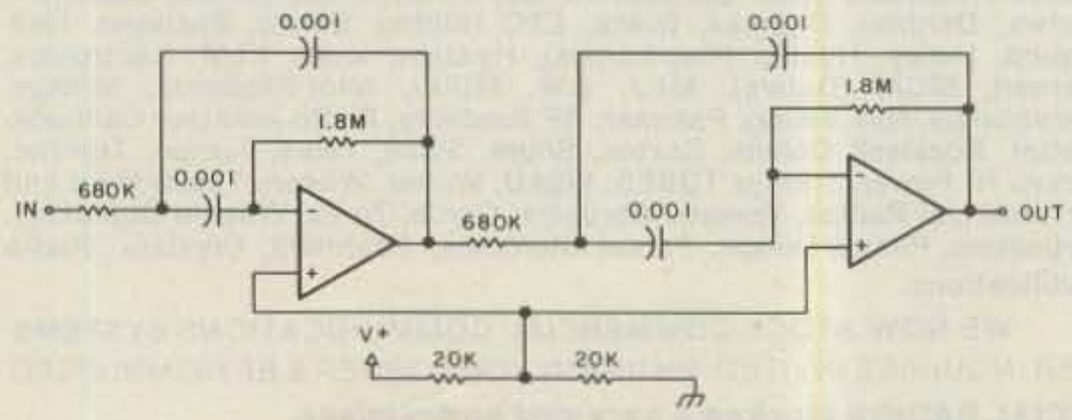

Fig. 1. A typical op-amp bandpass filter for 750–800 Hz.

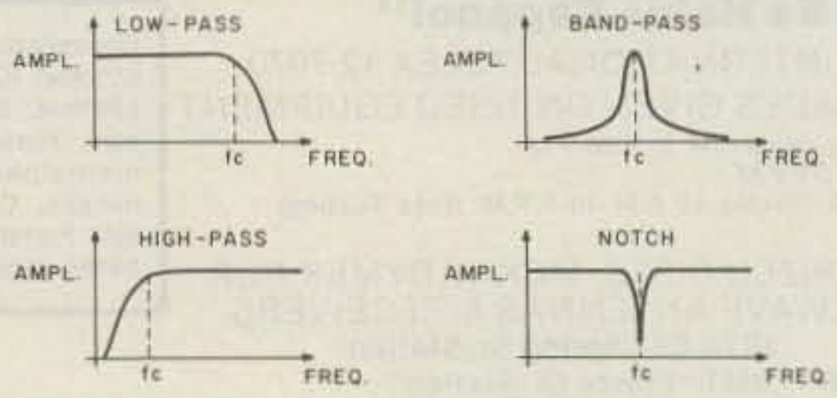

Fig. 2. Frequency response curves for standard filters.

let's use cutoff frequency, since it's fairly standard.

If a CW signal is being masked by one at a slightly higher audio frequency, you may be able to shift the interfering signal a bit higher and then use a bandpass filter to add further selectivity to the signal you are copying. If the cutoff frequency of your filter is fixed, this type of adjustment may be difficult. Many less expensive filters have a fixed cutoff frequency, while some of the more expensive ones, such as the M and M Electronics MSB-1, use ganged potentiometers so that the center frequency can be varied. Ganged pots get to be expensive, so designs are generally limited to two pots operated by the same knob. Since ganged potentiometers don't always track one another perfectly, filter performance is affected.

The Bencher XZ-2 bandpass filter has a variable cutoff frequency, but ganged pots are not used. A single potentiometer controls several transistors that act as variable resistors in the individual filter stages. This allows the center frequency to be changed rather easily, and it seems to be a reasonable solution to the mechanical problems of ganged potentiometers.

CW Regenerators

A CW regenerator is a fairly simple circuit in which a phase-locked loop (PLL) or other tone-detecting circuit is used to pick out a narrow frequency band.[6] Since the output of the PLL is a logic signal indicating tone or no tone, the CW signal being received is tuned so that the PLL "follows" it. An LED on the output provides a visual signal that can be used to show you when the PLL is accurately tracking the CW signal you are hearing. The output of the PLL is used to trigger an oscillator, and this tone is heard in a headset or on a speaker.

The net effect is to "reconstruct" the signal by having a narrow tone bandwidth detected and using this to generate a perfect tone for the listener. A CW regenerating unit called the Amcoder was available from AMC Engineering a few years ago, and a block diagram of this unit is shown in Fig. 3. Since PLL circuits are sensitive to the amplitude of the input signal, an agc stage between the receiver audio output and the PLL input is recommended.

Another CW regeneration circuit was described in *QST*.[7] This makes use of an "envelope detector" that demodulates the CW tones and triggers an oscillator to regenerate a perfect tone. This circuit also incorporates a delay so that noise spikes do not trigger the tone oscillator.

Many other types of filters—LC, RC, acoustic, etc.—have been described by amateurs and professionals.[8]

Switched-Capacitor Filters

During the last year or so, a new type of filter integrated circuit has come on the market. This is called the *switched-capacitor filter*, or SCF, and several types are available. Among the easiest to use is the National Semiconductor MF-10 SCF.[9] It costs about $3.00 and can be set up easily to perform any of the four filter operations. No external capacitors are needed, and only a few external resistors are used. There are two filter circuits in each MF-10 integrated circuit. Without going into the theory of operation, I'll just tell you that the cutoff frequency of the MF-10 filter chip is set by using an external clock. The clock frequency is selected to be either 100 or 50 times that of the cutoff frequency of the filter you are designing. The 100/50 ratio is preset at one pin on the MF-10 chip. Since this is just a logic-state input, it provides an easy way to change the

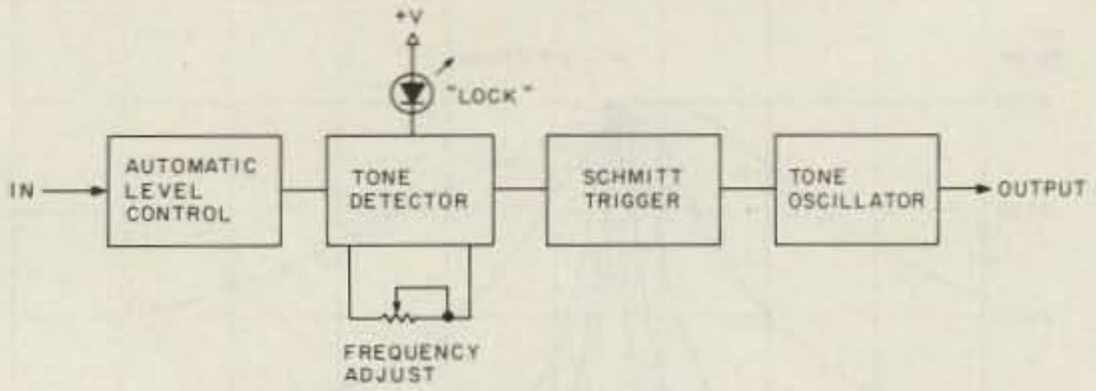

Fig. 3. Block diagram of a CW regenerator.

range of the filter. Either a CMOS- or a TTL-compatible clock signal may be used.

If you want to use the MF-10, you can set it up for a particular type of filter and vary the cutoff frequency of the filter by varying the clock frequency. One problem with all SCF circuits is that a small amount of clock signal is superimposed on the audio signal being filtered. However, since the clock frequency is so much higher than the audio signal, one, you won't be able to hear it, and two, it's easy to put a simple RC low-pass filter in the final audio output circuit to remove most of it. A typical fourth-order, 1-kHz low-pass filter is shown in Fig. 4.

In this circuit, both filter circuits in the SCF chip (each of which is a second-order filter) have been used in series. Using a common clock frequency for all of the filter stages lets you easily change the center frequency of the filters, and they all track one another without significant errors. Additional information about the MF-10 is found in the 12-page data sheet for this device.

Two other SCF devices are the Motorola MC145414 dual tunable low-pass filter and the MC145433 notch filter.[10,11] These devices were designed for use primarily in data communications equipment and modems, but they can be adapted for amateur use. They are a bit expensive, in the $10 to $20 range.

The Reticon R5620

I have found that the most interesting SCF is the R5620, manufactured by EG & G Reticon and available for about $7.50. This filter has built-in high-pass, bandpass, notch, and low-pass operations, and no external filter components are needed. All of the filtering is done on the chip with built-in circuitry. The EG & G Reticon Company manufactures linear photodetector arrays

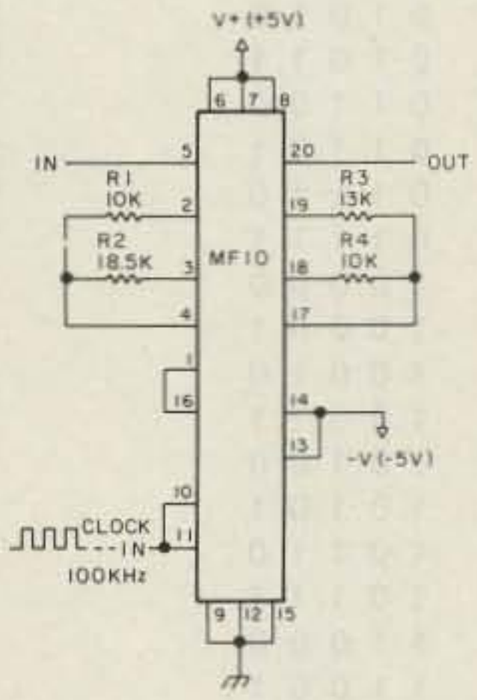

Fig. 4. Using an MF-10 filter chip for a 1000-Hz, fourth-order, low-pass filter.

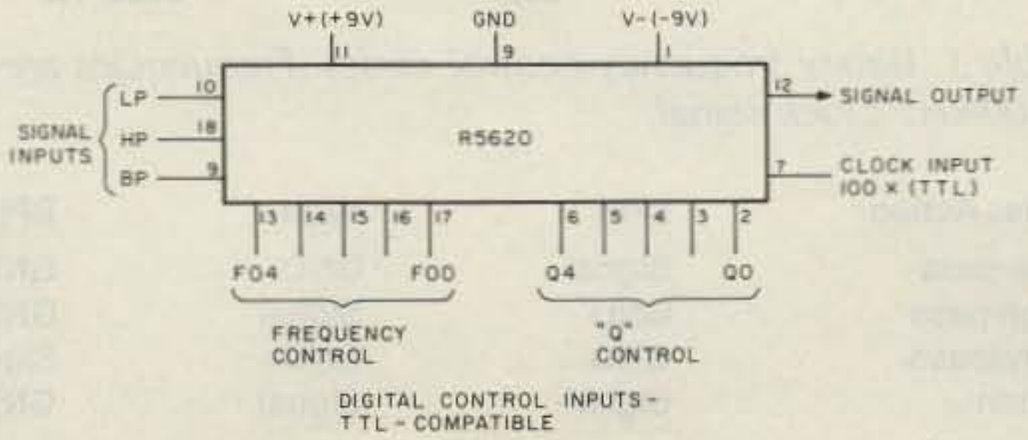

Fig. 5. Pin configuration of the Reticon R5620 SCF chip.

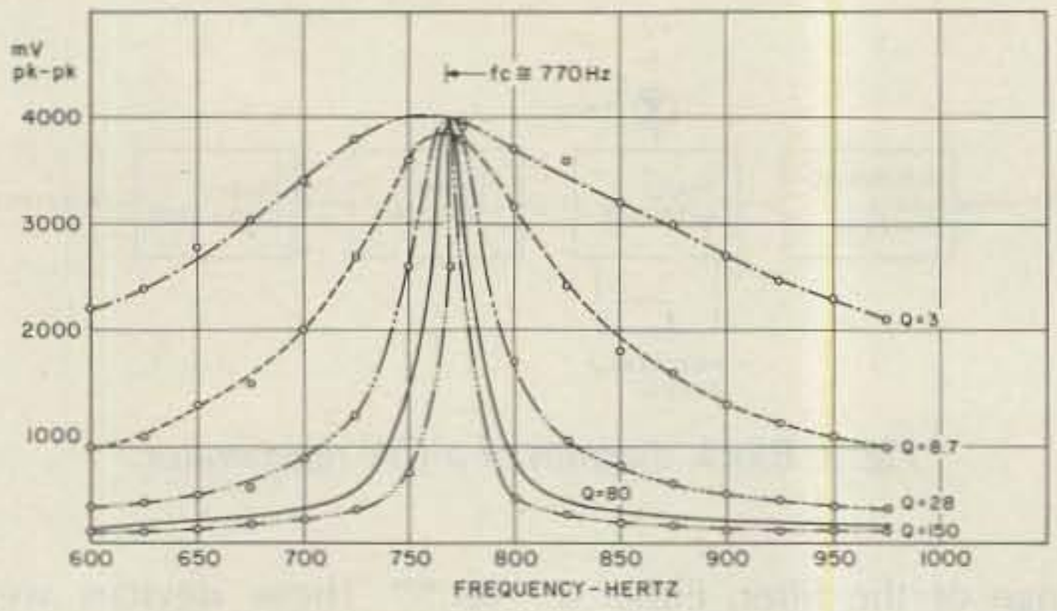

Fig. 6. Response curves for the Reticon R5620 used as a bandpass filter.

and x-y photodetector arrays that are used in solid-state TV cameras. They also produce very complex and expensive filter devices for special signal-processing applications.

In a filter circuit that uses the R5620, the cutoff frequency and its Q are independently set by providing five binary (logic 1, logic 0) inputs for each function. This means that there are 32 independent settings for each one. Any one of the four filter actions can be selected. Except for a few resistors on signal inputs, no other external components are required. A pin configuration diagram of this chip is shown in Fig. 5. This chip uses a split +9-volt power supply and an external clock signal. The clock signal can be TTL-compatible, but it is also easy to build a clock circuit that will run from the +9-volt power supply.

The center frequency of the R5620 filter can be changed by changing the clock frequency or by changing a 5-bit binary code applied as logic levels to five pins on the R5620 chip. It is this set of digital inputs that gives the R5620 a great deal of flexibility. The five digital inputs are labled FO4–FO0 and they are shown in Table 1. The clock rate is listed as the ratio of the cutoff frequency to the clock frequency. The control inputs are simply provided as a 5-bit straight-binary code. Let's look at an example. We'll assume that a 100-kHz clock signal is used and that the ratio of 102.3 has been chosen by setting FO4–FO0 to 01111. The filter's cutoff frequency is 978 Hz.

If the 100-kHz clock signal is used, the filter's cutoff frequency can be varied from 500 Hz to 2 kHz by varying the 5-bit binary code on frequency-control lines FO0–FO4 between 00000 and 11111. The 32 frequency steps are logarithmic, which simply means that the frequency ratios are fairly even, about 4 to 5% per step.

The alternate approach is to preset the 5-bit frequency code for the R5620 at about its mid-frequency setting (10000) and then vary the frequency of the clock signal controlling the filter. Without careful clock-circuit design, this can present problems. Many home-brew clock circuits spread out the low frequencies on one side of the frequency-controlling potentiometer, but high frequencies are "scrunched" at the other side. Using a fixed clock frequency and changing the 5-bit control input seems the better method of frequency control.

The Q of the filter also can be varied by using the five digital inputs labeled Q4–Q0. As shown in Table 2, the Q can be varied from 0.57 to 150. That's right, 150! Of course, you're not going to get much useful information through a bandpass filter with this high a Q, but in between 150 and 0.57 there is a lot of useful filter power. Typical bandpass response curves are shown in Figure 6.

The R5620 has three signal inputs, LPin, HPin, and BPin, and by connecting the audio signal to be filtered to one of these, the appropri-

Frequency Binary Code FO4 . . . FO0	Clock Frequency / Cutoff Frequency	Cutoff Frequency for 100-kHz Clock
0 0 0 0 0	200.0	500 Hz
0 0 0 0 1	191.3	523
0 0 0 1 0	182.9	547
0 0 0 1 1	174.9	572
0 0 1 0 0	167.2	598
0 0 1 0 1	159.9	625
0 0 1 1 0	152.9	654
0 0 1 1 1	146.2	684
0 1 0 0 0	139.8	715
0 1 0 0 1	133.7	748
0 1 0 1 0	127.9	782
0 1 0 1 1	122.3	818
0 1 1 0 0	116.9	855
0 1 1 0 1	111.8	894
0 1 1 1 0	106.9	935
0 1 1 1 1	102.3	978
1 0 0 0 0	97.8	1022
1 0 0 0 1	93.5	1070
1 0 0 1 0	89.4	1118
1 0 0 1 1	85.5	1169
1 0 1 0 0	81.8	1222
1 0 1 0 1	78.2	1279
1 0 1 1 0	74.8	1337
1 0 1 1 1	71.5	1399
1 1 0 0 0	68.4	1462
1 1 0 0 1	65.4	1529
1 1 0 1 0	62.5	1600
1 1 0 1 1	59.8	1672
1 1 1 0 0	57.2	1748
1 1 1 0 1	54.8	1825
1 1 1 1 0	52.3	1912
1 1 1 1 1	50.0	2000 Hz

Table 1. Binary frequency-control codes. Frequencies are for a 100-kHz clock signal.

Q Binary Code Q4 . . . Q0	Q
0 0 0 0 0	0.57
0 0 0 0 1	0.65
0 0 0 1 0	0.71
0 0 0 1 1	0.79
0 0 1 0 0	0.87
0 0 1 0 1	0.95
0 0 1 1 0	1.05
0 0 1 1 1	1.20
0 1 0 0 0	1.35
0 1 0 0 1	1.65
0 1 0 1 0	1.95
0 1 0 1 1	2.20
0 1 1 0 0	2.50
0 1 1 0 1	3.00
0 1 1 1 0	3.50
0 1 1 1 1	4.25
1 0 0 0 0	5.00
1 0 0 0 1	5.80
1 0 0 1 0	7.20
1 0 0 1 1	8.70
1 0 1 0 0	10.0
1 0 1 0 1	11.5
1 0 1 1 0	13.0
1 0 1 1 1	15.0
1 1 0 0 0	17.5
1 1 0 0 1	19.0
1 1 0 1 0	23.0
1 1 0 1 1	28.0
1 1 1 0 0	35.0
1 1 1 0 1	40.0
1 1 1 1 0	80.0
1 1 1 1 1	150

Table 2. Binary Q-control codes.

Filter Action	LPin	HPin	BPin
Low-pass	Signal	GND	GND
High-pass	GND	Signal	GND
Bandpass	GND	GND	Signal
Notch	Signal	Signal	GND

Table 3. Signal input connections for different filter actions.

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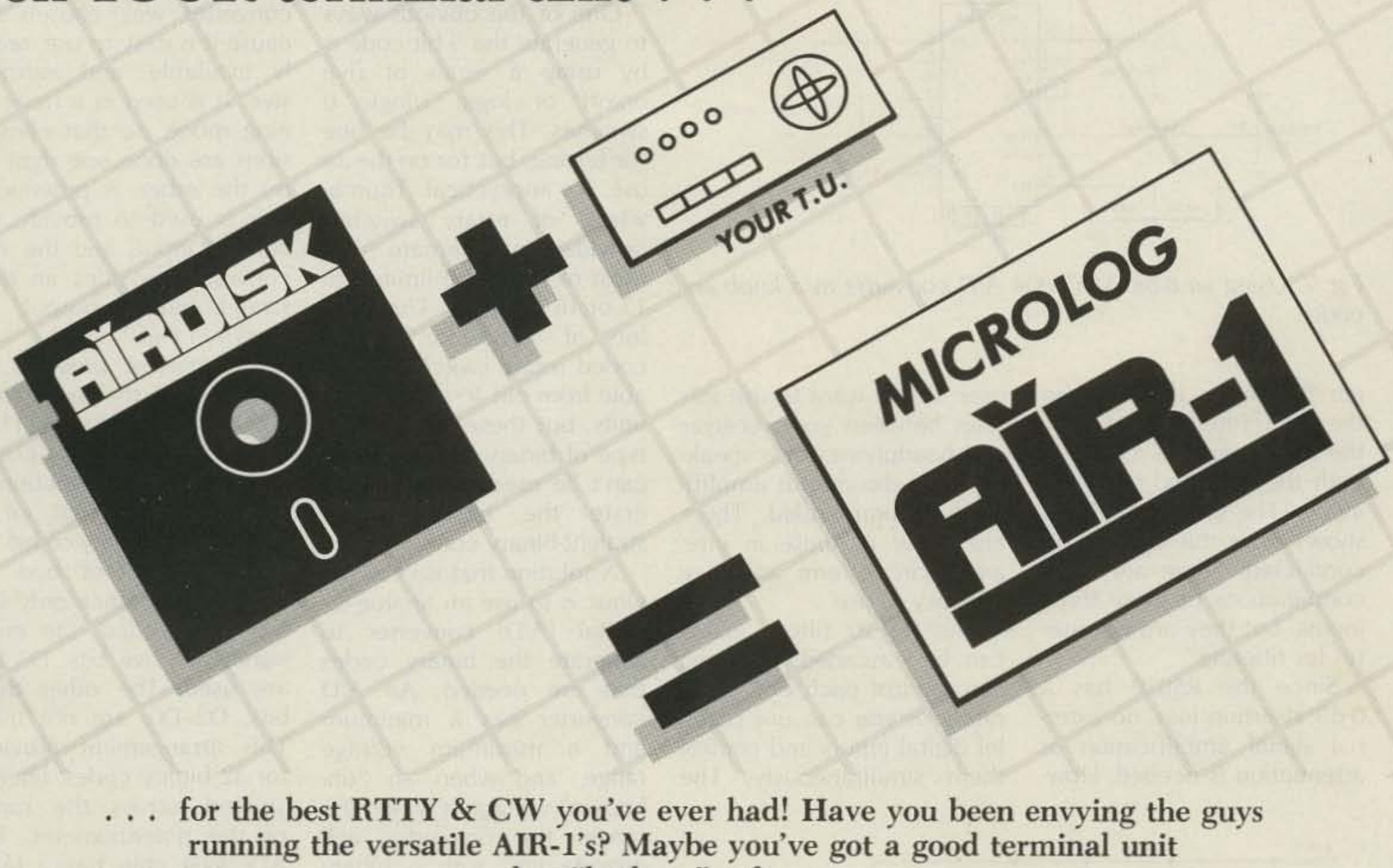

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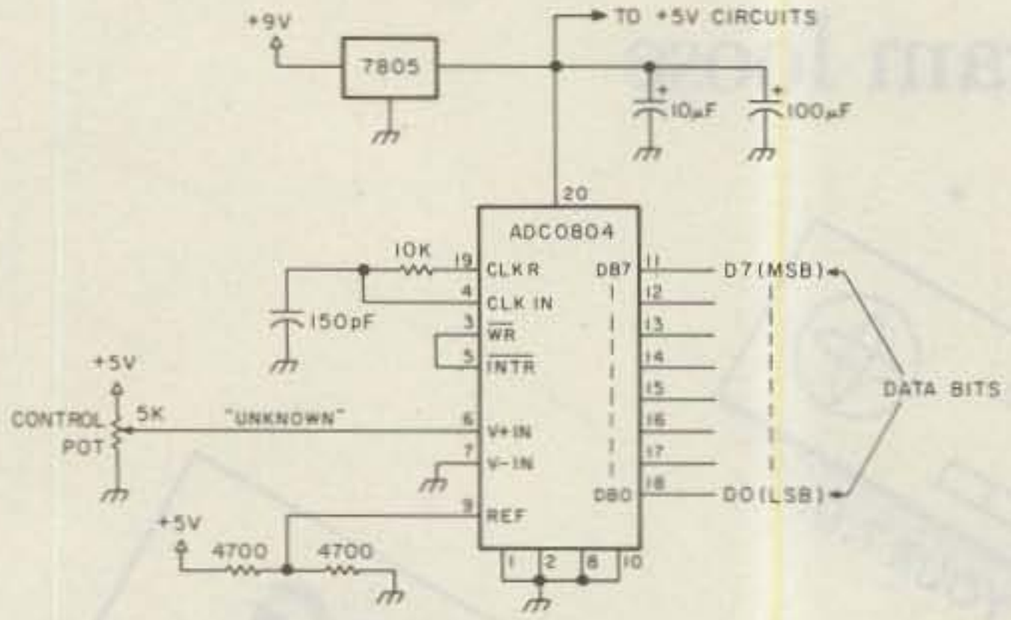

Fig. 7. Using an 8-bit ADC0804 A/D converter as a knob encoder.

ate filtering is done. When the notch filter is to be used, the audio signal is routed to both the LPin and the HPin inputs. The chart in Table 3 shows how the signals are connected. There are other combinations of these three inputs, but they are not useful for filtering.

Since the R5620 has a 0-dB insertion loss, no external signal amplification or attenuation is needed. However, if you want to use this filter between your receiver and headphones or a speaker, an audio output amplifier is recommended. There are many of these in integrated-circuit form, and they are easy to use.

The R5620 filter circuits can be cascaded, and you can control each one separately or you can use parallel digital inputs and control them simultaneously. The

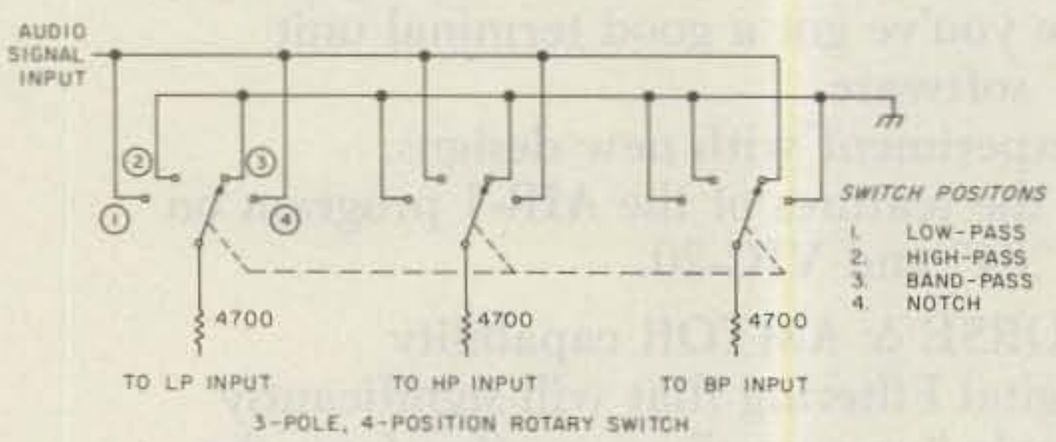

Fig. 8. Schematic diagram of the filter control switch.

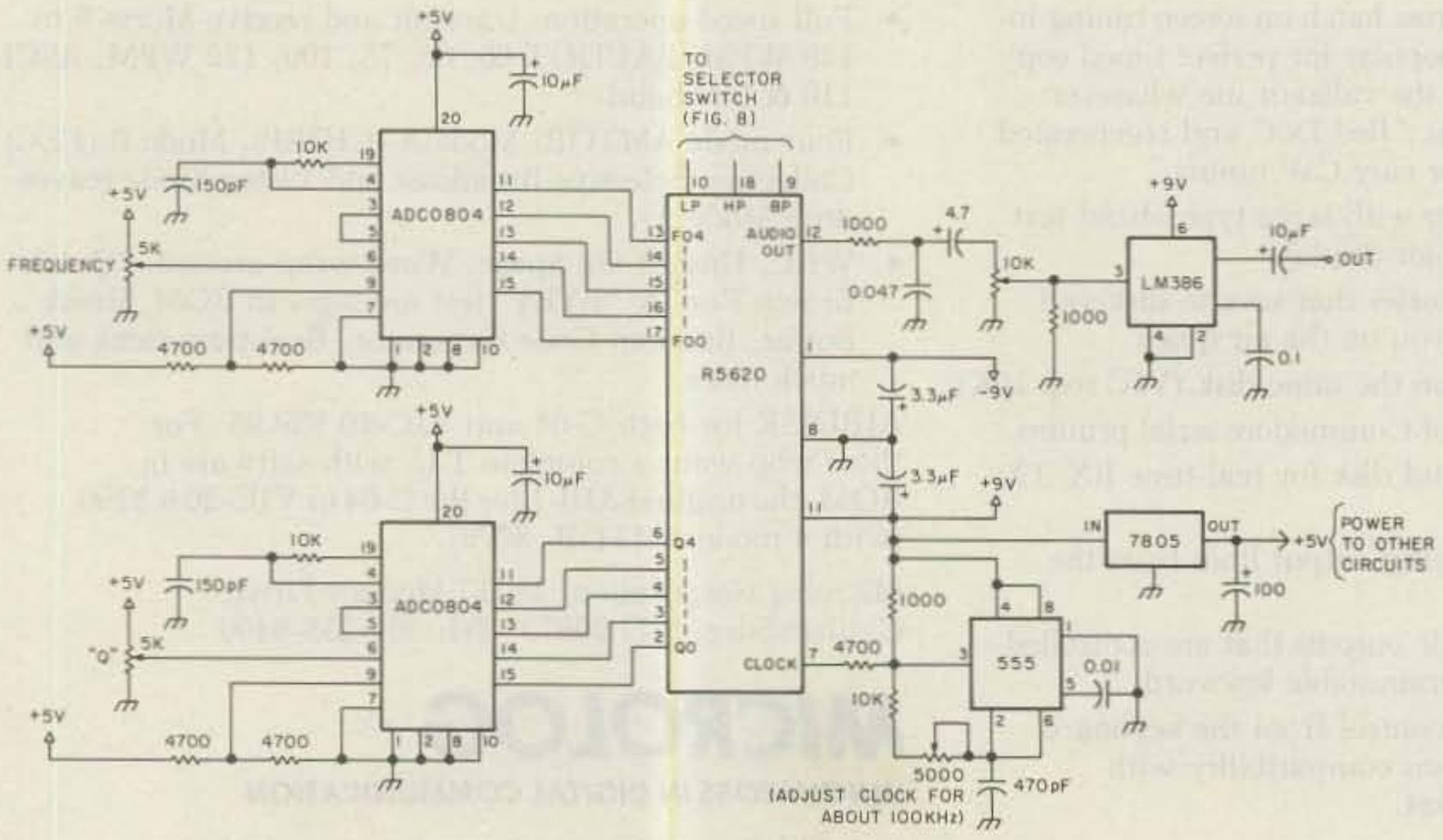

Fig. 9. Schematic diagram of the complete filter circuit.

next question is how to get a 5-bit binary code.

Digital Filter Control

One of the obvious ways to generate the 5-bit code is by using a series of five on/off or logic 1/logic 0 switches. This may be fine for testing, but for on-the-air use, it's impractical. Thumbwheel or rotary switches provide an alternate, but most of these are limited to 12 or 16 positions. There are lots of 40-position binary-coded rotary switches available from old 40-channel CB units, but these use an odd type of binary code, so they can't be used easily to generate the required 5-bit straight-binary code.

A solution that isn't as obvious is to use an analog-to-digital (A/D) converter to generate the binary codes that are needed. An A/D converter has a minimum and a maximum voltage range, and when an "unknown" voltage is within the range, the converter will provide you with a binary code that represents the unknown voltage. Thus, for an 8-bit converter, the range of measurable voltages might be between 0 and 5 volts, with the binary outputs being 00000000 up to 11111111. Computers and other digital devices use A/D converters to measure unknown voltages.

The National Semiconductor ADC0804 8-bit A/D converter was chosen because it is easy to use, readily available, and inexpensive. It is used in a free-running mode, so that conversions are done one right after the other. A potentiometer is used to provide the voltage input, and the A/D converter provides an 8-bit straight-binary output, as shown in Fig. 7.

This circuit provides an 8-bit output that goes from 00000000 up to 11111111, from one side of the pot to the other. The function is the same as that of a 256-position binary-coded rotary switch. Not bad for about $4.00. Since only five bits are needed, the most-significant five bits, D7–D3, are used. The other three bits, D2–D0, are not used. This arrangement provides for 32 binary codes, linearly spaced across the range of the potentiometer. The ADC0804 chip has a fairly low input impedance, so a low-value potentiometer must be used to provide the unknown voltage that is to be converted into a binary code.

A rotary switch with four positions and three poles is used to route the input audio signal to the correct inputs for the four filter actions. This is shown in Fig. 8.

A complete filter circuit is shown in Fig. 9. You can cascade as many of these stages as you want to and put them together in various combinations. For example, you might have two filters in series. Both could be set up for low-pass operation, providing a fourth-order low-pass filter. Or you could set one for low-pass operation and the other for notch operation. Of course, the audio output amplifier is only needed at the end of the filter chain.

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versatile filter, particularly since all of the basic filter operations are available on one chip. Since the cutoff frequency and the Q can be varied, this type of filter is useful for SSB, CW, and RTTY operations.

For example, if you are using a Bell-202-compatible modem, you'll be using tones of 1200 and 2200 Hz. You can build a switched-capacitor filter for each frequency, deriving the clock signal from one common crystal. The frequency would be 1200 × 2200, or 2.640 MHz. Since the filter's clock frequency must be 100 times the center frequency of the signal being filtered, dividing the 2.640-MHz clock by 22 and by 12 gives the proper clock signals for the two filters: 120 kHz and 220 kHz, respectively.

In this application, bandpass filters would be used and the cutoff frequency controls would be preset. The Q of both filters could be set in parallel by a single control or each could be set separately.

A filter-and-monostable RTTY demodulator is described in the 1982 edition of *The Radio Amateur's Handbook*,[12] and several SCF circuits could be used in place of the op-amp-based active filters. Using SCF circuits allows the filter characteristics and frequencies to be easily changed.

Switched-capacitor filters provide an alternative to op-amp-based filters in many ham-radio applications. They are not much more expensive than the classic circuits, particularly when you consider their flexibility and the ease of designing circuits around them. I think you'll see more amateurs using SCF chips and coming up with new applications for them. ■

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In my January, 1983, *73* article, the question was, "Can you really see which way the wind is blowing with optoelectronics?" Now, I ask, can you really see *how fast* the wind is blowing?

The answer to both questions is, of course, yes. We will use the GE H13A1/H21A1 interrupter module to tell us wind velocity—how fast the wind is blowing.

Perhaps I should reiterate at this time that the GE number for the H13A1 interrupter module has been changed from H13A1 to H21A1. The modules are interchangeable. So from here on, I will refer to it as the H21A1.

General Circuit Description

This circuit uses very few electronic components. A good portion of the work involved in building the anemometer head is the mechanical end of it. But more about that later. The electronic components consist of an H21A1 and a 2N3904 transistor line driver up in the head of the anemometer. Down in the shack there is an LED that blinks when the wind is blowing (I am not quite sure why I put that in there—I guess I just like whistles, lights, and bells). There are twelve in-

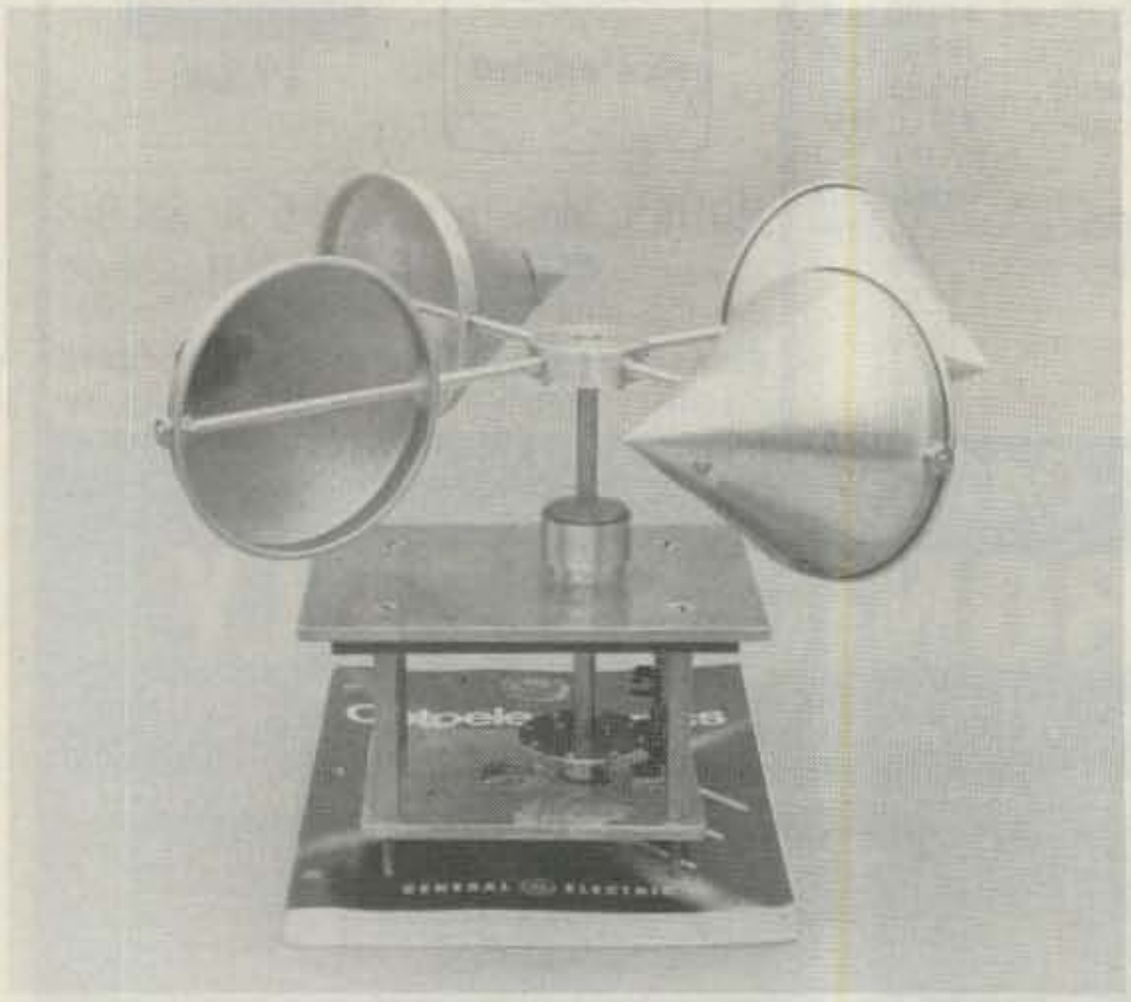

Photo A. Anemometer head with weather cover removed.

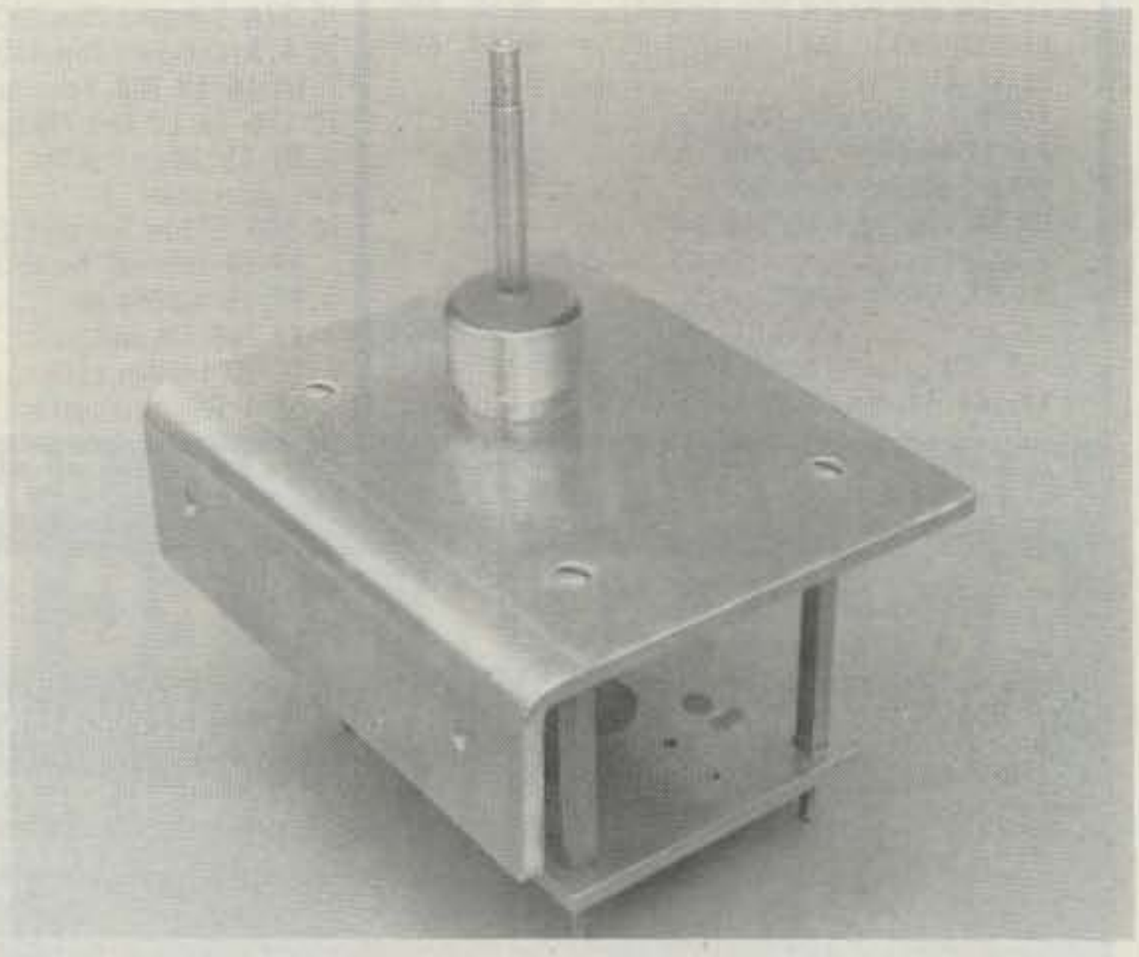

Photo B. Anemometer head with cups removed showing top bearing seal and side mounting surface.

Mph	mA	Pps	Rpm
5	.17	7.2	54
10	.33	14.3	107
15	.50	21.5	161
20	.67	28.7	215
25	.83	35.8	269
30	1.0	43.0	322
	High Scale		
15	.17	21.5	161
30	.33	43.0	322
45	.50	64.5	484
60	.67	86.0	645
75	.83	107.5	806
90	1.0	129.0	967

Table 1. Speed conversion chart.

verter gates in the two DIP packages, a few resistors and capacitors, a 3.6-volt power supply, and a 1-milliamp meter. Perhaps I should mention at this time that the meter and your calibration are the only two things that would limit the accuracy of the electronic circuit. The electronics are extremely linear, so it is important that you use a good meter, one with which you can redo the scale as we did—it's not hard. More on that later, too.

The MC789P or ECG9989 RTL inverters are part of an old family of ICs, but they are still readily available at an inexpensive $3.00 price. The most important reason we like this circuit is that it works without a hitch.

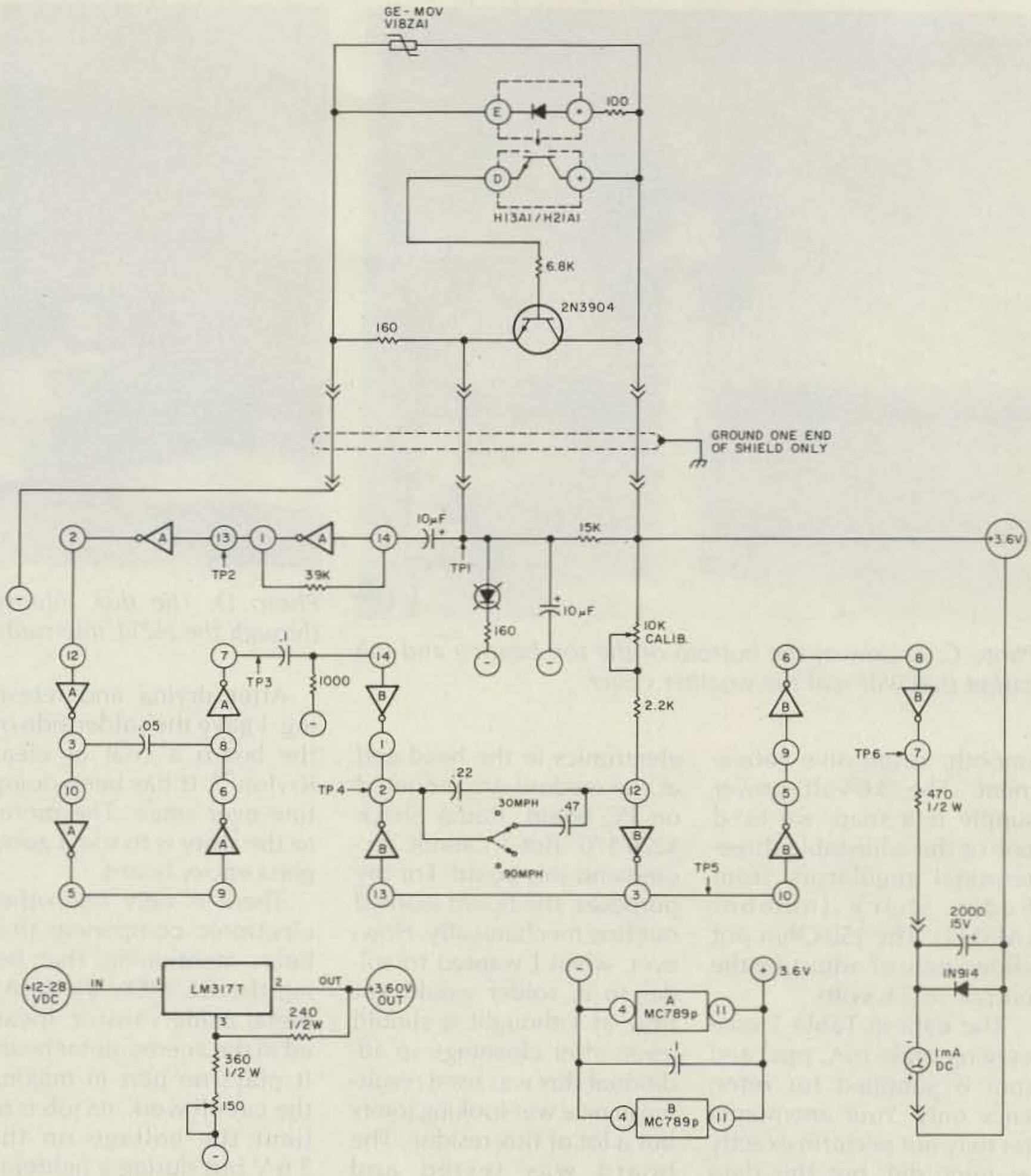

Fig. 1. Velocity meter circuit. All resistors ¼ W except as noted. All capacitors uF. Look on top of H13A1/H21A1 for correct pinout.

The trend toward digital readouts is usually an improvement over the old analog meter, but there are always exceptions to the rule and, in my opinion, wind speed is one of them. Unless, of course, you need a digital number to be used in an automated calculation, the old analog readout is a more comprehensive representation of what the wind is doing.

About the Circuit

From the schematic and the test-point waveforms in Fig. 2, the theory of the circuit will become apparent. A three-wire shielded cable is required to connect the anemometer head, up on the tower, to the readout in the shack. From there on it's just ones and zeros. Well, almost. The first entire IC package (6 gates) is used for shaping and compensating the input pulses. The second chip uses an RC network to generate a low for the exact period of time it takes to make the meter read correctly.

Switching-in the .47 μF capacitor affords you a full scale of 30 mph (a good scale for normal operation); during a storm, flipping the switch will give you 90 mph full scale. The 2000-μF capacitor across the output tailors the meter to a nice,

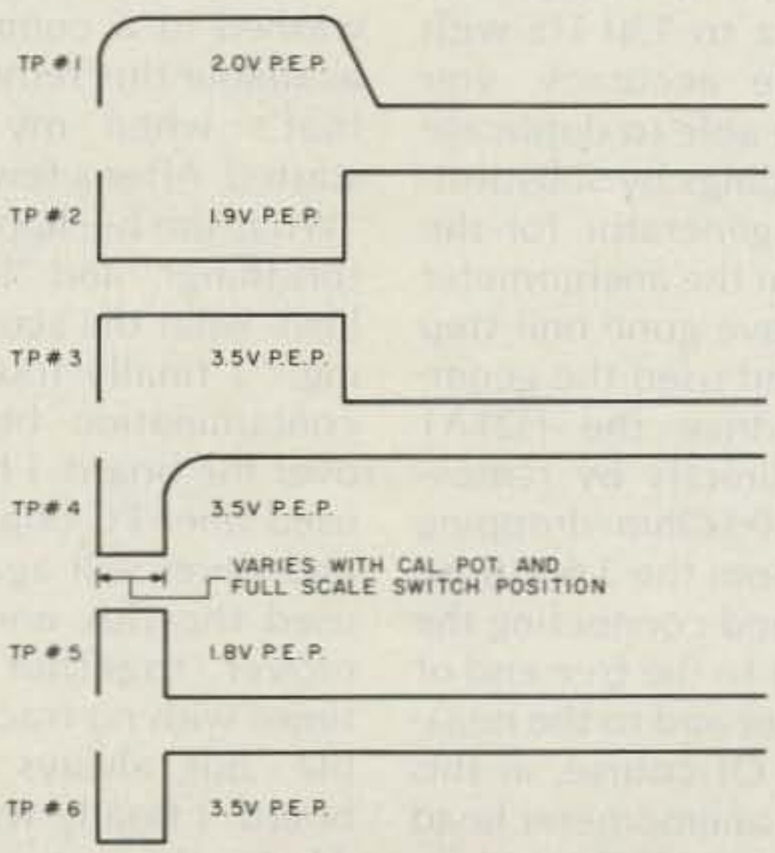

Fig. 2. Pulse trace. Waveforms taken with 43 Hz in, 2-ms sweep.

Photo C. A view of the bottom of the top bearing and the gasket that will seal the weather cover.

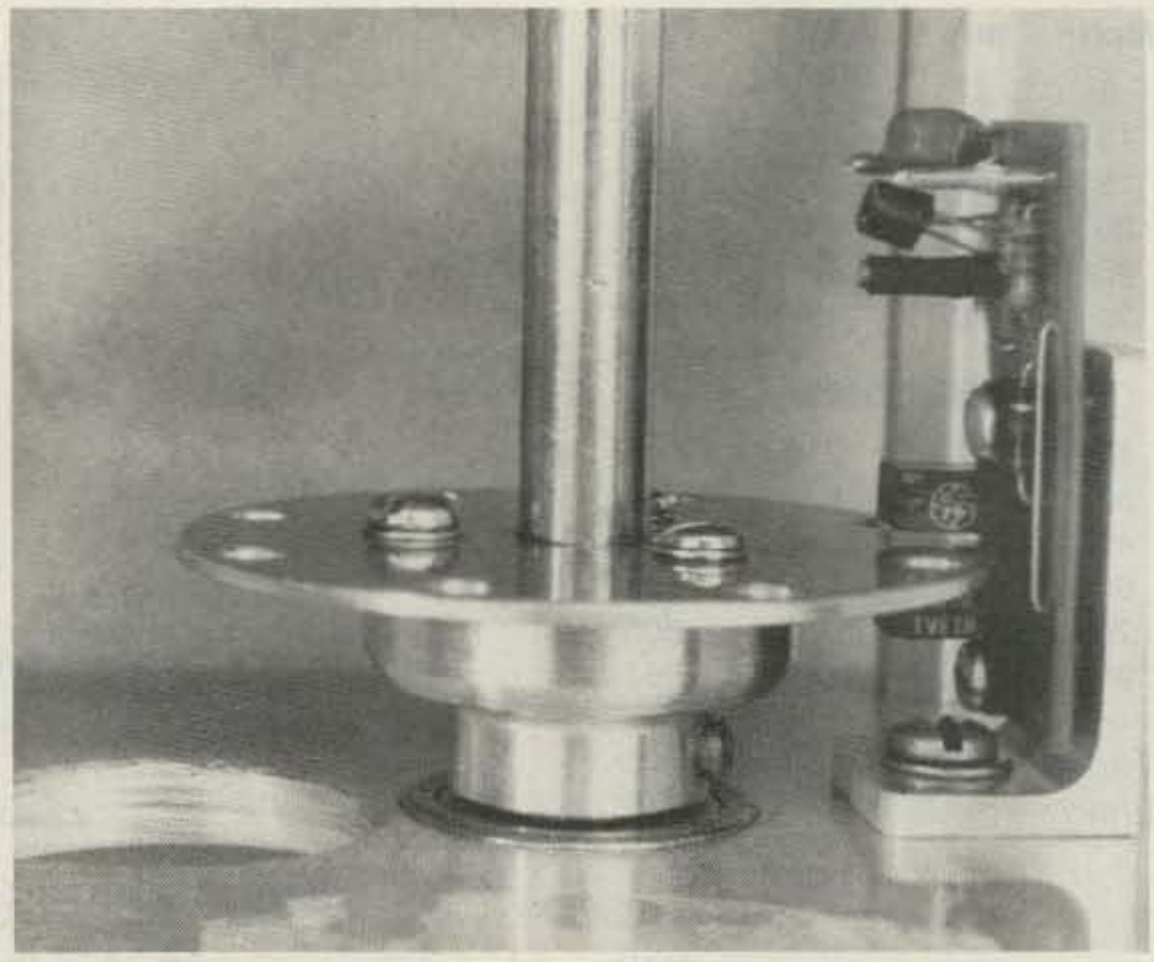

Photo D. The disk interrupter with its 8 holes running through the H211 interrupter module.

smooth, responsive movement. The 3.6-volt power supply is a snap; we used one of the adjustable three-terminal regulators from Radio Shack (number LM317T). The 150-Ohm pot allows ease of adjusting the output to 3.6 volts.

The data in Table 1 concerning mph, mA, pps, and rpm is supplied for reference only. Your anemometer may not perform exactly as mine did, but this data will give you a starting point.

If you have a signal or function generator with a 1.5- to 3-volt range and you can adjust its frequency from 7 Hz to 130 Hz with reasonable accuracy, you should be able to duplicate these readings by substituting your generator for the input from the anemometer head. I have gone one step further and used the generator to drive the H21A1 emitter directly by removing the 100-Ohm dropping resistor from the 3.6-V positive bus and connecting the generator to the free end of the resistor and to the negative bus. Of course, in this case, the anemometer head will remain connected to the readout board.

As seen in the photos, the electronics in the head and at the readout are mounted on PC board, Radio Shack #276-170. But I cannot recommend this board. For my purposes, the board worked out fine mechanically. However, when I wanted to solder to it, solder would not flow as I thought it should (even after cleaning), so additional flux was used resulting in nice wet-looking joints but a lot of flux residue. The board was tested and worked fine. By the way, the circuit was debugged and tested on a push-on breadboard before assembly on the Radio Shack board.

The board was then washed in a commercially available flux remover, and that's when my trouble started. After a few hours of "What the h— happened to this thing?" and "I can't believe what the scope is saying," I finally found I had contamination bridges all over the board. I had never used fiber PC board before and never will again. I had used the flux and flux remover together lots of times with no trace of trouble, but always on glass board. I finally washed the whole thing in detergent and water after trying some other solvents to no avail.

After drying and retesting, I gave the solder side of the board a coat of clear Krylon™. It has been doing fine ever since. The moral to the story is to use a good glass epoxy board.

There is only one other electronic component that bears mentioning, that being the GE MOV #V18ZA1 metal oxide varistor, located in the anemometer head. It plays no part in making the circuit work; its job is to limit the voltage on the 3.6-V bus during a lightning strike or other power-line spike. They have proven to me to be very effective in their job of over-voltage spike protection. If these units are sized correctly for the job, they will conduct during a spike and then restore to normal, over and over again. For their low price they sure can save you a bundle of trouble. So a word to the wise is sufficient: If you are not familiar with the MOV line, you may needlessly be jeopardizing some of those priceless gems in your shack.

The Mechanics

The model pictured in Photo A has 4" cups. They are bigger than they would have to be for just a wind-velocity meter. These cups were fabricated from 4" aluminum funnels. I cut the snouts off the ends of the funnels and bent very thin aluminum sheet metal into the shape of a cone to close the holes. Then I secured it to the funnels with aluminum pop rivets. I would suggest using aluminum soup ladles, approximately the two-inch size, for your cups. The rods are ¼" aluminum, threaded on one end to secure the cups, and they're approximately 2.25 times the diameter of the cups in length. The hub that mounts the rod to the shaft was machined from a solid piece of aluminum round stock 2" × ¾" thick. Holes were drilled and tapped for set screws to secure the rods and shaft. If soup ladles were used I am sure some bolting or clamping arrangement could be devised to secure the ladle handles to the shaft. This would eliminate the need for a machined hub, if the machine work is a problem. I would also recommend using a ⅜" shaft instead of a ¼" shaft.

Photo B is a view of the anemometer with the cup assembly removed to get a better look at the top bearing seal and the side mounting surface. The top bearing seal is exactly as described in the previous article ex-

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cept it is epoxied to the shaft instead of clamped with a set screw. The mounting surface would depend on what you are going to mount it on. We mounted the wind-velocity and directions heads on a piece of 2"×2" box aluminum approximately 5' long and bolted it to the tower. There will be some wind load so whatever you mount it on must be good and stiff.

Photo C is a view looking up under the top plate to show that the bearings in this unit were pressed into the ¼" top plate and bottom plate rather than using bearing blocks as described for the wind-direction model. I prefer the bearing block method because of ease of precision alignment. Also shown in Photo C is the cork gasket used for sealing the five-sided weather cover.

Photo D is a look at the disc interrupter running through the H21A1 with its associated electronic components such as the 2N3904 line driver, the V18ZA1 MOV, etc. The disk interrupter is nothing more than a 2½"-round by ⅛"-thick aluminum disc with eight evenly spaced ¼" holes in it. It is secured to the shaft by a machined collar. It also serves as the bottom shaft stop, which rides on top of the bottom bearing. Collars such as those pictured in Photo C can be purchased for approximately $1.00 at any machinery house, and the interrupter disc could be epoxied to it instead of a machined collar.

The PC board is mounted on a piece of aluminum angle with insulating standoff washers (such as are used in mounting transistors to heat sinks). The hole in the bottom plate that the angle mounting screw goes through is oversized to facilitate alignment. The same method used in the wind-direction indicator for getting wires off the board and down to the shack is used here. There are two male pins near the top of the board and one female pin covered with shrink tubing below. Another method would be to run the three wires of the board to a barrier strip as pictured in Photo F, but with only three lugs of course.

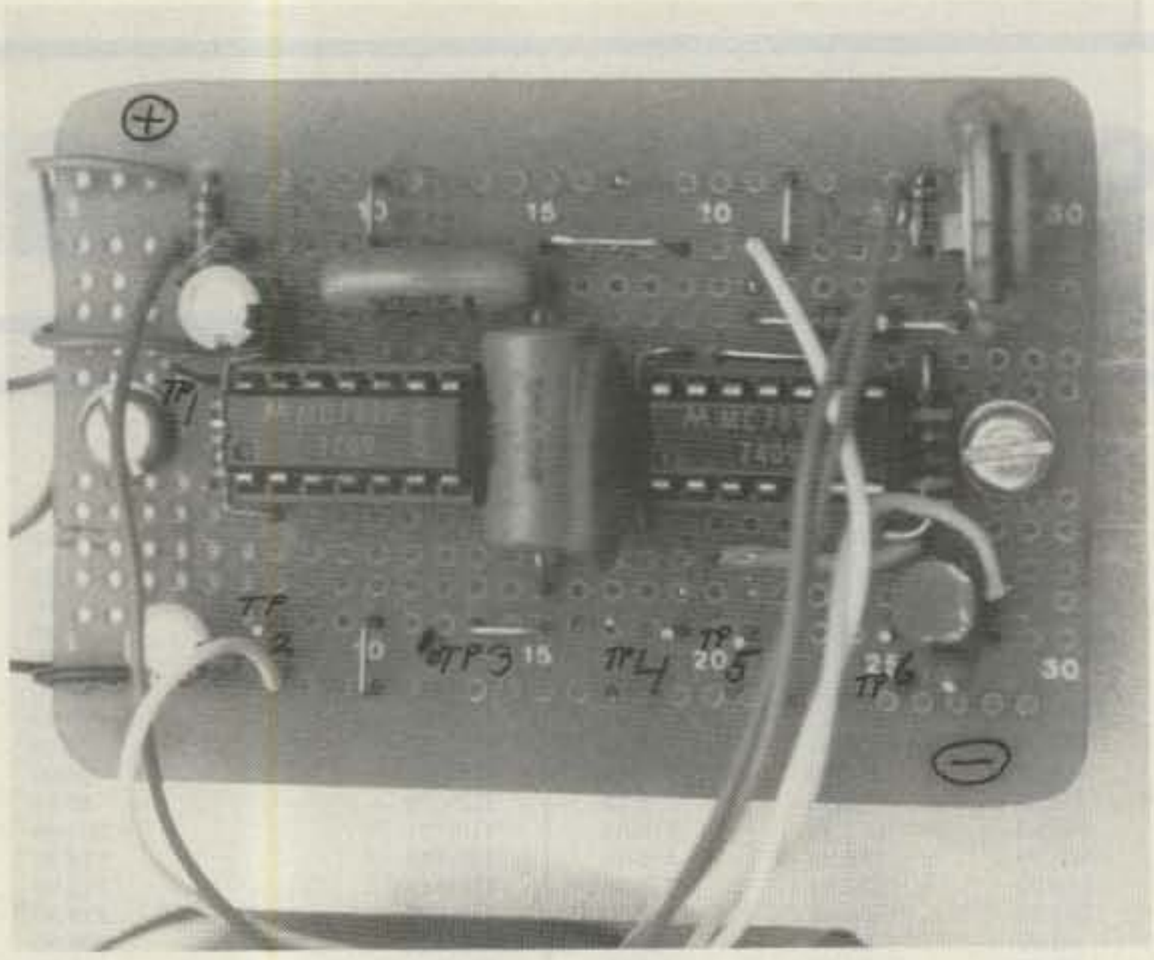


Photo E. The circuit board that drives the readout meter. Note test points.

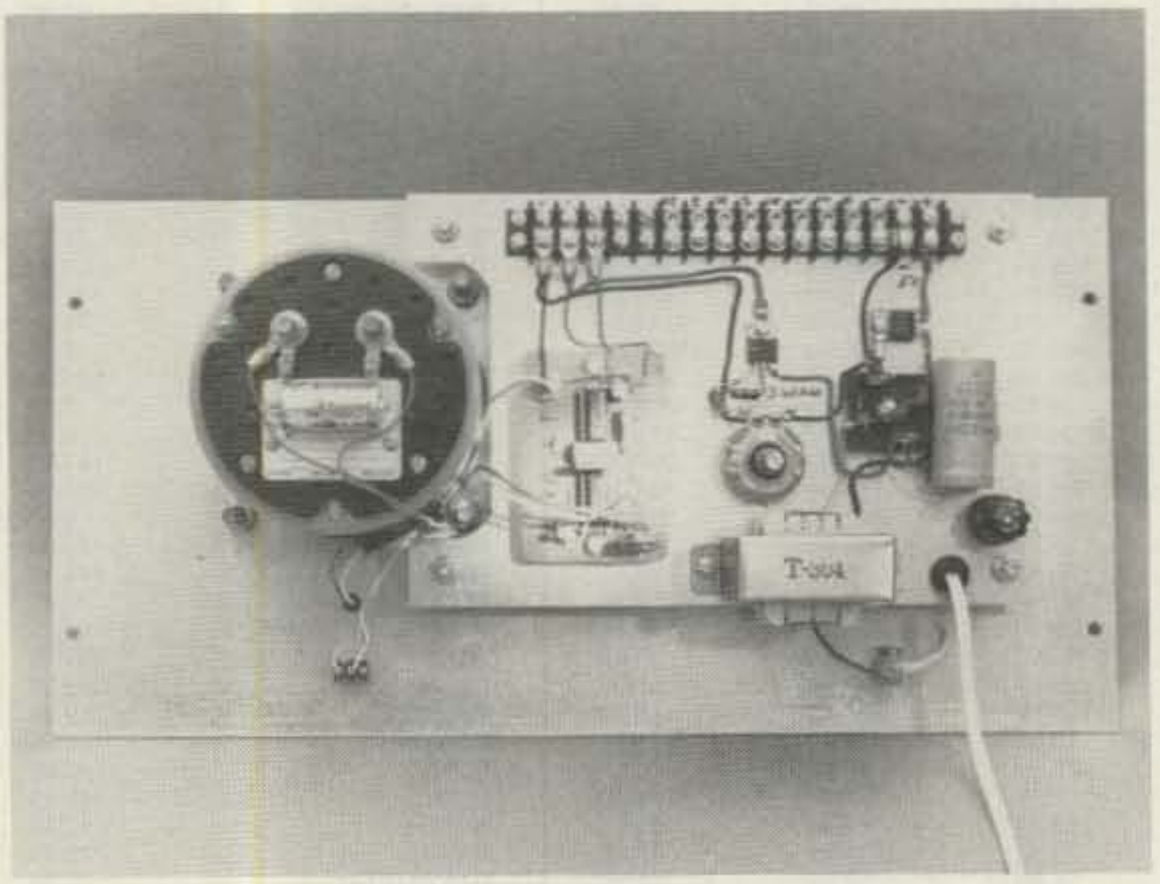


Photo F. Rear of readout panel.

Photo E is the electronics board at the readout. Layout of this board is not critical. (Where have I heard that before?) The vertical trimpot at the right-hand corner is the calibration pot. It's the only electronic adjustment in the whole circuit except for the power-supply voltage.

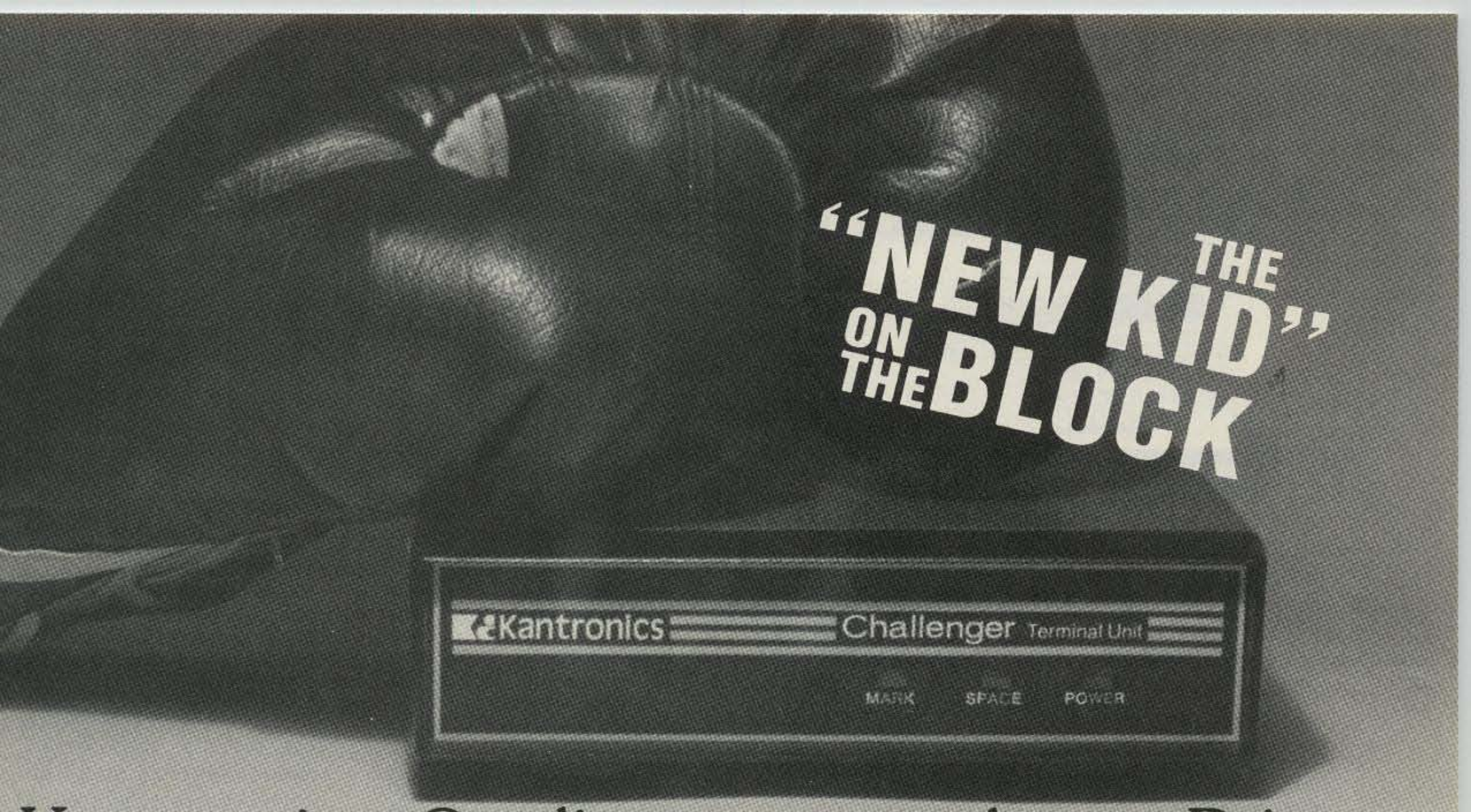
Photo F is a view of the back of the readout panel. This panel as seen in Photo G is used for wind direction and velocity with some spare room for future generator control. On the left is the velocity meter with the 2000-μF capacitor across its terminals. Under the meter are the range switch and blinking LED. On top is the barrier strip on which all the wires terminate that go to the two heads up on the tower. Next are the electronics board as pictured in Photo E, the 3.6-V regulator and adjusting pot, and the 5-V regulator for the wind direction electronics. Below are the rectifier bridge, filter·capacitor, power transformer, line fuse, and on-off switch.

Photo G is of course a front view of the readout panel. Perhaps now is as good a time as any to talk about the meter scale. As I mentioned before, this scale was hand calibrated, reincremented, and numbered. For those of you who have never tried that sort of thing, let me tell you, it's not as hard as you might think. However, you must start with a one-milliamp meter that you can separate without destroying. We will get into calibration shortly.

Take the meter apart and very carefully remove the face. You will find the bigger and better meters are easier to work with. Then spray the face with a flat white spray can until all traces of the old markings are no longer visible except 0 and full scale. When dry, give it a coat or two of clear Krylon. Now new increments and numbers can be put back on with comparative ease. Use a fine felt-tip black indelible pen, such as used to mark clothing, for the increments. They must all point to the pointer shaft. The meter in Photo G has a 4" face and I used ¼" vinyl stick-on numbers. You can also use roll-on numbers but in my opinion, they are harder to work with. The pen and the numbers can be purchased at any stationery store.

Calibration

I am sorry to say I have no sure-fire method for you to follow. But I can tell you how I set mine, and it duplicates the reading of a commercial unit not far away. After looking high and low for a calibrated wind tunnel with an aperture big enough to get this thing in, I finally gave up and decided I must come up with some other method. The only way I could think of to calibrate



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the meter was with my Jeep. It has a roof carrier on top so it would be no problem to mount the anemometer head on it and just calibrate my new gadget by driving down the road using the speedometer for my reference.

But how accurate is the speedometer? After beating the bush a little more, we found an automotive shop that was set up to certify auto speedometers for police departments, and after telling the fellow what I wanted, he agreed to test my speedometer for a nominal fee. He would make no corrections but would give me a graph showing what my speedometer indicated and what the true speed was. Well, that sounded good to me. It turned out that my speedometer was flat up to 70 mph. I am told it is not unusual for an auto speedometer to be a fairly accurate device if the car has the original size tires and they are not worn too badly.

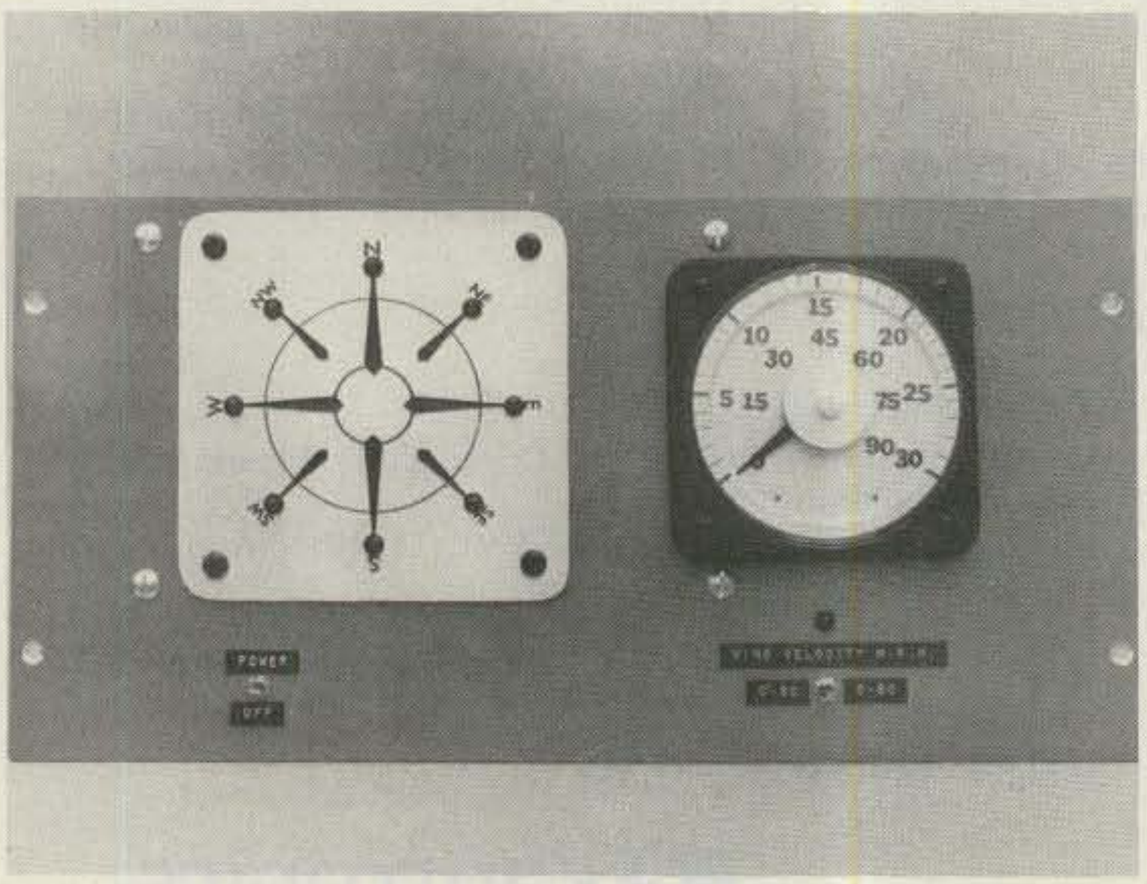

Photo G. Face of readout panel.

I got everything ready, brought a few pieces of wood to help mount the head to the roof carrier, and installed the weather seal cover, etc. As soon as a nice zero wind day came along, we would be ready to go. The day finally came, with my son Mike at the wheel and me in the back seat with all the goodies: a counter, DVM, the readout panel, and a 12-volt battery which, by the way, is how we powered the input of the 3.6-volt regulator during our mobile test. After hitting the open road, calibration went very well. I had already established, with the function generator described before, that the electronics were sound. But we had some apprehension about the cups being nonlinear at the very low end and the very high end. But even with the over-sized cups used in this model, linearity did not display itself as a problem. The calibration pot was set at exactly 30 miles per hour to indicate 1 milliamp on the meter (with the range switch set to the zero- to thirty-miles-per-hour position). At this speed, the counter indicated 43.0 pulses per second. With a few more tests and a little help from the calculator, we calculated how many pps we should get every five miles an hour from 5 mph to as fast as we could go.

Surprisingly, everything held out very well. However, we still had some doubts about the top end of the 0-90-mph range, so I said to Mike, "Let's make one more high-speed run and then head for home." Well, let me tell you everything was looking good. We came up through 30 mph, 45 mph, and 60 mph, and I was thinking to myself that if we could only hold 75 mph for a few miles I would be satisfied that we had made a valid test. I heard Mike say "uh oh," simultaneous with what I recognized immediately as the wail of an electronic arm-of-the-law-type siren.

I think the cups on top were still turning as that big dude walked over to the Jeep. He did not want to believe that thing on top was not some new device designed to foul up his radar. Nor did he stop writing when I mentioned that maybe Wayne Green would hear about this. So, like I said before, I wish I could tell you a better way to calibrate this thing.

The test data in Table 1 was obtained from the aforementioned test, so it was possible now to go back to the bench and use the function generator to reincrement the meter.

If you don't have a generator, you can mark the face of the meter at the 5-, 10-, 15-, 20-, 25-, and 30-mph points with a pencil while you are doing your calibration run and then ink them in later.

After reincrementing and numbering the face, it was given an additional coat of clear Krylon, reassembled, and retested. The whole system has worked fine ever since.

May I take this opportunity to thank my wife, Ann, for her help and support while getting this article together. And, of course, my son Mike who got the ticket. ■

References

Optoelectronics, General Electric Company.

Transient Voltage Suppression Manual, Second Edition, General Electric Company.

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Rampant RTTY

Create the ultimate mailbox! KØWVN describes a system that operates from 45 to 1200 baud with dual shifts—automatically!

A ROM-116 RTTY mailbox system is a good tool for local amateurs to keep in touch with each other on VHF and UHF frequencies. It can also be used in disaster-type operations as temporary storage for messages.

I witnessed a great need for this sort of system when I happened to be listening to a bunch of VHF phone traffic after a small tornado hit a portion of Topeka. There was so much delay caused by hand copying and repeating of information that I felt sorry for the operators. A RTTY mailbox system would have been the answer to their communication problem; just a plain RTTY system with a printer would have done the trick.

Later, after the operation was completed, the local club did invest in RTTY communications for both the mobile unit and the base station. I am sure that the system will speed up this sort of traffic handling and improve accuracy. When the traffic is coming in from all directions, it is nice for a RTTY system to remember what was said and be able to print it out when you want it.

Flesher Corporation is now the sole distributor of the ROM-116 and is now responsible for its future. This interface has proven to be one of the most dependable systems ever made to interface with the Radio Shack TRS-80 (Models I, III, and 4). The author of the ROM-116 software, Craig Larsen WA7HTN, and his partner, Gary Martin W7XT, spent a great deal of time creating a system that would satisfy even the most picky operator (such as myself).

Crown Microproducts (located in Marysville WA) was made up of these two dedicated hams, and between the two of them, they created their primary product, the ROM-116. I know that Craig had spent a great deal of time on the standard operating software and was in no mood to tackle another project. His time spent creating the software probably did not return him fifty cents an hour, which sours many a programmer from creating hobby software to begin with.

After so many hours of Craig's time in writing the standard RTTY/CW software, it was a struggle for the ROM-116 users to talk him into writing another

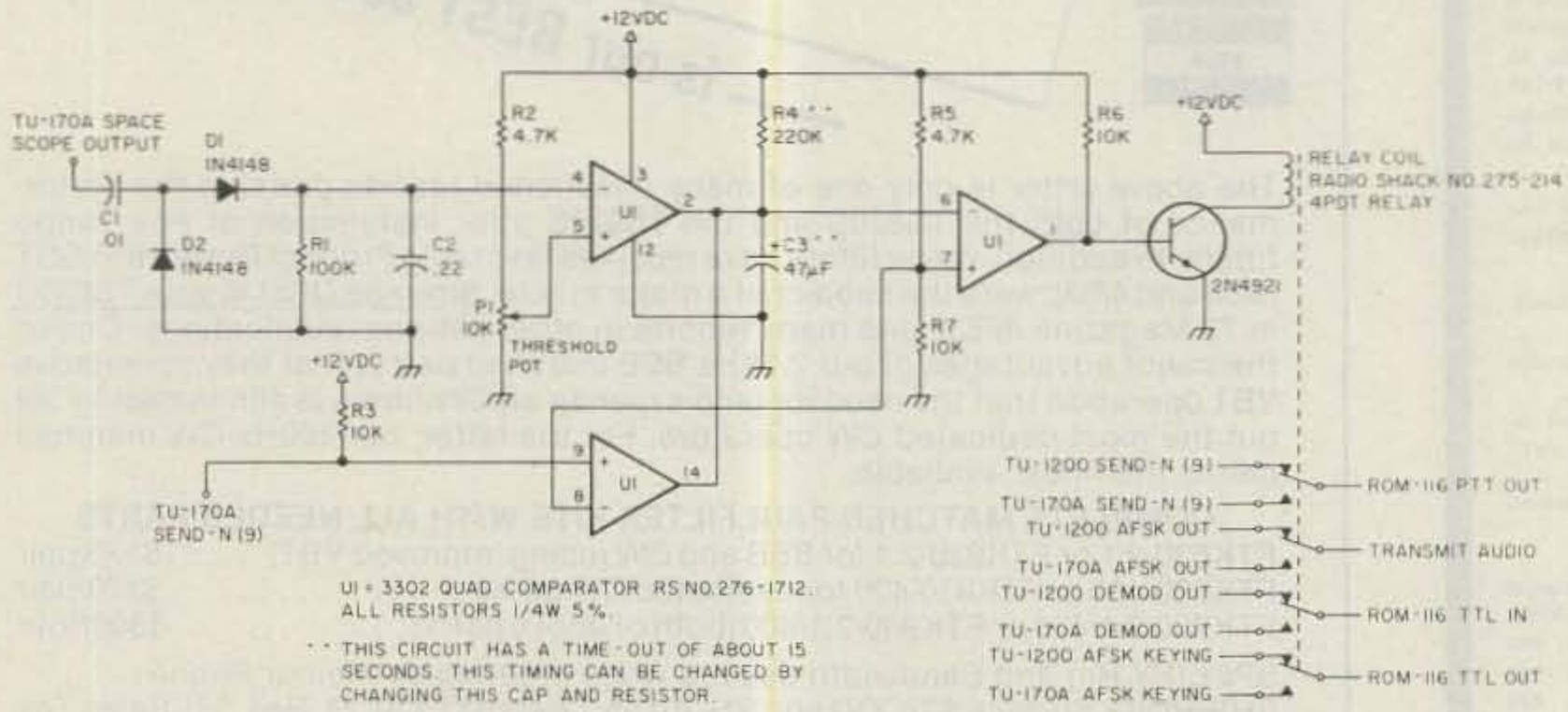

Fig. 1. The circuit and the relay connections. Caution: Do not use the TU-1200's 12-V-dc power supply to supply the circuit or the relay. The TU-1200 will not handle any supply drain outside of the unit.

software creation. It takes time, patience, total concentration, and determination. You can imagine; both of these fellas already had a full-time job, and total concentration can be hard to achieve in a family atmosphere.

After several prototype mailbox programs, Craig finally settled on version 1.4.2 MBO for the Model I and 3.4.2 MBO for Models III and 4. I will briefly touch on a couple of features that the ROM-116 has to offer, at least the ones we will be working with on the additional circuitry.

The ROM-116 mailbox-system communications-rate feature is like none other I have seen. It has ability to receive a remote command over the airways to change the baud rate from 45.5 to 1200 baud. This is one of the few (if not the only) systems that has the ability to run at this fast of a baud rate and still maintain a split-screen format. The control operator has to initialize a baud rate agreeable to everyone on the system, and this initialized baud rate will set a default. If a mailbox user accidentally sets a speed that he is unable to communicate with, the system will delay and default back to the speed set by the control operator. This is only one of many fine features the system has to offer, and it would take another article just to explain the remaining features of the ROM-116 mailbox software.

I had a problem with the hams in this area when I tried a system that had to have an "open command" before you could ask the system for your mail (which was another command on top of that). After you started the mailbox system sending your mail, you had to remain in the shack to give it an "exit command." The users of this mailbox system started dying off, discouraged with the procedure required in order to get the mail. Most of the users wanted a system that would allow them to go into the shack, give a read command for their mailbox, and walk off—having the messages print out without having to wait to close the mailbox.

The ROM-116 mailbox software was the answer to this problem, and everyone was happy with the elimination of a lot of "Howdy," "Exit," and all that sort of chit-chat from the computer on the other end. This is called user friendly according to some, but our group calls it time-consuming nonsense. For some reason, there is a large number of operators that like mailbox software programs that talk a lot to the users of the system. Our group here could care less about chatting to the computer; it seems to insult their intelligence.

It is not the purpose of the system to carry on a conversation with a computer controlling the mailbox system.

Our system was very simple—nothing fancy or expensive to maintain. The rig consisted of an old 1950s-vintage General Electric VHF transceiver that had a Flesher Corporation HF-144 on the receiver to give us about a 30-dB gain for those weak signals. It could transmit 50 Watts all day long. This rig had held my house down during high winds for many years, and it took the better part of our backs to remove it from my shack. After we healed from the hauling of the transceiver, we acquired a Radio Shack TRS-80 Model I with 48K of memory (and one disk drive from Andy Anderson KØNL). A single-density disk will not hold very much data for a mailbox system, so I purchased a double-density controller board and installed it into the expansion interface of the TRS-80. I had three ROM-116 interfaces (for some unknown reason) and I donated one for this interesting project, along with the antenna. Jerry Flesher KØTNC donated the location and a TU-170A. It was all interfaced together, and the final tuning was done by Gene Godsey KØBXJ.

Well, everything seemed to be running smoothly. The ROM-116 and the Flesher TU-170A ran flawlessly for over a year. Then, Flesher Corporation came out with the TU-1200 terminal unit, capable of running at any rate from 45.5 to 1200 baud. Here is a terminal unit that would do both Baudot and ASCII and could be run at the full output rate of the ROM-116 system. Up until this point, we had been limited to the 300-baud maximum of the TU-170A.

The TU-1200 is a 1000-Hz-shift terminal unit using 1200-Hz and 2200-Hz tones (Bell 202 compatible). The TU-170A had been running 170-Hz-shift (2125-Hz and 2295-Hz) tones.

Okay, we could now get our speed up, but there was one minor problem of what to do about the people still wanting to use the 170-Hz shift. I wanted to have both on the same system. It was hardly worth two identical systems just for faster baud rates.

So, the problem was to find a way of using both the TU-170A and the TU-1200 on the same system without sacrificing anything we already had. After trying several circuits, a workable solution to the problem was found. By detecting the space signal (2295 Hz) from the scope output of the TU-170A, we were able to make the system work perfectly normally for either terminal unit.

As shown in Fig. 1, the space scope output of the TU-170A is fed into the circuit through C1 and D1 to pin 4 on U1. A threshold pot (P1) is used to set the sensitivity of the input. Time-out delay is set with the combination of R4 and C3, and with the values shown, the delay will be about 15 seconds. When a space signal is detected from the TU-170A, U1 will trigger Q1 and then pull in the relay, connecting all the necessary I/O to the TU-170A. When the circuit remains inactive for the set time (determined by R4 and C3), the relay will then release and reconnect the I/O to the TU-1200. The TU-170A SEND-N (pin 9) connects to the circuit board at pin 9 of U1 and also connects to one of the relay contacts (normally open) of the relay. When the 170-Hz shift is detected and the relay is pulled in, the PTT of the ROM-116 will keep the input at U1 pin 6 constant and prevent the circuit timer from timing out and dropping the relay during transmission.

A 12-V-dc DPDT relay with 5-Amp contacts is installed inside the ROM-116 and is used to make contact with external PTT requirements. The relay will key a common to the TUs and to the transmitter PTT input. This was a must on our set-up since the PTT relay inside of the transmitter is powered with about 30 volts ac, and solid-state devices do not mix with ac too well. Some VHF and UHF rigs may pull a lot of current on the PTT inputs; the relay would be the answer to this situation, too.

Adjusting the threshold potentiometer (P1) of the detector circuit can be done by connecting a 2200-Hz tone oscillator to the audio input of the TU-170A and adjusting P1 so that the 2200-Hz tone will not activate the relay. Touching up on this adjustment may be required in actual operation at a later time. Power for the circuit and the relay can be obtained from the TU-170A's power supply. I built the circuit up on a piece of hobby perfboard which can be bought at Radio Shack (along with most of the other components).

The TU-1200 is not just for the group that has 1200-

baud capability, it is for anyone that wants to use the system from 45.5 baud to 1200 baud. If anyone wishes to access the mailbox system with a 170-Hz terminal unit, it is no problem at all. Using 1200 baud sounds like a buzz saw to those not familiar with the sound, and it is impossible to read as it is being displayed on the screen. I can now get a long picture or bulletin from the system, save it to memory, and print it out later, or save it to disk. What used to take forever (receiving text at 60 wpm (45.5 baud)), now takes only a matter of seconds.

This circuit seems to be very quick when switching, so nothing seems to be cut out. The ROM-116 RTTY operating software has a diddle feature that can be set to however many diddles you desire. I set mine for 10 diddles, and this seems to do fine for even the 1200-baud operation. There is a delay due to the PTT circuit in both the mailbox system and my system. So, by the time my transmitter drops out and is ready to receive, I may have missed part of a word. However, I do not see that this is a big problem. A change can be made to allow for the delay in the mechanical relays in the software.

We all got the word about the FCC not requiring CW identification every ten minutes while on RTTY. Now all we have to do is give identification in RTTY. Well, the following will tell you what to change in order to do this with your ROM-116 mailbox system.

The TRS-80 Models III and 4 can use the patch utility to make the following changes. The Model I will have to use a utility such as NEWDOS's SUPERZAP. The changes are as follows:

Model I, Ver 1.4.2 MBO
Address: 6D61H
Find: D5 3A A0 83 21
Change to: D5 C3 88 6D 21

Models III and 4, Ver 3.4.2. MBO
Address: 6DA9H
Find: 3A F5 83
Change to: C3 CF 6D

The exact patch format is: PATCH MBORTTY/CMD:0 (ADD=6DA9,FIND=3AF583,CHG=C3CF6D)

While this fixes the program so it will not send the CW identification, it also eliminates the only ID it has. So, the following patches will identify in RTTY whatever you have stored in buffer 6, such as "DE KØWVN MAILBOX SYSTEM TOPEKA." Here are the necessary patches:

Model I, Ver 1.4.2 MBO
Address: 57DBH
Find: 0A 00 C9 D7 0A 0A
Change to: 0A 00 C9 D7 0A B6

Models III and 4, Ver 3.4.2. MBO
Address: 57A4H
Find: C9 D7 0A 0A 00
Change to: C9 D7 0A B6 00

The exact patch format is: PATCH MBORTTY/CMD:0 (ADD=57A7,FIND=0A,CHG=B6)

Model I, 1.4.2 MBO: Addresses 57CF, 635D, 6379, 63B4, 63ED, 6418, 6454, 64AA, and 64F4; Find 4E; Change to B6.

Models III and 4, 3.4.2 MBO: Addresses 5799, 63A4, 63C0, 63FB, 6434, 645F, 649B, 64F1, and 653B; Find 4E; Change to B6.

After these changes are made, whatever you decide to enter into buffer 6 to be printed as an identification, be sure to add a carriage return before entering anything else in the buffer.

This should give you a super sytem, one that will operate trouble-free for a long time to come. Those of you using a different terminal unit can probably interface it in the same manner as the TU-170A with the TU-1200. In any case, I hope you have fun using the system and the faster baud rates.■

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Decode Soviet Space Messages

As you read this, mysterious signals are being beamed into your shack. What do they mean? Where are they coming from? Use WDØBCI's satellite-telemetry reading program to uncover the facts.

You hear it on the high end of 10 meters whenever the RS satellites pass over: *RS5 K00 D00 O00 G00 U00 W00*—the heartbeat of the satellite, the telemetry beacon. It provides a constant stream of data about the health of the spacecraft, but what does it all mean? Is there a way to figure it out? Take heart, because I am about to describe what the telemetry means, the hard way to decode it, and a much simpler way to decode it using a computer (you do have a computer, don't you?).

The telemetry provided by the RS series of satellites contains a wealth of information about the operating parameters of the spacecraft. It will tell you everything from the power output of the transponder to the ambient temperature. This information gives you an overall view of the health of the system. It can also tell you such things as how much time the satellite is spending in sunlight, or the moment when the satellite passes into or out of Earth's shadow.

So why bother to take an interest in this data? For one thing, the telemetry tells you if the transponder is turned on. You can't make contacts through the bird if it's not listening. Also, you can tell when the satellite is on the decline and about to fail. Besides, it can become

Frame	Chan.	Parameter	Unit of measure	Decoding formula
()/E	K	Output power of transponder	mW	$(N^2)/5$
	D	Voltage of power source	V	0.2N
	O	Load current	mA	20 (100 – N)
	G	Telemetry test	—	None
	U	Hermetically-sealed container pressure	—	None
	S	Temp. of stabilizing unit	°C	N
	W	Temp. of transmitter radiator	°C	N
I/S	K	Output power of transponder	mW	$(N^2)/5$
	D	Zero-setting of telemetry mV meter	—	N
	O	Output power of beacon	mW	$(N^2)/5$
	G	Repeater sensitivity control	dB	N
	U	S-meter for 1st service receiver	S	0.1 (N – 10)
	S	S-meter for robot receiver	S	0.1 (N – 10)
	W	S-meter for 2nd service receiver	S	0.1 (N – 10)
A/U	K	Output power of transponder	mW	$(N^2)/5$
	D	9-V voltage at transponder	V	0.1N
	O	7.5-V voltage at transponder	V	0.1N
	G	9-V voltage at 1st stabilizer	V	0.1N
	U	7.5-V voltage at 1st stabilizer	V	0.1N
	S	9-V voltage at 2nd stabilizer	V	0.1N
	W	7.5-V voltage at 2nd stabilizer	V	0.1N
M/W	K	Output power of transponder	mW	$(N^2)/5$
	D	Filling-out of robot log	QSO	N + 1
	O	Power of turned-on heaters	W	0.1N
	G	Power of robot transmitter	mW	20N
	U	Power of service-channel transmitter	mW	20N
	S	Sensitivity control for robot transmitter	dB	N
	W	Sensitivity control for service-channel transmitter	dB	N

Note: The first frame identifier indicates normal operation. The second frame identifier indicates that the satellite is being serviced.

Table 1. Formulas used to decode telemetry of RS-series satellites.

an interesting diversion from the ordinary operation through the satellite.

OK, so there's some interesting information there, but how do you get it from *K00 D00...?* Each character specifies a *channel* of telemetry. A channel is a single parameter such as the power output of the transponder. The telemetry channels are grouped into sets of seven which are known as *frames*. The frames are sent sequentially, and there are four possible frames in a full set of telemetry data. From one to four frames may be sent by the satellite, depending on how the ground-control stations have configured the satellite for the day's passes. Frame identifiers also change if the spacecraft is in service mode, when the satellite is being commanded by ground control, or if the transponder is switched off to give the bird a rest.

Now that you know how the telemetry is sent, how do you go about decoding it? There are two ways—manually and by computer. Manually decoding the telemetry has one advantage—it's cheap. If you want to decode it in this fashion, Table 1 provides you with the necessary formulas to do it yourself.

Decoding telemetry by hand is a relatively easy exercise, but it's kind of boring. Face it, you probably have better things to do than figure out values from equations. It's really kind of dry. Well, thanks to technology, you don't have to slave over those formulas. The computer revolution has set you free. If you have a programmable calculator, you can program the formulas into it and ease the pain somewhat. Of course, you still have to look at the tables to assign some meaning to the numbers you get from the formula. But if you have a computer, it can do the work for you and even label the results.

Listing 1 shows a program that accepts telemetry data and converts it to human-readable form. It is written in Basic for the IBM Personal Computer but can be readily converted to run on other machines by anyone who is familiar with Basic.

The program prompts you for the frame identifier of the telemetry data, and then for the numbers following the channel identifier. The computer will calculate the values for each of the telemetry channels and print the corresponding values, all nicely labeled, on the screen for your examination. This can be repeated for as many frames of telemetry as desired.

After studying the program, you might wonder why I didn't include any routines to provide hard copy of the results of the telemetry decoding. The simple fact is that on the IBM PC, these routines are not needed since there is a key on the machine that allows you to dump the contents of the display to the printer. If you are adapting this software to another system, it is a simple matter to write the necessary routines to provide hard copy, or to replace appropriate PRINT statements with LPRINT (or whatever your particular system requires).

Now that you can understand this data, what can you do with it? For starters, try graphing load current on a pass-by-pass basis for sev-

Listing 1. Program to analyze and display RS-series telemetry.

```
30 'RS satellite telemetry decoding program V 1.0 by Todd Enders WD0BCI
40 '
50 'This program decodes telemetry data for the soviet RS3 through RS8 series
60 ' of amateur satellites.
70 '
80 '
90 'clear screen and display header and prompt for frame id
100 '
110 '
120 KEY OFF
130 CLS:LOCATE 1,20:PRINT"RS 3-8 Satellite Telemetry Decoder"
140 LOCATE 3,5:INPUT"frame ( none, E, I, S, A, U, M, W) ";FR$
150 '
160 '
170 'prompt for telemetry channel data
180 '
190 '
200 LOCATE 5,10:PRINT"K:"
210 LOCATE 6,10:PRINT"D:"
220 LOCATE 7,10:PRINT"O:"
230 LOCATE 8,10:PRINT"G:"
240 LOCATE 9,10:PRINT"U:"
250 LOCATE 10,10:PRINT"S:"
260 LOCATE 11,10:PRINT"W:"
270 LOCATE 5,14:INPUT K:LOCATE 6,14:INPUT D:LOCATE 7,14:INPUT O
280 LOCATE 8,14:INPUT G:LOCATE 9,14:INPUT U:LOCATE 10,14:INPUT S
290 LOCATE 11,14:INPUT W
300 '
310 '
320 'determine which frame to calculate data for
330 '
340 '
350 IF FR$="" OR FR$="E" OR FR$="e" GOTO 450
360 IF FR$="i" OR FR$="I" OR FR$="S" OR FR$="s" GOTO 680
370 IF FR$="A" OR FR$="a" OR FR$="U" OR FR$="u" GOTO 910
380 IF FR$="M" OR FR$="m" OR FR$="W" OR FR$="w" GOTO 1160
390 GOTO 130
400 '
410 '
420 'calculate data for base frame/E frame parameters
430 '
440 '
450 EK=K^2/5:ED=.2*D:EO=20*(100-O):EG=G:EU=U:ES=S:EW=W
460 '
470 '
480 'display data for base frame/E frame
490 '
500 '
510 CLS:LOCATE 1,20:PRINT"Channel ( )/(E) telemetry parameters:"
520 LOCATE 5,10:PRINT"Output power of transponder:";:LOCATE 5,50:PRINT EK;" mW"
530 LOCATE 6,10:PRINT"Voltage of power source:":LOCATE 6,50:PRINT ED;" V"
540 LOCATE 7,10:PRINT"Load current:":LOCATE 7,50:PRINT EO;" mA"
550 LOCATE 8,10:PRINT"Telemetry test:":LOCATE 8,50:PRINT EG
560 LOCATE 9,10:PRINT"Hermetically sealed container pressure:"
570 LOCATE 9,50:PRINT EU
580 LOCATE 10,10:PRINT"Temp. of stabilizing unit:":LOCATE 10,50:PRINT ES;" C"
590 LOCATE 11,50:PRINT EW;" C"
600 LOCATE 11,10:PRINT"Temp. of transmitter radiator:"
610 LOCATE 24,10:PRINT"press any key to continue":A$=INKEY$:IF A$="" GOTO 610
620 GOTO 130
630 '
640 '
650 ' calculate data for I/S frame telemetry parameters
660 '
```

```
670 '
680 IK=K^2/5:ID=D:IO=O^2/5:IG=G:IU=.1*(U-10):IS=.1*(S-10):IW=.1*(W-10)
690 '
700 '
710 'display data for I/S frame telemetry
720 '
730 '
740 CLS:LOCATE 1,20:PRINT"Channel (I)/(S) telemetry parameters:"
750 LOCATE 5,10:PRINT"Output power of transponder:":LOCATE 5,50:PRINT IK;" mW"
760 LOCATE 6,10:PRINT"Zero setting of telemetry mV meter:":LOCATE 6,50:PRINT ID
770 LOCATE 7,10:PRINT"Output power of beacon:":LOCATE 7,50:PRINT IO;" mW"
780 LOCATE 8,10:PRINT"Repeater sensitivity control:":LOCATE 8,50:PRINT IG;" dB"
790 LOCATE 9,10:PRINT"S-meter for 1st service receiver:"
800 LOCATE 9,50:PRINT" S- ";IU
810 LOCATE 10,10:PRINT"S-meter for ROBOT receiver:":LOCATE 10,50:PRINT" S- ";IS
820 LOCATE 11,10:PRINT"S-meter for 2nd service receiver:"
830 LOCATE 11,50:PRINT" S- ";IW
840 LOCATE 24,10:PRINT"press any key to continue";:A$=INKEY$:IF A$="" GOTO 840
850 GOTO 130
870 '
880 ' calculate data for A/U frame telemetry parameters
890 '
900 '
910 AK=K^2/5:AD=.1*D:AO=O*.1:AG=.1*G:AU=.1*U:AS=.1*S:AW=.1*W
920 '
930 '
940 ' display data for A/U frame telemetry
950 '
960 '
970 CLS:LOCATE 1,20:PRINT"Channel (A)/(U) telemetry parameters:"
980 LOCATE 5,10:PRINT"Output power of transponder:":LOCATE 5,50:PRINT AK;" mW"
990 LOCATE 6,10:PRINT"9 V voltage at transponder:":LOCATE 6,50:PRINT AD;" V"
1000 LOCATE 7,10:PRINT"7.5 V voltage at transponder:":LOCATE 7,50:PRINT AO;" V"
1010 LOCATE 8,10:PRINT"9 V voltage at 1st stabilizer:":LOCATE 8,50:PRINT AG;" V"
1020 LOCATE 9,10:PRINT"7.5 V voltage at 1st stablilzer:"
1030 LOCATE 9,50:PRINT AU;" V"
1040 LOCATE 10,10:PRINT"9 V voltage at 2nd stabilizer:"
1050 LOCATE 10,50:PRINT AS;" V"
1060 LOCATE 11,10:PRINT"7.5 V voltage at 2nd stabilizer:"
1070 LOCATE 11,50:PRINT AW;" V"
1080 LOCATE 24,10:PRINT"press any key to continue";:A$=INKEY$:IF A$="" GOTO 1080
1090 GOTO 130
1100 '
1110 '
1120 'calculate M/W telemetry parameters
1130 '
1140 '
1150 '
1160 MK=K^2/5:MD=D:MO=.1*O:MG=20*G:MU=20*U:MS=S:MW=W
1170 '
1180 '
1190 'display data for M/W telemetry frame on screen
1200 '
1210 '
1220 CLS:LOCATE 1,20:PRINT"Channel (M)/(W) telemetry parameters:"
1230 LOCATE 5,10:PRINT"Output power of transponder:":LOCATE 5,50:PRINT MK;" mW"
1240 LOCATE 6,10:PRINT"Filling out of ROBOT QSO log:":LOCATE 6,50:PRINT MD
1250 LOCATE 7,10:PRINT"Power of turned-on heaters:":LOCATE 7,50:PRINT MO;" W"
1260 LOCATE 8,10:PRINT"Power of ROBOT transmitter:":LOCATE 8,50:PRINT MG;" mW"
1270 LOCATE 9,10:PRINT"Power of service channel transmitter:"
1280 LOCATE 9,50:PRINT MU;" mW"
1290 LOCATE 10,10:PRINT"Sensivity control for ROBOT transmitter:"
1300 LOCATE 10,50:PRINT MS;" dB"
1310 LOCATE 11,10:PRINT"Sens. control for serv. chan. trans. :";
1320 LOCATE 11,50:PRINT MW;" dB"
1330 LOCATE 24,10:PRINT"press any key to continue";:A$=INKEY$:IF A$="" GOTO 1330
1340 GOTO 130
```

eral passes. Look for a long-term trend. I have suggested this exercise because load current varies with such things as transponder load and the input power of each user into the satellite. It is probably the most variable of the telemetry data and usually shows changes more readily than any of the other parameters.

Voltage at the power source is also an interesting parameter to watch. It can indicate a satellite-damaging condition such as battery overcharge (usually fatal if prolonged or excessive). If the voltage suddenly changes, it is a good bet that the satellite has passed from daylight into darkness or vice versa. Most of the parameters are worth watching for long-term changes (monthly, seasonal, etc.). It can grow into an interesting pastime, much like keeping weather records. You can also pass the data along to AMSAT. They are always looking for telemetry information from amateur satellites.

Now that you are able to decode RS telemetry, try listening to the satellites on 29.500 and 29.450 MHz CW. You can do with it what you want, but in any case, have fun with the program and the data that you can obtain from it. You might even get more out of playing with the telemetry data than working people through the satellite! ■

The End of the Line

What's the point in sending power up the coax if it never reaches the antenna? These tips on connector installation and care will help maximize your station's signal.

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As supervisor of automation and communications systems on offshore oil platforms, I have learned that the following methods and materials produce long-lasting results even in salt-spray conditions on motor vessels and oil platforms in the Gulf of Mexico. If care is not exercised initially, moisture and improperly soldered coaxial rf connections can yield undesirable operation of your antenna system.

Cable Preparation

Proper soldering of the RG-8 shield to the barrel of a PL-259 coax connector can be accomplished by tinning the braid as shown in Photo A. Tin the circumference of the braid in an area that will be under the solder holes in the connector. Tinning must extend well forward of the solder holes to allow knife cutoff of braid and center insulation as shown in Photo B. Cutting through the soldered portion of the braid requires a sharp knife and considerable pressure. Work around the cable using a rocking motion of the knife blade rather than slicing.

Place the knurled connector nut over the coax with the threaded portion facing toward the prepared end. Apply a small amount of silicone grease or petroleum jelly to the black outer insulation and thread the connector onto the coax. Make sure the tinned area is in full view in all four holes of the connector and that the center conductor is in view for soldering.

Photo A. Tin the braid in an area under the solder holes.

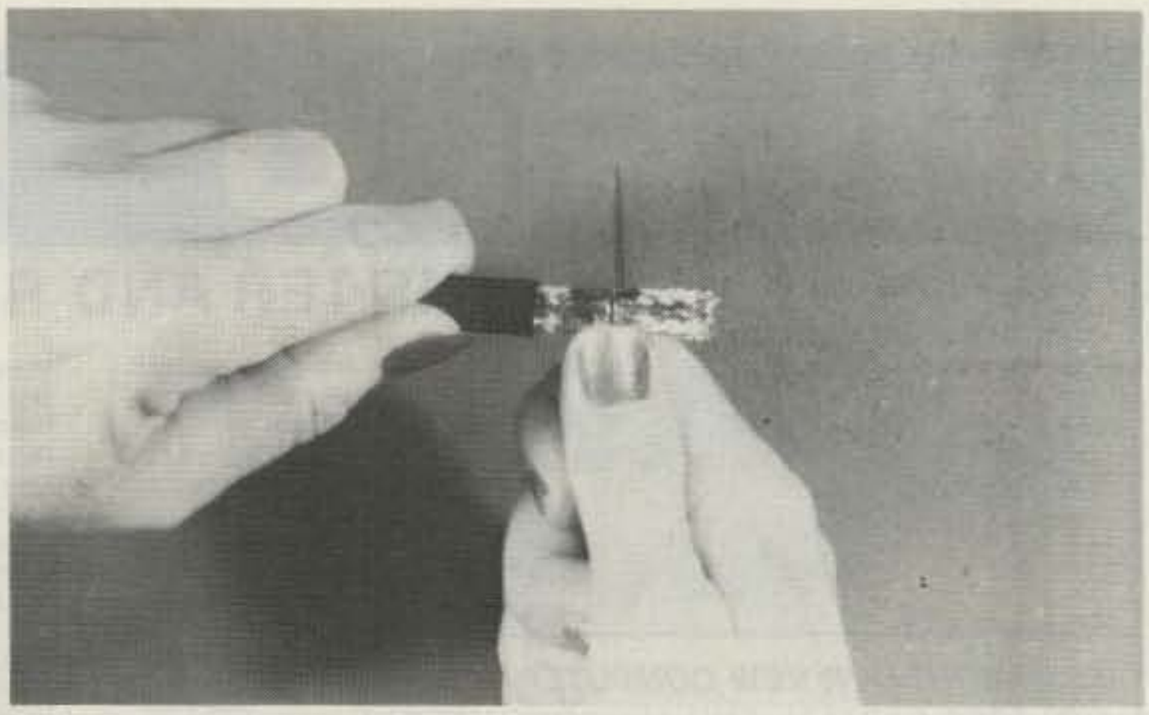

Photo B. Use a sharp knife to cut through soldered braid and insulation.

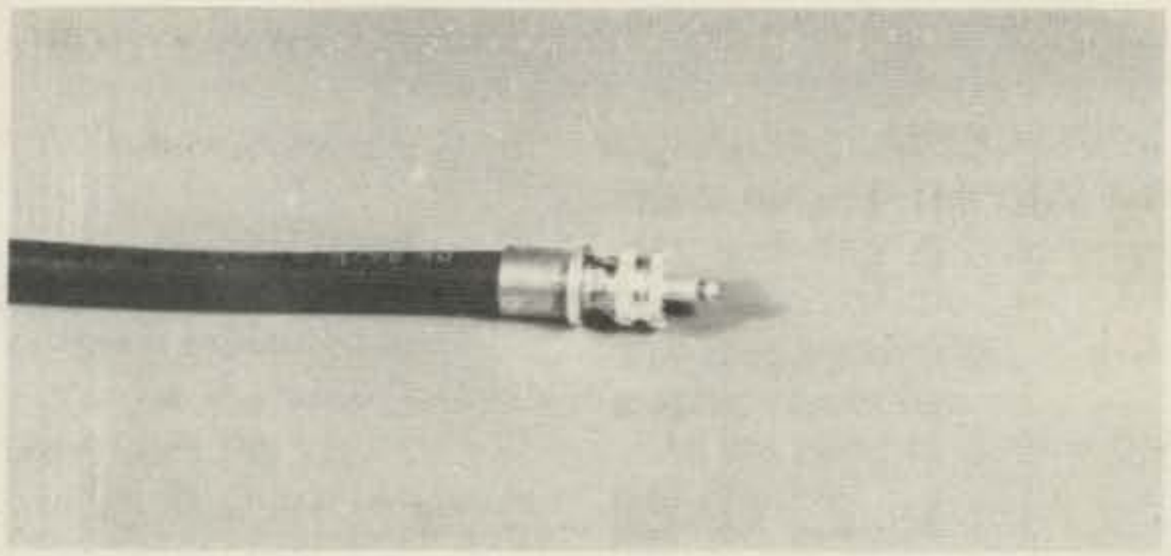

Photo C. Soldered connector with all holes filled. Use plenty of heat.

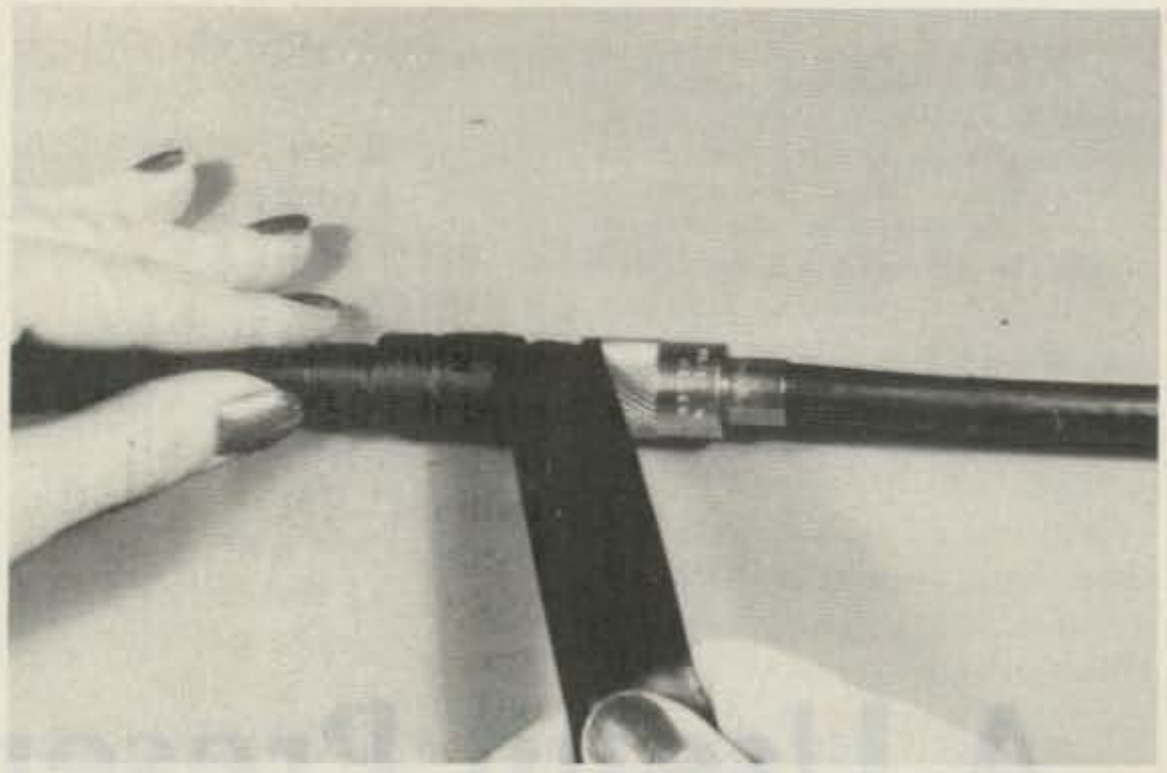

Photo D. Apply rubber tape with tension to conform to the irregular shape of connector.

Solder the Connector

Soldering must be done with enough heat to securely bond the coax shield to the connector. At least a 100-Watt soldering iron or gun is required to apply the necessary heat. Inadequate heat is responsible for most coax-connector problems.

Apply heat and then solder to each hole of the connector. Go from hole to hole around the connector with heat and solder. When the connector has absorbed enough heat, solder will freely flow into the holes and bond with the shield. It may take two or three passes in quick succession to achieve this. Next, solder the center conductor and allow to cool. The finished solder joints should be smooth and shiny—no solder beads or dull rough areas. See Photo C.

Now that your connectors are properly soldered, a check must be made to ensure that no shorts between the center conductor and shield have been created. A volt/ohmmeter, set on the 10k-Ohm range or higher and connected between center pin and body of the connector, should indicate infinite resistance if all is okay.

Protection Is a Must

Rf connectors used outside and exposed to the weather must be waterproofed to eliminate corrosion. Corroded connectors contribute to elevated swr and can radiate rf-causing TVI. A simple layer or two of vinyl electrical tape will *not* provide the necessary weather protection! The following method is used by radio technicians installing antenna systems in the Gulf of Mexico and can easily be applied by amateurs. I have used this method for eight years with no corrosion problems.

3-M Scotch® product numbers will be referred to, but other manufacturers' products are available to yield the same results.

Seal the Connector

The plug and receptacle portions of the connector must be joined firmly to provide a good electrical connection. The connector is now covered with a layer of Scotch No. 23 rubber splicing tape. Remove the protective backing and start wrapping 1/2" ahead of the connector on the coax. Stretch the tape at least twice its original length as you wrap, overlapping half the width of the tape, and continue the length of the connector. Be careful to fill voids and make the tape conform to the shape of the connector as in Photo D. This tape is both cohesive and adhesive and forms a solid covering.

A layer of Scotchkote® electrical coating is now applied liberally over the rubber tape for a sealer. See Photo E. This is a fast-drying liquid and imparts a waterproof seal. I have also used this type of sealant on bolted rf connections on antennas. It will coat the bolt and nut to retard corrosion and will allow removal of parts later. When the coating is almost tack free, start a layer of Scotch No.88 vinyl electrical tape on the coax just ahead of the rubber tape. The tape should be applied firmly with a slight amount of stretch. Continue down the connector, overlapping about half the tape width to the end, and then return in the opposite direction to the beginning. The last two wraps back at the beginning should be made with very little tension to avoid tape unwrap. Finally, one last coat of Scotchkote will seal the vinyl tape from moisture. Your finished product, in the case of a line splice, should look like Photo F.

This method should be used on all antenna connectors whether they be coaxial or coaxial cable terminated with screws and lugs. Also, many hams provide a splice connection at the tower to allow "fold-over." This splice should also be protected. ■

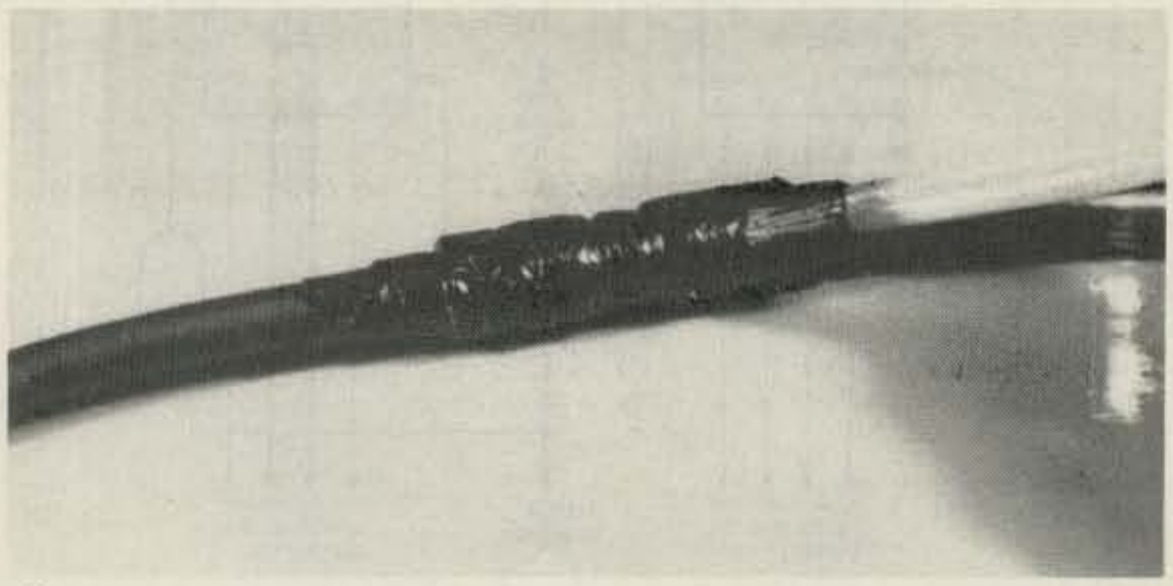

Photo E. Coat rubber tape with electrical sealer.

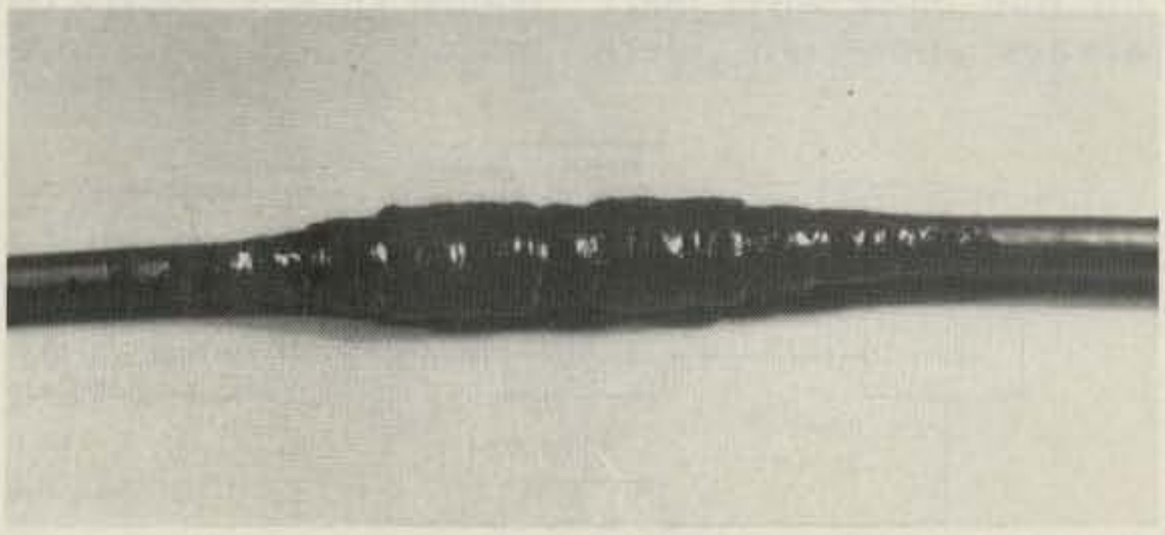

Photo F. Final covering of vinyl tape with outer coating of electrical sealer.

A Useful Present You Can Build

How about a high-tech holiday gift?

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Learning new technology can be a painful experience and breaking into digital electronics on your own can be positively frustrating. That is why I decided to get some help in my attempt to update to digital electronics and enrolled in some classes at San Diego City College. (Yes, California does have more than surf and sun!) By the end of the first semester I had learned a little, so I decided to combine the final laboratory project with my need for a Christmas gift for my wife. Since wives don't always appreciate electronic gadgets, I felt I should come up with something she would consider practical . . . without attempting something that would be too difficult.

Happily, my wife likes to cook. And, conveniently, her old-fashioned kitchen timer had recently failed. The obvious solution was to build her a kitchen timer (eminently practical) using digital circuitry, as required for the lab project. I decided this timer would not need to display seconds, nor would it require greater than 60 minutes capacity. Its alarm should be audible for 50 feet in a normal house (whatever that is) and its display should be visible for 20 feet so it could be seen across a normal kitchen. Battery operation would be convenient, and I decided to lay out the controls for a left-handed user since the cook in my house is left-handed.

Theory

The timer is built around an up/down counter driving a seven-segment LED display, as shown in Fig. 1. The counter is set by clocking it up using push-button switches in the control section and is clocked down by a one-pulse-per-minute signal from the clock. The alarm, which is triggered by the counter's zero count, is modulated by signals from the clock so as to reduce current consumption yet achieve the required audibility. The control section includes an automatic power-disconnect circuit to prevent draining the batteries

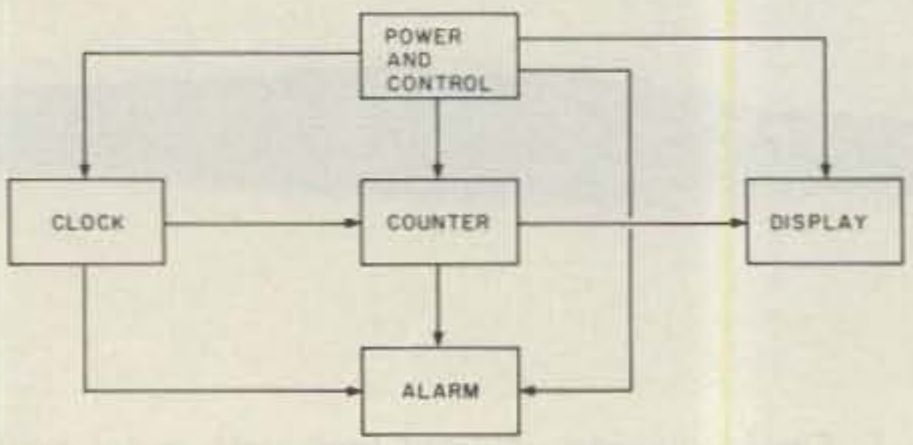


Fig. 1. Timer block diagram.

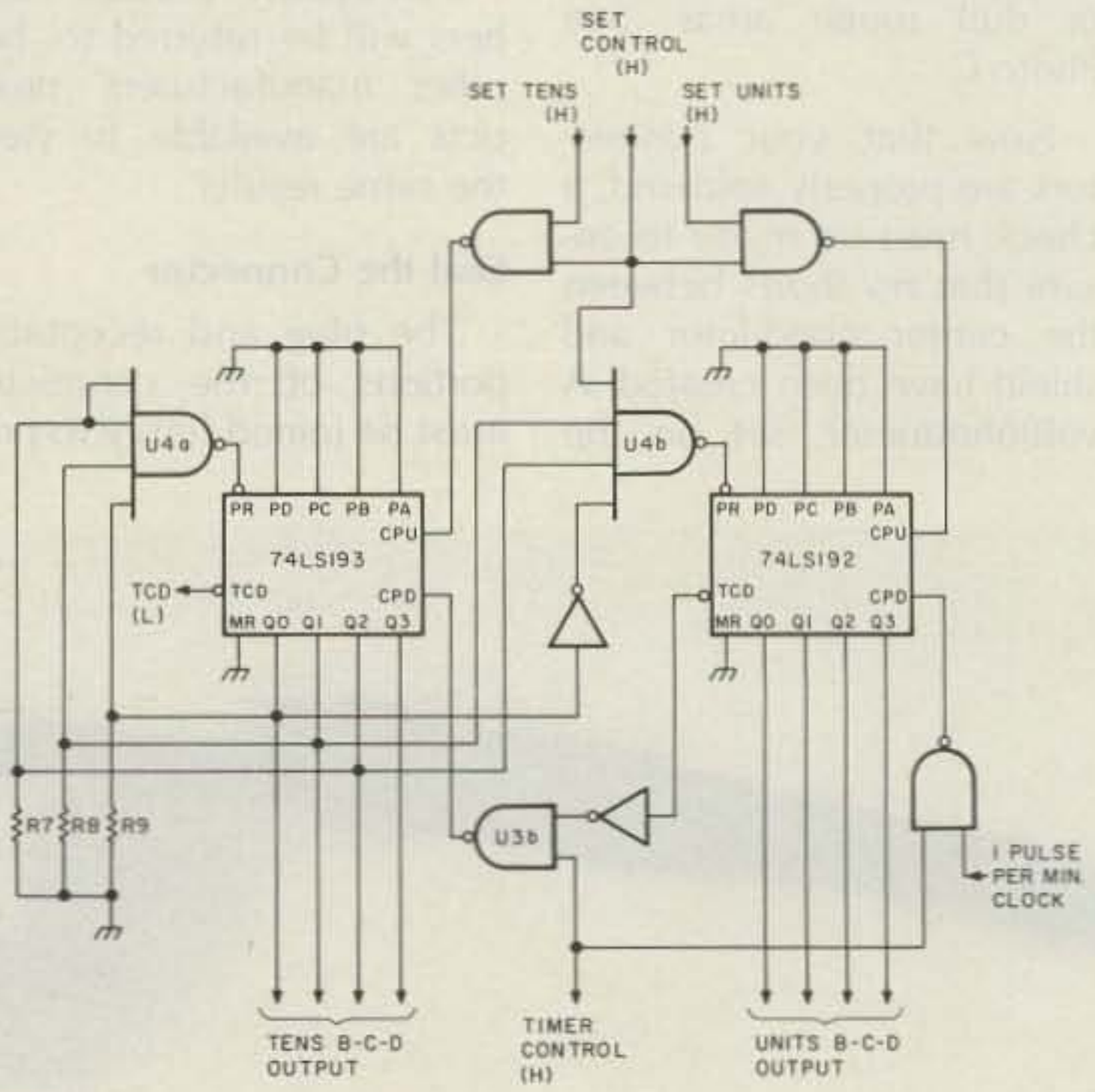


Fig. 2. Counter logic diagram.

by inadvertently allowing the alarm to sound excessively.

Circuit Description

The counter, shown in Fig. 2, utilizes two up/down binary counters in cascade. The units display requires a full decade, so a 74LS192 is suitable. The tens display requires only 0 through 6, so its counter is preset to zero by count 7 so that the timer cannot be set to more than 60 minutes. Using a 74LS193, whose count sequence includes 0 through 15, and wiring the preset gate, U4a, to force preset when the Q_0–Q_2 outputs are all high will cause preset on count 7 or count 15. The counter will then be forced to operate between 0 and 6 as it cannot be clocked up beyond 6 or down beyond 0.

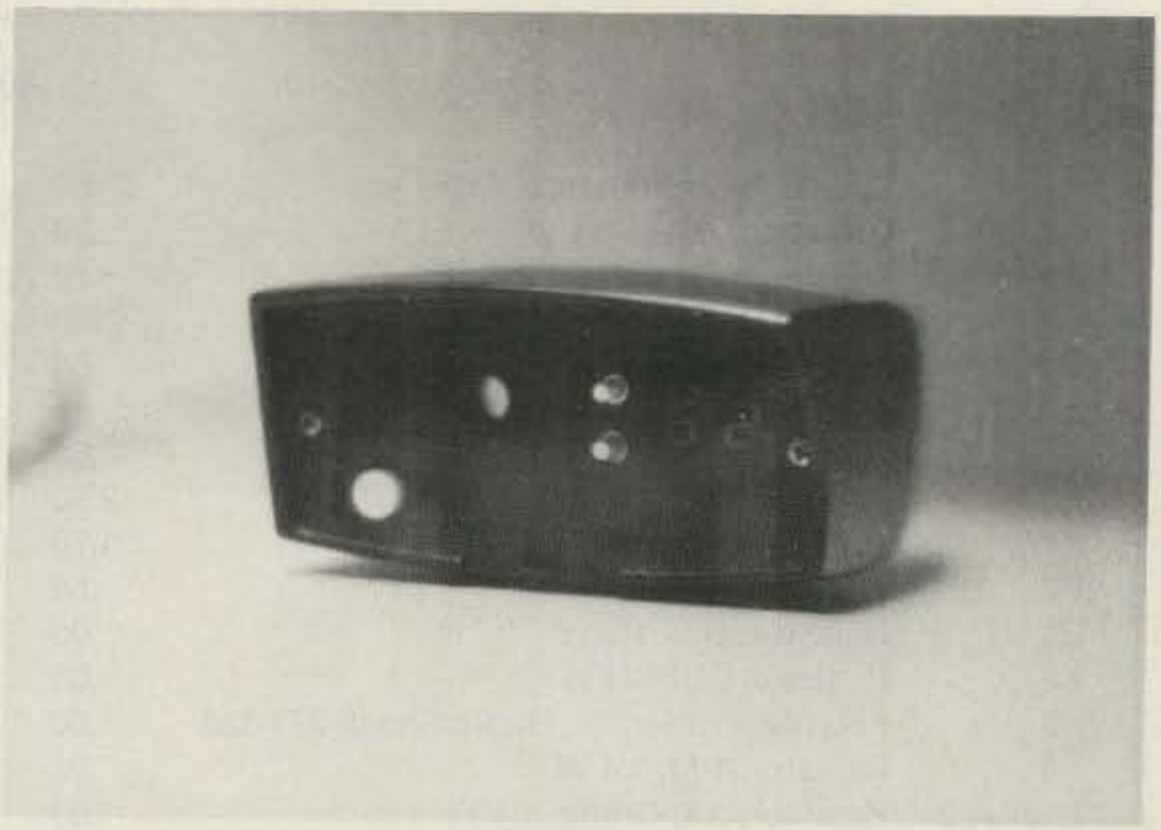
U4b is wired as a preset gate to force the units counter to zero when the timer is being set and the tens counter is at 6. This establishes 60 minutes, rather than 69, as the maximum timer capability. U4b is disabled in Timer mode when the Set control line goes low so as to allow the units counter to be clocked down normally. Otherwise the units counter would be locked at zero by the tens counter's 6, preventing the application of clock pulses to the tens counter, locking the timer at 60.

R7, R8, and R9 are pull-down resistors for the inputs of U4b. This was found to be necessary in order to prevent presetting on the 6 count due to "racing." Evidently, between count 5 (binary 0101) and count 6 (binary 0110), Q_0 was not going low before Q_1 went high, so the preset gate interpreted the 6 as a 7. The pull-down resistors cured the problem.

All clock lines must be held low when switching modes in order that their associated NAND gates be disabled. This will hold the clock inputs to the counters high during mode changes, thus preventing spurious clocking when switching modes.

The 74LS192/LS193 counters are designed to be cascaded by connecting the TC output of one directly to the CP input of the next. U3b, the Mode gate, inverts the TC_D signal before it reaches the CP_D input of the tens counter, so an inverter must be included in the signal path to restore the proper polarity. Without the inverter, the count is 50, 59, 58, etc.

Fig. 3 shows the waveforms of the counter in Timer mode with the units counter clocked by a symmetrical square wave whose period is 1 second. The Q outputs of the 74LS192/LS193 change states on the low-to-high clock transition. The TC_D output goes low with the low portion of the clock pulse when all its Q outputs are low. In Timer mode, counting down, the binary output of the units counter changes to 0000 with the rising edge of the 0 clock pulse. The falling edge of that pulse, 30 seconds later, causes the units TC_D to go low. 30 seconds later, the clock pulse again goes high, clocking the units counter to its 9 count and forcing the TC_D back to its high state. As the units TC_D goes high, it clocks the tens counter.



Digital kitchen timer in use.

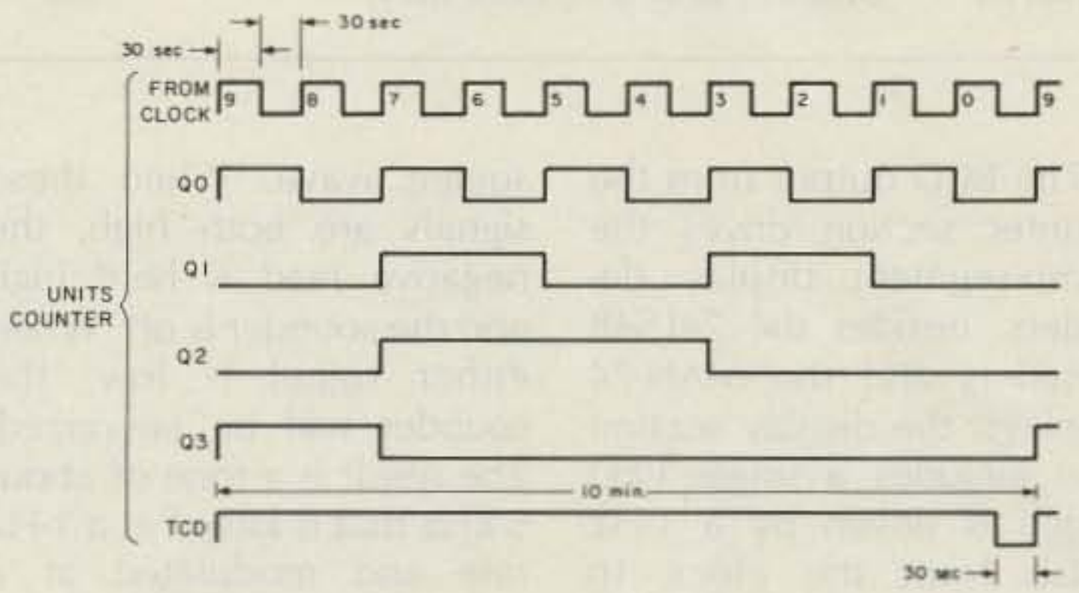


Fig. 3. Counter waveforms.

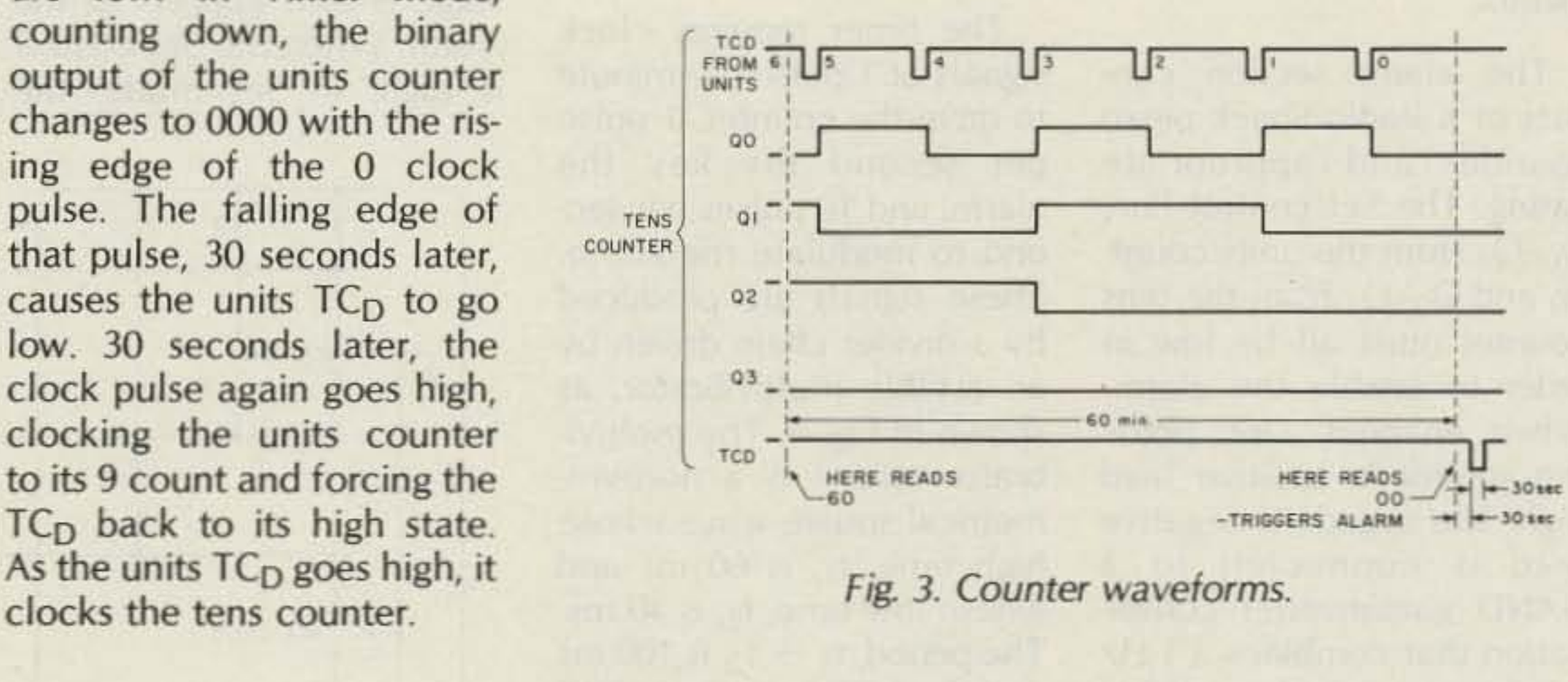


Fig. 4. Clock-generator logic diagram.

Parts List

C1	Capacitor, tantalum, 2.7 uF	$ .60	U1	74LS192	.95
C2, C4–7	Capacitor, disc, .01 uF	.20	U2	74LS193	.95
C3	Capacitor, tantalum, 4.7 uF	.70	U3, 6, 7, 13	74LS00	.38
C8	Capacitor, tantalum, .1 uF	.50	U4	74LS20	.38
D1	LED, red	.30	U5	74LS04	.38
J1	16-pin DIP socket	.45	U8	LM556	1.50
J2	2-pin socket	.50	U9, U10	74LS90	.66
K1	Relay, 5-V coil, Radio Shack 275-243	2.50	U11	74LS92	.66
P1	16-pin DIP plug	1.70	U12	74LS02	.38
P2	2-pin plug	.50	U14, U16	74LS48	1.10
R1	Resistor, 10k, 1/4 W	.03	U15, U17	Seven-segment, common cath. display (MAN 74)	1.60
R2	Resistor, 22k, 1/4 W	.03	U18	+ 5-volt regulator, LM340T-5 (7805)	1.60
R3	Potentiomenter, 1k, Radio Shack 271-333	.50	Piezo sounder, Radio Shack 273-060		3.00
R4	Resistor, 1 M, 1/4 W	.03	Battery holder, 4 × AA cell		1.00
R5, R7–9	Resistor, 330 Ohms, 1/4 W	.03	Enclosure		5.00
R6	Resistor array, 5 × 1k, Radio Shack 271-096	.90	Grid board, 2 pieces 2-3/4" × 3-3/4", Radio Shack 276-161		3.00
S1	Switch, PB, DPDT (push-on/push-off)	2.00	IC sockets, solder-in (optional), 18 required		.45
S2, S3	Switch, PB, SPDT (momentary)	1.60	(Prices as of January, 1984)		

The BCD output from the counter section drives the seven-segment display decoders. Besides the 74LS48 decoders and the MAN-74 displays, the display section also includes a single LED which is driven by a 1-Hz pulse from the clock to serve as a Timer mode indicator.

The alarm section consists of a Radio Shack piezo sounder and appropriate gating. The Set control line, Q_0–Q_3 from the units counter, and Q_0–Q_2 from the tens counter must all be low in order to enable the alarm. When enabled, U6c holds the sounder's positive lead high. The sounder's negative lead is connected to a NAND gate/inverter combination that combines a 1-Hz square wave with a 10-Hz square wave. When these signals are both high, the negative lead is held high and the sounder is off. When either signal is low, the sounder will be energized. The result is a tone of about 5 kHz that is keyed at a 1-Hz rate and modulated at a 10-Hz rate.

The timer requires clock signals of 1 pulse per minute to drive the counter, 1 pulse per second the key the alarm, and 10 pulses per second to modulate the alarm. These signals are produced by a divider chain driven by an astable multivibrator, as shown in Fig. 4. The multivibrator output is a nonsymmetrical square wave whose high time, t_1, is 60 ms and whose low time, t_2, is 40 ms. The period, $t_1 + t_2$, is 100 ms and the frequency is thus 10 Hz. These times are determined by the following relationships: $t_1 = 0.693 (R_1 + R_2) C_1$; $t_2 = 0.693 \times R_2 \times C_1$. The 10-Hz signal from the multivibrator is used to modulate the alarm as well as serving as the input for the divider chain. The 1-Hz signal from the divide-by-ten stage is also applied to the alarm. When the Set control is high, in Set mode, the 74LS92 and the first 74LS90 will be disabled by the high applied to their R_0 inputs and the clock output will be held low. As mentioned previously, this is necessary to prevent spurious clocking when switching modes. Fig. 5 illustrates the clock-generator waveforms.

Power from four AA cells is applied to the circuit

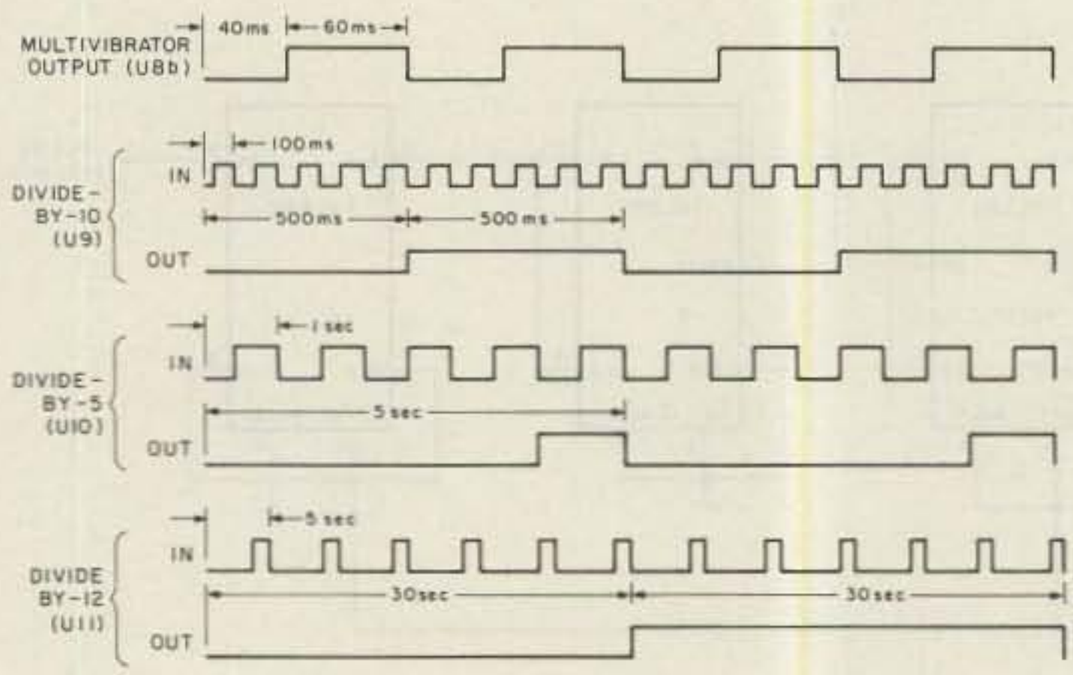


Fig. 5. Clock waveforms.

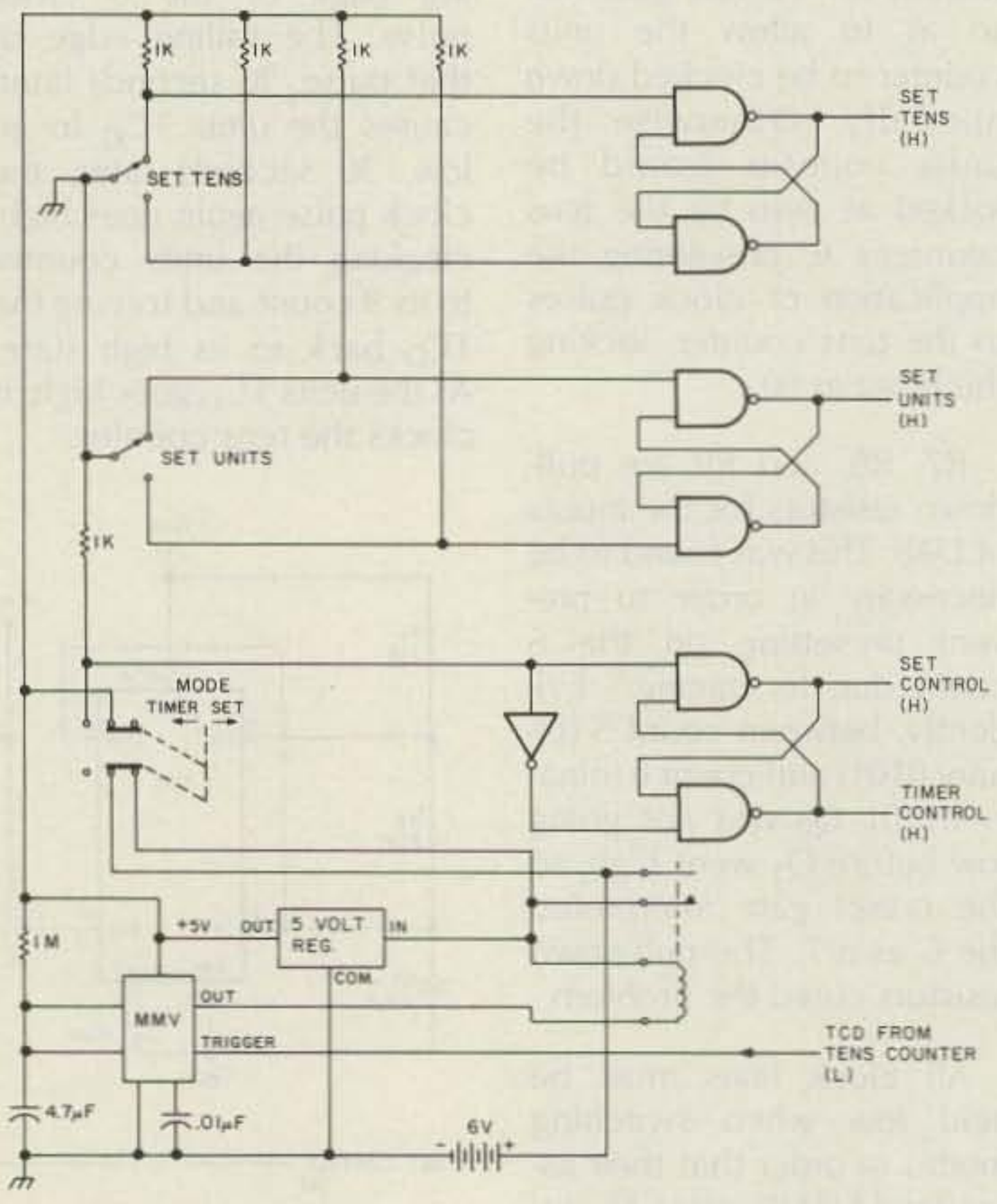


Fig. 6. Power and control logic diagram.

Fig. 7. Timer schematic diagram.

through normally-open relay contacts, as shown in Fig. 6. Placing the timer in Set mode applies power to the circuitry, providing a path to ground for the relay by energizing the monostable multivibrator. The relay, once energized, latches power to the circuitry even though the mode switch is moved to Timer. The positive transition of the last 0 pulse from the clock drives the counter to all zeros, triggering the alarm. 30 seconds later, the clock's 0 pulse goes low, causing the units TC_D to go low. When the units TC_D goes low, the tens TC_D is driven low. The low TC_D from the tens counter, which comes 30 seconds after the alarm sounds, triggers the monostable multivibrator. This drives the multivibrator output high, causing the relay to open, which provides the automatic shut-off feature after a 30-second alarm period. The period of the multivibrator, determined by the resistor/capacitor combination, is not critical as long as it is sufficient to allow the relay to open.

Push-button switches, debounced by NAND gates, are provided to permit setting the two counters individually. These are wired so as to hold the Set lines normally low to prevent spurious clocking when changing modes. Mode control is provided by an R-S flip-flop circuit controlled by contacts on the push-on/push-off mode switch. The mode-control signals, which are active high, are thus guaranteed to be complementary.

Construction

The timer is constructed in two units so as to fit a relatively compact enclosure, as indicated by the Main board/Aux. board divisions on the schematic diagram (Fig. 7). The main circuit board, shown in Fig. 8, includes the clock, the counters, the alarm gating, and the Timer indicator LED. The auxiliary circuit board, shown in Fig. 9, includes the control switches, the digital display, the piezo sounder, the battery pack, and the voltage regulator. These two boards are interconnected by means of a 16-conductor flat cable through J1/P1 and a 2-conductor cable through J2/P2. Though indicated together on the schematic, the decoupling capacitors (C5, C6, and C7) are spread out along the IC power bus.

I housed the timer in a black plastic case I chanced

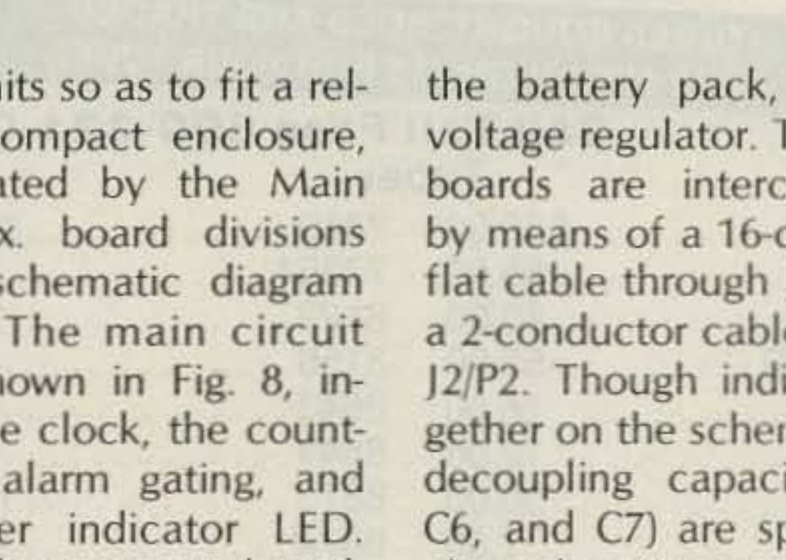
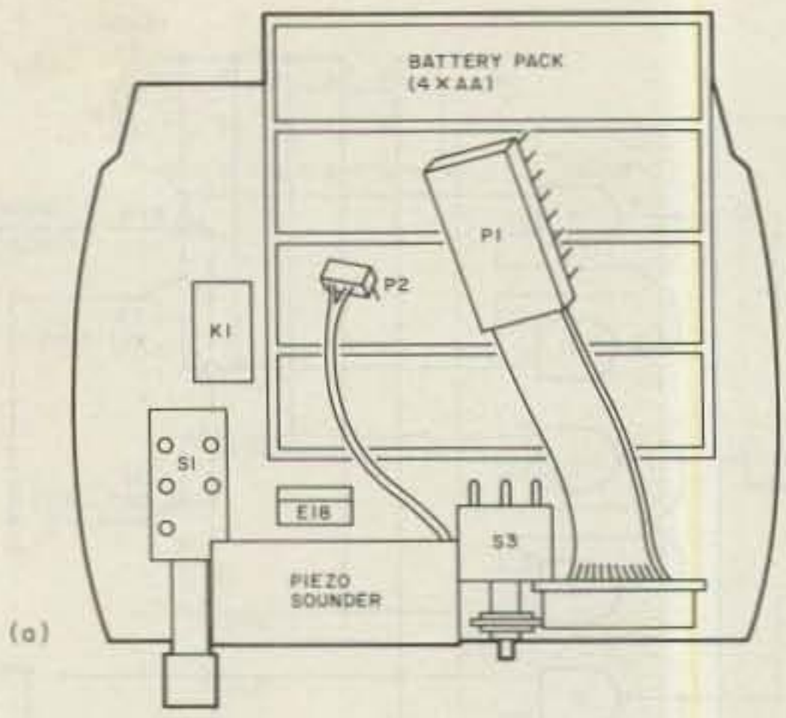


Fig. 8. Main circuit-board layout.



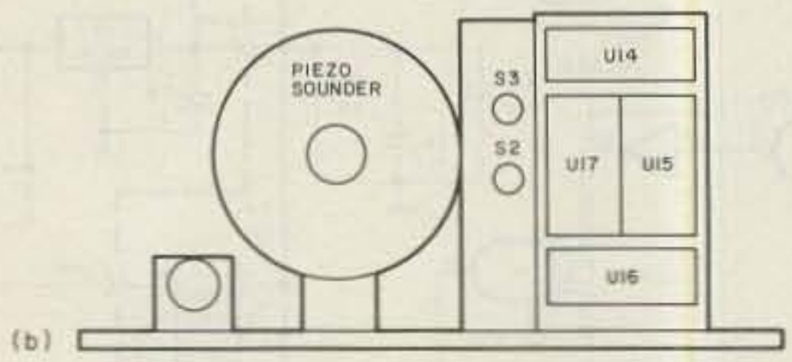


Fig. 9. Auxiliary circuit-board layout.

upon in a local surplus-electronics store, which is the reason for the strange shape of the circuit boards. The front panel is a red Plexiglas™ sheet through which the display is clearly visible. The controls have been arranged on the left side so that a left-handed cook can operate the timer without blocking the view of the display. The completed timer is shown in Fig. 10.

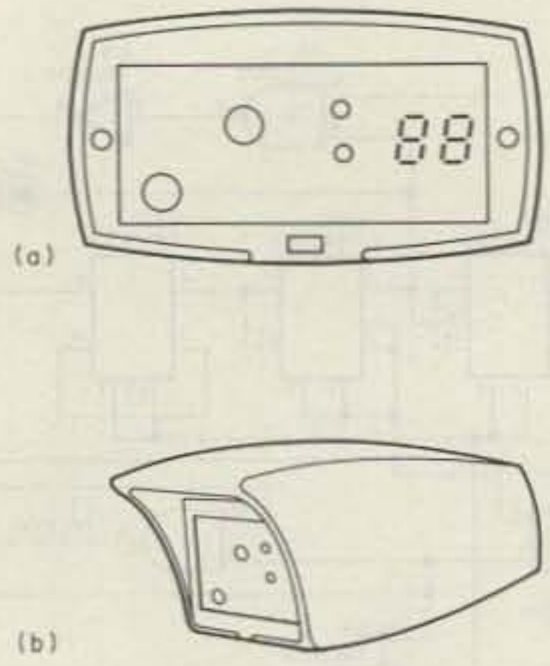


Fig. 10. Kitchen-timer views.

Conclusion

The timer has proven to be quite convenient to use. Pressing the mode switch latches the timer in the Set mode, allowing the user to clock the display up to the desired setting using the Set push-buttons. Setting the timer beyond its upper limit of 60 minutes returns it to zero, so setting errors can be corrected. Pressing the mode switch a second time releases it and places the timer in the Timer mode. A flashing LED indicates that the timer is functioning in this mode. The LED display is visible for a distance of 20 feet, except in very bright light. When the display reaches zero, an alarm sounds for 30 seconds, then the timer automatically turns off. The alarm is audible for a distance of 50 feet through several rooms in a house with carpeted floors.

Current drain from fresh batteries was measured as less than 150 mA, so battery operation is practical for occasional use. I have found it necessary, though, to install an ac adapter because my children like to play with Mom's kitchen timer—which suggests ideas for next Christmas! ■

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Ham Over Fist

Here's a VIC-20 CW program with a twist: Its real-time display lets you watch your dits and dahs dance across the screen. But be forewarned—you may not like what you see!

```
10 REM      CW BANNER PROGRAM.....VIC-20 VERSION
20 REM
30 REM      BY DENNIS C. FAIT
40 REM      PO BOX 22
50 REM      SLIPPERY ROCK,PA
60 REM
70 REM
80 PRINT "{CLR}"
90 REM RESERVE SPACE FOR MACHINE LANGUAGE PROGRAM
100 REM AND CHARACTER GENERATOR
110 POKE 52,26:POKE 56,24
120 REM TURN UP VOLUME
130 POKE 36878,15
140 REM FILL ONE LINE ON SCREEN
150 PRINT "{10 DOWN}@ABCDEFGHIJKLMNOPQRSTU"
160 REM PUT CHARACTER GENERATOR AT 7168D
170 POKE 36869,255
180 REM CLEAR CHARACTER GENERATOR WITH NULLS
190 FOR X=7168 TO 7679:POKE X,0:NEXT
200 AD=6630:REM BEGINNING ADDRESS OF ML PROGRAM
210 READ B:IF B=999 THEN SYS 6630
220 POKE AD,B:AD=AD+1
230 GOTO 210
240 REM
250 REM
260 DATA 32,91,26,162,8,160,23,136,240,47
270 DATA 189,0,28,24,42,144,20,32,73,26
280 DATA 189,0,28,56,42,157,0,28,32,82
290 DATA 26,32,82,26,76,237,25,32,73,26
300 DATA 189,0,28,24,42,157,0,28,32,82
310 DATA 26,32,82,26,76,237,25,32,106,26
320 DATA 173,9,144,201,255,208,16,173,176,28
330 DATA 56,42,141,176,28,169,225,141,12,144
340 DATA 76,230,25,173,176,28,24,42,141,176
350 DATA 28,169,127,141,12,144,76,230,25,202
360 DATA 202,202,202,202,202,202,202,96,232,232
370 DATA 232,232,232,232,232,232,96,32,159,255
380 DATA 32,228,255,201,0,240,3,141,105,26
390 DATA 96,0,138,72,152,72,174,105,26,160
400 DATA 255,136,208,253,202,208,248,104,168,104
410 DATA 170,96
420 DATA 999
430 END
```

Listing 1. VIC-20 Basic-language CW Banner program. The program initializes the screen and various memory pointers and nulls the new character-generator table before poking the machine-language program into memory. Execution is then transferred to the machine-language program.

Did you ever wonder just what your CW fist sounds like? I'm sure some of you have had a friend tape-record your signal from the air, but have you ever *seen* your fist? ("Why, of course," you answer. "Now do you want to *feel* my fist?")

Before you get hostile, please let me explain the little program in this article.

My CW Banner program is written for the unexpanded Commodore VIC-20 computer and will display on your television screen the dots and dashes received by your HF rig. As a bonus, it will do it in high-resolution graphics.

What you'll see when you run this program is a series of dots and dashes appearing on the right side of the screen and smoothly moving across the screen to the left side. As more elements appear on the right, older elements will disappear on the left. And that isn't all: The VIC will also beep the television audio in time with the dots and dashes.

This program can be a useful tool also for deaf hams who still want to work with dots and dashes and for displaying other TTL signals (with certain timing re-

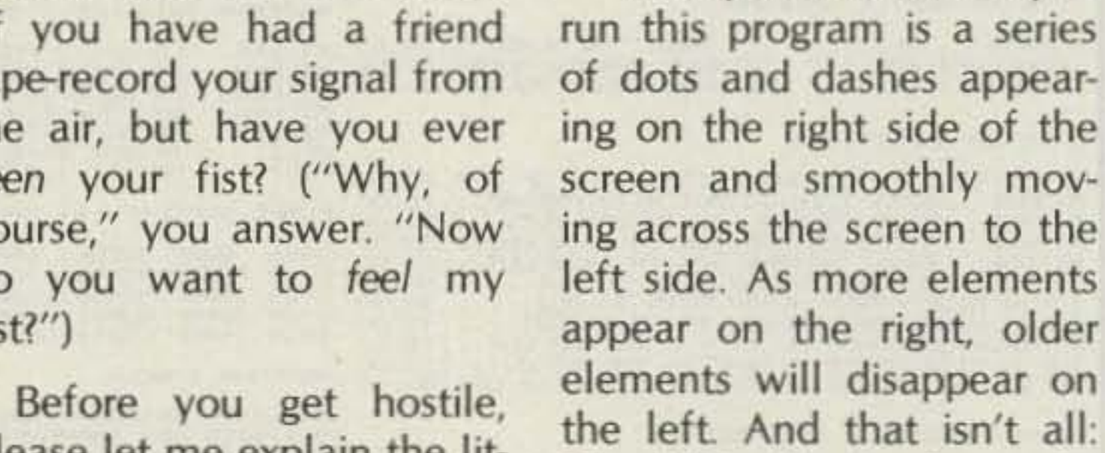

Fig. 1. Example of how the first byte of each 8-byte character definition in the character generator is modified to roll dots and dashes to the left.

straints on the top end).

Fist still curled, you ask, "Well, how do we do all of that?"

I'm glad you asked.

Program Explained

To get the resolution we want from the VIC, we must change its character-generator pointer to point to RAM instead of ROM and then dynamically change what is in that RAM to define the dots and dashes we wish to see.

The ROM character-generator table contains eight bytes for each character that the VIC is capable of displaying. Each of the eight bytes defines one line of eight pixels in the 8 × 8 character grid. The table begins with the @ character and then continues with the alphabet, numerics, and graphic characters.

All we need to do is redefine one line in each of the first 22 characters in the RAM character generator (@ through U), setting a bit if a CW signal is present and resetting it if there is no signal.

Take a look at (a) in Fig. 1. This represents a simplified screen only three characters wide which I'll use to explain what the program does. Our three characters on the screen are @, A, and B. The program looks at the most significant bit (MSB) of byte 2. If it is low (1), then it resets the least significant bit (LSB) of byte 3 (2). If byte 2's MSB is high, then the LSB of byte 3 is set. In either case, the byte is then rotated one bit to the left and poked back into the character-generator table in RAM. The program then skips to the next byte, byte 1, and does the same thing (4 and 5). The POTY pin of the joystick port is then checked for a signal. If it is low (indicating a signal is present), the LSB of byte 1 is set, otherwise it is reset (6 and 7). Byte 1 is rotated left and poked.

I should remind you that the bytes we're messing with above are the first of the eight bytes that define each character. The other seven bytes were previously nulled by the Basic program and are not used. They remain transparent so that the only things visible are the dots and dashes that are defined by the first byte.

In Fig. 1, (b) shows the screen after the dots and dashes have been moved to the left by one pixel.

```
*** PASS ONE ***


*** PASS TWO ***
0000            0010 * FILENAME--> CWBANNER.S
0000            0020 *
0000            0030 *
0000            0040 * CW BANNER PROGRAM FOR VIC-20
0000            0050 *
0000            0060 * BY DENNIS C. FAIT
0000            0070 * PO BOX 22
0000            0080 * SLIPPERY ROCK, PA. 16057
0000            0090 *
0000            0100 * The following assembled object code is contained within
0000            0110 * the DATA lines of the accompanying BASIC program.
0000            0120 *
0000            0130 *
0000            0140 CHARGEN    EQU   $1C00     ;CHAR GENERATOR RAM
0000            0150 LASTCHAR   EQU   $1CB0     ;LAST CHAR USED IN CHARGEN
0000            0160 SCNKEY     EQU   $FF9F
0000            0170 GETIN      EQU   $FFE4
0000            0180 TONE3      EQU   36876     ;SOPRANO TONE ADDRESS
0000            0190 POTY       EQU   $9009     ;POT Y ADDRESS
0000            0200 *
19E6            0210            ORG   $19E6
19E6            0220 *
19E6  20 5B 1A  0230 BEGIN      JSR   GETDELAY
19E9  A2 08     0240            LDXI  $8        ;INITIAL OFFSET
19EB  A0 17     0250            LDYI  $17       ;DO FOR 22 CHARS
19ED  88        0260 START      DEY             ;DECR. CHAR COUNTER
19EE  F0 2F     0270            BEQ   RITECHAR
19F0  BD 00 1C  0280            LDAX  CHARGEN   ;GET CHAR SPECS.
19F3  18        0290            CLC
19F4  2A        0300            ROLA            ;ROTATE MSB7 INTO CARRY
19F5  90 14     0310            BCC   RESETBIT  ;IF CARRY CLEAR GOTO
19F7  20 49 1A  0320 SETBIT     JSR   DEC
19FA  BD 00 1C  0330            LDAX  CHARGEN   ;GET CHAR TO LEFT
19FD  38        0340            SEC
19FE  2A        0350            ROLA            ;SET BIT 0 IN LEFT CHAR
19FF  9D 00 1C  0360            STAX  CHARGEN   ;AND POKE NEW CHAR AT LEFT
1A02  20 52 1A  0370            JSR   INC
1A05  20 52 1A  0380            JSR   INC
1A08  4C ED 19  0390            JMP   START
1A0B  20 49 1A  0400 RESETBIT   JSR   DEC
1A0E  BD 00 1C  0410            LDAX  CHARGEN
1A11  18        0420            CLC
1A12  2A        0430            ROLA            ;RESET BIT 0 IN LEFT CHAR
1A13  9D 00 1C  0440            STAX  CHARGEN   ;AND POKE IT
1A16  20 52 1A  0450            JSR   INC
1A19  20 52 1A  0460            JSR   INC
1A1C  4C ED 19  0470            JMP   START
1A1F  20 6A 1A  0480 RITECHAR   JSR   DELAY
1A22  AD 09 90  0490            LDA   POTY      ;GET PORT DATA
1A25  C9 FF     0500            CMPI  $FF       ;FF IF SIGNAL PRESENT
1A27  D0 10     0510            BNE   RITE1
1A29  AD B0 1C  0520            LDA   LASTCHAR
1A2C  38        0530            SEC
1A2D  2A        0540            ROLA
1A2E  8D B0 1C  0550            STA   LASTCHAR
1A31  A9 E1     0560            LDAI  $E1
1A33  8D 0C 90  0570            STA   TONE3     ;TURN ON TONE
1A36  4C E6 19  0580            JMP   BEGIN
1A39  AD B0 1C  0590 RITE1      LDA   LASTCHAR
1A3C  18        0600            CLC
1A3D  2A        0610            ROLA
1A3E  8D B0 1C  0620            STA   LASTCHAR
1A41  A9 7F     0630            LDAI  $7F
1A43  8D 0C 90  0640            STA   TONE3     ;TURN OFF TONE
1A46  4C E6 19  0650            JMP   BEGIN
1A49  CA        0660 DEC        DEX
1A4A  CA        0670            DEX
1A4B  CA        0680            DEX
1A4C  CA        0690            DEX
1A4D  CA        0700            DEX
1A4E  CA        0710            DEX
1A4F  CA        0720            DEX
1A50  CA        0730            DEX
1A51  60        0740            RTS
1A52  E8        0750 INC        INX
1A53  E8        0760            INX
1A54  E8        0770            INX
1A55  E8        0780            INX
1A56  E8        0790            INX
1A57  E8        0800            INX
1A58  E8        0810            INX
1A59  E8        0820            INX
1A5A  60        0830            RTS
1A5B            0840 *
1A5B  20 9F FF  0850 GETDELAY   JSR   SCNKEY    ;SCAN KEYBOARD
1A5E  20 E4 FF  0860            JSR   GETIN     ;GET CHAR
1A61  C9 00     0870            CMPI  0         ;NULL?
1A63  F0 03     0880            BEQ   GTDY1     ;YES
1A65  8D 69 1A  0890            STA   DELAYVAL  ;ELSE SAVE IT HERE
1A68  60        0900 GTDY1      RTS
1A69            0910 *
1A69            0920 DELAYVAL   DB    0         ;STORE DELAY VALUE HERE
1A69  00
1A6A            0930 *
1A6A  8A        0940 DELAY      TXA             ;PUT X INTO A
1A6B  48        0950            PHA             ;PUSH A
1A6C  98        0960            TYA             ;PUT Y INTO A
1A6D  48        0970            PHA             ;PUSH A
1A6E  AE 69 1A  0980            LDX   DELAYVAL  ;GET DELAY VALUE INTO X
1A71  A0 FF     0990 DELY1      LDYI  $FF       ;INIT Y DELAY VALUE
1A73  88        1000 DELY2      DEY
1A74  D0 FD     1010            BNE   DELY2
1A76  CA        1020            DEX
1A77  D0 F8     1030            BNE   DELY1
1A79  68        1040            PLA             ;POP A
1A7A  A8        1050            TAY             ;A INTO Y
1A7B  68        1060            PLA             ;POP A
1A7C  AA        1070            TAX             ;A INTO X
1A7D  60        1080            RTS
```

Listing 2. The object code produced by this program is contained within the DATA lines of the program in Listing 1. Mnemonics used in this listing are a modified form of those commonly used. (The "I" attached to some of the above mnemonics (LDXI, for example) means "immediate." ROLA means "rotate the contents of the accumulator left one bit," as opposed to ROLX, which does the same to the X register.)

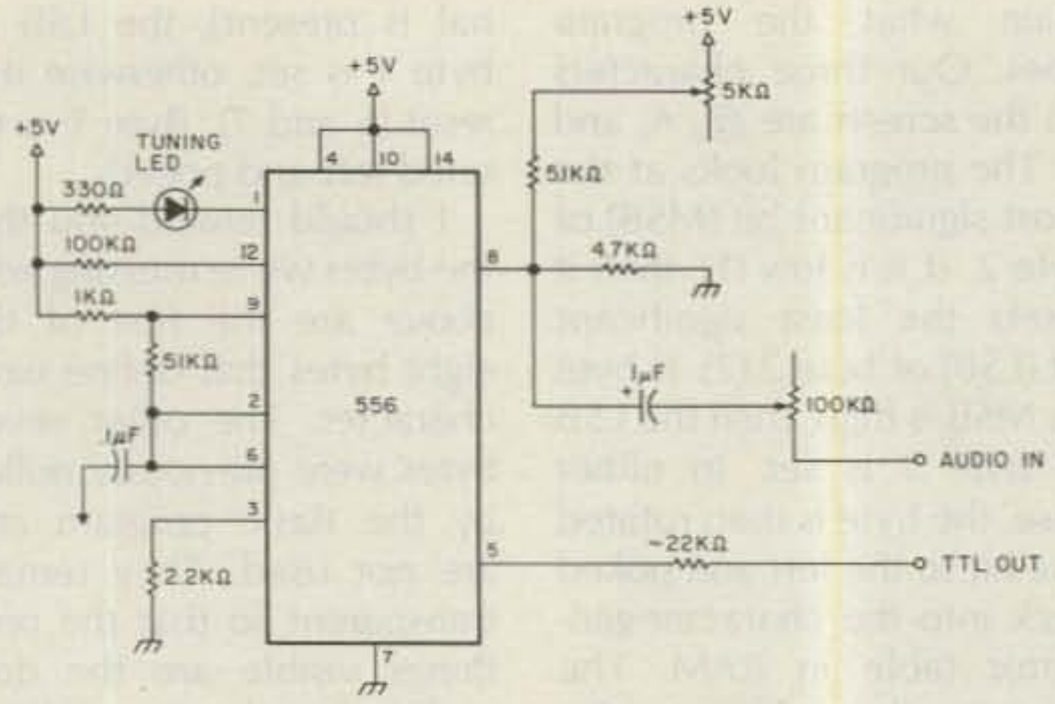

Fig. 2. Usable interface for converting your HF rig's audio to a TTL signal for the VIC-20. Do not omit the 22k resistor at the output.

In addition to redefining our 22 characters, the program will turn the audio on and off (see lines 560, 570, 640, and 650 in the assembly listing). This is an advantage if your rig's audio is muted or disappears because you have stuck a patch cord into the headset/external speaker jack.

One other desirable feature included is the ability to vary the speed of the characters moving across the screen. All you need to do is touch any of the keys on the keyboard to affect the speed. The letter keys are among the slowest, while RETURN and RUN/STOP are the fastest. The faster the code is coming from the rig, the faster you'll want the display to move; otherwise, the dots and dashes will be very short and hard to see. However, the slower the display speed, the more dots and dashes that can be displayed on the screen at one time.

The Basic program (Listing 1) does the following:

- In line 110, a part of RAM is reserved for the machine-language program. Line 170 turns up the sound. Then in line 150, twenty-two characters are printed across the screen. These are the characters which will be redefined as dots and dashes.
- Next, in line 170, the character-generator table is moved to RAM and line 190 fills the table with zeros.
- Last, lines 210-230 poke the machine-language program into memory and then transfer control to that program.

Hardware Required

The program as written may not be compatible with Kantronics' hardware. But changing the value of POTY in line 190 of the assembly listing to the input address that Kantronics uses and (if necessary) the logic used in the RITECHAR routine beginning at line 480 should do the trick.

For those of us who like to go our own way, Fig. 2 is the circuit I'm using to convert the rig's audio to the +5/0-volt signal that the VIC requires. Be sure to include the 22k-Ohm resistor in series (as shown) between this circuit and the VIC.

Kudos

I'd like to thank Skeeter N3HB for the original idea for the CW Banner project. His was written for a homebrew 6800 machine. I wrote the 6502 version for the VIC after gaining experience writing one for an 8085/TMS9918A home brew. ■

✓ See List of Advertisers on page 88

Paul Terwilliger KB2WM
54 Derry St.
Merrimack NH 03054

Homemade Defroster Shutoff

This simple gadget has nothing to do with amateur radio, but it's a neat little project anyway.

Is your car equipped with an electric rear-window defroster grid? Have you ever turned it on and forgotten about it until several days later? No? then don't bother reading any further.

Being somewhat absent-minded, this problem has been with me for years. I finally became motivated to build some type of automatic shut-off circuit when I purchased a new car. This car had a factory-installed defroster that was controlled by an on/off switch without a shut-off feature, and I felt my new "toy" deserved better than that. The original control scheme is shown in Fig. 1.

My old car was equipped with a fan that cleared the rear window by blowing the car interior's air at it. Marginal performance and a desire to mount a hi-fi speaker in its place had resulted in replacing the fan with a stick-on grid defroster. This after-market unit did not have a relay to control the defroster power; all the current flows directly through the switch.

Since I had decided to build a timer circuit, it seemed a good idea to install a similar design for this after-market, relay-less defroster.

As a first step, several design goals for the timer were developed. (1) The existing defroster was not to be altered, other than to cut wires. (2) There was to be no power consumption when the power-control switch was off. (3) The existing pilot light should indicate when power was applied to the defroster grid. (4) It should be possible to reset or turn off the defroster timer at any time. (5) The circuit should be able to cope with power-supply variations and noise.

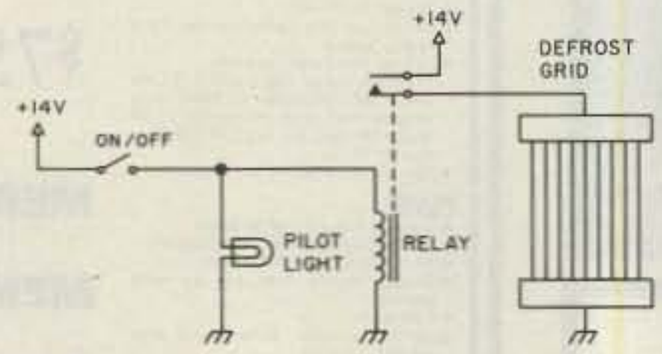

Fig. 1. The existing defroster circuit.

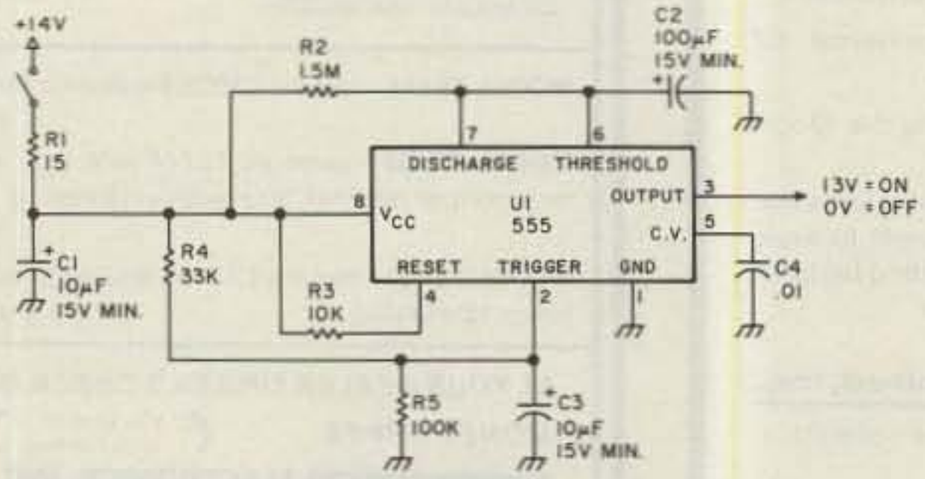

Fig. 2. Schematic of the timer circuit.

Circuit Description

Fig. 2 shows the circuit that evolved from the design goals. A 555 timer chip was chosen as the control element. R2 and C2 are the timing components. The values shown produce an on-time of approximately four minutes. This has proven to be adequate for most situations. Increasing the value of R2 will increase the on-time, and vice versa. The relationship between R2 and the on-time is roughly linear: doubling R2 doubles the on-time.

I have shown power-supply connections as going to +14 V. These connections are really to the positive side of the car's battery, and the voltage may not be exactly 14. The circuit will function over a wide range of supply voltages, however, so this is not a problem.

The 555 is triggered by a low voltage (less than one third the supply) at pin 2. C3 and R4 ensure a low voltage at pin 2 for a fraction of a second after power is applied. R5 guarantees a rapid discharge of C3 when power is removed, allowing the circuit to be reset and restarted quickly. R1 and C1 are a simple supply filter. The output of the 555 (pin 3) will be at zero volts when off (or when power is removed) and at about one volt less than the supply voltage when on.

There are at least three ways to configure the defroster drive circuit (R6, Q1, B1, K1). Figs. 3(a), 3(b), and 4 show the choices. With the circuit of Fig. 3(a), the exact timer output voltage does not make much difference; the key is to drive Q1 into saturation. When Q1 is saturated, its collector-to-emitter voltage is very small, so the voltage applied to the relay and indicator light is nearly the supply voltage. In addition, power dissipation in the transistor will be minimized.

If the circuit of Fig. 3(b) is used, Q1 will not be driven into saturation but will act like a large-signal emitter follower. Available drive for the relay will be about 2 volts less than the supply voltage due to the base-emitter drop across Q1, the drop in R6, and the limited maximum voltage at the 555 output. Power dissipation in Q1 will be increased be-

cause of increased collector-to-emitter voltage.

I recommend using the circuit of Fig. 3(a) when possible, but when the connections to the relay coil are difficult to access, it may be easier to use the configuration of Fig. 3(b).

Use Without a Relay

Due to the high current in most grid-type defrosters (10 Amperes or more), it is not advisable to drive the defroster directly with this circuit. If it is desired to eliminate the relay, the circuit shown in Fig. 4 may be employed. The added transistor, Q2, is to boost the current applied to the base of Q1 to ensure that it is saturated (minimum power dissipation). Q1 still may dissipate several Watts, so a heat sink should be used.

Construction

Layout and construction style are not critical. I chose to use a small piece of punched phenolic board for the timer and point-to-point wiring.

R2 and C2 are the only components with somewhat critical values. Most other components can be of whatever values exist in your junk box. Every one of the timers I have constructed used different component values! Just make sure Q1 will saturate and that the potential on pin 2 of the 555 will rise above 5 volts after C3 charges.

Installation

Finding a convenient location for the timer may be the most difficult part of the project, especially if a factory-installed defroster and switch are to be modified. There is usually very little extra space behind the dashboard, and Murphy's Law says that if there is extra space it will be located so as to be least useful.

If a relay is not used, an acceptable solution might be to mount the timer right at the defroster grid's terminals or just on the other side of whatever hole the wires go through. Since the circuit can be made reasonably small, it might not be objectionable if left in the open.

After-market add-on defrosters should make for an easier job. There is probably enough room near the switch to install the circuit.

Many defroster switches have an indicator light incorporated into the same package. A suggested method for using this type of switch/light combination is shown in Fig. 5.

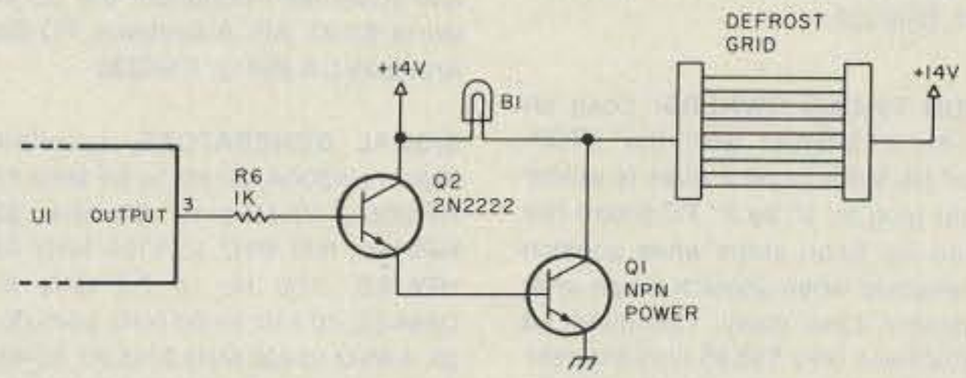

Fig. 4. Output circuit for a relay-less system.

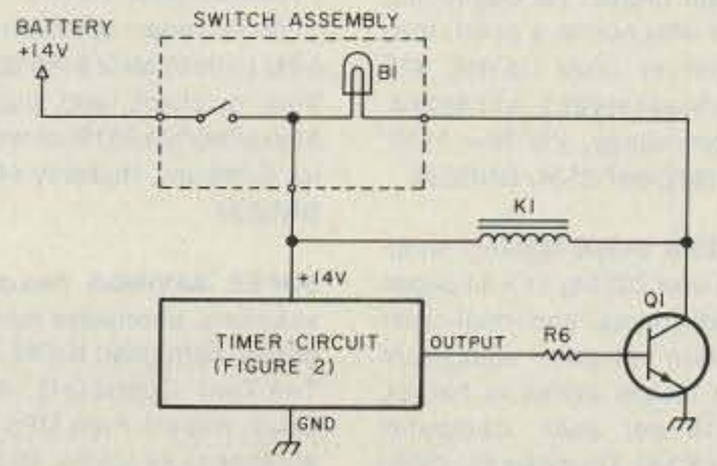

Fig. 5. Taking advantage of a combined switch/light assembly.

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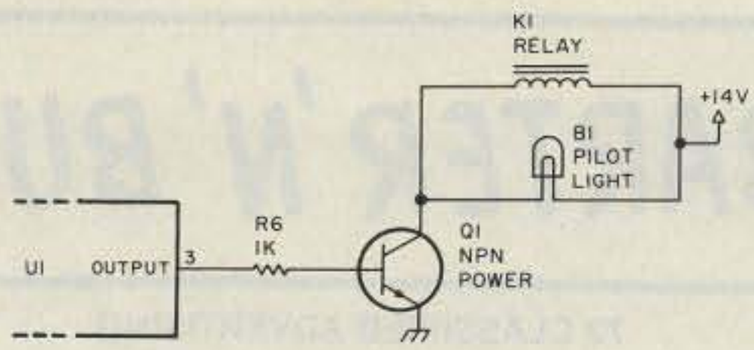

Fig. 3(a). Preferred output circuit.

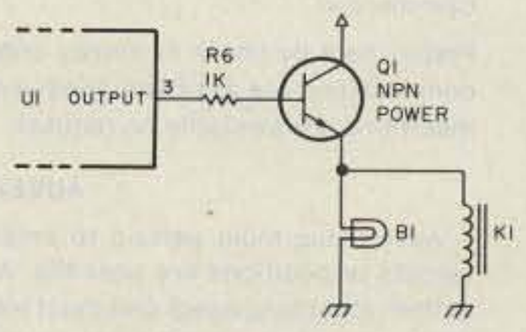

Fig. 3(b). Alternative output circuit for use when relay is hard to access.

As with any electronics, care should be taken to install the circuit so that it will not accidentally contact metal and short out. I chose to let the circuit be supported by its connecting wires and insulated it by wrapping it in several layers of electrical tape.

Final Comments

All three timer circuits have been tested in my cars. Although the timer chip I used (an NE555) is rated for the "commercial" temperature range—zero to 70 degrees centigrade—the circuit still worked well when temperatures dropped to about minus 15° C. A military temperature range (−55° to +125° C) version, an SE555 for example, would increase low-temperature reliability, but I have not been able to locate a source for this version. ■

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SIGNAL GENERATORS, excellent lab-tested HP606A, 50 Hz to 65 MHz $375.00; HP-608C, 10 MHz to 480 MHz $345.00; HP614A, 900 MHz to 2100 MHz $345.00; HP618B, 3.80 Hz to 7.6 GHz $375.00; URM-2S, 10 kHz to 50 MHz $245.00; URM-26, 4 MHz to 400 MHz $245.00; TS-497/URR, 2 MHz to 400 MHz $185.00; Jerrold 900C sweep generator, 500 kHz to 1200 MHz $345.00; military SG-3/URM-70 FM signal generator, 50 MHz to 400 MHz $285.00; HP8708A synchronizer $325.00; TS-148/UPM-33 radar spectrum analyzer, 8470 MHz to 9630 MHz $185.00. We accept M/C, Visa, or check; add shipping. Phone Bill Slep (704)-524-7519; or write Slep Electronics Company, Highway 441, Otto NC 28763. BNB234

SUPER SAVINGS Bearcat and Regency scanners, shortwave receivers and accessories, ham gear: ICOM, Kenwood, Yaesu, Ten-Tec, Cushcraft, MFJ. Antennas, Coax, more!! Free UPS shipping and insurance to 48 states. 25-page picture catalog $1.00 (refundable). Galaxy Electronics, Box 1202, Akron OH 44309; (216)-376-2402 9–5 EST. BNB235

HAM HELP

I am seeking technical assistance in modifying the TX/RX switching speed of a Yaesu FT-101ZD for use on AMTOR.

Daniel Murray WA7YIC
1541 Oxbow Circle RR #11
Billings MT 59101

I need car license plates with ham calls for my collection. I collect used plates from any state. I will gladly pay for the mailings—surface please. Addresses where I can get plates would also help.

Wilhelm Johannes YD2DKL
Pandega Duta III-17
Yogyakarta, Indonesia
(274) 2341

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
6 Jenny Lane
Pikesville MD 21208

Chalk up another victory for the pirates. Calm down Pittsburgh, not the ones that played our Orioles a few years back, I am talking about the software variety.

I have been gently nudging my acquaintance out west, Clay Abrams, to try to adapt some of his CoCo® RTTY software to the newer versions of the TRS-80C Color Computer® and to add disk capabilities. Well, Clay has written me that, for a variety of reasons, such a version will not be forthcoming. One of the major reasons that Clay has come to this decision is that there appears to be a huge number of bootlegged copies of his tape-based programs in circulation. Huge, that is, when compared to the number he has sold. So Clay has come to the conclusion that it is not worth investing large amounts of time and sweat into a program only to have it circulated "freebie-style" between buddies. Flattery is nice, but it don't pay the bills.

So look for more of Clay's work not in a catalog, but in the pages of this and other magazines. By publishing what he writes, he can realize a return on his effort and make the information available to interested individuals.

As for my efforts along the same lines, I am continuing to dabble and will either publish a set of routines here (in serial fashion) or try to organize them into an article for independent publication. Stay tuned.

Along these lines, regards to Frank Fields KB0QJ who is using a CoCo under Clay's original program. Keep up the spirits, Frank. With the capabilities inherent in the CoCo, I am sure that a program will appear on the scene which will run rings around those available for other small computers.

Along the line of useful tidbits comes a letter from Ocean City, Maryland. In this vacation haven of Maryland lives Jim Conner W3HCE, an old-time RTTY buff from the "old school," as he puts it. Jim is an active amateur on the Maryland eastern shore, using a local two-meter repeater for VHF RTTY operation. He picked up the new Heathkit HD-3030 RTTY terminal interface. This $250 box is a combined terminal unit and AFSK generator, sort of a RTTY modem, which appears to have great capabilities (according to the catalog blurb). Maybe I can convince Benton Harbor to spring for some more information on it in the future.

Anyway, Jim thought that the utility of the HD-3030 would be enhanced if an interface between it and his piles of ham gear could be designed. His intent was to be able to operate either on Morse or RTTY on both the HF and VHF bands, allowing for monitoring of the signals and control of the transmitter push-to-talk (PTT) line; features which the HD-3030 lacks.

Attacking the PTT problem head on, Jim found that while the voice-operated transmit switch (VOX) on most HF transmitters allowed operation unmodified with that mode, there was no convenient way to key the PTT line on the VHF transmitter. Digging into the HD-3030 revealed that the send-receive push-button is a double-pole switch, with only one pole being used. Running a wire from the unused side of the switch to pin 23 on the DB-25 connector, an unused pin, and to ground on the other side of the switch provided a convenient added PTT switch, appropriately labeled, with minimal modification to the HD-3030 itself.

He then used a four-position, seven-pole rotary switch to select which of four modes—VHF MCW, VHF RTTY, HF CW, or HF RTTY—is to be operated. The switch used is a Centralab PA-1027, an eight-pole, five-position switch which is only partially used. You may have to try some of the larger parts jobbers in your area to find this switch. To help shield the

PARTS LIST

Cabinet		
1	Switch, rotary, Centralab PA-1027 (8 Pole, 5 Position)	
1	Cabinet	270-269
2	4-pin mike sockets	274-002
2	4-pin mike plugs	274-001
5	Phono sockets	274-346
5	Phono plugs	274-339
1	3" PM speaker	40-248
5	LEDs w/holder	276-080
1	25-pin socket (D-25)	276-1548
1	25-pin plug (D-25)	276-1547
1	Hood for D-25 plug	276-1549
1	SPDT center-off toggle switch	275-325
1	330-Ohm, 1/4-Watt resistor	271-1315
1	Knob w/indicator (for switch)	274-414
1	Knob (for volume control)	274-415
1	Ac line cord	278-1255
1	Fuse holder	276-369
1	Fuse, 1 Amp	270-1273
Power Supply		
1	Power transformer, 6.3 V, 300 mA	273-1384
4	Rectifier diodes, 1N4001	276-1101
1	Capacitor, 1000 µF, 35 V	272-1019
1	Capacitor, 10 µF, 35 V	272-1013
1	Voltage regulator, 7805, 5 V	276-1770
1	330-Ohm, 1/4-Watt resistor	271-1315
Af Amplifier		
1	Op amp, LM386 IC	276-1731
1	8-pin IC socket	276-1995
1	220-µF, 16-V capacitor	272-1029
1	0.05-µF disc capacitor	272-134
1	0.1-µF disc capacitor	272-135
1	0.01-µF disc capacitor	272-131
1	10-Ohm, 1/4-Watt resistor	271-1301
1	10k-Ohm volume control	271-1721
Af Oscillator		
2	2N2222 transistors	276-2009
1	2N3904 transistor	276-2016
2	91k-Ohm, 1/4-Watt resistors	Jameco
1	4.7k-Ohm, 1/4-Watt resistor	271-1330
1	180k-Ohm, 1/4-Watt resistor	Jameco
1	3.3k-Ohm, 1/4-Watt resistor	271-1328
1	1k-Ohm, 1/4-Watt resistor	271-1321
1	10k-Ohm, 1/4-Watt resistor	271-1335
1	5k-Ohm, PC-type potentiometer	271-217
1	10k-Ohm, PC-type potentiometer	271-218
2	0.0047-µF mylar™ capacitors	Jameco MY.0047/100

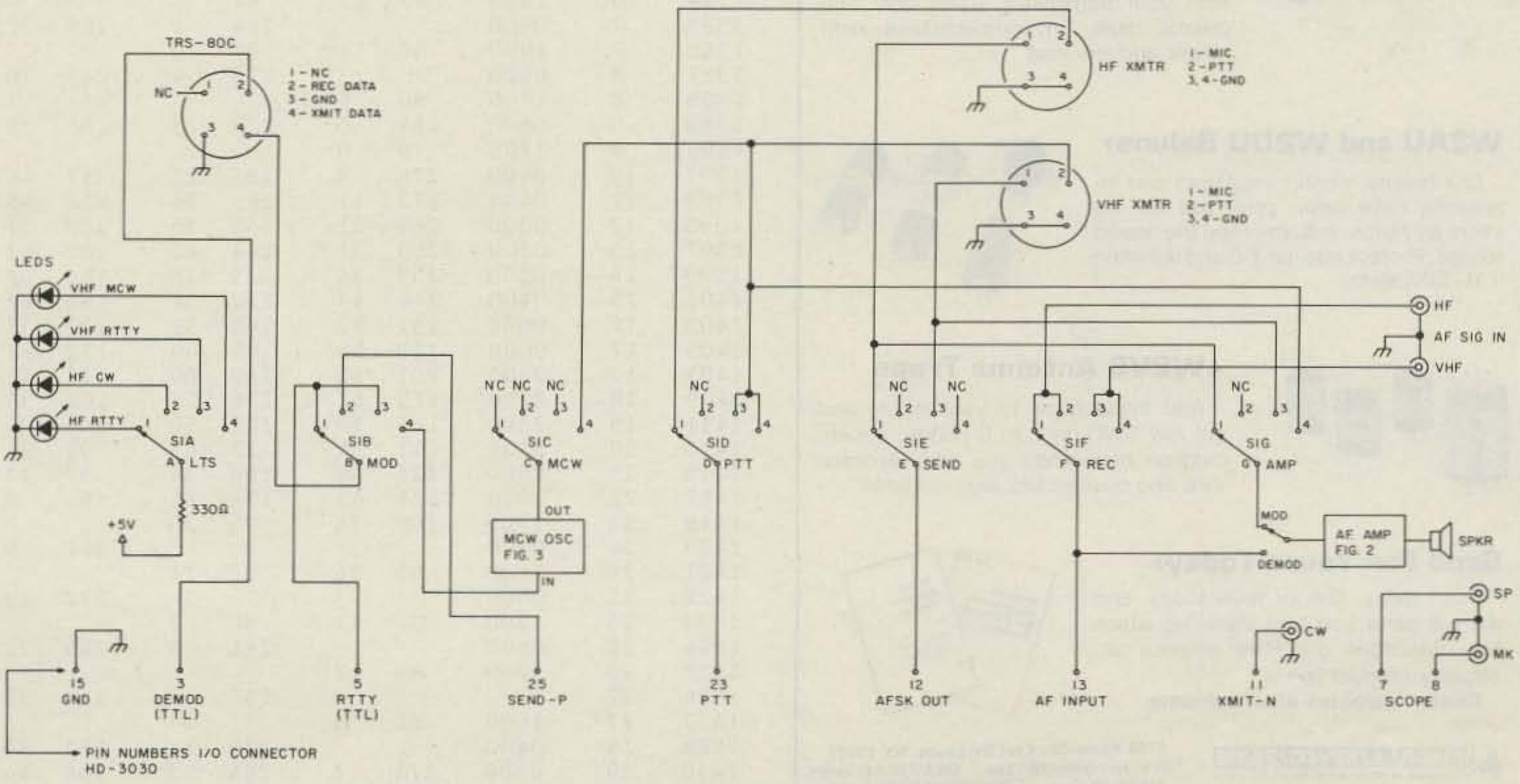


Fig. 1. HD-3030 wiring modifications.

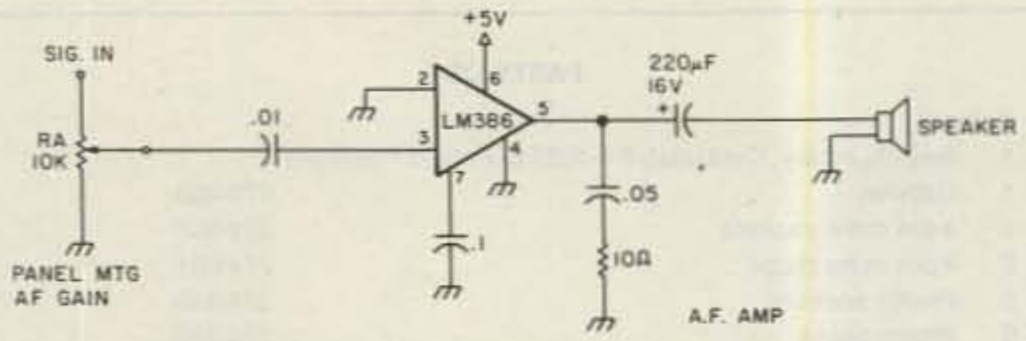


Fig. 2. This circuit adds an audio output to the HD-3030.

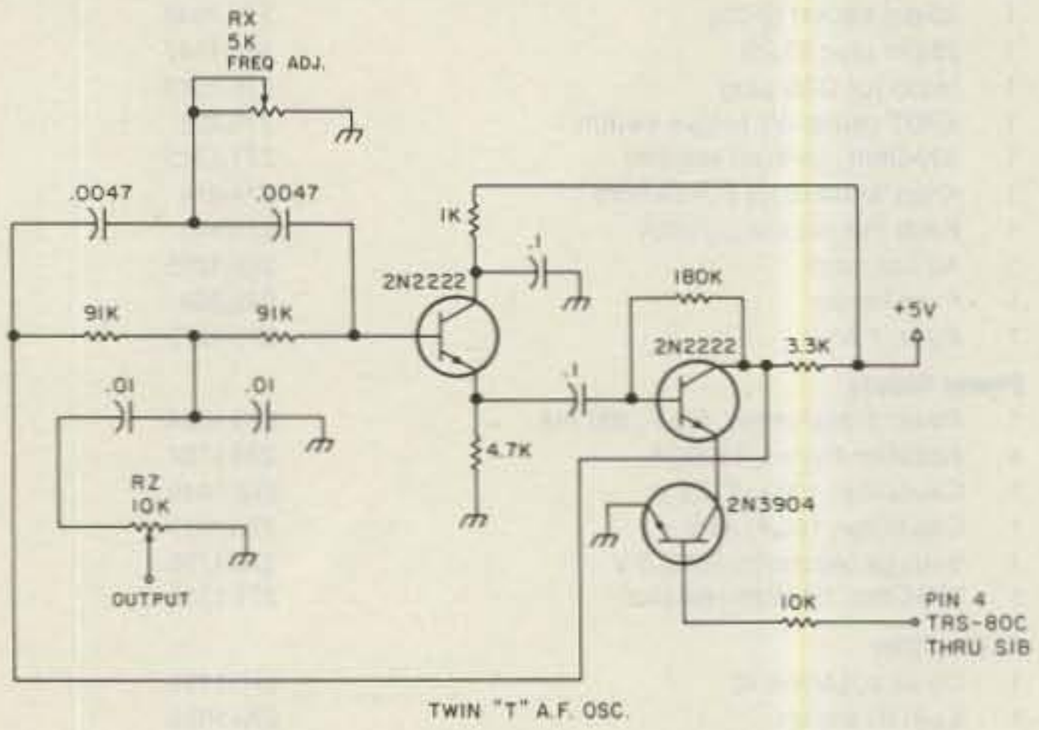


Fig. 3. A twin-T audio oscillator used to generate MCW.

cabling from floating rf, the wires between the HD-3030 and the interface box were all enclosed in a braided shield removed from an old coaxial cable. Fig. 1 shows the wiring of the main interface unit.

Several auxiliary boards were also constructed to add a few features here and there. Fig. 2 shows a small audio amplifier, based on the LM386 op amp, which is used to drive a small speaker with either the transmit or receive audio. Although the HD-3030 is able to receive modulated CW (MCW), it cannot generate this type of signal. Therefore, Jim used a classic circuit, the twin-T audio oscillator, to generate the audio waveform which the computer can turn on and off in order to transmit MCW. This circuit is shown in Fig. 3.

A rather conventional five-volt power supply runs the whole thing, and Jim's version is shown in Fig. 4. Except for the Centralab switch, all of the parts used in the interface are available from a variety of sources. The parts list gives a Radio Shack part number for all parts available there. Those few that are not carried at the

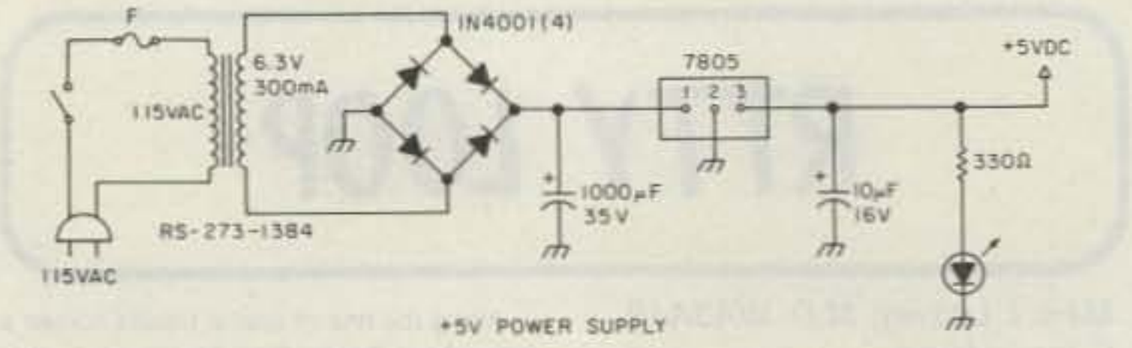


Fig. 4. An easily constructed 5-volt power supply.

Shack can be found in the Jameco catalog or on the wall of an independent electronics store. It would appear that even if you live in the middle of nowhere, you should be able to obtain the parts by mail order.

Jim drives the HD-3030 and his RTTY station with a program running on a TRS-80C. He did not specify which program he uses, but I would not doubt if it is Clay Abrams' NEWRTTY that we talked about earlier. Well, Jim, this looks like a very fine piece of work, and I am sure that the crowd appreciates your sharing it with us.

For those of you who have been looking for RTTY mailboxes, the coming months' "RTTY Loops" will be just the ticket. I have received quite a few listings and will put them all together for your enjoyment. I will also have the usual December shopping spree, a feature I know you enjoy by your comments. Also, the first four issues of "RTTY Loop" extracts remain available. Send $2.00 for each issue desired with a self-addressed, stamped envelope for each issue to the above address. If you would like a listing of what's available, just send the SASE. I especially appreciate all the nice comments I have been receiving lately, particularly those which say that when the new *73* arrives, the first place you turn is back here, to "RTTY Loop!"

SATELLITES

USING THE AO-10 APOGEE PREDICTIONS

Apogee predictions for the month of November are provided for three sections of the United States: Washington DC at 39N 77W, Kansas at 39N 95W, and California at 38N 122W. Times are in UTC and apogee in this case is mean anomaly 128 rounded to the nearest whole hour. Use the chart as a guide in aiming your antenna, then fine-tune the azimuth and elevation values to peak the satellite's beacon signal. If you require more accurate orbital predictions, contact AMSAT at PO Box 27, Washington DC 20044.

			WASH		KANSAS		CALIF	
ORBIT	DAY	TIME	AZ	EL	AZ	EL	AZ	EL
1374	1	2200	140	59	115	46	93	24
1376	2	2100	122	52	104	37	85	15
1378	3	2100	118	46	102	31	84	9
1380	4	2000	107	38	93	23	77	1
1381	5	0800					280	3
1382	5	1900	97	29	85	14		
1383	6	0700					274	13
1384	6	1900	95	23	84	8		
1385	7	0600			284	1	269	22
1386	7	1800	87	14	77	0		
1387	8	0600			279	4	263	26
1388	8	1700	80	6				
1389	9	0500	284	0	273	13	256	36
1390	9	1700	79	0				
1391	10	0400	278	8	267	23	247	46
1393	11	0400	273	11	261	26	238	48
1395	12	0300	267	21	253	36	223	57
1397	13	0200	260	31	244	45	202	63
1399	14	0200	253	34	235	48	188	62
1401	15	0100	244	43	220	56	161	62
1403	16	0000	231	52	198	62	137	57
1405	17	0000	221	54	185	60	132	57
1407	17	2300	201	60	160	60	117	44
1409	18	2200	175	62	138	56	105	36
1411	19	2200	164	59	132	50	104	30
1413	20	2100	141	55	117	43	95	21
1415	21	2000	124	49	106	34	87	12
1417	22	2000	121	43	104	28	86	6
1419	23	1900	109	35	95	20		
1420	24	0600					277	9
1421	24	1800	99	26	87	11		
1422	25	0600					272	12
1423	25	1700	91	17	80	3		
1424	26	0500			281	0	265	22
1425	26	1700	89	12				
1426	27				257	9	258	32
1427	27	1600	82	3				
1428	28	0400			270	12	252	34
1430	29	0300	275	7	264	22	242	44
1432	30	0200	269	17	256	32	229	53

SPECIAL EVENTS

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received by 73 Magazine *by the first of the month, two months prior to the month in which the event takes place. Mail to Editorial Offices,* 73 Magazine, *Pine St., Peterborough NH 03458.*

ALBUQUERQUE NM
NOV 3

The UNM ARC and the Westside ARC will jointly sponsor a tailgate swapfest on November 3, 1984, from 10:00 am to 2:00 pm MST, on the UNM North Campus parking lot, corner of University Boulevard and Tucker Avenue, Albuquerque NM. Admission is free; bring your own tables as none will be furnished. Talk-in on 147.75/147.15 MHz and 449.3/444.3 repeaters. For further information, send an SASE to Gary Bonebrake K8BI, 974 Arkansas SE, Rio Rancho NM 87124, Robert Scupp WB5YYX, 648 Marquis Drive NE, Albuquerque NM 87123, or Jay Miller WA5WHN, 4613 Jupiter NW, Albuquerque NM 87107, or via 3.939 MHz, 0100 UTC daily.

SOUTH GREENSBURG PA
NOV 3

The Foothills ARC will hold its sixteenth annual hamfest on Saturday, November 3, 1984, at St. Bruno's Church, South Greensburg PA. Tickets are $2.00 each or 3 for $5.00; indoor flea-market tables are $5.00. Refreshments and food will be available. Talk-in on 147.78/.18. For further information, advance tickets, or tables, contact Ronald Naviglia WA3HOL, or write FARC, PO Box 236, Greensburg PA 15601.

SELLERSVILLE PA
NOV 4

The R. F. Hill Amateur Radio Club will hold its annual indoor Winterfest on Sunday, November 4, 1984, beginning at 8:00 am, at the Sellersville National Guard Armory (located approximately 5 miles from the Pennridge Airport, halfway between Philadelphia and Allentown, near the junction of PA Routes 309 and 563), Sellersville PA. Entry is $2.00 and non-ham spouse and children are admitted free when accompanied by a paying ham. Indoor spaces (6' × 6') are $6.00 each and outdoor spaces (1 parking-space-width frontage) are $4.00 each. The purchaser of vendor space will receive a single admission and must supply his own table. Food will be available on the premises and restaurants are nearby. Talk-in on 145.19(R), 148.88(R), and 146.52 (simplex). For vendor-space reservations, write PO Box 29, Colmar PA 18915, or phone (215)-721-0278 (call will be returned collect during the evening). Because there is no discount for advance purchase of entry, buyers are encouraged to purchase admission at the gate.

GRAYSLAKE IL
NOV 4

The Waukegan Civil Air Patrol will hold its 4th annual hamfest on Sunday, November 4, 1984, from 0700 to 1700, at Lake County Fairgrounds, Rtes. 45 and 120, Grayslake IL. Admission is $3.00 and tables are $5.00. For further information and reservations, send an SASE to CAP, 637 Emerald, Mundelein IL 60060.

TAYLOR MI
NOV 4

The RADAR eighth annual Swap and Shop will be held on November 4, 1984, from 8:00 am to 3:00 pm, at Kennedy High School in Taylor MI. Activities and forums are scheduled and free parking will be available. For more information, send an SASE to RADAR, Inc., PO Box 386, Taylor MI 48180, or call (313)-291-2298.

MONTVALE NJ
NOV 10

The Stateline Radio Club of New York and New Jersey will hold RadioExpo '84 on Saturday, November 10, 1984, beginning at 8:00 am, rain or shine, at Pascack Hills High School, Grand Avenue and Spring Valley Road, Montvale NJ. Take New York State Thruway south to the Schoolhouse Road exit, then south on Schoolhouse/Spring Valley Road; or take Garden State Parkway north to Exit 172, then east on Grand Avenue. Donations are $3.00 each (available only at gate). Tables are $10.00 by mail prior to October 31st and $13.00 at the gate; tailgaters' fees are $5.00 by mail prior to October 31st and $7.00 at the gate. Doors open for vendor setups at 6:00 am. Features will include FCC license exams through Extra class, DX films and forums, multimedia programs, a transceiver clinic (HTs checked free of charge), a food concession, and ample parking. Talk-in on 146.835 repeater and 146.565 simplex. For further information, contact Robert Greenquist, PO Box 325, Montvale NJ, or phone (201)-666-3902, day or evening.

WEST CONCORD MA
NOV 10

The 35th annual New England DXCC Dinner will be held on November 10, 1984, at the Concord Lodge of Elks, Baker Avenue, West Concord MA (near Routes 2 and 62). Activities will begin at 2:00 pm with a variety of DX talks and slide programs including video tapes of VU7WCY and XU1SS. The charge for the afternoon session is $2.00. The cocktail hour will be at 6:00 pm and at 7:30 pm, a seven-course, family-style roast beef dinner will be served. The banquet speaker will be Fred Laun K3ZO (ex-HS1ABD). The charge for the evening is $14.95. For more information, contact Steve Tolf K1ST, 12 Phylmor Drive, Westboro MA 01581.

WEST MONROE LA
NOV 10

The Twin City Hams will sponsor an all-indoor hamfest on Saturday, November 10, 1984, from 9:00 am to 3:00 pm, at the Convention Center, N. 7th Street, West Monroe LA. Features will include exams, swap tables, new-equipment dealers, and a ladies' program. Talk-in on 146.25/.85. For

↙ *See List of Advertisers on page 88*

more information, contact Benson Scott AE5V, 107 Contempo, West Monroe LA 71291.

NEWMARKET ONT CAN
NOV 10

The York Region ARC will present the 8th annual Newmarket Flea Market on Saturday, November 10, 1984, beginning at 0800, at the Newmarket Community Center, Civic Drive, Newmarket (just north of Toronto). Admission is $2.00 per person and children under 12 will be admitted free. Table rentals are $3.00 each plus general admission and will be held only until 0800 unless payment is made in advance (setup is at 0630). Refreshments will be available. For table reservations (include a check or money order made out to the York Region ARC) or more information, contact Geoffrey Smith VE3KCE, 7 Johnson Road, Aurora, Ont., Canada L4G 2A3, or phone (416)-727-6672 (evenings).

STONE MOUNTAIN GA
NOV 10–11

The Alford Memorial Radio Club will host the 12th annual Stone Mountain Famvention on November 10–11, 1984, at Stone Mountain Park, Stone Mountain GA. Hours on Saturday are 9:00 am to 5:00 pm and on Sunday, 9:00 am to 3:00 pm. Admission is $4.00, which includes admission for both days, parking at the hamfest site, and the Saturday-night cookout. Activities will take place at Lakeside Center, with inside dealer displays and light refreshments in the Hospitality Room. The Boneyard Mile will be just outside and a full-hookup campground is adjacent. Plans are at this time to give exams, Novice through Extra class, at the Stone Mountain Inn on Saturday and Sunday beginning at 8:30 am. Talk-in on 146.16/.76. For more information, write Jim Garner KE4BI, 490 Village Green Court, Lilburn GA 30247, or phone (404)-921-7588.

VETERANS DAY SPECIAL EVENT
NOV 10–11

The Armored Force Amateur Radio Nationwide Emergency Team (A FAR NET) will sponsor a Veterans Day activity for the amateur community on the weekend of November 10 and 11, 1984. Member stations will participate as special-event stations for the net. A special commemorative certificate will be available to all amateur stations that make contact with one member station. Net stations will operate on the Veterans Day weekend from 1200 GMT on Saturday, November 10, 1984, through 2400 GMT on Sunday, November 11, 1984. Primary frequencies will be as follows: 7285 kHz, 14,325 kHz, 21,375 kHz, and 28,640 kHz (plus or minus QRM). To obtain the certificate, send a QSL and a large SASE to the net's manager, Alfred G. Beutler, 36 Manchester Rd., East Aurora NY 14052.

NORTH HAVEN CT
NOV 11

The Southcentral Connecticut Amateur Radio Association (SCARA) will hold its 5th annual Electronics Show and Flea Market on Sunday, November 11, 1984, from 9:00 am to 3:00 pm, at the North Haven Recreation Center, Linsley Street, North Haven CT. Admission is $1.50 and children under 12 accompanied by an adult will be admitted free. Tables are $10.00 in advance for the main hall and $12.00 at the door. (Reservations are strongly advised.) Setup will be at 8:00 am, and for new-equipment vendors, a special exhibit area with setup security arrangements will be made available. There will be food both at the food booth and from a mobile cart. Features will include the latest in ham radio, computers, and electronics. Talk-in on 146.01/146.61 (W1GB). For more information, directions, and reservations (make checks payable to SCARA), send an SASE to Tony Vanacore AK1O, PO Box 81, North Haven CT 06473, or phone (203)-484-4175 (home) or (203)-239-5321, extension 311 (days).

FORT WAYNE IN
NOV 11

The Allen County Amateur Radio Society, Inc., will sponsor the 12th Fort Wayne Hamfest on Sunday, November 11, 1984, from 8:00 am to 4:00 pm, at the Allen County memorial Coliseum, Coliseum Boulevard (US 30) at Parnell Avenue. Tickets are $3.00 in advance and $3.50 at the door. Tables are $8.00 and premium tables are $20.00. Vendor setup is from 5:00 am to 7:00 am. No tables will be sold at the door, and the ticket- and table-reservation deadline is October 20th. Activities will include a large indoor flea market, commercial vendors, the Ham Band under the direction of Luke Matthew WB9EWJ, and all classes of radio exams (send Form 610 and an SASE to VE Coordinator, FWRC, PO Box 15127, Fort Wayne IN 46885, by October 26th). Talk-in on .88. For tickets, tables, or more information, contact Hamfest Chairman AC-ARTS, PO Box 10342, Fort Wayne IN 46851, or call Dave Smith KA9FFT at (219)-493-2439.

MASSILLON OH
NOV 11

The Massillon ARC will sponsor Auctionfest 84 on November 11, 1984, at the Massillon K of C Hall, off Route 21, Massillon Ohio, from 8:00 am to 5:00 pm. Sellers' setup is at 7:00 am. Admission is $2.50 in advance and $3.50 at the door. Tables are available at $7.00 per 8-foot space. Refreshments are available and there will be a sit-down dinner. There will be plenty of free parking. The auction starts at 11:00 am. Talk-in on W8NP, 147.78/.18. For advance registration or information, send an SASE to MARC, 920 Tremont Avenue SW, Massillon OH 44646.

PENANG, MALAYSIA
NOV 16–18

The Malaysian Amateur Radio Transmitters Society (MARTS) will host the 14th SEANET Convention on Friday, Saturday, and Sunday, November 16–18, 1984, at the Eastern and Oriental Hotel, Penang, Malaysia. Features will include symposiums, luncheons, tours, and rag-chewing. For more details, contact Malcolm Westwood, Organizing Secretary, SEANET, PO Box 13, Penang, West Malaysia.

BILLERICA MA
NOV 17

The Honeywell 1200 Radio Club and the Waltham Amateur Radio Association will hold their annual amateur-radio and electronics auction on Saturday, November 17, 1984, beginning at 10:00 am, at the Honeywell Plant, 300 Concord Road, Billerica MA (Exit 27 off Route 3). There will be a snack bar, a bargain parts store, and free admission and parking. Talk-in on 147.72/.12 and 146.04/.64 (club-sponsored repeaters). For more information, contact Doug Purdy N1BUB, 3 Visco Road, Burlington MA 01803.

PLYMOUTH MA
NOV 22

A special-event station (WA1NPO) from Plymouth, Massachusetts (America's Hometown) will be sponsored by the Whitman Amateur Radio Club and Plimoth Plantation on Thanksgiving Day, November 22, 1984. An attractive certificate suitable for framing will be issued to any foreign or domestic amateur who makes contact with this station, which will operate from 9:00 am until 3:00 pm. The station will be in operation at the Plimoth Plantation from an indoor site in the museum's 1627 Pilgrim Village.

Frequencies are as follows: 1300 to 1430 GMT—21.260 MHz; 1430 to 1730 GMT—7.280 MHz ± QRN and/or 7.050 MHz (CW); 1730 to 2000 GMT—21.385 MHz; 1300 to 1600 GMT—14.255 MHz or 14.180 MHz; 1400 to 1500 GMT—14.025 ± QRM; 1600 to 2000 GMT—14.345 MHz. There will be limited 2-meter operation on the local club repeater (tentative): 147.225/.835 and 146.52 simplex.

A UK club station is planning to participate: GB2UST (United States Thanksgiving) on 20m and 15m and GB4UST on 80m and 40m; they have some forty acres in which to erect antennas.

To receive a certificate, send proof of contact and $1.00 or four IRCs to the Whitman ARC, PO Box 48, Whitman MA 02382.

GREENSBORO NC
NOV 24–25

The 4th annual Greater Greensboro Hamfest will be held on November 24–25, 1984, from 9:00 am to 5:00 pm, at the National Guard Armory, 1100 Franklin Boulevard, Greensboro NC. For advance tickets, send an SASE to Fred Redmon N4GGD, 2305 Sherwood Street, Greensboro NC 27403. For dealers' space, tables, and flea-market information, contact Coy Hennis WD4NHL at (919)-294-2841.

OAK PARK MI
NOV 25

The Oak Park High School Electronics Club will hold its 15th annual Swap 'N' Shop on Thanksgiving Sunday, November 25, 1984, from 8:00 am to 4:00 pm, at the Oak Park High School, Oak Park MI. The doors will open at 6:00 am. Admission is $2.00 and 8-foot tables are $6.00. Refreshments will be available. For more information, send an SASE to Herman Gardner, Oak Park High School, 13701 Oak Park Boulevard, Oak Park MI 48237, or phone (313)-968-2675.

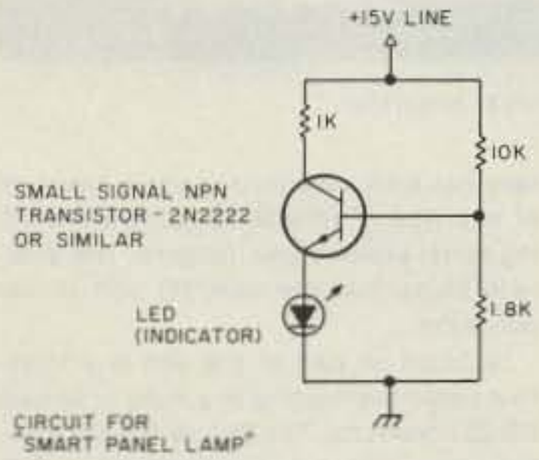
STONY BROOK NY
NOV 25

The Radio Central ARC will present the 6th annual ARRL Ham-Central on Sunday, November 25, 1984, from 9:00 am to 3:00 pm, in the social hall of Temple Isaiah, 1404 Stony Brook Road, Stony Brook, Long Island NY. General admission is $3.00 and children under 12 and XYLs will be admitted free. An 8-foot table space is $7.00 and includes one free admission. Doors will open at 7:30 am for dealers and sellers (ham-related items only). There will be food, drinks, and free parking available. Seminars will feature speakers Gerry Hull VE1RM/W1 on the St. Paul Island DXpedition of 1983, Paul Beeman KA2MUM with an OSCAR lecture and slide show, and Art Greenberg W2LH and Madeline Greenberg W2EEO with an antenna lecture. Talk-in on 144.550/145.150 and 146.52. For reservations and more information, contact Bob Yarmus K2RGZ, 3 Haven Court, Lake Grove NY 11755, or phone (516)-981-2709 Monday through Friday after 6:00 pm.

CIRCUITS

Do you have a technique, modification, or easy-to-duplicate circuit that your fellow readers might be interested in? If so, send us a concise description of it (under two pages, double-spaced) and include a clear diagram or schematic if needed.

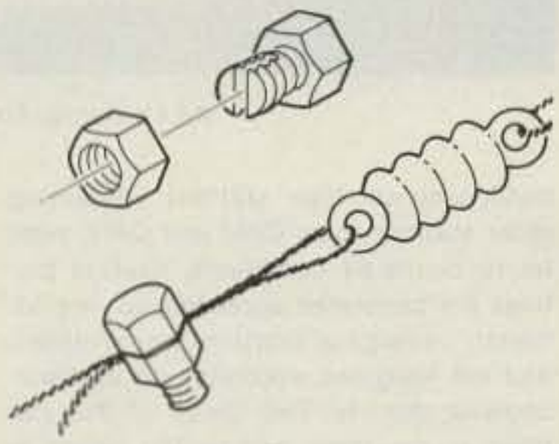
In exchange for these technical gems, 73 offers you a one-year subscription (or extension), to be sent upon publication. Submit your idea to: Circuits, Editorial Offices, 73 Magazine, *Peterborough NH 03458. Submissions not selected for publication will be returned if an SASE is enclosed.*



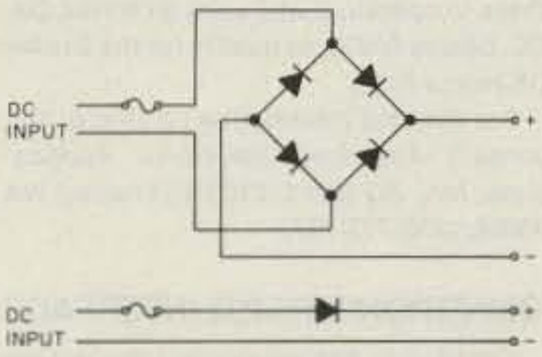
CIRCUIT FOR "SMART PANEL LAMP"

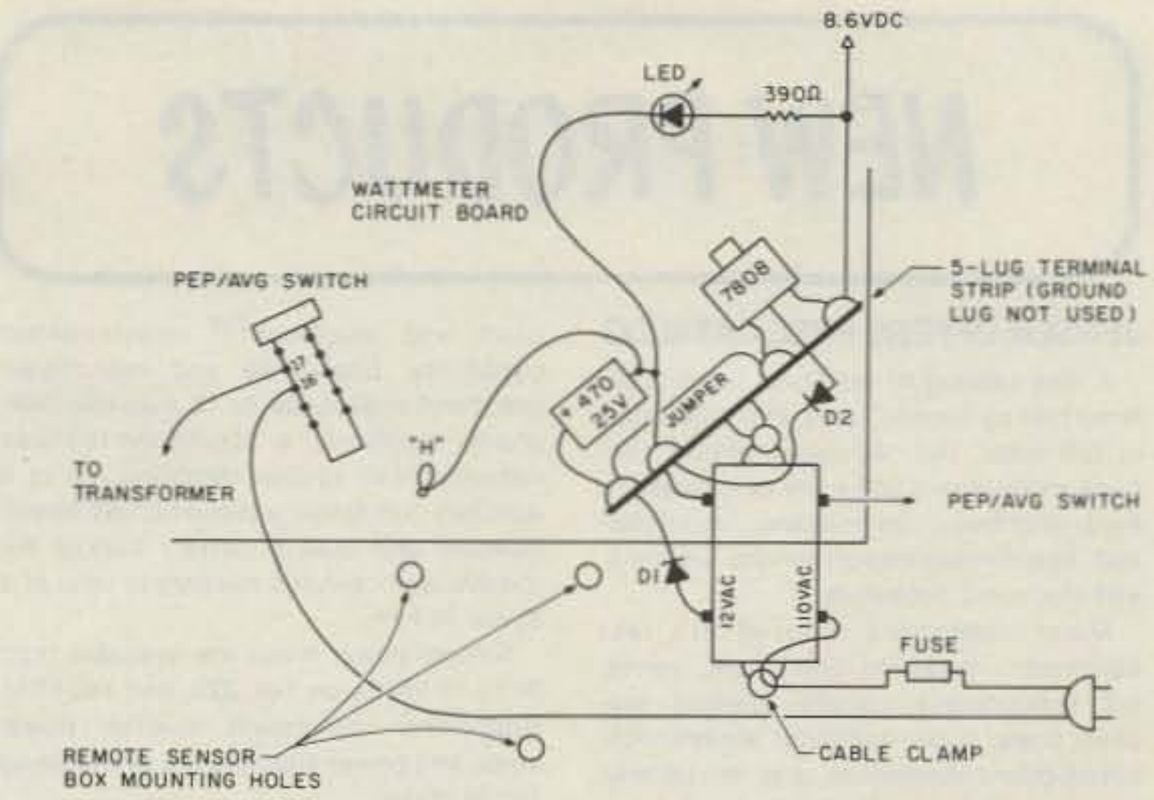
AS DESIGNED FOR REGULATED 15V LINE

SMART PANEL LAMP: This power-on indicator for your regulated 15-V supply also indicates overload conditions (current-induced voltage drop) and can be easily modified for other voltage levels. Two resistors sample the output voltage and compare it with the 2.2-V reference defined by the LED and transistor emitter-base-junction voltage drop. If the regulated 15-V line drops by about a volt, the indicator LED goes out. The 1k resistor in the collector circuit limits the current draw to 15 mA so the indicator won't burden the supply.—Penn Clower W1BG, Andover MA.



INVERTED-V TUNING TRICK: Tuning the inverted-V antenna requires adjustment of both the enclosed angle and the length of each side of the dipole. You can take the pain out of length adjustments by fastening the ends to the insulators with split bolts. These come in various sizes, and I recommend using the kind made from bronze.—Wm. Bruce Cameron WA4UZM, Temple Terrace FL.





SELF-CONTAINED BATTERY ELIMINATOR FOR THE HEATH HM-2140: This simple circuit is built into the wattmeter cabinet and doesn't interfere with the internal mounting of the remote sensor box. The PEP/AVG push-button switch has an extra set of contacts which can be used to switch the power supply on when PEP readings are desired. The LED is centered between the meters on the front panel. The fuse holder can be an inline type or be mounted on the circuit board behind the battery clip. Note that the negative side of the power supply does not go to ground. If you don't plan portable battery operation in the future, the 8.6-V output can be permanently wired to lug 2 of the PEP/AVG switch. The transformer is mounted between the existing screw near the battery clip and a spacer installed on the bottom cabinet. A five-lug terminal strip mounted with the transformer at the corner of the circuit board will hold the other components, and a cable clamp on the other side of the transformer secures the line cord. If a type 7808 three-terminal regulator is not readily available, an LM317T adjustable regulator (Radio Shack #276-1778) can be substituted.—Wayne Arnett AI7C, Chandler AZ.

POLARITY PROTECTION FOR PLUG-IN RADIOS OR OTHER SOLID-STATE DEVICES: By adding a diode or a diode bridge in the dc power-input circuit, you can have complete protection against ever connecting the unit backwards. With the bridge circuit, it makes no difference which way the connection is made. However, if the diode is connected in reverse, there will be no current to the unit due to blocking action of the diode. When connected correctly, diode will conduct and the unit will work. Using this with plug-in radios, mount the bridge or diode inside the chassis. Be sure the bridge or diode will handle the maximum current requirement.—E. A. Rowe W7PWQ, Chelan WA.

HAM HELP

We are happy to provide Ham Help listings free, on a space-available basis. We are not happy when we have to take time from other duties to decipher cryptic notes scrawled illegibly on dog-eared postcards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½" × 11" sheet of paper and use upper- and lowercase letters where appropriate. Also, please make a "1" look like a "1," not an "l," which could be an "el" or an "eye." and so on. Hard as it may be to believe, we are not familiar with every piece of equipment manufactured on Earth for the last 50 years! Thanks for your cooperation.

About three years ago I built a CMOS digital thermometer out of *Popular Science* magazine. The probe uses a Texas Instruments 6.8k Tm-1/4 sensistor with a positive temperature coefficient. I haven't been able to find this part—can anyone help?

David Shoaf WD4CZW
Rt. 5 Box 375
Mocksville NC 27028

Just a note to some of the readers concerning "Ham Help." If someone sends you the information you need, please send an acknowledgement back to that person, perhaps including the postage. After all, he or she went out of the way to find and copy the material for you.

I don't know how many people respond to these requests for help, but in April I mailed 78 pages of information to 7 different hams. Only one person, a teacher, returned a note of thanks. In January it was 5 sets of information—with no replies.

I'll still send the stuff out, but I wonder what happened to the spirit of amateur radio?

J.Y. Lem KB6BO
5222 Coringa Drive
Los Angeles CA 90042

Has anyone been successful in converting a Swan 500C to a 500CX? I also would like to increase the stability of the 500C, and to overcome its transmit-to-receive problem.

John Matthews K6VS
12206 Huston Street
North Hollywood CA 91607

I will pay for any data concerning the Nems Clarke UHF receiver model 2801A.

John Elmquist
3308 Bahama N.E.
Albuquerque NM 87111

I am interested in obtaining a National NCX-1000 or NCX-2000, used or reconditioned. Write with price and condition via airmail to:

Fermin Anzalaz LU1SH
PO Box 155
5300 La Rioja
Argentina, South America

I need manuals for a Lavoi spectrum analyzer LA-17 and a DEI telemetry-receiver tuning unit T-102-A (216-260 MHz). Will pay reasonable costs incurred.

Paul Veltman WA6OKQ
5333 York Drive
Fremont CA 94536

Would someone please help me find a schematic or manual for a Communications Power, Inc., model WM-1000 wattmeter? I will gladly pay for any costs incurred.

Richard Whipkey AD6X
866 Yolo Way
Livermore CA 94550

NEW PRODUCTS

JENSEN OFFERS FREE CATALOG

A new catalog of precision tools is offered free by Jensen Tools, Inc. Illustrated in full color, the 160-page catalog contains more than 3,000 tools of interest to field engineers, technicians, computer- and telecommunication-service persons, and electronic hobbyists.

Major categories covered are test equipment, soldering equipment, tweezers, screwdrivers, cutters, drafting supplies, power tools, computer accessories, circuit-board equipment, and miscellany. Also included are many new products from Jensen and over 40 pages of service kits and tool cases for electronic specialists and technicians.

To obtain a free copy, write *Jensen Tools, Inc., 7815 S. 46th Street, Phoenix AZ 85040; (602)-968-6231.* Reader Service number 482.

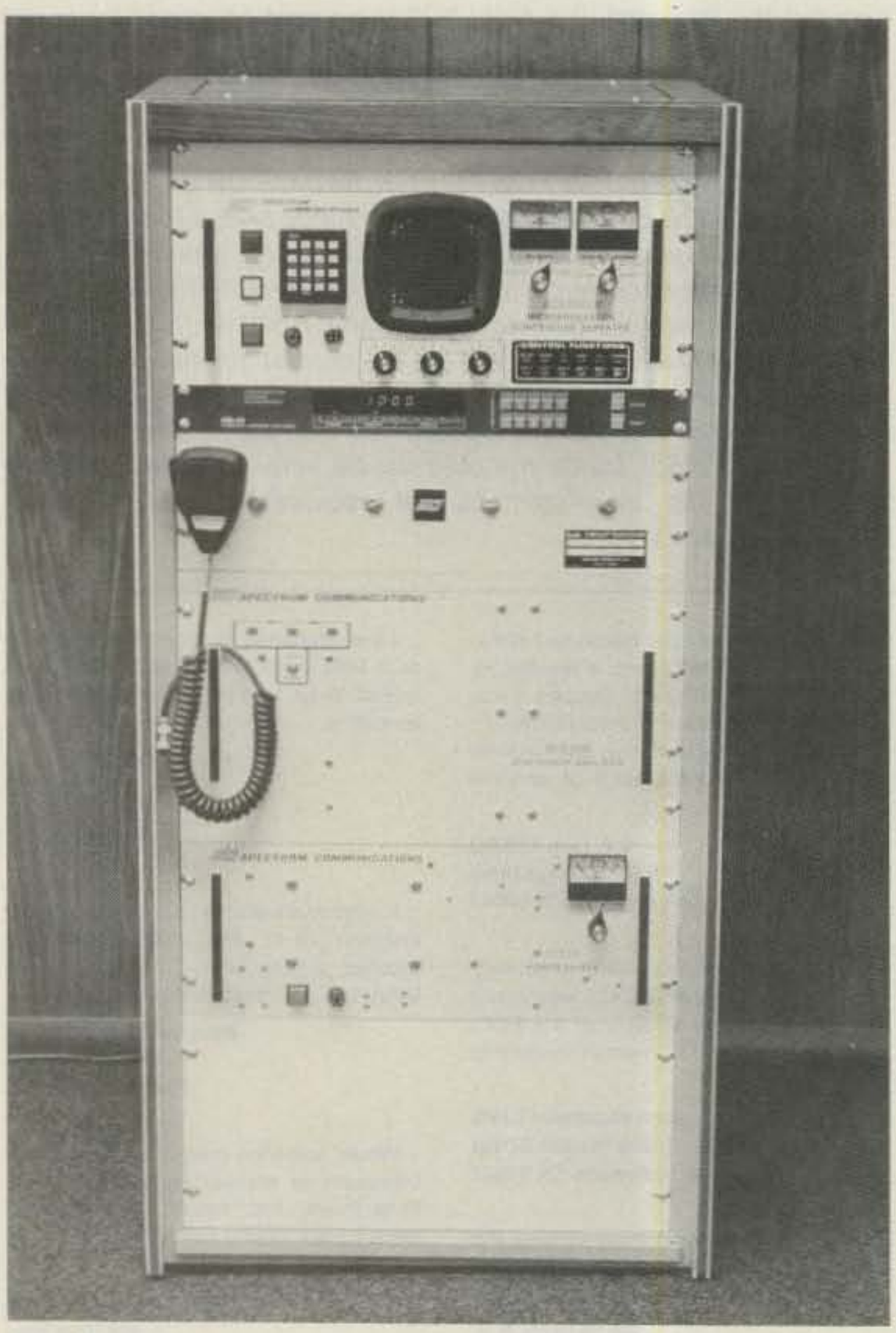
SPECTRUM COMMUNICATIONS' SCR2000X REPEATER

Spectrum Communications' SCR2000X microprocessor-controlled repeater combines the latest digital techniques with Spectrum's highly-refined rf technology to yield an advanced, high-performance repeater system.

Standard features include: full auto-patch and touchtone™ remote-control capability, phone-line and over-the-air command modes, up to 13 auto-dial telephone numbers, a touchtone-to-pulse converter, full 16-digit decoding, up to 6 auxiliary functions, automatic CW identification, and built-in battery backup for the microprocessor's memory in case of a power failure.

Several power levels are available from 30 to 75 Watts on 144, 220, and 440 MHz. High-power rack-mount repeater power amps and power supplies are available up to 150 Watts.

For more details, contact *Spectrum Communications Corp., 1055 W. Germantown Pk., Norristown PA 19401-9616; (215)-631-1710.* Reader Service number 478.



Spectrum Communications' SCR2000X repeater.

DOCTOR DX BY AEA

Doctor DX by AEA is a complete CW contest simulator packaged in a plug-in cartridge for the Commodore 64. It is a computer simulation of the *CQ*WW DX Contest, allowing you to work the HF bands using a computer-generated modern-style transceiver and omnidirectional antenna.

All of the stations you will work using Doctor DX are generated by the computer. As you tune up and down a particular band, you will hear stations contacting other stations, plus QRM and QRN, similar to on-the-air conditions. Station prefixes are generated according to international callsign-allocation conventions, and are weighted according to amateur-operator density. The speed of the stations at the lower end of the bands is much faster than that of stations higher up, and the low-end operators have greater "savvy."

The propagation programmed for each band is driven by a real-time clock, with conditions varying by the time of day and band selected. Band conditions are simulated for a sunspot-cycle peak for a station using an omnidirectional antenna.

A typical two-way contact involves exchanging callsigns, signal reports, and *CQ*WW zones. If you miss part of a report, you may ask for and receive a repeat. If you make an error, the simulated station will request a repeat. You may also request the other station to QRS or QRO.

Doctor DX approaches reality in its operation. AEA even offers award certificates to operators who work all zones, DX-CC, 5-band DXCC, or qualify for the Doctor DX Honor Roll.

For detailed information on Doctor DX, contact *Advanced Electronic Applications, Inc., PO Box C-2160, Lynnwood WA 98036; (206)-775-7373.*

AEA's Doctor DX contest simulator.

OMNITRONIX RS-232 INTERFACE

Omnitronix has announced the release of their Deluxe RS-232 Interface for the VIC-20, C64, and SX64. The RS-232 interface has been designed to allow easy use of any type of RS-232 equipment, including serial printers and modems. The interface plugs into the user I/O port of the computer.

Included as part of the unit is a three-foot cable terminating in a male or female DB-25 connector. The Deluxe RS-232 Interface can also be supplied with a PC-board-mounting female DB-25, allowing it to replace the 1011A. Three switches in the case cover allow you to set the unit for DTE/DCE, invert pins 20 and 5, and select the Busy line polarity. The RS-232 interface supports virtually all RS-232 signals including Ring Detect and can operate at up to 2400 baud. The manual includes a type-in Basic terminal program and a tutorial on using the RS-232 port.

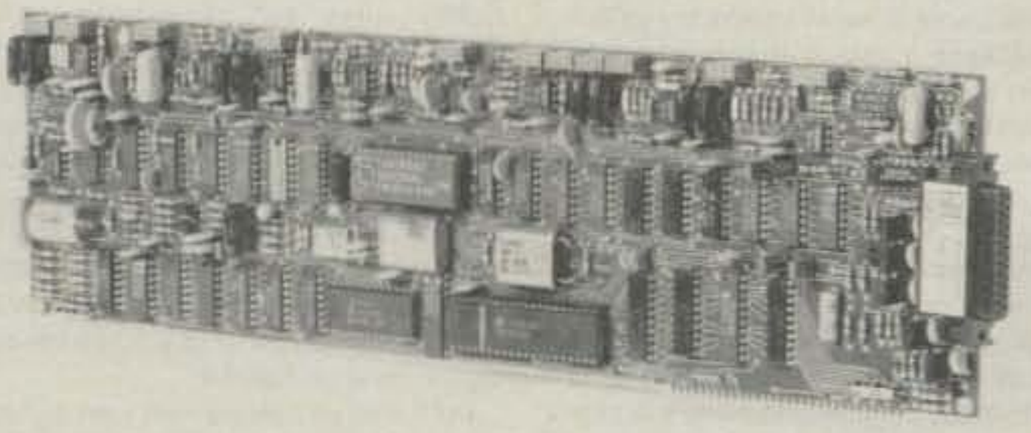
For additional information, call or write *Omnitronix, PO Box 43, Mercer Island WA 98040; (206)-236-2983.* Reader Service number 480.

HAL'S IBM/RTTY INTERFACE

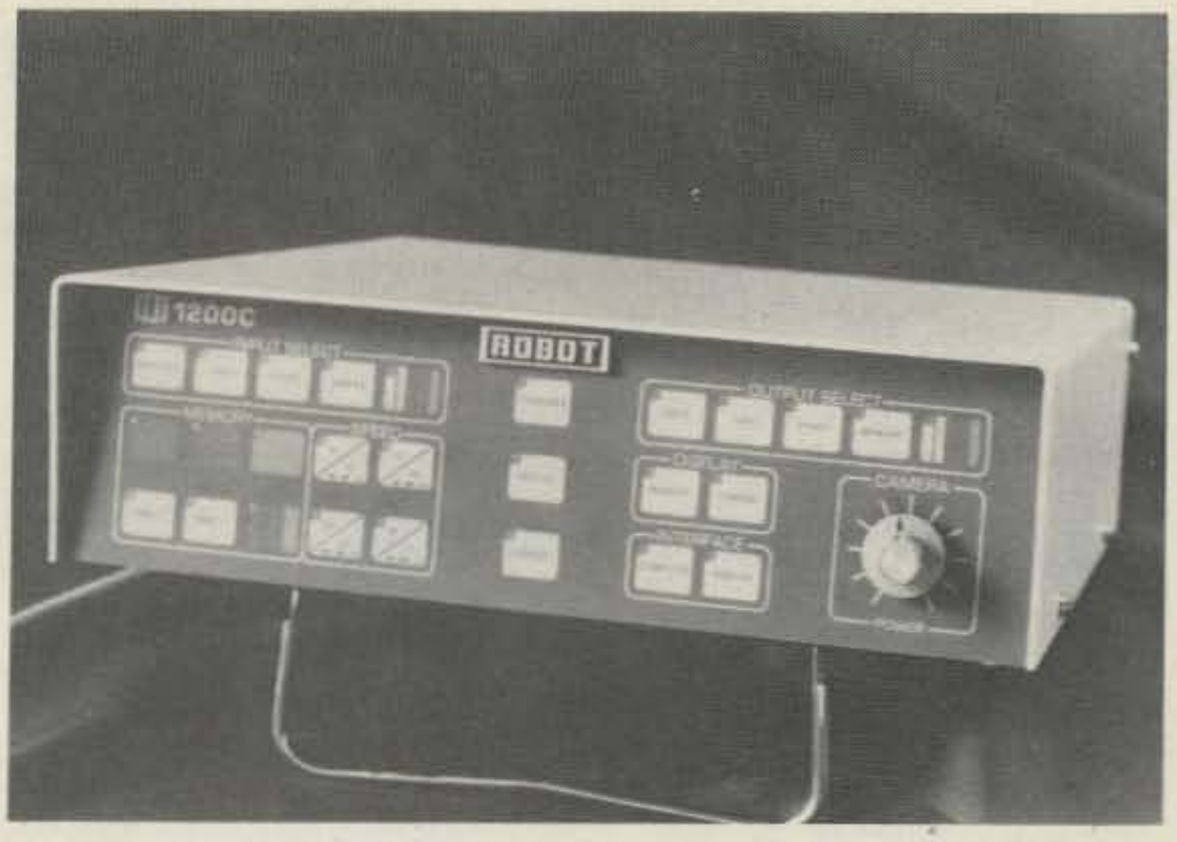
HAL Communications Corporation is offering their new PCI-2000 RTTY interface module for the IBM-PC™. Features include full Bell 103/202 support, 170/425/850-Hz shift, direct FSK output, 45–1200-baud transmission rate, and Morse, Baudot, or ASCII codes.

The supporting software incorporates such features as split-screen formatting, transmit and receive buffering, and disk-file storage and retrieval. All PCI-2000 parameters are set using the PC's FN keys.

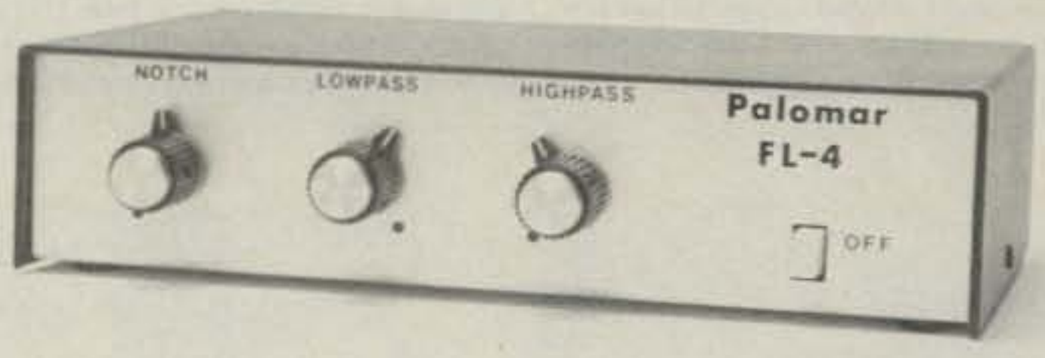
Commodore RS-232 interface from Omnitronix.



HAL's IBM-PC RTTY/CW interface.



The Robot 1200C color SSTV converter.



The Palomar FL-4 Universal Audio Filter.

For further information, contact *HAL Communications Corporation, PO Box 365, Urbana IL 61801; (217)-367-7373.* Reader Service number 484.

HI-RES COLOR SSTV CONVERTER FROM ROBOT

A new high-resolution color SSTV converter has been added to Robot's line of amateur-radio products. Designated the Model 1200C, it is capable of transmitting color video images that rival broadcast television in picture quality. The Model 1200C has three selectable 6-bit memory planes that combine to form 262,144 color combinations in a 256 × 240 line full-screen display.

Eight different black-and-white- and color-transmission formats are available with automatic selection on receive. Up to six separate pictures may be stored in memory. The unit accepts color or black-and-white composite video from standard TV cameras and has RGB, composite, or rf-modulated video output.

A unique feature of the Model 1200C is the 8-bit parallel I/O port for computer interfacing. This allows total access to each individual pixel by a host computer for image processing, transformation, storage and recall, and graphics. This port also allows connection to a printer for black-and-white or color hard-copy picture printing.

The Model 1200C features touch-sensitive front-panel switches for full station control and several automatic functions. Fine tuning, speed switching, and color or black-and-white detection are automatically accomplished without operator intervention.

For further information, contact *Robot Research, Inc., 7591 Convoy Ct., San Diego CA 92111; (619)-279-9430.* Reader Service number 479.

UNIVERSAL AUDIO FILTER FROM PALOMAR

Palomar Engineers has announced a new universal audio filter. Model FL-4 is for SSB/CW/RTTY and features switched-capacitor filters. A 10-pole low-pass and an 8-pole high-pass can be moved anywhere in the 200–3500-Hz range to form a sharp bandpass filter at any frequency and of any bandwidth. A notch filter is also included.

The filter connects to the receiver's phone jack and provides 2 Watts of audio to drive a speaker. The on-off switch bypasses the filter when not in use. It operates from 15 V dc.

For further information, contact *Palomar Engineers, Box 455, Escondido CA 92025.*

SIMPSON PANEL METER CATALOG

Simpson Electric Company is offering a new four-color catalog, number 5400-P. The catalog lists the entire Simpson line of over 1500 US-made analog and digital panel meters, meter relays, and controllers. Also listed are panel-mount chart recorders.

Simpson, manufacturer of the world-famous 260® VOM, is a member of the Katy Industries, Inc., Electrical Equipment and Products Group. For a free copy of Simpson Catalog 5400-P, write to *Simpson Electric Company, 853 Dundee Avenue, Elgin IL 60120-3090; (312)-697-2260.* Reader Service number 483.

ISS HALON EXTINGUISHERS

International Safety Systems, Inc., (ISS) has announced two fire-fighting products designed specifically for consumers, using Halon, a colorless, odorless, electrically nonconductive vapor.

Halon chemically interferes with the combustion process by breaking up its complex chemical reactions, while other extinguishing agents only smother the fire. It is extremely low in toxicity, does not damage property, leaves no residue, and has a twelve-year shelf life.

ISS's Halon products consist of two models; the 12-C and the 24-H, containing .75 lbs and 1.5 lbs of Halon, respectively. The smaller 12-C is ideal for placement in an auto glove compartment or in a kitchen. The 24-H is excellent for a light aircraft, camper, or workshop.

For further details, contact *ISS, 2227 Idlewood Rd., Suite 4, Tucker GA 30084.* Reader Service number 485.

REVIEW

BREAK COMMUNICATIONS SYSTEMS EQUIPMENT CONSOLE

Amateur equipment comes in all shapes, sizes, and levels of complexity. But whether you're using the latest solid-state marvel or a venerable old "boat anchor," one piece of gear is an absolute necessity: some sort of operating table or console.

After years of operating from various tables with mixed results, I recently took the plunge and acquired an equipment console from Break Communications Systems (BCS), Inc. It not only provides a convenient and rugged operating position, it's also a superb-looking piece of furniture.

Description

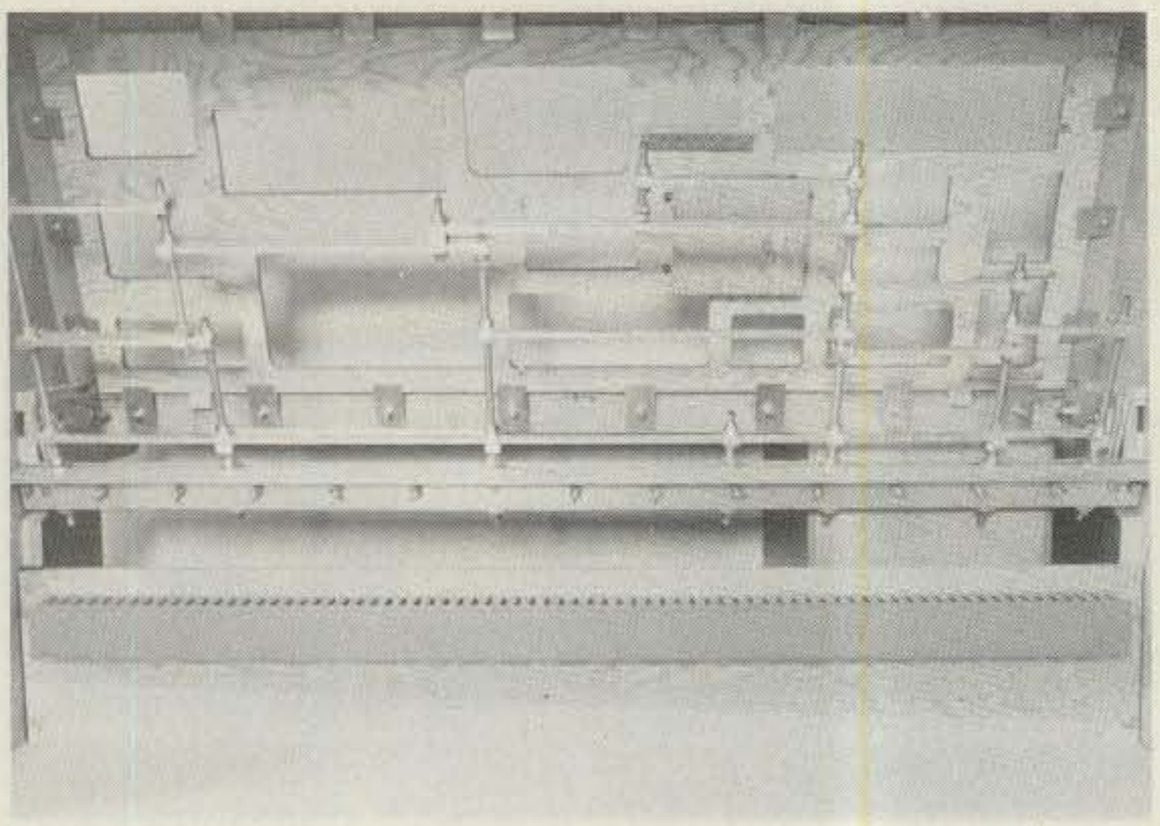
As the photos show, the BCS console consists of a desk top or writing surface and a gently sloped front panel with cutouts to allow the front of each piece of equipment to protrude through. Behind the front panel is an aluminum and steel support rigging that carries most of the weight of the gear. The holes in the front panel are cut by a computer-driven saw to fit precisely around the equipment with little or no "slop." The front panel is attached to the console with a number of heavy steel clamps, allowing replacement of the panel when new equipment is acquired.

The console is constructed of hardwood, 1/2" and 3/4" plywood, and 1/2" particle board. BCS consoles are covered in a high-pressure laminate (the generic name for materials such as Formica). Standard consoles are four, six, or eight feet wide and weigh from 150 to 350 pounds without radio gear. Many accessories and options are also available, as are L- and U-shaped consoles.

Designing The Console

No two hams have the same radio gear or operating habits. Therefore, the ideal operating console should be customized for every ham. The key to customization in the BCS design is the front panel, which is cut to accept the equipment in any arrangement desired by the customer. BCS has developed some interesting techniques that allow the creation of front panels with precisely-cut equipment holes without the need to actually lay their hands on the gear. Getting the console exactly right becomes a cooperative effort between BCS and each customer.

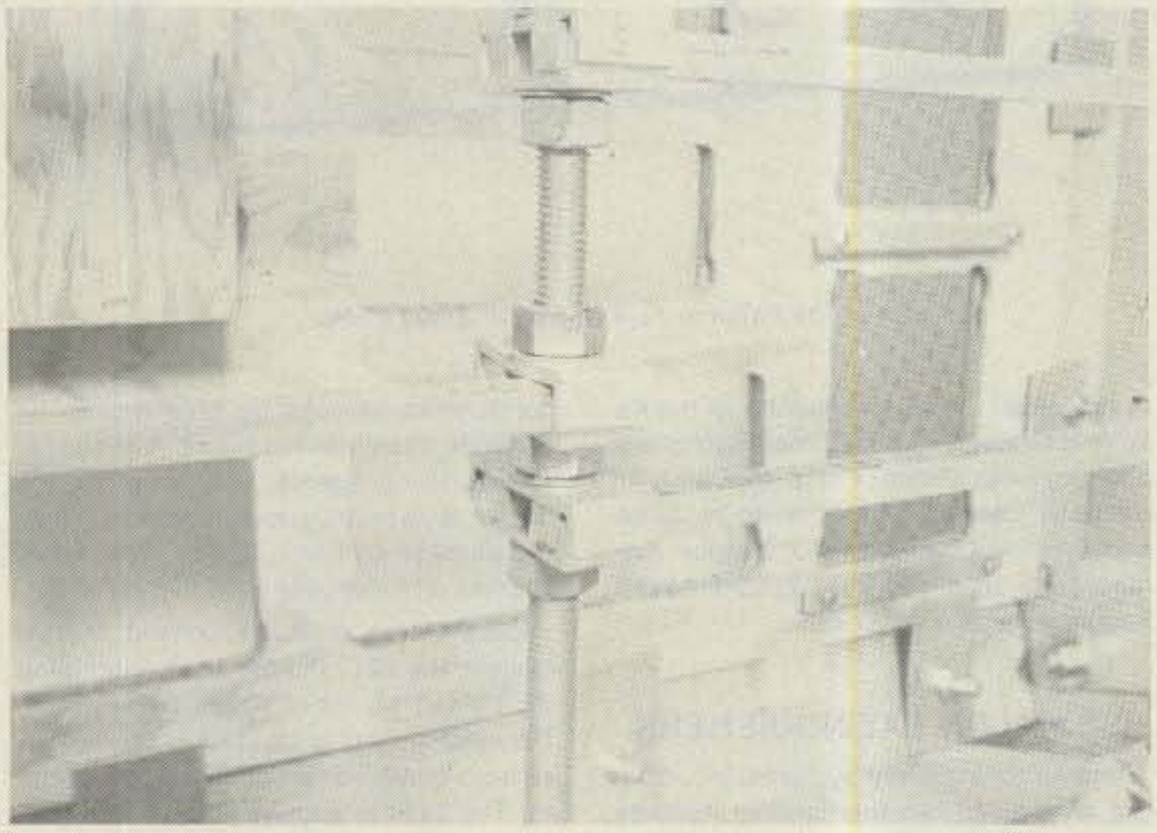
Once the basic size of the console is selected (for my equipment, a six-footer was just right), then begins the process of determining the exact size and shape of each hole BCS will cut in the front panel. It starts with BCS sending the customer a basic measuring kit and wooden templates or "test cuts" for any of the gear for which BCS has previously cut front-panel holes. The customer must carefully measure any equipment BCS has not dealt with before. Also, each template must be carefully checked to see that it fits per-



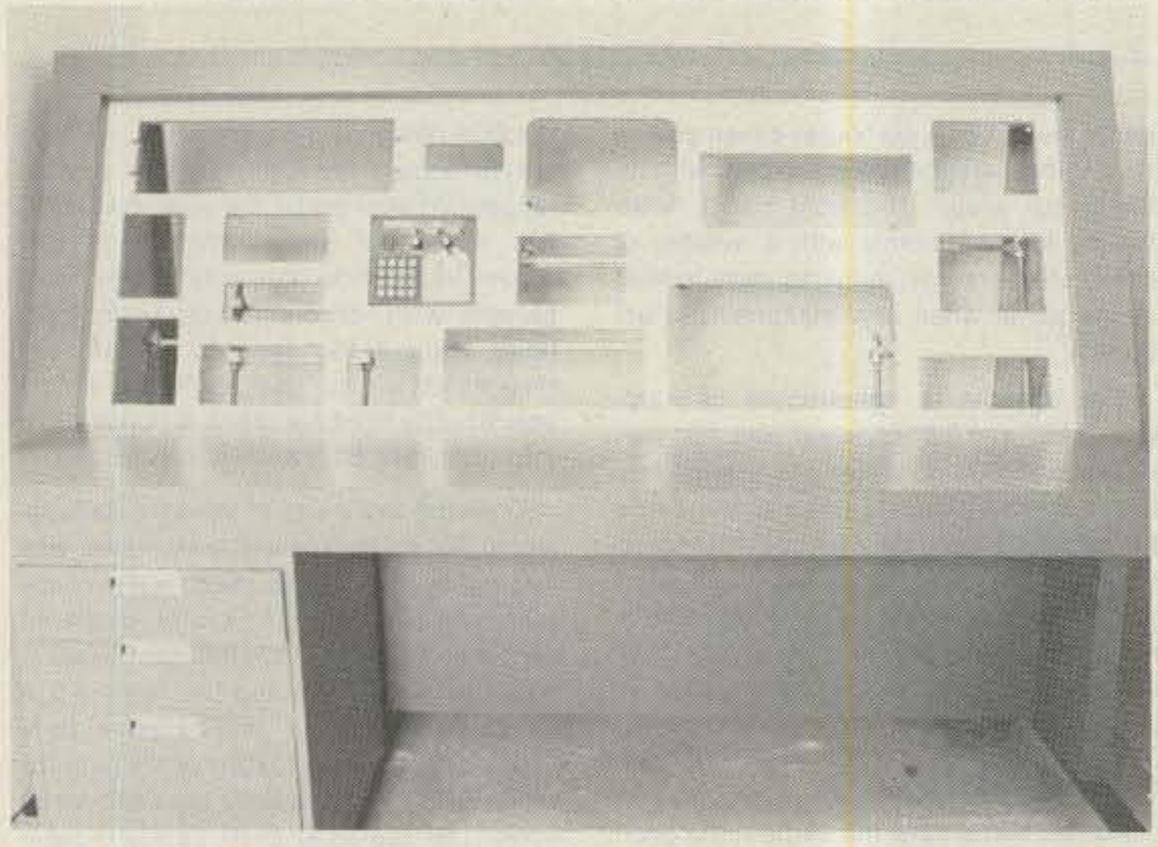
Rear view of BCS console, showing the equipment support rigging, the cutouts in the front panel for radio gear, and the steel clamps (around the perimeter) which hold the front panel in place.

fectly around the front of its respective gear. It turns out that manufacturing tolerances allow for considerable variation in the dimensions of rigs of the same model, so BCS gives customers a special form on which to indicate how each template must be modified for a perfect fit.

All measurements and template modification instructions are phoned or mailed to BCS, which then sends out a complete new set of wooden templates for any rigs that weren't perfect the first time. This sequence of template modification followed by new templates continues until the customer has a template that fits each piece of gear as precisely as possible, the goal being no more than 0.03" of slop.



Closeup of a portion of the steel and aluminum support rigging. The vertical members are 1/2-inch threaded rod.



The completed BCS console, ready to receive the station equipment. My keyer, an unusually-shaped piece of gear, is already in place, having been custom-mounted for me at the factory.

The arrangement of the equipment on the front panel is what makes the difference between a station that is easy and efficient to operate and one that is (literally) a pain in the neck. A poorly-planned layout can have the operator forever straining to reach an often-used accessory. For its part, BCS sends each customer a one-half-scale mock-up of the front panel, along with one-half-size cardboard cutouts (called "puppets") in the proper shape of each piece of equipment. It is then up to the customer to move the puppets around the front-panel mock-up until the best layout is found.

Once the templates fit properly, the front panel is laid out, all options are specified, and the color scheme is selected (not easy—there are thousands of choices!), then the console can be prepared and shipped in about two weeks. Total elapsed time from the start of the design process is six to eight weeks. It took a bit longer in my case, but only because I didn't respond as quickly as I might have when new templates were shipped to me. Total time invested on my part was less than three hours.

Performance

The BCS console is worth waiting for. Overkill is the only word to describe the protective shipping crate in which my console arrived. I've never seen sturdier packaging. Assembly was a snap, even for one person, and can easily be accomplished in an afternoon. The only tools required are 9/16" and 3/4" open-end wrenches, although a socket wrench makes the job much easier. I encountered no problems whatever.

Mounting the equipment is equally undramatic. The rugged metal support rigging was set up at the factory for my equipment layout and worked exactly as advertised—very solid. Minor adjustments were made to square up each piece of gear with the front panel, and I found it convenient to remove the rubber feet from some pieces. The console can be rolled about easily on its heavy-duty casters and the back is open, allowing access to the rear panels of all gear. There is also plenty of room in the rear of the console for accessories such as power supplies, VHF amplifiers, and other items not requiring front-panel space. An optional drawer/bookshelf unit provides a handy place to store things like logbooks, message forms, and spare fuses.

Conclusions

There are pluses and minuses to this type of operating console. On the plus side, there is the complete absence of unsightly wires and cabling, having all equipment within easy reach (yet not piled on top of itself), the convenient access to the rigs from behind, and the knowledge that if I ever buy new equipment, I need replace only the front panel and support rigging for a relatively small fee. Equally important, perhaps, is the feeling of pride one gets in operating from such an impressive looking console. It's like having a seat at mission control.

On the other hand, a ham who replaces his gear frequently, or who likes to rearrange his operating position once a month, may find it prohibitive to replace front panels so often. For my purchasing patterns and operating style, it presents no problem, as it is usually two or three years between major changes at WB8BTH.

In summary, I couldn't be more pleased with my BCS console. The workmanship is first rate, and the console is built like a tank. Larry Kushner WA6BKC/4 and his crew have done a fine job.

Prices for BCS consoles start at $600. For more information, write *Break Communications Systems, Inc., 5817 SW 21st Street, Hollywood FL 33023.* Reader Service number 486.

Jeff DeTray WB8BTH
73 Staff

MIZUHO MINIATURE SIX-METER MULTIMODE

A couple of years ago at the Dayton Hamvention, I saw a little Japanese transceiver kit for sale. It was about the size and shape of an ICOM 2A, but it wasn't an FM rig. It was a *sideband* handie-talkie with only a quarter-Watt output; the Mizuho MX-6Z. Amusing, I thought, but not really serious. It turned up again in 1983 at Dayton and began to be advertised in the ham magazines. Three models were now available, covering 15, 6 and 2 meters, plus amplifiers for the 15- and 6-meter units and some accessories. So they *were* serious after all! Curious about what sort of rig it could be, I bought a pair of the six-meter versions. (A pair, to ensure someone to talk to. I wasn't sure what sort of 6-meter activity there was here in eastern Tennessee).

Assembling the kits turned out to be quite simple, taking only about 45 minutes each, despite some missing steps in the English-language instructions. The full Japanese instruction set was included too, with enough drawings to make up

Only the faceplate of each piece of gear protrudes through the front panel, giving the console a sophisticated look.

4' console displayed

Dealer inquiries invited.

MICA COMMUNICATIONS CONSOLES

4'-6'-8' Wide – *1' to 8' wide optional*
"L" & "U" & Circular set up's – *with optional corner table*
Replaceable Front Panel – *for station changes*
Precisely cut panel holes – *by computerized wood cutter*
High station density – *because no shelves are used!!*
Hidden accessory shelf – *for power supplies, dummy load*
Puppets of all your equipment – *for easy station layout*

OPTIONAL ITEMS:
Drawer/Bookshelf combination – *hangs under desk*
1000 Mica's to select from – *to match your decor*
Desk recessed for keyboard – *optimum 26" typing height*
Desk top extensions into panel – *for apple computer or storage*
Matching dolly for floor amp's – *with concealed casters*
Shelf under desk, quick access – *for headphones, Key, Mic*
Exhaust cooling fan system – *thermostatically controlled*
Wire duct, wire labels, etc...

Break Communications Systems, Inc.

5817 S.W. 21st Street, Dept. 73 • Hollywood, Florida 33023
Phone (305) 989-2371

Radio equipment not included

Also Available....
Floor Space: 51" Wide by 30" Deep
$199.50

. . . at last . . . your shack organized!

A beautiful piece of furniture – your XYL will love it!

$184.50 S-F RADIO DESK

Deluxe - Ready to Assemble

Designed with **angled** rear shelf for your viewing comfort and ease of operation.

FINISHES: Walnut or Teak Stain.
Floor Space: 39" Wide by 30" Deep
Additional Information on Request.
Checks, Money Orders, BankAmericard and Master Charge Accepted.
F.O.B. Culver City. (In Calif. Add 6% Sales Tax.)
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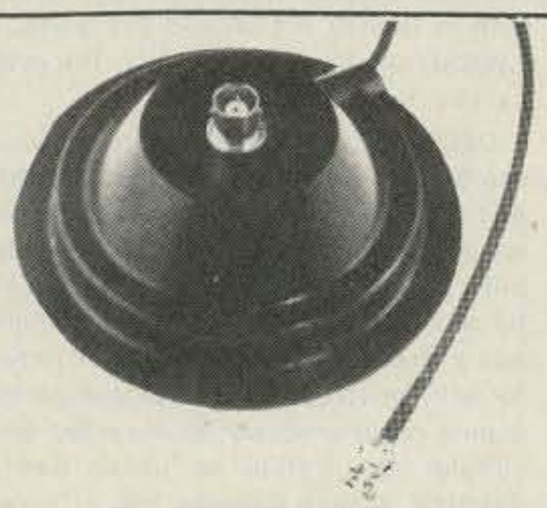

UP YOUR ERP

For HT owners operating inside a vehicle and wanting increased T/R range, RF PRODUCTS has the low cost solution.

Remove your BNC antenna from the HT and mount on the RF PRODUCTS BNC magnet mount, install the magnet mount on the roof top and connect the BNC co-ax connector.

The magnet mount (part no. 199-445) has 10 feet of small (5/32") co-ax with BNC connector attached and is priced at $15.95 (including shipping by UPS to 48 states).

TO ORDER - send $15.95 money order or cashiers check only
Fla. residents add 5% tax, for air UPS add $1.50

The RF PRODUCTS Magnet Mounts are one of the few magnetic antenna mounts available that can be repaired should the co-ax cable be damaged. The co-ax cable connector includes a shrink tubing strain relief for long life at the connector/cable flex point (an RF PRODUCTS exclusive on all cable assemblies).

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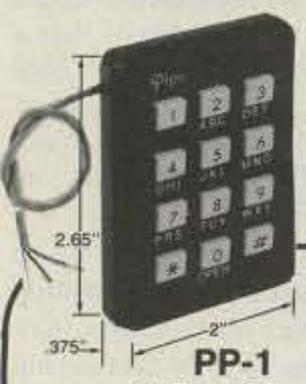
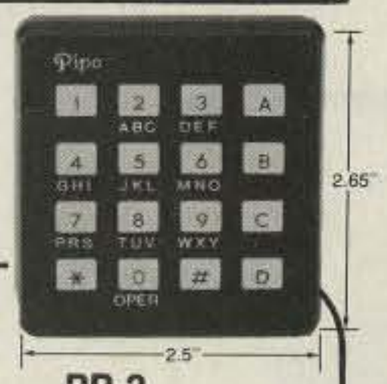


PP-1
& PP-1K



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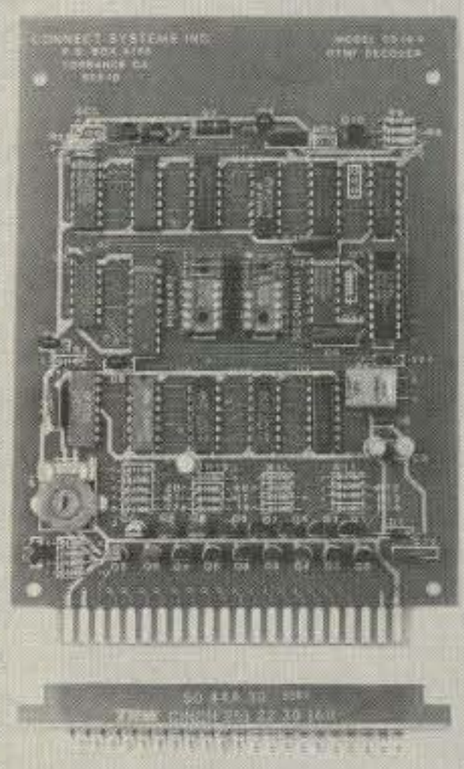

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for the missing info. There were also some suggested modifications in the Japanese instructions, such as an S-meter (though I don't know where you'd mount it!), a transmit light, and a CW sidetone, which aren't in the English version. The two circuit boards were already assembled, tested, and mounted, leaving only a little wiring and case assembly to do. Two types of battery holder were provided; a 9-volt transistor-battery connector, and a holder for six AAA cells. I recommend the latter, since the unit draws enough current to deplete almost any 9-volt transistor battery in short order.

Both units worked as soon as power was applied, and no tune-up was necessary (no instructions were provided anyway). Initial tests with bench supplies showed a need for a little more bypassing at the external-power input jack on the bottom of the case since the supplied external-power cord was radiating more than my dummy load! A .001-uF ceramic across the dc-input terminals quieted things down. One unit put .275 Watts into the load on CW and SSB voice peaks, the other a little less. However, both drew 220 mA from the 9-V supply while doing it. Current drain on receive is about 40 mA, and 100 mA during key-up transmit. A regular carbon-zinc transistor battery went flat very quickly under the strain, so I switched to alkaline AAA cells which have held up pretty well in light usage. A separate power supply or external battery pack is really necessary for any serious long-term operating. It looks to me as if a battery pack from an ICOM 2A would fit perfectly on the bottom of the case if it could be attached securely.

Initial tests in the field (literally a field!) showed that the little units have good audio quality and frequency stability on both transmit and receive. The 11-inch "super rubber ducky" antennas supplied gave perfect copy at a range of a half mile with a hill and building in between. The tuning knob is on the top of the case and controls a variable crystal oscillator with a range of 50 kHz. A "band" switch next to it switches between either of two crystals (one is provided, for 50.2 to 50.25 MHz), giving it a total of 100 kHz of coverage. The necessity of tuning in the other station and the lack of squelch are a little strange at first when your only other hand-held experience is with 2-meter FM. Perfectly normal on HF sideband, but unexpected in a handie. The transmit button isn't a push-to-talk type. It's a latching switch—push once to transmit, again to receive. Since the MX-6Z also transmits CW (from a tiny button on the top panel or through a miniature jack on the bottom), this does make some sense. The internal microphone is an electret type, and there is an external-mike jack on top of the case next to the headphone jack. A noise-blanker switch is below the tuning knob, and the blanker does seem to work pretty well on ignition noise, an important consideration on six meters.

As you'd expect in any unit that packs this many features into so small a case, the circuitry is pretty simple. One of the two PC boards is devoted to rf, and the other to i-f, sideband generation, and audio. The receiver is a single-conversion type with a fixed-tuned dual-gate MOSFET rf-amplifier stage. I measured the sensitivity (crudely) as about 0.8 uV for 20-dB signal-to-noise; I could hear a signal at 0.1 uV. The i-f frequency is 7.8 MHz, and the tiny crystal filter seems adequate on both receive and transmit. A quick and dirty check showed a 6-dB bandwidth of about 2 kHz, from rf in to speaker out. The transmitter has three "power amplifier" stages following the transmit mixer, the first of which is a dual-gate MOSFET which is keyed for CW. All of the stages are broadly tuned and inductively coupled except the final, which is a multi-stage pi type. Transmit-receive switching is done with diodes and is accomplished with a closure to ground, so CW break-in operation might be possible with a simple modification. Audio output and quality is pretty much on a par with other handie-talkies, with an LM386 audio-amp IC driving a two-inch speaker.

The best part of this little rig is that it's fun! It really works pretty well for its low power. When six is open, not much power is needed, of course, and when the band is closed, not much will help. One of the first contacts I made after building and testing my MX-6 was with a south Texas station, followed by contacts with Oklahoma and Minnesota, all between 800 and 1000 miles from my Tennessee QTH. This was done with an 80-meter dipole, since I didn't have a six-meter antenna up! A proper antenna and more power would help a lot. QRO is available in the form of a 5-Watt amplifier, the PL-6.

Ultimately, this little rig is likely to be used for portable or mobile work such as mountaintopping. Its small tuning knob and limited tuning range, to say nothing of its low power, will not make it a favorite of hard-core six-meter operators, but it is a nice cheap way to get on six-meter sideband. I use mine mostly for local monitoring and checking for band openings, tasks for which the rubber-ducky antenna works fine. When activity occurs I can hurry to the shack and plug in the outside antenna and sharpen up my QRP operating skills. One of these days I'm going to get a portable six-meter beam and hike up into the Smokey Mountains and hope for a band opening. Then the MX-6 will really be in its element!

For further information, contact *Ace Communications, 2832-D Walnut Ave., Tustin CA 92680; (714)-544-8281.* Reader Service number 477.

Mark Nelson AJ2X
Knoxville TN

YAESU FT-726R

Remember the advertising bit about "Who put eight great tomatoes in that little bitty can?" I think I know who did it, and they now work for Yaesu! The features packed into Yaesu's FT-726R go beyond those of the early all-mode rigs to create a truly impressive radio. A glance at the front panel finds controls usually associated with an advanced HF rig rather than a VHF one. One's choice of options centers largely around band preferences rather than operating modes or signal processing. More about that in a moment.

The FT-726R comes with 2 meters as standard equipment, with provisions for installing two optional modules for other bands. Available modules include those for HF (15, 12, 11, or 10 meters), 6 meters, and 70 cm (430–440 MHz or 440–450 MHz), with thinly veiled rumors of forthcoming 220- and 1296-MHz modules. The optional satellite module permits full-duplex crossband operation via OSCAR or RS satellites. Operation on LSB, USB, CW, and FM is standard. No optional speech processor or noise blanker here; both are standard. As in most digitally-tuned rigs, there are two vfos plus memories, along with scanning features. A microprocessor keeps track of the mode of operation and controls the memory and scanning functions. Receiver performance is enhanced by controls for agc time constant, i-f shift, i-f width, rf gain, audio tone, and clarifier (RIT). Provision is made for installation of a CW filter.

Mizuho MX-6Z controls.

Impressions

The review unit was equipped for the satellite enthusiast and casual operator on 2 meters and 70 cm. Modules for 2 meters, HF, and 70 cm were installed, along with the satellite unit and a 300-Hz CW filter (model YK-455.8MCN). Even after operating a variety of gear over the years, my initial reaction to the front panel was one of mild panic—how could I master all those (41!) controls? A look at the rear panel, though, found it surprisingly "clean" with jacks for key, 600-Ohm audio output, external speaker, external push-to-talk, and power. Each module has two rear-panel jacks: the separate coaxial connectors that allow bandswitching without swapping cables, and companion 3.5-mm jacks which provide ground-on-transmit to energize an external amplifier on the appropriate band. It was reassuring to find a type-N coax fitting on the 70-cm module.

It didn't take long to find room for the 726—it can replace *six* boxes in my shack! A closer look at the front panel and perusal of the operating manual showed that the controls are logically grouped, and later operating bore that out. Don't think you can make this radio do all its tricks without looking at the manual, though.

A word on the manual itself is in order here. It is definitely an *operating* manual. There is no theory of operation or detailed parts layout. Complete installation and operating instructions, schematics, and block diagrams are included, as well as procedures for installation of options. The only fault I could find with the manual turned up when I tried to operate through OSCAR 10 and the 726 seemed to get "confused." It turns out that when operating crossband full-duplex, the uplink and downlink modules must both be in CW or both be in SSB. A LSB/USB mix works; a CW/SSB combination does not. The manual isn't too clear on this.

OSCAR 10 operation was good when using a 16-element linear yagi on 435 MHz and my four-yagi EME array with tower-mounted preamp on the downlink. A later attempt on Field Day was not so successful when using the same uplink antenna and a 10-element "twist" downlink antenna with no preamp. Reasonable performance could probably be expected with circular polarization on uplink and a downlink system between the extremes tried here.

Moonbounce operation proved the worth of the i-f-shift and width controls and the 20-Hz clarifier steps in enhancing weak-signal readability. The results were so dramatic that I didn't even try the outboard audio filter I usually use. Semi-break-in CW is smooth at about 18 wpm, but the delay is too short for the slower speeds used on EME—the extent PTT could be wired with a toggle switch to get around this. Incidentally, it appears that a variable resistor (VR07 on the tx unit) controls break-in delay, but it isn't mentioned anywhere. (Nor is VR08, which controls sidetone volume. *Operating* manual, remember?).

The 726 was pressed into service on 70 cm during contest operation from a hilltop near Ithaca NY. Intermod problems from an FM station 2 miles away on the next hill disappeared when we substituted the FT-726R for our usual 432 rig. Receiver sensitivity seemed good and the transmitter drove a solid-state amplifier nicely. The other operators in our multi-op effort mastered the rig's essential controls quickly and easily.

Assorted Pluses and Minuses

The CW filter has its own front-panel

control and that's great! Hats off to the engineer who gave the filter in/out choice to the operator and made clockwise rotation of the tuning knob increase frequency. On the negative side, I found the CW sidetone clicky to the point of being slightly annoying, especially in headphones. A few spurious signals turned up in the HF region even when the antenna was replaced with a good 50-Ohm load. The spurs didn't show up on 2 meters or 70 cm. Power-line noise had to exceed S3 on the S-meter before the blanker had an effect. Suprisingly, the blanker could do nothing with ignition noise from my neighbor's lawn mower. It's obvious that noise rise time and level both determine how effective the blanker will be.

The Bottom Line

Overall, the FT-726R gets very good marks. Any faults I have noted are minor in comparison to its performance and features. It is evident that a lot of commonsense thinking went into the design of this rig. Learning to sort out all the controls was painless with the aid of the manual. The ability to hop back and forth between a 10-meter sporadic-E opening and 432-MHz activity at the flip of a switch is quite remarkable. Even while writing this, I'm letting the rig scan the various calling frequencies in hopes that one of the bands will open!

For further details, write or call *Yaesu Electronics Corporation, 6851 Walthall Way, Paramount CA 90723; (213)-633-4007.* Reader Service number 476.

Richard R. Farman K2QR
Endicott NY

The Kantronics Interface II

THE KANTRONICS INTERFACE II

As an amateur enthusiast of some twenty-four years turned computer crazy, I am particularly interested in software and hardware packages that can be used in the ham shack. While the actual sending of CW, RTTY, AMTOR, and ASCII is "duck soup" for virtually any home computer, the need for an interface between the computer and the ham equipment is still a necessity. I've previously had the chance to review the original Kantronics Interface and the AEA CP-1, but I was anxious to see how the Kantronics Interface II would perform. Here are the results of my "on-line" tests.

The first thing that struck me is the size of the unit. It is small! I guess it must be my vacuum-tube background, but I always expect things that do a big job to be larger than they really are.

The next thing I noticed is that like many accessories these days, the unit does not contain or come with its own power source. I suppose this saves a few bucks and some amateurs would rather power everything off of one big twelve-volt supply. I'm not one of them.

The original Kantronics Interface, though it performed well, was sort of a minimal TU for anyone who has ever used more expensive units. The interference-rejection and signal-fading capabilities were not very good. The single bar-graph LED tuning indicator left a lot to be desired. The original was designed only for 170-Hertz-shift signals. It could be made to work on other shifts, but not very effectively. No provision was made for generating 850-Hertz-shift tones for VHF and MARS work on transmit.

The Interface II, I'm happy to say, has addressed many of these problems and conquered most of them. The unit has been completely redesigned so that it now makes full use of both the mark and space signals rather than relying on single-tone detection.

Perhaps one of the nicest features is the new tuning-indicator system. It still uses an LED bar graph, but much in the tradition of the old "magic eye" tubes of days gone by. I've used a tuning scope for RTTY and found it to be a nice luxury, but far from a necessity. With the dual-bar system used in the Kantronics Interface II, I found that tuning was just as easy and accurate as using a scope. Scope outputs are available if you still want to hook up that old tuning indicator.

The next area that I found impressive was the switch-selectable shift options. Most amateur work takes place at 170-Hertz shift, but almost none of the commercial traffic uses this shift. Units such as the AEA CP-1 allow for a variable-shift option. My experience, though, is that this is still not as convenient or accurate as having the 425- and 850-Hertz shift options switch-selectable. I'm still an old SWL at heart and enjoy tuning the press and weather transmissions. The Kantronics II is the first unit I have used that handles the commercial shifts well.

Kantronics did use one cost-saving technique for wider shifts. The same 1100-Hertz or so bandpass filter is used for both 450- and 850-Hertz modes rather than providing, say, a 550-Hertz filter for the 450-Hertz mode. This is a noticeable omission, but only slightly hampers operation at the intermediate shift.

Another nice feature is that you can hook up two different stations to the interface and select the one you want by means of a front-panel switch. This is particularly handy if you operate both an HF and VHF station using the same computer equipment.

The final new addition is an FM/AM switch. Those terms are a little misleading. Under normal conditions the TU operates in the FM mode. A small amount of audio is amplified so that it brings an op amp in the unit into hard limiting. This effectively turns over control for the signal level to the TU. Under adverse band conditions this can create a problem. In the AM mode, the hard limiter is bypassed. More audio is required to drive the unit, but you can use the audio and rf-gain controls on your receiver to more effectively control the signal going to the TU. The advantage gained can be a large one, but practice helps!

I found one major shortcoming in comparing the Interface II to the AEA CP-1. The AEA unit still seems to perform somewhat better under adverse signal conditions in the 170-Hertz mode. It also seems to permit less "garbage" through when tuning between good signals. So the choice may come down to how you feel about the availability of the commercial shifts and the switch selection between two stations. All in all, Kantronics has done an excellent job of responding to the suggestions of its customers. List price for the Kantronics Interface II is $269.95. I recommend it.

For more information, contact *Kantronics, 1202 E. 23rd Street, Lawrence KS 66044; (913)-842-7745.*

Jim Grubbs K9EI
Springfield IL

WHAT DO *YOU* THINK?

Have you recently purchased a new product that has been reviewed in *73*? If you have, write and tell us what *you* think about it. *73* will publish your comments so you can share them with other hams, as part of our continuing effort to bring you the best in new product information and reviews. Send your thoughts to Review Editor, *73: Amateur Radio's Technical Journal*, Peterborough NH 03458.

AWARDS

SCHOLARSHIP WINNERS

The Foundation for Amateur Radio is pleased to announce the 1984 winners of the fifteen scholarships which it administers.

John W. Gore Memorial Scholarship—$900: David J. Schmocker KJ9I, Oconomwoc WI.

Richard G. Chichester Memorial Scholarship—$900: Paul D. Sargis KI6U, Modesto CA.

Edwin S. Van Deusen Memorial Scholarship—$350: Timothy Wettach N2TW, Webster NY.

QCWA Silent Key Memorial Scholarships—$500 each: Bruce A. Wade N9UR, Glendale WI; Ian R. McNicholl KA9KOW, La Habra CA; Scott Smith KA2EMO, Malone NY.

Radio Club of America Scholarship—$500: Doyle B. Johnson KF6BD, Pleasant Hill CA.

Edmund B. Redington Memorial Scholarship—$500: David Swiatlowski KA2KLM, Camillus NY.

Young Ladies' Radio League Scholarship—$500: Diane E. Willemin N8CAY, Elyria OH.

Amateur Radio News Service Scholarship—$500: Marc C. Vernon KI9V, Hinsdale IL.

Columbia (MD) Amateur Radio Association Scholarship—$650: Eric J. Smith KA3KJO, Silver Spring MD.

Baltimore (MD) Amateur Radio Club Scholarship—$500: Richard A. White, Jr. KA3T, Mt. Airy MD.

Dade Radio Club Tropical Hamboree Scholarships—$500 each: Wayne F. Poole KC4XL, Surfside FL; Craig F. Rodgers WA4C, Boca Raton FL.

Lewis G. Wilkinson Memorial Scholarship—$500: David Cheitel KA2PNR, Bronx NY.

These scholarships were open to all radio amateurs meeting the qualifications and residence requirements of the various sponsors. The Foundation is a non-profit organization representing fifty clubs in Maryland, the District of Columbia, and northern Virginia. It is devoted exclusively to the scientific, literary, and educational pursuits that advance amateur radio. Information regarding the 1985 awards will appear in the spring in *73*.

VFN 50TH

A certificate is being offered by the Virginia Fone Net in commemoration of 50 years of continuous traffic-net operation on the 75-meter band, handling traffic into, through, and out of the state of Virginia. The net is non-affiliated but has a membership of 150 registered and numbered licensed amateurs. The VFN holds 2 conventions per year at various places in Virginia and all amateurs are welcomed. Membership information may be obtained from any net control or will be furnished with your certificate, if requested.

To obtain this handsome multicolored certificate, an applicant must make 2-way contact with 25 or more VFN members on any band *except during net operation.* Net time is daily on 3.947 MHz at 1600 and 1930 EST.

Send your log of information including the call of the station worked and the name and VFN number of the station worked to: Bill Redmond K4IEC, 917 Rockspring Drive, Winston Salem NC 27105. Include a summary log. Contacts will be verified from your list. Include $1.00 for handling and a #10 SASE, or $2.00 for a "flat pack" envelope. All certificates will be serial numbered and will be hand-lettered with the recipient's name and call. Contacts and requests must be made between September 30, 1984, and June 30, 1985.

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 4

on 220 MHz and see if it would work here. They were absolutely disgusted when the ARRL fought them and amateurs were massively against even a no-code experiment.

I would not look for much in the way of sympathy or help from the FCC with regard to fighting off commercial demands for amateur frequencies. The hobby is no longer seen as a service, but more as entertainment for a very few technical nuts which is taking up some enormously valuable spectrum space which could be much better used.

What Will Go First

The first push is to get the 220-MHz band, which the FCC had saved from CB for the no-code ham experiment. Next look for six meters to be reallocated to something more productive for the country. Then we can expect to lose most of the microwave bands which are desperately needed for business communications. Remember that communications are going to be growing by a factor of about *one million* over the next few years. Some of this will use fiber optics, some cable, but much of it will go via microwave and satellites, and that means spectrum sacrifices.

Perhaps if the FCC had been a bit more forthright and made it clear to the League directors that the choice was between no-code on 220 or losing the band, the League might not have pushed so hard to defeat the Commission. Oh, the Commission tried to make it clear, within their legal limits, but the League was not paying attention.

From the FCC's viewpoint, amateur radio is an increasing nuisance. The hobby used to pride itself on being self-policing. Now the FCC gets complaints that it isn't monitoring and policing our bands for us. It sees a bunch of increasingly retired, lazy old men sitting around helplessly wringing their hands and bitching when other hams jam their nets and repeaters, but making no real effort themselves to solve their problems.

The FCC sees today the remnants of what was once a feisty service, one which was responsible a generation or two ago for the development of virtually every breakthrough in communications—one which greatly helped the country win WWII by providing desperately needed technically-oriented youngsters—back when the average age of hams was nearer 30 than 60.

FEMA Replaces the FCC

This year the FCC even got out of the emergency communications business by turning it over to FEMA, the Federal Emergency Management Authority. FEMA has almost no connection with amateurs, so we're losing one of the last stronghold excuses for the hobby: emergency communications. What's left in the way of rationalizations for amateurs having the use of billions of dollars worth of spectrum?

Amateur radio exists at the whim of the FCC, so why are we kicking the Commissioners in the face when they try to help us? Perhaps it is a death wish by the old-timers. Did one single amateur who fought the no-code proposition think in terms of what was good for amateur radio and for our country? Or were they thinking only of the misery they had in learning the code and which should therefore be shared by all newcomers as a rite of passage? Never mind that the newcomers aren't coming, but are telling us to shove amateur radio and Morse code up our antique antennas.

Sure, I know I'm a pariah to many hams because I stand up and tell it like I see it. That's never been popular, so I shouldn't mind when ham popularity polls put me on a level with Nixon, Watt, or Oswald. From my viewpoint, I go to great lengths to do my homework before I write. My opinions are solidly based on facts. No, the attacks are usually personal, attacking me, not what I've written. Well, how else can someone fight where the facts are against them?

What Can Be Done?

With four more years of Reagan Commissioners, if amateur radio were put on the stock market, I don't think our stock would sell. What an incredible pity, for here we are at the right time in history to provide desperately needed services to our country—and to the world. The whole world is going high-tech and here we are with one of the best training grounds for youngsters to steer them into high-tech careers—and we aren't just not doing it, no, we're doing everything we can to prevent it.

With communications about to explode, amateur radio has the opportunity as never before to invent and pioneer new communications technologies. Sadly, the hams we need to do this were shut out of the hobby, so we don't have 'em available. Luckily for the world, though not for us, Japan does have the needed technicians and engineers. They came into high-tech through Japan's no-code ham license. So we're going to have to continue to buy Japanese ham gear, two-way equipment, telephones, and so on. We no longer have the technical people to keep up with their creative designing. Soon we may not even have enough technicians to service the satellite, microwave, and fiber-optic communications equipment which is pouring into the country.

If you know of any approach which will convince youngsters that they should learn the code, let me know. I'm ready to try and get ham clubs started in every high school in America, but it is a complete waste of time even trying this without some convincing explanation for the code.

No, they won't buy that crap about Morse code getting through when all else fails. Nor will they buy it being less expensive than phone. Heck, you don't believe that old bunk any more than I do—and this in my 46th year in amateur radio. If you can give me *one* convincing reason for the code, I'll be able to get started.

FUN!

John Edwards KI2U
PO Box 73
Middle Village NY 11379

CONTESTS

I'll be honest, I've never been a big contest fan. Oh, once or twice in my hamming career I've seated myself behind a microphone, intent on winning one competition or another. Unfortunately, I've never managed to do better than to win first place in the 1977 Manitoba QSO Party. Of course, I was the only New York station to participate in the Manitoba QSO Party that year, so I'm not quite sure how valuable that particular victory was.

I think I can attribute my lack of contesting enthusiasm to three factors: no antenna, no linear amplifier, and greed. Given enough money, I could easily solve the antenna and amp problems. The greed factor, however, is a bit trickier. You see, my natural avarice tends to keep me from entering contests that only offer fragments of sheepskin as prizes. A trip around the world? A 1985 Corvette? Sure. A certificate? Forget it.

Of course, the widespread cheating that goes on also turns me off. Just who regulates what goes on during these contests, anyway? Faulty IDing, the disregard of contest exchange rules, exaggerated signal reports, and just plain crummy operating practices are commonplace. Perhaps we should recruit a cadre of contest referees—hams who would be willing to tune around the bands and snitch on these creeps and cheats. Maybe then I'll be able to take contests seriously.

Anyway, for whatever it's worth, here are this month's quizzes. I feel obliged to do a column on contesting now and then, but I don't much enjoy the task.

ELEMENT 1
MULTIPLE CHOICE

1) The very first ARRL Sweepstakes was held in:
   1) 1954
   2) 1917
   3) 1930
   4) 1964

2) The very first ARRL Field Day was held in:
   1) 1933
   2) 1962
   3) 1957
   4) 1929

3) Which of the following magazines/organzations has *never* sponsored a 160-meter contest?
   1) ARRL
   2) *73 Magazine*
   3) *CQ Magazine*
   4) Quarter Century Wireless Association

4) During its heyday in the mid-1970s, approximately how many hams each year sent CW and Phone ARRL Sweepstakes logs to the League's headquarters?
   1) 500
   2) 1000
   3) 2500
   4) 10,000
5) Who is *73 Magazine's* contest editor? (No fair peeking.)
   1) Robert Baker WB2GFE
   2) Robert Swirsky AF2M
   3) Marc Leavey WA3AJR
   4) Chod Harris VP2ML

ELEMENT 2
SCRAMBLED WORDS

Unscramble these contest-related terms:

netcots	ogl	pude
plitumlire	xov	retcmopu
coclk	eky	efefoc
nananet		

ELEMENT 3
TRUE-FALSE

	True	False
1) In 1968, a Technician-class ham won the ARRL DX Contest.	____	____
2) The ARRL once sponsored a contest that ran for eight months.	____	____
3) The Helvetia Contest, held each April, is sponsored by a Swedish ham society.	____	____
4) The ARRL once sponsored a Crossband Get-Acquainted Party to "promote fraternalism" between 15- and 20-meter operators.	____	____
5) Most contesters use a "check sheet" to keep track of countries and/or states that still must be worked.	____	____
6) The first ARRL VHF Sweepstakes was held in 1947.	____	____
7) The first ARRL 10-Meter Contest was held in 1962.	____	____
8) The first ARRL 11-Meter Contest was held in 1959.	____	____
9) The first *73 Magazine* 75-Meter World SSB Championship was held in 1970.	____	____
10) The winning operator in the first ARRL sweepstakes worked 20 stations in 12 sections.	____	____

ELEMENT 4
MATCHING

Match the contests in Column A with the months in Column B.

Column A	Column B
1) County Hunters SSB Contest	A) January
2) ARRL VHF QSO Party	B) February
3) ARRL Field Day	C) March
4) *A5* International SSTV DX Contest	D) April
5) ARRL UHF Contest	E) May
6) ARRL 10-Meter Contest	F) June
7) ARRL Sweepstakes	G) July
8) Washington State QSO Party	H) August
9) *73* 40-Meter World SSB Championship	I) September
10) ARRL DX (Phone)	J) October
11) Dutch PACC Contest	K) November
	L) December

THE ANSWERS

Element 1:
1—3 In January.
2—1 In June.
3—4 Not yet, anyway.
4—3 Those were the days.
5—1 The one and only.

Element 2:
(Reading from left to right): contest, log, dupe; multiplier, vox, computer; clock, key, coffee; antenna.

Element 3:
1—False Even 1968's sunspots weren't able to provide that much help.
2—True The 1946 VHF Marathon.
3—False It's a Swiss contest.
4—False It was between 40- and 80-meter operators
5—False To keep track of stations already worked to prevent duplicate contacts.
6—True To the distress of VHF operators everywhere.
7—False Ten-meter operators had to wait until 1973 for their feelings of distress.
8—False The ARRL never held such a contest. Maybe if they had, we would still have the band.
9—False In 1982.
10—False He managed a not-so-staggering 153 stations in 43 sections.

Element 4:
1—D, 2—E, 3—F, 4—G, 5—H, 6—L, 7—K, 8—I, 9—A, 10—C, 11—B.

SCORING

Element 1:
Five points for each correct answer.
Element 2:
Two and one-half points for each word correctly unscrambled.
Element 3:
Two and one-half points for each correct answer.
Element 4:
Two points for each correct match.

How did you do?
1–20 points—Transmitting into a dummy load
21–40 points—Your elements are bent
41–60 points—A respectable performance
61–80 points—Almost a clean sweep
81–100+ points—No contest!

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

DARC CORONA 10-METER RTTY CONTEST
1100 to 1700 GMT November 3

This is the last of four tests during the year sponsored by the DARC eV to promote RTTY activity on the 10-meter band. Use the recommended portions of the 10-meter band. Each station can be contacted only once. Operating classes include single/multi-operator and SWL printer.

EXCHANGE:

RST, QSO number, name, and US state.

SCORING:

Each completed two-way RTTY QSO is worth 1 point. Multipliers include the WAE and DXCC lists, each US state, and each district in VE/VO, and VK. The final score is the total QSO points times the total multiplier.

AWARDS:

Appropriate awards to the leading stations in each classification, assuming reasonable scores.

ENTRIES:

Logs must contain name, call, and full address of participant. Also show class, time in GMT, exchange, and final score. SWLs apply the rules accordingly. Logs must be received within 30 days after the test. Send all entries to Klaus K. Zielski DF7FB, PO Box 1147, D-6455 Erlensee, West Germany.

ARRL SWEEPSTAKES
CW
Starts: 2100 GMT November 3
Ends: 0300 GMT November 4
PHONE
Starts: 2100 GMT November 17
Ends: 0300 GMT November 18

Note that these rules were taken from last year's contest. This year's rules were not received from the ARRL in time to make the printing deadline. Check *QST* for any last-minute changes!

US and Canadian stations work other US and Canadian stations using 1.8- through 28-MHz bands, excluding 10 MHz. Operate no more than 24 of the 30 hours with on/off times noted clearly in your log. Listening time counts as operating time. Operating categories include single oper-

CALENDAR

Nov 3	DARC Corona 10-Meter RTTY Contest #4
Nov 3–4	ARRL Sweepstakes—CW
Nov 10–11	Delaware QSO Party
Nov 10–11	European DX Contest—RTTY
Nov 10–12	Montana QSO Party
Nov 11	International OK DX Contest
Nov 17–18	ARRL Sweepstakes—Phone
Nov 24–25	*CQ* Worldwide DX—CW
Dec 1–2	ARRL 160-Meter Contest
Dec 8–9	ARRL 10-Meter Contest
Dec 26–Jan 1	QRP Winter Sports—CW
Dec 30	Canada Contest
Jan 12	*73* 40-Meter World SSB Championship
Jan 12–13	Hunting Lions In The Air Contest
Jan 13	*73* 75-Meter World SSB Championship
Jan 19–20	*73* 160-Meter World SSB Championship
Jan 26	*73* 15-Meter World SSB Championship
Jan 27	*73* 20-Meter World SSB Championship
Feb 23	*73* RTTY World Championship Contest

FEEDLINE

BULLETIN OF THE CANTON AMATEUR RADIO CLUB
Affiliated with the "American Radio Relay League"

NEWSLETTER OF THE MONTH

One of ham radio's deep mysteries revealed itself to me the other day. I was sitting at my desk with hundreds of newsletters—most of them terminally dull—stacked around me, reading Canton Amateur Radio Club's *FEEDLINE*. There it was, a great truth, in a report on parade communications: ". . . a big thanks to each of you."

So what's the mystery? Just this: A newletter *is* as the club *does*. For each boring newsletter, there must be an equally boring club. In the Canton ARC, *everyone* participates! President Scott Duncan KK8D must be a really amazing fellow. And Editor Bill Parks K8JZN must have a tough time keeping up with all of the activity, yet he handles it with a flair for detail. Congratulations to Scott, Bill, and *every* member of the Canton ARC—you're doing one heck of a job!

To enter your club's newsletter in *73*'s Newsletter of the Month Contest, send it to *73*, Pine Street, Peterborough NH 03458, Attn: Newsletter of the Month.

ator and multi-operator with a single transmitter.

No crossmode contacts are allowed and each station can only be worked once, regardless of band. A transmitter used to contact one or more stations may not subsequently be used under any other call during the contest period (with the exception of family stations where more than one callsign is assigned by FCC/DOC). One operator may not use more than one callsign from any given location during the contest period. The use of two or more transmitters simultaneously is not allowed.

EXCHANGE:

Consecutive serial number, precedence (A if you run 150 W output or less, B if more than 150 W), your callsign, check (last two digits of the year you were first licensed), and your ARRL section.

FREQUENCIES:

CW—1800-1810, 3550-3650, 7050-7100, 14050-14100, 21050-21100, 28050-28100. Novice—3710, 7110, 21110, 28110. Phone—1855-1865, 3850-3950, 7200-7250, 14250-14300, 21300-21400, 28550-28650.

SCORING:

Count 2 points for each completed 2-way QSO. Multipliers are each ARRL section plus VE8/VY1 (74 max.). KP4, KV4/KP2, and KG4 stations are in the West Indies section, while KH6 and other US possessions in the Pacific count as the Pacific section. Final score is QSO points times the number of ARRL sections (plus VE8/VY1).

AWARDS:

Certificates to the top single-operator CW and phone scorers in both the A and B categories in each ARRL section, and the top multi-operator entry in each ARRL division.

ENTRIES:

Contest forms (log sheets, summary sheet, dupe sheet) are available from ARRL headquarters for an SASE. Official forms are recommended. Any entry claiming more than 200 QSOs must submit duplicate checking sheets. Incomplete or late entries will be classified as check logs. Logs should include date, QSO time, exchange sent/received, band, and mode. Postmark your entry for either mode by December 21. Send it to ARRL, 225 Main Street, Newington CT 06111.

Each entrant agrees to be bound by the provisions as well as the intent of the official ARRL rules, the regulations of his licensing authority, and the decisions of the ARRL Awards Committee. Usual disqualification rules apply.

DELAWARE QSO PARTY
Starts: 1700 GMT November 10
Ends: 2300 GMT November 11

Sponsored by the Delaware ARC. Stations may be worked once per band and mode for QSO and multiplier credits.

EXCHANGE:

QSO number, RS(T), and Delaware county, ARRL section, or country.

FREQUENCIES:

CW—1805, 3570, 7070, 14070, 21070, 28070. SSB—1815, 3975, 7275, 14325, 21425, 28650. Novice—3710, 7120, 21120, 28120.

SCORING:

Delaware stations score 1 point per QSO. Multiply total by the number of ARRL sections and DX countries worked. Others score 5 points per Delaware station worked. Multiply total by the number of Delaware counties worked on each band and each mode (maximum of 36 multipliers possible).

ENTRIES AND AWARDS:

Appropriate awards will be given to the top scorers. In addition, a certificate to all stations working all three Delaware counties. If you work all three counties and want the WDEL Award, send two 20-cent stamps and an address label. Mail logs by December 17 to: Charlie Sculley AE3H, 103 E. Van Buren Avenue, New Castle DE 19720. Send an SASE for a copy of the results.

EUROPEAN DX CONTEST—RTTY
Starts: 0000 GMT November 10
Ends: 2400 GMT November 11

Sponsored by the Deutscher Amateur Radio Club (DARC). Only 36 hours of operation out of the 48-hour period are permitted for single-operator stations. The 12 hours of nonoperation may be taken in not more than three periods at any time during the contest. Operating classes include: single operator allband and multi-operator single transmitter. Multi-operator single-transmitter stations are only allowed to change bands one time within a 15-minute period, except for making a new multiplier. Use all amateur bands from 3.5 through 28 MHz. A contest QSO can be established between all continents and also one's own continent. However, QSOs as well as QTC traffic with one's own country is *not allowed*! Each station can be worked only once per band.

EXCHANGE:

Exchange the usual six-digit number consisting of RST and progressive QSO number starting with 001.

SCORING:

Each QSO counts 1 point. Each QTC (given or received) counts 1 point. Multipliers will be counted according to the European and ARRL countries lists. The multiplier on 3.5 MHz may be multiplied by 4, on 7 MHz by 3, and on 14 through 28 MHz by 2. However, contacts within the same continent only count as a multiplier of one per band (including 80 and 40 meters). The final score is the sum of QSO and QTC points, times the total multiplier.

QTC TRAFFIC:

Additional point credit can be realized by making use of the QTC traffic feature. A QTC is a report of a confirmed QSO that has taken place earlier in the contest, which you send to another station. The general idea being that after a number of stations have been worked, a list of these stations can be reported back during a QSO with another station. An additional 1-point credit can be claimed for each station reported.

A QTC contains the time, call, and QSO number of the station being reported, e.g., 1300/DA1AA/134. This means that at 1300 GMT you worked DA1AA and received number 134. A QSO can be reported only once and not back to the originating station. A maximum of 10 QTCs per station is permitted. You may work the same station several times to complete this quota, but only the original contact has QSO point value. Keep a uniform list of QTCs sent. QTC 3/7 indicates that this is the 3rd series of QTCs sent and that 7 QSOs are reported.

AWARDS:

Certificates to the highest scorer in each classification in each country, reasonable score provided. Continental leaders will be honored with plaques. Certificates will also be given to stations with at least half the score of the continental leader or with at least 250,000 points. The minimum requirements for a certificate or a trophy are 100 QSOs or 10,000 points.

ENTRIES:

Violation of the rules, unsportsmanlike conduct, or taking credit for excessive duplicate contacts will be deemed sufficient cause for disqualification. The decisions of the Contest Committee are final. It is suggested that contestants use the log sheets of the DARC or equivalent. Send a large SASE to get logs and summary sheets (40 QSOs or QTCs per sheet). SWLs apply the rules accordingly. Entries should be sent no later than December 15 to: DARC DX Awards, PO Box 1328, D-895 Kaufbeuren, West Germany.

EUROPEAN COUNTRY LIST:

C31, CT1, CT2, DL, DM, EA, EA6, EI, F, FC, G, GC Guer, GC Jer, GD, GI, GM, GM Shetland, GW, HA, HB9, HB0, HV, I, IS, IT, JW Bear, JW, JX, LA, LX, LZ, M1, OE, OH, OH0, OJ0, OK, ON, OY, OZ, PA, SM, S, SV, SV Crete, SV Rhodes, SV Athos, TA1, UAs 1, 3, 4, 6, UA2, UB5, UC2, UN1, UO5, UP2, UQ2, UR2, UA Franz Josef Land, YO, YU, ZA, ZB2, 3A, 4U1, 9H1.

MONTANA QSO PARTY
1700 GMT November 10 to 0400 GMT November 11
1700 GMT November 11 to 0100 GMT November 12

Sponsored by the Yellowstone Radio Club of Billings, Montana. Work stations once per band and mode with Montana-to-Montana QSOs allowed. Work portables and mobiles as they change counties. No repeater QSOs.

EXCHANGE:

RS(T), serial number, and state, country, or Montana county.

FREQUENCIES:

Phone—1835, 3905, 7285, 14285, 21385, 28585. CW—1810, 3540, 7035, 14035, 21035, 28035.

SCORING:

Count one point for phone QSOs and two points for CW QSOs. Montana stations multiply total QSO points by number of states, countries, Canadian provinces, and Montana counties. Others multiply total QSO points by number of Montana counties worked (56 max.).

ENTRIES:

Mail logs by December 15 to Yellowstone Radio Club, 2626 Burlington, Billings MT 59102.

INTERNATIONAL OK DX CONTEST
Starts: 0000 GMT November 11
Ends: 2400 GMT November 11

Participating stations work stations of other countries according to the official DXCC country list. Contacts between stations of the same country count only for multipliers, but have no QSO point value. Each station may be worked once on each band. Use all bands, 160 through 10 meters on phone or CW. Crossband or crossmode contacts are not valid. Operating categories include: A—single operator all bands, B—single operator one band, and C—multi-operator all bands. Any station operated by a single person obtaining assistance, such as in keeping the log, monitoring other bands, tuning the transmitter, etc., is considered a multi-operator station. Club stations may work in category C (multi-op) only.

EXCHANGE:

RS(T) and 2-digit number indicating the ITU zone. Please note that ITU zones are quite different from the ARRL zones! For a list and map of the ITU zones, send 2 IRCs to the entry address listed below.

SCORING:

Each QSO counts one point, or 3 points if with an OK station. Final score is QSO points times the total number of ITU zones worked on each band.

ENTRIES:

A separate log must be kept for each band and must contain the full date. The log must contain in its heading the category of the station (A, B, C), name, callsign, address, and band(s) used. Also show the total number of contacts, QSO points, multipliers, and total score. Each log must be accompanied by the following declaration: "I hereby state that my station was operated in accordance with the rules of the contest as well as all regulations established for amateur radio in my country, and that my report is correct and true to the best of my belief."

A certificate will be awarded to the top-scoring operators in each country and each category. The 100 OK Award may be issued to stations for contacts with 100 OK stations, and an S-6-S Award or endorsements for individual bands may be issued to a station for contacts with all continents. Both awards will be issued upon a written application in the log and no QSLs are required. Logs must be postmarked no later than December 31 and sent to: The Central Radio Club, PO Box 69, 113 27 Praha 1, Czechoslovakia.

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

DXPEDITION TO KERMADEC

"Ron, Ron, wake up. The storm last night sank our boat! We're stuck here on Raoul Island!"

Ron Wright ZL1AMO pulled himself out of a deep sleep at 6 am to this unpleasant news. "But then I decided I couldn't do anything about the boat, so I went over to the shack and started operating."

So the unflappable DXpeditioner handled the news that his only means of transportation back to New Zealand now lay under 50 feet of shark-infested water. Operating as ZL8AMO, Ron handed out more than 10,000 CW contacts from the Kermadec Island Group, hundreds of miles north of his native New Zealand.

The Kermadec story began in 1983, when Jim Smith VK9NS contacted the New Zealand Lands and Survey Department about a joint scientific and amateur-radio expedition to Raoul Island. Jim, you will remember, led the second DXpedition to Heard Island earlier that year. Over the next few months, details of the DXpedition began to fall into place, under the guiding hand of Dr. J. L. Craig of the Zoology Department of Auckland (NZ) University.

After an exhaustive two-month search for an appropriate vessel to sail the 10-member team from Auckland to Raoul Island, both the scientific and amateur-radio teams boarded the ferroconcrete ship *Shiner* on March 13. The 18-month-old ship was registered just before sailing; this was to be its first (and last!) official voyage.

The 700-mile sail passed relatively uneventfully for the party, with some of the first-time sailors enjoying the dolphins cruising in the bow wake. The only problem was lack of wind, forcing the crew to motor almost a third of the distance. Five days later the *Shiner* dropped anchor near the loading crane, just off the northernmost (and only permanently-inhabited island) of the Kermadec Islands: Raoul.

The amateurs on the ship were in contact with the crane operator, the only amateur on Raoul, Warrick ZL8AFH. Soon the tedious and dangerous task of moving ten people, scientific gear, radio equipment, and supplies began. DXpeditioners loaded their gear into an inflatable "Zodiac" and edged closer to the sheer cliffs that mark the landing zone. Warrick swung his power crane out over the water and lowered the net to the Zodiac, which was bobbing up and down in the heavy swells. A deep sigh of relief came from scientists and amateurs alike as all equipment safely made the passage up the cliff.

Then it was time for the members of the party themselves to land. No safety net for people: just a ladder swinging on the end of the long crane. The hams grabbed at the ladder as it swung past and, hanging on tight, were whisked up the cliff, trusting to the capable hands of Warrick.

With the help of the only motorized vehicles in the Kermadecs, an old tractor and an even older truck, the five-member team permanently stationed on the island assisted the visitors to their fine accommodations. Soon the hams and scientists were comfortably installed in their quarters and ready for the serious work of the trip.

The amateur team of Ron ZL1AMO, John ZL1AAS, Roly ZL1BQD, and Duane W6REC quickly began setting up four complete stations (including an ICOM 745, ICOM 740, Kenwood TS-830, and a Kenwood TS-430). The antenna farm consisted of two tribanders and dipoles for the lower bands. The 160-meter and 80-meter dipoles were hung at the 100-foot level between towering Norfolk Pines, thanks to the climbing ability of scientist Mark Vette. Another dipole handled the 40-meter skyhook chores, as well as backing up the higher 80-meter wire.

Not long after arriving on Raoul, Ron made the first contact as ZL8AMO with N4VZ on 40 CW. Good radio propagation, especially on 10 meters, kept the QSO rate high. Everything was going swimmingly until late Wednesday night, March 21, three days after the crew landed on Raoul.

Cyclone Cyril was headed for the very exposed Raoul, so the boat captain, John Taylor, moved the *Shiner* around to the far side of the island and the most sheltered spot, Boat Cove. The three-man crew on the ship maintained hourly radio contact with the rest of the party on the island. Then, in the wee hours of the morning, the cyclone changed direction and high winds, heavy seas, and driving rain smashed into Boat Cove.

Soon the *Shiner*'s anchor began to drag, and then broke. There was nothing to prevent the ship from crashing against the rocks. All three men aboard leaped into their inflated life raft, and, thanks to a great stroke of good fortune, made it safely through the violent sea and storm to shore.

Although no lives were lost and no one was seriously injured, the boat was a total loss. While almost all the radio gear was high and dry on the island, a great deal of personal equipment and scientific gear now lay at the bottom of the Pacific. The two marine biologists took time out from chronicling new species of fish to rescue as much gear as the surf and sharks allowed. Meanwhile, Ron continued to operate, piling up more of his 10,000 CW contacts.

With their only means of transportation now gone, the party began to tune around the marine bands, looking for a ship going in the right direction. Fortunately, the *MV Vili* from Tonga was on its way south to Auckland and agreed to detour to Raoul to pick up the stranded party.

The change in plans cut the operating time short, but who knows when the next ship might have appeared. The group accepted the truncation of the operation and the additional $3000 cost and began packing their gear.

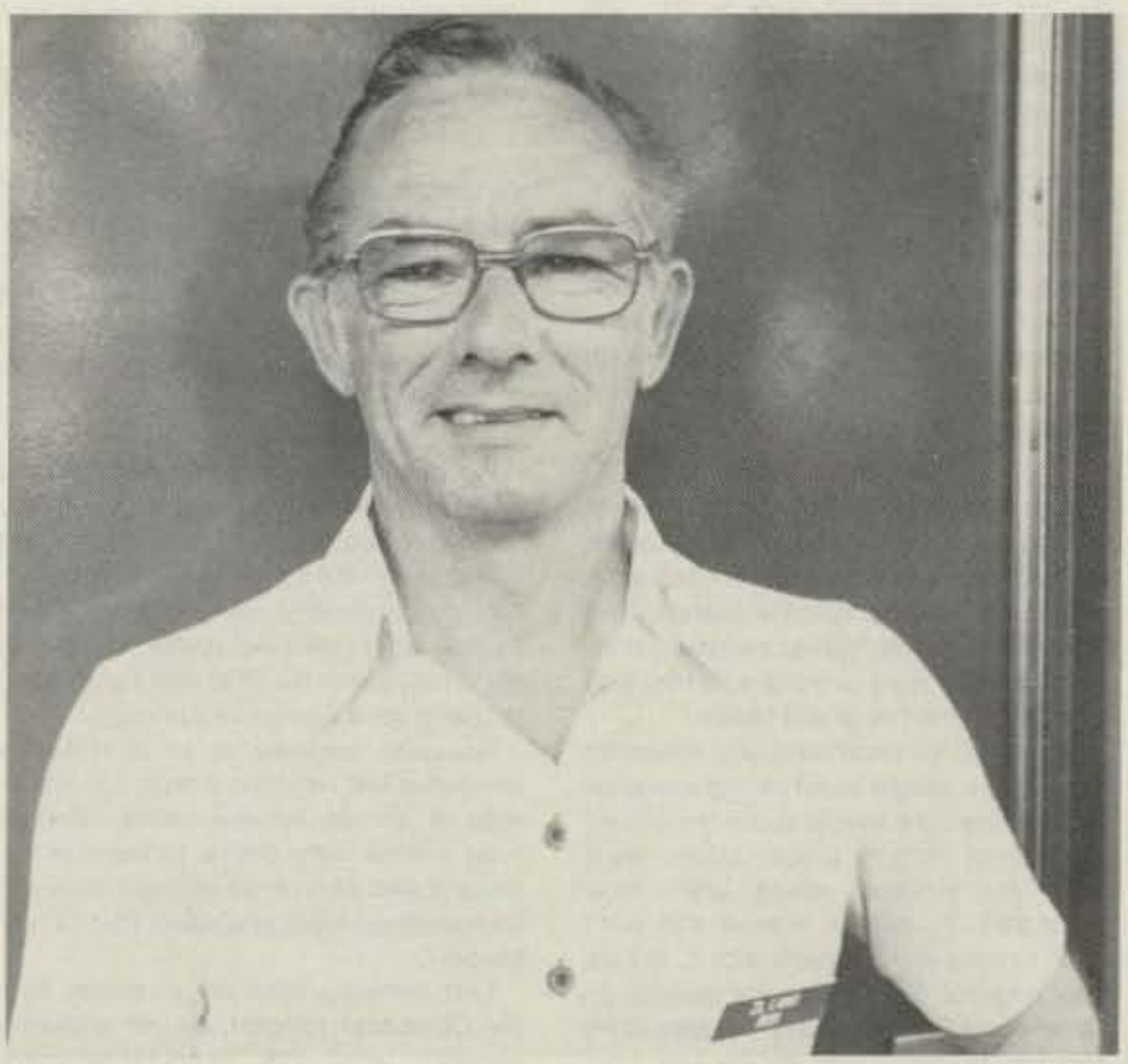
So 8-1/2 days after going on the air from Raoul, the amateurs closed down. During that time they logged more than 30,000 contacts, knocking Kermadec from 17th in *The DX Bulletin*'s Most-Wanted List right off the chart! One of the high points of the DXpedition was getting a call from BY1PK!

The amateurs left some good antennas for Warrick, so ZL8AFH could help keep the demand for ZL8 low. Warrick had a unique way of repaying this kindness.

The way off of the island was as harrowing as getting on. The gear rolled down the "Flying Fox" tram from the top of the island to the small landing platform, where Warrick stood with his trusty crane. After the gear was safely stowed aboard the landing craft, the radio operators were treated to a Raoul Island farewell: Warrick swung the hams, clinging desperately to the ladder, out over the Pacific, and dropped them straight into the water! After this ceremonial dunking, the now thoroughly-soaked hams bid good-bye and boarded the *Vili* to dry out and steam toward Auckland and home.

Ron Wright ZL1AMO

What kind of amateur turns back to the radio after hearing that his chartered ship just sank? Ron Wright says he enjoys the more relaxed pace and limited demands of a DXpedition compared to his daily job driving a taxicab in downtown Auckland. Traffic must be pretty bad if losing one's ship is more relaxing than driving!



Ron Wright ZL1AMO led four amateurs to the Kermadec Islands off New Zealand this past spring.

We can thank Ron's grandfather for his lifelong interest in ham radio. Ron first began playing with radios in high school, and in 1953 obtained his first amateur license as ZL1AMO, a call he has held for the last 31 years. During his long amateur career, Ron has remained very active, especially in contesting and DX, as well as in constructing his own gear.

Then in 1978, when his personal DXCC total stood at about 300, Ron decided the time had come to "put a little back into amateur radio in exchange for all the DXpeditions I had worked over the years." With the youngest of his 5 children well grown, Ron took some time off from guiding his taxi to join a contest DXpedition to Chatham Island, a few hundred miles east of New Zealand. While operating as ZL3HI/C in the *CQ*WW CW Contest, Ron met Chuck ZL1ADI.

Pitcairn Island

Both the successful contest operation and the friendship with Chuck helped launch Ron on his DXpedition career. Their next stop was Pitcairn Island, where Ron helped meet the demand for CW contacts as VR6HI.

Transportation to and from tiny, isolated Pitcairn is always chancy. Chuck and Ron caught a freighter bound from the southern tip of New Zealand and arrived on Pitcairn a week later. After struggling up the long, steep cliff from the tiny landing area to the town, the two amateurs erected a triband, a dipole, and a vertical, and settled down to some serious radio.

Despite the mosquitos, black flies, and large, hairy spiders, the hams made plenty of contacts, relieving some of the pressure on resident amateur (and direct descendent of the colony's founder) Tom Christian VR6TC. Now the only question was how to get off Pitcairn.

The few dozen permanent residents of the island watch carefully for any passing boats (a major source of income is their trade with these ships). Whenever a ship nears Pitcairn, Tom makes contact over the radio and the islanders launch their sturdy rowboats with loads of wood carvings and postage stamps.

Ron accompanied the islanders on these trips, looking for passage off the island, hopefully toward New Zealand. The first week went by without success. Then the second week also passed without any possible arrangements. As the third week on Pitcairn rolled to an end, Ron and Chuck were beginning to wonder if they were ever going to get back to New Zealand.

Finally the *Yankee Trader*, a cruise ship which hits many of the lesser-visited Pacific islands, hove-to off Pitcairn. Yes, the captain said, he had room for exactly two people, if they didn't mind going to Tahiti.

At that point, anywhere but Pitcairn was fine with Ron and Chuck. Several days later they tried to explain to the officials in Tahiti why they had arrived without a visa. Lacking any French, it was quite some struggle, but finally both DXpeditioners were flying back to New Zealand, having made more than 33,000 contacts during their three weeks on Pitcairn.

This experience didn't discourage Ron from continuing his DXpeditioning career. Over the next few years, he operated from both North and South Cook Islands, Tonga, Western Somoa, the Solomons, Lord Howe, New Hebrides, Niue, and other spots in the region. Ron explains this wanderlust, "With my family grown, I wanted to see some of the world outside of New Zealand. With emphasis on 'seeing.' I have an eye problem that is getting steadily worse, and I wanted to hurry up and see a few things before I couldn't see them anymore."

Ron finances his own DXpeditions, saving up money from his taxi driving and sometimes leasing his cab during his longer trips. Lately he has received some help from some of the major DX foundations and radio clubs, but most of the money has come from his own pocket.

His understanding wife stays home ("She doesn't like to travel much," Ron explains) and answers the 70,000+ QSLs Ron has received from his DXpeditioning. She claims if she wasn't answering the cards, she'd be working crossword puzzles. Answering some of the cards with the wrong time or local time instead of UTC must make crossword puzzles seem like child's play.

Operating Tips

Ron's DXpedition radio is a Kenwood TS-830. He uses an Autek Research memory keyer and has recently upgraded his paddle to a Bencher model. As with most CW DXpeditioners, Ron usually operates about 25 kilohertz up from the bottom of the band: 7025, 14025, etc. Again following standard CW practice, he listens "up" about 2-3 kilohertz.

He found the pileups from Kermadec so intense that he was unable to maintain an acceptable QSO rate following normal procedures, so he resorted to some subterfuge. While continuing to say he was listening up, he actually made most of his contacts *below* his transmit frequency. "A little bit of deception, perhaps, which provided more opportunities for stations to work Kermadec," Ron justifies this unusual practice.

This illustrates the importance of one of the most fundamental operating strategies for working DX: listen for the station the DX is working, not just to the DX station itself. Chuck Coleman K6ZUR explains how he snagged ZL8AMO: "He was sending 'listen up' but I didn't hear any of the stations he was working above his transmit frequency. I tuned down below and heard one of the stations he called. I quickly zero-beat that station, gave a short call, and he came right back!"

Ron continued to work a few stations above his transmit frequency just to keep the pileup honest and to separate those DXers who were listening for the stations he was working from those with their ears glued to his transmit frequency.

Ron also likes to work down into the pileup to some extent. "The loudest stations are going to make it sooner or later, so I look for the weaker stations, the ones that might only have one chance." Let's hope not too many Big Gun DXers tore their stations apart after being beaten in the pileup by the peanut whistle down the street.

Another good way *not* to work Ron is to send your call several times. Once is enough. If you don't get through, send it once again. And don't send Ron's call; he knows who he is, and if you're in that pileup, the odds are you are calling him. (On the rare occasions that two DX stations on opposite sides of the world are trying to use the same listening frequency, you might indicate your preference.)

Ron also has little patience for the "dumb" questions which use up operating time without providing contacts. If you really want to ask him his name, location, or QSL address, wait until he's back in Auckland. "Each dumb question uses up an opportunity for someone else to work a new one," Ron explains. By the way, QSL all Ron's DXpeditions to his home call, good in any *Callbook*.

Keeping a very accurate clock is another hint toward getting a QSL card from one of Ron's DXpeditions. To save on log paper, Ron records contacts 5-10 across on his specially designed log. He notes the times for each row of contacts. In this way he fits as many as 400 contacts on a single log sheet. Obviously, if the time on your QSL card is wrong by even a few minutes, your call will be very difficult to find in that solid mass of stations.

Where will Ron be off to next? We'll have to keep our ears peeled, check the weekly DX bulletins and the local DX repeater, and practice listening to both the DX station and the station he is working, so we'll be ready for ZL1AMO's next CW DXpedition.

Special thanks to ZL1BQD, the Northern California DX Foundation, and of course Ron Wright ZL1AMO for this column.

Listen for your loyal DX editor as T32AW from Christmas Island late October-early November. QSL via K1RH.

LETTERS

DOWN WITH CODE

As a new subscriber to *73*, I opened the magazine for the first time and ran right into your editorial message. It was surprising to find such an important and relevant message in what I thought was going to be only a technical amateur-radio magazine.

I am writing to you to express in detail my strong support for the opinions and positions you put forth in this editorial. My fear is that negative feedback from some amateurs concerning the code issue might spill over into the far more important issue you address—the importance of amateur radio as the country's main backup communication system in the case of any natural or man-made disaster up to an including nuclear war. Your concerns that amateur radio in the US may be a dying hobby, attracting few younger members, with declining strength as a market for new products or as a source of high-tech training are in my opinion true and very relevant. The current code requirements may be contributing in one way or another to all those conditions and to the detriment of the hobby; I join you in thinking that it is. But the old-timers are never going to change, and the problems may be eliminated by the upcoming computerization of code-message transmission and reception. As you point out in various articles in your magazine, with the assistance of a $350 computer and the right software, any licensed amateur operator can send and receive messages in code at speeds up to and exceeding 2000 words per minute without any personal knowledge of the code. That fact will soon allow most amateur operators to send and receive messages at a rate well beyond anyone's ability to copy manually. In an environment where it is no longer necessary to know any code to copy (even if you do you won't be able to use that knowledge in normal future QSO situations involving routine high-speed computer-assisted code transmissions), it may become even more obvious that the current code requirement is a non-productive carry-over from the past, possibly harming the hobby. Knowledge of the code is useless in the current and ever changing nature of the hobby.

Fred K. Martin
Santa Clara CA

Fred, there are a lot of active hams using code—because it is fun to use. I'm not even remotely against the code—as a fun mode of communications. My approach is purely pragmatic: We need more hams, young hams, desperately. Japan has proven beyond any argument that no-code is the answer to this one with their 1.3 million hams, so I and the FCC figured this was worth a test on 220 MHz, which is seriously underused and without a new group like this coming in will likely be lost. The ARRL led the fight opposing it, supported by ARRL clubs from coast to coast. I sure hate to see us lose 220 MHz, but it now looks like a goner, and that could start the dominoes falling, losing us the rest of the microwave spectrum. And where is communications going? Microwaves and satellites. Well, I intend to hang in there and see if I can be one of the last live amateurs, doddering into my ham shack with my walker, looking for anyone else left on 20 meters.—Wayne.

Wayne, I really enjoyed your editorials in the May, June, and July issues of *73*. I agree wholeheartedly with you that if most amateurs are against a no-code license, then these same people should be retested every two to five years to make sure they stay proficient in their code and theory.

I have yet to undersand why American hams are so uptight about having a no-code license. There are several countries, among them Great Britain, Brazil, Japan, Hong Kong, and probably others, which have some sort of no-code license and don't seem to have any problems with it. In fact, their amateur populations are growing (in some cases by leaps and bounds) while ours just trudges along. By the way, I got this information out of the "*73* International" section which I really enjoy reading.

It would seem to me that many amateurs are afraid that having a code-free license would let a lot of nuts and troublemakers into some parts of the bands. Undoubtedly they don't listen to 2-meter FM repeaters or to the 40-, 75- and 80-meter bands very often. If they did they would know that the nuts and troublemakers are already there regardless of the code requirement that is now in effect.

In closing, an interesting side note. In this month's *73* (August, '84) the results of the recent "FUN!" poll are given. In Element 2, question 16, 87% of the people polled didn't want the FCC to increase the speeds on CW exams. In response to question 24, 94% said they did not want hams to be subjected to periodic retesting. I wonder why? Could it be that they would not be able to pass the individual CW or theory tests (or both) again? They then contradict themselves in Element 3 by saying in question 35 that 70% of them can solidly copy CW at the speed at which they were licensed. Then in question 36, 72% said they could pass the theory test for their license class. If this is true, then why are 94% of them afraid of periodic retesting? Sounds very fishy to me.

Michael Friedel
Deer Park TX

Michael, a great many amateurs would much prefer to bar all further entry into the hobby in order to keep QRM down on the bands. Tests are to keep people out, not let them in. And, as you suggested, the inmates are in control of the asylum.—Wayne.

I've read *73* for years, whenever I could find it at the local newstand, but I've finally decided to subscribe. I'm not now, nor do I intend to become a ham, but I enjoy the articles and especially your editorials. Since the last time I tuned in it seems you've been doing battle with the FCC over the reason I refuse to get a license: Morse code.

Requiring someone to know Morse is somewhat like requiring a thorough knowledge of ancient Hebrew before being issued a Bible. Why bother to learn an obscure dialect when more efficient modes of communication are available? That is nonsense!

Lest someone think me a refugee from the CB-trucker mindset, let me explain. I presently work with computer-generated video—specifically, the cockpit displays in the Navy's F/A 18A Hornet fighter. This technology could easily be put to good use on the amateur bands. Can you imagine how many youngsters would become interested if they could plug the Intelevision into Dad's moonbouncer for an interactive game of real star wars?

You keep working on 'em, Wayne! I'd be Extra class tomorrow if it weren't for this "dah-dit-dah" stuff.

F. C. Glascock
Hanford CA

No, FC, I give up.—Wayne.

I have just learned something about ham radio, and after reading your May and June editorials, I am writing to tell you how right you are. I too am retired and seeking a communications medium to combat the boredom that losing daily contact with others brings.

I have only been involved in ham radio since May, and am frustrated by the difficulty encountered in acquiring information about the hobby. It's sad to see such a fine hobby suffering from a lack of publicity.

I have also developed a deep appreciation for the potential for major service by hams to our country in times of an emergency. In Connecticut, Governor Grasso was so pleased by the service hams rendered during the terrible blizzard of several years ago that she signed legislation enabling ham operators to obtain callsign license plates for only $5. Most Connecticut hams don't even know about it.

As I began reading your appraisal of the current status of the hobby, I sensed immediately that you were correct. Here I am, another old duffer joining the ranks instead of a high-school student. Certainly ham radio should be made available to them today. The various Boards of Education must take action. But, after serving three terms as our town's First Selectman, I know how very difficult it is to change ponderous democratic practices.

I am laboriously learning Morse code. As far as that is concerned, one need only listen to the bands to know that CW is obsolete and should be abandoned by hams in their licensing procedure.

Don't stop fighting for change! I already share your views, and when I get my General-class ticket I'll do whatever I can to join you in the battle. In the meantime, keep your speed up.

Norman E. Brown
Brookfield CT

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73 INTERNATIONAL

Each month, 73 brings you ham-radio news from around the world. In this collection of reports from our foreign correspondents, we present the latest news in DX, contests, and events, as well as keep you abreast of the technical achievements of hams in other countries.

If you would like to contribute to your country's column, write to your country's correspondent or to 73: Amateur Radio's Technical Journal, *Pine Street, Peterborough NH 03458, USA, Attn: Perry Donham KK2Y.*

AUSTRALIA

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ANOTHER NOISE GENERATOR

Australia is about to get the German-standard stereo system, and it has caused a large amount of comment within the amateur fraternity due to both the likelihood of this system being susceptible to amateur transmissions on both 2 and 6 meters and the fear that there will also be interference to the amateur service over a large area because of the transmission frequencies of this dual-sound system's audio carriers.

The WIA (Wireless Institute of Australia) has written to the Minister of Communications in regard to this matter and a letter has been received back, but the reply is not very helpful to the amateur community.

In essence, the reply says that in the interests of making available this advance in broadcasting technique to the general public, Mr. Duffy, Minister of Communications, is asking members to accept any small inconvenience to their service which might occur in some geographical areas.

This I feel will also (when propagation is right) include areas as far away as Japan and the Pacific Ocean Islands, New Zealand, or anywhere that can receive 144-MHz and 51-MHz signals from Australia, the reason being that channel 5A, which is one of our problem TV channels down here, operates on 137–144 MHz and is used by the National Broadcasting Service.

The channel 5A vision carrier is on 138.25 MHz and the sound carrier at present is on 143.75 MHz. The second sound carrier for stereo TV will be located 5.742 MHz above the vision carrier, placing it only 7.8 kHz below our 2-meter band allocation. Going by stated deviation figures for stereo sound in the television industry, however, a deviation figure of 50 kHz can be expected, placing it into the first 100 kHz of the amateur band.

This should make all of those amateurs, both locally and internationally, who are experimenting in the 144.0-to-144.1-MHz section of the band, less than happy—to say the least.

Channel O is the other problem area as it operates on 45–52 MHz and is operated by the ABC plus NBS, catering mainly to ethnic television transmissions.

As you can see by the above, our 2- and 6-meter operations now have the potential for interference problems even without this new addition.

The Channel O first sound carrier is on 51.75 MHz, with the second sound carrier for stereo TV being located around 51.992 and deviated to (approx.) 52.042. This puts it nicely into the international 6-meter amateur band.

This latest intrusion by other services into the amateur bands could prove a greater headache, interference-wise, than the computer and VCR craze we are presently going through down here.

At the present rate of introduction into this country of rf-susceptible devices for general public use, we amateurs soon will need to have either a degree in interference engineering or very, very friendly neighbors.

VK3—150-YEAR AWARD

It is a long way back from today's celebrating of our 150 years of statehood to those first years of European settlements in the southern part of Australia.

The first purchase of land in what was to become Victoria (VK3) was made by John Batman in 1835 when he bought two million acres of land surrounding what in those days was known as Port Phillip. This land was purchased from a local aboriginal called Fudgaree for the princely sum of one dozen blankets, six dozen tobacco pipes, 150 figs of tobacco, and two bottles of rum!

John Batman marked off a site on the northern shores of Port Phillip Bay for a town that he was going to call Batmania. Luckily for us this town was eventually called Melbourne, otherwise we down here would undoubtedly have been called Batmen or Batwomen.

To celebrate our 150 years of statehood, the WIA will sponsor, from November, 1984, until April, 1985, a Victoria 150 Award Certificate.

Award Rules

Overseas amateurs have only to either contact or, in the case of SWLs, log one VK3 station to be eligible for this award. Mail claims to Victoria 150 Award, Wireless Institute of Australia, 412 Brunswick Street, Fitzroy, 3065, Victoria, Australia. You must include either a log extract of the contact or the claimant's QSL card, completed with QSO details for their VK3 contact, plus $2.00 to cover the award and postage.

The Victorian State Government is helping to print this Victoria 150 Award and has permitted amateurs to use a special "Victoria—Growing Together" logo on their QSL cards.

AX PREFIX

Our Department of Communications usually grants the use of the AX prefix for special events, such as the above. Unfortunately, it has been found that while most Australian amateurs who use the special AX prefix do the right thing by fellow amateurs, there are always the few who use these special-event callsigns for DX contacts and fail to honor any QSL obligations. Trying to remedy this situation, the WIA has requested that unless amateurs using special calls are prepared to QSL on request, they should use their VK prefix only and leave the AX to those amateurs who will QSL, thereby improving our overseas image regarding the return of QSL cards.

BRAZIL

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Brazil

CW AWARDS IN BRAZIL

Brazilian CW groups are almost sure that awards are the best way to interest and develop CW operation amongst radio amateurs here. Although we have plenty of contests, it seems that freedom to operate at will and depending on available time and dates according to each one's peculiarities, awards are much more convenient to be worked than contests with all their pileups and QRM and limited time and dates.

So CW groups are doing their best to present interesting awards to hams. These are the latest three CW awards, just born for our entertainment:

CWSP YL Award—available to all radio amateurs and SWLs for proof of two-way QSOs with five Brazilian YLs, CW mode, two of them being CWSP members. Endorsement seals are available for 10, 20, or 30 YL stations from anywhere, CW mode only (YL CWSP members: PY2ATL, PY2ADI, PY2DHP, and PY2TR are always present on the BRYLA net). Do not send QSLs, but rather a certified log; fee is 10 IRCs; send to CWSP Award Manager, PO Box 15098, Sao Paulo, 01599, SP Brazil. Valid from May 1, 1984.

Coming from the CWGO group, Goias, are two new awards: *WAPP 2nd Series*—the Worked all PP-prefixed areas, 2nd Series award is available to all radio amateurs and SWLs for proof of two-way QSOs with 6 different CWGO members and 5 stations from different PP-prefixed call areas: PP1-, PP5-, PP6-, PP7-, and PP8. QSOs valid from January 1, 1984, on CW mode only.

DIB CWGO Award—the Diploma Interior Brasileiro (Brazilian Inland Award)—available to all radio amateurs and SWLs for proof of two-way QSOs, only CW mode, with all nine inland states (no ocean-bordered). QSOs valid from February 28, 1984, on. States are: PP2—Goias, PP8—Amazonas, PT2—Brasilia, Federal District, PT8—Acre, PT9—Mato Grosso do Sul, PV—Roraima, PW8—Rondonia, PY4—Minas Gerais, and PY9—Mato Grossop. PP2 Goias must be represented by six CWGO Group members. If two more CWGO members are worked, they can be used to substitute for two of the inland states.

Do not send QSLs. Logs, certified by a radio-amateur association or by two radio amateurs, are acceptable. The fee for each CWGO award is 10 IRCs. Send to CWGO Award Manager, PO Box 676, CEP, 74000, Goiania, GO Brazil.

CWGO members list: PP2-AAM, -ABE, -ABV, -ACJ, -ACK, -AEP, -AGS, -AHR, -AML, -BD, -BS, -BT, -BW, -CD, -CE, -CH, -CW, -CY, -CZ, -DN, -DO, -DV, -DX, -EHE, -EM, -FCZ, -FN, -FUT, -GHN, -INC, -JB, -JQ, -JT, -MMO, -RR, -RS, -SJ, -US, -VR, -WT, -WV, -XI, -YY, -ZI, PY3YXZ/PP2, PP2CW being the CWGO station call.

Brazilian CW groups realized that amusing-rules awards are the best way to develop radio amateurs' interest in CW operations, and so efforts are all towards this direction.

PPC Picapau Carioca (Carioca Woodpeckers Group), the oldest of CW groups in Brazil, is now coming to its 20th year having almost reached its "20 Awards Program," a sweeping and amusing program to meet all interests—with some not-so-difficult and some not-so-easy awards, and plenty of fun to amuse all and to enhance CW practice among Brazilian radio amateurs.

The just-launched *PPCMC Members and Countries Award*, joining DX countries (ARRL list) and PPC members, with a special Honor Roll Award when 200 points are reached (and a basic award at 50 points—at least 40 DX countries) seems to raise unusual interest due to the "permanent" classification list like the DXCC. QSLs are valid from January 1, 1980, so old-timers can join the fun of new hunting.

The *PPCPU Award* is presented to welcome new class-C PU prefixes. The basic award is obtained by proof of 9 PU QSOs, from PU1 to PU9; later endorsements are for the remaining 18 possible PU calls, according to suffix letters allocated to each of 27 Brazilian states and territories.

The three-class *PPC Samba Award* (South American Maritime Borders Award) is another very amusing game to be launched pretty soon, with interesting conditions and rules.

Keep an eye out for Brazilian new awards! They are fine!

CZECHOSLOVAKIA

Rudolf Karaba (OK3KFO ARC)
Komenskeho 1477
955 01 Topolcany
Czechoslovakia

CRC, PO Box 68, 113 27 Praha 1, Czechoslovakia, is offering these awards for non-European countries:

P-75-P is awarded for contacting or listening to stations in various ITU zones. There are 75 zones altogether, and three sorts of awards are available: 3rd class for contacts with 50 zones, 2nd class for contacts with 60 zones, and 1st class for contacts with 70 zones.

All contacts since January 1, 1960, irrespective of the class of operating service or the band used, are valid for the awards. It is necessary to send the applications together with 10 IRCs and QSL cards to CRC. A list of zones can be found in the *Callbook*.

S-6-S is awarded for contacts with one station on every continent on one mode. Endorsements for separate bands are available. Contacts after January 1, 1950, are valid.

It is necessary to send 5 IRCs and QSL cards to CRC.

More in my next column.

AMSAT

At the end of March, OK3DQ from Nizna nad Oravou in northwestern Slovakia started using AO-10. Jan is using a 30-Watt SSB/CW transmitter with a 21-element yagi (F9FT). His receiver has a BF981 transistor or three SK-97s, and a 2 × 10 element yagi—PA0MS. Both the an-

tennas are of vertical polarization. He is praising a busy operating service that in his bad QTH is a pleasant change in VHF/UHF. During the first two weeks of operating in mode B, he established 272 contacts (115 of them SSB) with 48 DXCC countries. By operating SSB he heard another Czechoslovak station, OK1VKP.

OK1BMW (maybe also other Czechoslovak stations) received a QSL card from W5LFL for listening to the signals from the sky!

RTTY IN CZECHOSLOVAKIA

Nearly 40 stations from Czechoslovakia are working actively on RTTY. Radio club OK1KMU is another new station. During 6 months there have been established contacts with more than 25 DXCC countries in 3 shortwave bands. In the 144-MHz band, they have had contacts with 5 stations from Czechoslovakia and 4 stations from West Germany.

FEDERAL REPUBLIC OF GERMANY

Ralf Beyer DJ3NW
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Federal Republic of Germany

IARU—REGION 1 CONFERENCE

The International Amateur Radio Union, Region 1, represents 55 national amateur-radio societies with about 250,000 licensed amateur-radio operators. Their last triannual meeting took place in April, 1984, in Cefalu, Sicily, Italy. Among the very many topics discussed, some got my particular attention.

First, the IARU proposed a new statute to its members in Regions 1, 2, and 3 which has been accepted in the meantime. Now each region will have a chance to send two representatives to the IARU Administrative Council. Together with the regulation that the office of the IARU must not necessarily be associated with the ARRL offices in the future, the new statute offers a chance to assign responsibilities and duties to an internationally more balanced group than was the case in the past. However, the ARRL has been elected again to take care of the "International Office" of the IARU.

Second, from time to time small steps towards a political union of the European Community (EC) are achieved. The latest achievement in this respect is an agreement between France and the Federal Republic of Germany that motorists need not stop and identify themselves at the border between the countries any more if they have nothing to declare.

It is only logical that the IARU, Region 1, would formulate similar goals like, for example, an international amateur-radio license. However, it will be difficult to come to such an agreement within the EC because of the sometimes very different national license regulations. I consider it rather impossible in the foreseeable future to agree on an international amateur-radio license which is honored in all countries of Region 1 because of the sometimes severe conflicts involved.

Nevertheless, some days later at the CEPT Subgroup R21 Conference in Madrid, Spain, an interesting approach to the problem was developed. It aims at a multitude of bilateral agreements which, in fact, could form a solid basis for a truly international amateur-radio license in the future.

And last, the IARU, Region 1, attempted to reduce the number of contests on all shortwave bands and formulated the following recommendations: Limit all contests to a maximum duration of 24 hours, assign only one weekend for the phone and/or CW portion of a contest, merge smaller contests into larger ones, and have only one large and one small contest per month in Region 1.

Furthermore, it was recommended to limit contest operation on 80 and 20 meters to the following band segments: 3500–3560 kHz and 14000–14060 kHz for CW and 3700–3800 kHz and 14125–14300 kHz for phone. I personally would like to see even tighter restrictions. On an annual basis, I'd like to suggest that only 5% of the number of weekends (52) times the available frequency spectrum (300 kHz on 80 meters plus 350 kHz on 20 meters in Region 1) should be available to contesters—.05(52 × 650) = 1590 frequency-hours. It would then be up to the contesters how they utilize their available time. For example, they could run 2–3 full contests per year the usual way or 8–9 contests per year employing only 200 kHz of the available frequency spectrum on 80 and 20 meters and so on. Wouldn't this make sense?

The next IARU Region 1 Conference is scheduled for 1987 in the Netherlands. Then it will be the time to review the progress they—and we—have achieved in the meantime.

GREAT BRITAIN

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THE UK SCENE

The difficulties of obtaining convictions in cases of illegal use of transmitting equipment in the UK (and including the pirating of amateur bands) are eased somewhat by the provisions of the Telecommunications Act 1984, which received the Royal Assent and therefore became embodied in the law of the land in July.

To date it has been necessary for the police (we do not have an FCC equivalent) to catch offenders in the act of transmitting in order to be assured of a conviction. Just as soon as the knock came on the door, the offender would power down and so be largely immune from prosecution. The possession of equipment capable of transmitting on frequencies for which the owner was not licensed was not, in itself, a felony.

The new act conveys wide powers, both to the police and the newly-formed Radio Investigation Service (which used to be the Radio Interference Department of British Telecom), both of whom are given powers to seize equipment allegedly used for illegal transmissions. The courts may also order forfeiture of equipment without any criminal proceedings being initiated.

The act also provides new powers for the Secretary of State to "restrict the sale and possession of specified wireless telegraphy equipment" and to "carry our approval of equipment and require marking of apparatus."

The former provision raises the specter of a ban on 28-MHz linear amplifiers (similar to that imposed in the US) to prevent their use as "burners" by CB operators in the 27-MHz band. Such a ban is not likely to achieve its laudable aims, of course, since the illegal users can always find something else to occupy themselves, but it does deprive genuine users of the ability to acquire a particular facility.

The latter provision makes me wonder if the authorities ever take any notice of rules and regulations that have been previously implemented. The liberalization of British Telecom and relaxation of their monopoly included the provision that subscribers could, for the first time, buy extension and other telephone equipment from high-street stores.

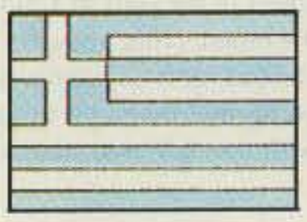
In order to protect BT's network, it was decided that only equipment marked with a green dot and the word "approved" could be connected to a BT-supplied telephone outlet. Equipment not so approved must be marked with a red triangle and the words "not approved." So far so good, but if an article cannot be connected, is there any point in allowing it to be sold?

If I take a walk down London's Tottenham Court Road—the mecca for hi-fi, video, and computer enthusiasts—I can see approved and non-approved equipment side by side in the many shop windows. The non-approved equipment tends to have more facilities and be cheaper than that with the green dot. I do not think it requires too much guesswork to figure out which equipment sells the most. One can envisage a few years hence the ham shop selling a 440-Watt approved linear and a 2-kW non-approved one—quite a dilemma for the DXer!

Finally, with the Telecommunications Act 1984, the police are given some powers of arrest without a warrant in cases of illegal transmitting where a question of identity arises. I wonder if this could result in the need for hams to carry some form of ID card?

The RSGB has launched a monthly circular called *VHF/UHF Newsletter* to keep devotees of the shorter-wavelength bands fully up to date. Subscription for 12 issues is $6.00 for UK subscribers—$10.00 should be enough for any airmail costs to be covered. Enquiries to the RSGB at Alma House, Cranbourne Road, Potters Bar, Herts EN63JW, England.

This month's column is a little shorter than usual because I am rather busy with a new job. This is as General Manager of the telecommunications branch of a major airline. In addition to the thousands of data terminals worldwide, the UK telephone system, and the airport PMR and departure control systems, I have discovered I also have responsibility for a major HF station. That may well provide some interesting material for the future...



GREECE

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Since as I'm writing this month's column we are in the middle of the summer, it is very hard to get in touch with most of my fellow SV DXers. Therefore, I have to stop for the time being introducing them, but for sure I'll come back later when everybody is back home and accessible.

These past few months we heard a new repeater that came on the air from the city of Kavalla, up in the northeast part of Greece. This one works on European Repeater Channel R7 and looks like it will be able to cover the northern part of the Aegean sea and most of the national road that connects Thessalonica with all major cities in northeast Greece up to the border with Turkey.

There is also another one that is expected to be installed very soon on the island of Kefalonia, but more news on that when it is on the air.

I would like to point out that since Greece is mostly a mountainous country, we need to have as many repeaters as we can, not only to cover the national roads and to give to amateurs in the whole country the opportunity to communicate with each other, but we need the repeaters for emergency communications—such as during earthquakes, fires, and so on.

I can assure you that we have plenty of both, especially during the summer when we have hundreds of fires in all Greek national forests. Then repeaters can prove to be very useful, as they can establish communications between city and forest departments with the assistance of radio amateurs who provide the necessary eyes for them. I'm sure that every country can take advantage of radio amateurs and their knowledge of communications, especially in times of disaster.

INDIA

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India

DUTY-FREE IMPORTS FOR INDIAN HAMS

Indian hams have something to rejoice about—import duty has been completely waived on amateur equipment. The waiver covers not only transmitters, receivers, and transceivers, but also gadgets like Morse-code readers and aural frequency readouts.

This move—license-free, duty-free import—could conjure up visions of ham shops full of amateur equipment. There is a catch to it, however. The user alone is entitled to import the equipment, so that each amateur has to import one piece of equipment and dealers cannot import for stock and sale. To be eligible for exemption from duty, the importer should obtain a license from the Wireless Adviser to the Government of India (counterpart of FCC) before the equipment is received in India.

Amateurs can join together and import equipment under a joint bill of lading or can give a letter of authority to a dealer who then can import a consolidated shipment as their agent. One dealer, VU2TP, agent for Yaesu, tried to put together a group of over 75 for the FT-77 at a discount of over 20% over the normal rate. He enrolled over 100, but could never quite make it. Enter the 757GX, and the FT-77 group dwindled to well below 75. Back to square one!

Now is the time for anyone wishing to send gifts of new or used equipment to Indian amateurs. Here is the checklist:

- Notify your donee that you propose to give him equipment as a gift.
- Enclose a catalog page, preferably showing the price. The amount of the price is immaterial—he can receive up to US$870 in a fiscal year (April to March) and does not have to pay a cent of duty.
- If no price is listed, obtain a quotation from your local friendly dealer or make a copy of any classified ad to establish a price (*any* price!). If you are offering home-

brew equipment, enclose a declaration that it was homemade and that it cost you so many dollars.

- Wait till the donee confirms that he has the WPC license for this specific piece of equipment. *Only then can he import it duty-free.*
- Ship it by any mode; surface mail, air mail, air cargo, or even sea cargo, but *not* as passenger baggage. Ham equipment as baggage *is not eligible* for duty-free entry.
- Send the bill of lading to the donee by air mail. If sent by air cargo, QSP to him the particulars of the bill of lading or send him a cable. Demurrage on air cargo is quite heavy and could add up to a hundred dollars in eight weeks.
- Do not ship by air cargo to donees who are not in the cities of Bombay, Delhi, Calcutta, Madras, or Bangalore. Others will have to make arrangements at one of the entry points to file a bill of entry and to clear the parcel through customs.

The Indian amateur can import components, too, but only as spares for equipment that he imports. Obviously, this bit has been influenced by commercial interests—the home-brewer still has to pay duty if he wants components. Strange situation, but one learns to take these in one's stride. The Federation of Amateur Radio Societies has made representations that the home-brewers' imports of components (not spares) should also be exempt from duty. Let's keep our fingers crossed!

Here is the full list of equipment and components that are exempt from import duty:

Wireless Apparatus and Accessories

1. HF transreceiver (transceiver) meant for amateur frequency(ies) with accessories.
2. VHF transreceiver meant for amateur frequency(ies) with accessories.
3. UHF transreceiver meant for amateur frequency(ies) with accessories.
4. VHF/VHF or VHF/UHF repeater (combination of transmitter and receiver) with accessories meant for amateur frequencies.
5. Control unit for the 4 items above with accessories.
6. Aural readout displayed frequency.
7. Aural readout displayed time.
8. Aerial/antenna for amateur frequencies.
9. Balun transformer.
10. Swr bridge or reflectometer.
11. Digital frequency counter (up to 600 MHz) with accessories.
12. Morse reader.
13. Noise bridge.
14. Microphone (with or without loudspeaker).

Components

1. Transistors, diodes, integrated circuits/chips.
2. Thermionic valves or vacuum tubes.
3. Toroidal cores.
4. Quartz crystals.
5. Variable condensers, air-dielectric type.
6. Precision capacitors (fixed type), value(s) between 1 pF and 5000 pF.
7. Relays.
8. Rf cables.
9. Spare nicad cells or pack as required or used with items 2 and 3 above (in case of hand-held transceivers).
10. Rotary switches.
11. Keyer paddle.
12. Ferrite beads.

ITALY

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18 AND 24 MHZ

It is a few months now that 18 and 24 MHz have been used by Italian hams, but there is not too much activity. If you open your rig there you will only find QRM. The reason could be the fact that no Ws or JAs are allowed there, but maybe there is another reason. The fact that both bands, by IARU decision, are not used during contests and are not valid for any award probably keeps us off them. The reason for the IARU decision was justified by the need for not having all of us there together, but it seems they have obtained the opposite result: nobody is there. The cost of antennas with practically no return in terms of what is wanted by DXers (contests and awards) is too high. According to old-timers, this happened also to 21 MHz years ago, so probably it is not necessary to worry too much; we're waiting for our friends from Japan and the States to come and give some life to the two new bands.

UHF SHF

Years ago the I2X beacon was installed in Milan, operating with 40 mW on 10 GHz. The results have been very good; the beacon was well received within a range of 250 kilometers, with mostly late-evening openings. During the month of July, I0SNY of the 10-GHz world record will be back in North Africa trying to set new records, working 24, 10, and 1.2 GHz, and offering the possibility to have a new one to many Europeans on 144 and 432 from EA9.

DINO ISLAND EXPEDITION

Dino Island is located in Calabria very close to the coast. (This answers all those that have asked for it as, being very small, it is not on normal maps.) It is very easily reached with a small boat and is populated only during the summer by tourists living in a small village.

The island was activated for the first time in June, 1983, with the call ID8UDB, a new prefix and a new IOTA number. It was activated mainly on CW (95% of the total QSOs) by three operators of INORC (Italian Naval Old Rhythmers Club) and the DX Blue Team: I2BVS Enzo, I2DMK Max, and I2NYN, his son, Marco.

The operation started on June 7 and ended June 14 with 5600 contacts, most of them on 14-MHz CW, as the propagation was quite poor. The antennas used were a two-element beam for 10, 15, and 20 meters installed on top of a 10-meter portable tower of only 8 kilos, and a ground plane for 80–10 meters.

The ground plane was not working too well on 40 meters and a new antenna was installed, coupling a 12-meter longwire to the metal tower. The sloper so obtained was working perfectly, giving satisfaction in working many USA, JA, and VK stations on 40. As said above, 20 meters has been quite good while 15 has been very lousy. 10 meters has been offering short-skip openings to Europe and some sporadic-E to South America. QSL cards via I2MQP.

9X5GB

If you have the opportunity to work the above callsign (it is not yet official as the station has been working up to now with the call I2XDP/9X5), you will realize, upon receiving the QSL card, that it is not a normal station. It is the station of the hospital run by Italian missionaries in Musha and, on top of it, it's working with the power of solar panels that are linked to two batteries of 12 V, 66 Amps. The rig is an FYT-707 and the antenna is a 3-element by Hy-Gain.

Other solar panels are linked to batteries that are used to serve all the mission. Of course the strength of the sun in Rwanda must be consistent to do such a beautiful job, but the Black Continent and Italian ingenuity can offer you more surprises—like the 5H3KG station (another well-known call run by another Italian missionary) that is powered by the wind. I will offer you more news on it in a future column.

WORKING THE LOW BANDS

Due to the actual slowdown of sunspot numbers and thanks to the new life given to the low bands, a new antenna is becoming popular in Italy. It's the DB24, the 4-element by Hy-Gain, with two active elements on 40 and two on 20. The price is quite attractive, being about $180 while you have to pay more than $650 for a TH7DXX. So, if you find many more stations during the next contest season working on 40 from Italy, you can bet that many of them are using it.

Always staying on the low bands, a modification to the well-known W3DZZ has been offered in the July issue of the Italian amateurs' magazine by I0NQT, allowing the popular dipole to work on 160 meters. Two traps have been added with 33 feet of wire. The antenna is working very well.

The first contact between Italy and Australia has been made by I2BBJ and VK6HD on April 25. The contact was made feeding the 30-meter tower you can see in the photo.

LIBERIA

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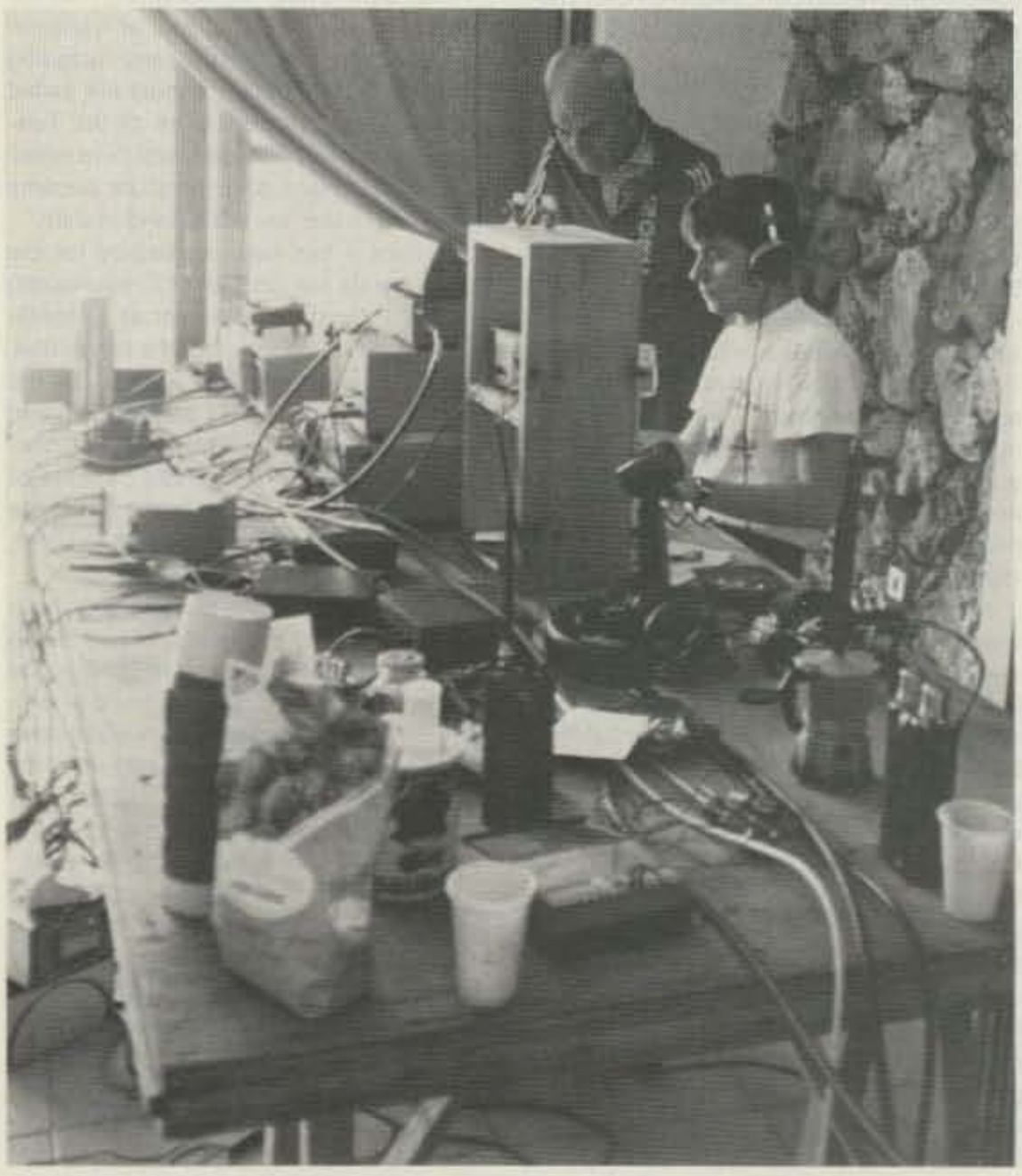
AMATEUR RADIO IN LIBERIA

The Ministry of Post and Telecommunications called a meeting of all the amateurs in Liberia. It was called in conjunc-

Dino Island.



The I2BBJ end of the VK6HD-Italy contact.

tion with the Liberia Radio Amateur Association (which did put out an agenda), but the object of the Minister's interest in the meeting was not given. The Ministry expressed a degree of urgency in their notices to the amateurs to attend the meeting and implied that absence without good reason would not be taken lightly.

The amateurs came into Monrovia by air, by private automobile, by taxi, and by whatever mode of travel was available, and the meeting was the best attended and the most successful that I have seen in my three and a half years in Liberia. As the assembly gathered, there was tension in the air and everyone walked around with a feeling of apprehension. As it worked out, this apprehensive feeling proved to have been unfounded, however; this meeting was some kind of a first and no one knew just what to expect.

The Minister—actually the Assistant Minister in charge of radio operations—opened the meeting. One could have heard a pin drop. Sensing the tension, the Minister did what he could to make everyone feel more relaxed and comfortable. He welcomed those present and expressed satisfaction at the number who had responded to his call. A roll call indicated that upwards of ninety percent of the amateurs of Liberia were in attendance. Those who were not present were either out of the country on leave or at work in a position that did not permit absence.

The Minister did not keep the group waiting. He stated simply and briefly that a problem was developing in Liberia in the area of third-party traffic and other markedly commercial (and therefore illegal) communications in the amateur bands. He said that complaints were coming in from countries outside. He pointed out that for many years Liberia has enjoyed an enviable reputation in the world of amateur radio for its courtesy and its observance of national and international law, and he said that the Ministry and the amateur community of Liberia is very jealous of this reputation and will preserve it.

He was quick to mention that the problem is not widespread. The aim of the Ministry is to see to it that the problem does not grow. He asked the cooperation of the amateurs to eliminate the problem completely.

I have noted in other columns that I have sent to *73* that I have been greatly edified by the caliber of courtesy and the observance of amateur regulations here in Liberia. I have a hunch that these few problem-amateurs are expatriates. If this is true, it is unfortunate because the Ministry of Post and Telecommunications has been most generous in licensing people who are not citizens of the country. As an instructor in amateur radio and as a member of the examination committee, I have been working rather closely with the Ministry and there is not a single instance, in my experience, in which a foreigner, of whatever race, has been denied a license when he has completed the requirements in code and theory.

This is not true in all countries. I personally was denied a license in another country where I was working for eight years simply because I was not a native. At least that is the reason that was given. We, who are visitors in Liberia, would do well to cooperate with the Ministry and observe the law.

The Minister spent the greater part of the meeting encouraging the amateurs to be more active, to participate in the local nets, and to join the Liberia Radio Amateur Association. He suggested that the amateurs use the facilities of the Association to handle QSL cards, going and coming, and to work with the Association in instructing and training new amateurs. He recommended that local areas organize clubs or associations so as to coordinate their efforts to manage and develop the amateur community in Liberia.

In the meantime, the Association is working on a program for Amateur Radio Week. It will be held in the latter part of November or the first part of December, and while things are in no way finalized, it is fairly certain that there will be a special callsign for that period. There will be a special-event station and there may be awards. Turn your dial, look for Liberia, and take full advantage of this opportunity! There will be publicity. Be on the alert and don't miss it.

The Association again petitioned the Ministry for a spot in the broadcast band to transmit code for practicing beginners. The proposal was well received and it may well be that, one of these days, there will be something to report in this area.

We, the amateurs of Liberia, look forward with confidence and hope. We are sure that we will continue to grow in strength and prestige as we hold our place among the amateurs of the world.

MOZAMBIQUE

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Greetings from Maputo (old name: Lourenco Marques) by the beautiful Indian Ocean. No, fellows I don't have a license yet. As of this writing, amateur radio is "suspended" in the People's Republic of Mozambique. I am a foreign service officer, and in the diplomatic lexicon "suspended" is better by far than "prohibited" or "cancelled." If an activity is "suspended," then the authority is stating that the condition is temporary. I still remain very optimistic that amateur radio will return to Mozambique.

Mozambique has a full share of the typical third-world nation's problems. It is one of the most miserably poor nations on Earth. In 1983, 100,000 people starved to death. (Your tax dollars are supporting the largest aid program on Earth to get food to the people here.) Three out of five Mozambicans cannot read or write. Virtually all the technicians in the country are foreigners from Europe or the communist bloc.

The main reason for the absence of amateur radio is the fact that the country is undergoing a massive guerrilla insurgency. This city of 850,000 people is virtually cut off from the outside world as far as overland travel is concerned. Add that to the government's general paranoia and distrust of foreigners, and it is apparent that amateur radio is not at all welcome under the current security situation.

My wife Yee's (N4GPB) and my chief concern is food. The currency here is virtually worthless. The official exchange rate is 40 per US dollar, but the free-market rate is 1500. The currency cannot be converted at the official rate. The stores have no food and the restaurants serve only a rice-water gruel. When the road to South Africa is open, it is a 5-hour drive to the grocery store. Now that the road is closed, we have to get our foodstuffs shipped in and rely on the "hard" currency shop here in Maputo.

As far as ham radio goes, I am occupying my time by teaching ham radio to four other Americans and modifying my gear to run on 220 V, 50 Hz. My house servant plugged my 24-hour digital clock into the 220-V current and blew it up. It cost more than he earns in three months. Most Mozambicans earn less than the cost of a 2-meter transceiver in a year.

My house was built before electricity and the wiring is adequate, but nothing fancy. I am getting additional outlets and transformers installed in my radio room. We get television from ZS and 3D6 here, so the city is filled with towers and antennas. I am getting a 60-foot tower installed and I will hang my tribander on it. I have been monitoring the bands and have heard many US stations on 20m, but I have not heard any amateur stations on 30m here yet.

I have been doing preliminary research into the possibility of running a DXpedition to some of the offshore islands. The French have a large embassy here, and I can easily arrange transport to Europa and Juan de Nova islands. The western diplomatic community here is very close, and arranging the landing permits and operating permission should present no real problem.

I will remain in Mozambique for at least two years, perhaps until 1988. I am hopeful that I will receive operating permission before I depart. Mozambique is a difficult and uncomfortable place to live, and amateur radio would make it much more pleasant. I am planning to visit several of the nearby countries during my stay here, and I plan to operate from several of them.

I have never run a DXpedition before, so if any *73* readers could offer assistance in DXpeditioning, I would be most grateful. Unfortunately, there is no "handbook."

NEW ZEALAND

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This month I shall continue the New Zealand offshore islands' stories with an excerpt from the Raoul Island expedition story, through the courtesy of the author, Roly Runciman ZL1BQD, and *Break-In*, the NZART Official Journal. As reported in my July column, the Raoul Island DXpedition took place in the second half of March this year and was successful from the radio and scientific points of view, but a disaster for the owner of the yacht *Shiner* used to transport the expedition to the Kermadec Islands.

Departure: Tuesday, March 13, 1984, at 11:30 am NZT, the group was aboard the yacht *Shiner* on their way to one of life's great adventures. Years of hard work by Ron ZL1AMO and months of departmental negotiations by Dr. John Craig, the leader of the scientific party, had finally paid off and they were on their way to the Kermadec Group of Islands, destination Raoul Island, ETA 5 days.

The Travelling Party: There were ten persons on board, five in the scientific party, four in the amateur party, and the Captain, John Taylor. The scientific party consisted of Dr. John Craig, expedition leader, who was to study both the native Kiore rat and the introduced Norwegian rat populations on the island; Anne Stewart, to study the native Tui bird population and compare their song and other characteristics with the New Zealand native Tui bird; Mark Vette, a great climber of trees, which was very much appreciated when antennae went up and down, whose main job was assisting both John and Anne in their studies (Mark is by trade a very capable scientist in animal behavior patterns); Dr. David Schiel, a marine biologist and an extremely good diver (he assisted when disaster struck the yacht); and Mike Kingsford, another marine biologist studying fish life and migration patterns from the northern Pacific down to New Zealand. For his investigations, Raoul Island is a very handy "half-way house" for the migration patterns.

The amateur-radio party consisted of Ron Wright ZL1AMO/ZL8AMO (and many other DX calls—the CW expert who worked approximately 10,000 QSOs); John Litten ZL1AAS/ZL8AAS, who mainly operated phone and stacked up about 5000 QSOs; Roly Runciman ZL1BQD/ZL8BQD, who operated both phone and CW on all bands, also working 10,000 QSOs; and Duane Ausherman W6REC/ZL0ADW/ZL0ADW/8, who operated both SSB and CW with slightly more emphasis on CW and did very well with 5000 QSOs for his first DXpedition.

Journey to Raoul: The journey-to-Raoul routine consisted of three hours on watch and six hours off for the five days. Time is measured by daylight and darkness rather than by the days of the week—every three hours another shift comes on and the one going off gets a quick bite to eat and then tumbles into bed.

One of the amazing occurrences during the voyage was seeing the small "Welcome Swallows" along with other bird life with land two or three hundred miles away in either direction. The scientific experts when asked, "Where do they go at night?", replied, "Oh, back home again; they can fly enormous distances, and they will be back here again tomorrow!" Then there were the dolphins riding our bow wave. . .and the spectacular sight of seeing the seas burst into green light with phosphorescence during the small hours of the morning watch. And there were the moths and butterflies three hundred miles from land; where do they come from?

Every hour the travelling log is read and entered into the ship's log, and every day we call up Auckland Radio and "home" to give positional reports and get the latest weather information.

After four days of nothing we sight the first island of the Kermadec Group, Esperance Rock. Later that day we passed between the next group of islands, Curtis Island, which is still an active volcano with quite a bit of steam escaping from the crater, and Cheesman Island, with an extinct volcano, covered with quite bushy vegetation and inhabited by bird life. Soon radio contact was made with Warrick ZL8AFH via Marine Channel 16, and we are told to lay off as close to the landing platform as we like. The great moment is at hand; we have arrived at Raoul Island!

Landing: Landing at Raoul is a very delicate task. There is no jetty or wharf. Goods and chattels have to be landed by being lifted from small boat to the landing platform by a manually operated crane using a cargo net. Mere humans have to clutch a ladder attached to the crane hook and hope that the crane operator knows what he's doing in the winch house! Judging the position of the ladder relative to the swells is quite a feat.

The small landing boat, *Chunder [Ed.—A down-under word meaning throw up]*, is well named and it, along with everything else, makes the journey up the cliff from the landing platform, "the flying fox," hauled by yet another manually operated winch, quite exciting.

Once at the top, there is conclusive proof that we are indeed on Raoul Island,

for we are confronted with a large notice with instructions "to prevent damage to the vegetation and the natural features of the island."

Our Temporary QTH: Raoul Island is quite a paradise in the South Pacific. It is still an active volcano with upwards of six earthquakes per day, most not felt by those on the island, though one or two heavier jolts reminded us of the continued activity. Most of the island is covered in Nikau palms as a type of undergrowth, with a canopy of beautiful Pohutukawa trees overhead. Along the northern coastline is a self-sufficient farm which supports the permanent residents on the island. The coastline is extremely rugged, with only a very small rocky beach along the western coast where the original settlers, the Bell family, used to live many years ago. There are still a few goats and many wild cats on the island, and, of course, lots of rats. Bird life is quite prevalent, with the song of the Tui making the bush come alive. The oranges from the orange grove have to be tasted to be believed, and delicious bananas grow freely as well.

The personnel on the island are a terrific band of fellows, and they treated the expeditioners very well during their stay, especially when the tragedy with the yacht occurred a few days after arrival. Mike (the officer in charge) took care of the landing formalities, passports, etc., and settled us into our quarters; Paul (Lands and Survey Department) was our island tour guide and was a tower of strength; Garth (Met Office) was the Raoul Island champion table-tennis player, who was deposed by Roly ZL8BQD. Garth is also the photographic expert in the group. Tom is the resident mechanic and an expert cook into the bargain; and Warrick ZL8AFH was the technician and radio operator. When the amateur DXpedition left the island, they left Warrick a triband beam and various assortments of wire and coax, so his signals on the higher frequencies should be better than they were before.

The Amateur DXpedition: Radio operation was the amateur highlight of the trip and, of course, one of the reasons for the expedition. Some 30,000 QSOs were made with all points of the globe, propagation being good on all bands at some time every day. Antennas were a 160/80m dipole, up about 80 feet between two very high Norfolk Pine trees, and two triband beams. Equipment used were the ICOM IC-745, IC-740, ICOM Auto Tuners, and the Kenwood TS-830 and TS-430.

The DXpedition again tried to cater to as many facets of the hobby as possible, especially QRP operation. For those stateside stations who stood by to enable the DXpedition to do this, they extend their grateful thanks. The best QRP was with N6HJ with 100 milliwatts, believe it or not, and many stateside stations gave the report, "I don't know how QRP I am, but nothing is moving here!" Great stuff fellows, hope we can do it again sometime from other Pacific DX locations.

One QSO that made a nice change was being called by BY1PK, an unusual switch that was appreciated by all. Also the operators would like to make special mention of Werner DM9KE and his net on 21.157 MHz; thanks Werner for getting so many of the Europeans through to make those valuable ZL8 QSOs.

Disaster Strikes: Life was quite exotic until March 21, three days into the operation, when Cyclone Cyril made its way down from Tonga and struck the island in the small hours of the morning amidst driving rain, total darkness, and driving seas. At 12:15 am the anchor ropes holding our yacht, *Shiner*, broke and allowed the boat to hole itself against the rocks in Boat Cove. Our Captain, John Taylor, and two of the scientists were on board at the time and had to abandon ship into their Avon landing craft amidst all the elements. They made their way to shore to a landing over very large and dangerous rocks. All they had to guide them was the light of two torches held by the shore party to show them a "channel." They were indeed fortunate to catch the right wave and surf over the rocks to make a scrambled, but safe, landing.

We were indeed fortunate no lives were lost. The boat was a total loss, including quite a bit of personal gear on board. Our hosts on the island together with the oceanographers from the scientific party did a terrific job salvaging what was possible from the wreck over the next two days. A bit of a damper to the expedition, but when it was known that no lives were lost, the radio operation could at least carry on with easier minds. Of course, they now had to find a way to make alternative arrangements for the trip back to New Zealand. After several different alternatives, they finally had to accept the offer of a diversion pick-up by the coastal freighter *MV Vila* en route from Tonga to Auckland. The cost of the diversion was $3,000, an added expense they had not counted on, but there was no choice.

So, after an uneventful trip home, apart from a little seasickness, the expeditioners arrived back in Auckland for a reunion with their families; so ended the trip of a lifetime to the rare and exotic Kermadec Islands.

BITS 'N' PIECES

One of the chores the members of the Kermadec expedition told us about was the baking of their own bread and the trouble they had keeping track of which loaves were the fresh ones. Amateur ingenuity and some food dye came through with the answer—color-coded bread, a great idea so long as someone remembered the color coding.

More 6m VHF news from Terry ZL2TPY indicated that April provided more surprises with every type of propagation taking place during the month: sporadic-E, F2, TEP (Class 1 and 2), Backscatter, and tropo, etc. His running total of 6m QSOs for the last four and half months has well passed the 1000 mark (nothing under 160 kms) with over 600 plus stations worked. The overseas DX within the Pacific Basin and the States continues with this month's total bringing up his total of call areas worked to 39 for the same period. The JA totals for the past summer season to April was 440 JAs, all 10 Districts, and 54 JA prefixes, so 6 was very much alive in the early part of this year.

Old-Timers Club news for the month included a 50-year Certificate to Honorary Member Mrs. Austine Henry VK3YL and 60-year Certificates to Frank Bell ZL4AA (ZL's first amateur) and Bern Spackman ZLIGV, ex Z2BM. Silent Keys recorded were Morrie Walker ZL1AU, ex ZL3FQ, Wally Wainwright ZL2IS, ex ZL2IE, and Clinton Way, ex ZL2JC, and Sydney Carpenter.

OTC Awards made at the annual meeting of the Club held during the NZART Conference recently were to Arthur Allen ZL1JQ, who is the Grand Old Man (President) for the 1984/85 year, and the Montgomery Cup, for the best contribution to *Break-In*, went to George Anderson ZL2JG, for his several contributions to *Break-In* during the past year.

NORWAY

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Here we are again. I sincerely hope you all have had a pleasant vacation, nice weather, etc. I have had the pleasure to be able to join in on a couple of ham meetings, and I will today take you to the biggest ham festival in Europe, The HAM-64, at Friedrichshafen, southern Germany (or "Bodensee Treffen," which it's also called since Friedrichshafen lies on the shore of the Bodensee, facing the Swiss border).

We were three ham operators taking the ferry from Oslo to Kiel in northern Germany, and we drove the 1000 kms south to Friedrichshafen in one day. Henry LA3FI, the owner of Norsk Radio Supply, took care of the driving and Brynjar LA1AR and I took care of the mapping and sign reading. We never left the Autobahn except for refilling the car and the stomachs. LA3FI's Mercedes never got below the 100-km/h mark, and very often it was closer to 200 km/h. Certainly we did not see much of the landscape.

We came down to Friedrichshafen and had quite some problems in getting lodging, but managed after a while to get booked in at a couple of small hotels. Remember, when traveling in Germany, to take your own soap with you if you want to shower. We didn't remember, but a little organizing worked that out.

The very next day we had the pleasure to see the biggest and nicest place for a ham operator to see. Gee, man, even we who work in the business were amazed. And the flea market overflowed with all kinds of surplus and used gear. We spent some good times chatting with exhibitors from all over the world. We did have the great pleasure to meet Mr. Bob Cushman from the Cushcraft company and spent quite some time chatting about antennas. A very pleasant meeting indeed, both personally and business-wise.

Other exhibitors included, of course, Telex-Hy-Gain, and we did have a couple of nice chats there, too. There's only one drawback in dealing with US companies these days, the US dollar is so extremely expensive at this time. During the last six months it has gone up 16 percent, and that is very hard on amateurs. Raw materials have been raised 20 percent, and it's really a killer for business. But anyhow, we did enjoy the whole exhibition.

Later that evening we had the pleasure to join the ham party and had a very nice chat with Kurt HB9MX and Baldur DJ6SI. The latter is a very famous DXpeditioner who you certainly have worked from a few of those far-off rare DX countries.

We also met Bjorn SM6EHY, who immediately got fired up on low-band DXing. I will write about Bjorn in a later column. One thing that really surprised me was the generally friendly attitude shown by everyone to everyone. It was just a great pleasure to be a foreign visitor. As a DXer, I certainly got interested in the DARC's DX

Continued on page 100

Kurt HB9MX (right) showing his scrapbook to Baldur DJ6SI.

The DARC's DX stand. In the middle are Herb DL2DN and Harry DL8CM.

Food for thought.

Our new Universal Tone Encoder lends its versatility to all tastes. The menu includes all CTCSS, as well as Burst Tones, Touch Tones, and Test Tones. No counter or test equipment required to set frequency-just dial it in. While traveling, use it on your Amateur transceiver to access tone operated systems, or in your service van to check out your customers' repeaters; also, as a piece of test equipment to modulate your Service Monitor or signal generator. It can even operate off an internal nine volt battery, and is available for one day delivery, backed by our one year warranty.

- All tones in Group A and Group B are included.
- Output level flat to within 1.5db over entire range selected.
- Separate level adjust pots and output connections for each tone Group.
- Immune to RF
- Powered by 6-30vdc, unregulated at 8 ma.
- Low impedance, low distortion, adjustable sinewave output, 5v peak-to-peak
- Instant start-up.
- Off position for no tone output.
- Reverse polarity protection built-in.

Group A

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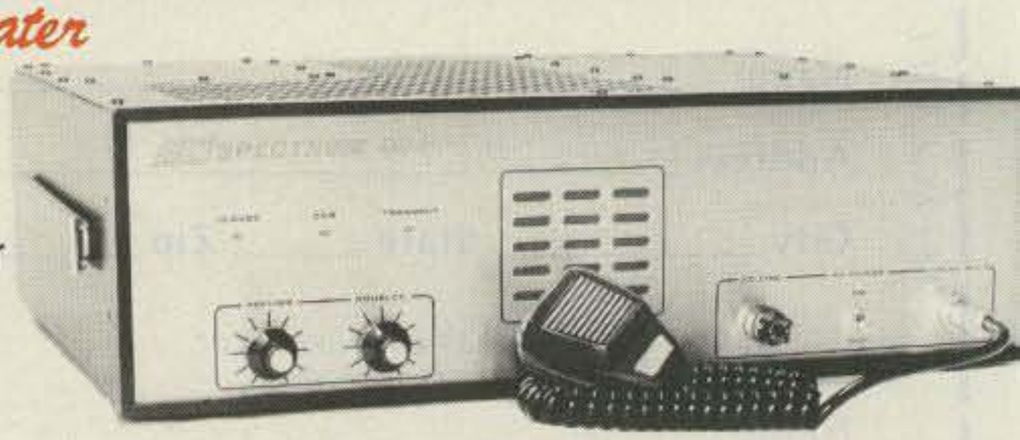

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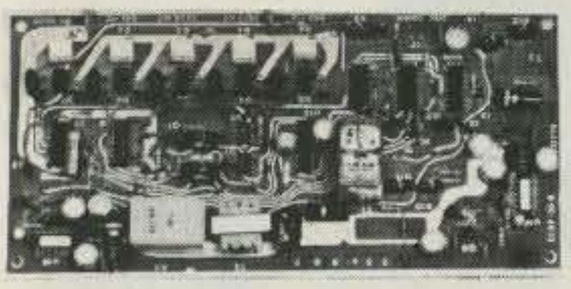

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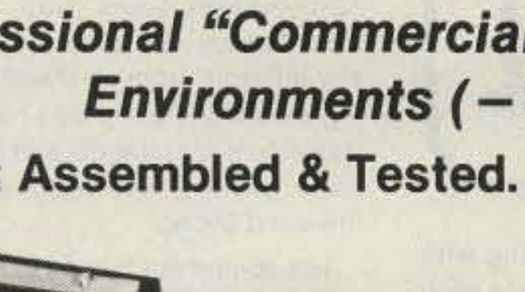

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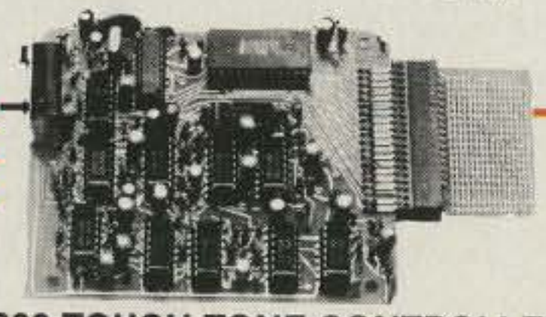

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73 INTERNATIONAL

from page 94

stand and had nice chats with a few of the guys behind the stand.

We did, of course, take the opportunity to use the hospitality given by the combined representatives from the Post and Telegraph services in Austria, Switzerland, Lichtenstein, and Germany, who on the spot issued visiting licenses on a reciprocal basis without any fees at all. I personally had the opportunity to obtain LA5YJ/HB, LA5YJ/HB0, DL/LA5YJ, and the tongue-breaking OE1XFB/LA5YJ. Only the French representative was missing, and we were missing him.

As you may have gathered already, we did take a trip through Austria, Lichtenstein, Switzerland, France, and Germany, but unfortunately we did only bring a 2m FM rig this time, and I had the pleasure of chatting with amateurs from all of these QTHs except from France, where we couldn't obtain a license on such short notice. The only thing that took some pleasure off the trip was the weather. Maybe someone disliked the kind of rf I was transmitting through the air! It was raining like I have seen only in the tropics, and I'm sure that part of the world got enough rain to put the Sahara Desert under water during that day.

Everyone assured us that this was very unusual; normally the weather should be nice and sunny this time of the year. However, next time we're going to bring with us an HF rig and spend some time in each of the countries trying to create a few pileups. I'm sure the weather will be much better then. I will say that if you get the opportunity to go to Europe during the last part of June next year, take the chance and join in on the Bodensee-treffen 1985. You surely won't regret it. If interested, write to DARC-Deutscher Amateur-Radio Club e.V., 3507 Baunatal, Lindenalle 6, Germany. The affair is absolutely one of the best I have attended, and remember, it's only for ham radio.

BJARNE ERIKSEN LA4HF

I would like to present to you another DXer from Norway, one of those you never hear too much from or about, which does not mean that he is not one of the big ones. Just the contrary. Depending on what you consider as a "Big Gun"—one with a big antenna farm, big equipment, or the capability to get the rare ones—Bjarne P. Eriksen LA4HF, from Likollen, near Oslo, belongs to the last category. He was born in the southern part of northern Norway in 1928, and will soon be 56. He was first licensed in 1955 and was really bit by the bug when he worked his first real rare one in 1958, VK0TC, on 15-meter AM. Since then it seems that his interest in DXing has just increased, though it has never taken control over his life and work.

Bjarne lives with his wife, Liv, in a one-story house in a suburb of Oslo. Around 20 km from the inner city, nothing except the 12-meter-high tower with a Classic 33 from Mosley can pick him out as being any different from all the other people living around there. He also has a multiband trap dipole for local 80- and 40-meter work, since he never has taken any interest in low-band DXing.

His equipment has been for many years a Yaesu FT-500, but last year he realized that the rig was starting to get a bit too old, and he traded it in for a brand new Yaesu rig, the FT-980 CAT. You can imagine his happiness about this rig. Even though he thought quite well about the old one, which had served him well for so many years, his answer to my question the other night, if he would like to switch back was rather short and precise: No way! And you know, the new toy got the flame burning a little higher. He is really sincere about his hobby, and it relaxes him from his work as a Managing Director at E. Stephesen AS, in Oslo—a firm specializing in hearing aids.

When I was visiting him I tried hard to move him into buying a new tower and a bigger antenna, but he was concerned about his neighbors. The idea is not new to him, however; I think time will tell!

Bjarne has managed to work 304/318 and is still waiting to work such easy goodies as 4U1UN, ZL/Chatham, XF4, and BY. I know that Bjarne would be very happy if anyone working from those locations could give him a hint about when they will be active. In addition to his FT-980, he has an SB-230 linear, Amtor MkII from ICS electronics, and a BBC model B computer.

LA4HF has other interests as well. He loves traveling and is starting to be a little globe-trotter. He has been visiting HS, CN, 3V8, SV5, and 5Z4 and is planning to pay a longer visit to HB9 this summer. He also is very interested in salt-water fishing and is very happy to pull up a couple of big cod.

Bjarne is very happy to spend time chatting with people and does not mind ragchewing at all, but a new one gets him always on the tense side, so to speak. Understandable, and I sincerely wish him luck towards the DXCC Honor Roll, where I, personally, think he belongs.

In another column I will present to you Bjorn SM6EHY of Sweden and another ham meeting we have been to.

Take good care, my friends; see you soon.

POLAND

Jerzy Szymczak
78-200 Bialogard
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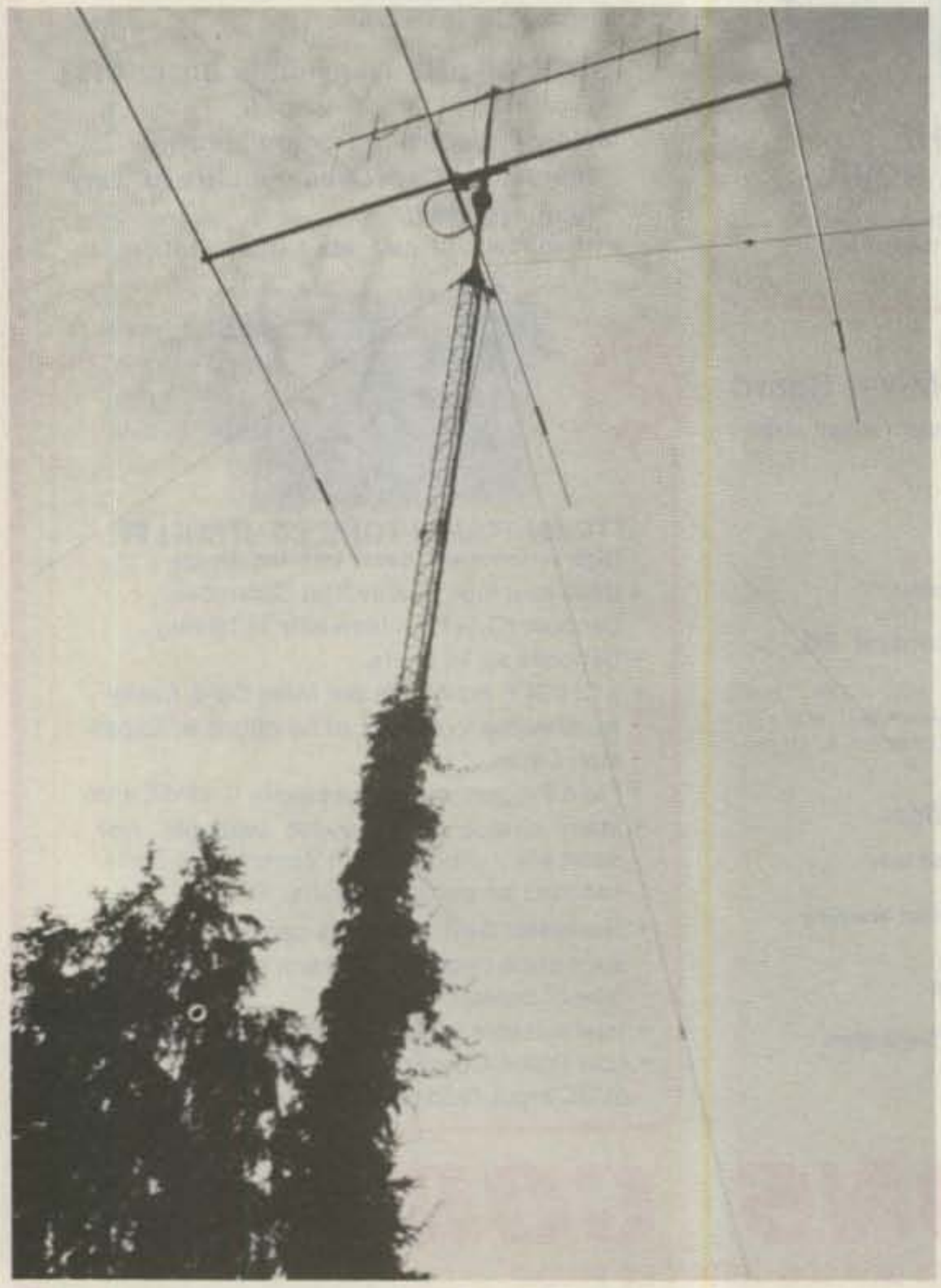
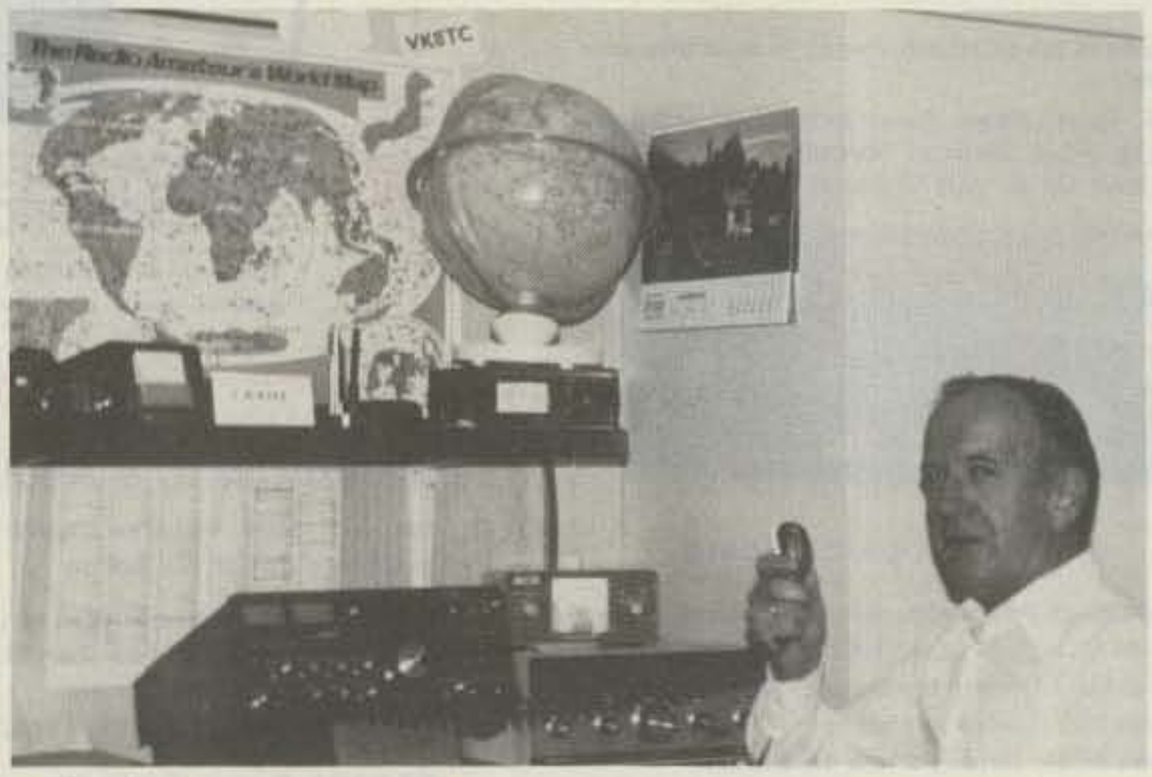
Poland

On January 28, 1984, the plenary session of Headquarters of PRAA (Polish Radio Amateurs Association) took place in Warsaw. Important resolutions that will exert an influence on the future activity of Polish hams were adopted. The PRAA electoral campaign began in February. Elections of delegates to district conventions were to take place at electoral meetings of radio-amateur clubs from February 1 to March 31. The district conventions elect deputies to the National Congress of PRAA in October or November. All



LA4HF's antenna farm. The wild climbing plant adds an unusual touch.



Bjarne LA4HF in front of his operating desk.

LA4HF's QTH during Christmas season.

Director C. C. Lee of Post and Telecommunications with Mr. Shozo Hara, Deputy Director Shih, and Tim Chen. (Photo by BV2A)

DXFF members. Second and fourth from the left, front row, are old-timers. (Photo by BV2A)

holders of valid licenses may have a share in the district conventions as ordinary members; on the other hand, persons who are bringing their licenses up to date may take part in them as "extraordinary members" if they are elected by a club. One deputy to the National Congress is to be elected for every 20 ordinary delegates to district conventions. Candidates elected by simply majorities are to be deputies; the number of deputies from each district depends on the number of members at the district conventions.

The Presidium of PRAA hopes that more former radio amateurs will resume their activities. The pity is that so many ex-hams do not apply for licenses. The spirit is willing but the flesh is weak? Some radio fans did not regain their licenses. They appealed to verification boards and in some instances received their longed-for papers. To encourage indifferent hams, the time for bringing licenses up to date has been extended for three months.

Considering the reduced number of radio amateurs, the Headquarters of PRAA made a decision to propose the liquidation of the functions of agents in some districts of Poland. The former agents are to hand over documents to other appropriate District Departments of PRAA. The District Departments of PRAA are authorized to commission the former agents to continue their functions or to designate others. From February 1, the radio amateurs of districts Bielsko Podlaskie, Chelm, and Zamosc belong to the district of Lublin; the radio amateurs of districts Ciechanow and Plock go to the district of Warsaw; Przemysl goes to Rzeszow; Slupsk to Koszalin; Walbrzych to Wroclaw; Wloclawek to Bydgoszcz; and Tarnobrzeg and Radom to Kielce. These organizational changes are to render the administration of PRAA more efficient.

Norms for staffing of PRAA are exceeded, the Presidium says. Salaried workers should be replaced by active hams.

At the request of the vice-president of PRAA Headquarters, SP3AUZ (the Polish Radio Videography Club) was founded on January 28, this year.

TAIWAN

Tim Chen BV2A/BV2B
PO Box 30-547
Taipei, Taiwan
Republic of China

After decades of endeavor, we are pleased to see that the Chinese government has decided to renew the licensing system with a ceiling of 12 ham stations to be distributed in 4 districts. The northern district will be allotted 4 stations, central 3, southern 3, and eastern, 2. We anticipate many license applicants, and the limit of 12 stations will not meet the demand. To solve this problem, club stations will mostly be the way to absorb more operators at the beginning.

The regulations governing ham-radio stations are under revision. The usable frequencies allowed will be only on the 40-, 20-, 15-, and 10-meter bands. The China Radio Association (CRA) is requesting the authority to add the 80-meter band for ham use in order to facilitate 5-band QSO possibilities. VHF and UHF are still out of the question. However, 144/430 were recently used by the Japan DXFF DXpedition on a temporary basis, so it is possible we can apply for them in like situations.

The Directorate General of Telecommunications (DGT) will give public examinations once or twice in a year. The first examination was scheduled for September. All participants have to pass the qualification test. It covers Morse code at 30 wpm on both sending and receiving for 3 minutes, radio principles, electricity principles, telecommunications law, international radio regulations relevant to amateur radio, English, and communications geography. Oral tests on alphabetical and numeral spellings are also required.

DXFF DXPEDITION

The Japan DXFF DXpedition group consisted of 12 members, including two XYLs and one reporter/photographer. They were divided into three teams and arrived on June 8, 13, and 14, respectively. As usual, the ham visitors wasted no time setting up station BV0JA/BV0YL and antennas immediately after their arrival in Taipei. The DXpedition venue was at the same place which had been used by former groups. It is facing a public park, with a spacious roof on a 12-story building for antenna installation good towards east, north, and west.

The special callsigns BV0JA and BV0YL were assigned for use by the OMs and YLs of the group. By estimate, over 15,000 QSOs were made during the 10-day operation. The most outstanding aspect of the DXFF group was the operation on 144/430 with AO-10 (B), from which nearly 200 QSOs (CW/phone) covering 4 continents (excepting South Africa and South America) were obtained. It is a record for ham operation with satellites in this area. We have informed the DXCC of these operations and callsigns which had been approved by the Chinese Government and considered legal for DX credits.

Shozo Hara JA1AN, president of JARL,

DXpedition station BV0JA/BV0YL.

recently made a courtesy call on C. C. Lee, Director of Post and Telecommunications, MOC. Their talk about world amateurs was fruitful and meaningful in promoting ham activities in our country. Therefore, further cooperation between JARL and CRA is expected. A second Japanese group was to visit BV-land in July, and the callsign BV0AB was requested for the mission.

After expedition activities, our visitors' stations had materially improved QSOs to world hams; we should be very appreciative of their efforts as they spent lots of time and money to carry out their missions. Perhaps there will be two bigger groups scheduling arrivals this fall; please look out for them.

Local authorities have so far approved four expedition groups from abroad; we are going to strengthen the ham movement gradually, although we do not have many stations at present.

There is no doubt that ham activities have become popularized step by step in this land. Enquiries by letters and phone calls are frequently received. Newspapers and the broadcast media are quite encouraging, giving us good comments. Furthermore, one of local TV stations, the CTS, had a vivid telecasting of our activity in its news program on prime time. Its lady reporter, Miss Lee, said, "Now I am also tempted by the hobby!" HI YL! Welcome to amateur radio!

"Why not have a telephony class?" asked Dr. Wayne Green W2NSD during his sojourn in Taipei with his XYL, Sherry, recently. (Congratulations, Dr. Green, for your new title.) You should be also pleased to learn that we are stepping forward, but we have to stick on CW/phone at the beginning. Thanks for your concern!

✓ *See List of Advertisers on page 88*

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4PR60A	200.00	6883B/8032A/8552	10.00	6GF5	5.85
4PR60B	345.00	6897	160.00	6GJ5A	6.20
4PR65A/8187	175.00	6907	79.00	6GK6	6.00
4PR1000A/8189	590.00	6922/6DJ8	5.00	6HB5	6.00
4X150A/7034	60.00	6939	22.00	6HF5	8.73
4X150D/7609	95.00	7094	250.00	6JG6A	6.28
4X250B	45.00	7117	38.50	6JM6	6.00
4X250F	45.00	7203	P.O.R.	6JN6	6.00
4X500A	412.00	7211	100.00	6JS6C	7.25
5CX1500A	660.00	7213	300.00*	6KN6	5.05
KT88	27.50	7214	300.00*	6KD6	8.25
416B	45.00	7271	135.00	6LF6	7.00
416C	62.50	7289/2C39	34.00	6LQ6 G.E.	7.00
572B/T160L	49.95	7325	P.O.R.	6LQ6/6MJ6 Sylvania	9.00
592/3-200A3	211.00	7360	13.50	6ME6	8.90
807	8.50	7377	85.00	12AT7	3.50
811A	15.00	7408	2.50	12AX7	3.00
812A	29.00	7609	95.00	12BY7	5.00
813	50.00	7735	36.00	12JB6A	6.50

NOTE * = USED TUBE

NOTE P.O.R. = PRICE ON REQUEST

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"FILTERS"

COLLINS Mechanical Filter #526-9724-010 MODEL F455Z32F

455KHZ at 3.2KHz wide. May be other models but equivalent. May be used or new. $15.99

ATLAS Crystal Filters

5.595-2.7/8/LSB, 5.595-2.7/LSB
8 pole 2.7KHz wide Upper sideband. Impedence 800ohms 15pf In/800ohms 0pf out. 19.99

5.595-2.7/8/U, 5.595-2.7/USB
8 pole 2.7Khz wide Upper sideband. Impedence 800ohms 15pf In/800ohms 0pf out. 19.99

5.595-.500/4, 5.595-.500/4/CW
4 pole 500 cycles wide CW. Impedance 800ohms 15pf In/800ohms 0pf out. 19.99

9.0USB/CW
6 pole 2.7KHz wide at 6dB. Impedance 680ohms 7pf In/300ohms 8pf out. CW-1599Hz 19.99

KOKUSAI ELECTRIC CO, Mechanical Filter #MF-455-ZL/ZU-21H

455KHz at Center Frequency of 453.5KC. Carrier Frequency of 455KHz 2.36KC Bandwidth.
Upper sideband. (ZU) 19.99
Lower sideband. (ZL) 19.99

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CRYSTAL FILTERS

NIKKO	FX-07800C	7.8MHz	$10.00
TEW	FEC-103-2	10.6935MHz	10.00
SDK	SCH-113A	11.2735MHz	10.00
TAMA	TF-31H250	CF 3179.3KHz	19.99
TYCO/CD	001019880	10.7MHz 2pole 15KHz bandwidth	5.00
MOTOROLA	4884863B01	11.7MHz 2pole 15KHz bandwidth	5.00
PTI	5350C	12MHz 2pole 15KHz bandwidth	5.00
PTI	5426C	21.4MHz 2pole 15KHz bandwidth	5.00
PTI	1479	10.7MHz 8pole bandwidth 7.5KHz at 3dB, 5KHz at 6dB	20.00
COMTECH	A10300	45MHz 2pole 15KHz bandwidth	6.00
FRC	ERXF-15700	20.6MHz 36KHz wide	10.00
FILTECH	2131	CF 7.825MHz	10.00

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CERAMIC FILTERS

AXEL	4F449	12.6KC Bandpass Filter 3dB bandwidth 1.6KHz from 11.8-13.4KHz	10.00
CLEVITE	TO-01A	455KHz+-2KHz bandwidth 4-7% at 3dB	5.00
	TCF4-12D36A	455KHz+-1KHz bandwidth 6dB min 12KHz, 60dB max 36KHz	10.00
MURATA	BFB455B	455KHz	2.50
	BFB455L	455KHz	3.50
	CFM455E	455KHz +-5.5KHz at 3dB , +-8KHz at 6dB , +-16KHz at 50dB	6.65
	CFM455D	455KHz +-7KHz at 3dB , +-10KHz at 6dB , +-20KHz at 50dB	6.65
	CFR455E	455KHz +-5.5KHz at 3dB , +-8KHz at 6dB , +-16KHz at 60dB	8.00
	CFU455B	455KHz +-2KHz bandwidth +-15KHz at 6dB, +-30KHz at 40dB	2.90
	CFU455C	455KHz +-2KHz bandwidth +-12.5KHz at 6dB , +-24KHz at 40dB	2.90
	CFU455G	455KHz +-1KHz bandwidth +-4.5KHz at 6dB , +-10KHz at 40dB	2.90
	CFU455H	455KHz +-1KHz bandwidth +-3KHz at 6dB , +-9KHz at 40dB	2.90
	CFU455I	455KHz +-1KHz bandwidth +-2KHz at 6dB , +-6KHz at 40dB	2.90
	CFW455D	455KHz +-10KHz at 6dB , +-20KHz at 40dB	2.90
	CFW455H	455KHz +-3KHz at 6dB , +-9KHz at 40dB	2.90
	SFB455D	455KHz	2.50
	SFD455D	455KHz +-2KHz , 3dB bandwidth 4.5KHz +-1KHz	5.00
	SFE10.7MA	10.7MHz 280KHz +-50KHz at 3dB , 650KHz at 20dB	2.50
	SFE10.7MS	10,7MHz 230KHz +-50KHz at 3dB , 570KHz at 20dB	2.50
	SFG10.7MA	10.7MHz	10.00
NIPPON	LF-B4/CFU455I	455KHz +-1KHz	2.90
	LF-B6/CFU455H	455KHz +-1KHz	2.90
	LF-B8	455KHz	2.90
	LF-C18	455KHz	10.00
TOKIN	CF455A/BFU455K	455KHz +-2KHz	5.00
MATSUSHIRA	EFC-L455K	455KHz	7.00

****

SPECTRA PHYSICS INC, Model 088 HeNe LASER TUBES

POWER OUTPUT 1.6MW. BEAM DIA. .75MM BEAM DIR. 2.7MR 8KV STARTING VOLTAGE DC
68K OHM 1WATT BALLAST 1000VDC +-100VDC At 3.7MA $59.99

ROTRON MUFFIN FANS Model MARK4/MU2A1

115 VAC 14WATTS 50/60CPS IMPEDENCE PROTECTED-F 88CFM at 50CPS $ 7.99
105CFM at 60CPS

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TYPE	PRICE	TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
2N1561	$25.00	2N5920	$ 70.00	40608 RCA	$ 2.48	BFY90	$ 1.50
2N1562	25.00	2N5921	80.00	40673 RCA	2.50	BLW60C5	15.00
2N1692	25.00	2N5922	10.00	40894 RCA	1.00	BLX67	12.25
2N2857	1.55	2N5923	25.00	60247 RCA	25.00	BLX67C3	12.25
2N2857JAN	4.10	2N5941	23.00	61206 RCA	100.00	BLX93C3	22.21
2N2857JANTX	4.50	2N5942	40.00	62800A RCA	60.00	BLY87A	7.50
2N2876	13.50	2N5944	10.35	62803 RCA	100.00	BLY88C3	13.08
2N2947	18.35	2N5945	10.00	430414/3990RCA	50.00	BLY89C	13.00
2N2948	13.00	2N5946	12.00	3457159 RCA	20.00	BLY90	45.00
2N2949	15.50	2N5947	9.20	3729685-2 RCA	75.00	BLY92	13.30
2N3118	5.00	2N6080	6.00	3729701-2 RCA	50.00	BLY94C	45.00
2N3119	4.00	2N6081	7.00	3753883 RCA	50.00	BLY351	10.00
2N3134	1.15	2N6082	9.00	615467-902	25.00	BLY568C/CF	30.00
2N3287	4.90	2N6083	9.50	615467-903	40.00	C2M70-28R	92.70
2N3288	4.40	2N6084	12.00	2SC568	2.50	C25-28	57.00
2N3309	4.85	2N6094	11.00	2SC703	36.00	C4005	2.50
2N3375	17.10	2N6095	12.00	2SC756A	7.50	CD1659	20.00
2N3478	2.13	2N6096	16.10	2SC781	2.80	CD1899	20.00
2N3553	1.55	2N6097	20.70	2SC1018	1.00	CD1920	10.00
2N3553JAN	2.90	2N6105	21.00	2SC1042	24.00	CD2188	18.00
2N3632	15.50	2N6136	21.85	2SC1070	2.50	CD2545	24.00
2N3733	11.00	2N6166	40.24	2SC1216	2.50	CD2664A	16.00
2N3818	5.00	2N6267	142.00	2SC1239	2.50	CD3167	92.70
2N3866	1.30	2N6304	1.50	2SC1251	24.00	CD3353	95.00
2N3866JAN	2.20	2N6368	30.00	2SC1306	2.90	CD3435	26.30
2N3866JANTX	3.80	2N6439	55.31	2SC1307	5.50	CD3900	152.95
2N3866JANTXV	4.70	2N6459	18.00	2SC1424	2.80	CM25-12	20.00
2N3866AJANTXV	5.30	2N6567	10.06	2SC1600	5.00	CM40-12	27.90
2N3924	3.35	2N6603	13.50	2SC1678	2.00	CM40-28	56.90
2N3926	16.10	2N6604	13.50	2SC1729	32.40	CME50-12	30.00
2N3927	17.25	2N6679	44.00	2SC1760	1.50	CTC2001	42.00
2N3948	1.75	2N6680	80.00	2SC1909	4.00	CTC2005	55.00
2N3950	25.00	021-1	15.00	2SC1945	10.00	CTC3005	70.00
2N3959	3.85	01-80703T4	65.00	2SC1946	40.00	CTC3460	20.00
2N4012	11.00	35C05	15.00	2SC1947	10.00	DV2820S	25.00
2N4037	2.00	102-1	28.00	2SC1970	2.50	DXL1003P70	22.00
2N4041	14.00	103-1	28.00	2SC1974	4.00	DXL2001P70	19.00
2N4072	1.80	103-2	28.00	2SC2166	5.50	DXL2002P70	14.00
2N4080	4.53	104P1	18.00	2SC2237	32.00	DXL3501AP100F	47.00
2N4127	21.00	163P1	10.00	2SC2695	47.00	EFJ4015	12.00
2N4416	2.25	181-3	15.00	A2X1698	POR	EFJ4017	24.00
2N4427	1.25	210-2	10.00	A3-12	14.45	EFJ4021	24.00
2N4428	1.85	269-1	18.00	A50-12	24.00	EFJ4026	35.00
2N4430	11.80	281-1	15.00	A209	10.00	EN15745	20.00
2N4927	3.90	282-1	30.00	A283	6.00	FJ9540	16.00
2N4957	3.45	482	7.50	A283B	6.00	FSX52WF	58.00
2N4959	2.30	564-1	25.00	A1610	19.00	G65739	25.00
2N5016	18.40	698-3	15.00	AF102	2.50	G65386	25.00
2N5026	15.00	703-1	15.00	AFY12	2.50	GM0290A	2.50
2N5070	18.40	704	4.00	AR7115	20.00	HEP76	4.95
2N5090	13.80	709-2	11.00	AT41435-5	6.35	HEPS3002	11.40
2N5108	3.45	711	4.00	B2-8Z	10.70	HEPS3003	30.00
2N5109	1.70	733-2	15.00	B3-12	10.85	HEPS3005	10.00
2N5160	3.45	798-2	25.00	B12-12	15.70	HEPS3006	19.90
2N5177	21.62	3421	28.00	BAL0204125	152.95	HEPS3007	25.00
2N5179	1.04	3683P1	15.00	BF25-35	56.25	HEPS3010	11.34
2N5216	56.00	3992	25.00	B40-12	19.25	HF8003	10.00
2N5470	75.00	4164P1	15.00	B70-12	55.00	HFET2204	112.00
2N5583	3.45	4243P1	28.00	BF272A	2.50	HP35821	38.00
2N5589	9.77	4340P3	18.00	BFQ85	2.50	HP35826B	32.00
2N5590	10.92	4387P1	27.50	BFR21	2.50	HP35826E	32.00
2N5591	13.80	7104-1	28.00	BFR90	1.00	HP35831E	30.00
2N5596	99.00	7249-2	10.50	BFR91	1.65	HP35832E	50.00
2N5636	12.00	7283-1	37.50	BFR99	2.50	HP35833E	50.00
2N5637	15.50	7536-1	30.00	BFT12	2.50	HP35859E	75.00
2N5641	12.42	7794-1	10.50	BFW16A	2.50	HP35866E	44.00
2N5642	14.03	7795	15.00	BFW17	2.50	HXTR2101	44.00
2N5643	25.50	7795-1	15.00	BFW92	1.50	HXTR3101	7.00
2N5645	13.80	7796-1	24.00	BFX44	2.50	HXTR5101	31.00
2N5646	20.70	7797-1	36.00	BFX48	2.50	HXTR6104	68.00
2N5651	11.05	40081 RCA	5.00	BFX65	2.50	HXTR6105	31.00
2N5691	18.00	40279 RCA	10.00	BFX84	2.50	HXTR6106	33.00
2N5764	27.00	40280 RCA	4.62	BFX85	2.50	J310	1.00
2N5836	3.45	40281 RCA	10.00	BFX86	2.50	JO2000	10.00
2N5842	8.45	40282 RCA	20.00	BFX89	1.00	JO2001	25.00
2N5847	19.90	40290 RCA	2.80	BFY11	2.50	JO4045	24.00
2N5849	20.00	40292 RCA	13.05	BFY18	2.50	KD5522	25.00
2N5913	3.25	40294 RCA	2.50	BFY19	2.50	KJ5522	25.00
2N5916	36.00	40341 RCA	21.00	BFY39	2.50	M1106	13.75

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M1107	$16.75	MRF458	$20.70	NEO2160ER	$100.00	SD1009	$15.00
M1131	5.15	MRF464	25.30	NEO21350	5.30	SD1009-2	15.00
M1132	7.25	MRF466	18.97	NE13783	61.00	SD1012	10.00
M1134	13.40	MRF472	1.50	NE21889	43.00	SD1012-3	10.00
M9116	29.10	MRF475	3.10	NE57835	5.70	SD1012-5	10.00
M9579	6.00	MRF476	3.16	NE64360ER-A	100.00	SD1013	10.00
M9580	7.95	MRF477	20.00	NE64480 (B)	94.00	SD1013-3	10.00
M9587	7.00	MRF479	8.05	NE73436	2.50	SD1013-7	10.00
M9588	5.20	MRF492	23.00	NE77362ER	100.00	SD1016	15.00
M9622	5.95	MRF502	1.04	NE98260ER	100.00	SD1016-5	15.00
M9623	7.95	MRF503	6.00	PRT8637	25.00	SD1018-4	13.00
M9624	9.95	MRF504	7.00	PT3127A	5.00	SD1018-6	13.00
M9625	15.95	MRF509	5.00	PT3127B	5.00	SD1018-7	13.00
M9630	14.00	MRF511	10.69	PT3127C	20.00	SD1018-15	13.00
M9740	27.90	MRF515	2.00	PT3127D	20.00	SD1020-5	10.00
M9741	27.90	MRF517	2.00	PT3127E	20.00	SD1028	15.00
M9755	16.00	MRF525	3.45	PT3190	20.00	SD1030	12.00
M9780	5.50	MRF559	1.76	PT3194	20.00	SD1030-2	12.00
M9827	11.00	MRF587	11.00	PT3195	20.00	SD1040	5.00
M9848	35.00	MRF605	20.00	PT3537	7.80	SD1040-2	20.00
M9850	13.50	MRF618	25.00	PT4166E	20.00	SD1040-4	10.00
M9851	20.00	MRF626	12.00	PT4176D	25.00	SD1040-6	5.00
M9860	8.25	MRF628	8.65	PT4186B	5.00	SD1043	12.00
M9887	2.80	MRF629	3.45	PT4209	25.00	SD1043-1	10.00
M9908	6.95	MRF641	25.30	PT4209C/5645	25.00	SD1045	3.75
M9965	12.00	MRF644	27.60	PT4556	24.60	SD1049-1	2.00
MM1500	25.00	MRF646	29.90	PT4570	7.50	SD1053	4.00
MM1550	10.00	MRF648	33.35	PT4577	20.00	SD1057	10.00
MM1552	50.00	MRF816	15.00	PT4590	5.00	SD1065	4.75
MM1553	50.00	MRF823	20.00	PT4612	20.00	SD1068	15.00
MM1607	8.45	MRF846	44.85	PT4628	20.00	SD1074-2	18.00
MM1614	10.00	MRF892	35.50	PT4640	20.00	SD1074-4	28.00
MM1810	15.00	MRF894	46.00	PT4642	20.00	SD1074-5	28.00
MM1810	15.00	MRF901 3 Lead	1.00	PT5632	4.70	SD1076	18.50
MM1943	1.80	MRF901 4 Lead	2.00	PT5749	25.00	SD1077	4.00
MM2608	5.00	MRF902/2N6603JAN	15.00	PT6612	25.00	SD1077-4	4.00
MM3375A	17.10	MRF902B	18.40	PT6619	20.00	SD1077-6	4.00
MM4429	10.00	MRF904	2.30	PT6708	25.00	SD1078-6	24.00
MM8000	1.15	MRF905	2.55	PT6709	25.00	SD1080-7	7.50
MM8006	2.30	MRF911	2.50	PT6720	25.00	SD1080-8	6.00
MM8011	25.00	MRF965	2.55	PT8510	15.00	SD1080-9	3.00
MPSU31	1.01	MRF966	3.55	PT8524	25.00	SD1084	8.00
MRA2023-1.5	42.50	MRF1000MA	32.77	PT8609	25.00	SD1087	15.00
MRF134	10.50	MRF1004M	31.05	PT8633	25.00	SD1088	22.00
MRF136	16.00	MRF2001	41.74	PT8639	25.00	SD1088-8	22.00
MRF171	35.00	MRF2005	54.97	PT8659	25.00	SD1089-5	15.00
MRF208	11.50	MRF5176	24.00	PT8679	25.00	SD1090	15.00
MRF212	16.10	MRF8004	2.10	PT8708	20.00	SD1094	15.00
MRF221	10.00	MSC1720-12	225.00	PT8709	20.00	SD1095	15.00
MRF223	13.00	MSC1821-3	125.00	PT8727	29.00	SD1098-1	30.00
MRF224	13.50	MSC1821-10	225.00	PT8731	25.00	SD1100	5.00
MRF227	3.45	MSC2001	30.00	PT8742	19.10	SD1109	18.00
MRF230	2.00	MSC2010	93.00	PT8787	25.00	SD1115-2	7.50
MRF231	10.00	MSC2223-10	245.00	PT8828	25.00	SD1115-3	7.50
MRF232	12.07	MSC2302	POR	PT9700	25.00	SD1115-7	2.10
MRF237	3.15	MSC3000	35.00	PT9702	25.00	SD1116	5.00
MRF238	13.80	MSC3001	38.00	PT9783	16.50	SD1118	22.00
MRF239	17.25	MSC72002	POR	PT9784	32.70	SD1119	5.00
MRF245	35.65	MSC73001	POR	PT9790	56.00	SD1124	50.00
MRF247	31.00	MSC80064	35.00	PT31083	20.00	SD1132-1	15.00
MRF304	36.00	MSC80091	10.00	PT31962	20.00	SD1132-4	12.00
MRF306	50.00	MSC80099	3.00	PTX6680	20.00	SD1133	9.50
MRF313	11.15	MSC80593	POR	RE3754	25.00	SD1133-1	10.00
MRF314	29.21	MSC80758	POR	RE3789	25.00	SD1134-1	2.50
MRF315	28.86	MSC82001	33.00	RF35	16.00	SD1134-4	12.00
MRF316	55.43	MSC82014	33.00	RF85	17.50	SD1134-17	12.00
MRF317	63.94	MSC82020M	130.00	RF110	21.00	SD1135	10.25
MRF412	18.00	MSC82030	33.00	S50-12	23.80	SD1135-3	12.00
MRF420	20.12	MSC83001	40.00	S3006	15.00	SD1136	12.50
MRF421	25.00	MSC83003	82.00	S3007	10.00	SD1136-2	12.50
MRF422	38.00	MSC83005	70.00	S3031	22.00	SD1143-1	10.00
MRF427	17.25	MSC83026	POR	SCA3522	5.00	SD1143-3	17.00
MRF428	63.00	MSC83303	POR	SCA3523	5.00	SD1144	4.00
MRF433	12.07	MSC84900	60.00	SD345	5.00	SD1145-5	15.00
MRF449/A	12.65	MT4150	14.40	SD445	5.00	SD1146	15.00
MRF450/A	14.37	MT5126	25.00	SD1004	15.00	SD1147	15.00
MRF452/A	17.00	MT5596(2N)	99.00	SD1007	15.00	SD1188	10.00
MRF453/A	18.40	MT5768(2N)	95.00	SD1007-2	15.00	SD1189	24.00
MRF454/A	20.12	MT8762	25.00	SD1007-4	15.00	SD1200	1.50
MRF455/A	16.00	NEO2136	2.00	SD1007-5	15.00	SD1201-2	15.00

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"All parts may be new or surplus, and parts may be substituted with comparable parts if we are out of stock of an item."

For information call: (602) 242-3037

MHz electronics

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

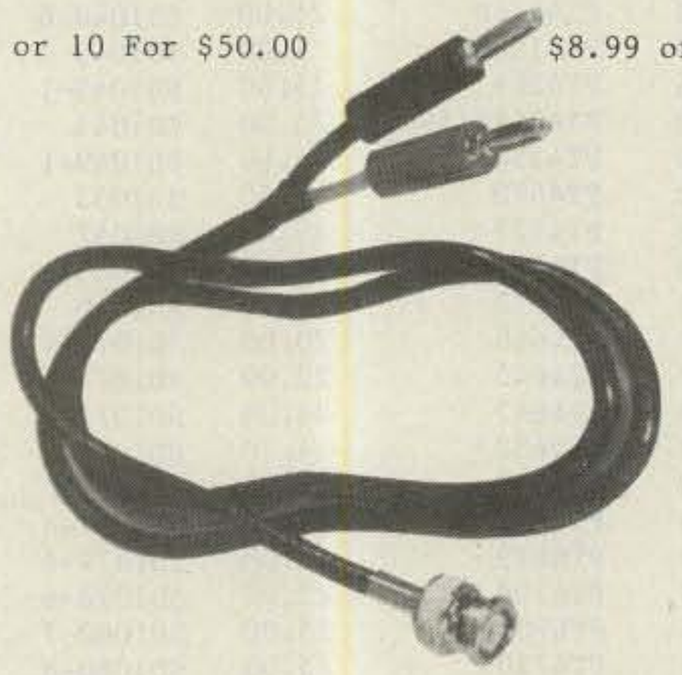
RF Transistors (continued)

SD1202	$10.00	SD1304-8	$ 2.50	SD1451-2	$15.00	SRF1427	$50.00	SD1244H12	25.00	SD1410-8	21.00	SD1536-1	41.00	SRF2917	15.00
SD1212-8	4.95	SD1305	3.00	SD1452	20.00	SRF1431	40.00	SD1262	15.00	SD1413-1	18.00	SD1539H	100.00	SRF2918	15.00
SD1212-11	4.95	SD1307	3.00	SD1452-4	24.00	SRF1834	40.00	SD1263	15.00	SD1416	28.00	SD1542H1	170.00	SRF2919	15.00
SD1212-16	4.95	SD1308	3.00	SD1453H1	20.00	SRF2053-3	60.00	SD1263-1	15.00	SD1422-2	24.00	SD1544	26.00	SRF3071PF	50.00
SD1214-7	5.00	SD1311	1.00	SD1454-1	48.00	SRF2092	50.00	SD1272	10.95	SD1428	24.00	SD1545	33.00	SS4006	25.00
SD1214-11	5.00	SD1317	8.00	SD1477	35.00	SRF2147	22.00	SD1272-1	10.95	SD1428- 6084	12.00	SD1546H1	55.00	SS4152	15.00
SD1216	12.00	SD1319	2.50	SD1478	21.00	SRF2225	15.00	SD1272-2	10.95	SD1429-2	15.00	SD1561	79.00	TA7686	15.00
SD1219-4	15.00	SD1345-6	5.00	SD1480	53.00	SRF2264	25.00	SD1272-4	10.95	SD1429-3	14.90	SD1574-1	6.95	TA8559	15.00
SD1219-5	15.00	SD1347-1	1.00	SD1484	1.50	SRF2265	100.00	SD1278	13.75	SD1429-5	15.00	SD1575	6.95	TA8561	15.00
SD1219-8	15.00	SD1365-1	2.50	SD1484-5	1.50	SRF2281	5.00	SD1278-1	13.75	SD1430	12.00	SF4557	25.00	TA8562	15.00
SD1220	8.00	SD1365-5	2.50	SD1484-6	1.50	SRF2371	15.00	SD1278-5	13.75	SD1430-2	18.00	SK3048	5.00	TA8563	15.00
SD1220-1	9.50	SD1375	7.50	SD1484-7	1.50	SRF2347	50.00	SD1279-1	18.00	SD1434	28.00	SL501-59	15.00	TA8564	15.00
SD1220-9	8.00	SD1375-6	7.50	SD1488	22.85	SRF2356	38.00	SD1279-3	18.00	SD1434-5	28.00	SL501-173	15.00	TA8894	15.00
SD1222-8	16.00	SD1379	15.00	SD1488-1	28.00	SRF2378	16.00	SD1281-2	8.00	SD1434-9	28.00	SM7714	5.00	TIS189	3.55
SD1222-11	7.50	SD1380-1	1.00	SD1488-7	27.00	SRF2572	25.00	SD1283	10.00	SD1438	26.00	SRF112	15.00	TP312	2.50
SD1224-10	18.00	SD1380-3	1.00	SD1488-8	28.00	SRF2584	40.00	SD1283-2	10.60	SD1441	56.00	SRF395	50.00	TP1014	5.00
SD1225	18.00	SD1380-7	1.00	SD1499-1	36.00	SRF2597	25.00	SD1283-3	10.00	SD1442	15.00	SRF750	36.00	TP1028	15.00
SD1225-1	15.00	SD1405	21.00	SD1511H3	75.00	SRF2741	40.00	SD1283-4	10.00	SD1444	3.25	SRF769H	20.00	TRW3	5.00
SD1229-7	10.95	SD1408	25.00	SD1520-2	18.00	SRF2747	40.00	SD1289-1	15.00	SD1444-8	3.25	SRF887K3	2.50	TXVF2201/HP	450.00
SD1229-16	10.95	SD1409	18.00	SD1522-4	33.00	SRF2767H	40.00	SD1290-4	15.00	SD1444-9	3.25	SRF989K	15.00	V222-2	25.00
SD1232	4.00	SD1410	18.00	SD1528-1	24.00	SRF2821	25.00	SD1290-7	15.00	SD1446	4.03	SRF1005	50.00	V410IE	20.00
SD1240-8	15.00	SD1410-3	21.00	SD1528-3	34.00	SRF2822/2N6603	13.50	SD1300	1.25	SD1450-1	28.00	SRF1018	5.00	V415	5.00
SD1244-1	14.00	SD1410-6	21.00	SD1530-2	38.00	SRF2857	20.00	SD1301-7	3.00	SD1451	15.00	SRF1074	50.00		

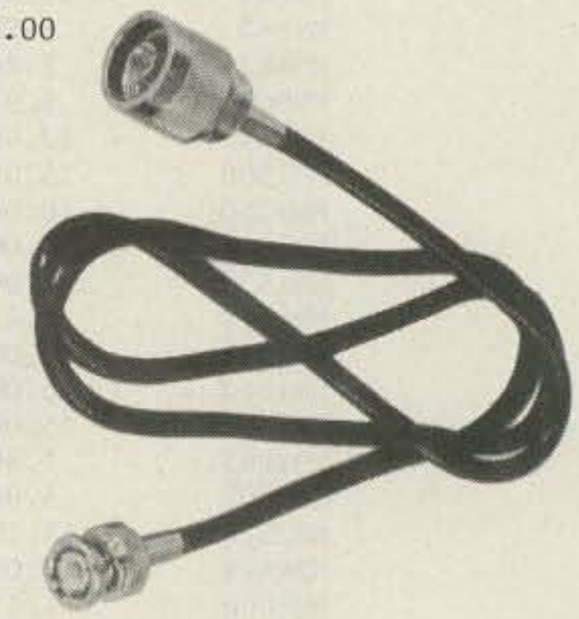
Relays

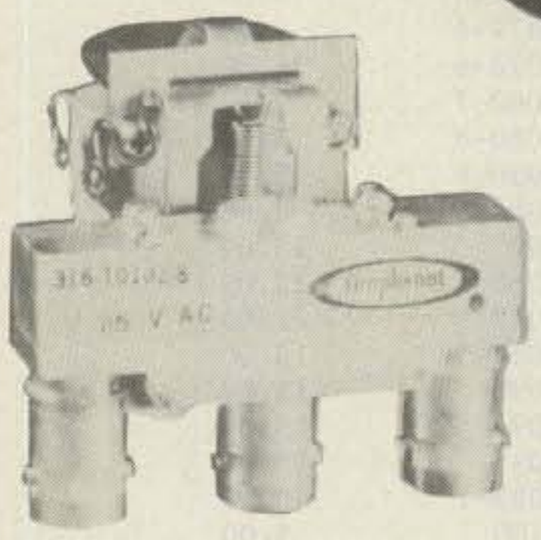
BNC To Banana Plug Coax Cable RG-58 36 inch or BNC to N Coax Cable RG-58 36 inch.

$7.99 or 2 For $13.99 or 10 For $50.00



$8.99 or 2 For $15.99 or 10 For $60.00





Amphenol
Part # 316-10102-8
115Vac Type BNC DC to 3 GHz.

$29.99

COAXIAL RELAY SWITCHES SPDT

FXR
Part # 300-11182
120Vac Type BNC DC to 4 GHz.
FSN 5985-543-1225

$39.99

FXR
Part # 300-11173
120Vac Type BNC Same
FSN 5985-543-1850

$39.99

TERMS: DOMESTIC: Prepaid, C.O.D. or Credit Card
FOREIGN: Prepaid only, U.S. Funds, Money Order, or Cashier's Check Only.

C.O.D.: Acceptable by telephone or mail. Payment from customer will be by Cash, Money Order, or Cashier's Check. We are sorry but we cannot accept personal checks for C.O.D.'s. C.O.D.'s are shipped by air only and thru United Parcel Service.

CONFIRMING ORDERS: We would prefer that confirming orders not be sent after a telephone order has been placed. If company policy necessitates a confirming order, please mark "CONFIRMING" boldly on the order. If problems or duplicate shipments occur due to an order which is not properly marked, the customer will be held responsible for any charges incurred, plus a 15% restock charge on the returned parts.

CREDIT CARDS: We are now accepting MASTERCARD, VISA, AND AMERICAN EXPRESS

DATA SHEETS: When we have data sheets in stock on devices we will supply them with the order.

DEFECTIVE MATERIALS: All claims for defective materials must be made within 30 DAYS after receipt of the parcel. All claims must include the defective material (for testing purposes), a copy of our invoice, and a return authorization number which must be obtained prior to shipping the merchandise back to us. This can be obtained by calling (602) 242-8916 or sending us a postcard. Due to Manufacturer warranties we are unable to replace or issue credit on items which have been soldered to or have been altered in any way. All return items must be packed properly or it will void all warranties. We do not assume responsibility for shipping and handling charges incurred.

DELIVERY: Orders are usually shipped the same day they are placed or the next business day, unless we are out of stock on an item. The customer will be notified by post card if we are going to backorder the item. Our normal shipping method is UPS or U.S. Mail depending on size or the weight of the package. Test Equipment is shipped only by air and is freight collect, unless prior arrangements have been made and approved.

FOREIGN ORDERS: All foreign orders must be prepaid with a Cashier's Check, or Money Order made out in U.S. FUNDS ONLY. We are sorry but C.O.D. is not available to foreign countries and letters of credit are unacceptable as a form of payment. Further information is available on request.

HOURS: Monday thru Friday 8:30 a.m. to 5:00 p.m. Saturdays 8:30 a.m. to 4:00 p.m.

INSURANCE: Please include 25¢ for each additional $100.00 over $100.00, UPS ONLY. All insured packages are shipped thru UPS only. If you wish to have it shipped through the post office there is a $5.00 fee which is additional to the shipping, handling and insurance.

OPEN ACCOUNTS: We regret that we do not issue open accounts.

ORDER FORMS: New order forms are included with each order for your convenience. Additional order forms are available on request.

PARTS: We reserve the right to substitute or replace any item with a part of equal or comparable specification.

POSTAGE: Minimum shipping and handling in the U.S., Canada, and Mexico is $3.00 for ground shipments, all other countries is $5.50. Air rates are available at the time of your order. All foreign orders please include 25% of the ordered amount for shipping and handling. C.O.D.'s are shipped AIR ONLY.

PREPAID ORDERS: Orders must be accompanied by a check.

PRICES: Prices are subject to change without notice.

PURCHASE ORDERS: We accept purchase orders only when they are accompanied by a check.

RESTOCK CHARGES: If parts are returned to MHZ ELECTRONICS, INC. due to customer error, the customer will be held responsible for all fees incurred and will be charged a 15% RESTOCK CHARGE with the remainder in CREDIT ONLY. The following must accompany any return; A copy of our invoice, return authorization number which must be obtained prior to shipping the merchandise back. Returns must be done within 10 DAYS of receipt of parcel. Return authorization numbers can be obtained by calling (602) 242-8916 or notifying us by post card. Return authorizations will not be given out on our 800 number.

SALES TAX: ARIZONA residents must add 6% sales tax, unless a signed ARIZONA resale tax card is currently on file with us. All orders placed by persons outside of ARIZONA, but delivered to persons in ARIZONA are subject to the 6% sales tax.

SHORTAGE OR DAMAGE: All claims for shortages or damages must be made within 5 DAYS of receipt of parcel. Claims must include a copy of our invoice, along with a return authorization number which can be obtained by contacting us at (602) 242-8916 or sending a post card. Authorizations cannot be on our 800 number. All items must be properly packed. If items are not properly packed make sure to contact the carrier so that they can come out and inspect the package before it is returned to us. Customers which do not notify us within this time period will be held responsible for the entire order as we will consider the order complete.

OUR 800 NUMBER IS STRICTLY FOR ORDERS ONLY (800) 528-0180. INFORMATION CALLS ARE TAKEN ON (602) 242-8916 or (602) 242-3037.

MHz electronics ↙48

2111 W. CAMELBACK ROAD
PHOENIX, ARIZONA 85015

master charge · VISA · AMERICAN EXPRESS Cards Welcome

"All parts may be new or surplus, and parts may be substituted with comparable parts if we are out of stock of an item."

For information call: (602) 242-3037

Toll Free Number
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(For orders only)

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You have a large technical audience that speaks English and is in need of the kind of microcomputer information that CW/Peterborough provides.

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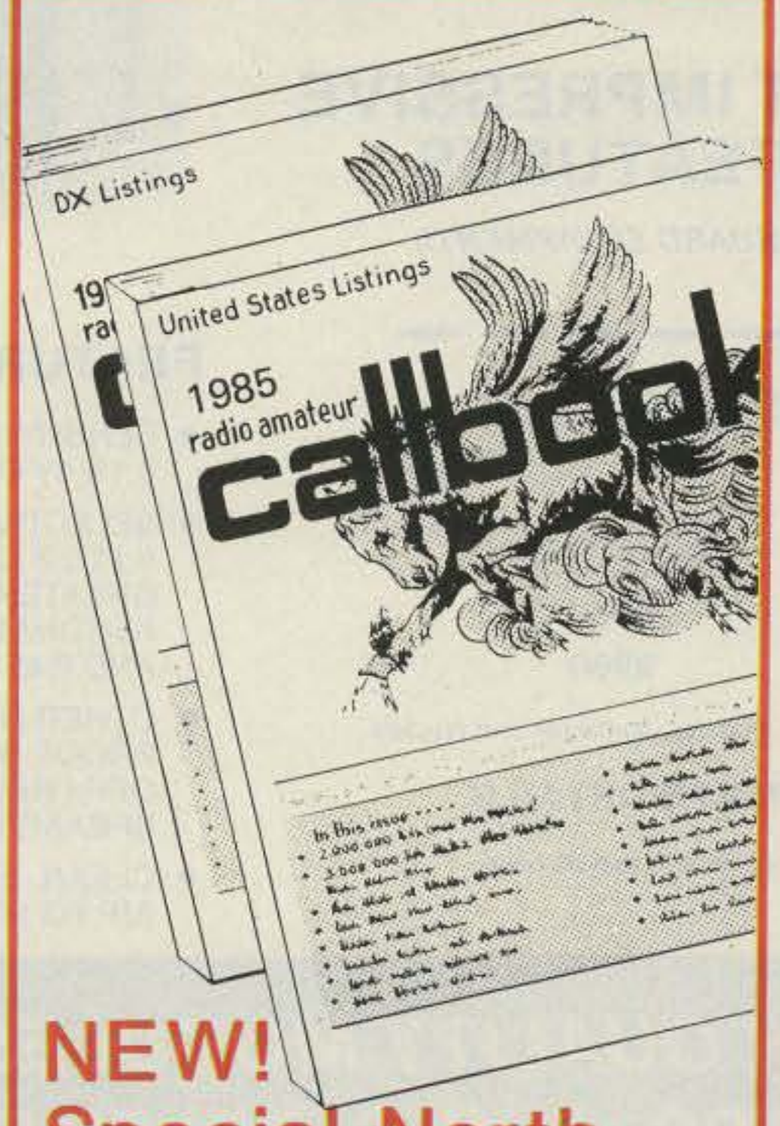
1985 CALLBOOKS



NEW! Special North American Edition

As an added bonus, the 1985 U.S. Callbook also lists the amateurs in Canada and Mexico! You get the complete and accurate U.S. listings (prepared by our own editorial staff), all the usual up-to-date Callbook charts and tables, PLUS Canada and Mexico. Now that's real value!

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	Each	Shipping	Total
□ U.S. Callbook	$21.95	$3.05	$25.00
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Order from your dealer or directly from the publisher. Foreign residents add $4.55 for shipping. Illinois residents add 6% sales tax.

Keep your 1985 Callbooks up to date.

The U.S. and Foreign Supplements contain all activity for the previous three months including new licenses. Available from the publisher in sets of three (March 1, June 1, and September 1) for only $15.00 per set including shipping. Specify U.S. or Foreign Supplements when ordering. Illinois residents add 6% sales tax. Offer void after November 1, 1985.

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Houston, Texas 77010
Call for Quotes
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CLOSEOUT CORNER-SOME GOOD DEALS IN HERE
We plan to feature things we "found" in our warehouse. If you ever saw the warehouse you would understand! This month's "FINDS" are:

AEA MT-1 Morse Trainer	25.00
AEA MT-1P as above with nicad battery	50.00
AEA KT-1 Keyer/Trainer	25.00
DRAKE P-75 Power Supply	100.00
DRAKE 550 Cade Reader	300.00
DRAKE TR7/R7 RX Cable	20.00
HAL ST-5000H TU	185.00
HAL CT-2100	699.00
HAL DS3100	1599.00

NOTE — QUANTITIES ARE VERY LIMITED
USED GEAR — YOU BET! CALL FOR UP TO THE MINUTE ITEMS AND PRICES. 90 DAY WARRANTY, SALES PRICE REFUNDED WITHIN TWO WEEKS. SIX MONTH FULL TRADE IN TOWARDS NEW GEAR.

SPECIAL!!!! SPECIAL!!!! SPECIAL!!!!
CALRAD 65-287 SWR/RELATIVE POWER METER
ONLY $29.95
DAWIA CN620B POWER/SWR METER 109.00

SOMETHING NEW FROM AEA
By the time this ad hits the stands AEA will have something new at the store:

MBA-TOR now for the VIC-20	99.95
SWLTEXT for the C-64 and VIC-20	99.95
TI-1 tuning indicator	99.95
PKT-1 Packet unit	499.95

Watch the magazines for details in the AEA ads

PACKAGE SPECIAL is the highly acclaimed CP-1 with the new MBA-TOR software, a high performance package for the more serious operator.

AEA CP-1 TU	retail	239.95
AEA MBA-TOR Software for C-64	retail	119.95
AEA TI-1 Tuning Indicator	retail	119.95
One Mic Connector 4 or 8 pin	retail	4.95
5 ft Belden Mic Cable	retail	5.00
	TOTAL	$489.80

PACKAGE SPECIAL! $389.95 YOU SAVE $$$

EQUIPMENT
As you know, Madison is an authorized dealer for all the popular equipment lines such as: DRAKE, KENWOOD, YAESU, ICOM, KDK, TENTEC, SANTEC, etc. BE SURE TO CALL US FOR A PRICE BEFORE YOU MAKE ANY EQUIPMENT PURCHASE. WE WOULD LIKE YOU TO BE OUR CUSTOMER.

KDK FM4033...NEW 220mhz	349.00
KDK FM2033	289.95
SANTEC ST142 ...++FREE GOODS++	299.95
SANTEC ST440up	250.00
KENWOOD TR2600	Give us a ring
TENTEC 2591	269.00
ICOM IC-02AT	Talk to us
TOKYO HI POWER amps	less 15%
MIRAGE amps	less 12%
VOCOMM amps	Less 10%
TOKYO HI POWER HC2000 tuner	289.95
TOKYO HI POWER HC400L tuner	129.95
TOKYO HI POWER HC200 tuner	89.95
DRAKE MN75	125.00
WM. NYE MB-V 3KW tuner & ant switch	489.00
WM NYE 46-6 phone patch for ICOM (8 wire)	82.00
BEARCAT DX-1000	499.95
SIGNAL ONE MILSPEC 1030	6295.00
ACCESSORIES AVAILABLE	CALL

BOOKS—We stock a wide selection of books on **Electronics, Communications and Computers.**

DON'S CORNER

Well, I just came back from the Shreveport La. Hamfest. (August 11 & 12). I watched for the results of the volunteer exams given during the Hamfest. Boy the pass rate was low. Probably the worst I have ever seen. The problem appears to be the lack of study materials for the testing. Remember that the BASH BOOKS are good for the FCC exams but not for the V.E. Program. For the V.E. tests used the ARRL study guide or the Ameco License guides. Good luck on the upgrade. 73 for now.

1-800-231-3057

✓ See List of Advertisers on page 88

THE MOST AFFORDABLE REPEATER

ALSO HAS THE MOST IMPRESSIVE PERFORMANCE FEATURES

(AND GIVES THEM TO YOU AS STANDARD EQUIPMENT!)

JUST LOOK AT THESE PRICES!

Band	Kit	Wired/Tested
10M,6M,2M,220	$680	$880
440	$780	$980

Both kit and wired units are complete with all parts, modules, hardware, and crystals.

CALL OR WRITE FOR COMPLETE DETAILS.

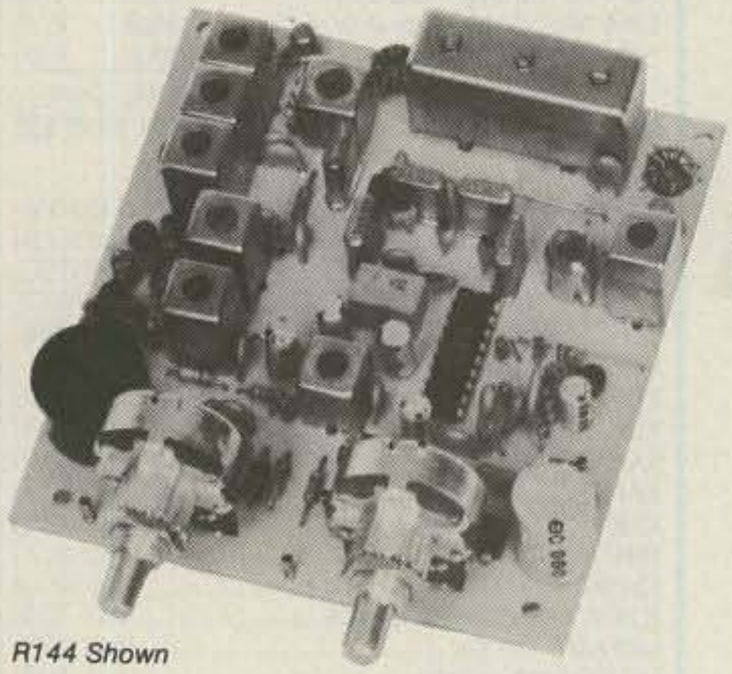
Also available for remote site linking, crossband, and remote base.

FEATURES:

- SENSITIVITY SECOND TO NONE; TYPICALLY 0.15 uV ON VHF, 0.3 uV ON UHF.
- SELECTIVITY THAT CAN'T BE BEAT! BOTH 8 POLE CRYSTAL FILTER & CERAMIC FILTER FOR GREATER THAN 100 dB AT ± 12KHZ. HELICAL RESONATOR FRONT ENDS. SEE R144, R220, AND R451 SPECS IN RECEIVER AD BELOW.
- OTHER GREAT RECEIVER FEATURES: FLUTTER-PROOF SQUELCH, AFC TO COMPENSATE FOR OFF-FREQ TRANSMITTERS, SEPARATE LOCAL SPEAKER AMPLIFIER & CONTROL.
- CLEAN, EASY TUNE TRANSMITTER; UP TO 20 WATTS OUT (UP TO 50W WITH OPTIONAL PA).

HIGH QUALITY MODULES FOR REPEATERS, LINKS, TELEMETRY, ETC.

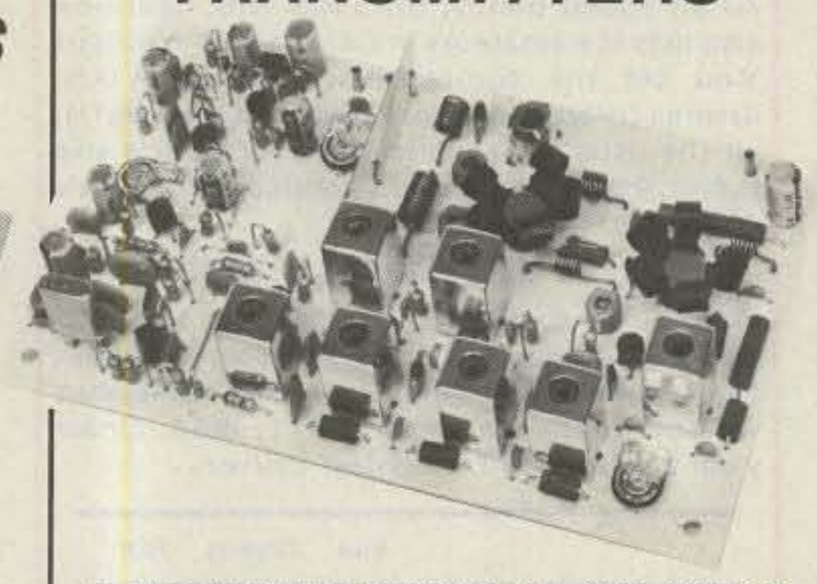
HIGH-PERFORMANCE RECEIVER MODULES



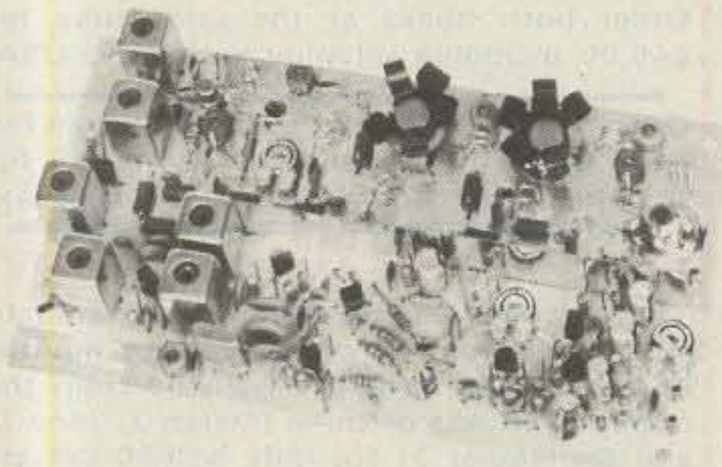
R144 Shown

- **R144/R220 FM RCVRS** for 2M or 220 MHz. 0.15uV sens.; 8 pole xtal filter & ceramic filter in i-f, helical resonator front end for exceptional selectivity, more than −100 dB at ±12 kHz, best available today. Flutter-proof squelch. AFC tracks drifting xmtrs. Xtal oven avail. Kit only $138.
- **R451 FM RCVR** Same but for uhf. Tuned line front end, 0.3 uV sens. Kit only $138.
- **R76 FM RCVR** for 10M, 6M, 2M, 220, or commercial bands. As above, but w/o AFC or hel. res. Kits only $118.
  Also avail w/4 pole filter, only $98/kit.
- **R110 VHF AM RECEIVER** kit for VHF aircraft band or ham bands. Only $98.
- **R110-259 SPACE SHUTTLE RECEIVER,** kit only $98.

TRANSMITTERS

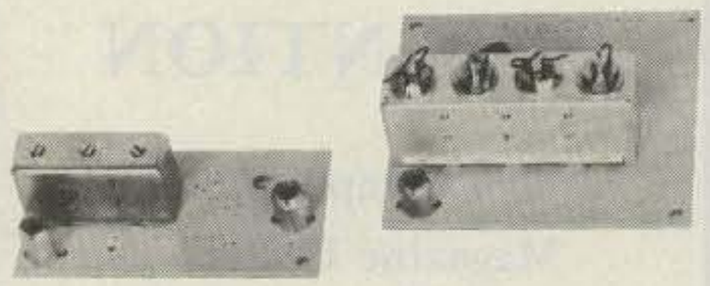


- **T51 VHF FM EXCITER** for 10M, 6M, 2M, 220 MHz or adjacent bands. 2 Watts continuous, up to 2½ W intermittent. $68/kit.



- **T451 UHF FM EXCITER** 2 to 3 Watts on 450 ham band or adjacent freq. Kit only $78.
- **VHF & UHF LINEAR AMPLIFIERS.** Use on either FM or SSB. Power levels from 10 to 45 Watts to go with exciters & xmtg converters. Several models. Kits from $78.
- **A16 RF TIGHT BOX** Deep drawn alum. case with tight cover and no seams. 7 x 8 x 2 inches. Designed especially for repeaters. $20.

ACCESSORIES



- **HELICAL RESONATOR FILTERS** available separately on pcb w/connectors.

  HRF-144 for 143-150 MHz $38
  HRF-220 for 213-233 MHz $38
  HRF-432 for 420-450 MHz $48

- **COR-2 KIT** With audio mixer, local speaker amplifier, tail & time-out timers. Only $38.
- **COR-3 KIT** as above, but with "courtesy beep". Only $58.
- **CWID KITS** 158 bits, field programmable, clean audio, rugged TTL logic. Kit only $68.
- **DTMF DECODER/CONTROLLER KITS.** Control 2 separate on/off functions with touchtones®, e.g., repeater and autopatch. Use with main or aux. receiver or with Autopatch. Only $90
- **AUTOPATCH KITS.** Provide repeater autopatch, reverse patch, phone line remote control of repeater, secondary control via repeater receiver. Many other features. Only $90. Requires DTMF Module.

- **NEW – SIMPLEX AUTOPATCH**
  Use with any transceiver. System includes DTMF & Autopatch modules above and new Timing module to provide simplex autopatch and reverse autopatch. Complete patch system only $200/kit. Call or write for details.

hamtronics® 33

NEW LOW-NOISE PREAMPS

Hamtronics Breaks the Price Barrier!

*

No Need to Pay $80 to $125 for a GaAs FET Preamp.

FEATURES:

- Very Low Noise: 0.7 dB VHF, 0.8 dB UHF
- High Gain: 18 to 28 dB, Depending on Freq.
- Wide Dynamic Range for Overload Resistance
- Latest Dual-gate GaAs FET, Stable Over Wide Range of Conditions
- Rugged, Diode-protected Transistors
- Easy to Tune
- Operates on Standard 12 to 14 Vdc Supply
- Can be Tower Mounted

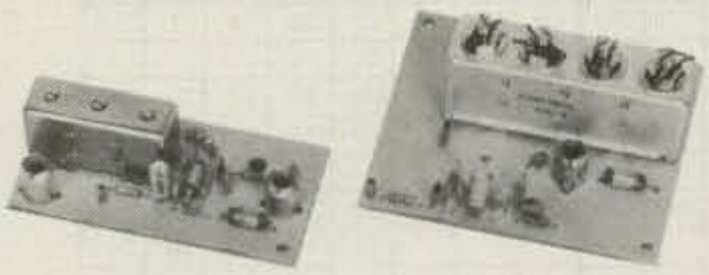
MODEL	TUNES RANGE	PRICE
LNG-28	26-30 MHz	$49
LNG-50	46-56 MHz	$49
LNG-144	137-150 MHz	$49
LNG-220	210-230 MHz	$49
LNG-432	400-470 MHz	$49
LNG-40	30-46 MHz	$64
LNG-160	150-172 MHz	$64

ECONOMY PREAMPS

Our traditional preamps, proven in years of service. Over 20,000 in use throughout the world. Tuneable over narrow range. Specify exact freq. band needed. Gain 16-20 dB. NF = 2 dB or less. VHF units available 27 to 300 MHz. UHF units available 300 to 650 MHz.

- P30K, VHF Kit less case $18
- P30W, VHF Wired/Tested $33
- P432K, UHF Kit less case $21
- P432W, UHF Wired/Tested $36

HELICAL RESONATOR PREAMPS



Our lab has developed a new line of low-noise receiver preamps with helical resonator filters built in. The combination of a low noise amplifier and the sharp selectivity of a 3 or 4 section helical resonator provides increased sensitivity while reducing intermod and cross-band interference in critical applications. See selectivity curves at right. Gain = approx.12 dB.

Model	Tuning Range	Price
HRA-144	143-150 MHz	$49
HRA-220	213-233 MHz	$49
HRA-432	420-450 MHz	$59
HRA-( )	150-174MHz	$69
HRA-( )	450-470 MHz	$79

RECEIVING CONVERTERS

Models to cover every practical rf & if range to listen to SSB, FM, ATV, etc. NF = 2 dB or less.

	Antenna Input Range	Receiver Output
VHF MODELS	28-32	144-148
	50-52	28-30
Kit with Case $49	50-54	144-148
Less Case $39	144-146	28-30
Wired $69	145-147	28-30
	144-144.4	27-27.4
	146-148	28-30
	144-148	50-54
	220-222	28-30
	220-224	144-148
	222-226	144-148
	220-224	50-54
	222-224	28-30
UHF MODELS	432-434	28-30
	435-437	28-30
Kit with Case $59	432-436	144-148
Less Case $49	432-436	50-54
Wired $75	439.25	61.25

SCANNER CONVERTERS Copy 72-76, 135-144, 240-270, 400-420, or 806-894 MHz bands on any scanner. Wired/tested Only $88.

SAVE A BUNDLE ON VHF FM TRANSCEIVERS!

FM-5 PC Board Kit – **ONLY $178**
complete with controls, heatsink, etc.
10 Watts, 5 Channels, for 2M or 220 MHz.

Cabinet Kit, complete with speaker, knobs, connectors, hardware. Only $60.

REPEAT OF A SELLOUT!

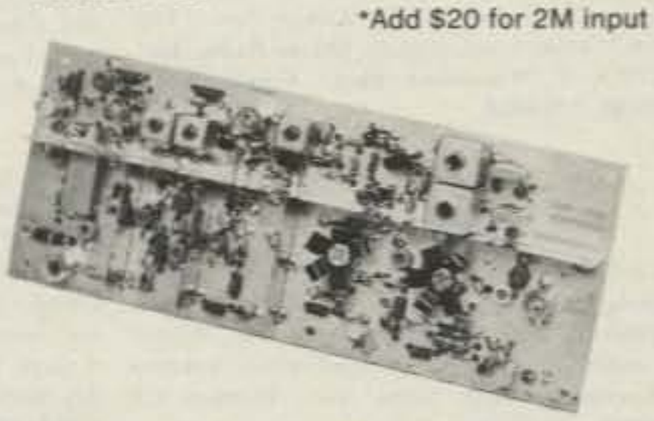
While supply lasts, get $60 cabinet kit free when you buy an FM-5 Transceiver kit.
Where else can you get a complete transceiver for only $178

TRANSMIT CONVERTERS

For SSB, CW, ATV, FM, etc. Why pay big bucks for a multi mode rig for each band? Can be linked with receive converters for transceive. 2 Watts output vhf, 1 Watt uhf.

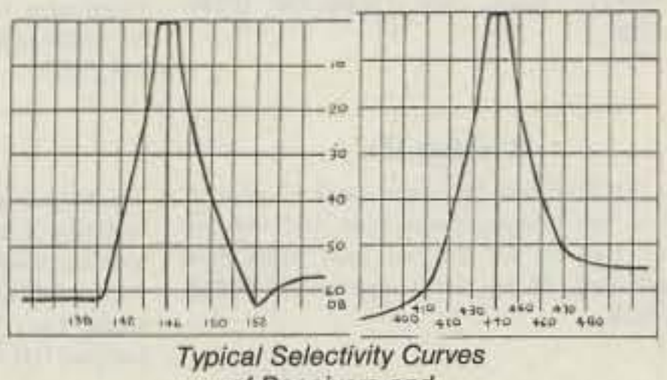
	Exciter Input Range	Antenna Output
For VHF,	28-30	144-146
Model XV2	28-29	145-146
Kit $79	28-30	50-52
Wired $149	27-27.4	144-144.4
(Specify band)	28-30	220-222*
	50-54	220-224
	144-146	50-52
	50-54	144-148
	144-146	28-30
For UHF,	28-30	432-434
Model XV4	28-30	435-437
Kit $99	50-54	432-436
Wired $169	61.25	439.25
	144-148	432-436*

*Add $20 for 2M input



VHF & UHF LINEAR AMPLIFIERS. Use with above. Power levels from 10 to 45 Watts. Several models, kits from $78.

LOOK AT THESE ATTRACTIVE CURVES!



Typical Selectivity Curves of Receivers and Helical Resonators.

IMPORTANT REASONS WHY YOU SHOULD BUY FROM THE VALUE LEADER:

1. *Largest selection of vhf and uhf kits in the world.*
2. *Exceptional quality and low prices due to large volume.*
3. *Fast delivery; most kits shipped same day.*
4. *Complete, professional instruction manuals.*
5. *Prompt factory service available and free phone consultation.*
6. *In business 21 years.*
7. *Sell more repeater modules than all other mfrs. and have for years. Can give quality features for much lower cost.*

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- **(Send $1.00 or 4 IRC'c for overseas mailing)**
- **Order by phone or mail ● Add $3 S & H per order**
  (Electronic answering service evenings & weekends)
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Jun's Electronics, 3919 Sepulveda Blvd., Culver City CA 90230, 390-8003. Trades 463-1886 San Diego, 827-5732 (Reno NV).

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Bay area's newest amateur radio store. New & used amateur radio sales & service. We feature Kenwood, ICOM, Azden, Yaesu, Ten-Tec, Santec & many more. **Shaver Radio, Inc., 1775A S. Winchester Blvd., Campbell CA 95008, 370-6665.**

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The reliable ham store serving NE. Full line of ICOM & Kenwood. Yaesu HTs, Drake, Daiwa, B&W accessories. Curtis & Trac keyers. Larsen, Hustler, Telex/Hy-Gain products. Mirage amps., Astron P.S., Alpha Delta protectors, ARRL & Kantronics instruction aids. Whistler radar detectors. Full line of coax fittings. **TEL—COM Electronic Communications, 675 Great Rd. (Rt. 119), Littleton MA 01460, 486-3400/3040.**

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Complete photovoltaic systems. Amateur radio, repeater, satellite, and computer applications! Call Paul WD8AHO. **Encon Photovoltaics, 27600 Schoolcraft Road, Livonia MI 48150, 523-1850.**

Lincoln NE

G&C Communications is a full-line distributor of major-line amateur equipment and accessories, antennas, and everything. **4230 Progressive Ave., Lincoln NE 68504, 46-RADIO.**

Derry NH

Serving the ham community with new and used equipment. We stock and service most major lines: AEA, Astron, Azden, B&W, Cushcraft, Hy-Gain, Hustler, ICOM, Kenwood, KLM, Larsen, Mirage, Mosley; books, rotors, cable and connectors. Business hours 9–7 Monday through Thursday, and 9–5 Friday and Saturday. **Rivendell, 68 Warner Hill Road, Derry NH 03038; 434-5371.**

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Kenwood, ICOM, Ten-Tec, Belden, Cushcraft, Larsen, Hustler, ARRL, Hy-Gain, B&W, MFJ, Mirage. New and used equipment. Serving the amateur community since 1942. **Adirondack Electronics, Inc., 1991 Central Avenue, Albany NY 12205, 456-0203** (one mile west of Northway exit 2W).

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Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the December '84 issue must be in our hands by October 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

PROPAGATION

Jim Gray W1XU
73 Staff

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	20						20					15
ARGENTINA	20	40A	20	40					10		20A	20A
AUSTRALIA	20	40A		40	40	20	20	20		20	15	15
CANAL ZONE	40A	40A	40	40	40		20	20A	10	15A	20A	20
ENGLAND	40	40	40	40				15	20A	20		
HAWAII	20	20				20	20			15	15	15
INDIA						20	20	20				
JAPAN	20					40	20				15	15
MEXICO	40A	40A	40	40	40		20	20A	10	15A	20A	20
PHILIPPINES							20					
PUERTO RICO	40A	40A	40	40	40	20	20A	15A	15A	20A	20	40A
SOUTH AFRICA	40	40A	20					15A	15A	20A	20A	20A
U.S.S.R.	20	20					20	15			20	20
WEST COAST	21A	20	40	40	40	40	40	20	15	15A	15A	15A

CENTRAL UNITED STATES TO:

ALASKA	20				40	40	20	20			15	15
ARGENTINA	20	40	40	40						15A	20A	20A
AUSTRALIA					40	40	20	20	20		15	15
CANAL ZONE	40	40	40	40	40	20	20	15	15A	15A	15A	15
ENGLAND	40	40	40	40				15	15	20A	20	20
HAWAII	20	20	20	40	40		20	20		10	10	15
INDIA	20	20					20	20				
JAPAN	20					40	20	20				15
MEXICO	40	40	40	40	40	20	20	20	20	15A	15A	15
PHILIPPINES	20A	20					20	20			15	15
PUERTO RICO	40	40	40	40	40	20	20	20	20	15A	15A	15
SOUTH AFRICA							10	15A	15	20A	20A	20
U.S.S.R.							20	20A	15	20	20	

WESTERN UNITED STATES TO:

ALASKA	20A	20A	20			40	40	40A	20	20	20	20A
ARGENTINA	20A	20	40A	40						15A	15A	15A
AUSTRALIA	20A	20A	20	20	40	40	40		20	20	15	15
CANAL ZONE	20	20	40A	40A	40			20	20A	15A	15A	15A
ENGLAND			40					20	15	20A	20	20
HAWAII	15	20A	20A	40A	40	40	40	20	20	20		15A
INDIA	20A	20A						20	20			
JAPAN	20A	20A	20			40	40	40A	20	20	20	20A
MEXICO	20	20	40A	40A	40			20	20A	15A	15A	15A
PHILIPPINES	15			20		40	40		20	20		
PUERTO RICO	20	20	40A	40A	40			20	20A	15A	15A	15A
SOUTH AFRICA	20							20	20	15	20	20
U.S.S.R.			40	40				20A	15A	10	20	20
EAST COAST	15A	20	40	40	40	40	40	20	15	15A	15A	15A

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

G = Good, F = Fair, P = Poor.

NOVEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
				1 G	2 G	3 G
4 G	5 F	6 F	7 G	8 G/F	9 F/P	10 P
11 F	12 F	13 G	14 G	15 G	16 G	17 G
18 F	19 F	20 F	21 F	22 G	23 G/F	24 F
25 F	26 P	27 P	28 P/F	29 G	30 G	

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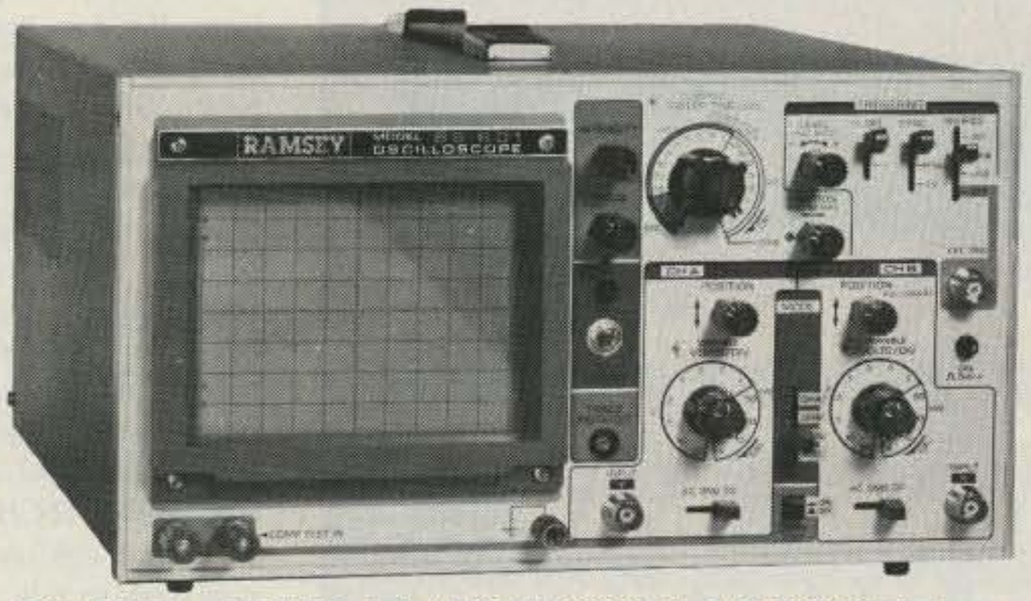
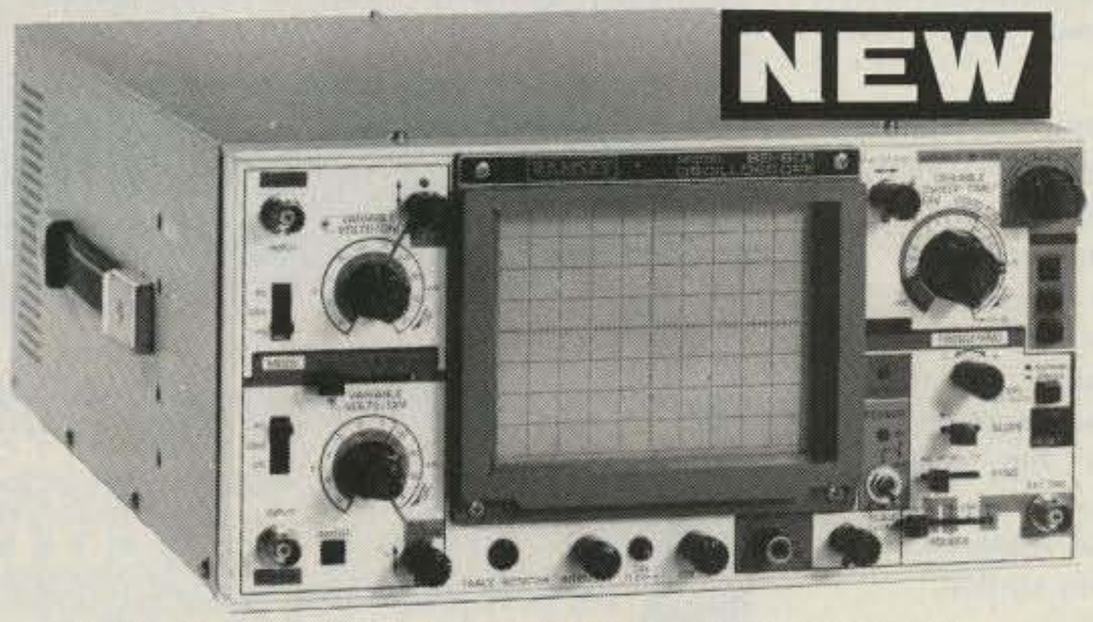


20 MHz DUAL TRACE OSCILLOSCOPE

Unsurpassed quality at an unbeatable price, the Ramsey oscilloscope compares to others costing hundreds more. Features include a component testing circuit for resistor, capacitor, digital circuit and diode testing. • TV video sync filter • wide bandwidth & high sensitivity • internal graticule • front panel trace rotator • Z axis • high sensitivity x-y mode • regulated power supply • built-in calibrator • rock solid triggering

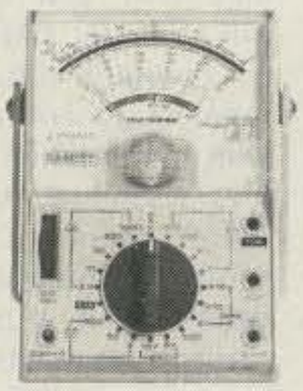
$399.95 high quality hook on probes included



45 MHz DUAL SWEEP OSCILLOSCOPE

The Ramsey 625 is a dual time base, delayed sweep unit that includes a built-in signal delay line to permit clear viewing during very short rise times of high frequency waveforms. Other features include; variable trigger holdoff • 20 calibrated sweep time ranges from 0.5 s/div to 0.2 μS/div • fully adjustable sweep time • X5 sweep magnification • five trigger sources; CH1, CH2, LINE EXTernal and INTernal (V mode) • front panel x-y operation, Z axis input • sum difference of CH1, and CH2 waveforms displayed as single trace • sweep gate and sweep output • auto focus • single sweep

$799.95 high quality hook on probes included



RAMSEY D-1100 VOM MULTITESTER

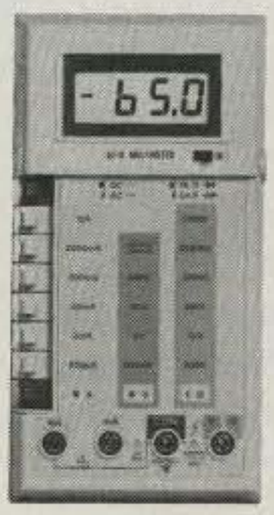
Compact and reliable, designed to service a wide variety of equipment. Features include • mirror back scale • double-jeweled precision moving coil • double overload protection • an ideal low cost unit for the beginner or as a spare back-up unit.

$19.95 test leads and battery included

NEW RAMSEY 1200 VOM MULTITESTER

Check transistors, diodes and LEDs with this professional quality meter. Other features include; decibel scale • 20K volt metering system • 3½" mirrored scale • polarity switch • 20 measuring ranges • safety probes • high impact plastic case

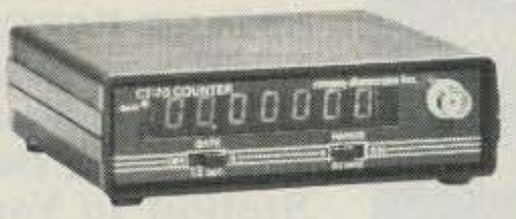
$24.95 test leads and battery included



RAMSEY D-3100 DIGITAL MULTIMETER

Reliable, accurate digital measurements at an amazingly low cost • in-line color coded push buttons, speeds range selection • abs plastic tilt stand • recessed input jacks • overload protection on all ranges • 3½ digit LCD display with auto zero, auto polarity & low BAT. indicator

$49.95 test leads and battery included



CT-70 7 DIGIT 525 MHz COUNTER

Lab quality at a breakthrough price. Features • 3 frequency ranges each with pre amp • dual selectable gate times • gate activity indicator • 50mV @ 150 MHz typical sensitivity • wide frequency range • 1 ppm accuracy

$119.95 wired includes AC adapter

CT-70 kit $99.95
BP-4 nicad pack 8.95

CT-90 9 DIGIT 600 MHz COUNTER

The most versatile for less than $300. Features 3 selectable gate times • 9 digits • gate indicator • display hold • 25mV @ 150 MHz typical sensitivity • 10 MHz timebase for WWV calibration • 1 ppm accuracy

$149.95 wired includes AC adapter

CT-90 kit $129.95
OV-1 0.1 PPM oven timebase 59.95
BP-4 nicad pack 8.95

CT-125 9 DIGIT 1.2 GHz COUNTER

A 9 digit counter that will outperform units costing hundreds more. • gate indicator • 24mV @ 150 MHz typical sensitivity • 9 digit display • 1 ppm accuracy • display hold • dual inputs with preamps

$169.95 wired includes AC adapter

BP-4 nicad pack 8.95

CT-50 8 DIGIT 600 MHz COUNTER

A versatile lab bench counter with optional receive frequency adapter, which turns the CT-50 into a digital readout for most any receiver • 25 mV @ 150 MHz typical sensitivity • 8 digit display • 1 ppm accuracy

$169.95 wired

CT-50 kit $139.95
RA-1 receiver adapter kit 14.95

DM-700 DIGITAL MULTIMETER

Professional quality at a hobbyist price. Features include 26 different ranges and 5 functions • 3½ digit, ½ inch LED display • automatic decimal placement • automatic polarity

$119.95 wired includes AC adapter

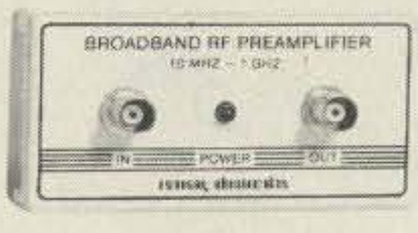
DM-700 kit $99.95
MP-1 probe set 4.95

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

$49.95 wired

PS-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 shifting RF • ideal receiver/TV preamp

$44.95 wired includes AC adapter

PR-2 kit $34.95

PS-1B 600 MHz PRESCALER

Extends the range of your present counter to 600 MHz • 2 stage preamp • divide by 10 circuitry • sensitivity: 25mV @ 150 MHz • BNC connectors • drives any counter

$59.95 wired includes AC adapter

PS-1B kit $49.95

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

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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 • overseas add 15% for surface mail • COD add $2.50 (COD 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

RAMSEY ELECTRONICS, INC.
2575 Baird Rd.
Penfield, N.Y. 14626 268

See List of Advertisers on page 88

With SMART PATCH You are in CONTROL

With CES 510SA Simplex Autopatch, there's no waiting for VOX circuits to drop. Simply key your transmitter to take control.

SMART PATCH is all you need to turn your base station into a personal autopatch. SMART PATCH uses the only operating system that gives the mobile complete control. Full break-in capability allows the mobile user to actually interrupt the telephone party. SMART PATCH does not interfere with the normal use of your base station. SMART PATCH works well with any FM transceiver and provides switch selectable tone or rotary dialing, toll restrict, programmable control codes, CW ID and much more.

To Take CONTROL with Smart Patch – Call 800-327-9956 Ext. 101 today.

What To Look For In A Phone Patch

The best way to decide what patch is right for you is to first decide what a patch should do. A patch should:

- Give complete control to the mobile, allowing full break in operation.
- Not interfere with the normal operation of your base station. It should not require you to connect and disconnect cables (or flip switches!) every time you wish to use your radio as a normal base station.
- Not depend on volume or squelch settings of your radio. It should work the same regardless of what you do with these controls.
- You should be able to hear your base station speaker with the patch installed. Remember, you have a base station because there are mobiles. ONE OF THEM MIGHT NEED HELP.
- The patch should have standard features at no extra cost. These should include programmable toll restrict (dip switches), tone or rotary dialing, programmable patch and activity timers, and front panel indicators of channel and patch status.

ONLY SMART PATCH HAS ALL OF THE ABOVE.

Now Mobile Operators Can Enjoy An Affordable Personal Phone Patch. . .

- Without an expensive repeater.
- Using any FM tranceiver as a base station.
- The secret is a SIMPLEX autopatch, The *SMART PATCH.*

SMART PATCH Is Easy To Install

To install *SMART PATCH*, connect the multicolored computer style ribbon cable to mic audio, receiver discriminator, PTT, and power. A modular phone cord is provided for connection to your phone system. Sound simple? . . . IT IS!

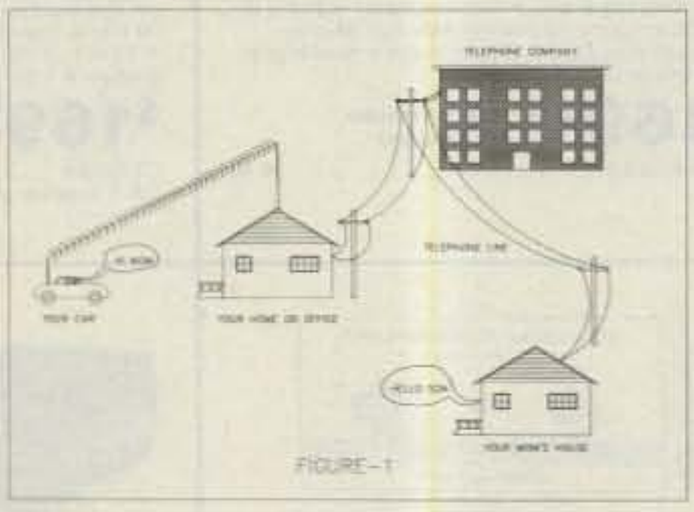


FIGURE-1

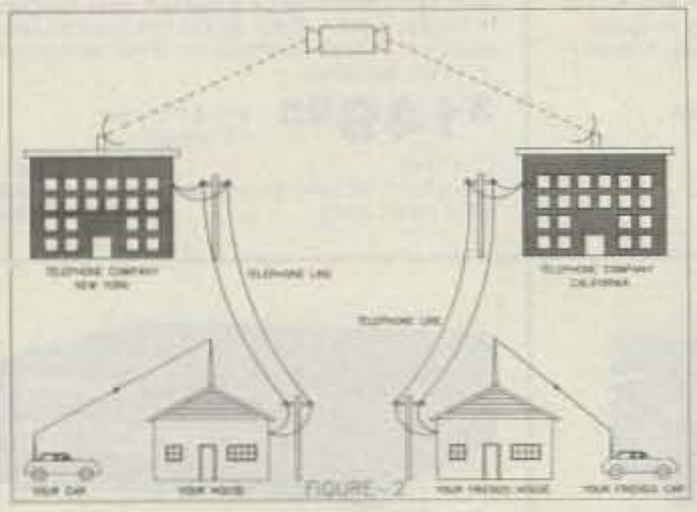


FIGURE-2

How To Use *SMART PATCH*

Placing a call is simple Send your access code from your mobile (example: *73). This brings up the Patch and you will hear dial tone transmitted from your base station Since *SMART PATCH* is checking about once per second to see if you want to dial, all you have to do is key your transmitter then dial the phone number. You will now hear the phone ring and someone answer. Since the enhanced control system of *SMART PATCH* is constantly checking to see if you wish to talk, you need to simply key your transmitter and then talk That's right, you simply key your transmitter to interrupt the phone line The base station automatically stops transmitting after you key your mic. *SMART PATCH* does not require any special tone equipment to control your base station. It samples very high frequency noise present at your receivers discriminator to determine if a mobile is present. No words or syllables are ever lost.

SMART PATCH Is All You Need To Automatically Patch Your Base Station To Your Phone Line.

Use *SMART PATCH* for:

- Mobile (or remote base) to phone line via Simplex base. (see fig 1.)
- Mobile to Mobile via interconnected base stations for extended range (see fig. 2.)
- Telephone line to mobile (or remote base).
- *SMART PATCH* uses SIMPLEX BASE STATION EQUIPMENT. Use your ordinary base station. *SMART PATCH* does this without interfering with the normal use of your radio.

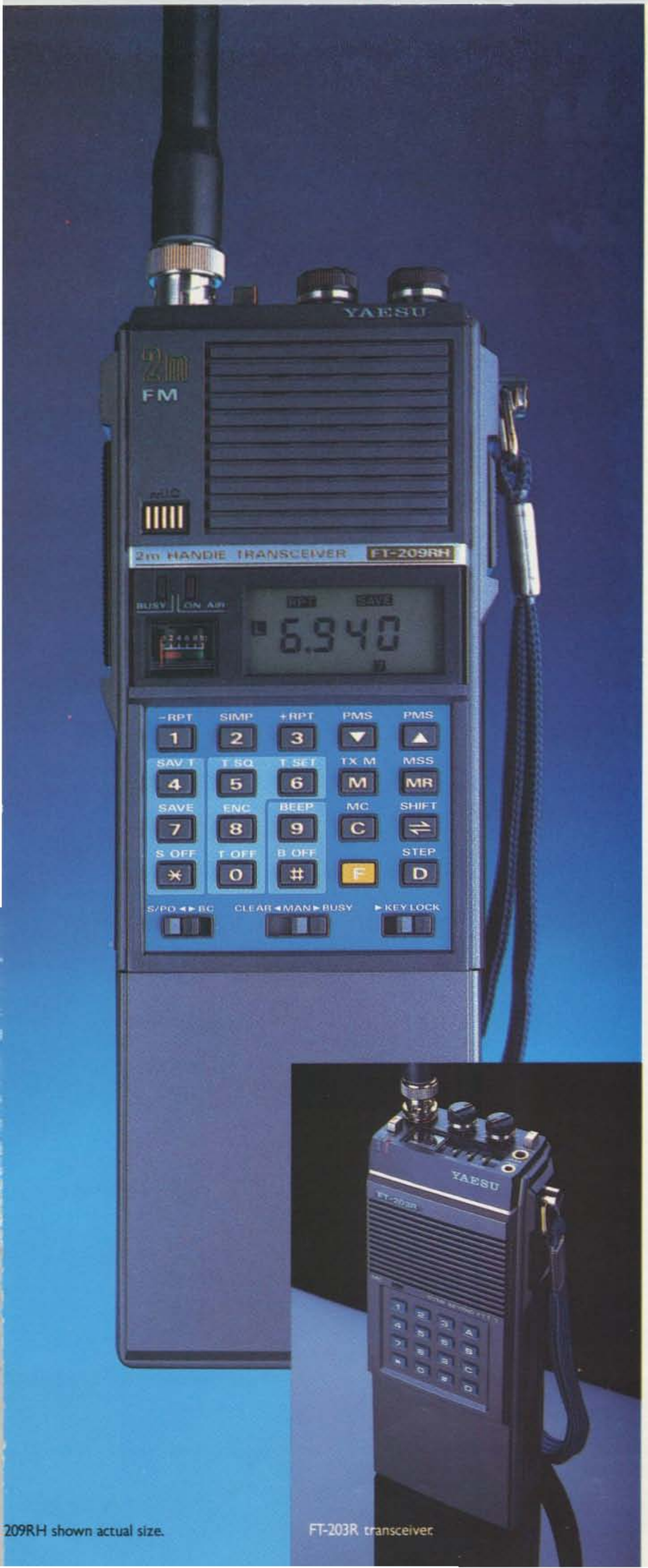
WARRANTY?

YES, 180 days of warranty protection. You simply can't go wrong.

An FCC type accepted coupler is available for *SMART PATCH.*

CES® ✓462

Communications Electronics Specialties, Inc.
P.O. Box 2930, Winter Park, Florida 32790
Telephone: (305) 645-0474 **Or call toll-free (800)327-9956**



209RH shown actual size.

FT-203R transceiver.

The Yaesu FT-209RH. 5 watts that your batteries can live with.

Have the power you need when you need it with Yaesu's new 5-watt, 2-meter handheld. Power to get out in situations where ordinary HTs just won't make it.

We designed our HT with a unique user-programmable Power Saver that puts the rig to "sleep" while you're monitoring and "wakes it up" when the squelch breaks. So you can listen for hours and still have plenty of power to hit those hard-to-reach repeaters when you need to.

With the FT-209RH there's no need to fiddle with knobs when you change from one memory channel to another. That's because you can independently store everything you need in each of the ten memories: receive frequency, standard or non-standard offset, even tone encode/decode with an optional module. And then recall any channel at the touch of a button.

It's easy to hear what's happening on your favorite repeaters or simplex frequencies. Just touch a button and scan all memory channels, or selected ones. Or all frequencies between any two adjacent memories. Use the priority feature to return automatically to your special frequency when it becomes active.

Bring up controlled-access machines with the optional plug-in subaudible tone encoder/decoder, independently programmed from the keyboard for each channel. Listen for tone-encoded signals on selected channels—without having to hear a bunch of chatter—by enabling the decode function.

The FT-209RH, which covers 10 MHz for CAP and MARS use, comes complete with a 500-mAh battery, charger and soft case.

For those who want a basic radio without the bells and whistles, consider the compact, lightweight FT-203R. This economical HT features 2.5 watts of power and an optional DTMF keypad. Most all the accessories for the 209 work with the 203, including an optional VOX headset that gives you hands-free operation that's perfect for public service events.

So when you visit your dealer, let him know you won't settle for anything but the best. A radio built by Yaesu.

YAESU

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(213) 633-4007.

Yaesu Cincinnati Service Center
9070 Gold Park Drive, Hamilton, OH 45011
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Prices and specifications subject to change without notice.

KENWOOD

...pacesetter in amateur radio

TS-930S "DX-traordinary"

TS-930S

We call it "DX-traordinary" because the TS-930S has now become the favorite rig of the serious contester! Its superior capability for full break-in split-frequency operation, the speed and convenience with which its eight memory channels can be accessed, its unsurpassed receiver dynamic range and its remarkable ability to select the desired signal during periods of heavy QRM, utilizing VBT, Slope tuning, IF Notch filtering, and tuneable audio filtering, have all combined to make this the rig that gives you the EXTRA EDGE!

The TS-930S is loaded with all the special features that you always wanted in an HF transceiver. Full coverage of the 160 through 10 meter bands, including the new WARC frequencies, (easily modified for HF MARS), plus a general coverage receiver that can tune any frequency from 150 kHz to 30 MHz. Operation in the SSB, CW, FSK, and AM modes, with selectable full or semi CW break-in. All solid-state, with 250 watts PEP input on SSB, CW, FSK, and 80 watts input on AM. SWR/power meter. Triple final protection circuits plus two cooling fans built-in. 10-Hz step synthesized frequency control. Available with optional automatic antenna tuner built-in, another industry first! Dual digital VFO's. Eight memory channels that store both frequency and band information, with internal battery back-up, (batteries not supplied). Dual mode adjustable noise blankers, especially effective in eliminating "woodpecker" type interference. SSB IF slope tuning, for maximum rejection of interference. CW variable bandwidth, with pitch and sidetone control. IF notch filter. Tuneable audio peaking filter. Unique six digit white fluorescent tube digital display is easy-on-the-eyes during those long contests. RF speech processor, for higher average "talk-power." SSB monitor circuit. 4-step RF attenuator. VOX. 100-kHz marker. AC power supply built-in, 120, 220, or 240 VAC.

TS-930S Optional Accessories: AT-930 automatic antenna tuner, SP-930 external speaker, with selectable audio filters, YG-455C-1 (500 Hz), YG-455CN-1 (250 Hz), YK-88C-1 (500 Hz) CW filter, YK-88A-1 (6 kHz) AM filter, all plug-in type. SO-1 commercial stability TCXO, MC-60A deluxe desk microphone, MC-80 and MC-85 communications microphones, MC-42S mobile hand microphone, TL-922A linear amplifier (not for CW QSK), SM-220 station monitor, PC-1A phone patch, SW-2000 SWR/power meter, 160 ~ 6 meter, SW100A SWR/power/volt meter 160-2m HS-4, HS-5, HS-6, and HS-7 headphones.

Isn't it about time you stepped into the winner's circle?

More information on the TS-930S is available from authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, California 90220.

Specifications and prices are subject to change without notice or obligation.