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73

Amateur Radio's Technical Journal

A Wayne Green Publication

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One-Tube Receiver—64

IC-R70

NEW!

The Commercial Grade Communications Receiver that everyone has been asking for........at a price you can afford!

GENERAL COVERAGE RECEPTION AT ITS BEST

Listen to the world of HF with the R70, a 100KHz to 30MHz commercial grade receiver designed by ICOM Incorporated, the leader in advanced receiver design. Built from knowledge gained by designing receivers for commercial, marine, and amateur use, the R70 surpasses other receivers on the market...even receivers costing more than twice as much.

Utilizing ICOM's DFM (Direct Feed Mixer), the R70 is a receiver which in normal usage is virtually immune to intermodulation distortion or cross modulation, yet still maintains superior sensitivity. Whether you are a SWL (short wave listener), Ham (amateur radio operator), maritime operator or commercial user, the R70 provides the features you need.

DESIGN

The R70 incorporates an UP conversion system, utilizing a direct feed mixer proven to be the best design for minimizing interference from strong adjacent signals. A preamp is provided for making the weakest of signals readable. High grade filters in conjunction with the built-in PBT (pass band tuning) system and notch filter, provide the ultimate in interference rejection. Selectable AGC (fast/slow/off), noise blanker (wide or narrow), and tone control improve readability under the worst conditions. An AGC derived squelch, operative in all modes, adds to operating ease.

Dual VFO's with three tuning rates provide quick QSY (frequency change), memory for an important station, or by equalizing the VFO's (A=B), a digital RIT. 13.8 VDC operation is provided as an option, 117 VAC is standard.

HAM'ING

The R70 is an ideal general coverage receiver to complement any ham shack. Use it with your existing tramsmitter or transceiver to provide dual receiver capability.

The R70's built-in monitor system lets you listen to your own transmitted audio and a mute input automatically protects the R70's receiver from your signal.

An option for FM allows listening to the 10 meter FM activity.

As an additional plus to ICOM IC-720A owners, the R70 has an optional interface that will allow the R70 to control the transmit frequency of the 720A for the ultimate in hamming versatility.

SWL'ING

For the short wave listener, the readout section of the R70 gives all the information for logging a station to be returned to at a later time. Frequency, mode, VFO, signal strength are all displayed. A dial lock prevents accidental loss of a signal.

A front mounted speaker provides 3 watts of crisp clear audio. A record jack allows easy attachment of a tape recorder.

ICOM SYSTEM

Like all ICOM HF products, the R70 fits into the ICOM system concept of accessories allowing you to use previously purchased accessories such as the HP1 headphone, SP3 external speaker, and AH1 auto bandswitching antenna.

PRICE

Check with your local ICOM dealer for pricing on the R70. You will be amazed.

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Front panel switching allows independent MODE and optional crystal filter selection.

A passive double balanced mixer is employed in the receiver front end. This stage is preceeded by a low noise high dynamic range bipolar rf amplifier to provide good, strong signal performance and weak signal sensitivity.

Accurate digital readout of operating carrier frequency is displayed to 100 Hz.

A rugged, solid-state PA provides continuous duty in SSB and CW modes. A cooling fan (FA7) is available for more demanding duty cycles, such as SSTV or RTTY. The PA also features very low harmonic and spurious output.

VOX GAIN, VOX DELAY, VOX disable, QSK, selectable AGC time constants, RIT and noise blanker selection are front panel controlled for ease of operation.

The TR5 is designed with modular construction techniques for easy accessibility and service.

GENERAL

Frequency Coverage: 1.8-2.0*, 3.5-4.0, 7.0-7.5, 10.0-10.5, 14.0-14.5, 18.0-18.5*, 21.0-21.5, 24.5-25.0*, 28.0-28.5*, 28.5-29.0, 29.0-29.7* MHz. (*With accessory range crystal).

Modes of Operation: Usb, Lsb, Cw.

Frequency Stability: Less than 1 kHz drift first hour. Less than 150 Hz per hour drift after first hour. Less than 100 Hz change for a ± 10% line voltage change.

Readout Accuracy: ± 10 ppm ± 100 Hz.

Power Requirements: 13.6 V-dc regulated, 2 A. 12 to 16 V-dc unregulated, 0.8 V rms maximum ripple, 15 A.

Dimensions:
Depth: 12.5 in (31.75 cm), excluding knobs and connectors.
Width: 13.6 in. (34.6 cm).
Height: 4.6 in. (11.7 cm) excluding feet.

Weight: 14 lb. (6.35 kg)

TRANSMITTER

Power Input (Nominal): 150 Watts, PEP or Cw.

Load Impedance: 50 ohms.

Spurious and Harmonic Output: Greater than 40 dB down.

Intermodulation Distortion: Greater than 30 dB below PEP.

Carrier Suppression: Greater than 50 dB.

Undesired Sideband Suppression: Greater than 60 dB at 1 kHz.

Duty Cycle:
Ssb, Cw: 100%.
Lock Key (w/o FA7 Fan): 30%, 5 minutes maximum transmit.
Lock Key (w/FA7 Fan): 100%.

Microphone Input: High Impedance.

Cw Keying: Instantaneous full break-in, adjustable delay.

RECEIVER

Sensitivity: Less than 0.5 uV for 10 dB S+N/N except less than 1.0 uV, 1.8-2.0 MHz.

Selectivity: 2.3 kHz minimum at −6 dB. 4.1 kHz maximum at −60 dB (1.8:1 shape factor).

Ultimate Selectivity: Greater than −95 dB.

Agc: Less than 5 dB output variation for 100 dB input signal change, referenced to agc threshold.

Intermodulation: (20 kHz or greater spacing) *Intercept Point:* Greater than 0 dBm. *Two-Tone Dynamic Range:* Greater than 85 dB.

I-f Frequency: 5.645 MHz.

I-f Rejection: 50 dB, minimum.

Image Rejection: 60 dB, minimum below 14 MHz. 50 dB, minimum above 14 MHz.

Audio Output: 2 watts, minimum @ less than 10% THD (4 ohm load).

Spurious Response: Greater than 60 dB down.

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Model 7022 SL500 CW Filter
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Model 7026 SL4000 AM Filter
Model 7024 SL6000 AM Filter
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Model 1507 CW75 Keyer
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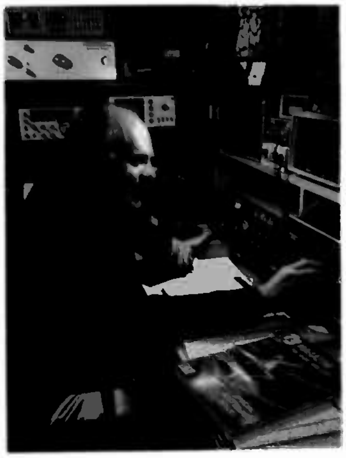
W2NSD/1 NEVER SAY DIE

editorial by Wayne Green



SHOULD DXCC BE PROHIBITED?

The blatant arrogance of the PY0SB DXpedition shook the amateur bands, bringing on wild attacks of jamming in retaliation. Frankly, after trying to use the twenty-meter band for an hour, I didn't blame the jammers much. Not since Don Miller have I heard such a total disregard for the hobby.

This was, in my estimation, amateur radio at its worst. Those refugees from CB set up on one of the most rare spots in the world and then, transmitting outside of the American phone band, asked US hams to call them anywhere from 14,200 to 14,300. This went on, totally killing the band for any other use as thousands of stations called steadily, hour after hour. There was no possible way to make a normal contact anywhere in that entire band while this was going on.

This is totally unnecessary, as anyone with even a small amount of DXing experience knows. It is arrogant. It is a shameless flaunting of the power of one group to bring the whole band to a halt. It isn't even a fast way of making contacts. There is not even a remote excuse for such a display.

I've operated from some fairly remote spots and have faced as big pileups as anyone. I got started in seriously working DX in late 1945, the day our first DX band opened after the war. When I moved to New Hampshire, I started all over again, working 100 countries in the first week on twenty phone, 200 in the first month, and 300 in the first year. So I know the receiving end of the stick.

In 1958, I went on my first serious DXpedition... KC4AF, Navassa Island. Since then, I've operated from a bunch of places...come to mind 5Z4, ZS6, 3D6, 7P8, OD5, YK1, YA1, VU, 9N1, HL6, VR2, 5W1, KS6, FO8, HH, JY, OH0, KH2, KW6, and a bunch of non-rare countries. I've tried every way known to ham to get the most contacts per hour on the air from these rare places, so I have a good idea of what works and what does not work. Hmmm, I forgot to mention VP5, J6, and a revisit to Navassa in 1972.

The results of all this? Well, unless your signal is particularly weak, the fastest operation is when you operate on a fixed channel, thus containing the band mayhem to one single pileup. I've found that out by making regular announcements to this effect: "I will be listening for about ten seconds on this channel for the last letter of your call. Please do not all jump in immediately, but wait so your calls will be spaced a bit. I will make a note of the last letter of your call and call you with it after writing down as many as I can hear. Do not... I repeat...do *not* call more than a couple of times. If I hear anyone pushing and shoving on channel I will work you, but there will be no QSL. Neither of us wants that."

The result is a relatively orderly sorting out of the problem, which is to get the call letters of those on channel as quickly as possible. The rest of the contact is a matter of a couple of seconds. The long, hard part is getting the calls through.

By asking for the last letter, I am able to quickly get things down to two or three, at most, responding when I break. It makes everyone shut up and listen. I can then confirm the call, exchange signals, and be on to the next. With this system, I can double or triple the throughput of any system which calls for tuning a band of frequencies, looking for calls in the open.

The calling stations, perceiving that I am able to cope with the chaos and that they will have a fair chance of getting through, respond very positively and line up, doing as I ask. Megawatts of power are saved. The entire band, except for about 6 kHz which I am using, is open for everyone...and at least twice as many operators are made happy with a new one. And think of the agonizing frustration saved for the thousands of ops, calling hour after hour, hoping to get through.

Another solution to the whole problem would be, of course, to get the League to cancel their Honor Roll and DXCC certificates so we wouldn't have this enormous pressure to make a radio contact with some stupid island somewhere. That would spoil a lot of fun for thousands of us DXers, but it would at least stop such carnage as the Peter and Paul jokers dumped on us.

This whole DX thing, while it may be fun for amateurs in most of the ordinary countries, is a royal pain in the...er...ear for the ham who lives in a rare spot.

HAM BILL SIGNED

It began as S.929, turned into H.R.5008, and came out of the Washington mill as H.R.3239, but the effect is the same: sweeping changes in amateur radio.

The bill, which has been signed by President Reagan, will give hams more control over licensing and policing and may also expand the 5-year ticket into a license renewable every 10 years.

With this moneysaving measure, FCC-approved hams and ham organizations will be both writing and administering exams. However, the exams may be written only by a ham with at least the class license that the exam is for, and tests can be given only by hams with a higher-class license. Extras, of course, will be allowed to test Extras.

Amateur radio's traditional self-policing policies have also been given a shot in the arm by the bill. The FCC can now use hams to track down illegal transmissions and accept reports on illegal activities which have been filed by hams. This bill gives the FCC permission to "recruit and train" hams for this purpose, and these amateurs will also be allowed to send warning notices to offenders. However, the amendment does not give hams authority to officially charge violators.

The self-regulatory aspect of the bill is the brainchild of Sen. Barry Goldwater K7UGA, who drafted the initial version as S.929. But to get it enacted, the concepts of S.929 were incorporated into a larger house bill, H.R.5008, which addresses a wide variety of changes in the Communications Act of 1934.

Hams plagued by RFI will find some respite under this bill, which will "establish minimum performance standards for home electronic equipment and systems to reduce their susceptibility to interference from radio frequency energy." However, the bill does not affect equipment already manufactured.

Other changes in the Communications Act eliminate licenses for CBers and radio control operators. Though CB operators will still be expected to comply with regulations, the change allows the Commission to officially wash its hands of the 27-MHz band.—WB8JLG.

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You wouldn't believe how soon the thrill of working stations for ten-second contacts palls. You might not find it as difficult to believe what a nuisance being expected to fill out and mail thousands of QSL cards is. Imagine, if you will, the excitement with which a ham in Tonga receives his 780th QSL from a WB2 station. It just goes into the nearest leftover washing machine carton.

Even with a QSL manager to take on the brunt of the card chore, the responsibility for keeping the log, getting a copy to the manager, and forever making instant contacts, with growing resentment whenever you stop to try to make friends with anyone forcing you to shut down . . . it's driven most hams in rare spots off the air.

With so many things of value which people can accomplish in this world, I am saddened when I see some ham who has gotten swept up in the DX Honor Roll excitement. What a frivolous waste of life it is to devote it to trying to make this silly list . . . and stay there . . . often at almost any expense.

Continued on page 172

QSL OF THE MONTH: XE1JRV

This month's QSL Contest winner is Jesus Retana XE1JRV. This modern rendition of an ancient temple is highlighted by the bright yellow sun, adding warmth and contrast to an otherwise stark scene.

To enter *73*'s QSL of the Month Contest, put your QSL card in an envelope with your choice of a book from *73*'s Radio Bookshop, and send it to *73*, Pine Street, Peterborough NH 03458, Attn: QSL of the Month. Entries without an envelope or book choice will not be considered.

Well . . . I Can Dream, Can't I? **by Bandel Linn K4PP**

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The Hangman's 2-Meter Collinear

Make your tower do double duty. Drop this array from the top and get 6-dB gain.

Here is a 2-meter FM base-station antenna that's inexpensive, easy to build, and has about 6 dB omnidirectional gain. It can be mounted on the side of a tower or put on a mast of its own. No special tuning equipment is required. All you need is an swr meter.

Design

The antenna described here is a 6-element vertical collinear array. It consists of six half-wave radiators placed end-to-end and fed in phase. The resulting directional pattern is theoretically a circle in the horizontal plane, with a gain of about 6 dB over a dipole. Results of testing at W1GV/4 indicate substantial improvement, both for transmitting and receiving, over a 5/8-wave antenna with ground plane at 25 feet.

Fig. 1 shows the configuration of the collinear antenna. Each element is 38 inches long. The end-to-end spacing between elements is negligible, about 1 inch. Allowing for a foot or two at the top and bottom, the entire antenna requires a vertical space of about 22 feet. Of course, the higher the system is placed, the better the performance will be.

Proper phasing is obtained by quarter-wave stubs between the elements. For all practical purposes, these stubs do not radiate, provided they are cut to the correct length. At 146.5 MHz, 18 inches with 2-inch spacing gives a reasonant, ultra-low-loss matching section. Fig. 2 illustrates the construction details for each stub.

The antenna can, as previously mentioned, be mounted on the side of a tower or alongside a TV mast; it can even be hung from a tree branch! If the antenna is mounted on the side of a tower, the directional pattern will be modified slightly. The gain will be reduced in the direction of the tower and increased in the direction away from the tower. Therefore, you should position the antenna to provide the most gain in whatever direction you desire the best coverage (Fig. 3).

If the antenna is suspended next to a TV mast or hung from a tree limb, the pattern will be omnidirectional.

Construction

To put this antenna on a tower, you will need the following hardware, in addition to the usual tools and soldering apparatus:

- 6 42-inch lengths No. 12 solid uninsulated copper wire

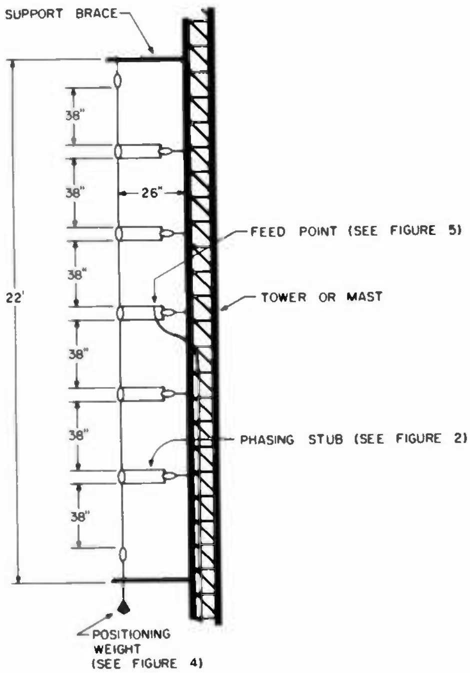

Fig. 1. Configuration of the 6-element, 2-meter wire collinear antenna. The overall height is 22 feet. The array is fed at the physical center.

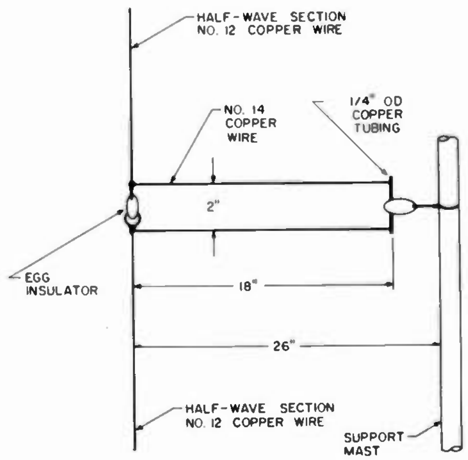

Fig. 2. Construction details for the tuning stubs. A spacing of 2 inches provides minimum loss while allowing essentially no radiation. When the stub is pulled tight, the wires will stay in place because of their stiffness.

● 10 20-inch lengths No. 14 solid uninsulated copper wire
● 1 20-foot (approx.) roll No. 12 solid wire
● 5 2-inch lengths 1/4-inch o.d. copper tubing
● 5 porcelain insulators (non-egg type)
● 7 small egg insulators
● 2 3-foot, 2-inch o.d. wooden dowel rods
● 2 screw-in-type TV standoff insulators
● 1 15- to 20-pound weight
● 1 roll of electrical tape
● 1 strong set of legs

First, screw the TV standoffs into one end of each dowel. Then, attach the rods sideways to the tower braces, 22 feet apart. (If the tower braces do not exactly line up to 22 feet, use the next brace that will allow a spacing greater than 22 feet.) Of course, the higher the overall position, the better! The dowels should extend 26 inches out from the tower. Use No. 12 wire to secure the dowels to the tower braces.

To assemble the antenna, attach the seven egg insulators at the ends of the six antenna elements, making a long chain. Wrap and solder each wire end to the egg insulators. To minimize interelement capacitance, it's best to loop the wires through the egg insulators as shown in Fig. 2, in such a way that if the insulator should break, the wires will come apart. The elements should each measure exactly 38 inches from loop tip to loop tip. Attach an 18-inch length of No. 12 wire to one end of the array and a 48-inch length to the other end.

To construct the phasing stubs, solder two 20-inch lengths of No. 14 wire to each element end (see Fig. 1). Wrap 1 inch of wire around each element end. Space the wires 2 inches apart. Put a 2-inch piece of copper tubing through one end of a standard porcelain or glass insulator and twist a short piece of stiff wire around the tubing if necessary to keep it from slipping up and down in the hole. Wrap 1 inch of the free ends of the stub wires around the ends of the tubing and solder them in place. When you are done, you should be able to pull the stub tight and have both wires evenly spaced, straight, and 18 inches long (Fig. 2). You will have to construct five of these stubs, in locations shown by Fig. 1.

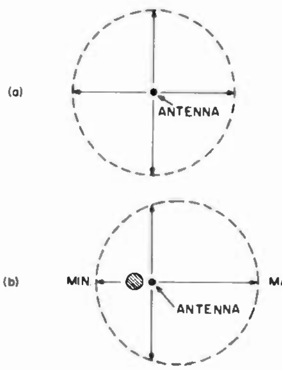

Fig. 3. Radiation patterns for a vertical array in free space (a) and near an obstruction such as a tower (b). The viewing position is directly overhead. The obstruction tends to reduce the gain in some directions while increasing it in others.

Now you're ready to hang this contraption. Grab the top end—the one with the 18-inch piece of wire attached—climb the tower (don't forget your safety belt!), and affix the wire to the TV standoff insulator at the end of the upper dowel. Then, climb back down to the lower dowel and run the 48-inch end wire through the standoff insulator there. Rotate the plastic inside the standoff so the wire can't pop out, and crimp the insulator ring to keep it in place. Cut the lower wire so that roughly 8 inches remains below the standoff. Then attach the weight to the end of the wire (Fig. 4). This weight keeps the array taut as the wires expand and contract with changes in temperature. An alternative arrangement to the weight is to use an elastic band in place of the lower section of wire; however, the array may have a tendency to "oscillate" in the wind if this scheme is used.

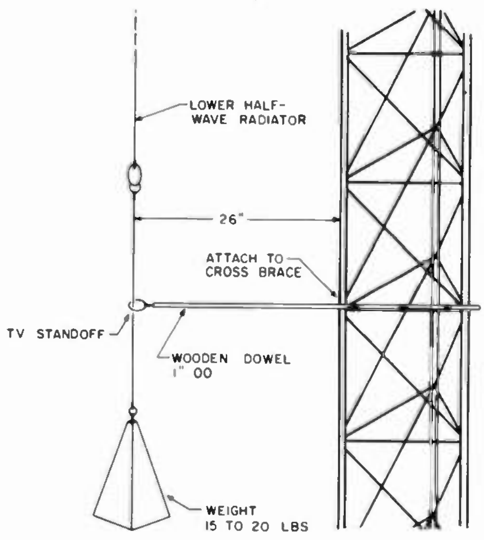

Fig. 4. Arrangement for keeping the array taut. The distance between the weight and the TV standoff should be great enough to allow for contraction with cold weather, but small enough to prevent excessive swinging of the weight.

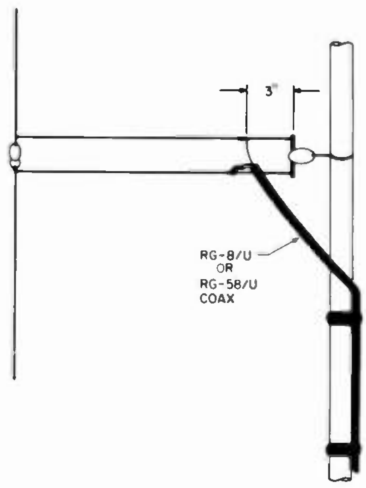

Fig. 5. Feedpoint diagram. The array should be fed at the center stub. A good starting point is 3 inches from the shorted end; however, some adjustment will probably be necessary to get a perfect match. Here, the center conductor of the transmission line is connected to the top part of the antenna and the shield to the bottom part. However, they could just as well be reversed.

To position the stubs, you'll need five pieces of wire about two feet long. Run one end through the insulator at the end of the stub, twist the wire onto the insulator, and pull the stub reasonably tight. Twist the other end of the wire around the tower support nearest the array (Fig. 2).

The Feedpoint

You can rest a bit now. As you're sipping a cool drink, admire the new appendage to your antenna farm. But don't get carried away; you still don't have it hooked up. And the final tuning procedure may require three or four more excursions up the tower.

Fig. 5 shows the matching section for the 6-element wire collinear. The transmission line is connected to the center stub. A good starting point is 3 inches from the shorted end, as shown. However, you'd better not solder the wires there right away. The size of your tower will have some effect on the exact final position. Larger towers will lower the impedance for any given tap point, as compared to smaller towers.

The feedpoint should be moved slightly toward or away from the shortened end of the stub until the swr is minimum at 146.5 MHz. It should be possible to get a nearly perfect match (at W1GV/4, a 1.3 swr was obtained). Always keep the coax shield and center-conductor taps at the same distance from the end of the stub; don't try to get fancy by putting them in different places.

The final tap position will be about 15 percent of the way from the shorted end of the stub to the antenna end. When the ideal position has been found, solder the wires in place and wrap the connections with electrical tape. Or, better, use silicone rubber cement. Tape the feedline cable to the inside of the tower to minimize possible induced currents on the coax from antenna coupling.

Closing Remarks

This antenna is a pleasure to use and requires essentially no maintenance. Since it is made from materials usually available at flea markets, the cost can be very low. I had much of the necessary hardware already in my junk box.

A gain of 6 dB over a dipole represents a quadrupling of the effective radiated power. But you get this gain on receive, too! With my Azden PCS-3000 at 25 Watts, I'm running 100 Watts effective radiated power, neglecting line losses. My installation, being attached to a TV mast with the bottom almost at ground level, is essentially omnidirectional. It is generally possible, in this pancake-flat South Florida area, to communicate with mobile stations via simplex out to 50 or 60 miles. Before, with the 5/8-wave antenna at 25 feet, the reliable range was only 30 to 40 miles. Of course, repeater operation is a breeze. I'm full-Q into all of the local repeaters.

There isn't any reason why more elements cannot be added to this array, except for height limitations and certain engineering requirements. An 8-element array would require about 28 feet of vertical space and would produce about 7.5 dB gain over a dipole; a 10-element array would give around 8.5 dB gain.

As the number of elements is further increased, tuning of the stubs and elements becomes more and more critical, and special equipment will be required to ensure correct phasing for optimum performance. (Even with a 1-inch error on each element, the total discrepancy would be 5 inches at the top and bottom of a 10-element array; this is 23 degrees at 146.5 MHz! Such an imprecision would surely degrade the performance of the antenna.) Furthermore, as the number of elements increases, the bandwidth of the array gets narrower because the error adds up for each element off resonance. There is a point of diminishing returns.

A 6-element array can provide good communication without the headaches of painstaking adjustment and narrow bandwidth, and so it represents a good compromise. This antenna is ideal for the 2-meter FM operator who wants omnidirectional operation, but is presently using only a ground plane. ■

Receiver, NRD-515

SPECIFICATIONS

Receiving frequency range:	100kHz to 30MHz continuous (30 bands)
Receiving modes:	USB/LSB/CW/RTTY/AM
Receiving system:	Up conversion type Double superheterodyne First IF 70 455MHz
Sensitivity (S/N 10dB):	CW, SSB AM
1 6 to 30MHz	0.5μV 2μV
100 to 1600kHz	2μV 6μV
Selectivity:	6kHz/2.4kHz/0 6kHz/0.3kHz (*Option)
Stability:	Within 50Hz/one hour
Power requirements:	AC 100/117/220/240V, 50/60Hz, 50VA
Dimensions and Weight:	340mm(W)×140mm(H)×300mm(D); Approx. 7.5kg
Preset memory (Option):	24ch
Frequency stability:	Less than 50Hz per hour after warming up.
Image rejection ratio:	70dB or more
IF rejection ratio:	70dB or more
Input impedance:	50 to 75 ohms, unbalanced
AF outputs:	
Speaker output:	1W or more (4 ohms)
Record/line output:	1mW or more (600 ohms)

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NRD-515

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Transmitter, NSD-515

SPECIFICATIONS

Rated output power:	100W NSD-515 (50W 28MHz band)
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Robin Becker KA3W
2912 N. Calvert St.
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Deep-Six Squelch Tails

Kerchunks take a dive with the addition of this audio delay.

Squelch tails are ugly. Few things are more annoying to repeater users than a long squelch tail every time someone drops his carrier. At WR3AFM, a Baltimore Amateur Radio Club (BARC) multiple-receive-site repeater,[1] this problem is compounded by a second squelch tail, that of the link receiver. The resulting overall squelch tail is approximately 110 milliseconds in duration. However, thanks to the circuit described below, it is no longer audible.

A squelch tail is the noise heard at a receiver's audio output after the transmitting station has dropped its carrier but before the receiver's squelch circuit can mute the audio output. This is what you hear whenever the repeater carrier drops off the air, for example. The duration of the squelch tail is a function of your particular receiver.

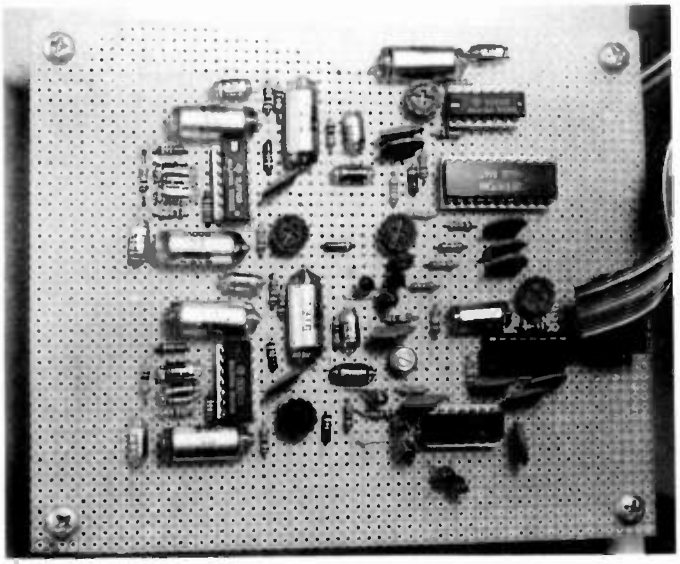

Photo A. The completed board installed at WR3AFM. The delay line is in the upper right. The I/O connector is in the far right. (Photo by N3IC)

Another source of squelch tails is a repeater receiver. Consider first a conventional single-site machine. Whenever the transmitting station drops its carrier, the repeater receiver's output follows with a burst of squelch noise. Since the repeater transmitter is still on the air at this point, this squelch tail is heard by all stations monitoring the machine.

Next, consider a split-site repeater (or a multiple-site repeater like WR3AFM) as shown in Fig. 1. In this type of setup, the repeater receiver (or each satellite receiver in a multiple-site scheme) is coupled to the repeater transmitter via a link, often on 450 MHz. The repeater receiver operates as before, appending a squelch tail to each transmission. The receiver output is sent by the link transmitter to the repeater transmit site, where it is received by the link receiver. When the link transmitter carrier drops, shortly after the repeater receiver squelch tail ends, the link receiver will append a squelch tail of its own to the audio output. Since the link receiver feeds the repeater transmitter (or voter, in the multiple-site case, which, in turn, feeds the transmitter), this (link) squelch tail also is heard by all monitoring stations.

In order to eliminate the squelch tail nuisance, a delay line was inserted into the audio-signal path. To see how this will allow the squelch tail to be silenced,

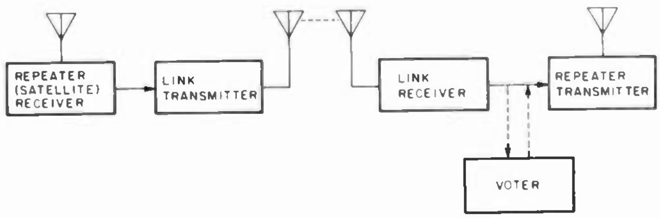

Fig. 1. Split-site (or multiple-site) diagram.

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refer to Fig. 2. Note that although the figure specifically illustrates the multiple-site (or split-site) system, by ignoring the link (second) squelch tail it is valid also for a single-site system.

Fig. 2(a) shows the audio output of a satellite receiver and its associated squelch tail. This signal is sent via a link transmitter to a link receiver, and from there to the voter, with the added link receiver squelch tail. The audio output of the voter, shown in Fig. 2(b), contains the satellite receiver squelch tail and the link receiver squelch tail. The carrier-operated switch (COS) depicted in Fig. 2(c), with logic high equivalent to on and logic low equivalent to off, changes state after both squelch tails are completed. Since the COS is usually employed to gate (switch on or off) the repeater transmitter audio (or the transmitter itself), both squelch tails are transmitted by the repeater.

Fig. 2(d) shows the voter audio output delayed in time. It can be seen that the squelch tails in Fig. 2(d) occur after the COS goes low. Using the COS signal to gate the audio in Fig. 2(d) gives Fig. 2(e). This audio contains no squelch tail at all.

The length of the satellite-receiver squelch tail is somewhat dependent on the received signal. Since the link transmitters and receivers are fixed, the link squelch tail is always the same length. To take this variability into consideration, the length of the delay was chosen to be longer than the worst squelch tail usually encountered. This ensures absolutely no transmitted squelch tail, but also chops off a small amount of audio in some cases. At worst, however, if the carrier is dropped immediately following a word, one syllable might be lost. This turns out to be insignificant in practice. Of the almost 500 members of BARC, only one seems ever to have problems with lost syllables, and then only on one-word transmissions! Overall performance has been great, and the total parts cost of approximately $70 puts the project within reach of most everyone.

General Theory

A block diagram of the overall system is shown in Fig. 3. Starting with the delay itself, the various blocks will be examined.

The heart of the circuit is a Reticon R5101 Charge-Coupled Device (CCD) which performs the delay. The CCD acts as an analog shift register. It stores time samples of the analog input signal as packets of charge. The amount of charge in each packet is proportional to the amplitude of the analog input at the time of sampling. The packets of charge are shifted through 2000 stages before they reach the output of the CCD. Thus, the chip has 2000 samples of the input stored at any given time, each separated in time by T seconds, where T is the time between samples. The CCD uses two clock cycles per shift, and hence the overall delay time (Td) is given by Td = 2000 × (2/Fc), where Fc is the clock frequency supplied by the oscillator block and is equal to 2/T.

Instead of using a CCD, other schemes could be used to achieve the desired delay. These include tape loops and digital sampling, which are discussed briefly below.

The tape-loop scheme involves continuously recording and simultaneously playing back the received audio on a tape recorder. Since there is a physical gap between the record head and the playback head, a time-delay is introduced (Td = G/V, where G = gap length in inches and V = tape speed in inches per second). A Td of up to one second is typical at slow tape speeds with this approach. This scheme is the simplest to implement, but was not used because of the problems of reliability of such factors as the tape transport mechanism, tape breakage, and dirt on the tape heads.

The digital-sampling scheme is similar to the CCD technique except that the audio signal is first digitized by an analog-to-digital converter, then stored in a digital shift register, and finally converted back to analog form by a digital-to-analog converter. This approach has the advantage of being able to achieve any desired delay by adding more shift registers. To get a reasonable signal-to-noise ratio and still preserve the dynamic range of speech, we would need either many bits (12 or more) in the digital words or we would have

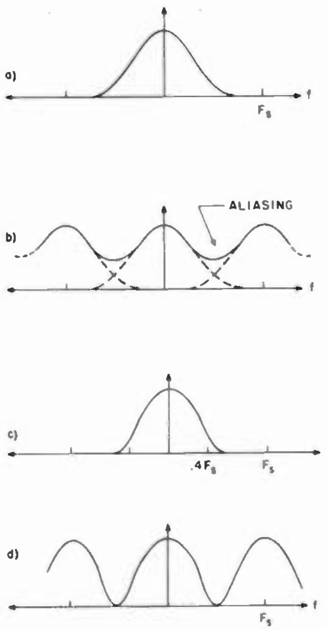

Fig. 4. Aliasing. (a) Spectrum of signal to be sampled at F_S (b) Spectrum after sampling without first low-pass filtering. (c) Spectrum of input signal after low-pass filtering with cutoff at .4 F_S. (d) Spectrum after sampling the low-pass-filtered signal.

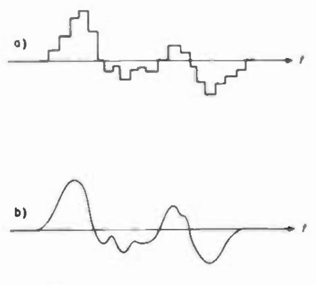

Fig. 5. CCD output filtering. (a) Before filtering. (b) After filtering.

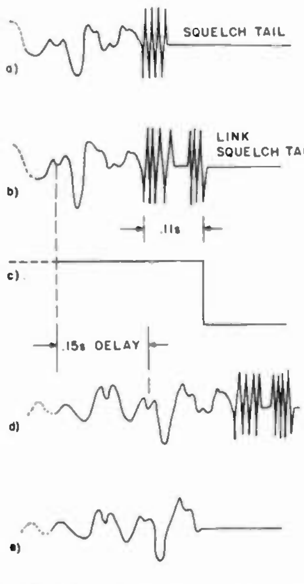

Fig. 2. Using delayed audio to eliminate squelch tails. (a) Repeater (satellite) receiver audio output. (b) Link receiver audio output. (c) COS. (d) Delayed link receiver (voter) audio output. (e) Gated repeater transmitter audio.

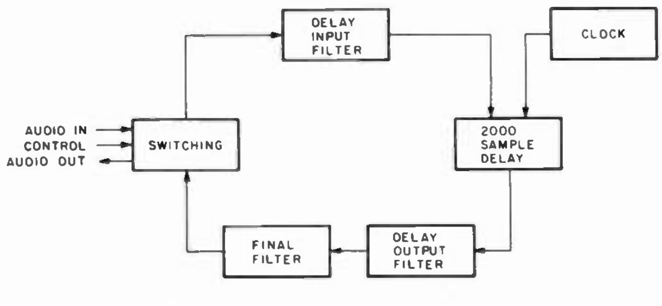

Fig. 3. System block diagram.

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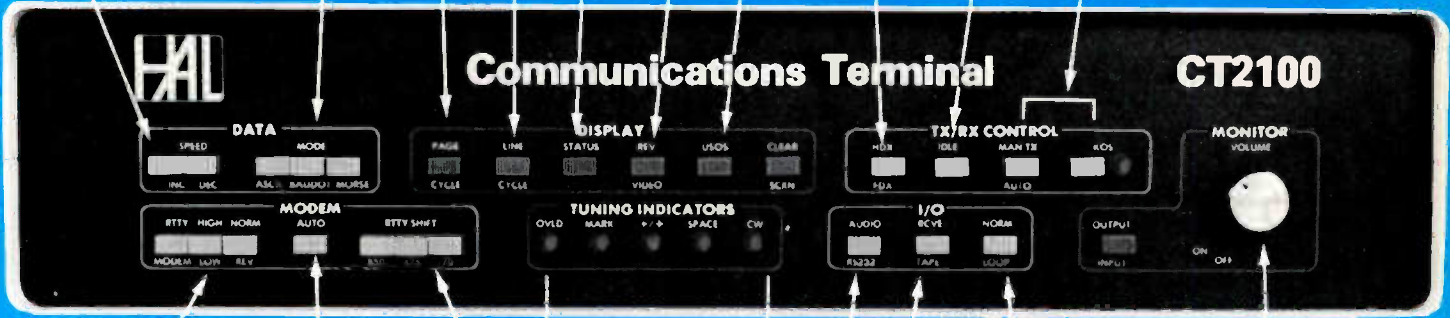

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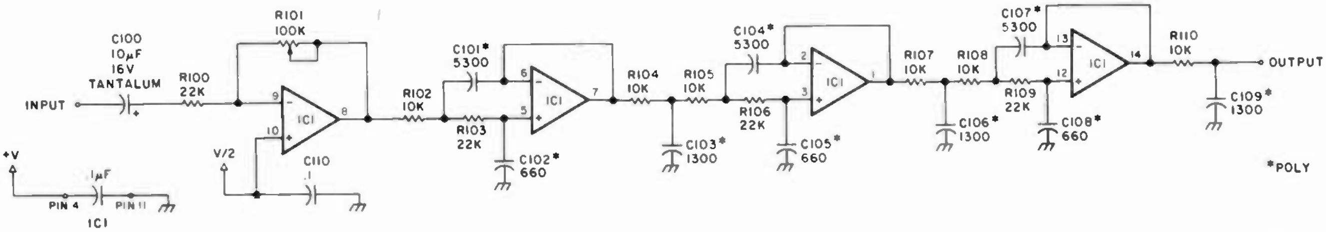

Fig. 7. Delay input and delay output filtering. Note: IC1 and IC2 are TL074Cs. IC1—100 series; IC2—200 series.

Frequency (Hz)	Gain (dB) (I/O 2 to I/O 6)
12	−3
20	−1.32
50	−.21
100	0
1k	.53
2k	1.59
2.2k	1.63
2.37k	1.59
3k	0
3.43k	−3
4k	−10
5k	−30
6k	−51

Fig. 6. Measured overall response. Conditions: 1) Delay = 150 ms (F_{clock} = 26.67 kHz); 2) two-pole adjustable low-pass filter set for 0 dB at 3 kHz.

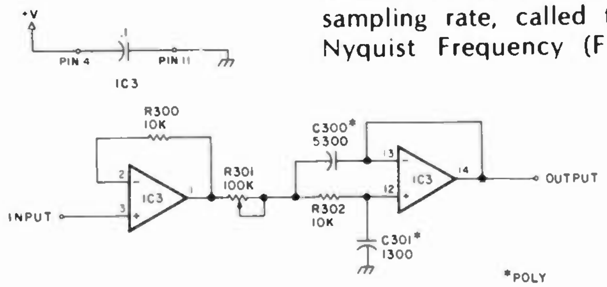

Fig. 8. Final filter. IC3 is a TL074C.

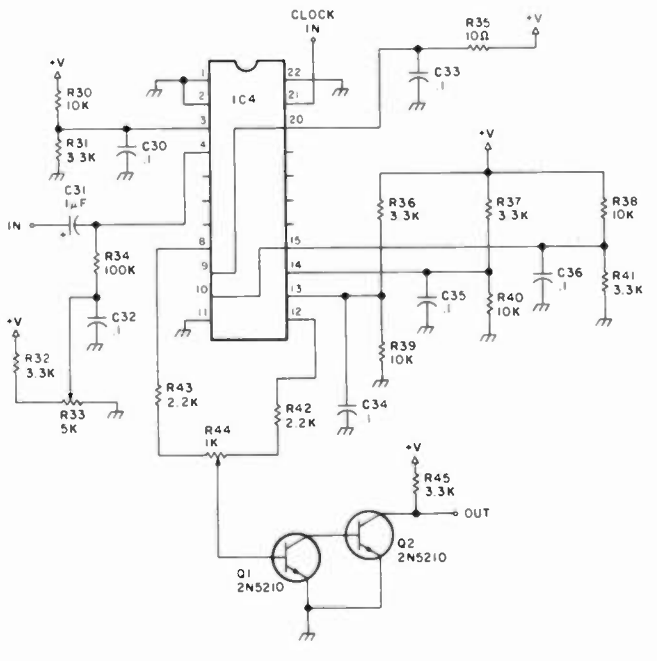

Fig. 9. 2000-sample delay. IC4 is a Reticon R5101.

to use a compression-expansion (companding) technique. Either way, due to the high cost of analog-to-digital converters and digital memory (the shift registers) and because of its higher total package count, these approaches were undesirable.

As in any time-domain sampling system, the input must be a band-limited process. In a low-pass application, such as with speech, any input components whose frequency is greater than one-half the effective sampling rate, called the Nyquist Frequency (Fc/4 here), must be removed prior to sampling to prevent a form of distortion called "aliasing." If not removed by filtering, these components will appear at the output as lower frequency (alias) signals (see Fig. 4).[2] Once aliasing occurs, it cannot be removed by filtering, since the aliased components are indistinguishable from the original components. The necessary filtering is performed here by a 3-section, 9-pole low-pass filter.

Since the CCD is a discrete time system (that is, its output changes only at specific times, resembling a staircase), the output also contains high-frequency terms which must be removed by filtering (see Fig. 5). This filtering is again performed by a 3-section, 9-pole low-pass filter.

Since the frequency response of the CCD is somewhat dependent on the clock frequency selected, a tunable low-pass filter is provided. By tweaking this filter, the overall response may be optimized for a particular clock rate. The response for the board at WR3AFM is given in Fig. 6. The tunable filter was set so that the response at 3 kHz was equal to that at 100 Hz (0 dB). Notice the excellent flatness over the speech bandwidth (−0 dB, +1.6 dB). The steep roll-off past 3 kHz also serves to attenuate wideband noise from other sources preceding the delay line.

Variable-gain input and output buffers are provided. The input buffer is set to limit the input to the CCD to less than 1 volt peak to prevent overloading the device, and the output buffer is set to achieve unity overall gain (0 dB) at 100 Hz. Thus, the whole board is transparent to the rest of the repeater.

The switching stage allows the delay to be bypassed (if desired) and permits the audio to be gated with the COS signal. This eliminates the need for any external audio switching.

Circuit Design

Filters

The circuit was designed in a fairly straightforward manner. Quad bi-FET op amps were chosen because their high input impedance makes designing with them simple. Specifically, the TL074 is a low-noise version of the popular TL084, which could be substituted, as could many other audio op amps.

Since the frequency response of the CCD starts to roll off at about 1.5 kHz when set for a 150-millisecond delay, some form of equalization was required to extend the usable bandwidth of the system. High-frequency pre-emphasis (that is, boosting the high-frequency components ahead of the CCD, as opposed to post-emphasis) has the advantage that the input signal is kept large with respect to the noise at all times. However, since the CCD overloads at about 1-volt peak input, any boost in the spectrum ahead of the CCD must be accompanied by an overall cut in the input level (relative to that permissible with no pre-em-

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phasis). Post-emphasis completely avoids this problem, but it also boosts any noise added by the CCD circuitry. As a compromise, equal amounts of pre- and post-emphasis were employed.

The low-pass filters were designed to provide the needed boosting as well as to attenuate the high-frequency components. In order to achieve a 150-millisecond delay, Fc = 26.67 kHz from the equation, above. Thus, the Nyquist Frequency (Fc/4 here) is 6.67 kHz. The low-pass filters must attenuate at and above this frequency. The 9-pole filters shown in Fig. 7 have a peak (boost) of approximately 6 dB before rolling off at −54 dB/octave. The overall response is shown in Fig. 6.

The final output filter, a buffer and 2-pole low-pass filter combination, is shown in Fig. 8.

CCD/Clock

Fig. 9 shows the circuitry surrounding the CCD that was suggested by the manufacturer, which was found to work well. The clock signal is produced from a simple two-inverter oscillator and is shown in Fig. 10.

Switching

Since WR3AFM is controlled by an 8080 microprocessor, all control signals are supplied by TTL open-collector outputs. Thus CMOS 4066 analog switches were a natural choice to handle the audio gating. The switching circuits are shown in Fig. 11.

Construction Notes

The board was built using point-to-point techniques. The actual layout, shown in Fig. 12, was carefully planned to ensure neat wiring and no ground loops. Any popular construction technique should work. Whatever method is used, however, the ground leads should be heavy enough to keep op-amp noise reasonable.

All op-amp Vcc inputs were bypassed to ground with a .1-uF disc capacitor right at the chip, on the underside of the board. Polystyrene capacitors were used in the filters to achieve close tolerance and good temperature stability. Sockets were used for all chips, with the one for the CCD being a must.

The input and output audio, switching, and power-supply connections can conveniently be made using ribbon cable and a 14-pin DIP socket. A suggested pin configuration is shown in Fig. 13. Unused lines should be grounded at the board end only, to reduce noise and prevent ground loops. The ground lead from the DIP socket should be connected to the ground bus on the board at the spot that results in the smallest amount of noise on the audio-output line. In the layout shown in Fig. 12, the best spot was found to be near the inverter chip.

Finally, as shown in Fig. 14, a 10-uF filter capacitor was placed from Vcc to ground and from Vcc/2 to ground. Tantalum capacitors were used because of their small size and low leakage, but any type capacitor will do.

Parts

The CCD is available for $50 from Reticon Corporation, 910 Benicia Avenue, Sunnyvale CA 94086, and their distributors (write to them for info). For most other parts, a good supply house is Digi-Key Corporation, PO Box 677, Thief River Falls MN 56701.

Adjustment

To set the clock frequency, adjust R21 while observing pin 15, IC5, on a scope or frequency counter. The desired frequency may be found from the equation, above. For a 150-millisecond delay, Fc = 26.67 kHz.

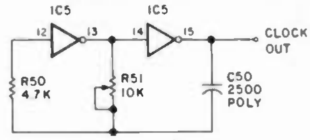

Fig. 10. Clock. IC5 is a CD4049AE.

R101 is adjusted to prevent overloading the CCD. Since the maximum pre-emphasis is 6 dB, the maximum signal at pin 8, IC1, must not exceed .5 volts peak for any input signal. However, to achieve the best signal-to-noise ratio, it is desirable to keep the signal as large as possible. Therefore, apply a sine wave at the maximum level to be encountered in operation (such as the level that gives 5-kHz deviation on the repeater) to the input (I/O pin 2) and adjust R101 until the level at pin 8, IC1, is .5 volts peak.

To adjust the bias and symmetry of the CCD, apply an audio-frequency sine wave to the input (I/O pin 2). Adjust the amplitude of the sine wave until distortion is just evident at pin 14, IC2. Next, set R33 and R44

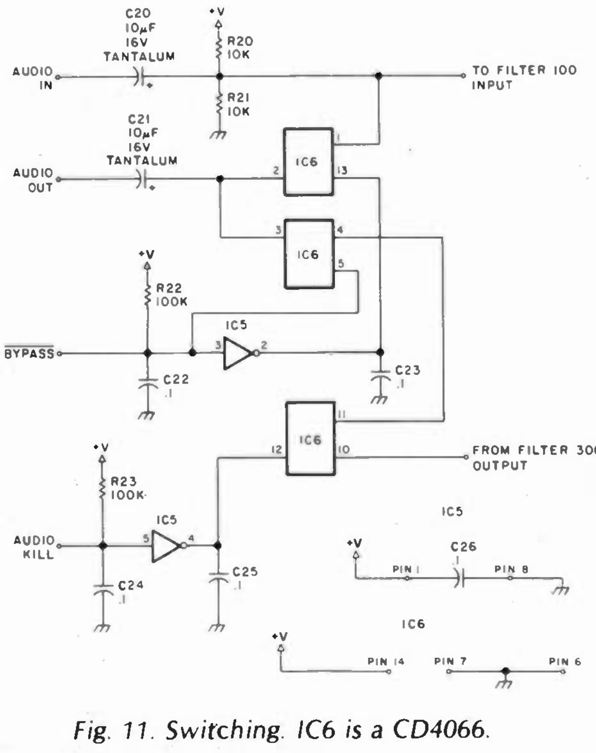

Fig. 11. Switching. IC6 is a CD4066.

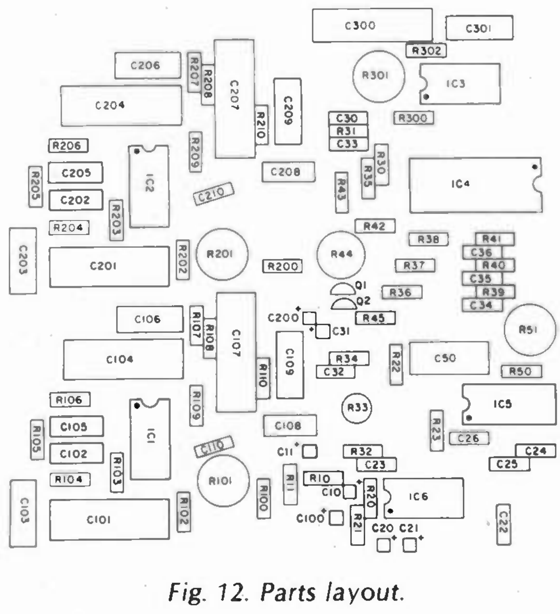

Fig. 12. Parts layout.

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to minimize the distortion, and then increase the input until the distortion is again visible. Continue this process until no further reduction in distortion is observed.

Adjust R301 so that the overall gain is equal (I/O pin 2 to I/O pin 6) at 100 Hz and 3 kHz. This gives a desirable response for a voice channel.

Finally, adjust R201 so that the overall gain (I/O pin 2 to I/O pin 6) is unity (0 dB) at 100 Hz (or 3 kHz).

Pin 2—Audio input
Pin 6—Audio output
Pin 7—Ground
Pin 8—Audio kill
Pin 9—Bypass
Pin 14— + 12 volts

Fig. 13. I/O connector wiring.

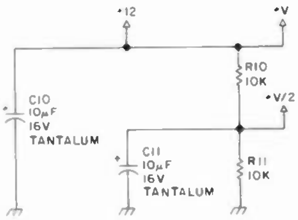

Fig. 14. Power supply filtering.

Echoes, Etc.

Since the unit introduces delay in the audio path, a rather interesting echo effect can be observed. Referring to Fig. 15, notice that due to the delay some audio output continues from the repeater after the transmitting station's carrier drops. The length of this audio is equal to the length of the combined squelch tails. Depending on the speed of the station's T-R switching, the operator will hear the end of his transmission coming back.

The only drawback of the device also is visible in Fig. 15. The final portion of audio is chopped by the circuit. The amount of audio lost is equal to the difference between the length of the delay and the length of the combined squelch tails. Since the usual squelch tail lasts for 110 milliseconds (at WR3AFM), if a short squelch tail was acceptable, the delay could be shortened to 110 milliseconds. In practice, almost everyone holds their PTT for a short amount of time after they stop speaking, so this is really a moot point.

The delay also causes a strange phenomenon if an operator is monitoring the repeater on a secondary receiver. It is virtually impossible to talk while listening to your own voice delayed by 150 milliseconds. This effect has encouraged the more fun-loving walkie owners to engage in the friendly game of sneaking up behind an unsuspecting repeater user while he is transmitting and then turning up the volume on the walkie. This fun alone justifies the work involved in building the delay line. ■

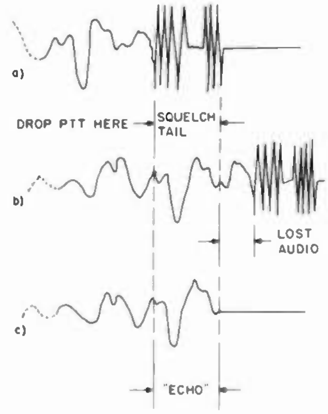

Fig. 15. Echo. (a) Transmitted audio plus squelch tails. (b) Delayed audio. (c) Repeater output.

References

1. Glaser, R., "An 8080 Repeater Control System," *73 Magazine*, February, 1979.

2. For a more complete discussion of sampling and signal processing in general, see, for instance, Schwartz, M., *Information Transmission, Modulation, and Noise*, McGraw-Hill, 1970 (second edition), or Rabiner, L. and Schafer, R., *Digital Processing of Speech Signals*, *Prentice-Hall, 1978*.

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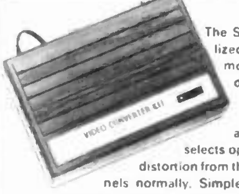

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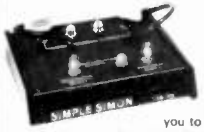

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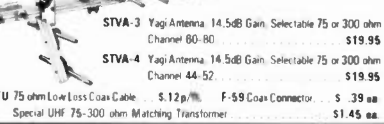

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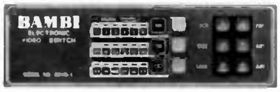

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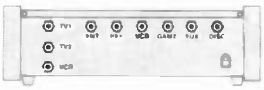

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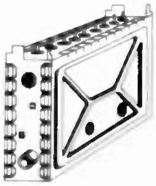

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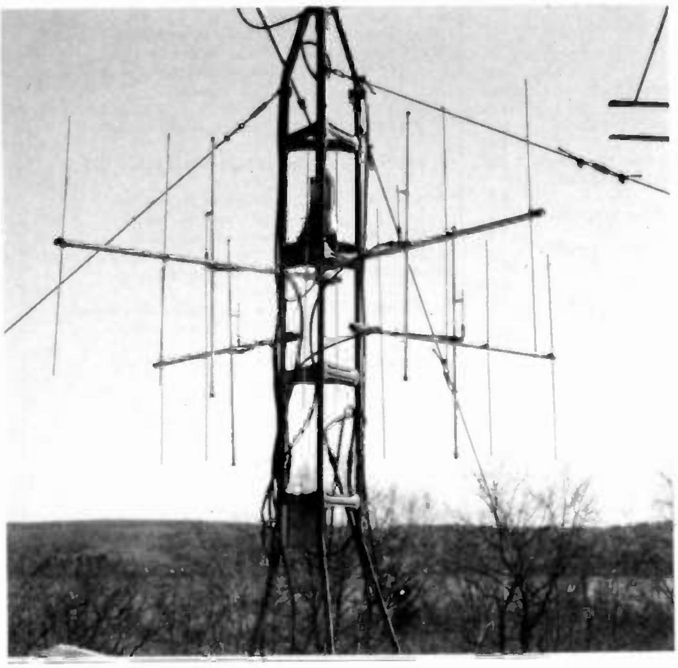
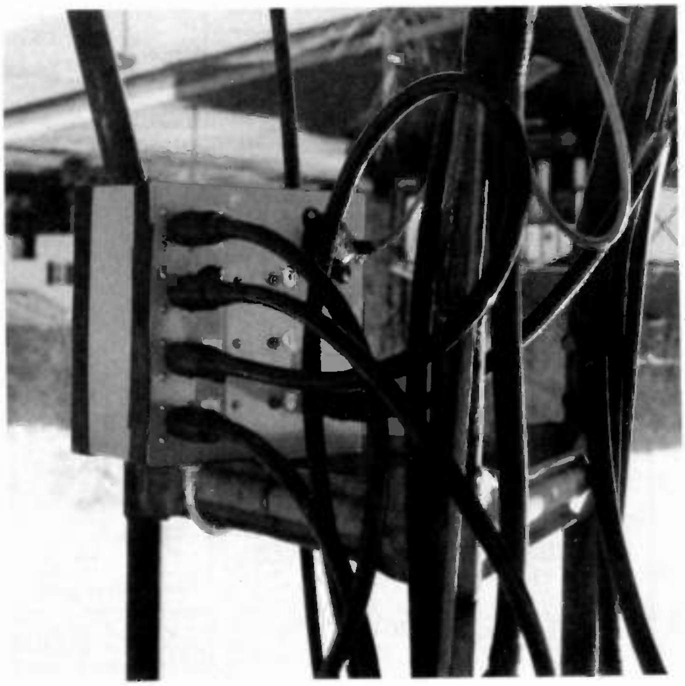
What a waste of time to be constantly turning beams during a VHF contest. Especially on FM, where a good operator in the metropolitan area can run 60 or more contacts per hour on 146.52 MHz or other popular simplex channel, if only he doesn't have to spend half his time turning a beam. But in a densely-populated area (and there are many such regions in the US) one simply cannot use an omnidirectional



The four A147-4 beams installed on the tower.



The relay box mounted on the tower. Note the well-taped PL-259s.

gain array, due to high QRM levels. What to do? Thought you'd never ask.

How about four vertical yagis, aimed at compass points or areas of known activity, side-mounted on your tower or mast, with remote switching from a single feedline? Too expensive? Not really. Cumbersome? Not as much as a rotator. Tricky? Not at all. Simple, in fact, and requiring little time or homebrewing expertise. And the benefits are attractive, not only to the VHF contester, but to any active FMer; of course, the principle described lends itself to a variety of other interesting applications, such as diversity reception experiments or phasing of HF steerable arrays.

Personally, I used four Cushcraft A147-4 short-boom 4-element 146-MHz yagis, for their ease of matching to an unknown line impedance, light weight, and low cost. If all the control box parts listed in the parts list are purchased new at list prices per the 1980 Allied Electronic catalog and added to the *73* advertisers' prices for the coax and antennas listed, the total cost of this entire project is $159.88. The only additional expense would be the feedline (hardline sells for 49¢ per foot from several *73* advertisers), the hardline connectors (brand new for $8.00 each from Phelps-Dodge, or available for much less at flea markets), and the 4-conductor control cable (the Belden cable listed sells for $12.00 per 100′ list price).

Sound like a lot of dough? I agree; that's why I bought most of the stuff (except for the antennas) at local surplus stores, which brought the cost of this project down to less than sixty bucks (minus antennas). The Cushcraft antennas specified sell for $21.00

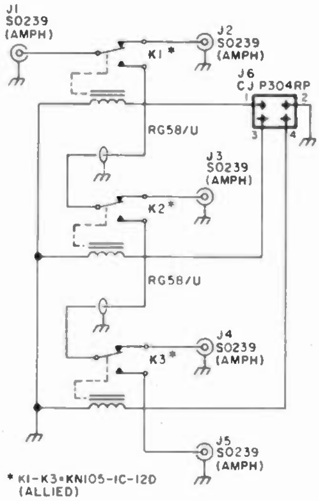
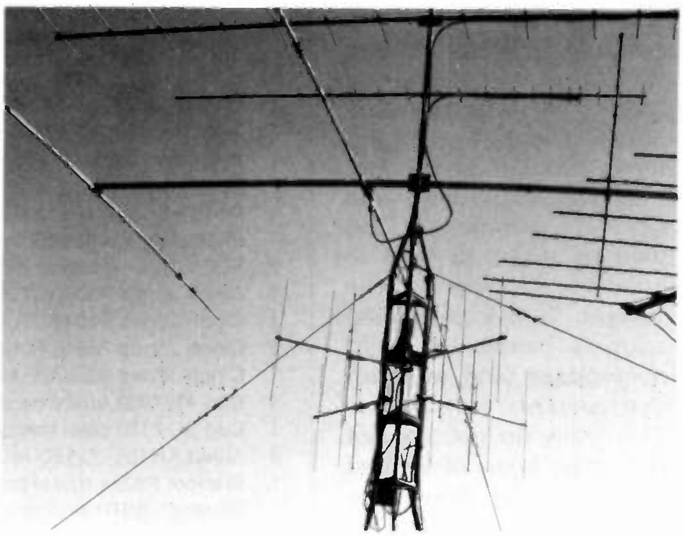


Fig. 1. Relay box.

each, but could be replaced with home-brew antennas—either yagis or quagis—for a fraction of that.

The A147-4s were selected here because they are small and light, they are end-mount types ideal for direct tower mounting, and they develop slightly over 6 dB gain, which is a tad more than my omnidirectional Phelps-Dodge Stationmaster. The Stationmaster, a well-respected, 20-foot-long fiberglass monster, sells for about $240.00; my 4-beam system works as well, and offers the advantage of selectable directivity for QRM reduction . . . and it costs far less.

See Fig. 1 for the circuit of the relay box and Fig. 2 for the control box. Real Novice stuff. Mount K_1, K_2, and K_3 in a line on one flat, removable panel of the Bud AU-1029 cabinet. Mount the four output SO239 connectors in a line parallel to and about an inch away from the relays. Mount the SO239 "common" or "input" connector an inch from K_1, on the opposite side of the relay from the four output connectors. Mount the Cinch Jones P304RP connector in whatever space is left on the same panel. Now all components and all wiring are on just one flat aluminum



Here you can see the company the four A147-4s have: 4 el on 20, 15, and 10 meters; 19 el on 70 cm; 16 el on 2 meters. Guys are broken up with ceramic insulators.

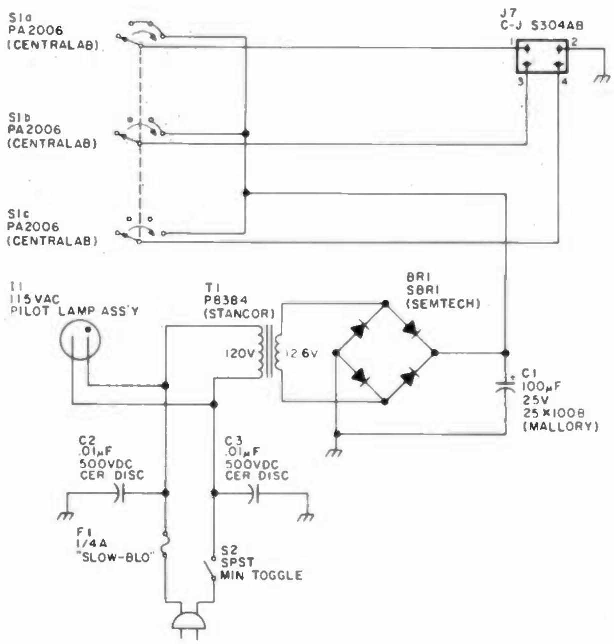


Fig. 2. Control box.

panel. The rest of the utility cabinet is only a weatherproof box for the relays.

Use the flattened braid from RG-58/U for the connections from each UHF receptacle to each corresponding relay terminal, per the schematic in Fig. 1. Keep these braid jumpers as short as possible—mine are about one inch long each. If this box is intended for use at 146 MHz, this is important. Use short lengths of RG-58/U to make the K_1-to-K_2 and K_2-to-K_3 jumpers (see Fig. 1), keeping all exposed leads short. Solder the RG-58/U braid to ground lugs installed near each relay for this purpose.

The three relay coils must operate independently but they can have a common ground: thus, the wiring shown and the four-pin connectors.

After all the wiring in both the relay and control boxes is completed and double-checked, make up a short 4-conductor cable with the appropriate Cinch Jones connector at each end, and bench-test the two units together. The dc output from the bridge rectifier should measure slightly over 17 volts with the rotary switch in position 1 (no load). This will drop to less than 17 volts with the switch in position 2, and then to about 16 volts in positions 3 and 4. The 12-volt relays specified seem to handle the slight overvoltage (and resultant overcurrent) just fine—their coils do not get hot even after hours of applied voltage. The maximum power dissipated in each relay coil is about 1.8 Watts.

Before the final installation of the relay box, drill two holes through one side of the box for a suitable U-bolt to clamp the box to your tower leg or mast. Then assemble the box on the tower or mast and caulk all corners and joints with the specified silicone caulking compound. I also wrapped the corners with Scotch 33 vinyl electrical tape.

The relay box provides a nice low vswr through about 50 MHz, but at 146 MHz it does not. Using my Bird model 43 wattmeter, a range 25C slug, a Dielectric Communications model 4050 50-Ohm, 50-Watt microwave dummy load, and a 146-MHz, 25-Watt transmitter, I measured the vswr looking into the box (with each output terminated in the 50-Ohm load) and found it to be less than 1.5:1 in position 1, but over 2:1 in the other three positions. However, there was no actual *loss* through the relays, just an impedance mismatch. What to do? Simple; tune the antennas to match the box!

Parts List

4 lengths of RG-8/U foam coax (Belden 8214), cut 64" long each
1 length of RG-58/U, about 36" long
1 suitable length of RG-331/U (½" alumifoam "hardline") feedline
8 PL-259 UHF plugs, silver-plated (Amphenol 83-1SP)
1 Phelps-Dodge #66-654 UHF hardline connector
1 Phelps-Dodge #66-656 UHF hardline connector
5 SO239 UHF receptacles (Amphenol 83-1R)
1 Cinch Jones P304CCT, 4-conductor cable plug
1 Cinch Jones S304CCT, 4-conductor cable receptacle
1 Cinch Jones P304RP, 4-conductor recessed panel plug
1 Cinch Jones S304AB, 4-conductor flush panel receptacle
1 Bud AU-1029 utility cabinet
1 Bud SC-2133 cowl minibox
3 Allied KN105-1C-12D relays (SPDT, 12 V dc/150-Ohm coil, 10-A contact rating)
1 Stancor P8384 transformer (12.6 V c-t, 1 A)
1 Semtech SBR1 bridge rectifier (100 piv/leg, 1.5 A dc)
1 Centralab PA2006 rotary switch (3 pole, 4 position)
1 Allied #652-0503 SPST miniature toggle switch
1 Mallory 25X100B electrolytic capacitor (100 μF, 25 W V dc)

Miscellaneous: #4-40 and #6-32 hardware and solder lugs; knob for rotary switch; pilot lamp assembly, 120 V ac; zip-cord/ac line plug assembly; GE silicone bathtub caulk, waterproof; terminal strips; grommet for ac line cord; hookup wire.

Note: None of the parts listed is particularly critical, and each may be substituted for as desired. However, I strongly recommend the following:

- Use only Amphenol rf connectors. Cheap substitutes may work at low frequencies, but at 146 MHz, PL-259s are marginal performers unless they're good ones and assembled properly.
- Use Cinch Jones 4-conductor plugs and sockets. They're easier to work with and are far more durable than cheap substitutes.
- Use Belden 8214, Times FM-8, or other high-quality, foam-dielectric cable for antenna/relay-box interconnects. Avoid CB-grade coax.
- If you cannot find truly high-quality foam coax, use Belden 8237 or any brand MIL-Spec RG-8/U cable (be sure the cable says "MIL" or "MIL-C-17" right on it) and change the length from 64" each to 53" each.
- *Do* use hardline as transmission line if your run to the shack is more than 50 feet. The difference in loss at 146 MHz is well worth the slightly higher cost. Why use a gain antenna system if that gain is thrown away in the feedline?
- The relays listed are somewhat critical. Avoid miniature and encapsulated relays; also avoid the plug-in type. Usually, the built-in interconnect leads are far too long for rf work, especially at VHF.

Here's what to do to make it all work well at 146 MHz:

- Connect each antenna, once mounted in its permanent position, to its respective port on the box, using the 64" RG-8/U foam cables and PL259 connectors. The 64" is a nice length because it reaches, and also because it is one wavelength (in foam cable) at 146 MHz, thus making the box think the antenna is coupled directly to it.
- Connect the control box to the relay box with a length of 4-conductor cable. Locate the control box on your roof or tower for this temporary arrangement.
- Connect a 10-to-25-Watt two-meter exciter through 50-Ohm cable (any length) to a 50-Ohm coupler (I used a Bird 43) which is connected directly (like with a double-male UHF adapter) to the "common" port of the relay box.
- Apply power to the rig and the control box. With the control box switch in position 1, transmit and measure vswr. If it's low, great. If not, adjust the gamma match on antenna 1 to bring reflected power to a minimum.
- Perform the same gamma-match adjustments on antennas 2 through 4, switching to each in turn by using the control box. It should be possible to bring the vswr of each antenna down to reasonable proportions with the gamma match provided on each A147-4.

Now the system is adjusted. Remove the wattmeter, etc. Locate the control box in the shack, run the feedline and control cables down into the shack, and you're on the air.

Voila! A really high-class antenna system in just an afternoon's work. My whole installation (pictured) took about four hours, including wrestling with the hardline. The two boxes took just one evening to assemble. It was worth it. As you can see in the picture, I do own a Stationmaster for 146-MHz FM work, and although it is an excellent antenna, it is 20' long, weighs over 25 lbs., catches a lot of wind (and ice), and cost over $200.00. The four beams are more versatile, occupy less space, work at least as well, and were far less expensive.

Now, when I hear a weak station calling, I can "turn the beam" in less than one second to pull him in. What a difference! ■

✓*See List of Advertisers on page 130*

Calvin McCarthy VE3LMP
98 Windsor Street
Thunder Bay, Ontario
Canada P7B 1T7

Taming the 2-Meter Linear

It lives in the forests of spurious oscillations and answers to the call of the correct bias. Catch one for yourself.

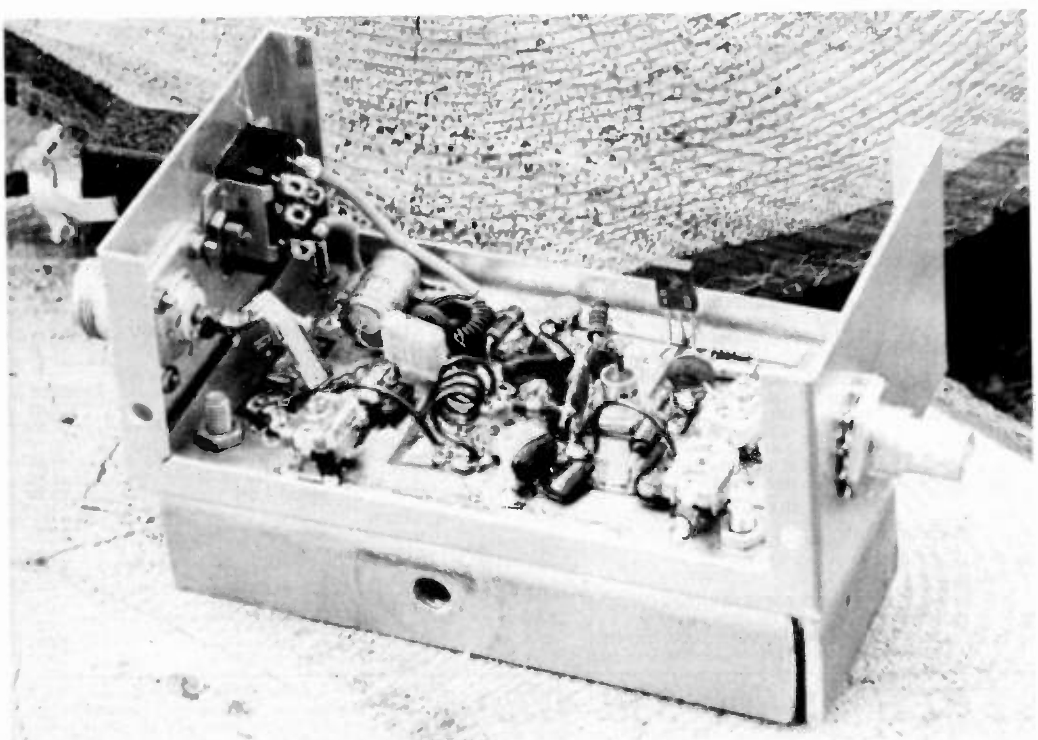
Class C amplifiers for the two-meter band are a "dime a dozen," with commercial models, kits, and schematics available from a good number of suppliers. Linear amplifiers are another story. Their design and construction is all black magic, and manufacturers are the only wizards in on the mystery. With a little sleuthing, I found that Motorola would sponsor my initiation into this exclusive cult, allowing me to build an amplifier to boost the output of my 2-meter OSCAR station from 2.5 Watts to 20 Watts.

In order to linearize a solid-state rf power amplifier, you must solve two problems. First, you must bias the transistor into the linear region while supplying a substantial amount of varying base current. Secondly, you must tame any spurious oscillations generated by the high-gain transistor used.

First, the biasing problem will be faced. A small-signal transistor amplifier is usually biased with a voltage-dividing network such as that shown in Fig. 1(a). The current flowing through the network resistors is set to be about ten times the current needed by the base. With our amplifier needing from 10 mA to 100 mA of base current at any time, this circuit would not be practical. As well, the bias voltage must be held at a constant stiff value for all values of base current, which is not possible with a resistive voltage-divider network.

An alternate solution to this biasing problem, which satisfies the need for a constant bias voltage while supplying varying currents, is the solid-state voltage regulator. Either the shunt regulator of Fig. 1(b), where the total bias supply current is greater than the maximum base current and the surplus current is shunted to ground by the reference diode, or the series pass regulator of Fig. 1(c) can be used. The series regulator reduces the current which must flow through the reference diode by i_{base}/hfe, and the total bias current used becomes virtually the base current needed at each instant. The bias voltage is set by the forward voltage drop of the diode reference which is approximately 0.6 volts. The series regulator bias is set by two forward-biased diodes in series, the second diode voltage drop compensating for the base-emitter junction drop of the series pass transistor so that the bias supply voltage output will equal only one PN junction voltage drop.

Now for a very important point! As a transistor warms, its base will draw more current, which increases collector current, which warms the transistor more, and this will continue until the component self-destructs. To offset this, the base bias voltage must be reduced as the transistor warms. By mounting D_{ref} as



MRF 2-meter linear amplifier.

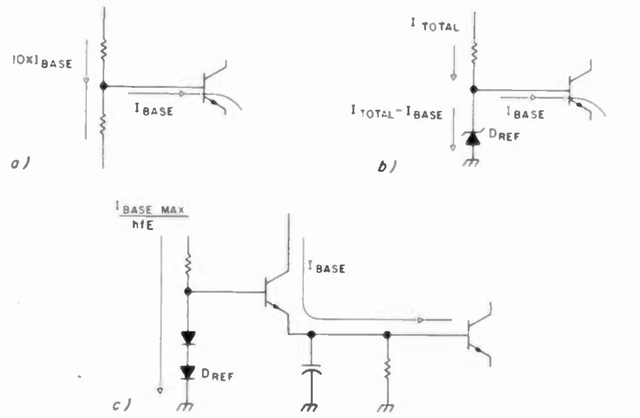


Fig. 1. Bias possibilities. (a) Voltage divider arrangement. (b) Zener diode stabilized. (c) Pass transistor circuit.

close to the rf transistor as possible to provide thermal contact, the diode junction voltage will *decrease* as the diode warms, neutralizing the base-emitter junction change of the rf transistor and thus keeping the base current under control. Remember! Attach the reference diode so that it will be warmed by the rf power transistor. Either physically attach it to the transistor body or to the heat sink as close to the transistor as possible. *Do not* expect the reference diode to thermally track if the thermal path is broken by air.

Low-frequency oscillations also are a problem. My amplifier first oscillated in the HF band because at these frequencies the transistor has very high gain. Bypassing the collector current feed did not tame these troublsome responses, so I took the brute-force method and fed back the collector signals to the base through a feedback network. The rf choke is a virtual short for the oscillations but an open circuit for the desired VHF response. The capacitor is a virtual short for the undesired oscillation but an open circuit for the collector supply. This network was placed between the collector and base with very short leads and the unwanted oscillations were completely suppressed.

The amplifier which I built (Fig. 2) is a modified version of the class C amplifier described by W4MNW in the November, 1977, issue of *73 Magazine*. I lifted RFC1 from ground, added bypass capacitors to the lifted end so the rf input would continue to see a ground, then connected the base bias supply to RFC1. The low-frequency feedback network was added to stabilize the amplifier and the linear amplifier was a reality. It would appear to be quite possible to linearize many of the class C amplifiers now in FM and CW use in the same way.

The testing of this amplifier was done with a regulated and current-limited power supply. This saved the transistor from destruction before I had tamed the low-frequency oscillations. The transistor is rated for a collector current of four Amperes, but I set the supply to limit current to a maximum of one Ampere until I was satisfied that the amplifier would not hurt itself.

Low-frequency oscillations manifest themselves by a sudden jump in collector current and corresponding drop in supply voltage. The first time this happened I thought I had destroyed the transistor, but the power supply protection

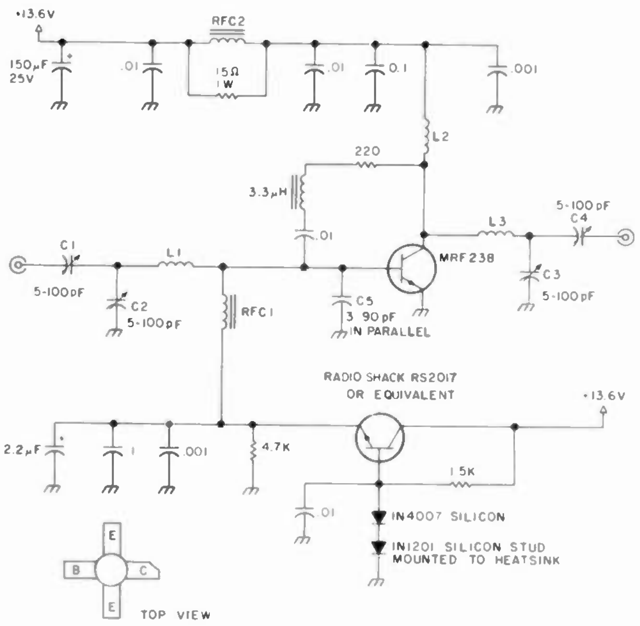


Fig. 2. Amplifier schematic.

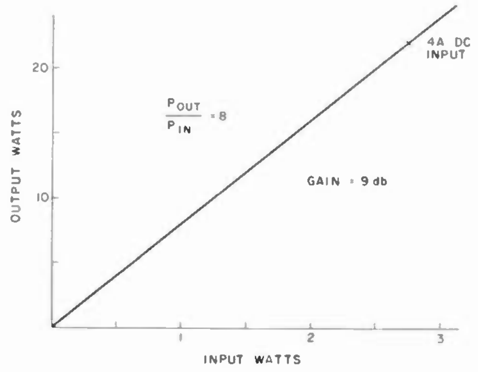


Fig. 3. Amplifier linearity.

had saved it. I was able to continue my study of the problem and a wideband oscilloscope revealed a pulse-type response on the collector output. This was suppressed by the feedback network shown in the schematic.

I made an interesting observation about amplifier efficiency while tuning the amplifier. There is a particular collector current needed to give a particular output power—not so collector voltage. Thus 0.5 Watts input will become 4 Watts output at 2 Amperes collector current whether the collector voltage is 5 or 12 volts. Under the same conditions, the dc input power changes from 10 Watts to 24 Watts. For maximum efficiency, it seems that the amplifier should be operated at the maximum linear power output possible for the applied collector voltage, or if it is desired to operate the amplifier at reduced power, the collector voltage should be re-

Coil Construction Details

RFC1 10 turns #22 on 270-Ohm, ½-Watt resistor
RFC2 13 turns #22 on T50-6 toroidal core
L1 ½ turn #16, approx. 1½"
L2 4 turns #16, 1/4" i.d.
L3 Curved wire, #16, 1-1/4" long

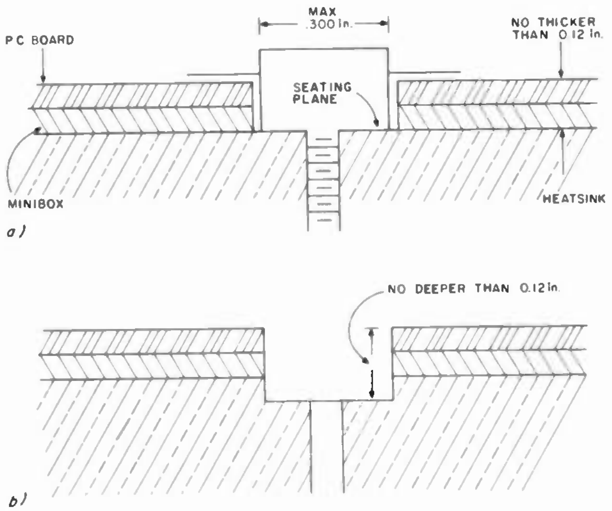


Fig. 4. MRF238 mounting details.

duced. Linear operation at 4-Ampere dc input is shown in Fig. 3.

The amplifier was built in a 5¼″ × 3″ × 2½″ minibox on double-sided epoxy glass PC board. The circuit lands were etched, but islands of PC board epoxied to the ground plane would serve as well. Be very certain that the capacitors that make up C5 are soldered with *short* leads as close to the transistor body as possible. Connect the ground plane on both sides of the board with eyelets or wire running through the board and solder on each side. A heat sink is necessary. My heat sink has 35 square inches of radiating area and it seems to be just satisfactory. A larger one is recommended.

The mounting of the MRF238 is very critical (see Fig. 4). Careless technique will result in a destroyed transistor if stress is placed on the leads. Mount the transistor seating plane with very good thermal contact to the heat sink. The thickness of the case metal and the PC board must not be greater than .120 inch. If it is, the transistor leads will be forced up, putting a strain on the transistor cap. On heating, the bonding material will fail and you will be out buying a new expensive transistor. If the PC board and case thickness together is much less than .120 inch, you may want to mill out the heat sink as in Fig. 4(b) so the transistor leads will not be bent down when soldered to the PC board. *Do not* solder the leads before tightening the stud mounting nut. *Do not* hold the transistor leads while tightening the nut. *Do* hold the transistor securely by the wrench flat on the end of the stud while tightening the nut. Only after the mounting nut has been tightened carefully may you solder the leads to the board.

The MRF238 Motorola transistor is available from Ramsey Electronics and Semiconductor Surplus, both *73* advertisers.■

References

1. Charles F. Clark AF8Z, "Solid-State Linear Amplifiers," *Ham Radio*, January, 1980, p. 48.
2. D.J. Lynch W4MNW, "Build a 2-Meter Power Amp," *73 Magazine*, November, 1977, p. 96.
3. Motorola Semiconductor Products, Inc., Box 20912, Phoenix AZ 85036:
AN546—Solid-state linear amplifier design.
AN555—Mounting stripline-opposed emitter (SOE) transistors.
AN791—A simplified approach to VHF power amplifier design.

Larry Franks N7BGZ
24001 SE 103rd Street
Issaquah WA 98027

The Frugal Floppy Bazooka

This 2-meter antenna coils up into a small package, but it shoots a straight signal.

Another 2-meter antenna for your handie-talkie? You bet! When you combine low cost, portability, and reasonable gain as this antenna does, it is well worth covering the subject again. The design of this gain vertical was inspired by the excellent article by W1IS in the May, 1981, issue of *73 Magazine*. One of the current-distribution charts reminded me of the "bazooka" coax-to-dipole decoupling scheme which uses a grounded sleeve in place of radials, and the "floppy bazooka" was born.

Construction

My prototype antenna was assembled from RG-58A/U (with the stranded center conductor), which is (a) very flexible and (b) what I had on hand. I started with about 20 feet of the cable and terminated one end with a BNC male to match the connector on my HT. The next step is to remove approximately 34 inches of the outer cover and braid from the loose end of the coax, leaving about ¼ inch of braid exposed and the center conductor intact.

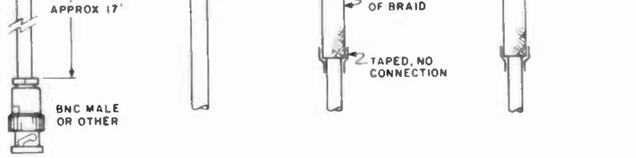


Fig. 1. The floppy bazooka.

Why 34 inches if a quarter wave at 146 MHz is about 19 inches? Because I had to compress the braid slightly, increasing its diameter and decreasing its length, to slide it over the feedline. After doing so, I *carefully* soldered the ¼ inch of exposed braid on the feedline to the braid sleeve, taking care to not melt the center conductor dielectric. I provided as much coverage as possible with the braid splice.

I covered the splice with heat-shrink tubing, although electrician's tape will do fine. Pull the braid down snug on the feedline and *now* measure the 19½ inches you expected, from the splice just covered to the lower end of the sleeve. I found this dimension to be very noncritical, but the shortening with compression varied from sample to sample of coax, which is why I started with 34 inches! After cutting the sleeve to length, I secured the end to the feedline in the same way I covered the splice.

Testing

The *first* test I made was with an ohmmeter: checking at the BNC end for a potential short. Don't trust the ability to receive a full-quieting signal as proof of proper wiring—I live less than a mile from a local repeater, which breaks the squelch on my HT fine without any antenna plugged in at all!

After avoiding the "smoke test," it was time to prune that 34-inch center conductor to resonance. My first cut was to 20½ inches, and out came the swr bridge. One quarter of an inch at a time, I marched up the band—on low power and avoiding repeater inputs, of course. I found that the antenna would give better than a 2:1 swr over about a 1.5-MHz range, with 19¼ inches hitting 146 MHz on the nose.

I wasn't thrilled with that bandwidth, so I opted for a simple modification: a "thicker" radiator. I started with a 20-inch piece of RG-174/U, with the center conductor and braid shorted together where they are spliced to the center conductor of the RG-58A/U and shrink tubing again covering the evidence. After the same pruning procedure, this came much closer to my expectations, covering the entire 144–148-MHz band with a worst-case swr of 1.8:1.

Use

I attached some 1/8-inch nylon cord to the top of the center conductor with two small wire ties, and the installation problem of a non-self-supporting antenna was solved. The antenna can now be suspended almost anywhere. Bear in mind that it has a very low angle of radiation and must be kept quite vertical to take advantage of its gain characteristics. I chose the 17-foot length of feedline as a reasonable trade-off between losses and the ability to put the antenna in better (higher) places. The antenna and nylon "mount" bundle neatly into a tiny package hardly larger than my HT, making it an ideal traveler's antenna.

My comparison of the floppy bazooka's performance to other antennas was not rigorous, but very satisfying. It significantly outperformed my ¼-wave ground plane in fixed-station use and incredibly outperformed the rubber ducky.

The floppy bazooka is cheap, easy to build, and works very well. It also lends itself well to modification and experimentation. Try it! ■

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George L. Thurston III W4MLE
2116 Gibbs Drive
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Taking It Higher

Raising a repeater's antenna is the way to wider coverage, right? Wrong.

When it comes to repeaters, higher is better! Right?

Not necessarily. It depends on what you want to accomplish.

Sooner or later, every repeater organization in the country gets the urge to move the repeater antenna up to twice as high as it already is, to improve coverage. Most of the time, it does improve. Every once in a while, though, some unexpected glitches result.

The Tallahassee Amateur Radio Society went through the process of moving from a downtown site with an antenna elevation of about 350 feet to a new commercial tower near the edge of town with an elevation of 800 feet above mean sea level (MSL). Sure enough, coverage was considerably extended. But sure enough, there were several surprising developments. What happened, and why, makes an interesting case study.

We knew from experience that the downtown site gave us an effective coverage range of about thirty miles in all directions over fairly mild terrain. South of the city, the coastal plain stretches away to the Gulf of Mexico, flat as a pizza, with an elevation of about 50 feet above MSL. But right in the middle of the city the terrain rises abruptly at the limestone scarp which, a few million years ago, was the coastline when sea levels were higher than now. These hills rise to elevations of 150 to 230 feet, with an average elevation of perhaps 175 to 200 feet above MSL on any bearing in the northern semicircle centered on Tallahassee.

What would happen when we moved from 350 feet to 800 feet? Would we be able to work 75 miles? 100 miles, as some members predicted?

The visual line-of-sight distance from an antenna to the horizon is expressed by the formula $R = \sqrt{2H}$, where R is the range (or radius) in miles and H is the height in feet of the antenna above average terrain. It is the basis, in commercial antenna engineering, for computer calculations of the antenna's performance, cranking in corrections for such things as absorption of radio energy by foliage and buildings, shadowing by hills, and the fact that radio signals can nearly always be heard beyond the visual horizon.

Without benefit of a computer, I modified the formula based on empirical observations of repeater performance in actual operation. The formula is intended to be an approximation, not a precise prediction. I cranked in a number of assumptions about ham radio which do not apply to commercial and public safety services.

For example, most amateurs are willing to settle for less than 100% reliability over a given path. And most of us are willing to accept a noisy signal if it is still readable. The modified formula turned out to be: $R = \sqrt{2.5H}$.

Applied to our downtown antenna site, it predicted a contour which agreed well with our experience with the repeater. Here it must be said that a number of other assumptions also must be made. For example, we assume that most mobiles will use about 15 Watts output to a quarter-wave whip, that they will be in motion, that they will have little or no ignition interference, that they have receivers with a sensitivity of half a microvolt or less for 20 dB of quieting, and that the ambient acoustical noise in the mobile will be fairly high.

The critical parameter was defined as the point at which "practical communication" through the repeater becomes possible between a mobile at the fringe of the coverage and a mobile or fixed station located within the full-quieting contour of the repeater. In effect, this boils down to: "Can I use the repeater to get useful information on road directions or weather conditions?"

Once the repeater was installed in the new location, I began collecting data by the simple expedient of working mobiles as they passed through the area and noting their positions when effective practical communication became impossible. Each such observation was noted on a large scale map (half an inch per mile) as a big red dot. Eventually, each of the roads into town became plastered with dots which sometimes covered several miles of road. These "smeared" observation points resulted from the variations between observations. One mobile might be using 25 Watts to a 5/8-wave whip. The next might be running only 10 Watts to a quarter wave. Another might suffer severe ignition noise on reception or his receiver might be "hot" or slightly "deaf." Propagation conditions might exert some influence from day to day. The final point on the road was chosen at about the middle of the "smear."

The results of the tests were plotted on a map, with the observation points on the highways being connected by a smoothed line. Circles, also centered on the repeater site, showed the 40- and 50-mile radii. The formula predicted an effective working range of 44 miles, disregarding terrain effects.

The interesting distortions of the working contour are almost entirely the result of terrain. A peculiar flattening in the northwest quadrant results from a ridge of hills along the eastern bank of the Apalachicola River. Mobile signals almost "wink out" when they drop over the crest of the hill into the river flood plain. The southern semicircle bulges outward because the terrain in that sector is substantially lower than Tallahassee and is dead flat coastal plain. The Gulf coast itself cuts off the bottom of what would be a rough circle. No observations were taken from boats in the Gulf. I suspect that the contour would bulge outward in that sector because of the high conductivity of the salt-water ground.

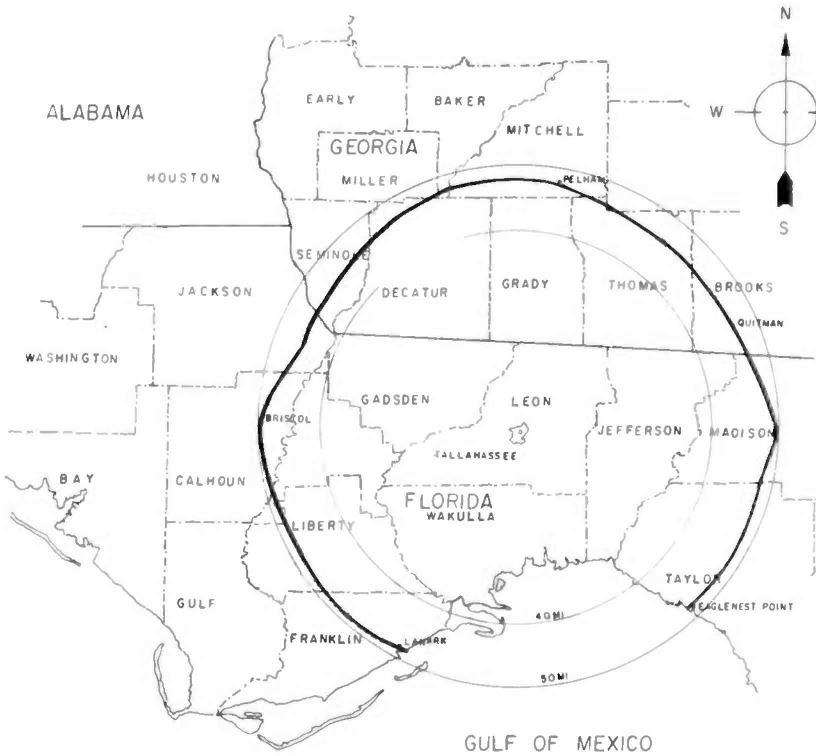

Fig. 1.

One unexpected side effect is that the repeater signal in the city of Tallahassee is not strong enough to quiet fully most mobile receivers. A possible reason is that the antenna is designed to provide some gain and it does this by taking energy away from the upper and lower hemispheres of the radiation pattern and concentrating it around the "equator." The antenna is so high that most of the city lies in the deprived cone directly below it. The favored lobe of radiation widens gradually as it goes away from the tower, and at 10 miles or so the signal at ground level is quite strong.

Another unexpected problem arose in early work at the new site. We tried to use the top antenna at 800 feet for receiving and a side-mounted antenna at 485 feet for transmitting. Reflections and other effects resulting from the tower, guy cables, and other factors produced a radiation pattern which was pulled in strongly to the west and had a powerful lobe to the northeast with an effective range of nearly one hundred miles in the favored direction. We solved the problem by using the top omni antenna for both transmit and receive.

The repeater is on 146.31/.91 MHz, and in this area we have very little, if any, co-channel interference unless there's a strong band opening. For a few days, we experimented with a 146.16/.76 machine on that tower. The results illustrate one of the problems which go along with great height. Mobiles trying to bring up the Valdosta, Georgia, repeater on .16/.76 eighty miles away also brought up the Tallahasee repeater. And because of the strong northeast lobe, our signal was nearly as strong in Valdosta as the Valdosta signal was!

In urban areas, it is entirely possible to cover so large a ham population that the traffic load on a repeater becomes unacceptably high unless access is restricted in some way. When contemplating a repeater on a tower at 2,000 or 3,000 feet above average terrain, it may be desirable to choose a site considerably distant from any expected concentration of ham stations. Otherwise, the area deprived of signal by the antenna gain effect may become a real problem. The effect is greater on UHF than on VHF.

The Stone Mountain repeater near Atlanta, for example, covers Atlanta and most of the surrounding country like a blanket, but it is located about twenty miles east of the city itself. Repeaters located in the Great Smoky Mountains of Kentucky, Tennessee, and northern Georgia cover enormous ranges in their favored directions (where mountainous terrain doesn't block the signals) and they serve a largely rural population without the dense concentration of stations which might cause problems in, say, New York City, Chicago, or Los Angeles.

It should be kept in mind, when trying to apply our rule-of-thumb range formula to other locations, that terrain is often a much bigger factor than it is in Tallahassee. The formula will give reasonably accurate results only when it is applied to one particular radius using the "average terrain elevation" along that particular line. A repeater in Iowa may well have an almost circular pattern. A repeater located in California or West Virginia is likely to be a totally different matter. The formula is not applicable directly to repeaters on bands other than two meters because terrain losses will not be the same. However, on any band, range will vary in direct proportion to the square root of the height of the antenna, and it should not be difficult to work out a new H multiplier which would give reasonably accurate results on, say, 50, 220, or 450 MHz.

Clubs which put up repeaters with wide coverage areas should be prepared to welcome and to serve many itinerant mobiles travelling through the area who may frequently be more interested in working each other than in working locals. Repeater groups that want to communicate among themselves for rag-chew, emergency, or other purely local communications purposes should give serious consideration to using a lower antenna site or a closed repeater operation using some form of restricted access. ■

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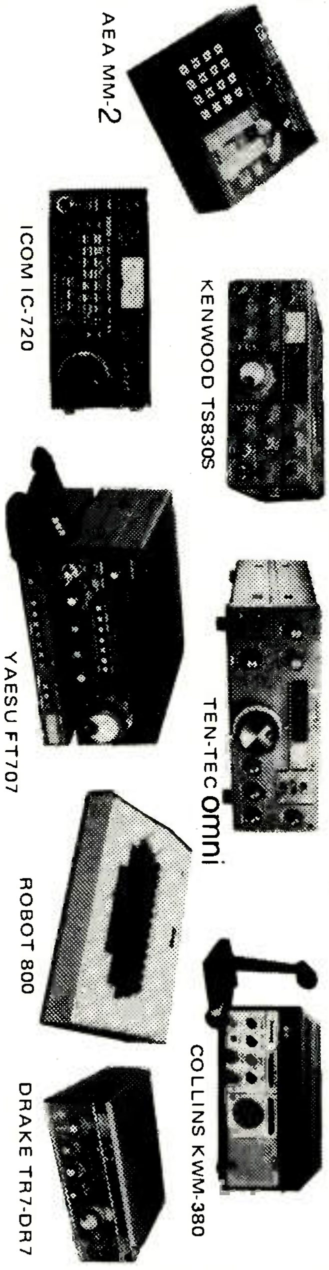

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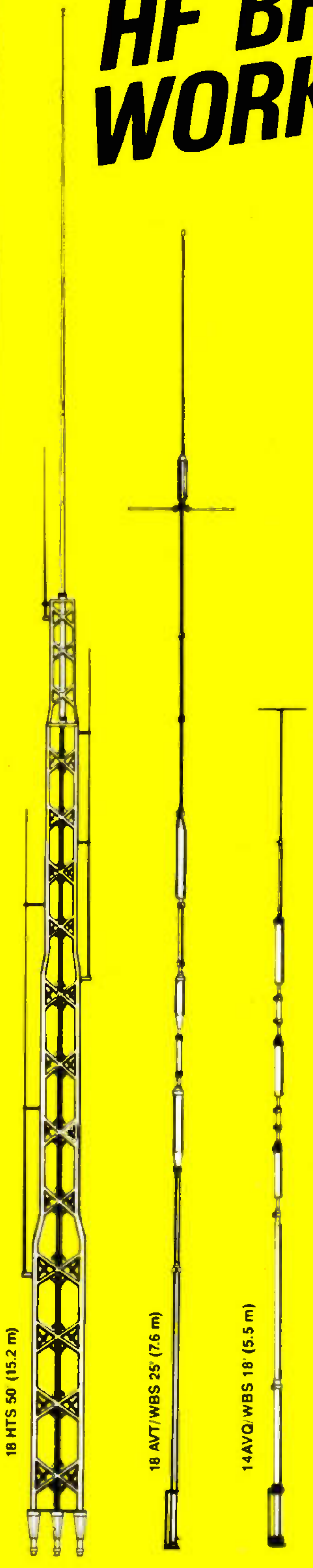

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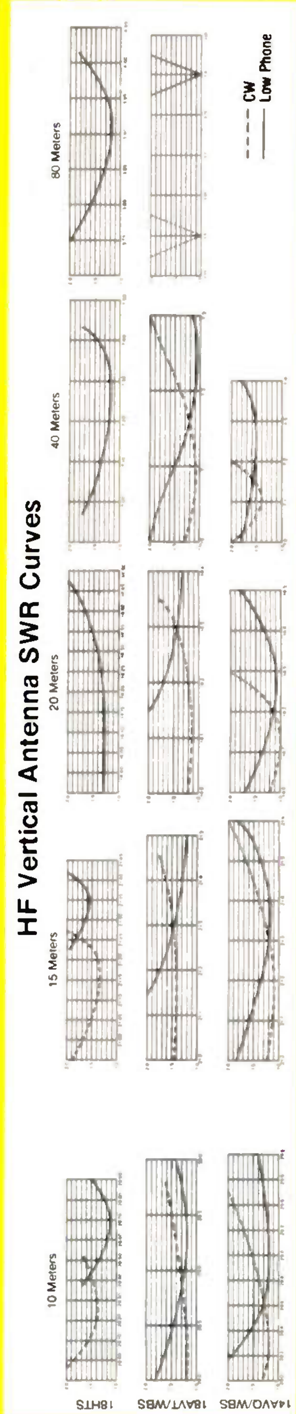
Other Hy-Gain vertical multiband antennas are available though not shown here. The 12AVQS (20, 15, 10 meter) is similar to 18AVT above but with VSWR of 1.5:1 or less on all bands. The 18VS (80-10 meter) comes with a base loading coil and may be installed on a short mast driven into the ground. All include stainless steel hardware.



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Dial-A-Frequency

Let your fingers do the walking with this remote control. All you need is a spare telephone.

Have you ever had a need to remote control a multi-channel radio over a distance but didn't want to run a multi-conductor cable? I have a Heathkit® HW-202 two-meter radio that is located in my shop which is in a barn about 150 feet from the house. I wanted to be able to use the radio in both the barn and the house without moving it. One solution to this problem is described here.

The system I developed allows me to dial up any one of four channels in my two-meter radio. This is done using a standard dial telephone with a minor modification for push-to-talk operation. The telephone is connected to a controller via a single pair of wires that can be several hundred feet long. Several phones may be connected to the line, although only one may be used at a time. Of course, the telephone may be moved about by using jacks.

I'll review a little of telephone basics, go into the development of the system, talk about construction details and adjustments, and offer some afterthoughts that you may want to include in your version. Successful duplication of the ideas presented depends on how resourceful you are, as some of the relays and transformers may be difficult to find.

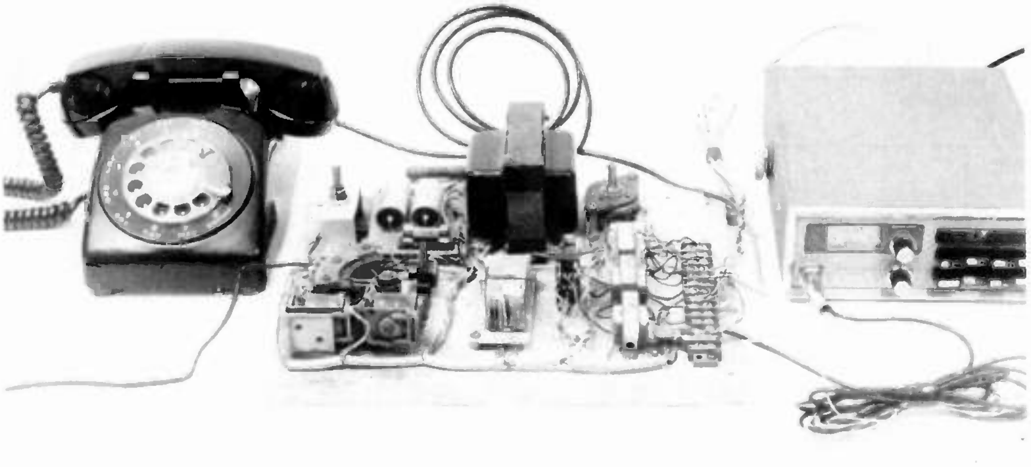

Photo A. Overall view of the remote two-meter dial-up system. The telephone can be located several hundred feet away from the radio and its controller.

Basic Terminology

We all use the telephone every day. It seems to be a simple enough device, and on close inspection, it is. Fig. 1 shows the basic circuit from the telephone to the central office. The two wires that connect these two locations are a twisted, balanced pair with a typical characteristic impedance of 600 Ohms. Longitudinal balance describes how closely each conductor matches the other along the

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...vide a dc bias current
...or the carbon microphone in the telephone. When you lift the telephone "off hook," the dc circuit is completed with current flowing through the microphone. When you turn the dial clockwise to the stop, a spring is wound up in the dial. When the dial is released, the spring returns the dial and a set of contacts opens and closes once for each digit dialed at a rate of 10 pulses per second. Many modern central offices can respond to 20 pulses per second, so some phones are so equipped. A tone-dial phone still requires a dc continuous circuit to tell the central office when it is off hook and to have dc bias for the carbon microphone and tone generating circuits.

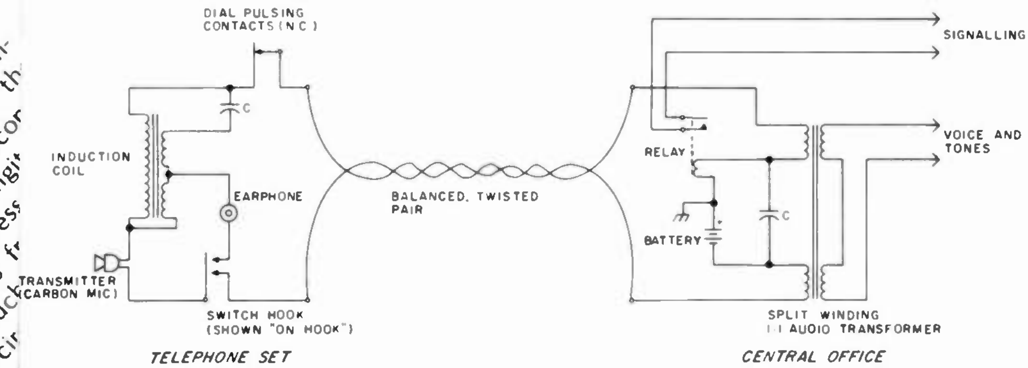

Fig. 1. Basic telephone circuit. Note that dc current flows from the central office battery through the carbon microphone—but only when the switch is "off hook."

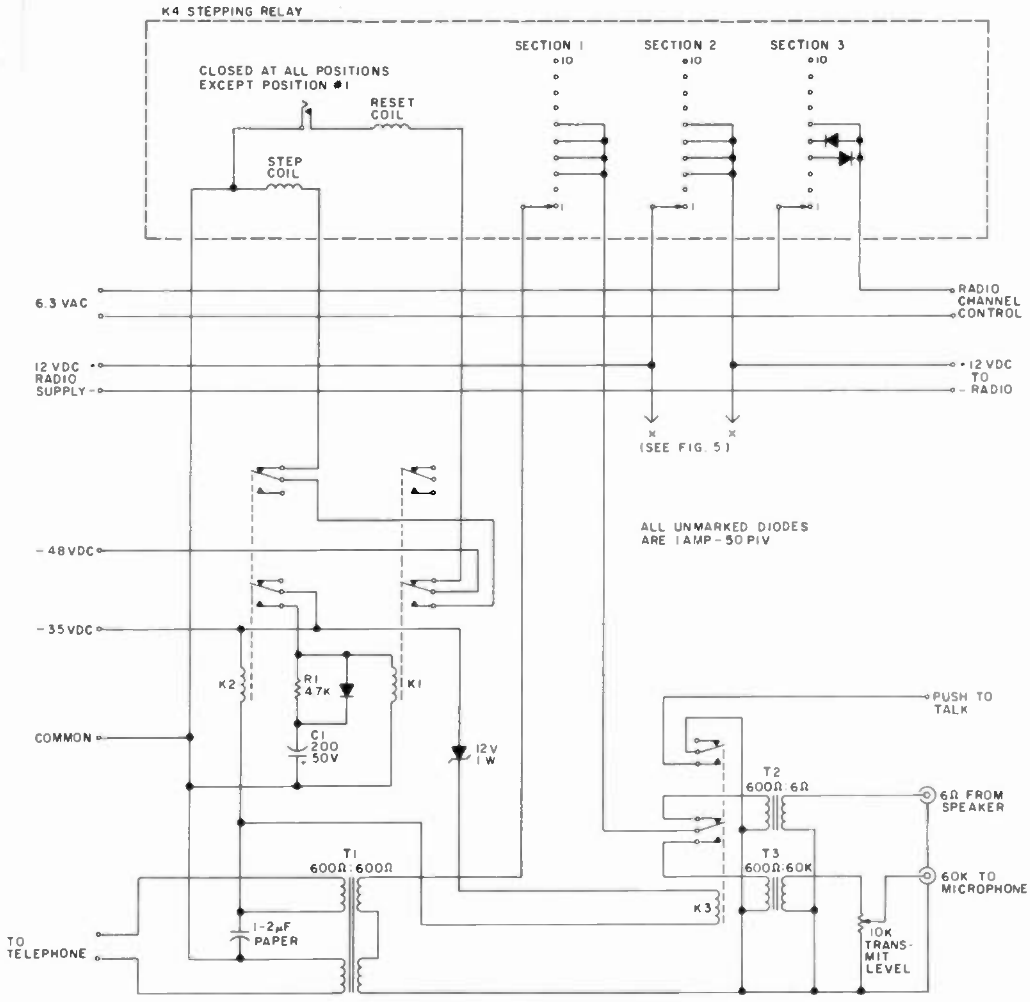

Fig. 2. Schematic diagram of the dial-up two-meter remote controller.

At the central end of the circuit, note the one-to-one ratio transformer with a split winding on one side. This transformer allows the insertion of dc current and the picking off of the control signals while maintaining the circuit balance to ground. At the same time, voice and tone signaling (if applicable) are coupled through to the other side of the transformer. The capacitor shunting the power supply and relay coil on the line side of the transformer bypasses audio frequencies.

The circuit shown in Fig. 1 is the basis of my two-meter dial-up remote controller. I won't go further into the operation of the central office, but if anyone is interested in further study in this area, *Basic Telephone Switching Systems* by David Talley (Hayden Book Company, New York NY) makes good reading.

Development of the Dial-Up Remote

There are three control functions that must be provided in the two-meter dial-up system: the off-hook condition, dial pulses, and push-to-talk function. These three functions are provided by relays K1, K2, and K3, respectively, in Fig. 2. The telephone set itself must be modified to provide push-to-talk operation. More about this later.

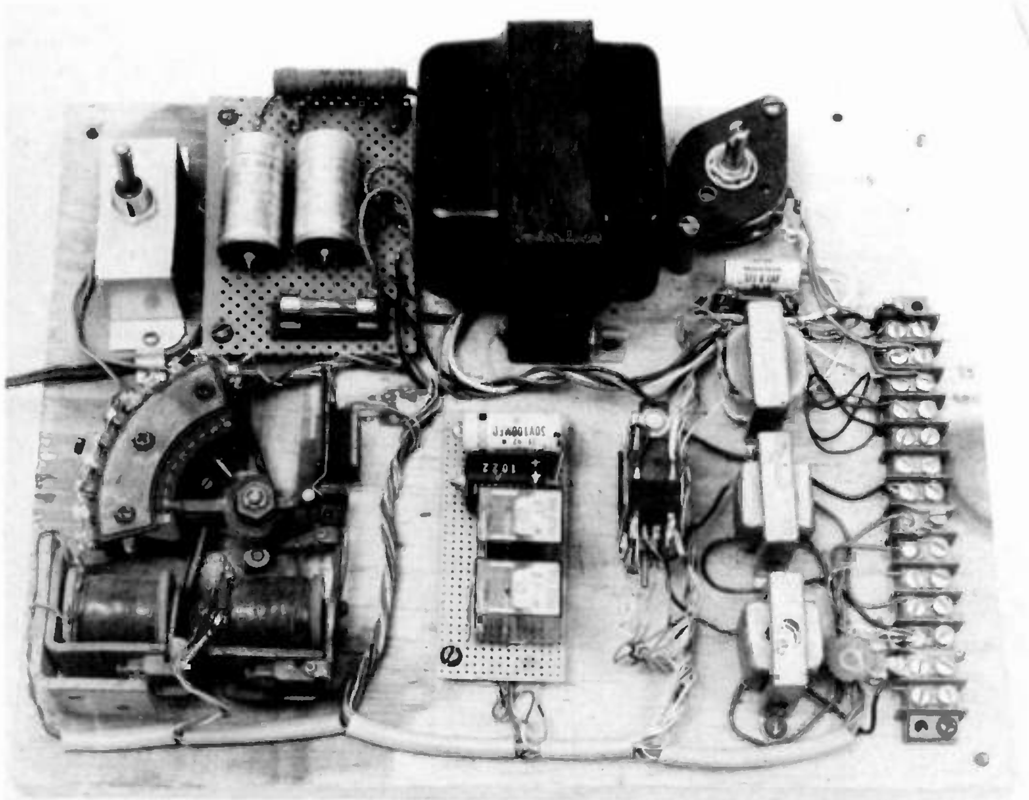

Photo B. *The controller with power supply at the rear, stepping relay at the left, K1, K2, and K3 in the middle, and the audio transformers next to the terminal strip on the right.*

When the telephone receiver is lifted off hook, the dc circuit is completed from the 35-volt source to K2 and to the series combination of the 12-volt zener diode and K3. Contacts on K2 apply 35 volts to K1 and charge C1 through R1. R1 is necessary to prevent contact arcing on K2. Now that K1 is picked up, the 48-volt source is removed from the reset coil on the stepping relay and applied to contacts on K2 which are connected to the stepping coil. A separate 48-volt source was necessary because of the particular stepping relay that I had available.

What happens now if the dc loop to the telephone set is broken for a fraction of a second by dialing a "1"? Relay K2 drops out for a brief period and picks up again when the dc loop is again completed. This removes the 35-volt source from K1 briefly, but the charge on C1 holds K1 closed through the diode. The 48-volt supply is therefore maintained to the contacts on K2 which close for the brief time that K2 drops out. This applies a single pulse of 48 volts to the stepping coil, advancing the switches one step to position two.

If you were to hang up at this time, relay K2 would immediately drop out. Relay K1 would remain energized for about one-half second because of the charge on C1. When K1 finally drops out, the 48-volt supply is applied to the reset coil. Because the switches are not in position one, the reset contacts on the stepping relay are closed. The reset coil will therefore reset the switches to position one, at which point the reset contacts on the stepping relay again would be open.

If we now lift the receiver and dial, for example, a three, the switches will advance to position four and stay there until we hang up again. Note that the stepping and reset coils never have voltage applied for any length of time. They usually are rated for intermittent duty only. Note also that dialing 12 or 21 has the same effect as dialing a three.

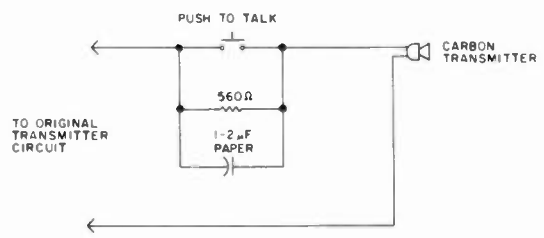

Fig. 3. Telephone set modification for push-to-talk operation.

Fig. 3 shows the modification for push-to-talk parallel

b… tor the at a loop, ing i When t… ton in pressed, t… tor is short higher volt… and the serie… of K3 and the… A zener diode… series with K3 ra… resistor so all of t… difference brough… by pushing the push button would appear… the relay. The capa… shunts the resistor for v… frequencies.

Relay K3 must be selected carefully. It must have a drop-out voltage not much less than its pick-up voltage. The unit I used has a 12-volt coil and is a plug-in type from an old IBM keypunch machine. Most 12-volt relays will pick up at about 10 volts but many will not drop out once picked up until the voltage is less than three or four volts. The variable resistor in the power supply (Fig. 5) is adjusted for proper push-to-talk operation. You may want to experiment with electronic circuits to sense the push-to-talk voltage change and which would, in turn, drive the push-to-talk relay. Another alternative would be to run a separate pair of wires for the push-to-talk button.

The push-to-talk relay, K3, grounds the push-to-talk line to the radio and switches the 600-Ohm audio from the split-winding transformer, T1, between the radio microphone input and speaker output. Impedance matching is required on both of these circuits. I used some small, 120-to-12-volt (10:1 ratio) filament

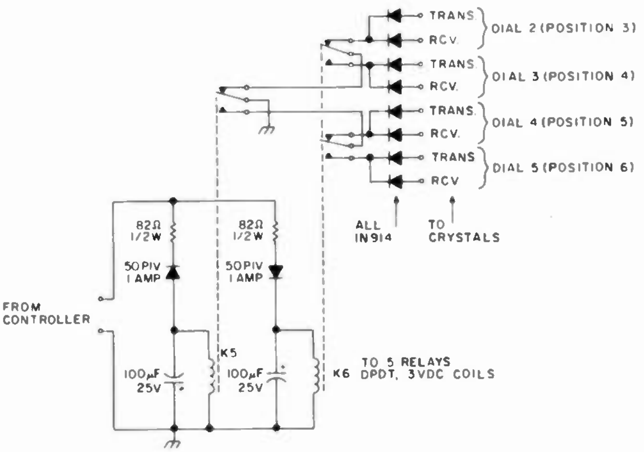

Fig. 4. Channel-change circuit located in the radio.

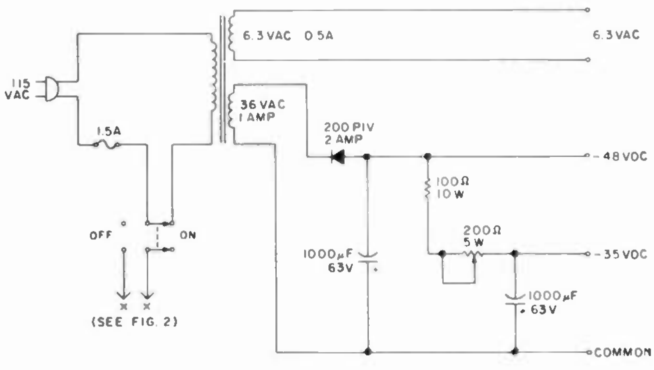

Fig. 5. Power supply schematic diagram.

transformers from my junk box.

The stepping relay that I used has three switch sections. It is a C. P. Clare model A321033 that was salvaged from an electrical circuit recloser. One section is used to connect the telephone circuit to the radio. This allows me to dial up other devices on other positions of the stepping relay, such as a weather receiver. The second section turns on the power to the two-meter transceiver. The third section changes channels in the radio. Stepping relays are available from time to time from surplus outlets such as Fair Radio Sales, 1016 East Eureka Street, PO Box 1105, Lima OH 45802.

Fig. 4 shows the channel-change circuit. Two miniature relays are used to select the appropriate crystals in the Heath HW-202. The resistors in series with the relays are necessary because the relays I had available have 3-volt coils. Note that when the stepping relay is in position three, neither relay is energized. When in position four, K6 is picked up, when in position five, K5 is picked up, and when in position six, both relays are picked up.

In each case, a different pair of crystal switching diodes is grounded. I disconnected the radio switch grounds from the chassis ground and reconnected them to be grounded when neither relay is energized, position three. This allows me to select with the radio switches which channel will be selected when dialing a two. It also allows the radio channel switches to function normally when not connected to the controller or when the controller is switched off. The other three positions are connected to the crystals of the most commonly used channels.

The power supply, Fig. 5, is straightforward. A small amount of 6.3-volt ac power is required for the channel-changing circuit. The 36-volt secondary on the transformer gives about 48 to 50 volts dc for the stepping relay. It must be capable of supplying the intermittent current requirements of the stepping relay, about 1 Ampere in my case.

Dropping resistors are used to supply a lower voltage for operation of K1, K2, and K3. This voltage should be relatively hum free as it is also used to bias the carbon microphone. The dropping resistor is made variable to allow setting the push-to-talk operating point. Positive grounds are used as this is telephone system convention but it certainly isn't necessary. If negative grounds are desired, it is only necessary to reverse the polarity of C1, the diodes associated with K1 and K3, and, of course, the power supply capaci-

Photo C. Modified telephone set. Note the push-to-talk button in the handset and the resistor-capacitor combination mounted on the added terminal strip.

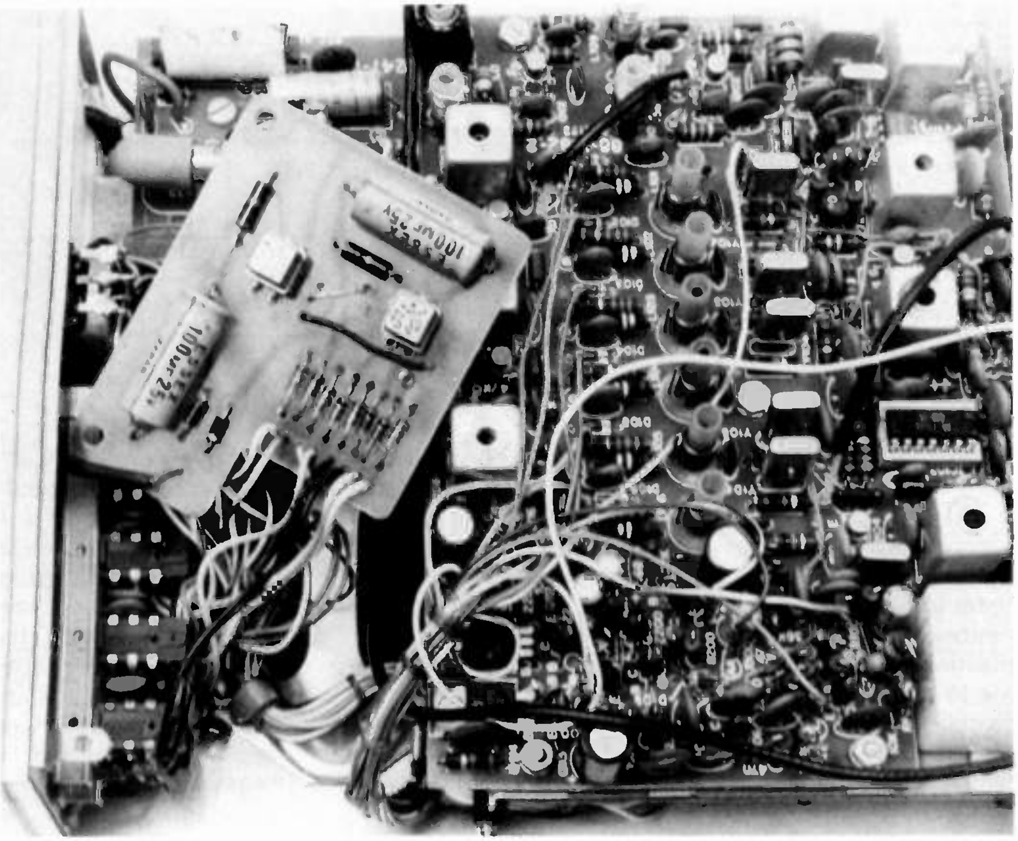

Photo D. Channel-change relay circuit board. The ungrounded side of the circuit pokes through the plastic filler where the burst encoder push-buttons would be located.

tors and diodes. Power supply requirements for other versions will probably be different depending on what relays the junk box and local surplus outlet may yield. Switch S1 turns on the power to the radio when switching the controller off so that the radio can be used in a normal fashion.

Construction

As can be seen by the photos, I mounted all components on a piece of wood. While this method of construction is simple and effective, it is not terribly attractive. I plan to reconstruct the unit in a 3″×10″×17″ chassis mounted on a 3½″×19″ relay rack panel. Layout is not critical.

Modification of the telephone consists of removing the bells to make room for a terminal strip on which to mount the added resistor and capacitor. See Photo C. The handset must be changed to a push-to-talk type (available from Graybar Supply, 345 Harrison Avenue, Boston MA 02118, and from Fair Radio Sales, previously mentioned). The resistor-capacitor-switch combination can be inserted anywhere in the dc current loop.

The channel-change relay circuit board (Photo D) was etched using a Radio Shack etch resist pen and etchant. The board is simple enough that no fancy techniques are required. Foil layout will vary depending on your radio and the relays you can find. The ungrounded side of the channel-change circuit clips to the wire poking through the plastic filler where the burst encoder would go. This can be seen in Photo A.

Cables between the controller and the radio should be only a few feet long because of the high-impedance microphone circuit. Run a separate return lead for the channel-change circuit. Otherwise, the return current will flow on the microphone cable sheath resulting in transmitted hum.

The 12-volt dc leads should be fairly heavy to carry the 2.5 Amperes or so required on transmit. The push-to-talk lead goes into the microphone connector with the microphone cable. Make the speaker connection to the remote speaker outlet and throw the speaker switch on the radio.

The connection between the telephone and the controller is a single pair of telephone wires, typically number 19. I use about 150 feet of ordinary telephone wire, but distances up to one-half mile or possibly more should work. The limiting factor will probably be getting the push-to-talk relay to operate properly due to additional resistance of the phone line.

Adjustments and Operation

The first adjustment is to set the variable resistor in the 35-volt portion of the power supply. Start by setting it for maximum resistance. Then with the push-to-talk button on the telephone pressed, decrease the resistance until K3 picks up. Note the position of the resistor shaft. Releasing the button should cause the relay to drop out. If it doesn't, the push-to-talk relay you've selected must be replaced with a different type with a higher drop-out voltage. Assuming your relay did drop out, continue decreasing the resistance while pressing and releasing the button. Note the point where the relay will no longer drop out. Set the variable resistor midway between this point and the point where the relay first picked up.

Setting the transmit level can be done several ways. The ideal way would be to use a deviation meter. Barring that, connect a VTVM set for ac to the microphone connector terminals at the radio. Note the level range for normal speech while using the radio's microphone. Now disconnect the microphone and connect the controller. Adjust the transmit level on the controller for a similar range while speaking normally into the telephone microphone. A third possibility would be to use on-the-air reports.

Once you've gotten everything working, operation is very simple. Lift the telephone receiver and dial a two for the channel selected on the radio switches, a three, a four, or a five for the specific channels you've chosen. You'll need to set the volume for a comfortable level in the telephone receiver. By switching the power supply to the off position, reconnecting the microphone, and switching back to the internal speaker, the radio is restored to normal operation including the channel selector switches.

Afterthoughts

If you don't mind running extra conductors between the controller and the radio, it would be simpler to run separate conductors for each channel rather than to use the relay switching scheme. The 6.3-volt winding wouldn't be required on the power transformer and there would be no concern about transmitting hum from the channel-change circuit. Also, more channels could be dialed.

Some stepping relays available from surplus outlets have more than 20 positions. All positions could be used by dialing digits that add up to the desired position minus one. For instance, to step to position 19 you would dial "99", "80", or "08".

The output of a dial-tone generator could be connected to position one of section one of the stepping relay.

You might leave power connected to the radio at all times and have a tone-dial decoder on the audio output ring a bell. Fellow hams can then reach you by using their tone-dial pads without you having to monitor the channel. Position one of section three of the stepping relay would select the appropriate channel.

Conclusions

I've described a system that will dial up channels remotely in a two-meter FM radio using a standard dial telephone. With it you can place as many remotes as you want at considerable distance from the radio on a single pair of wires. It has been in everyday operation. I've also offered some ideas for expansion to include other services. With this system as a basis, use your imagination and you can develop a great system to suit your own needs. ■

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Readout	LCD (full 6 digits)	LCD (4 digits)	LCD (4 digits)
Memory Channels	10	10	10
Memory of Offsets	YES	NO	NO
Memory Backup	YES, Capacitance	Yes, Lithium Batt.	Yes, Lithium Batt.
Search Mode	YES	NO	NO
Step Size	5-100 kHz	5 or 10 kHz only	5-30 kHz
Battery	Quick Change Pack 500 ma-hr, 9.6 V	Quick Change Pack 450 ma-hr, 10.8 V	Slide-on Pack 400 ma-hr, 8.4 V
Frequency Coverage	142-148.995 Tx (149.995 optional) 142-149.995 Rx	143.5-148.495 Tx/Rx	143.9-148.995 Tx/Rx
Power (max)	3.5 W High 1.0 W Med. 0.1 W Low	2.5 W High 0.2 W Low	2.5 W High
Priority	YES (in Mem Scan)	Yes (Priority Ch.)	NO
Clock	YES	NO	NO
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Display	6 Digits + Mem. #	4 Digits + Mem. #	4 Digits

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Improving God's IDer

Put more flexibility in the K2OAW circuit—and save the advantages of the original.

I have been a fan of Peter Stark's K2OAW IDer ever since the original design first graced these pages back in 1973. The simplicity of programming the thing, the low parts count requirement, and the lack of those hated Kernaugh maps made this, for me, the ideal IDer circuit. In the years since its first appearance, I have built maybe half a dozen of these circuits for my various repeaters and those of a few of my friends.[1]

With the advent of the FCC's decision to drop "R" calls for repeaters, regular

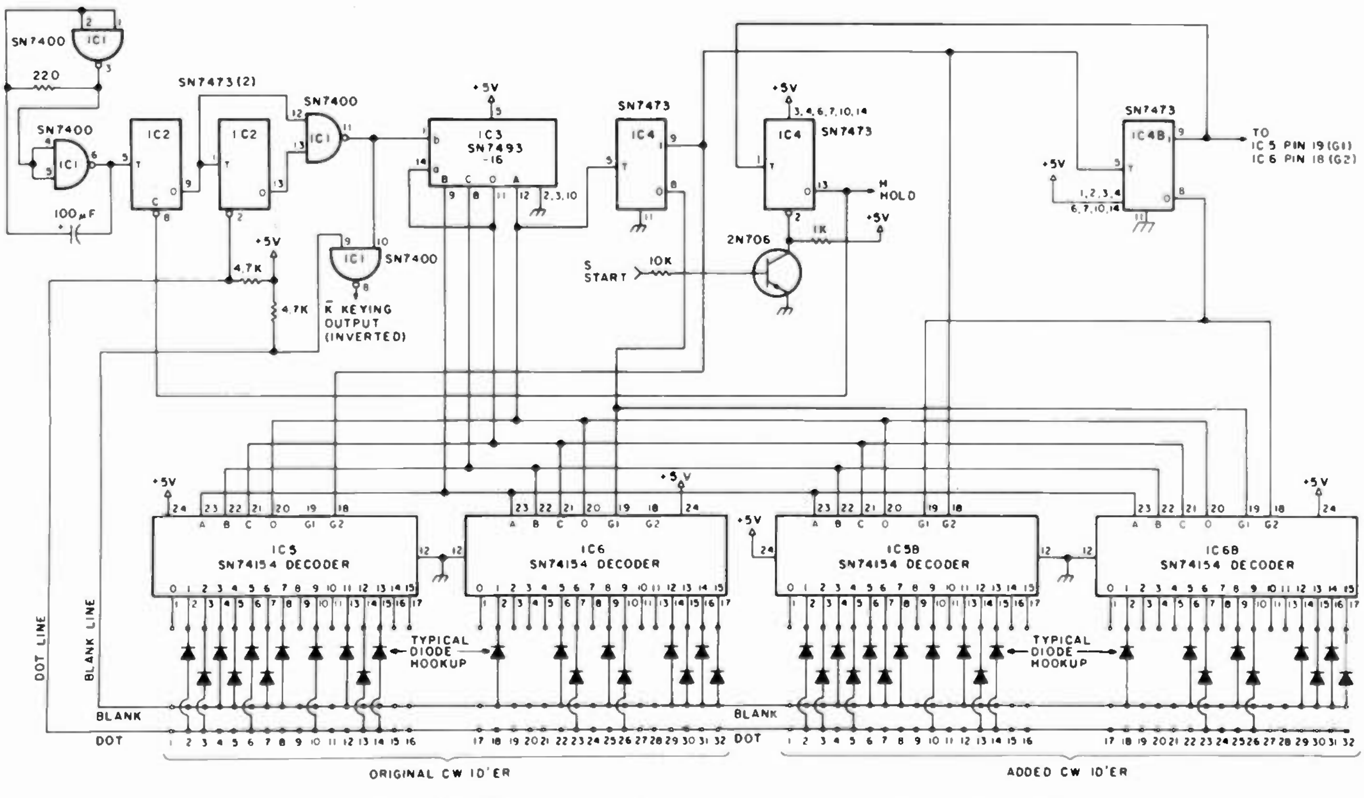

Fig. 1. K2OAW ID circuit update as it appeared in 73 in June, 1979.

amateur callsigns, followed by "RPT" or "/R", have generally necessitated more character space than the old K2OAW circuit could provide. So, a couple of years ago, Peter obliged the troops with an update of that original design which doubled, from 32 to 64 characters, the amount of information available for use in the IDer.[2]

However, though a lot of us need more than 32 characters for our ID, we don't always need *all* 64 of 'em, particularly those of us who believe that a repeater ID should say its legal piece and shut up. So, for those who wish to keep the ID process from continuing long after the CW is gone and to save a lot of diodes for the blank line, I hereby propose the "K2OAW IDer Update Update." As you will see, the improvements cover a lot more than what I've talked about so far.

Fig. 1 is the K2OAW ID circuit update as it appeared in the June, 1979, *73*. Peter added just 3 ICs, a 7473 (IC4B), and two 74154s (IC5B and IC6B) to accomplish the doubling of capacity. I changed the "ID hold" half of the original 7473 IC4B to a 74C76 (C? Yeah. Read on.), now called Z11A, and added one more IC, Z8, a 74C02 quad NOR gate. A 4001 would work just as well. To top things off, IC1A and IC1B, which comprised the clock oscillator in the original K2OAW circuit and its update, were scrubbed in favor of one half of an NE556 timer chip, running in the astable mode, with the other half being used for the ID audio oscillator. More on this later.

Fig. 2 shows how the two IC changes were implemented in the circuit. At the point in the ID where a stop bit is desired, two diodes are run to the appropriate pin on the 74C154 matrix, with one diode further connected to the dot line and the other attached to the blank line. The inputs of one gate of the 74C02 (Z8B) are connected to the dot and blank lines. This gate actually functions as a negative logic AND gate. When this aforementioned stop pin pulls both lines low together, the output of Z8B goes high.

This output is sent to two places, the "zero set" pins of Z3, which heretofore were grounded, and an inverter made from Z8A. Bringing the zero set pins on Z3 high sets all of its BCD outputs low. Grounding them allows the IC to operate normally.

The output of inverter Z8A feeds the "set" input on one half of the 74C76, Z11. A momentary low on this pin drives the $\overline{Q}$ output (also known as the ID hold line) low, halting the ID process in its tracks.

Z7A, half of the NE556, replaced IC1A and IC1B in the old circuit because the 556 is a much more reliable circuit, in my experience. The other half of the 556 is used in the astable mode as the ID tone generator.

IC1A and IC1B are not wasted, however. IC1B, now Z1B, is used to replace Q1, a 2N706 from the original ID circuit. It is connected as an inverter between the start line and the clear input of the 74C76. IC1A, now Z1A, is also used as an inverter, the input

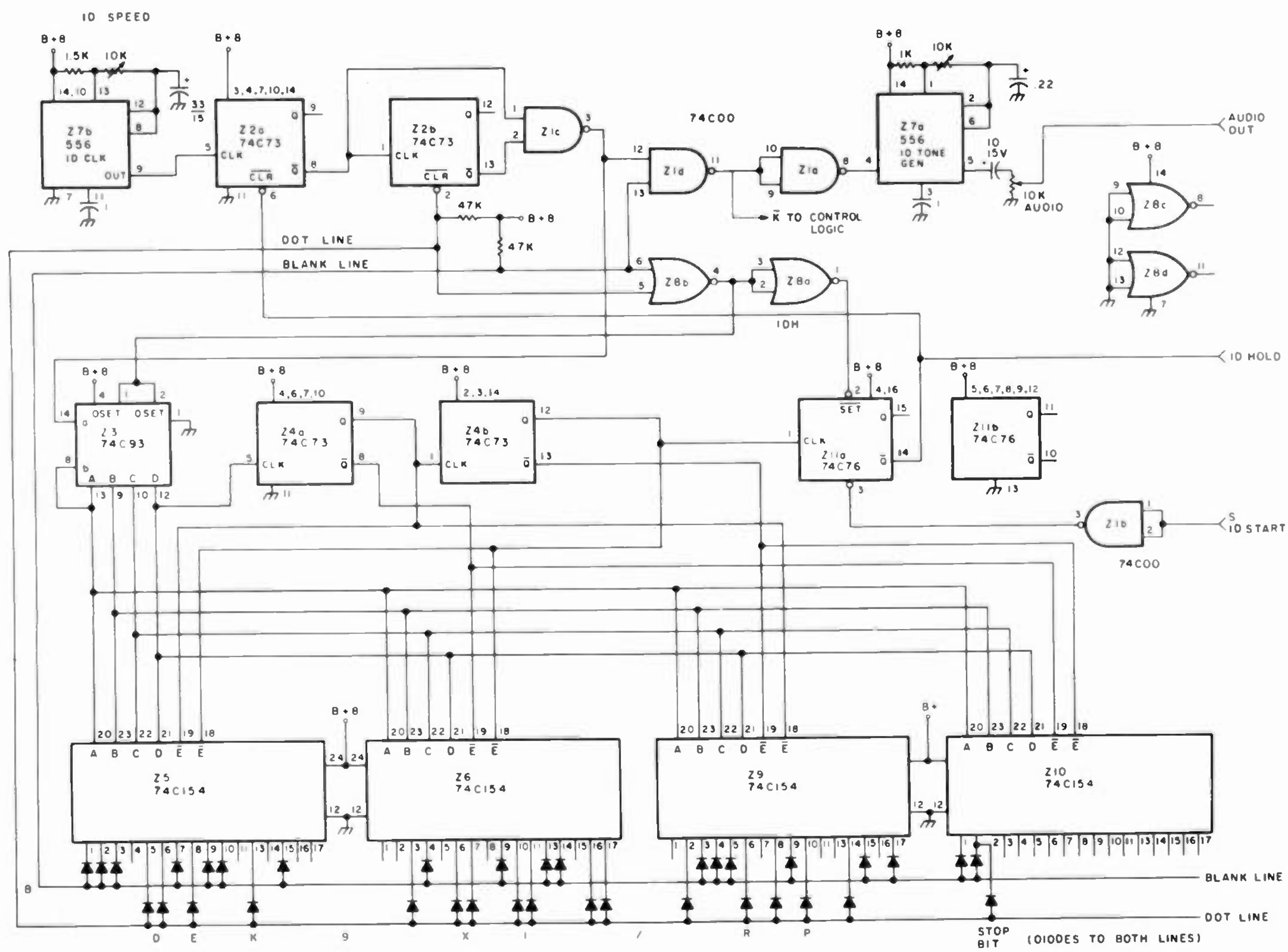

Fig. 2. The K2OAW update update.

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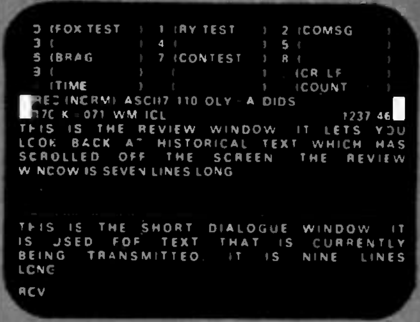
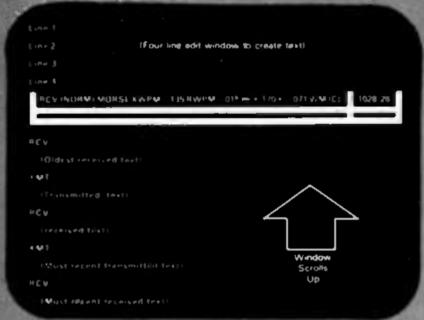


TRS-80 NORMAL DISPLAY



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connected to the $\overline{K}$ (keying) line, and the output connected to the reset pin of Z7B, keying the tone for the ID. The $\overline{K}$ line is still used for logic purposes.

The remaining two gates of Z8 are not used in this design and their inputs are grounded. Don't forget to tie all inputs of the other half of the 74C76 high. Leave the outputs floating.

Although this circuit adds 2 ICs to the design, it subtracts one transistor, and if your ID is short enough, you may be able to leave out Z10 as well, thus saving that expense. And you get a tone generator, a more reliable clock, and other improvements in the bargain.

About the 74C series: I switched all of my TTL to CMOS/TTL (by National Semiconductor) some time back. The savings in current is worth it, and the voltage requirement is not finicky like TTL. I use 8 volts on all my CMOS and timers.

One *caveat*: The 74C ICs used here are pin-for-pin replacements for their TTL counterparts *except* for the 74C93. If you're planning to retrofit an existing circuit and convert your 7493 to CMOS, you will have to rewire that part of the circuit.

With these modifications, I feel that the K2OAW IDer is the ultimate ID circuit. If you have one in use now and update to the circuit described here, I think you'll agree that the best has been made better. ■

References

1. Stark, "A Complete Repeater Control Circuit and ID," *73*, February and March, 1973.
2. Stark, "Update on the K2OAW ID Circuit," *73*, June, 1979.

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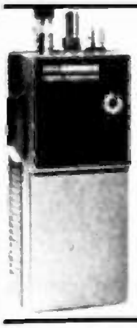

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The Bunesti Caper

The two British agents needed a power amp—fast. Could the American ham build one?

December 7, 1941, was a day of glory and achievement for the Japanese Empire because of the unbelievably effective attack upon military installations in Hawaii. In England, the long hoped-for involvement of America in the war now seemed assured. The "Day of Infamy," however, also brought a special sort of gloom and silence to one small segment of the American population—the amateur radio operators.

Photo A. The crew of Destiny Deb *prior to its final combat mission to Ploesti, Rumania. (The little guy on the left in the front row is W9PJF.)*

In the midwest that night, most of the ham bands were full of stations relaying the FCC announcement that all radio amateur activity was to cease immediately. It seemed that almost every ham in the country was trying to make as many contacts as possible that last night. I kept my 20-Watt AM rig (push-pull 45s modulated by 47s) going on 160 meters until well past midnight, but finally closed down when I got too sleepy to continue.

The next morning, I turned on my Howard 435A receiver and heard a couple of guys yakking away just as though the Pearl Harbor attack had never occurred. Naturally, I cranked up the rig and told them of the FCC notice. They claimed that my call was the first they had heard about it and that they thought their receivers had been "desensitized by a storm." Of course, I didn' believe them for even a ond, but that short 8 December 1941 my last ham World War II as

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After graduation from high school, I found that the Army Air Corps was glad to have my services, but they insisted that I go to Miami Beach for basic training. This was to introduce me to the finer points of the military organization, to teach me discipline and respect for authority, to enable me to distinguish between my left foot and my right foot, and to educate me in a host of related subjects such as KP, policing the area, saluting, scrubbing the barracks, why all relationships with females are dangerous, etc.

During my third day at basic, an announcement was made that all personnel who knew Morse code were to report to the administrative office at 1300 hours. I reported as ordered and was given a short code test that was sent at about 10 wpm. I don't think that I missed a letter, and the next day I was on a troop train bound for the radio school at Sioux Falls, South Dakota. In my hands were records showing that I had completed basic training (?) and a promotion order making me a PFC! Those long hours practicing code in order to pass the ham exam had finally paid off, since I avoided many miserable hours of close-order drill.

The Air Corps radio operator/mechanic school had a curriculum that covered basic theory, Morse code, and radio repair. It included an almost frightening amount of material in a very short time, but I was having a ball. The films, lectures, and demonstrations expanded and solidified my knowledge of the theories I had struggled with as a ham. The code classes were pretty much of a bore and I did not advance my speed very rapidly, but I did manage to pass 35 wpm. We were not allowed to use typewriters, however, so I felt that printing at 35 wpm wasn't too bad.

The practical part of the course was a snap, and I became reasonably proficient at the operation and maintenance of such items as the BC-221 frequency meter, BC-375 transmitter, BC-342 and BC-348 receivers, ARC-5-series HF transmitters and receivers, BC-610 transmitter, SCR-522 VHF transceiver, and miscellaneous aircraft electronic gear such as beacon receivers, the radio compass, interphone systems, etc. I was happy to be expanding my knowledge of electronics and was actually a bit sorry when I completed the course.

I declined an invitation to stay at Sioux Falls as an instructor and requested an assignment as a flight radio operator. Within a couple of days I was on another train, now enroute to Kingman, Arizona, this time to qualify as an aerial gunner. I spent some time on the train sewing on my new corporal stripes.

Gunnery school did not have the same fascination for me that I had felt at radio school. While all of the radio operators at gunnery school had to participate in weekly code practice sessions in order to maintain proficiency, I learned a lot more than I thought possible (or necessary) about the 50- and 30-caliber air-cooled machine guns, the 20 mm cannon, hydraulically- and electrically-operated gun turrets, and how to lead or lag moving targets in flight. We spent a few hours in the air shooting at airborne targets, but I enjoyed the skeet shooting part of the course most of all. We learned the basics of leading or lagging moving targets by shooting at clay pigeons from the back of a moving truck! On days off, we were encouraged to shoot regular skeet—the guns and ammo courtesy of Uncle Sam. After the moving truck training, the normal skeet seemed easy and I was soon 25 for 25 most of the time.

I was not sorry to finish the gunnery course although it had qualified me for the first "flight pay" of my life. I left Kingman as a brand new "Buck" Sergeant, and headed for a combat crew assignment at Tucson, Arizona.

It would take a whole

Photo B. Back in Italy just before returning to the USA, W9PJF points to the souvenir Rumanian Air Force pilot wings worn by "Charlie" Kourvelas, the tail gunner.

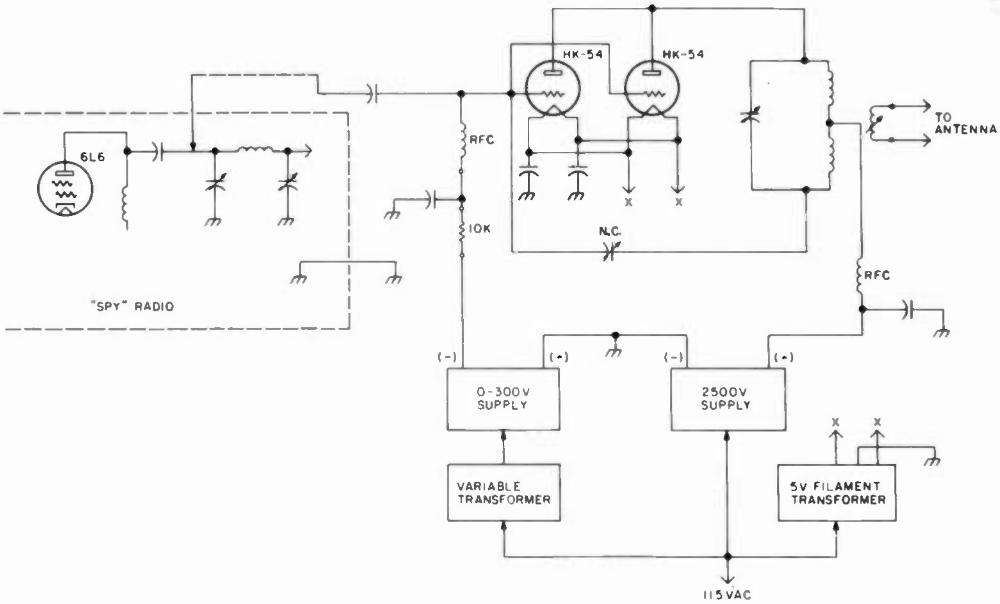

Fig. 1.

book to express my memories and feelings about our ten-man crew formed at Tucson. That crew became my family away from home, and a closeness developed between us that I have not experienced with any other group. Ten semi-trained civilians (four second lieutenants and six buck sergeants) became a reasonably competent crew for a B-24 Liberator, a heavy bomber. We soon were enroute overseas via Natal, Brazil, Dakar, West Africa, Marrakesh, and eventually to an austere base in southern Italy where our 450th Bomb Group joined the newly formed 15th Air Force.

I will always believe that aerial combat was at least as frightening as combat on the ground. Most of the time, our activities were conducted far inside enemy territory with the obvious risk of capture or death a long way from home base. We bombed a number of tough targets. We got shot at and were hit by fire from antiaircraft guns and fighter aircraft. We saw friends disappear in the cloud of an exploding aircraft, and we held back unmanly tears as corpsmen removed bodies from riddled airplanes. Our crew completed 34 missions with many close calls but with no physical wounds. Our flight engineer and I had been promoted to tech sergeant, and the other enlisted men now were staff sergeants. We were flying our third B-24, however: a nearly new one called *Destiny Deb*. Our first two aircraft had been totaled in crashes.

Our 35th mission was to bomb a target that was probably as well guarded as any in Europe. It was the oilfield/refinery complex at Ploesti, Rumania, which was a major source of petroleum products for the Nazi war effort. It was to be our second trip to Ploesti, and memories of the fighters and the intense antiaircraft fire were still fresh in our minds.

That mission turned out to be our last, as *Destiny Deb* was rocked by an enormous explosion just after we dropped our bomb load and while we were making a right descending turn to take up the return compass heading for Italy. An 88 mm shell had exploded between number two engine and the main fuselage, tearing a large hole in the fuselage and rupturing some fuel lines.

Only God knows why we were not immediately surrounded by flames. The number two engine quit immediately, and number three on the other side began to smoke. We fell well behind the squadron and obviously would soon be alone, an easy prey for any Luftwaffe fighters that saw our plight.

The Fates were again kind to us that day, however, and while the number one engine soon failed and power had to be reduced on number three, the old gal flew long enough for us to get well away from the target area. We realized that we would not see Italy very soon as reluctantly we parachuted out over open country near the small town of Bunesti, and soon we were uninvited and unwanted guests of the Rumanian government.

The life and times of a POW in that era cannot be described very well in a few sentences, but a great deal of my time was spent in planning what I might build as my postwar ham station. I was still constrained by my depression views, however, and my most grandiose design turned out to be a T-55 modulated by a pair of TZ-40s. For anten-

...as, I considered the 8JK ... 4 and 10 and perhaps a ... era ... hos... Zepp for 80 and ... ered ... other radio op- ... scheme ... weird p... Bucharest ... The A... June of 19... boost to our spirit of caut... began to spre... summer we trea... scrap of inform... could get about th... efforts in France. T... manians, however, more concerned ab... their own future in view... the failures of the Na... campaign in Russia.

The news of the war on the Eastern front reached us occasionally and, as the Russians advanced, our food improved measurably. The black bread was replaced by brown and the amount of meat in our thin stews seemed to be increased. The lieutenant in charge of our guards sometimes gave us copies of the local newspapers, and the rapid approach of the Russian troops to the Bucharest area was always a headline item. An aura of uncertainty and suspense appeared to envelope our captors and the element of fear could almost be felt. We heard rumors that British paratroopers had been captured, but it seemed hardly likely that any significant British airborne operation could be supported at this great distance from Italy.

One morning, an American major, accompanied by a Rumanian colonel and two men dressed in civilian clothes, entered our enlisted compound and asked if anyone had had any experience in building radio equipment. I explained my background in amateur radio and was told that two British agents had indeed parachuted into the area and that they needed a


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power amplifier for use with their small suitcase-sized radio station. Their transmitter provided only about 20 Watts of power, and they had been unable to contact their station in Egypt.

I must admit that I was a little confused by a situation wherein an agent of a nation at war with Rumania was to be assisted by an American prisoner of war in establishing radio contact with an Allied radio station in Egypt. The Rumanian colonel told me that the rapidly approaching Russian forces had created serious political problems and that the British communications arrangements had been approved by "high government officials."

I said that I could build a suitable amplifier if I had the necessary parts, and one of the civilians replied that parts were available. After trading my flying suit for a pair of pants and a shirt, in order to appear less military, I gathered up my small collection of personal belongings and left the prison camp by car in the company of the civilians and two other radio operators, Charlie P. Brewer from Beaumont, Texas, and Ray Jones, RAF, from Sutton, Surrey, England.

We were taken to a large building which must have been part of a university physics department. I was escorted to a room that was full of electronic equipment and told to select whatever I needed. I found many American-made parts and some power supplies that appeared to be operational. I selected some triode transmitting tubes (they were either the HK-54 Gammatrons by Heintz and Kaufman or the 35TGs by Eimac—my memories have been somewhat dimmed by the passage of some 37 years), a 2500-volt power supply, a 300-volt power supply, tube sockets, variable capacitors, wire, solder, a variable transformer (Variac), and an assortment of rf chokes, resistors, insulators, and fixed capacitors.

There was no heavy solid wire available, and I could find no meters or test equipment. I explained my need for wire or tubing to make coils, and one of the civilians said that he would bring some later. The parts that I selected were placed on a bench, and the civilian said they would be delivered to the transmitter location that afternoon.

We left the building and were driven to the Banca Nationale A Romania (The National Bank of Rumania). In one of the basement rooms we were introduced to the two British agents. One was a British captain and the other a Rumanian national who also was a lieutenant in the British army. They showed me their small transmitter/receiver, and I was happy to see that they had several extra coil sets available which I could use in the amplifier circuit.

When the parts from the school were delivered, I assembled a simple power amplifier on a piece of pine board. Electrically, it was a pair of power triodes in parallel (see Fig. 1). The 2500-volt supply provided the plate voltage, and the 300-volt supply, Variac controlled, provided the bias. I used two of the spare coils from the "spy" radio for the amplifier-plate coil and checked for approximate tuning by coupling the output from the small transmitter to the antenna link on the plate coil. Resonance was easily established by tuning for maximum rf voltage in the tank coil.

Next, I capacity-coupled the grids of the power amplifier to the plate of the 6L6 output tube in the small transmitter. I hooked a flashlight bulb to the output link and carefully read-

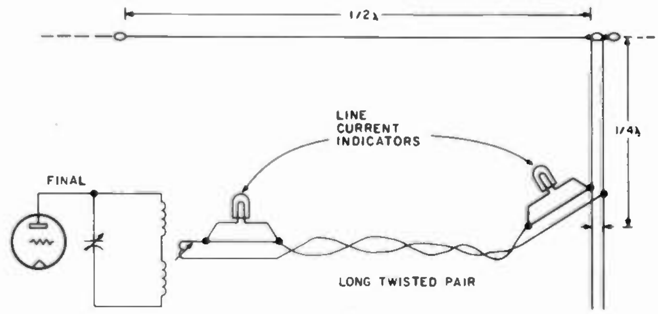

Fig. 2.

justed the amplifier plate, tuning for maximum output. Then the neutralizing capacitor was adjusted for minimum output, and the amplifier was ready for the first trial run. The flashlight bulb was replaced by a 300-Watt bulb, the bias voltage was set for maximum (−300 V) and the 2500-volt supply was turned on.

Surprisingly, nothing blew and no smoke appeared. By decreasing the bias voltage slowly and observing the intensity of the blue glow of the mercury-vapor rectifiers (866s) in the high-voltage supply, I could tell when the amplifier tubes began to draw plate current. I set the bias to a point where a definite plate current was evident and then keyed the small transmitter now being used as a driver for the amplifier. I was rewarded with a brilliantly glowing 300-Watt bulb and a large increase in the mercury-vapor glow.

The amplifier was indeed working and obviously was producing more radio energy than I had ever achieved with any of my ham gear. The only missing element now was an antenna, and the roof of the bank building was an awfully long way from the basement.

It was during this time period that a group of Rumanian leaders formed a provisional government, declared themselves the legal spokesmen, and agreed to cease combat activities against all Allied forces. I was introduced to Dr. Maniu who headed the provisional government and whose temporary abode was also in the basement of the bank. I understood that he had a long history of public service and was well thought of by the Rumanian people.

A man from the telephone company provided us with a large reel of twisted-pair telephone cable, a small reel of bare copper wire, and a great many glass insulators. Charlie, Ray, and I put a half-wave antenna with a quarter-wave matching stub on the roof and used the phone cable as a transmission line to the transmitter (see Fig. 2). The elevator shaft provided the shortest path for routing the cable between the roof and the basement.

During the installation of the antenna, the local German military authorities reacted immediately and harshly to the new government. Several Rumanian civilian facilities were bombed, and, for a few minutes one day while we were on the roof, we watched ME-109s dive-bomb nearby buildings. Luckily, the bank was not selected as a target.

I was concerned about the suitability of the phone cable as a radio-frequency transmission line because of the poor insulation and extreme length of the cable. (No one else there had ever heard about EO-1 cable). As it turned out, the phone cable was very lossy and the

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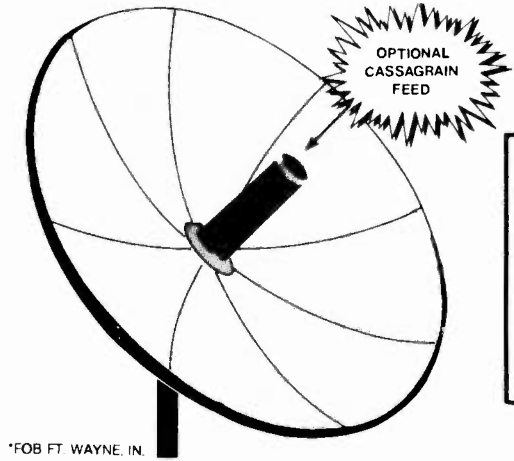

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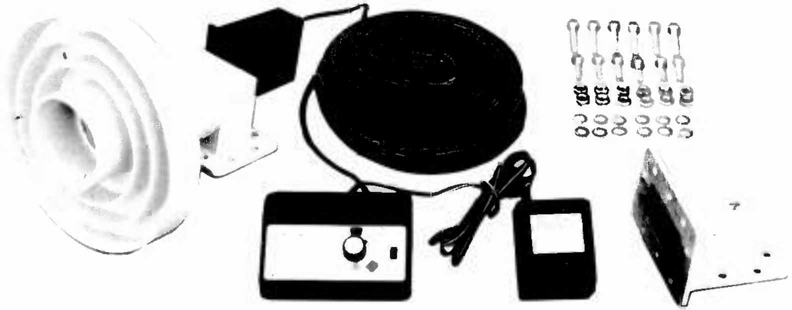

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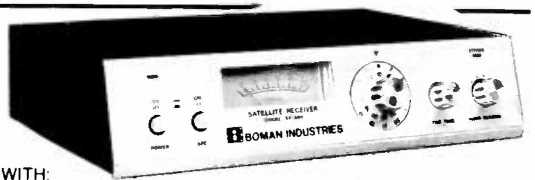

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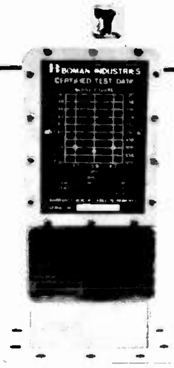

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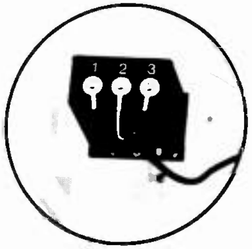

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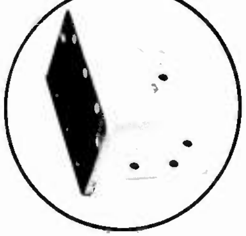

RIGHT ANGLE ADAPTER PERMITS VERTICAL OR RIGHT ANGLE LNA MOUNTING current flow into the antenna matching stub was much less than the current flow from the amplifier into the cable. In the final version of the antenna, the telephone cable was used as a single conductor connected to a water-pipe ground through the amplifier-output link. The cable length to the antenna was adjusted for best loading. This worked very well, and the British agents were soon in contact with the Allied radio station in Egypt. I have no idea of the purpose or content of their conversations as the messages were all encrypted—by use of the Bucharest telephone book.

The opportunity to improvise electronic equipment had been a splendid diversion, however, and during the two or three day period involved, I was directly concerned in an urgent project that was of value to our allies. During this period, I slept in the basement of the bank and food was sent in from a nearby restaurant. This was overwhelming in it's quantity, and I was never able to eat the entire portion. I took particular delight in the dill pickles since I had not tasted any since being shot down.

Within a few days, Russian troops entered Bucharest and the British and American POWs were flown to Italy in B-17 bombers with the protection of many P-51 fighter aircraft. We spent a few days visiting our respective squadrons and then departed from Naples for a fantastic voyage to the USA. By October of 1944, I was home on leave. I planned to ask for an assignment to a B-29 group so that I could get to the Pacific. That would also give me a chance to tinker with that new Collins rig, the ART-13. ■

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The Tube Returns

Move over, ICs. This receiver is easy to build, cheap, and works like a dream.

Bored with cranking out the contacts on your expensive transceiver? Been looking for a simple construction project to put some of the thrill back into ham radio? Maybe you'd just like to build something for the fun of seeing what you can make with that collection of old parts wasting away in the basement? If the answer is yes then this is for you.

Believe it or not, here is a surprisingly effective one-tube shortwave receiver you can build in a weekend. The cost is 0 to 15 dollars, depending on your resourcefulness. No slouch on performance, it will pull in just about every signal on the 80-meter ham band that an expensive commercial receiver will hear. As described here, it tunes from 3.5 to 7.5 MHz but the frequency range is determined by plug-in coils and can be extended easily in either direction.

Old-timers have already recognized this project as a regenerative receiver. This type of detector has its roots in the misty past of radio lore and its reputation for high sensitivity is well earned. Early amateurs found that putting an adjustable amount of positive feedback around a detector had several benefits: An astounding amount of gain was available, the selectivity of the associated tuned circuit was vastly increased, and with proper adjustment either AM or CW signals could be copied easily. If a dual triode is chosen for the tube, then one section can be the regenerative detector and the other an audio amplifier. The resulting receiver is easy to construct, sensitive, and inexpensive. It was a very popular design in the 1920s and 30s.

There are, of course, several drawbacks. To receive code signals the feedback is adjusted so the detector is just barely oscillating, and with that setting a long antenna blowing around in the wind can cause frequency instability on the higher bands. Since the detector is oscillating, a steady carrier can be broadcast via the antenna. A few microwatts isn't going very far but the ham next door might hear it. Furthermore, any receiver with a single tuned circuit will tune rather broadly. While that isn't too much of a problem when all of the signals in the band are of similar strength, a really strong station on a nearby frequency (within 30 kHz or so) can cause problems.

All of these problems were eventually solved with the development of the superheterodyne receiver, but the regenerative detector continued to be used, if to a lesser extent, because of its simplicity and sensitivity. Until the mid 1950s there was always a one-tube regen featured as a good beginner's receiver in the ARRL *Handbook*. Even in the 60s there were designs for simple superhet receivers using regenerative detectors and controlled amounts of i-f regeneration to sharpen selectivity.

So much for history; let's turn to the project at hand. This circuit is a distillation from several described in the literature of the 50s. I tried not to use components that would be difficult to locate today and I'll point out a lot of circuit alternatives to take care of the most likely junk-box shortages.

The receiver uses a plug-in coil—wound on the glass bulb of an extra octal tube—and covers 3.5 to 7.5 MHz. With that coil, the 80-meter band is covered with plenty of bandspread and the 40-meter band tunes pretty rapidly. You can wind other coils easily to cover 40 and 20 meters with plenty of bandspread.

The 80-meter tuning range is a good place to start since that band is not too crowded and the shortcomings of this simple receiver will be more pronounced on the higher frequency bands. The construction is genuine breadboard: very simple and easily adapted

Photos by W1GSL

The one-tube wonder at work.

to whatever parts you collect. The performance is remarkable. With a 30- to 50-foot endfed wire you will be able to copy just about everything on 80 meters, SSB included, without much problem. In fact, the 80-meter performance compares quite favorably with that of a 5- or 6-tube "all-wave" receiver. The regenerative detector won't tune as conveniently as the superhet, but with a little practice the results are the same.

The Circuit

The circuit diagram for my receiver is shown in Fig. 1. You can copy it exactly or use it as the starting point for your own version. Before getting into possible variations let's take a close look at Fig. 1.

The antenna is link-coupled to the detector coil through three or four turns of wire. This is the swinging coil visible in the photograph. There are two tuning knobs. One 365-pF section of the tuning capacitor from an old tube-type broadcast radio does the main tuning while a smaller, 140-pF variable, tapped down on the coil, is the slower tuning bandspread capacitor. A three- to four-turn feedback winding on the bottom end of the plug-in coil allows the detector to oscillate when the regeneration control is set high enough.

The plate lead from the detector triode is filtered clean of rf after running through that feedback winding and the audio is capacitively coupled into the grid of the audio-amplifier triode. An inductor (the primary of an audio-output transformer) keeps the audio from getting back to the power supply and a 25k pot sets the regeneration level by adjusting the detector's plate voltage.

The audio amplifier is pretty straightforward, except perhaps that the headphones are connected directly into the plate lead. This is simple and works well but please note that the B+ runs through the headphones and you should be mindful of the shock hazard. The headphone jack is wired so that the voltage doesn't appear on the external part of the jack (which is normally grounded) until the 'phones are plugged in and, of course, the jack is insulated completely from the front panel.

The power supply is correspondingly simple. Two small filament transformers feed each other back to back to provide both the 6.3 volts for the filament and a transformer-isolated 115 volts for the B+ supply.

Construction

The physical design is straight out of the 50s. A 7½- by 8-inch board is the base for the receiver, and most of the parts are mounted on terminal strips screwed to this board. The two tube sockets are mounted on 1-inch standoffs. The front panel is a piece of 1/16-inch aluminum to which are mounted the various controls. Most of the rf wiring is hung on the tuning capacitors, so it is important that the front panel be mechanically rigid and electrically shielding. These two conditions ensure a minimum of problems due to microphonics (audio noise in the headphones due to mechanical disturbance of the electrical parts) or hand effect (frequency shifts caused by circuit capacitance variations due to motion of the operator's hands near the receiver).

Behind the dials: A simple circuit and classic breadboard construction.

The antenna is coupled into the tuned circuit by means of a swinging link coil. As can be seen in the photograph, this link is mounted near the middle of a 5-inch length of 1/4-inch-

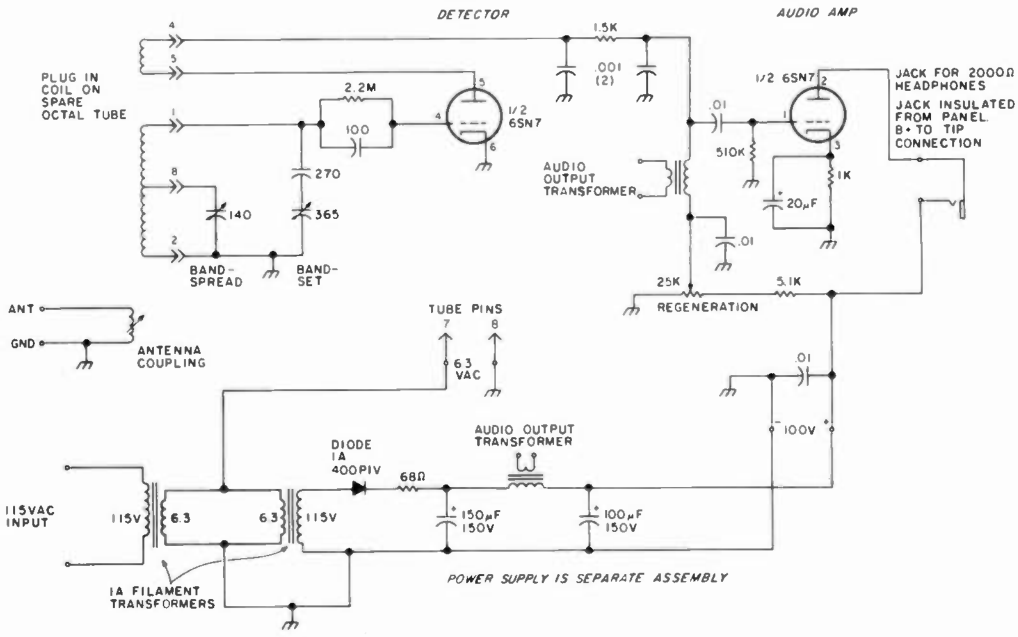


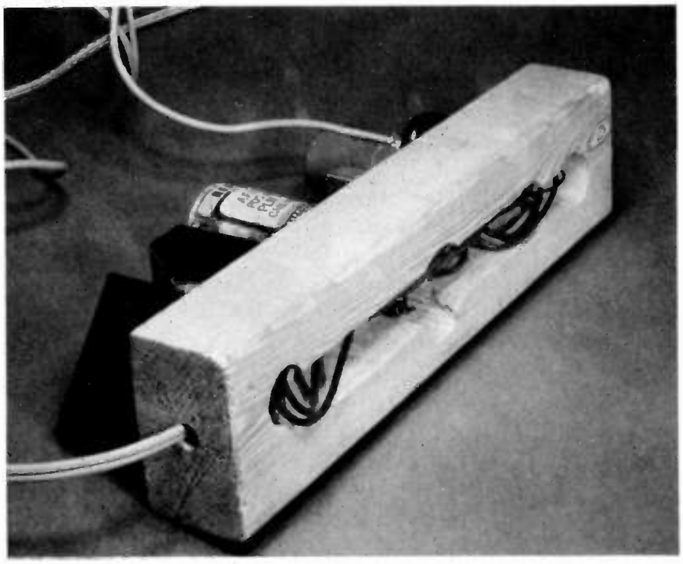
Fig. 1. One-tube receiver schematic.

diameter plastic rod. The rod need not be plastic—any insulating material will do, even wood. The rod is supported at the front panel by a bushing (which was salvaged from an old volume control in keeping with the spirit of the project) and at the other end by a wooden pillar having a 1/4-inch hole through it in the appropriate spot.

The link was formed by winding stiff wire around a wooden dowel slightly larger in diameter than the 6SN7 coil form. The wire is kept under as much tension as possible while winding. The time-honored method is to clamp one end of the length of wire in a vise and, with the wooden form held in both hands, lean back to put tension on the wire as you wind your way toward the vise.

The coil will spring out some when it is taken off the form and probably several turns at the start will be distorted. Save three or four good turns with an inch and a half or so of lead on them. When the rod and 6SN7 coil form are both mounted, you can measure where the antenna link will have to go on the shaft in order to swing over the coil. Drill a pair of wire-diameter-sized holes at the appropriate spots and mount the link through them.

The rest of the receiver layout is pretty well defined in the photographs. I used heavy wire for all of the rf wiring so that vibration-induced microphonic effects would be at a minimum. Your layout doesn't have to match mine exactly as you surely won't have a



The power supply: built on a hollowed-out length of 2 × 3.

matching collection of parts.

The construction style of the power supply is also historically motivated. The supply is built as a separate unit to minimize 60-cycle pickup in the receiver. I used a 1-foot-long section of wooden 2 by 3 with a slot jigsawed down the middle to contain the wiring. One concession was made to modern electronic design in the form of a silicon rectifier mounted on a terminal strip hidden under the "chassis." In earlier years, there would have been a 5Y3 or type-80 rectifier tube in the supply.

Alternate Parts and Circuits

Half the fun of building the one-tube receiver is coming up with a suitable collection of parts. The circuits are so noncritical that the builder can substitute with wild abandon and still have excellent results. This is especially true of the power-supply circuit.

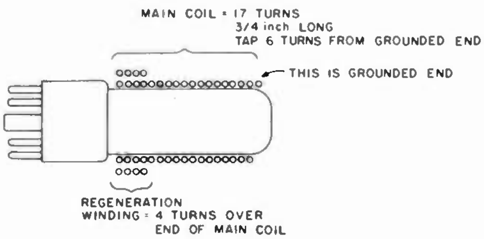


Fig. 2. Coil data for 3.5-7.5-MHz coil.

The receiver needs 6.3 volts ac at .6 Amps and 90 to 200 volts dc at 8 to 20 mA. If you're lucky, you will have a single small transformer providing these voltages and probably 5 volts as well (for a rectifier filament) that you won't need. I didn't have any suitable small power transformers, but I did have a collection of filament transformers. Two were wired back to back as indicated in Fig. 1.

Of course, it is all right to use a single large transformer if that's what's available. If the voltage is too high (250 volts or more), a 10 or 15k, 1-Watt resistor can always be used in place of the filter inductor. A really large transformer, like that from an old TV set, should probably be mounted on a metal chassis for safety's sake—an inverted cake pan will serve if the junk box lacks a chassis.

The rectifier I used is a small silicon unit rated at 1 Amp and 400 peak inverse volts. A full-wave bridge rectifier would be nicer since the 120-cycle ripple is easier to filter than the output of a single diode. The more filter capacitance the better. Don't be afraid to experiment with smaller amounts than I used, but be prepared to add more if hum is a problem. Be sure the capacitors are rated to work at voltages higher than they will see in the circuit. The filter inductor would ideally be a small 5- to 20-Henry unit rated at 20 mA or more. Small chokes, like small power transformers, are not too plentiful these days, so I used the primary of a salvaged TV set audio-output transformer instead.

An entire alternate receiver schematic is shown in Fig. 3. I haven't built a receiver using this schematic, but it is included here to illustrate a number of circuit variations. You can mix and match circuit features from Figs. 1 and 3 to make maximum use of the parts you have on hand. Note first how the antenna is capacitively coupled to the tuned circuit. If you have a small variable capacitor and a big knob, you may find this version easier to build than the swinging link. Both sides of the capacitor must be insulated from the panel and the large knob is desirable since placing your hand near the control shaft may influence the antenna coupling. This circuit arrangement was used in the 1952 ARRL *Handbook* receiver with a homemade capacitor constructed much along the lines of my swinging link—though plates were used instead of coils, of course.

If you have another small capacitor with a suitable shaft, you can use it as a bandspread capacitor. The smallest variable I had was 140 pF, so when I wound my coil I put a tap a few turns up from the ground end and connected that larger capacitor across only part of the coil. A 10- or 15-pF variable can go across the entire coil as shown in Fig. 3, and if you only have several 365-pF units, you can use a tap on the coil even closer to ground than mine. Don't overlook old FM radios as a

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The 100-pF coupling capacitor can be any value from 50 to 250 pF and the grid-leak resistor can range from 1 to 10 megohms. Even the tube itself can be changed; a 12AU7 or 6CG7 will work as well as the 6SN7, though the base wiring and filament needs will be different. Naturally a real plug-in coil form will work as well as the spare 6SN7 I used, and any straight-sided glass octal tube will do the job as well as a 6SN7. Be careful not to use both filament pins of a tube for coil connections unless the filament is burnt out. I used #24 solid insulated wire for winding the coils. The coil ends are brought down over the outside of the tube base and soldered to the ends of the pins. A dab of cement holds the wires in place on the glass.

One big change in the circuit of Fig. 2 is that the regeneration control has been replaced by a 365-pF variable capacitor. There is a good reason for this circuit change: lower adjustment noise. The trouble with the 25k pot used in Fig. 1 is that it has dc flowing through it. Carbon pots, unlike wire-wound ones, develop contact noise when used this way and eventually sound scratchy when rotated. I used the carbon pot because wire-wound ones are hard to find, but the variable-capacitor approach is a better solution to the problem and you may want to try it.

A 1- or 2.5-mH rf choke is used in the plate circuit and an audio-interstage transformer provides coupling to the audio amplifier. The audio-output transformer used for this purpose in Fig. 1 could also be replaced with any power-supply-type choke rated at more than 10 mA and 2 H or so inductance. Also shown in Fig. 2 is an audio transformer or supply choke used as a dc feed path for the audio amplifier. This permits ac coupling to the headphones and gets them out of the dc side of the circuit. If your main interest is in CW work, you may want to add some audio selectivity by placing a capacitor across the transformer winding as shown. The resulting tuned circuit can be set to the desired audio frequency by adjusting the capacitor value on a cut-and-try basis. The actual value will depend on the inductance of the transformer you have. Try starting with .01 or .05 uF and listen for an audio peak as you tune across a CW signal. Use a larger- or smaller-value capacitor to lower or raise the peak frequency as necessary.

Operation

Getting the most out of this little receiver is going to require some practice because the controls interact more than they do on a modern superhet. Peaking the preselector control on a transceiver may change the speaker volume a little, but you don't expect it to alter the i-f bandwidth or receiver tuning! Basic operation of the receiver is as follows: The main tuning is set to the approximate frequency of interest and the bandspread control to the middle of its range. The antenna-coupling link is positioned over the top of the coil and the regeneration control advanced. A "plop-hiss" noise in the headphones announces that the detector has started to oscillate. The control is positioned just after the oscillation starts and the receiver is tuned to a signal with the two tuning capacitors.

You will find that the sensitivity and selectivity are greatest with the regeneration set so the detector is close to the oscillation threshold. CW and SSB signals are copied with the detector oscillating, while for AM reception the regeneration is backed down just below the threshold. Often it is easiest to find a signal with the regeneration turned a bit to one side of the critical setting. Increasing the antenna coupling brings up the headphones volume but also reduces the amount of regeneration present and changes the received frequency slightly. The regeneration setting needed to maintain oscillation will vary some with frequency as well. All of this sounds more difficult than it really is. After a little experimentation, you'll find yourself pulling in an amazing number of signals.

Troubleshooting and Calibration

One side benefit of this design is that there is so little to go wrong. If the receiver is built according to the schematic and with good parts, it will most likely work when turned on. If it doesn't, and a series of circuit and voltage checks indicates that everything is OK, then the problem is probably with the regeneration coil. Try reversing the connection of the link winding. If the receiver cannot be made to oscillate on the lower end of the tuning range, then slide the feedback winding closer to the main coil. The coil dimensions recommended in Fig. 2 will surely get you off to a good start but you may wish to experiment with different geometries.

Once the receiver is pulling in signals, you will want to calibrate the dials. This is easy to do with the help of another receiver since the oscillating regenerative detector generates a weak carrier on the frequency to which it is tuned. Set the calibrated receiver to a given frequency, turn up the regeneration control on the little set, then sweep its bandset knob until you hear its carrier in the other receiver. At that setting the two receivers are listening to the same frequency. I glued a paper scale behind my tuning knobs and marked the bandset-dial

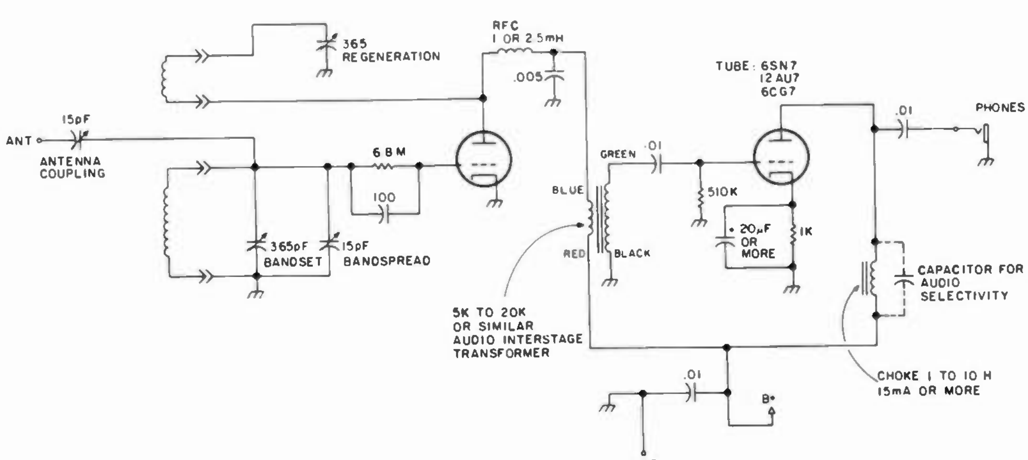

Fig. 3. Alternate schematic showing some possible circuit variations.

position at every half megahertz. The bandspread dial was marked for the 80-meter Novice band and the whole 40-meter band. Of course, the bandspread calibration is only accurate when the bandset knob is set properly.

Other Coils

Changing the tuning range means winding other plug-in coils. Simply use more turns to go down in frequency and fewer to go up. On the higher bands, space out the turns so the whole coil is 1/2 to 3/4 of an inch long. The number of regeneration turns should also increase or decrease one or two, in step with the main coil change. If your main tuning capacitor has two sections, you can place jumpers across otherwise unused coil pins and wire the socket to use both capacitor sections on low bands and only one on the higher frequencies.

A Word of Warning

This little receiver is really a lot of fun to operate. It is cheap to build and can be thrown together in a weekend. If there are a few spare octal tubes on hand, the frequency range can easily be extended in either direction. One word of caution is necessary though. The time will come when you tune across 80 meters with this set and realize that you *can* hear just about every signal on the band. In fact, you could actually use this little gem to make some real contacts (and enjoy shaking up the ham on the other end with a description of your receiver)! After you do that several times you'll naturally start to think about one-tube QRP transmitters. So when nosing around the local flea market for 6SN7s keep an eye out for a slightly larger power transformer, a 6AG7, some 80-meter crystals, and maybe a few old B&W plug-in coils. ■

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The Program That Knows It All

Repeater info, third-party agreements, you name it— this TRS-80 BASIC program knows it.

"Hey, OM. Shall I QRQ?"

"Er, uh, yeh. I guess." Boy, I sure wish I knew what he meant! Where did I put that list of Q-signals?

I operate contests quite a bit. I keep a dupe sheet in front of me, but I sure wish I could search through those calls faster!

Has it been ten minutes since I last IDed? Six minutes? Or 12?

Just showed that FCC examiner a few things and upgraded my license. Now let's explore this new territory . . . umm, how far down can I go? Am I in the phone portion of this new band?

Familiar situations? Well, now you can relax. This versatile program will put fun and pleasure back into your hamming. Just by inputting a bit of information about a repeater station (last three letters of its call, its frequency pair, or its location), the program will provide all the information concerning that repeater. If you are a contest operator, this program was made for you. It provides dupe sheet capability with memory and fast recall. No more lost contacts while you check your log to see if you worked that station. Those infrequently used Q-signals are now available when you need them and there is no more wondering whether that country has a third-party agreement before running the phone patch.

MENU OF COMMANDS
1. REPEATER INFO
2. CONTEST OPERATOR
3. Q-SIGNALS
4. THIRD-PARTY AGREEMENTS
5. IDER
6. FREQUENCY CHECK
7. EXIT
COMMAND?

Fig. 1. Sample run of commands available for user.

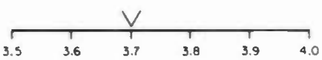

Fig. 2. Frequency check display showing 3.5-MHz band with operating frequency of 3.7 MHz. A display is provided for each band, 80-2 meters.

I remember when I upgraded and was operating on new and unfamiliar bands, I was constantly referring to a chart to see where the band limits were and if I was still in the phone or CW portion of the band. Before using this program, I still had to resort to that chart when I would occasionally operate on a seldom used band. Now the computer will verify the legality of my operating frequency and visually display where I am operating within that band.

Last but not least, the program provides a visual reminder to satisfy the station identification requirement and will give a flashing reminder when it is time to identify.

Written for the Radio Shack Level II TRS-80 with 16K memory, the program requires about 9K to run. Since there are no unique statements, it should readily adapt to other BASICs. The overall program is actually composed of seven different subprograms. By compartmentalizing it in this manner, the user may choose all or portions of the program to fit his particular needs or memory capability.

Program action is simple to follow. Just respond to the computer's requests and you cannot go astray. The program should be loaded and ready to use when the operator sits down for a hamming session. Then he will have all these capabilities at his fingertips.

Program Introduction: Statement lines 1 through 52 graphically introduce the program and ask the user to input his choice of subprograms. I have made extensive use of the INKEY$ function throughout the program. This allows faster responses and saves wasted effort by not having to use the ENTER key to input data. Safeguards have been incorporated to prevent the program from crashing if a wrong key is inadvertently hit.

Favorite Repeater: Statement lines 100 through 288 comprise the repeater infor-

See List of Advertisers on page 130

Program listing.

```
1 REM JACK MARTIN - W8XW
2 REM MAY 1980
9 CLEAR1000
10 DIMF$(10)
11 DIMC$(100)
12 CLS:PRINTCHR$(23)
14 PRINT@448,"*** H A M  H E L P E R ***"
16 FORY=1TO5
18 PRINT@710,"C Q  -  C Q  -  C Q"
20 FORX=1TO200:NEXTX
22 PRINT@710,"                              "
24 FORX=1TO200:NEXTX
26 NEXTY
28 CLS:PRINT"MENU OF COMMANDS"
30 PRINTSTRING$(55,"=");
32 PRINT:PRINT
34 PRINT"1. REPEATER INFO"
36 PRINT"2. CONTEST OPERATOR"
38 PRINT"3. Q - SIGNALS"
40 PRINT"4. THIRD - PARTY AGREEMENTS"
42 PRINT"5. ID 'ER"
44 PRINT"6. FREQUENCY CHECK"
46 PRINT"7. EXIT"
48 PRINT:PRINT"COMMAND?"
50 GOSUB10000:IFVAL(KB$)<1ORVAL(KB$)>8GOTO50
52 ONXGOTO100,300,500,700,900,1100,2100
100 CLS:PRINT"FAVORITE REPEATER INFO"
102 PRINT
104 PRINT"THIS PROGRAM WILL PROVIDE INFORMATION ABOUT"
106 PRINT"YOUR FAVORITE REPEATER(S). ENTER THE LAST"
108 PRINT"THREE LETTERS OF ITS CALL OR THE FREQUENCY"
110 PRINT"PAIR (13/73) OR THE NAME OF THE CITY WHERE"
112 PRINT"REPEATER IS LOCATED."
114 PRINT:PRINT
116 INPUT"STATION";S$
118 X=0:D$="DEG."
120 IFS$="ACO"ORS$="34/94"ORS$="BECKLEY"GOSUB200
121 IFS$="AER"ORS$="22/82"ORS$="CHARLESTON"GOSUB201
122 IFS$="AFE"ORS$="28/88"ORS$="ROANOKE"GOSUB202
198 IFX>0THEN282
199 GOTO280
200 PRINT"WR8ACO,34/94,350 ";D$;" ,BECKLEY,WV":X=1:RETURN
201 PRINT"WR8AER,22/82,345 ";D$;" ,CHARLESTON,WV":X=1:RETURN
202 PRINT"WR4AFE,28/88,76 ";D$;" ,ROANOKE,VA":X=1:RETURN
280 PRINT:PRINT"THAT STATION IS NOT ON FILE"
282 PRINT:PRINT"ANOTHER STATION (Y/N)?"
284 GOSUB10005
286 IFKB=89GOTO114
287 IFKB<>78GOTO284
288 IFKB=78GOTO28
300 CLS
302 PRINT"JUST ENTER CALL SIGN AND COMPUTER WILL LET"
304 PRINT"YOU KNOW IF IT IS A DUPLICATE."
306 PRINT:PRINT
308 INPUT"STATION (INPUT 'S' TO STOP):";A$
310 IFA$="S"GOTO28
312 LETX=0
314 X=X+1
316 IFC$(X)=""THEN322
318 IFC$(X)=A$THEN336
320 GOTO314
322 PRINT:PRINT"THAT IS A NEW ONE -- CALL IT"
324 PRINT:PRINT"WANT IT LOGGED (Y/N)?"
326 GOSUB10005
327 IFKB=89GOTO332
328 IFKB<>78GOTO326
330 IFKB=78GOTO306
332 LETC$(X)=A$
334 GOTO306
336 PRINT"ALREADY WORKED HIM --"
338 GOTO306
470 ,":"
475 ,":"
500 CLS:INPUT"Q - SIGNAL (ENTER 'S' TO STOP):";Q$
502 IFQ$="S"GOTO28
504 X=0
506 RESTORE
508 FORJ=1TO24
510 READA$
512 IFA$="END"GOTO550
514 IFA$=Q$GOTO520
516 NEXTJ
518 IFX>0THEN552
520 ONJGOSUB525,526,527,528,529,530,531,532,533,534,535,536,537,538,539,
    540,541,542,543,544,545,546,547:GOTO518
525 PRINT"QRL: ARE YOU BUSY?":X=1:RETURN
526 PRINT"QRM: AM I BEING INTERFERED WITH?":X=1:RETURN
527 PRINT"QRN: IS THERE STATIC?":X=1:RETURN
528 PRINT"QRO: SHALL I INCREASE POWER?":X=1:RETURN
529 PRINT"QRP: SHALL I DECREASE POWER?":X=1:RETURN
530 PRINT"QRQ: SHALL I SEND FASTER?":X=1:RETURN
531 PRINT"QRS: SHALL I SEND SLOWER?":X=1:RETURN
532 PRINT"QRT: SHALL I STOP SENDING?":X=1:RETURN
533 PRINT"QRU: HAVE YOU ANYTHING FOR ME?":X=1:RETURN
534 PRINT"QRV: ARE YOU READY?":X=1:RETURN
535 PRINT"QRX: WHEN WILL YOU CALL AGAIN?":X=1:RETURN
536 PRINT"QRZ: WHO IS CALLING ME?":X=1:RETURN
537 PRINT"QSB: ARE MY SIGNALS FADING?":X=1:RETURN
538 PRINT"QSK: DO YOU HAVE BREAK-IN?":X=1:RETURN
539 PRINT"QSL: DO YOU ACKNOWLEDGE RECEIPT?":X=1:RETURN
540 PRINT"QSM: SHALL I REPEAT LAST MESSAGE?":X=1:RETURN
541 PRINT"QSP: WILL YOU RELAY?":X=1:RETURN
542 PRINT"QSU: SHALL I SEND A SERIES OF V'S?":X=1:RETURN
543 PRINT"QSV: SHALL I CHANGE FREQUENCY?":X=1:RETURN
544 PRINT"QTB: WORD COUNT AGREE?":X=1:RETURN
545 PRINT"QTC: HOW MANY MESSAGES DO YOU HAVE?":X=1:RETURN
546 PRINT"QTH: WHAT IS YOUR LOCATION?":X=1:RETURN
547 PRINT"QTR: WHAT IS YOUR TIME?":X=1:RETURN
550 PRINT:PRINT"THAT ONE IS NOT ON FILE"
552 PRINT:PRINT"ANOTHER ONE (Y/N)?"
554 GOSUB10005
556 IFKB=89GOTO500
557 IFKB<>78GOTO554
558 IFKB=78GOTO28
600 DATA"QRL","QRM","QRN","QRO","QRP","QRQ","QRS","QRT"
601 DATA"QRU","QRV","QRX","QRZ","QSB","QSK","QSL","QSM"
602 DATA"QSP","QSU","QSV","QTB","QTC","QTH","QTR"
603 DATA"END"
700 CLS:PRINT"THIRD - PARTY AGREEMENTS"
702 PRINTSTRING$(55,"=");
704 PRINT
706 PRINT"(LU) ARGENTINA       (HC) ECUADOR        (EL) LIBERIA"
708 PRINT"(CP) BOLIVIA         (YS) EL SALVADOR    (XE) MEXICO"
710 PRINT"(PY) BRAZIL          (TG) GUATAMALA      (YN) NICARAGUA"
712 PRINT"(VE) CANADA          (8R) GUYANA         (HP) PANAMA"
714 PRINT"(CE) CHILE           (HH) HAITI          (ZP) PARAGUAY"
716 PRINT"(HK) COLUMBIA        (HR) HONDURAS       (OA) PERU"
718 PRINT"(TI) COSTA RICA      (4X4) ISRAEL        (9Y4) TRINIDAD"
720 PRINT"(CM) CUBA            (6Y5) JAMAICA       (CX) URUGUAY"
722 PRINT"(HI) DOMINICAN REP.  (JY) JORDAN         (YV) VENEZUELA"
724 PRINTSTRING$(55,"=");
726 PRINT:PRINT"HIT 'C' TO CONTINUE"
728 GOSUB10005
730 IFKB=67GOTO28
732 IFKB<>67GOTO728
900 CLS:PRINTCHR$(23)
902 PRINT@128,"HIT 'S' TO STOP"
904 PRINT@192,"HIT 'R' TO RESET"
906 A=1:B=0:C=0:D=0
908 PRINT@448,A;"    ";B;"  ";C;"    ";D
910 B=10
911 E=60
913 PRINT@470," ";
914 FORX=1TO320:NEXTX:E=E-1
915 PRINT@470,": ";
918 LETQ$=INKEY$
920 IFQ$="R"GOTO906
922 IFQ$="S"GOTO28
928 IFE=-1GOTO932
930 GOTO913
932 A=0:B=B-1:C=0:D=0
934 PRINT@448,A;"    ";B;"  ";C;"    ";D
936 IFB=0GOTO940
938 GOTO911
940 LETQ$=INKEY$
942 IFQ$="R"GOTO906
944 IFQ$="S"GOTO28
950 PRINT@832,"I D E N T I F Y ! !":FORX=1TO200:NEXTX
952 PRINT@832,"                    ":FORX=1TO200:NEXTX
954 GOTO940
1100 CLS:PRINT"CLASS OF LICENSE"
1102 PRINTSTRING$(55,"=");
1104 PRINT
1106 PRINT"<N>OVICE"
1108 PRINT"<T>ECHNICIAN"
1110 PRINT"<G>ENERAL (OR CONDITIONAL)"
1112 PRINT"<A>DVANCED"
1114 PRINT"<E>XTRA"
1116 PRINT
1118 PRINT"WHICH CLASS ARE YOU?"
1119 GOSUB10005
1120 IFKB=78ORKB=84ORKB=71ORKB=65ORKB=69GOTO1122
1121 IFKB<>78ORKB<>84ORKB<>71ORKB<>65ORKB<>69GOTO1119
1122 LETC=KB
1124 CLS:PRINT"BANDS OF OPERATION"
1126 PRINTSTRING$(55,"=");
```

mation program. When the user responds with the last three letters of the repeater's callsign, its frequency pair (e.g., 13/73), or the city where it is located, the computer will display pertinent information concerning that repeater. One helpful bit of data provided is the proper beam heading for that repeater. Lines 120 through 197 and 200 to 279 are reserved for the user to insert information pertaining to his favorite repeaters. I have put data in these lines just to provide formatting examples.

Contest Logger: This routine is the answer to the contester's prayers. It resides from lines 300 to 338. It will ask for the callsign of the station, check memory, and, if not already logged, will tell the operator that it is a new contact and to call it. If contact is made, the call can be saved in memory for recall later. If the station was previously logged, the user will be informed so that a different station can be checked. Searching action is completed in seconds—a lot easier than trying to find a callsign in a stack of dupe sheets! Statement line 11 is initialized for 100 contacts. This can be adjusted if desired.

Q-Signals: How many times have you heard a Q-signal used and tried to remember its meaning? Statement lines 500 through 603 provide instant recall. The user enters his own catalog of Q-signals into DATA statements beginning on line 600. I have already inserted 23 signals. These can be altered to suit individual needs. The only program modification required is changing the DATA statements and lines 525 through 547 to support the changes made. Be sure the last DATA element is "END".

Third-Party Agreements: This program will display the list of countries with which the United States has third-party agreements. Statement lines 700 to 732 support this function. The list includes call letter prefixes. If the country is not listed, do not make that phone patch!

Station Identification: The operator can initiate this program when the QSO

```
1128 PRINT
1130 PRINT"1. 3.5 (80M)                5. 28.0 (10M)"
1132 PRINT"2. 7.0 (40M)                6. 50.0 (6M)"
1134 PRINT"3. 14.0 (20M)               7. 144.0 (2M)"
1136 PRINT"4. 21.0 (15M)                              "
1138 PRINT
1140 PRINT
1142 PRINT"WHICH BAND ARE YOU OPERATING ON?"
1144 GOSUB10000:IFVAL(KB$)<1ORVAL(KB$)>7GOTO1144
1146 LETB=X
1148 IFC=78GOTO1152
1150 IFC=84GOTO1154
1151 IFC=71ORC=65ORC=69GOTO1156
1152 IFB=3ORB=6ORB=7THENPRINT"NOVICES CANNOT OPERATE THERE":GOTO1182
1153 IFB=1ORB=2ORB=4ORB=5GOTO1156
1154 IFB=1ORB=2ORB=3ORB=4ORB=5THENPRINT"TECHS ARE NOT ALLOWED":GOTO1182
1156 CLS:PRINT"MODE OF OPERATION: <C>W  OR  <P>HONE?"
1157 GOSUB10005
1158 IFKB=67ORKB=80GOTO1160
1159 IFKB<>67ORKB<>80GOTO1157
1160 LETM=KB:IFC=84ANDM=67THENPRINT"TECHNICIANS CANNOT USE CW":GOTO1182
1161 IFC=78ANDM=80THENPRINT"NOVICES DO NOT HAVE PHONE PRIVILEGES":GOTO1182
1162 PRINT:PRINT
1164 PRINT"WHAT IS YOUR PRESENT OPERATING"
1166 INPUT"FREQUENCY (I.E., 14.32)";F
1168 IFC=78GOTO1300
1170 IFC=84GOTO1320
1172 IFC=71GOTO1330
1174 IFC=65GOTO1370
1176 IFC=69GOTO1410
1178 LETX=INT(RND(5))
1180 ONXGOSUB1190,1192,1194,1196,1198
1182 PRINT:PRINT"DO YOU WISH A NEW FREQUENCY CHECK (Y/N)?"
1184 GOSUB10005
1186 IFKB=89GOTO1124
1188 IFKB<>78GOTO1184
1189 IFKB=78GOTO28
1190 PRINT"SORRY - YOU'RE ILLEGAL!!":RETURN
1192 PRINT"BETTER GET BACK IN THE BAND.":RETURN
1194 PRINT"CHECK YOUR VFO. YOU'RE OUT OF THE BAND!":RETURN
1196 PRINT"HERE COMES THE PINK SLIP!":RETURN
1198 PRINT"GOTCHA YOU!!":RETURN
1300 IFF>=3.70ANDF<=3.75GOTO1310
1302 IFF>=7.10ANDF<=7.15GOTO1310
1304 IFF>=21.10ANDF<=21.20GOTO1310
1306 IFF>=28.10ANDF<=28.20GOTO1310
1308 GOTO1178
1310 IFM=80THENPRINT"NOVICES DO NOT HAVE PHONE PRIVILEGES":GOTO1182
1312 GOTO1500
1320 IFF>=50.10ANDF<=54.00GOTO1500
1322 IFF>=145.00ANDF<=148.00GOTO1500
1324 GOTO1178
1330 IFF>=3.525ANDF<=3.775GOTO1358
1332 IFF>=3.89ANDF<=4.00GOTO1500
1334 IFF>=7.025ANDF<=7.15GOTO1358
1336 IFF>=7.225ANDF<=7.30GOTO1500
1338 IFF>=14.025ANDF<=14.20GOTO1358
1340 IFF>=14.275ANDF<=14.35GOTO1500
1342 IFF>=21.025ANDF<=21.25GOTO1358
1344 IFF>=21.35ANDF<=21.45GOTO1500
1346 IFF>=28.00ANDF<=28.50GOTO1358
1348 IFF>=28.51ANDF<=29.70GOTO1500
1350 IFF>=50.10ANDF<=54.00GOTO1500
1352 IFF>=144.0ANDF<=144.10GOTO1358
1354 IFF>=144.11ANDF<=148.00GOTO1500
1356 GOTO1178
1358 IFM=80THENPRINT"YOU ARE NOT IN THE PHONE PORTION":GOTO1182
1360 GOTO1500
1370 IFF>=3.525ANDF<=3.775GOTO1400
1372 IFF>=3.80ANDF<=4.00GOTO1500
1374 IFF>=7.025ANDF<=7.150GOTO1400
1376 IFF>=7.151ANDF<=7.30GOTO1500
1378 IFF>=14.025ANDF<=14.200GOTO1400
1380 IFF>=14.210ANDF<=14.35GOTO1500
1382 IFF>=21.025ANDF<=21.25GOTO1400
1384 IFF>=21.275ANDF<=21.45GOTO1500
1386 IFF>=28.00ANDF<=28.50GOTO1400
1388 IFF>=28.51ANDF<=29.70GOTO1500
1390 IFF>=50.00ANDF<=50.10GOTO1400
1392 IFF>=50.11ANDF<=54.00GOTO1500
1394 IFF>=144.00ANDF<=144.10GOTO1400
1396 IFF>=144.11ANDF<=148.00GOTO1500
1398 GOTO1178
1400 IFM=80THENPRINT"YOU ARE OUT OF THE PHONE BAND":GOTO1182
1402 GOTO1500
1410 IFF>=3.50ANDF<=3.775GOTO1440
1412 IFF>=3.776ANDF<=4.00GOTO1500
1414 IFF>=7.00ANDF<=7.15GOTO1440
1416 IFF>=7.16ANDF<=7.30GOTO1500
1418 IFF>=14.00ANDF<=14.20GOTO1440
1420 IFF>=14.21ANDF<=14.35GOTO1500
1422 IFF>=21.00ANDF<=21.250GOTO1440
1424 IFF>=21.251ANDF<=21.45GOTO1500
1426 IFF>=28.00ANDF<=28.50GOTO1440
1428 IFF>=28.51ANDF<=29.70GOTO1500
1430 IFF>=50.00ANDF<=50.10GOTO1440
1432 IFF>=50.11ANDF<=54.00GOTO1500
1434 IFF>=144.00ANDF<=144.10GOTO1440
1436 IFF>=144.11ANDF<=148.00GOTO1500
1438 GOTO1178
1440 IFM=80THENPRINT"BETTER GET BACK IN THE PHONE BAND":GOTO1182
1442 GOTO1500
1500 ONBGOTO1510,1550,1570,1590,1600,1610,1620
1510 GOSUB1700
1512 X=835:A=3.5:H=3.6:M=3.7:D=3.8:E=3.9:G=4.0:J=127
1514 PRINT@X,A:PRINT@X+10,H:PRINT@X+20,M:PRINT@X+30,D:PRINT@X+40,E:PRINT@X+50,
     G
1515 X=832
1516 GOTO1900
1550 GOSUB1700
1552 X=835:A=7.0:H=7.1:M=7.2:D=7.3:J=127
1554 PRINT@X,A:PRINT@X+10,H:PRINT@X+20,M:PRINT@X+30,D
1555 X=828
1556 IFF>=AANDF<HTHENZ=(F-A)+A:Y=0:GOSUB1800:GOTO1182
1558 IFF>=HANDF<MTHENZ=(F-H)+H:Y=10:GOSUB1800:GOTO1182
1560 IFF>=MANDF<DTHENZ=(F-M)+M:Y=20:GOSUB1800:GOTO1182
1561 IFF=DTHENZ=(F-M)+M:Y=28:GOSUB1800:GOTO1182
1570 GOSUB1700
1572 X=835:A=14.0:H=14.1:M=14.2:D=14.3:E=14.35:J=127
1574 PRINT@X,A:PRINT@X+10,H:PRINT@X+20,M:PRINT@X+30,D:PRINT@X+40,E
1575 X=821
1576 GOTO2000
1590 GOSUB1700
1592 X=835:A=21.0:H=21.1:M=21.2:D=21.3:E=21.4:G=21.45:J=127
1594 PRINT@X,A:PRINT@X+10,H:PRINT@X+20,M:PRINT@X+30,D:PRINT@X+40,E:PRINT@X+50,
     G
1595 X=814
1596 GOTO1900
1600 GOSUB1700
1602 X=835:A=28.0:H=28.5:M=29.0:D=29.5:E=29.7:J=127
1604 PRINT@X,A:PRINT@X+10,H:PRINT@X+20,M:PRINT@X+30,D:PRINT@X+40,E
1605 X=807
1606 GOTO2000
1610 GOSUB1700
1612 X=835:A=50.0:H=51.0:M=52.0:D=53.0:E=54.0:J=127
1614 PRINT@X,A:PRINT@X+10,H:PRINT@X+20,M:PRINT@X+30,D:PRINT@X+40,E
1615 X=785
1616 GOTO2000
1620 GOSUB1700
1622 X=835:A=144.0:H=145.0:M=146.0:D=147.0:E=148.0:J=127
1624 PRINT@X,A:PRINT@X+10,H:PRINT@X+20,M:PRINT@X+30,D:PRINT@X+40,E
1625 X=691
1626 GOTO2000
1700 CLS:Y=36
1702 FORX=10TO110
1704 SET(X,Y)
1706 NEXTX
1708 Y=37
1710 SET(10,Y)
1712 SET(30,Y)
1714 SET(50,Y)
1716 SET(70,Y)
1718 SET(90,Y)
1720 SET(110,Y)
1722 RETURN
1800 PRINT@(X+Y+Z)-J," U";
1808 PRINT@128,"HIT 'C' TO CONTINUE"
1810 LETQ$=INKEY$
1812 IFQ$="C"RETURN
1900 IFF>=AANDF<HTHENZ=(F-A)+A:Y=0:GOSUB1800:GOTO1182
1902 IFF>=HANDF<MTHENZ=(F-H)+H:Y=10:GOSUB1800:GOTO1182
1904 IFF>=MANDF<DTHENZ=(F-M)+M:Y=20:GOSUB1800:GOTO1182
1906 IFF>=DANDF<ETHENZ=(F-D)+D:Y=30:GOSUB1800:GOTO1182
1908 IFF>=EANDF<GTHENZ=(F-E)+E:Y=40:GOSUB1800:GOTO1182
1909 IFF=GTHENZ=(F-E)+E:Y=48:GOSUB1800:GOTO1182
2000 IFF>=AANDF<HTHENZ=(F-A)+A:Y=0:GOSUB1800:GOTO1182
2002 IFF>=HANDF<MTHENZ=(F-H)+H:Y=10:GOSUB1800:GOTO1182
2004 IFF>=MANDF<DTHENZ=(F-M)+M:Y=20:GOSUB1800:GOTO1182
2006 IFF>=DANDF<ETHENZ=(F-D)+D:Y=30:GOSUB1800:GOTO1132
2007 IFF=ETHENZ=(F-D)+D:Y=38:GOSUB1800:GOTO1182
2100 CLS:PRINTCHR$(23)
2102 PRINT@448,"7 3  &   G O O D   D X ! !"
2104 FORX=1TO1000:NEXTX
2106 CLS:END
10000 KB$=INKEY$:IFKB$=""GOTO10000
10001 LETX=VAL(KB$):RETURN
10005 KB$=INKEY$:IFKB$=""GOTO10005
10015 KB=ASC(KB$):RETURN
```

(where's that Q-signal program!) begins. A visual timer will be displayed, updated each minute, and provide a flashing reminder when the time limit has expired and station identification must be made. When the ID has been made, the time can be reset and the sequence repeated. Reset can occur any time by hitting the "R" key. Hitting "S" returns the program to the menu of commands. This IDer routine is in statement lines 900 to 954. The timing sequence is software controlled (FOR . . . NEXT loop) and may have to be adjusted to allow for differences in machines. Line 914 controls this timing.

Frequency Check: The largest and most complex subprogram, it resides from lines 1100 to 2007. Don't let that scare you, though. If you answer all prompts and data requests when required, the computer will provide the proper response. The program is designed to give the operator the security of knowing his operation is within the band limits established for his license. This verification is supported as the program is run and then reinforced by graphically displaying the operating frequency.

The frequency program can be customized for specific requirements. For example, if you always intend to remain a General, eliminate lines 1102 through 1121 and change lines 1100 and 1122 to read:

1100 CLS
1122 LET C=71

This eliminates answering the class of license question each time the program is run. If your operation is confined to one band, make variable B at line 1146 the applicable value. Also, if you never use CW, make M=80 at line 1160 to establish phone-only operation (also delete lines 1156 and 1157).

As previously stated, this is a highly versatile and useful program, either piecemeal or in its entirety. I believe it contains some routines which every ham will find helpful. I hope it will take some of the paperwork out of your operation and give you more time to rag-chew! ■

Edward W. Crandell WD8CBE
Rte. 8, Box 79
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Berserk Direction-Finding

Zero in on transmitters in seconds with this TRS-80 program. It will tell you how to get there, too.

In any radio direction finding operation, whether it be tracking a jammer or a distress signal, the time factor is important. The Radio Amateur RDF Assistant minimizes the time involved in tracking a transmitter. The program allows the operator to determine the general location of the transmitter instantly by entering the headings to the transmitter from two stations whose locations are known. The advantages of this method over the standard map, protractor, and straightedge approach are speed and accuracy. The high speed of the operation allows for comparison of headings from different stations and for quick, repeated calculations if the transmitter is moving.

Other features of the program include the giving of directions to the transmitter for field units and providing a listing of the DF committee members and repeater users, with their calls, phone numbers, and distances and directions to the transmitter, allowing the RDF net control to coordinate the efforts of the stations in reaching the transmitter site. The data for this listing is stored on tape, so the user may have different tapes for different repeaters or bands.

Instructions

After you have CLOADed the program and entered RUN, the computer will ask you if you want the data tape loaded before continuing with the program. You would normally do this when stations will not be giving you bearings immediately, such as right after a jammer or ELT has appeared on frequency. If you need to determine the transmitter's location immediately and have the appropriate information, enter N and the program will continue. You may load the tape later if needed by selecting that option from the menu.

Next, the computer will ask you for the coordinates of station A. Type in the horizontal coordinate, a comma, and the vertical coordinate of the first station that you will be taking a bearing from. (This information can be found by preparing an RDF Map and a Station Data Sheet described later.) Press ENTER and the computer will then ask you the bearing that that station has on the transmitter. Type in this and press ENTER. Repeat the procedure for station B, using a second station. It should be noted that you should not enter two stations that have the same bearings or whose bearings have a difference of 180°. This will result in a divide-by-zero error. This situation is rare and even if the computer were not used the results would be meaningless. The user should simply select another station to replace one of these.

Once this has been done, the transmitter's location is printed along with directions and distances from stations A and B to the transmitter. To see the list of options available, press ENTER.

The first option is DF-Fix Calculations, which was just described. You would select this option if you want to enter a new set of headings to the transmitter. This is the only option that affects the transmitter's location. The other options only use this data to provide related information.

The second option provides directions to the transmitter for a field unit. The computer will ask you for the coordinates of the

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field unit. Enter these coordinates. The coordinates can be found by finding the field unit on the RDF Map and finding its corresponding coordinates. The computer will then display the transmitter's location and the distance and directions to the transmitter from the field unit. This information is presented in two forms to allow for different types of field units. If the field unit is a car restricted to streets, the north/south and east/west directions are more appropriate. On the other hand, if the field unit is on foot or in open country, distance and bearing information is more relevant.

The third option is the DF-Net Listing. To use this option, you must have loaded the data tape in or inserted new data (option 5.2) during the current run of the program. The computer will first ask you for a maximum report range. The computer will list only those stations which are within the number of miles you entered to the transmitter. The computer will then ask if you want only DF committee members (those with asterisks at the front of their calls) to be listed. Enter either Y or N. The computer will then list the stations on the screen. It will only show eleven stations at one time, so merely press ENTER to see the next set of eleven. After the computer has listed all of the stations that have met the given requirements, it will tell how many stations were within the given range. You must press ENTER to see the list of options.

The fourth option is to load the data tape. The computer will guide you through the process of loading the tape. The menu will be displayed after the tape has been loaded.

The fifth option allows you to modify the data tape of the DF-Net stations (callsign, phone number, and location). How to determine the station's location will be discussed later. This option has five options of its own. The first merely lists the data. This allows you to check the data and see what, if anything, needs to be changed. The number displayed on the extreme left is a record number. This is the record number you will use in options 2 and 3. Before using options 2 and 3, it is a good idea to check the listing to make sure that you select the right number. To insert a new record, first determine after which record you would like the new record inserted. If it is the first record to be inserted, insert it after Ø.

The third option is the delete option. If you have a station which is no longer active or needs to be deleted for some other reason, find it on the listing (option 1) and note its record number. Then select option 3. Enter this number in response to the computer's question about which record number should be deleted. If you choose to de-

```
4 REM RADIO AMATEUR RDF ASSISTANT
5 REM PROGRAM BY EDWARD W. CRANDELL
6 REM             RT 8 BOX 79
7 REM             WARSAW, IN  46580
10 CLEAR5000
11 M=100
12 DIM D$(M),E$(M),X(M),Y(M)
15 CLS:PRINT"RADIO AMATEUR RDF ASSISTANT":PRINT
20 INPUT"DO YOU WANT TO LOAD THE DATA TAPE NOW (Y OR N)";G$:CLS
21 IF G$="Y"THEN GOSUB240
39 REM DF-FIX CALCULATIONS
40 CLS:PRINT"STATION A":INPUT"COORDINATES";A,B
45 INPUT"BEARING";C:PRINT
50 PRINT"STATION B":INPUT"COORDINATES";D,E
60 INPUT"BEARING";F:PRINT
75 C=450-C:F=450-F
90 C=TAN(C*3.14159/180):F=TAN(F*3.14159/180)
100 G=((F*D)+B-E-(C*A))/(F-C):H=C*(G-A)+B
105 G=INT(G*10+.5)/10:H=INT(H*10+.5)/10
110 X=A:Y=B:GOSUB2000:CLS:PRINT"TRANSMITTER'S COORDINATES: ";G",";H
111 PRINT:PRINT"DISTANCE FROM STATION A:";U"MILES":GOSUB1900
113 X=D:Y=E:GOSUB2000:PRINT"DISTANCE FROM STATION B:";U"MILES":GOSUB1900:INPUT"PRESS ENTER TO CONTINUE":P:CLS:GOTO300
140 REM FIELD UNIT ROUTINE
145 INPUT"FIELD UNIT'S COORDINATES";X,Y
150 PRINT"TRANSMITTER'S COORDINATES: "G","H:GOSUB2000
160 PRINT:PRINT"BEARING TO TRANSMITTER:"Z
165 PRINT"DISTANCE TO TRANSMITTER:"U:GOSUB1900:GOTO300
180 REM DF-NET LISTING
181 IFDF=0THENPRINT"***DATA TAPE HAS NOT BEEN LOADED***":PRINT"PLEASE LOAD DATA TAPE OR SELECT ANOTHER OPTION"ELSE185
182 GOTO300
185 INPUT"MAXIMUM REPORT RANGE";L
190 INPUT"DF-COMMITTEE MEMBERS ONLY";H$
191 R=0:V=0:RN=1
195 CLS:PRINT"  CALL     PHONE #    DISTANCE   BEARING          DIRECTIONS":PRINT
198 IFRN>TRTHEN230
200 D$=D$(RN):E$=E$(RN):X=X(RN):Y=Y(RN)
205 RN=RN+1
210 IFASC(H$)<>89THENGOSUB2000:GOTO220
215 IF ASC(D$)=42THENGOSUB2000ELSE224
220 IFU<=LTHENPRINT:D$;TAB(9);E$;TAB(20);U;TAB(31);Z;TAB(39);S;A$TAB(52)T;B$ELSE224
221 R=R+1:V=V+1:IFV<11THEN224
222 PRINT:INPUT"PRESS ENTER TO CONTINUE";P:V=0
223 GOTO195
224 GOTO198
230 PRINT:PRINTR;"STATIONS WITHIN"L"MILES OF TRANSMITTER":INPUT"PRESS ENTER TO CONTINUE";P:CLS:GOTO300
239 GOSUB240:GOTO300
240 REM DATA INPUT ROUTINE
241 PRINT"INSERT DATA TAPE":PRINT"PRESS PLAY":PRINT"PRESS ENTER WHEN READY TO LOAD":INPUTP
242 RN=1:DF=1:CLS:PRINT"FILE LOADING"
243 INPUT#-1,D$(RN),E$(RN),X(RN),Y(RN)
246 IF D$(RN)="END"THEN248
247 RN=RN+1:GOTO243
248 TR=RN-1:RETURN
250 REM MODIFY DATA TAPE
252 PRINT"1) LIST RECORDS":PRINT"2) INSERT RECORD":PRINT"3) DELETE RECORD":PRINT"4) WRITE DATA TAPE":PRINT"5) RETURN TO MAIN PROGRAM
":PRINT
253 INPUT"ENTER SELECTION";Q1:CLS
254 ON Q1 GOTO256,263,277,283,300
255 GOTO252
256 V=0
257 FOR RN=1TOTR
258 PRINT:RN;"  ";D$(RN);"  ";E$(RN);"  ";X(RN);"  ";Y(RN)
259 V=V+1:IFV<14THEN261
260 PRINT:INPUT"PRESS ENTER TO CONTINUE";P:CLS:V=0
261 NEXT RN
262 PRINT:INPUT"PRESS ENTER TO CONTINUE";P:CLS:GOTO252
263 DF=1:INPUT"ENTER CALL LETTERS OF STATION";D$
264 INPUT"ENTER STATION'S TELEPHONE NUMBER";E$
265 INPUT"ENTER STATION'S COORDINATES";X,Y
270 INPUT"AFTER WHAT RECORD NUMBER SHOULD THIS RECORD BE INSERTED (0 IF THIS IS THE FIRST RECORD)";NR:IFNR<>0THEN271:GOTO275
271 NR=NR+1:FOR FR=TR TO NRSTEP-1
273 NN=FR+1:D$(NN)=D$(FR):E$(NN)=E$(FR):X(NN)=X(FR):Y(NN)=Y(FR)
274 NEXTFR
275 D$(NR)=D$:E$(NR)=E$:X(NR)=X:Y(NR)=Y
276 TR=TR+1:CLS:GOTO252
277 INPUT"WHICH RECORD NUMBER SHOULD BE DELETED";DR
278 IF DR<=TR THEN 280
279 PRINT"RECORD NOT FOUND":GOTO277
280 FOR FR=(DR+1)TO TR
281 NN=FR-1:D$(NN)=D$(FR):E$(NN)=E$(FR):X(NN)=X(FR):Y(NN)=Y(FR):NEXTFR
282 TR=TR-1:CLS:GOTO252
283 RN=1:LR=0
284 PRINT"INSERT DATA CASSETTE IN RECORDER AND PRESS PLAY AND RECORD":PRINT"PRESS ENTER"
285 INPUTP
286 FORRN=1TOTR
287 PRINT#-1,D$(RN),E$(RN),X(RN),Y(RN):NEXTRN
288 PRINT#-1,"END","END",0,0
289 PRINT"TAPE WRITTEN"
300 REM MENU
305 PRINT:PRINT"1) DF-FIX CALCULATIONS"
310 PRINT"2) FIELD UNIT CALCULATIONS"
315 PRINT"3) DF-NET LISTING":PRINT"4) LOAD DATA TAPE":PRINT"5) MODIFY DATA TAPE":PRINT"6) END"
320 PRINT:INPUT"ENTER SELECTION";Q:CLS
325 ON Q GOTO39,140,180,239,250,9999
326 GOTO300
1900 PRINT"DIRECTIONS TO TRANSMITTER:"S;"MILES "A$"    "T;"MILES "B$:PRINT:RETURN
2000 REM CALCULATIONS SUBROUTINE
2001 S=G-X:T=H-Y
2005 U=SQR((S*S)+(T*T))
2006 IFS<>0THEN2015
2007 IFT>=0THEN2215ELSE2220
2015 Z=ATN(T/S)
2025 Z=Z*180/3.14159
2030 IF(S>=0)*(T>=0)THEN2195
2035 IF(S<0)*(T>=0)THEN2100
2040 IF(S>=0)*(T<0)THEN2205
2045 IF(S<0)*(T<0)THEN2210
2050 S=ABS(INT((S*10)+.5)/10):T=ABS(INT((T*10)+.5)/10):U=INT(U*10)/10:Z=INT(Z+.5)
2055 RETURN
2100 A$="WEST":B$="NORTH":Z=270-Z:GOTO2050
2195 A$="EAST":B$="NORTH":Z=90-Z:GOTO2050
2200 A$="WEST":B$="NORTH":Z=90-Z:GOTO2050
2205 A$="EAST":B$="SOUTH":Z=90-Z:GOTO2050
2210 A$="WEST":B$="SOUTH":Z=270-Z:GOTO2050
2215 A$="EAST":B$="NORTH":Z=0:GOTO2050
2220 A$="EAST":B$="SOUTH":Z=180:GOTO2050
9999 END
```

Program listing.

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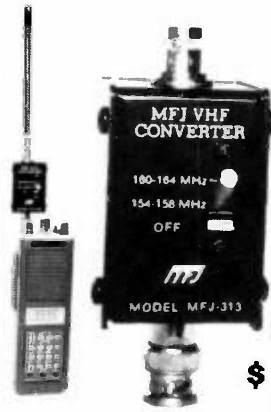

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lete a record number that does not exist, the computer will print RECORD NOT FOUND and ask you for the record number to be deleted again. If a record has some incorrect information on it, you must insert the complete correct record and then delete the incorrect one.

The fourth option will write a new data tape with all of the new changes or duplicate the old data tape if it has been loaded in and no changes have been made. To use this option, place the tape you want to put the data on in the recorder. Press the Play and Record buttons on the recorder and then press ENTER on the computer. After the data tape has been written, the computer will return to the main program and display the menu.

The fifth option simply returns you to the main program and displays the menu. You would select this in case you did not want to write a new tape or did not want to write immediately after making the changes.

RDF Map

In order to use this program, you must prepare a map with a coordinate system on it. First obtain a map of the coverage area. This map should have an appropriate scale for RDF use, that is, it should not be so small that one inch equals twenty miles. After the map has been obtained, you should determine what length on the map corresponds to a distance of one mile; for example, 0.5 inch=1 mile. Then, starting in the left-hand corner, you should make a mark every mile along the bottom edge of the map (see Fig. 1). Do the same along the top edge, starting in the upper left-hand corner. Repeat this procedure for the sides, starting in the lower left- and right-hand corners. Next, label them, starting with Ø and going from left to right and bottom to top. The markings on the side of your map should be similar to those in Fig. 1 (different scales and more numbers of course).

After you have prepared the map, you are ready to prepare the DF-Net station data sheet (see Fig. 2). Fill in the call and phone number columns with appropriate information. The first coordinate is the number on the top or bottom of the map which corresponds to the horizontal position of the station. The second coordinate is the number on the sides of the map which corresponds to the vertical position of the station. This sheet is sufficient for using options 1 and 2 of the program.

As has been stated before, in order to use the DF-Net Listing option, you must have previously inserted stations onto the data tape using option 5.2. The option will guide you through the procedure, but a few things should be mentioned before you use the option. First, answer all of the questions the computer asks about the station. Do not leave any answer blank. If a radio direction finding station does not have a call, (e.g., a future ham or SWL), type his name (if it is six or less letters) or his initials in response to the question about the station's callsign. If a station does not have a phone or his number is not known, type in NO PHONE or N/A in response to that question. If you would like a station to be included in a selective printout in the DF-Net Listing, put an asterisk in front of the station's callsign. The asterisk can be used to denote a station who is part of the DF committee or to denote those who have special RDF equipment in their cars, etc.

As well as using the program to find stations, it can be used to calibrate the members' antenna-heading indicators. To use the program for this purpose, RUN the program and load the data tape. Next, you need to insert the coordinates of the station that everyone will be aiming at. To do this, enter station A's coordinates as follows: first coordinate of station being aimed at, Ø. For the bearing, enter Ø. Enter B's coordinates as follows: Ø, the second coordinate of the station being aimed at. For the bearing, enter 90. Press ENTER to get to the menu, and select the DF-Net Listing option. Answer the questions as you normally would. The number in the bearing column of the listing is the direction that each station's heading indicator should show. This information should be relayed to each station so that he can either correct his indicator or make a note of the error and correct for it when he is tracking a station. A good station to calibrate on would be the repeater.

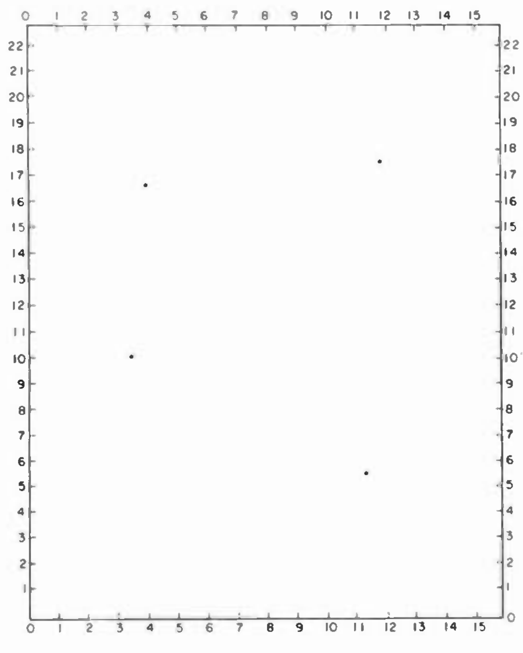
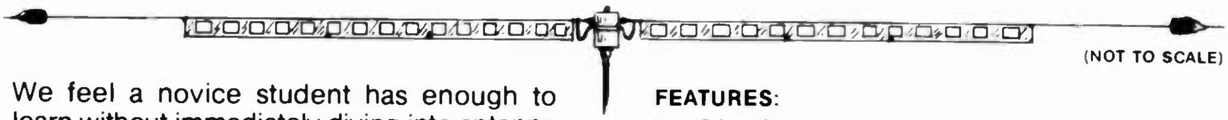


Fig. 1. RDF map.

CALL	PHONE NUMBER	COORDINATES	

Fig. 2. DF-Net station data sheet.

DO ANTENNAS WORRY YOU?



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You also may want to include the repeater in your DF-Net Listing so you can estimate the station's transmitter power by comparing the distance to the repeater with the signal strength into the repeater.

Technical Data

The program is divided into six subprograms (DF-fix calculations, field-unit calculations, DF-Net Listing, loading the data tape, modifying the data tape, and the menu) and one major subroutine.

Statements 5 through 12 merely initialize the program. String space (5000 bytes) is set aside and the arrays are DIMensioned to a value of 100. Statements 15 through 21 give the user the option to load the data tape before he actually starts to use the program.

The DF-fix routine (lines 39 through 113) determines the location of the transmitter from the information entered by the user. This location (G,H) is used in all of the other routines for determining the transmitter's relationship to the positions of the other stations.

Statements 40 through 60 prompt the user to input the tracking station locations and beam headings. Statement 75 converts these headings from compass bearings (0° = North, increasing in a clockwise direction) to polar bearings used by the computer. Statement 90 converts these headings from degrees to radians and takes the tangent. Statement 100 solves the simultaneous equations representing the lines from the tracking stations at the given bearings. Statement 105 rounds the results of the calculations (G,H—the transmitter's coordinates) to the nearest tenth. Statement 110 passes station A's coordinates to the variables used in the calculations subroutine. The results are then printed out.

Subroutine 1900 is called to print the directions, since it is used many times. This is again done for station B in line 113. The last half of line 113 is a dummy input used to pause the program and allow the user to continue when he is ready. This is done frequently throughout the program.

The field-unit routine prompts the user to input the field-unit's coordinates, calls the calculations subroutine, and displays the results. It then jumps to the menu. This routine is straightforward in that all it does is format the input and output of the calculations subroutine.

The DF-Net Listing first checks the data flag (DF) to see if data has been loaded in (line 181). The computer then prompts the user to input different parameters for the listing (lines 185 and 190). RN is the record number and specifies which element of the array is to be read. The computer compares the record number with the total number of records (TR). When RN exceeds TR, the listing routine then summarizes the results of the listing. If the user selects the selective printout, the program then checks to see if the first character of the callsign string (D$) is an asterisk (line 215). R is the "stations within range" counter and V is a line counter for limiting the number of stations printed on the screen at one time so that the results do not go flying off the screen before they can be read.

The data tape input routine is also straightforward. DF=1 sets the data flag. One record, D$,E$,X,Y, is input off the tape and stored in an array, with the subscript being incremented after each record. The computer checks D$ for the end of file indicator, END. TR is found by taking the total number of records read (RN) and decreasing it by one to remove the end-of-file indicator from the count.

The modify data tape routine has five options. The first option merely prints out the contents of the arrays. The second option (263 through 276) inserts a new record into the file. First, the user types the information in, then the computer moves all of the records after where the new one is to be inserted up one record number. The new record then is put in the hole left by the records moved.

The delete routine merely moves all of the records above the record to be deleted down one. This destroys that record by writing over it. The program checks to make sure the user does not try to delete records that do not exist.

The fourth option (283 through 289) just outputs the arrays to the tape recorder, using a similar approach to the way they are read in. The fifth option is merely a jump to the menu.

The menu is straightforward, using an ON/GOTO statement to branch. Line 326 takes care of inputs that are not covered in line 325.

The calculations subroutine calculates the distance to the transmitter (lines 2001 and 2005), bearings to the transmitter, and directions to the transmitter (lines 2006-2220). The subroutine is made up of different branches used to correct the ambiguity of the ATN function.

It is hoped that this program and the presence of a good RDF committee will reduce the amount of jamming and be a valuable tool in locating emergency locator transmitters quickly. ■

Variable List

A—First coordinate of station A's location
B—Second coordinate of station A's location
C—Bearing to transmitter from station A
D—First coordinate of station B's location
E—Second coordinate of station B's location
F—Bearing to transmitter from station B
G—First coordinate of transmitter's location
H—Second coordinate of transmitter's location
L—Maximum report range
M—DIMension of arrays
P—Dummy variable for pausing program
Q—Menu selection
R—Number of stations within given radius of transmitter
S—Horizontal distance between a station and transmitter
T—Vertical distance between a station and transmitter
U—Distance from transmitter
V—Line counter in listing
X—First coordinate of station's location when using calculation subroutine
Y—Second coordinate of station's location when using calculation subroutine
Z—Bearing to transmitter
DR—Record number to be deleted
DF—Data flag
FR—Former record number
NN—New number of record after being renumbered
NR—New record number (inserted record number)
Q1—Option selection under option 5
RN—Record number
TR—Total number of station records in arrays
A$—"EAST" or "WEST"
B$—"NORTH" or "SOUTH"
G$—"Y" or "N" to load data tape at beginning of program
H$—"Y" or "N" to "DF-COMMITTEE MEMBERS ONLY?"
D$—Station's call
E$—Station's telephone number

Food for thought.

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77.0 XB	100.0 1Z	131.8 3B	173.8 6A
79.7 SP	103.5 1A	136.5 4Z	179.9 6B
82.5 YZ	107.2 1B	141.3 4A	186.2 7Z
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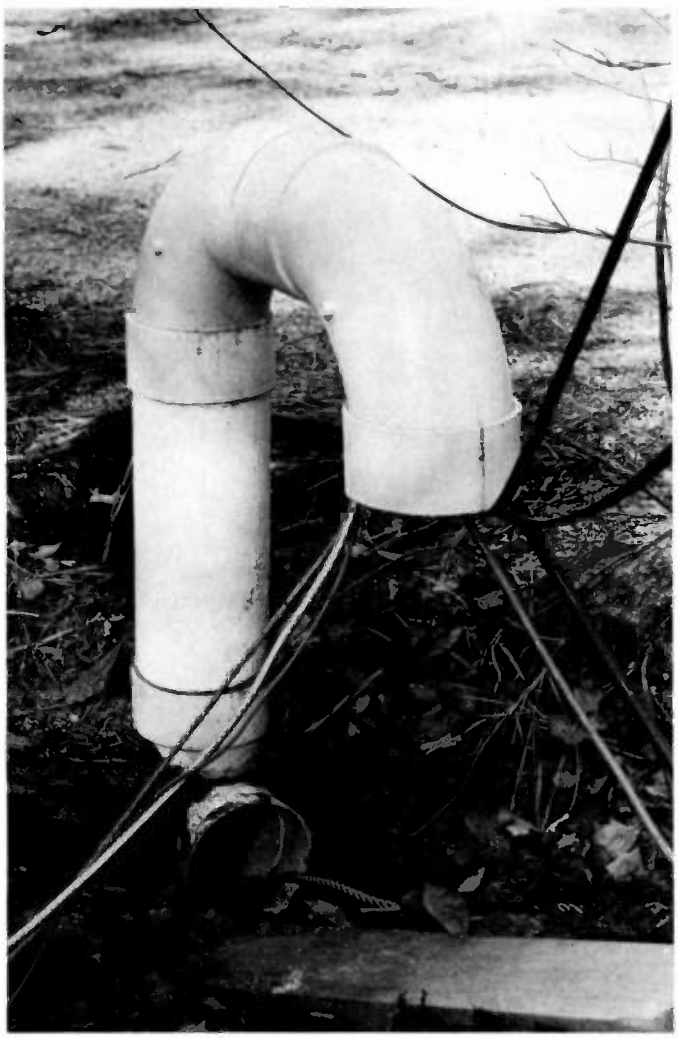

Photo A. The PVC pipe has a couple of elbows on the end of it to keep out rain and snow. A pull rope is left in the pipe to move additional antenna and rotor cables through; otherwise, the open end is capped and covered with dirt.

The problem of what to do with the radio equipment confonted me when my wife and I opted to have a new home built in a semi-rural area. In our old home on a suburban lot, it had been make-do in a third bedroom with the attendant problems of running antenna feedlines, supplying adequate electrical power, and establishing decent grounds for the equipment.

My solutions will not necessarily be your solutions, but variations of these ideas may help you in solving your installation problems. Funds were a consideration—the overall objective was, after all, to build the house! But when it was all done, I wound up with a fair amount of operating room, all the electrical power I needed, and a TVI-free environment for less than two percent of the total cost of the house and property.

Review the Plans

Once you have selected the location (no zoning restrictions on towers, right?) and a builder, look over the plans carefully to determine options for the radio room.

In our case, the locale dictated no basement because of the water table. We chose an L-shaped ranch on a slab of concrete. The options were to put the equipment into a bedroom or in the back of the garage. Neither option was desirable.

The solution was relatively simple. The garage was on one end of the house on the long side of the L. We had the builder expand the long side of the L by adding a 6-foot-wide room between the living area and the garage and adding one wall and door. See Fig. 1.

The additional room provided space for the amateur radio equipment, enabled my wife to get the washer-dryer out of an interior closet in the living area, and gave us a mudroom in which to leave boots, raincoats, and other items that should not be trailed across carpeting.

In solving your installation problem, factors to consider would be (1) accessibility to the back yard (or the side yard) for antennas, with a minimum feedline run, (2) keeping the station away from the sleeping areas of the house so that late night and early morning DXing sessions don't disturb the rest of the family, (3) keeping the family TV antenna, TV, and audio equipment apart from the radio equipment, and (4) the location of overhead power lines coming into the house.

If you opt to expand the house or add an addition to solve the location problem of your equipment, you can hold costs down by doing it in such a way that no new corners are created, needing additional forms for concrete and framing. For example, it would have been more costly for us to tack a room on to the back of the garage, extending that by 10 feet or so. Additional costs would have been incurred for laying forms around two additional corners, a redesign of the roof and supporting rafters in that part of the house, and a reconfiguration of the heating and cooling systems; considerably more concrete, lumber, and siding would have been needed.

Antenna Feedthroughs

Because space for antennas was available in the back yard, I agreed not to punch holes in the sides or roof of the new house and to see that everything was put in the back and out of sight.

Before the slab was poured, I had the builder lay down 4-inch PVC pipe extending from beyond the foundation of the house to the rear of the proposed station operating area. A 90-degree elbow and a short section of pipe at the desk end put that end above the floor level. The poured concrete anchored the 10-foot sections; a board temporarily capped the end outside the house.

Later, I purchased additional sections of PVC pipe and extended the run further into the backyard, bringing it above ground beyond the normal traffic patterns and behind some ground cover. Two 90° elbows are needed so that rain and snow do not enter the pipe. See Fig. 2.

In retrospect, I probably should have put two runs of PVC pipe into the shack area. While one handles a number of RG-8 and RG-8/X and control cables, hardline takes up a lot of room in a hurry.

Factors to consider in planning your own installation include (1) keeping runs of PVC pipe as straight as possible to minimize difficulties in routing cable, (2) leaving a "pull" rope in the pipe so that cable can be fed through from either end at any time (and don't forget to anchor it so that it's not accidentally pulled into the pipe beyond your reach), and (3) consideration of how many antennas and types of feedlines will be installed in the coming years.

Variations on the theme of using PVC pipe to route cable might include using PVC pipe inside the house to route cable to an exterior wall. Place the pipe inside the walls before the sheetrock is hung. Depending upon the design of the house, you may choose to route the pipe and cable to the attic from an interior first- or second-floor room chosen as the "shack," or route it to the basement or the garage before entering the underground run to the antenna tower.

Another variation, for those setting up the operating station in a basement or family room below ground level, would be to bring the PVC through the exterior wall to a point flush with the inside wall. Make up an appropriate bulkhead with connectors and label the lines. In times of electrical storms, shorting plugs can be put on each of the antenna feedthroughs and grounded through the ground attached to the bulkhead plate.

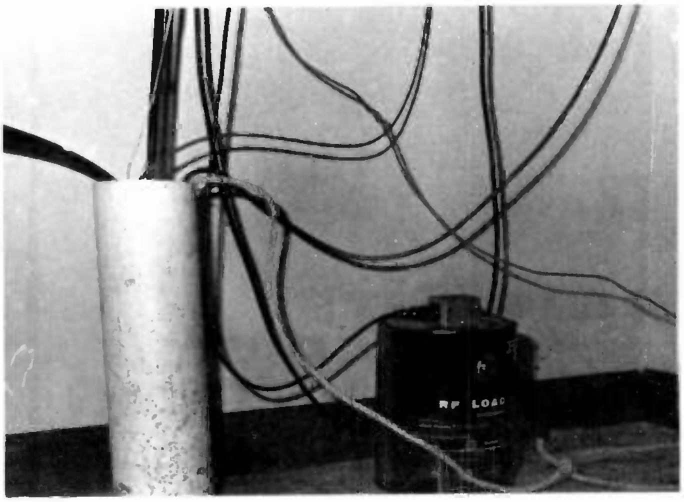

Photo B. The PVC pipe comes up under the operating desk. One of the two ground rods is visible on the right.

Grounds

At the same time that the PVC pipe was laid for the antenna cable runs and before the floor was poured, I installed 10-foot, ¾-inch ground rods at the rear of the area where the operating desk was to be placed. I left them about 8 inches above the finished floor.

That simple move has paid off handsomely in the reduction of in-house TVI and RFI on the operating desk compared with what I had been used to in the previous house. Ground leads are a maximum of 3 feet now.

In your installation, consider the shortest run possible. If you are setting up in an interior room, drop the ground leads through the walls directly to the basement. Use ground rods as long as possible; those 4-foot lengths just won't do the job. Run heavy wire; #4 would be fine. As the heavier wire is a bit difficult to work with, consider tying the heavy ground lead to a heavy-gauge metal plate that has been drilled and tapped with 3/8- or 1/2-inch bolts and place that behind the operating desk. The individual ground leads from the several pieces of equipment can be terminated with spade lugs and bolted to the plate.

Electrical

Before the wall between the added utility room/ham shack and the garage was closed, I had an electrician wire a separate electrical panel for the radio equipment. At the main electrical panel in the garage, a 70-Amp circuit breaker was installed. A three-wire line was run into the shack wall; another panel was installed with a 70-Amp main circuit breaker, and separate circuit breakers were installed to provide 220 and 110 V ac to a number of outlets.

Perhaps this was overkill, but the family members have instructions on how to turn off either main breaker in case of an emergency. Everything goes down when

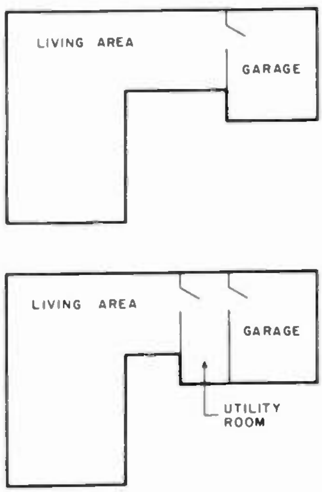

Fig. 1. Before (top) and after (bottom) adjustments to original house plan.

that switch is thrown. (That panel is low enough for even my youngster to reach.)

Plan your needs carefully. I had eight 110 V ac outlets installed, and still I ran out. Also consider height and placement of the outlets. Don't install outlets at tabletop height if the surface of the operating area runs wall-to-wall; put them above or below the tabletop.

Odds and Ends

Some other planning-ahead activities to consider as the house is framed and before the sheetrock is hung are all based around pre-wiring the house for a variety of items.

Don't forget to get the telephone installer at work before the sheetrock goes on. The job is a lot easier and cleaner. Run a telephone line into the shack, and consider having the house wired for two (or more) telephone lines. If you change your mind at the time the installer returns to fish out the lines to telephone jacks, there is no problem reverting to one line. There is no charge for pre-wiring the framed house.

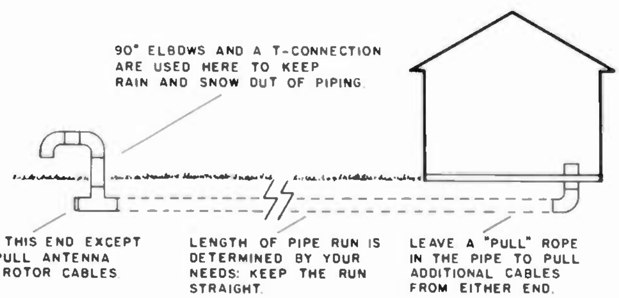

Fig. 2. Details of PVC pipe arrangement which contains coax and control cables

Want to install a burglar alarm system? A wired perimeter system tends to be the cheapest, and it's easy to do yourself. Supplies can be acquired from a number of wholesale and retail outlets. Pick the system best for you; it may be easiest to install before the walls are closed. Don't forget about electrical power to the system (most systems also have a battery backup).

Also consider pre-wiring for your stereo system. It's a lot easier to run speaker leads in the walls and over ceilings than under rugs or behind wall moldings. Use some larger-size electrical zip cord, such as #12 or #14, rather than the light stuff. Plan ahead for the day when you upgrade to a larger, more powerful amplifier and have speakers in other areas of the house. You can always leave the wires in the walls until you actually have speakers in hand.

An intercom system is also very easy to put in before the walls are closed. Plan ahead. (It's your choice to put one in the shack so that you can be called to do chores in the middle of a contest!)

Be sure to install 75-Ohm coaxial cable for the household TV and FM antenna system before closing the walls. Consider the placement of the antennas with respect to the ham equipment when routing the cable. I opted to install an antenna to take care of both the TV and the FM stereo receiver under the roof of the house, rather than outside, and hung it in the end of the house away from the shack. Plan ahead if you want multiple outlets for multiple TV sets, and don't forget an electrical source for a distribution amplifier if your plans require one. Using shielded cable and picking the right spot for your TV/FM antenna(s) will go a long way to eliminating in-house TVI.

I also took advantage of the open walls to install a coaxial cable which was later hooked up to an attic-mounted scanner antenna and a scanner in the family room; my wife and I eavesdrop on one or two police and fire frequencies, some remote broadcast stuff, and one or two 2-meter frequencies.

In Closing

The building of a new home or of a major addition to an existing home is a massive undertaking. Attention has to be given to everything, and the smallest detail has to be reviewed on a continuing basis. If you tell the builder *before* he begins that you want to install certain wires and pipes for the amateur radio station, there shouldn't be any problems. In my case, the builder gave me a schedule of construction and permission to come in to install the ground rods and the pre-wiring described above; he placed the PVC pipe for me, and the electrician came after I took title to the house.

Keep receipts on everything you purchase and install. That's all part of your tax records for calculating the adjusted cost of the house and the improvements, depending upon the dates involved.

Some of the ideas described above are not necessarily new or original, but they are intended as food for thought. Your needs are different from mine, but if I have reminded you to think about a particular installation problem before you begin a project, then I have been successful. Good luck in your building. ■

Reader Service for facing page ✓5→

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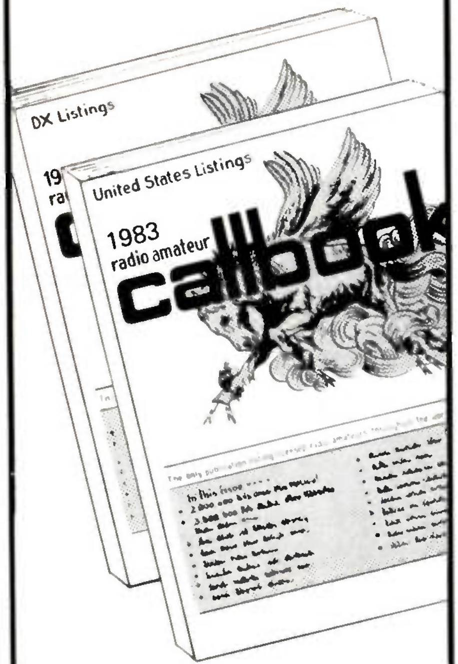

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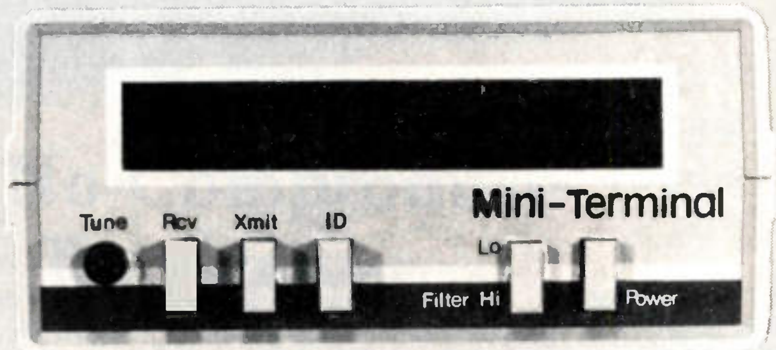

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travel through glass having a dielectric constant of 5, the distance it would move during the time period of one wavelength would be much shorter. In fact, one wavelength would be only 44.72% of the equivalent length in space. When converted to a decimal figure, .4472, this dielectric correction is the "velocity factor" (VF) of the glass. It is equal to the reciprocal of the square root of the dielectric constant or VF $= 1/\sqrt{5} = 1/2.236 = .4472$. This formula describes the mathematical relationship between "dielectric constant" and "velocity factor."

So, what can we do with dielectric constants or velocity factors? Actually, I can think of very few occasions when changing the dielectric in a capacitor would be necessary, desirable, or feasible. It would be fairly easy, though, to make a low-capacity variable capacitor by using two pieces of aluminum and to insert a variable amount of a plastic dielectric via a shaft and a dial system.

The velocity factor, though, is a much used and occasionally misused factor.

All of the coaxial and parallel-wire feedlines using solid dielectrics are characterized by higher losses than found in equivalent air-insulated lines and by having velocity factors of less than 1. These velocity factors mean that radio waves are propagated along these lines at velocities less than in free space. When the electrical length of the feedline to be used is critical, the velocity factor must be considered in calculating the physical length. If you wanted an electrical length of 1/2λ and the velocity factor was .80, then the desired formula for the physical length in feet would be: 1/2λ = (492 × .80)/frequency (MHz).

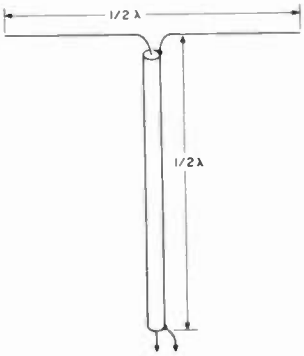

Fig. 2(a).

The velocity factors for some common coaxial feedlines range from .80 for polyethylene foam dielectrics to .66 for solid polyethylene. Some 300-Ohm parallel-conductor feedlines using a solid dielectric of polyethylene have a velocity factor of about .82. Why should that be? Fig. 1(a) shows a cross-sectional view of a piece of 300-Ohm line. The oval represents the solid dielectric and the dots represent the conductors. The arrowed lines represent an instantaneous electric field that might exist at a given moment in time. The fact that a portion of this field exists outside the solid dielectric is the reason that the 300-Ohm line velocity factor of about .82 lies between the .66 factor of solid polyethylene and the value of 1.0 for air. This also explains the sensitivity of oval 300-Ohm line to external influences such as rain, snow, and ice, or to the proximity of metallic objects.

Fig. 1(b) shows the cross section of a 100%-shielded coaxial cable. In this case, the electric field is wholly contained within the shield, and surrounding influences are minimal. That's why coaxial cable can be taped to your tower, run along gutters, or even buried with little observable effect upon its performance.

The velocity factor is used to determine the physical length of the line whenever a particular electrical

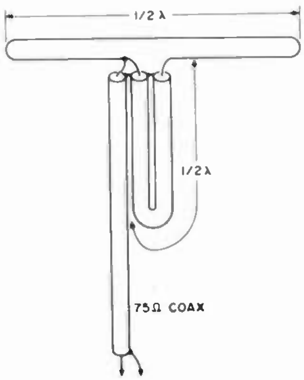

Fig. 2(b).

length of feedline is required, and when in the feedline's use an electric field will exist between the feedline conductors as a result of current flow along the conductors. Fig. 2 shows some of the typical cases wherein the velocity factor would be used in calculating the physical length of the required feedline. In Fig. 2(a), a feedline 1/2λ long is used so that the impedance at the center of the antenna will be repeated at the ground end for easy impedance measurements. The desired physical length of a 1/2λ line would be the free-space length times the velocity factor, or 1/2λ (ft.) = (492 × VF)/frequency (MHz). In this case, the line could be made any whole number multiple of the correct length if a single 1/2λ wasn't long enough.

Fig. 2(b) shows a 4:1 coaxial balun connected to a folded dipole radiator. The length of the 1/2λ U-shaped piece of coax is calculated with VF. Fig. 2(c) shows broadside radiating elements, each fed through a gamma match. Any equal lengths of cable could be used for pieces X and Y to satisfy the phasing requirements of the broadside array. The 3/4λ sections, however, also serve as impedance transformers between the radiators and the feedline junction. The physical length of the 3/4λ lines should be computed with the VF.

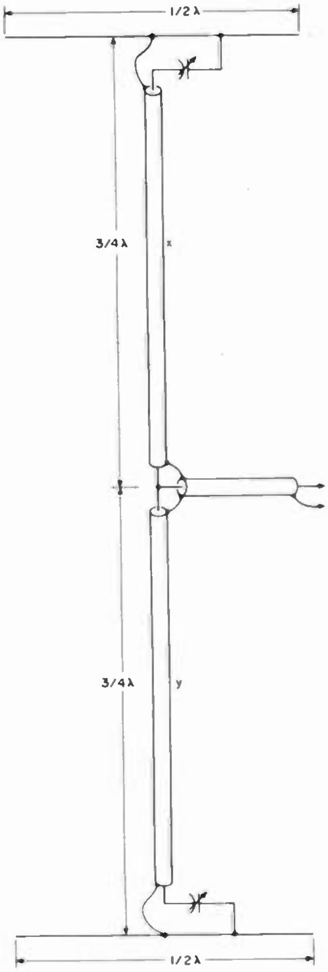

Fig. 2(c).

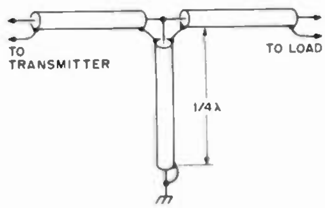

Fig. 2(d).

Fig. 2(d) shows a 1/4λ section of coaxial cable used as an rf choke. The shorted end of the 1/4λ section is transformed into a very high impedance at its connection point to the coaxial feedline. It has no effect upon the feedline as far as the operating frequency is concerned, but it keeps both sides of the coax at ground potential for dc or lightning protection. In addition, the 1/4λ section will act as a dead short across the coaxial cable at the second harmonic!

Fig. 2(e) shows 1/4λ ver-

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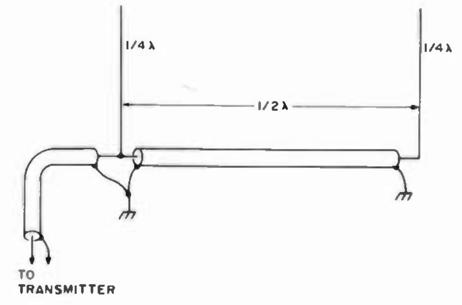

Fig. 2(e).

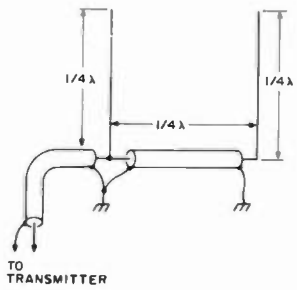

Fig. 2(f).

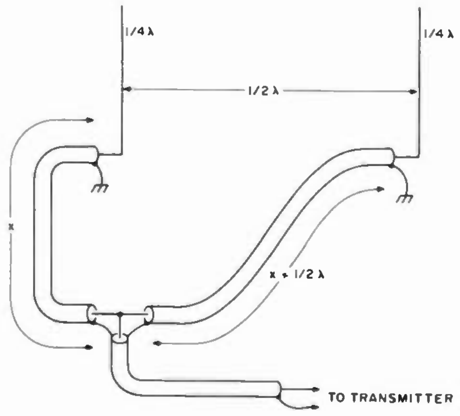

Fig. 2(g).

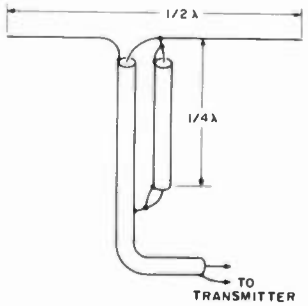

Fig. 3(a).

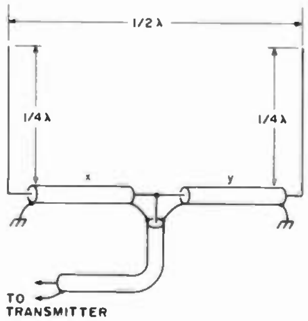

Fig. 3(b).

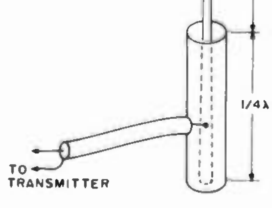

Fig. 4.

tical antennas spaced 1/2λ apart and fed 180° out of phase through a 1/2λ line to achieve a figure-eight radiation pattern. Fig. 2(f) shows similar antennas spaced 1/4λ apart and fed 90° out of phase to produce a unidirectional pattern. The velocity factor would apply to these phasing lines. Please note that Figs. 2(e) and (f) are just basic representations of an antenna system and not a practical arrangement.

How could you make a 1/2λ of coax (free space 1/2λ × VF) stretch between two verticals spaced a 1/2λ (free-space value) apart? It would be impossible unless you used an *air-dielectric* coax and then, of course, its proper length would be equal to the antenna spacing.

The proper phasing with solid-dielectric coax can be achieved as shown in Fig. 2(g). Dimension X is any convenient length of coax. The 1/2λ portion is computed with the VF. While this feedline system provides the proper phasing, it doesn't provide the necessary impedance matching. The same scheme could be used to provide the correct phasing for Fig. 2(f), but then the lines would be X, and X + 1/4λ.

Fig. 3 shows some cases where the velocity factor is *not* used in determining the physical length of solid-dielectric cables. In Fig. 3(a), a 1/4λ of coaxial cable is paired with a portion of the feedline to act as a decoupling stub or balun. Its length is approximately equal to the free-space length of a 1/4λ. The VF of the coax does *not* apply because no electric field exists between the inner conductor and the shield of the 1/4λ of coax. In fact, the inner conductor could be cut off flush with the dielectric, or even removed, as it has no function in this application other than to provide increased physical rigidity. In Fig. 3(b), line segments X and Y could be of any equal lengths and still provide the correct phasing for the broadside array. VF does not apply because a particular electrical length of feedline is not required.

The effects of velocity factor/dielectric constant in places other than feedlines can sometimes be important to the correct functioning of antennas or resonant circuits. For example, a coaxial version of a "J" antenna is shown in Fig. 4. The lower 1/4λ could be an air-insulated high-Q resonant section which matches the high end impedance of the 1/2λ radiator to the coaxial feedline.

This is a good, simple antenna for VHF. If it were to be built, though, you might be tempted to fill the lower 1/4λ section with plastic potting compound for improved physical rigidity or to minimize the effects of weather. Any dielectric added, however, would change the electrical length of the section, thereby detuning the system. A better approach would be to use the velocity factor of the plastic filler beforehand to determine the correct length of a plasticized 1/4λ section.

Why have I persisted in using the free-space formulas times the velocity factor to compute specific physical lengths? What's wrong with the old, tried and true formula, 468/frequency (MHz), to find the length of a 1/2λ? The reason is that antenna design is influenced by something called "end effect." This necessitates just about a 5% reduction of the free-space lengths when calculating the physical length of wire antennas. This phenomenon does not occur in transmission lines, so for these applications we just have to adjust the free-space figures with the velocity factor.

There is no doubt that coaxial cable is the most-used amateur feedline today. Its ease of use more than compensates for its small losses. If you need a critical electrical length, however, don't forget to use the velocity factor established by the cable manufacturer. ■

✓See List of Advertisers on page 130

HAL COMMUNI
RTTY & CW

PROFESSIONAL SYSTEM!

The DS3100ASR Terminal and ST6000 Demodulator are the choice of professional RTTY operators the world over. Some of the advanced features offered by this equipment are:

DS3100ASR:

● True ASR capabilities ● 200 line display storage ● 150 lines receive ● 50 lines transmit ● Baudot, ASCII, and Morse Codes ● 45 to 9600 baud RTTY ● 5 to 175 WPM CW ● WORD, LINE, and CONTINUOUS modes ● SYNC idle ("diddle") ● Unshift on space (USOS) ● WRU answerback ● Selective call printer control (SELCAL) ● Serial ASCII printer output for received text in any code ● Four keyboard controlled accessory switches ● RS232 or loop RTTY I/O ● 10 user-programmable HERE IS messages ● EAROM non-volatile storage of 4 HERE IS messages and operating conditions ● On-screen status indicators ● Custom labeled 3-legend keytops for non-confusing control operations ● Built-in 12 inch P31 display ● 120/240V, 50/60 Hz AC ● 13.5" × 20.5" × 15.25" ● 60 lbs. (two cartons)

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ST6000:

● Super RTTY demodulator ● Perfect companion to DS3100 in "dream station" ● All three standard RTTY shifts (170-425-850 Hz) ● Receive and Transmit circuitry ● Transmit tones crystal controlled ● Transmit CW ID - 100 Hz shift down in frequency ● Available for "high" or "low" tones (*High tones recommended for United States* - 2125 Hz mark) ● Wide bandwidth limiter for superior signal capture ● FM or AM operation ● Multipole active filter front-end ● Active filter discriminator ● Active low pass filter ● Synthesized transmit tone outputs ● ATC (automatic tone threshold control) ● DTH (decision threshold hysteresis) ● RS232, MIL188, CMOS, and current loop I/O ● Built-in 175 VDC, 60 ma neutral loop supply ● Motor control relay for autostart ● Antispace ● Built-in tuning oscilloscope ● 120/240V, 50/60 Hz AC ● Table or Rack cabinet (specify which) ● 3.5" × 9" × 17" ● 15 lbs.

PORTABLE RTTY and CW

The HAL CWR6850 brings a new dimension to amateur RTTY operation - PORTABILITY! Even though the size is small, the features are many:

CWR6850:

● Built-in display screen and demodulators ● 5" green CRT display ● 32 character display lines ● 4 pages of display ● 6 user-programmable HERE IS messages ● Internal RTTY demodulator for both "high" and "low" RTTY tones, three shifts each (170-425-850) ● Baudot or ASCII baud rates of 45 to 300 baud ● Morse code send and receive 3 to 40 wpm ● Parallel ASCII printer output for received text ● Separate, small keyboard ● Tape input/output connections ● Requires 12 VDC, 1.8 Amperes ● 12.75" × 11.75" × 5" (CWR6850); 13.75" × 2" × 7.25" (Keyboard) ● 20 lbs, including keyboard

LOW COST AND COMPACT!

The DS2050KSR is a time-proven RTTY terminal, combining the best of the popular HAL DS2000 and ST5000. Some of the DS2050 features are:

DS2050KSR:

● One cabinet for keyboard, display generator, and demodulator ● Full 72 character line by 24 line screen ● 2 programmable HERE IS messages ● Built-in RTTY demodulator for two shifts (170 or 850 Hz) ● Send and receive Baudot RTTY at 45 to 100 baud and ASCII RTTY at 110 to 300 baud ● Send CW at 5 to 100 wpm ● Receive CW (with MR2000 option) from 5 to 100 wpm ● RTTY CW ID is built-in ● KOS (Keyboard operated switch) ● Full current loop interface for send and receive RTTY loop (external loop supply required) ● SYNC idle ● USOS ● WORD mode ● Bright-dim video to distinguish TX and RX text ● 120/240V, 50/60 Hz AC ● 14.1" × 8.8" × 4.7" ● 18 lbs ● Two-tone tan cabinet ● External TV monitor required (HAL KG12 or ESM914 recommended).

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EQUIPMENT

COMMUNICATIONS TERMINAL

The CT2100 and KB2100 make up a very versatile and convenient RTTY and CW communications terminal. The CT2100 offers capabilities available in no other single-unit RTTY system. Some of these features are:

CT2100 & KB2100:

● KSR or split-screen operation ● Large or small character video ● 72 or 36 character display lines ● 24 lines per display page ● 2 pages of 72 character per line display or 4 pages of 36 character lines ● 12 line split screen transmit pretype buffer ● 2 user-programmable HERE IS messages ● Very large brag tape storage in MSG2100 (2K characters) ● 4 Built-in RTTY demodulators ● "High" tone RTTY (170-425-850 shift) ● "Low" tone RTTY (170-425-850 shift) ● 103 Modem RTTY (1070-1270 Hz; to 300 baud) ● 202 Modem RTTY (1200-2200 Hz; to 1200 baud) ● Baudot, ASCII, or Morse code ● 45 to 1200 baud Baudot or ASCII RTTY ● 5-100 WPM CW ● Crystal controlled synthesized transmit tones match receive filters ● RS232, Loop, or audio I/O interface ● Tape in/out connections ● KOS (keyboard operated switch) for auto TX/RX ● HDX or FDX ● Transmit data from loop device (paper tape distributor, etc.) ● Small separate keyboard with flexible cord for comfortable lap operation ● On-screen status line and tuning indicator ● Serial ASCII printer output to print all received text ● 120/240V, 50/60 Hz AC ● 16.75″ × 3.625″ × 10.375″; 19 lbs (CT2100) ● 14″ × 2.375″ × 7″; 7 lbs (KB2100) ● Two-tone gray cabinet with color front panel graphics ● External monitor required - HAL KG-12 or ESM914 recommended.

RS2100 - NEW RTTY TUNING SCOPE:

● Matches CT2100 cabinet ● Gives crossed-ellipse type of RTTY tuning indication for CT2100 ● Also includes built-in 175 VDC, 60 ma current loop supply ● Connects directly to CT2100 rear panel ● Also may be used with these other HAL products: DS2050, DS2000, ST5000, CWR685, CWR6850, CWR670, CWR6700, and ST5 or ST6 (with modification) ● One inch green phosphor CRT ● Front panel position, focus, and intensity controls ● 120/240V, 50/60 Hz AC ● 3.5″ × 8.25″ × 10.156″ ● 12 lbs.

MSG2100 - Message Storage ROM Option:

● Installs in CT2100 ● Stores 7 - 256 character and 1 - 192 character "brag-tape" or reply messages ● Also stores contents of both HERE IS messages ● Non-volatile storage is not lost when power is turned off ● Type 2716 EPROM programmed by HAL or by anyone with EPROM programmer ● Have several made - one for home, one for field day, etc. ● Coding forms included with each CT2100 - KB2100 system.

SWL - RTTY and CW, TOO!

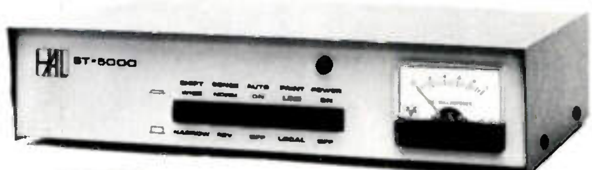
Now you can also enjoy shortwave listening to RTTY and Morse code transmissions with a unit designed for that purpose. The CWR6700 offers many advance features, previously available only in more expensive transmit-receive terminals. Some of these features are:

CWR6700:

● Receive ASCII, Baudot, or Morse code transmissions and see the decoded characters on the TV monitor screen ● RTTY speeds from 45 to 300 baud (60, 66, 75, 100, and 300 wpm) ● CW speeds from 4 to 50 wpm ● Unshift on space (UOS) for Baudot reception ● Parallel ASCII printer output ● Printer prints received ASCII, Baudot, or Morse signals ● Requires external TV monitor (HAL KG12 or ESM914 recommended) ● Runs on 12 VDC, 0.8 Ampere ● 8″ × 2.85″ × 12.6″ ● 8 lbs

RTTY DEMODULATORS:

HAL has long been a leader in the RTTY demodulator market. Our first two demodulator products, the ST5K and ST6K, are still in use all over the world and are still available on special order from HAL Communications (kit form only). The ST6000, as mentioned above, is a "standard of comparison" for performance and reliability. The ST5000 is a simplified version of the ST6000, particularly suited for limited budget installations where high performance is still a requirement. Some of the ST5000 features are:



ST5000:

● Two shifts - 170 and 850 Hz (others available on custom order) ● Internal 175 VDC, 60 ma current loop supply ● Motor control autostart with motor relay and outlet ● Built-in AFSK transmit tone generator with narrow-shift CW ID ● Meter tuning indicator with provision for external tuning scope (RS2100 recommended) ● 2.75″ × 8″ × 12″ ● 9 lbs shipping ● Two-tone blue and beige cabinet.

HAL COMMUNICATIONS, YOUR RTTY COMPANY:

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Since 1969, we have been designing and selling RTTY equipment for amateur and commercial use. We can claim many firsts in this business, including the first amateur video display of RTTY (RVD1001 and RVD1002) and the first commercial electronic amateur Baudot keyboard (DKB2010). The HAL people are proud of the equipment they sell and have a lot of experience in interfacing many types of equipment for RTTY and CW. Yes, RTTY can be confusing, but we'll be glad to help you if you give us a call.

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Red-Hot and Ready to Go

Anyone who has ever soldered knows that the cord gets in the way. Find freedom with this home-brew cordless iron.

Here's a simple, one-evening project that has proved to be very worthwhile. The end result is an instant portable soldering iron that is heavy enough for most soldering jobs short of antenna and chassis work. Since the tip can be changed from high to low power, the battery life may be extended when only light duty work is involved.

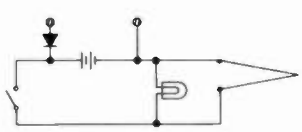
A 6-1/2" × 2" × 1-5/8" box neatly holds the parts, which consist of two size D nicads, two barrier strips, an on/off switch, a pilot lamp, a replacement soldering gun tip, and a diode to facilitate recharging the batteries. The pilot lamp is a #222 (2.25 V, 0.25 A).

Do use the lamp, as it is a very practical visual voltmeter and will give an indication as to when the battery needs a recharge. The tip still will get hot even if one of the cells is run down, and that can lead to deep discharge of the cell. Besides that, the lamp helps you to see where the solder is supposed to go inside of those dark and mysterious projects. (With 3.5-Ah cells and the tip removed, the thing makes an excellent 14-hour emergency flashlight.)

Without a doubt, there are better ways than the one shown to secure the tip, but this method is adequate and allows the business end of the instrument to get into tight places. If you wish to duplicate this mess, use a convenient length of #12 wire. The two-inch length shown has a voltage drop of about 10 millivolts per leg.

The heavy-duty tip, Wahl #7546, draws 8.5 A at 2.5 volts. The regular tip draws 6.5 A. With that kind of current, it is no surprise to find less than 2.5 V at the tip. The measured voltage is close to 2.1. The batteries fell to 2.25 volts.

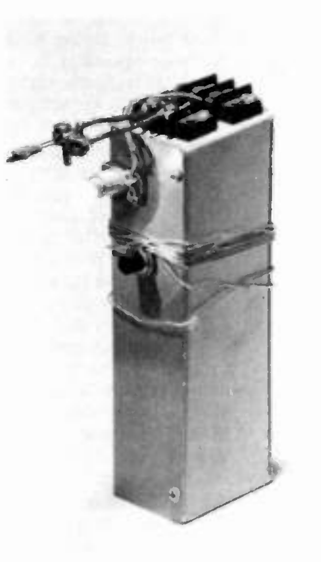
With that kind of current, the on/off switch must be a heavy-duty type. The least expensive on/off switch that I could get happened to be a push-on/push-off type. Since the iron stands by itself, this allows both hands to be used for bringing the work to the iron—which is often the most convenient way to do it. With the lamp glowing and the point smoking, you are not likely to go off and leave the thing turned on.



REPLACEMENT SOLDERING GUN TIP
#222 PILOT LAMP
SOCKET FOR LAMP
ON/OFF SWITCH
SIZE D CELLS 1AH OR 3.5AH
BARRIER STRIP
BOX
IN4001

Fig. 1.

A quick word concerning the batteries is now in order. With 1.2-Ah size D cells, expect about 8 minutes operating time. Allowing 10 seconds to reach operating temperature and another 10 seconds to make the connection, that would figure out to be about 25 connections (that's the high-power tip). With 3.5-Ah batteries, the arithmetic says to expect about 73 connections. The lighter tip should give about 23% more operating time.



Instant soldering iron.

The batteries may be recharged by means of a suitable current source connected to the second barrier strip. The battery manufacturers normally state on the battery how much current should be used and for how long. The diode is included to ensure that the current is not fed in backwards.

Since this is a cordless iron, there is no cord to use for storing solder. (You do keep a chunk of solder on your regular iron handle or cord, don't you?) The way the solder is stored here ensures an adequate supply and is almost self-feeding.

All of the parts for this project, except the batteries, were purchased new! (Don't faint!) The heavy-duty 3-4 Ah nicads are quite expensive if purchased from the regular wholesale outlets, so try to get them from one of the surplus sources.

The unit has proved itself after many hours of reliable operation. ■

NEW

"DX-traordinary."

Superior dynamic range, auto. antenna tuner, QSK, dual NB, 2 VFO's, general coverage receiver.

TS-930S

The TS-930S is a superlative, high performance, all-solid state, HF transceiver keyed to the exacting requirements of the DX and contest operator. It covers all Amateur bands from 160 through 10 meters, and incorporates a 150 kHz to 30 MHz general coverage receiver having an excellent dynamic range.

Among its other important features are, SSB slope tuning, CW VBT, IF notch filter, CW pitch control, dual digital VFO's, CW full break-in, automatic antenna tuner, and a higher voltage operated solid state final amplifier. It is available with or without the AT-930 automatic antenna tuner built-in.

TS-930S FEATURES:

- **160-10 Meters, with 150 kHz-30 MHz general coverage receiver.**
  Covers all Amateur frequencies from 160-10 meters, including new WARC bands, on SSB, CW, FSK, and AM. Features 150 kHz-30 MHz general coverage receiver. Separate Amateur band access keys allow speedy band selection. UP/DOWN bandswitch in 1-MHz steps. A new, innovative, quadruple "UP" conversion, digital PLL synthesized circuit provides superior frequency accuracy and stability, plus greatly enhanced selectivity.
- **Excellent receiver dynamic range.**
  Receiver two-tone dynamic range, 100 dB typical (20 meters, 50-kHz spacing, 500 Hz CW bandwidth, at sensitivity of 0.25 μv, S/N 10 dB), provides the ultimate in rejection of IM distortion.
- **All solid state, 28 volt operated final amplifier.**
  The final amplifier operates on 28 VDC for lowest IM distortion. Power input rated at 250 W on SSB, CW, and FSK, and at 80 W on AM. Final amplifier protection circuits with cooling fan, SWR/Power meter built-in.
- **CW full break-in.**
  CW full break-in circuit uses CMOS logic IC plus reed relay for smooth, quiet operation. Switchable to semi-break-in.
- **Automatic antenna tuner, built-in.**
  Covers Amateur bands 80-10 meters, including the new WARC bands. Tuning range automatically pre-selected with band selection to minimize tuning time. "AUTO-THRU" switch on front panel.
- **Dual digital VFO's.**
  10-Hz step dual digital VFO's include band information. Each VFO tunes continuously from band to band. A large, heavy, flywheel type knob is used for improved tuning ease. T.F. Set switch allows fast transmit frequency setting for split-frequency operations. A=B switch for equalizing one VFO frequency to the other. VFO "Lock" switch provided. RIT control for ±9.9 kHz.
- **Eight memory channels.**
  Stores both frequency and band information. VFO-MEMO switch allows use of each memory as an independent VFO. (the original memory frequency can be recalled at will), or as a fixed frequency. Internal Battery memory back-up, estimated 1 year life. (Batteries not Kenwood supplied).
- **Dual mode noise blanker ("pulse" or "woodpecker").**
  NB-1, with threshold control, for pulse-type noise. NB-2 for longer duration "woodpecker" type noise.
- **SSB IF slope tuning.**
  Allows independent adjustment of the low and/or high frequency slope of the IF passband, for best interference rejection. HIGH/LOW cut control rotation not affected by selecting USB or LSB modes.
- **CW VBT and pitch controls.**
  CW Variable Bandwidth Tuning control tunes out interfering signals. CW pitch controls shifts IF passband and simultaneously changes the pitch of the beat frequency. A "Narrow/Wide" filter selector switch is provided.
- **IF notch filter.**
  100 kHz IF notch circuit gives deep, sharp, notch, better than -40 dB.
- **Audio filter built-in.**
  Tuneable, peak-type audio filter for CW.
- **AC power supply built-in.**
  120, 220, or 240 VAC, switch selected (operates on AC only).
- **Fluorescent tube digital display.**
  Six digit readout to 100 Hz (10 Hz modifiable), plus digitalized sub-scale with 20-kHz steps. Separate two digit indication of RIT frequency shift. In CW mode, display indicates the actual carrier frequency of received as well as transmitted signals.
- **RF speech processor.**
  RF clipper type processor provides higher average "talk-power," improved intelligibility.
- **One year limited warranty on parts and labor.**

Other features:

- SSB monitor circuit, 3 step RF attenuator, VOX, and 100-kHz marker.

Optional accessories:

- AT-930 automatic antenna tuner.
- SP-930 external speaker with selectable audio filters.
- YG-455C-1 (500 Hz) or YG-455CN-1 (250 Hz) plug-in CW filters for 455-kHz IF.
- YK-88C-1 (500 Hz) CW plug-in filter for 8.83-MHz IF.
- YK-88A-1 (6 kHz) AM plug-in filter for 8.83-MHz IF.
- SO-1 commercial stability TCXO (temperature compensated crystal oscillator). Requires modifications.
- MC-60A deluxe desk microphone with UP/DOWN switch, pre-amplifier, 8-pin plug.
- TL-922A linear amplifier (not for CW QSK).
- SM-220 station monitor (not for pan-adapter).
- HS-6, HS-5, HS-4, headphones.

More information on the TS-930S is available from all authorized dealers of Trio-Kenwood Communications, 1111 West Walnut Street, Compton, California 90220.

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

TR-2500

size, smaller price!

The TR-2500 is a compact 2 meter FM handheld transceiver with every conceivable operating feature.

TR-2500 FEATURES:

- Weighs 540 g, (1.2 lbs). 66 (2-5/8) W x 168 (6-5/8) H x 40 (1-5/8) D, mm (inches).
- LCD digital frequency readout.
- Ten memories includes "MO" for non-standard split repeaters.
- Lithium battery memory back-up built-in, (est. 5 year life).
- Memory scan.
- Programmable automatic band scan, and upper/lower scan limits; 5-kHz steps or larger.
- Repeater reverse operation.
- 2.5 W or 300 mW RF output. (HI/LOW power switch).
- Built-in tunable (with variable resistor) sub-tone encoder.
- Built-in 16-key autopatch encoder.
- Slide-lock battery pack.
- Keyboard frequency selection.
- Covers 143.900 to 148.995 MHz.

CONVENIENT TOP CONTROLS

- Optional MS-1 mobile or ST-2 AC charger/supply for operation while charging.
- Battery status indicator.
- Complete with flexible antenna, 400 mAH Ni-Cd battery, and AC charger.

Optional accessories:

- ST-2 Base station power supply/ charger (approx. 1 hr.)
- MS-1 13.8 VDC mobile stand/ charger/power supply.
- VB-2530 2-M 25 W RF power amps., (TR-2500 only).
- TU-1 Programmable CTCSS encoder (TR-2500 only).
- TU-35B Programmable CTCSS encoder (mounts inside TR-3500 only).
- PB-25H Heavy-duty 490 mAH Ni-Cd battery pack.
- DC-25 13.8 VDC adapter.
- BT-1 Battery case for AA manganese/alkaline cells.
- SMC-25 Speaker microphone.
- LH-2 Deluxe leather case.

NEW

TR-3500

70 CM FM Handheld

- Covers 440-449.995 MHz in 5-kHz steps.
- HI-1.5 W, Low-300 mW.
- TX OFFSET switch, ±5 kHz to ±9.995 MHz programmable.
- Auto/manual squelch control.
- Tone switch for opt. TU-35B
- Other outstanding features similar to TR-2500.

- BH-2A Belt hook.
- RA-3 2 m 3/8 λ telescoping antenna (for TR-2500).
- WS-1 Wrist strap.
- EP-1 Earphone.

TR-7950/7930

Big LCD, Big 45 W, Big 21 memories, Compact.

Outstanding features providing maximum ease of operation include a large, easy-to-read LCD display, 21 multi-function memories, a choice of 45 watts (TR-7950) or 25 watts (TR-7930), and the use of microprocessor technology throughout.

TR-7950/TR-7930 FEATURES:

- New, large, easy-to-read LCD digital display. Easy to read in direct sunlight or dark (back-lighted). Displays TX/RX frequencies, memory channel, repeater offset, sub-tone number, scan, and memory scan lock-out.
- 21 new multi-function memory channels. Stores frequency, repeater offset, and optional sub-tone channels. Memory pairs for non-standard splits. "A" and "B" set band scan limits. Lighted memory selector knob. Audible "beep" indicates channel 1 position.
- Lithium battery memory back-up. (Est. 5 yr. life.)
- 45 watts or 25 watts output. HI/LOW power switch for reduction to 5 watts.
- Automatic offset. Pre-programmed for simplex or ±600 kHz offset, in accordance with the 2 meter band plan. "OS" key for manual change in offset.
- Programmable priority alert. May be programmed in any memory.
- Programmable memory scan lock-out. Skips selected memory channels during scan.
- Programmable band scan width.
- Center stop circuit for band scan, with indicator.
- Scan resume selectable. Selectable automatic time resume-scan, or carrier operated resume-scan.
- Scan start/stop from up/down microphone.
- Programmable three sub-tone channels with optional TU-79 unit (encoder).
- Built-in 16-key autopatch encoder, with monitor (Audible tones).
- Front panel keyboard control.
- Covers 142.000-148.995 MHz in 5-kHz steps.
- Repeater reverse switch. (Locking)
- "Beeper" amplified through speaker.
- Compact lightweight design.

Optional accessories:

- TU-79 three frequency tone unit.
- KPS-12 fixed-station power supply for TR-7950.
- KPS-7A fixed-station power supply for TR-7930.
- SP-40 compact mobile speaker.

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NEW

TL-922A

Maximum legal power on 160-15 meters

The TL-922A linear amplifier provides maximum legal power on the 160-15 meter Amateur bands.

TL-922A FEATURES:

- 2000 W PEP (SSB)/1000 W DC (CW, RTTY) input power on 160, 80, 40, 20, and 15 meters, with 80 W drive.
- Excellent IMD characteristics.
- Pair of EIMAC 3-500Z high-performance transmitting tubes.
- Safety protection.
- Blower with automatic turnoff-delay circuit.
- Variable threshold level type ALC.
- Two meters, one indicating plate current, and the other indicating grid current, relative RF output, and high voltage.

SM-220

High-performance oscilloscope for various monitoring functions

The SM-220 Station Monitor provides a variety of waveform-observing capabilities, and an optional pan display.

SM-220 FEATURES:

- Monitors transmitted SSB and CW waveforms from 1.8 to 150 MHz.
- Monitors signal waveforms in receiver's IF stage.
- Functions as high-sensitivity, wide-frequency-range (up to 10 MHz) oscilloscope.
- Tests linearity of linear amplifiers (provides trapezoid pattern).
- Allows observation of RTTY tuning points (cross pattern).
- Built-in two-tone (1000-Hz and 1575-Hz) generator.
- Expandable to pan-display capability for observing the number and amplitude of stations within a switchable ±20 kHz/±100 kHz bandwidth.

Optional accessories:

- BS-8 pan-display module for TS-180S, TS-830S, and TS-820 Series.
- BS-5 pan-display module for TS-520 Series.

ACCESSORIES

A wide selection of optional accessories is offered for optimum operating flexibility. In addition to the optional items listed with each piece of equipment described in this catalog, the following accessories are also available:

(FCC Part 68 registered)

PC-1A Phone Patch
PC-1A Phone Patch with hybrid circuit and VU meter for null and audio gain measurements.

BO-9A System Base (for TR-9130, TR-9500, TR-9000).
With memory backup supply, speaker sound port, ST-BY switch, power switch, headphone jack.

VB-2530 25 W RF Power Amplifier (for TR-2500).
BNC-BNC cable, and mounting bracket supplied.

DM-81 Dip Meter

The DM-81 dip meter is highly accurate and features, in addition to the traditional inductive-coupling technique, capacitive coupling for measuring metal-enclosed coils and toroidal coils.

DM-81 FEATURES:

- Measuring 700 kHz-250 MHz in seven bands.
- Capacitance probe for measuring resonant frequencies without removing coil shields, and also for measuring resonant frequencies of toroidal coils.
- Built-in storage compartment for coils, and accessories.
- All solid-state and built-in battery.
- HC-25U and FT-243 sockets for checking crystals and marker-generator function.
- Amplitude modulation.
- FET for good sensitivity.
- Absorption frequency meter function.
- Earphone for monitoring transmitted signals.

HC-10 Digital Quartz Clock
The HC-10 digital world quartz clock with dual 24-hour display shows local time and the time in 10 preprogrammed plus two programmable time zones.

MICROPHONES:

- **MC-60A** Deluxe desk microphone with UP/DOWN switch, pre-amplifier. 50 kΩ/500Ω, 8-pin. Adapter cords PG-4A (4-pin), PG-4B (6-pin), available. PG-4C, supplied with MC-60A.
- **MC-60N4** Deluxe desk microphone. 50 kΩ/500Ω, 4-pin. (UP/DOWN switch, pre-amp. (not included). PG-4C available.
- **MC-50** Desk microphone, 50 k/500Ω, 4-pin.
- **MC-46** 16-key autopatch UP/DOWN microphone, 6-pin.
- **MC-42S** Hand microphone with UP/DOWN switch, 500Ω, 8-pin.
- **MC-30S** Hand microphone, 500Ω, noise-cancelling, 4-pin.
- **MC-35S** Hand microphone, 50 kΩ, noise-cancelling, 4-pin.

Microphone Plug Adapters:

- MJ-48 (4-pin microphone to 8-pin transceiver).
- MJ-84 (8-pin microphone to 4-pin transceiver).
- MJ-86 (8-pin microphone to 6-pin transceiver).

HEADPHONES:

- **HS-5** Deluxe headphones.
- **HS-6** Lightweight headphones.
- **HS-4** Standard headphones.

GENERAL PURPOSE AC POWER SUPPLIES:

- **KPS-7A** 13.8 VDC, 7A intermittent
- **KPS-12** 13.8 VDC, 12A intermittent.
- **KPS-21** 13.8 VDC, 21A intermittent.

OTHER ACCESSORIES:

- **SP-40** Compact external mobile speaker.
- **RD-20** Dummy load, 50Ω, DC-500 MHz, 50 W intermittent, 20 W continuous.
- **PG-3A** DC line noise filter for mobile.

SERVICE MANUALS:

- Available for most transceivers, receivers, and major accessories.

NOTE: Prices and specifications of all Trio-Kenwood products are subject to change without prior notice or obligation.

KENWOOD
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1111 West Walnut, Compton, California 90220

Cutting Current to Size

Measuring large ac currents can be difficult unless you know a trick or two. W7CRY explains how.

Larry T. Wier W7CRY
1068 149 Pl. SE
Bellevue WA 98007

Have you ever tried to measure large ac currents and found your trusty VOM somewhat short? Welcome to the club. I was stuck with the problem of finding the current used by an electric hot water heater but no way of measuring it.

I also found my wallet short after letting my fingers walk through several instrument catalogs. Several hours of thrashing around the workbench yielded a simple and, best of all, inexpensive way of measuring large ac currents using an ordinary 88-mH choke, a trick or two, and Ohm's law.

Theory

Perhaps a little transformer theory should be covered before Ohm's law and the tricks are applied.

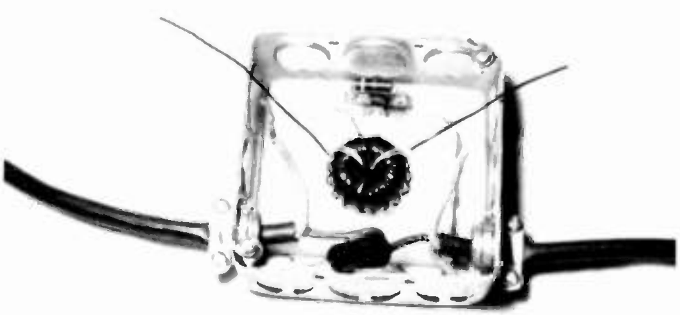
By definition, a transformer is exactly what its name implies: It transforms one voltage (or current) to a different level. The major differences between a voltage transformer and current transformer are the turns ratio and power-transfer characteristics. Depending on design, the voltage transformer has a low turns ratio, i.e., approximately 19 to 1 (118/6.3) for a filament transformer. The current transformer, on the other hand, has a turns ratio from around 300 to greater than 10,000 to 1, depending on the burden (load) on the secondary.

The current transformer always has the burden specified along with the current ratio. For example, a typical 50-Amp to 5-Amp current transformer will require a burden of .25 Ohms. If the secondary burden were to open or be removed, the transformer would be destroyed because the voltage developed across the resulting open circuit would cause arcing within the windings.

An additional consideration is that the current transformer should not introduce significant changes in the circuit being measured.

Hybrid Current Transformer Design

Fig. 1 shows the basic technique in utilizing the 88-mH choke as a current transformer. The term hybrid is used because in using the choke, a "halfway in-between" turns ratio will result. The approximate number of turns is determined by measuring the resistance of the coil, finding



The almost-completed ac current transformer. The transformer is mounted on a piece of styrofoam™ which is glued to the box. Contact or rubber cement can be used for both the foam and transformer. The signal wires (not shown) can be routed out through any of the knockouts.

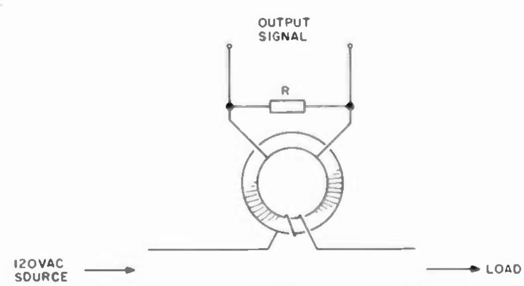


Fig. 1. Basic hybrid current transformer.

More Transceiver

Contest or rare DX–the world is waiting to hear from a new breed of HF operators who'll have the power of a microcomputer at their instant command. The Heath SS-9000 signals a new era in Amateur Radio, full of exciting promise. Challenge. And opportunity...

Keyboard command also allows you to set and switch the band, mode, passband shift, baud and scan rates, plus switch to one of five antennas *automatically.*

MORE WORLD HORIZONS

In the SS-9000, we met a major design goal: *provide the highest-tech, most versatile transceiver possible.* Our objective? Nothing less than setting the pace for transceiver performance in the next decade. And transforming the state-of-the-art in amateur telecommunications potential.

As a microprocessor-based, fully-synthesized nine band Transceiver, your SS-9000 leads the new revolution in computer-enhanced hamshacks – with an array of applications yet to be discovered. At your command under direct or RS-232 control, it could break all known records for station performance.

MORE MICRO CONTROL

Harness the SS-9000 to a video terminal, ASCII teletype or home computer. Commands are available to select, display and change all 27 operating and memory frequencies, assign and toggle T/R/Tr status on the dual readout, and freely manipulate the three stored frequencies on each band, with full diagnostic error-prompting.

MORE POWER AS A PAIR

The PS-9000 AC Power Supply has an in-cabinet speaker and two digital 12 or 24-hour clocks. Both units benefit from thermal and over-current protection with high VSWR cutback. Test-prove the assembled System 9000. Get a hands-on tryout at your nearby Heathkit Electronic Center.*

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AM-429

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the wire size, and, from a wire table, finding the resistance per foot. By taking the average diameter of the donut and average cross section, a rough turns count can be calculated.

For those not willing to take the time to play with the math, a quick test can be found in the calibration section. If the ratio is found to be in excess of about 300, the choke is a good candidate.

Apparently, there are several so-called surplus 88-mH-type chokes. I found some with and some without center tap. I have also found some with two separate windings. These can be used if the windings are connected in series adding. Even though the choke defined here was intended for the audio frequencies, it works well at 60 Hz if the power levels are kept low.

Construction

The only construction required is covering the existing windings with tape. Once the value of R is determined, it can be soldered to the windings and taped to the body of the coil or mounted as shown in Fig. 3. The signal wires are attached across the resistor and routed where necessary. Wire length is not critical, but wires should be routed away from high-noise areas.

Calibration

Fig. 2 shows the test setup used to calibrate the current transformer. It is not necessary to use the 120-volt, 60-Hz line to do the calibration. As shown, a low-voltage, high-current voltage transformer with an adjustable input is the quickest and safest.

For calibration purposes, R can be a quality pot. The 100-Ohm resistor is used to prevent shorting the transformer, but is part of the burden. The source and load will depend on what is available. Use the following steps to calibrate the transformer:

1) Make sure that there are ten complete turns of #18 insulated wire wound as shown in Fig. 2.

2) Adjust the load for 10.0 Ohms.

3) Adjust the voltage to the load for 10.0 V ac.

4) Adjust R (1k pot) for an even value of voltage—preferably 0.1 V ac. Remove power.

(If 0.1 volt was not obtainable, replace R with a 2k pot. If the measured voltage was higher than 0.1 V ac, set the value to any even value above 0.1 V, e.g., 0.3 V ac.

(The current ratio is calculated as follows: $I = E/R$, where E was set to 10.0 V ac and R was set to 10.0 Ohms. Therefore, $I = 10\ V/10\Omega = 1$ Amp.

(Then 1 Amp through 10 turns equals 10 Amp/turns which is also equal to 10 Amps with 1 turn through the transformer. With one turn in the primary and the measured value across R of 0.1 V ac, the ratio becomes 10 to 0.1. By Ohm's law, E is equal to I times R, and if R is held constant, then E must be proportional to I.

(What this boils down to is that the current through the transformer will generate a proportional voltage across R as long as R stays constant. If the ratio has been set correctly, adjusting the load to 1.0 Ohms and again adjusting the voltage across the load to 10.0 V ac, a value of 1 V ac should be measured across R.)

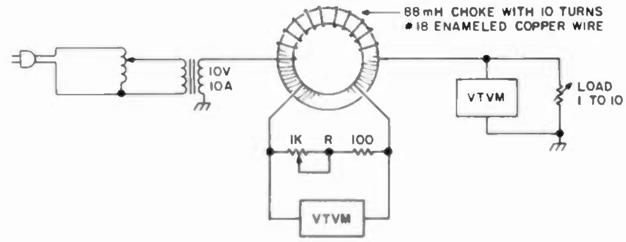

Fig. 2. Calibration test setup.

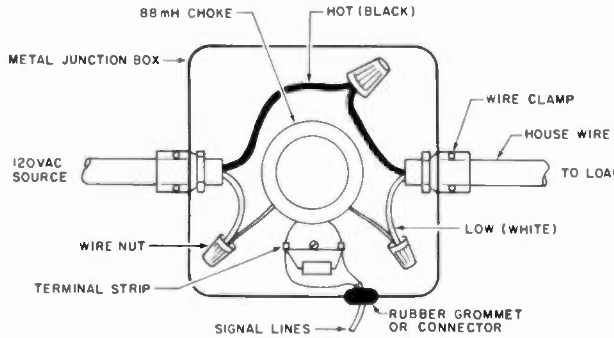

Fig. 3. Mounting fixture.

5) Determine the wattage for R by measuring the value of R and calculating as follows: $P_{Watts} = E^2/R$. Generally, a ½-Watt resistor will be more than sufficient. Replace the pot and 100-Ohm resistor with a fixed value equal to the combination of the two in series.

Application

Obviously, this combination can be used with any current range. It is limited only by the size of wire capable of being wound (1 turn) through the donut. Note that at least one turn is necessary to excite the transformer core. Passing the wire through the hole is not sufficient. Practically speaking, a #5 (solid enameled) wire is about the maximum-size wire which can be formed into one turn around the donut. This limits the upper current range to around 50 Amps.

The number of turns wound on the current transformer will depend on the current range to be measured and wire size. As an example, suppose a motor rated at 15 Amps (running) is to be monitored. We know from our calibration that 10 Amps gave us 0.1 V ac across R. Therefore, one turn of #12 wire through the donut should give us 0.15 V ac across R. The #12 was chosen because it is the smallest size generally used for motors in this range.

Another example is the case where only 1 Amp is to be measured. In this case, the wire size (assumed to be #14) is too large to pass a large number of turns through the donut. If you can assume also that nothing larger than approximately 5 Amps will be

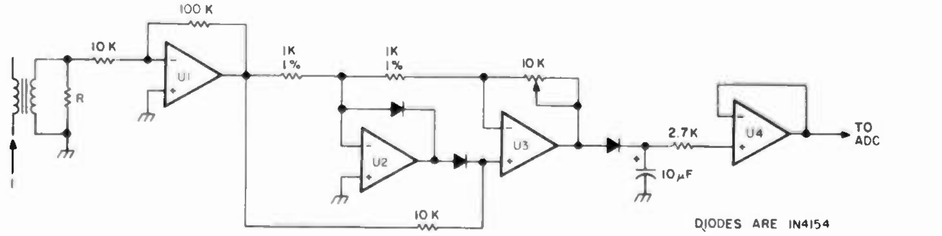

Fig. 4. Precision rectifier/buffer.

The ultimate team...the new Drake "Twins"

The TR7A and R7A offer performance and versatility for those who demand the ultimate!

TR7A Transceiver

• **CONTINUOUS FREQUENCY COVERAGE** — 1.5 to 30 MHz full receive coverage. The optional AUX7 provides 0 to 1.5 MHz receive plus transmit coverage of 1.8 to 30 MHz, for future Amateur bands, MARS, Embassy, Government or Commercial frequencies (proper authorization required).

• **Full Passband Tuning (PBT)** enhances use of high rejection 8-pole crystal filters.

New! **Both 2.3 kHz ssb and 500 Hz cw crystal filters, and 9 kHz a-m selectivity are standard,** plus provisions for two additional filters. These 8-pole crystal filters in conjunction with careful mechanical/electrical design result in realizable ultimate rejection in excess of 100 dB.

New! **The very effective NB7 Noise Blanker is now standard.**

New! **Built in lightning protection** avoids damage to solid-state components from lightning induced transients.

New! **Mic audio available** on rear panel to facilitate phone patch connection.

• **State-of-the-art design** combining solid-state PA, up-conversion, high-level double balanced 1st mixer and frequency synthesis provided a no tune-up, broadband, high dynamic range transceiver.

R7A Receiver

• **CONTINUOUS NO COMPROMISE 0 to 30 MHz** frequency coverage.

• **Full passband tuning (PBT).**

New! **NB7A Noise Blanker supplied as standard.**

• **State-of-the-Art features of the TR7A,** plus added flexibility with a low noise 10 dB rf amplifier.

New! **Standard ultimate selectivity choices include the** supplied 2.3 kHz ssb and 500 Hz cw crystal filters, and 9 kHz a-m selectivity. Capability for three accessory crystal filters plus the two supplied, including 300 Hz, 1.8 kHz, 4 kHz, and 6 kHz. The 4 kHz filter, when used with the R7A's Synchro-Phase a-m detector, provides a-m reception with greater frequency response within a narrower bandwidth than conventional a-m detection, and sideband selection to minimize interference potential.

• **Front panel pushbutton control** of rf preamp, a-m/ssb detector, speaker ON/OFF switch, i-f notch filter, reference-derived calibrator signal, three agc release times (plus AGC OFF), integral 150 MHz frequency counter/digital readout for external use, and Receiver Incremental Tuning (RIT).

The "Twins" System

• **FREQUENCY FLEXIBILITY.** The TR7A/R7A combination offers the operator, particularly the DX'er or Contester, frequency control agility not available in any other system. The "Twins" offer the only system capable of no-compromise DSR (Dual Simultaneous Receive). Most transceivers allow some external receiver control, but the "Twins" provide instant transfer of transmit frequency control to the R7A VFO. The operator can listen to either or both receiver's audio, and instantly determine his transmitting frequency by appropriate use of the TR7A's RCT control (Receiver Controlled Transmit). DSR is implemented by mixing the two audio signals in the R7A

• **ALTERNATE ANTENNA CAPABILITY.** The R7A's Antenna Power Splitter enhances the DSR feature by allowing the use of an additional antenna (ALTERNATE) besides the MAIN antenna connected to the TR7A (the transmitting antenna). All possible splits between the two antennas and the two system receivers are possible.

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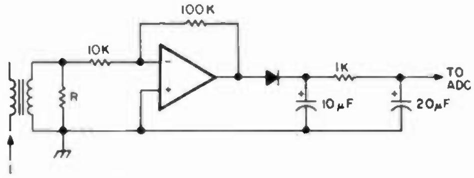

Fig. 5. Half-wave rectifier.

passed through the donut, then ten turns of #18 (solid enameled) will generate 0.1 V ac across R. In most cases, the number of turns will be determined by the measurement requirements.

Installation

According to most electrical codes, any splices of power lines must be located in a box. An outlet or junction box will work equally well. The transformer should not touch the metal box, and make sure that only the circuit being measured is in the box. It is best to use the low side (white wire) because the voltage between the low side and ground will not exceed the voltage rating of the enameled wire.

When measuring a 220-V ac line it will be necessary to use either of the two hot (red or blue) lines. In this case, the donut should have at least one layer of electrical (plastic) tape between the two sets of windings. Fig. 3 shows one method of mounting the donut and resistor R. Any method which meets your local code requirements will work.

Use

Now that you have a current transformer, how can it be used? The answer to that depends on why it was built. The easiest use of the current transformer is with an ac voltmeter. In my case, it is being used in a computer-controlled power system. Since a computer does not know ac from dc (or much else), the ac signal across R must be signal conditioned. There are many ways to signal-condition, but the method I chose was determined by the analog-to-digital converter (ADC) used with my computer. It has ±15 V dc available, so that the use of operational amplifiers seemed to be the best solution.

Fig. 4 is an example of how the ac signal is conditioned from ac to dc for the ADC. It is beyond the scope of this article to dissect the operation of Fig. 4 except to note that U2 and U3 form an absolute value (precision-rectifier) circuit. U1 is an inverting amplifier and U4 is used as a unity-gain buffer. U1 and U4 are in one LM747 and U2 and U3 are in another. Any general-purpose operational amplifier will work. (More information on this particular absolute-value circuit may be found in the November 8, 1979, issue of *Electronic Design*, page 94.)

A simple amplifier and diode arrangement also will work if accuracy and response time are unimportant. Fig. 5 is the method used in this case.

Summary

No matter what the requirement, a simple arrangement such as described here will provide a reasonably accurate measurement of ac line current. Sources of 88-mH chokes are found in the back of most electronic magazines and cost around $3.00.

Now I need to look into a method of measuring the gas pressures in my heat pump! ■

Reader Service for facing page ✓ 15→


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Construct This All-American Audio Signal Generator

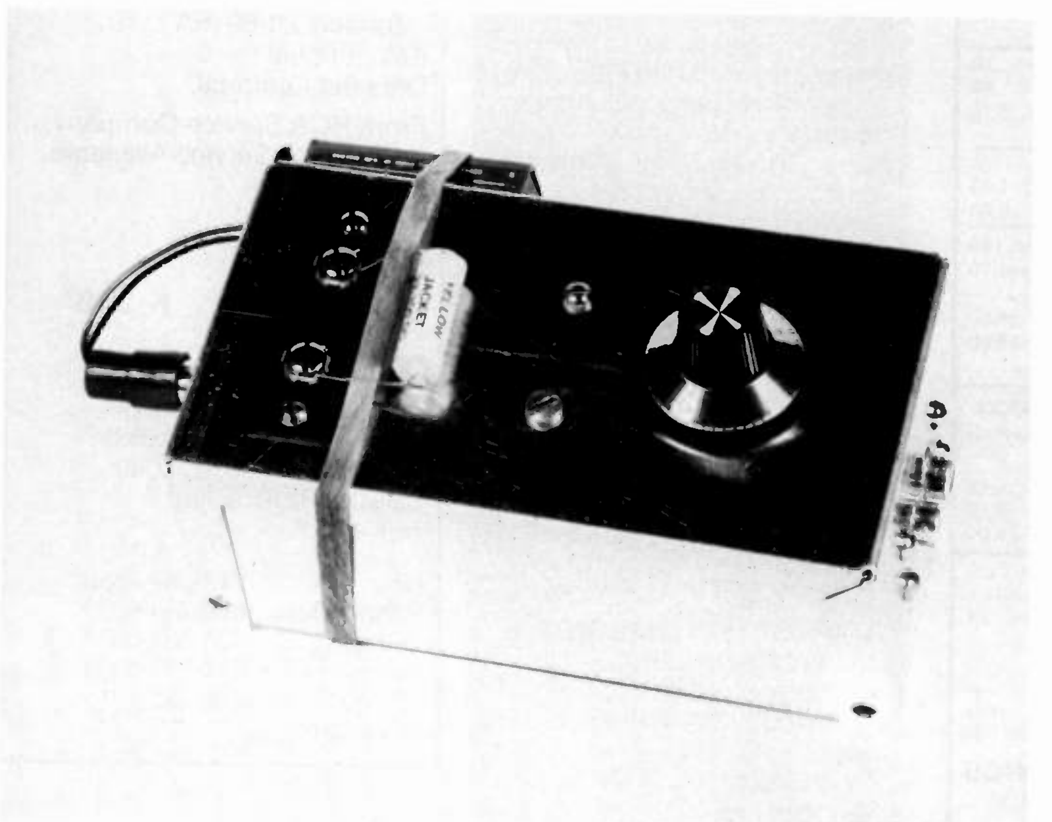
The perfect project for starting a test bench or rounding one out.

It is still possible for the average builder to design and make equipment that is competitive in cost and effectiveness with that which is store-bought. Many simple, standard design concepts can be applied to modern technology.

The Circuit

This FET audio signal generator is an easy project derived from the audio oscillator circuit presented in "Working with FETs—part 1," in *73* in November, 1979. There are some simple additions in the finished circuit which make it far more useful than just the basic circuit (see Fig. 1).

I could have used a switch and a selection of fixed values, but it would have cost more and built in a fixed limit. The easy way out was to put the frequency-determining capacitor outboard so that it can be changed quickly. You can use a substitution box or your junk-box selection with ease, but most of the time you can just leave the fixed value in place. I have rarely needed more than the one tone for testing.



Top view of FET audio signal generator.

Potentiometer R2 gives you an adjustable output level. This is very handy for testing or troubleshooting. Resistors R3 and R4 form an output attenuator network that gives you a low-level adjustable output. This is useful when working with high-gain circuits. Using an attenuator network gives you a cleaner low-level signal than trying to use a high-level signal at the lowest setting.

A 9-volt transistor radio battery or a power supply can be plugged in at J3. This way you can change quickly between battery and fixed supply, or use your battery or supply with other equipment. It's handy. The low power drain, about 2.2 mA, makes this a really practical project for battery and portable operation.

There are only a few parts values that are at all critical. The design center was for 10% tolerance and in most cases it is much wider. Except in one important case, the voltage rating is anything reasonable over 20 WV dc.

L1 is an 88-mH unpotted toroid. It is a common surplus item, but you may have to look around. They are often used for filters in RTTY equipment.

C1 in combination with L1

is what actually sets the audio tone. My substitution box gave usable tones from 0.22 uF up, but the highest tones were out of the comfortable audio range. I think that 0.1 uF to 0.22 uF would be a good starting point. Get out the junk box and play around.

R1 limits the voltage swing of the output waveform at the gate of Q1. If it were not there, under some conditions the signal might be large enough to damage the transistor. The value is not critical; 3.3k or more will do, but have something there for protection.

Q1 is a Motorola HEP-801, a commonly available audio FET. It has four pins, the fourth being a connection to the outer case. When I made the prototype circuit, the matrix board automatically connected the case to the source pin. It worked well that way so I left it in the finished circuit.

Drain bypass capacitor C5 is not critical. Anything from 20 to 100 uF at 20 volts or more should do. The circuit worked well without it, but it might be needed to keep any noise from getting in from your supply. Keep in mind that to further decouple the circuit you can also add a 2.2k or so resistor in series with the drain line if you have a stubborn noise problem. The greater the capacitance of output coupling capacitor C2, the better the low frequency response. I used a 0.1-uF 50-V-dc disc ceramic that was on hand.

Output level control R2 is a 50k linear-taper potentiometer. A linear taper is used because it is a voltage divider application, not a true volume control. Mine has an ac switch (SW1) right on the back, but you can use a separate switch.

R3 (470k) and R4 (47k) form the attenuator network. The textbook values would be different, but since I aimed for a wide 10% tolerance, it worked out well. The measured output is very close to a 10:1 ratio. My resistors happen to be 5% values as they were available in the store. Output coupling capacitors C3 and C4 have the only critical ratings: Both are 0.01 uF at 1000 volts disc ceramics.

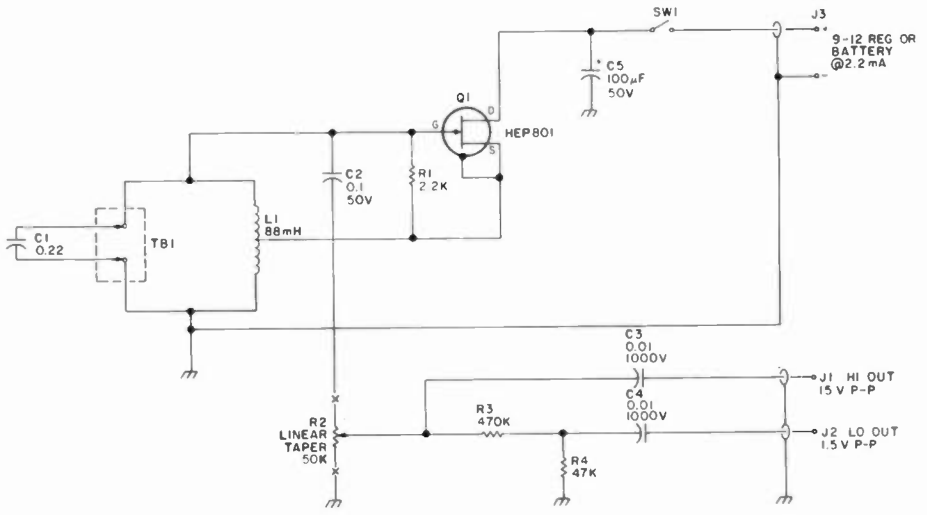


Fig. 1.

The voltage rating is critical. They block any dc voltage in the test circuit (such as a tube-type amplifier) from getting back into the generator and frying all the little parts. Use at least 500-volt capacitors, preferably higher. You should not be using equipment like this in really high-voltage circuits. It's unhealthy. But a good safety margin will keep you going when you work with most tube-type equipment.

These two capacitors also will determine the frequency response of your generator and it's hard to find high capacitance at high working voltage. This means that your lowest audio tones will have less output voltage than mid or high tones.

I should stress that the low-frequency loss comes from the coupling capacitors in the circuit, not the oscillator, which will provide far flatter output across the audio spectrum.

Construction

Construction is easy. There are only a few mechanical problems to watch for. The photos show the parts layout and there are a few tricks to make it easier.

I used cardboard at the top and bottom of toroid L1 and a short length of insulation over the screw where it went through the toroid to prevent any shorting.

There is one potential trouble area. Clean the enamel off the magnet wire ends of the toroid very carefully. I mean really get in there with a sharp penknife and *scrape it off*. I was sloppy the first time. It looked good but it didn't work. It took me a while to find the problem. Check for a good clean contact with your ohmmeter. It doesn't matter which end is grounded when you install it, but when you make the center-tap, look for the two ends that are closest together.

Use a good quality transistor socket. The cheap one I tried at first fell apart. I soldered the leads to the socket first and then wired it to the terminal strip. I was going to tack it down with silicone sealer, but the wire was stiff enough that it didn't wander.

RCA jacks were used throughout. They are not the last word in connectors, but they are cheap and easy to get.

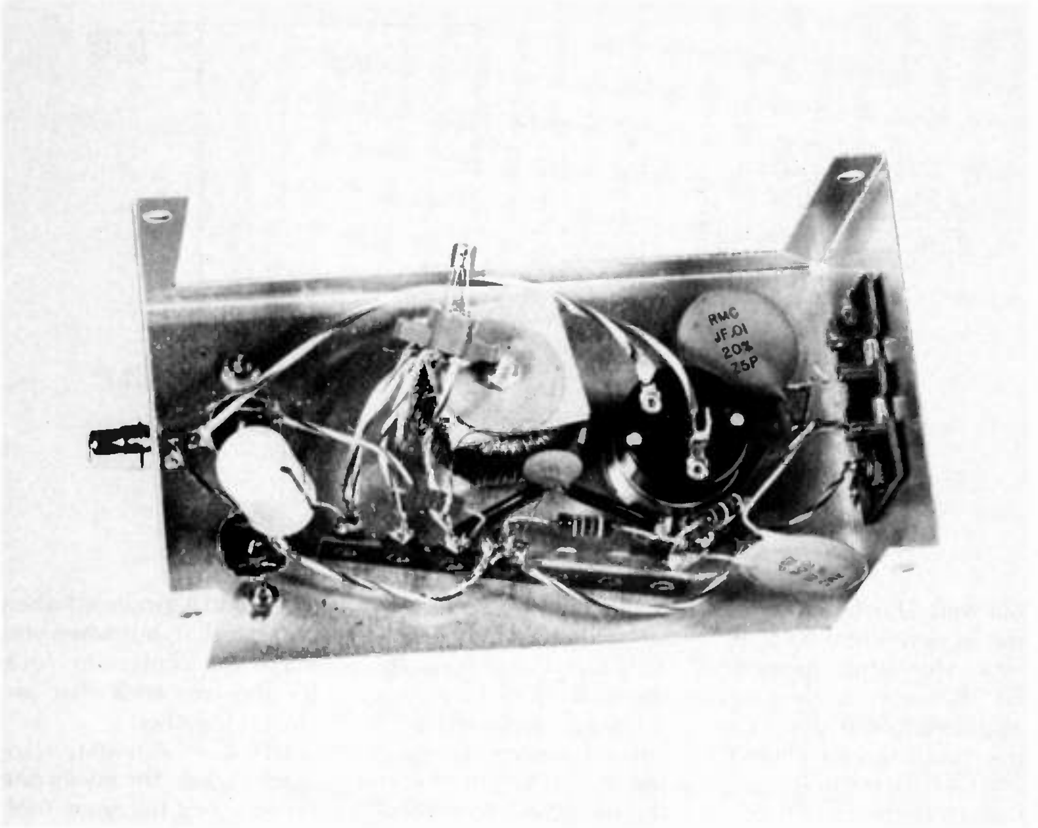
There are many styles of enclosure available; it just has to all fit. I did not try

Parts List

C1—0.22-uF, 20-volt or greater
C2—0.1-uF, 50-volt disc ceramic
C3,C4—0.01-uF, 1000-volt disc ceramic (voltage rating critical)
C5—100-uF, 50-volt electrolytic
J1, J2, J3—RCA jacks
L1—88-mH toroid
R1—2.2k, ½-Watt 5 or 10%
R2—50k, linear-taper pot. (Radio Shack 271-1716)
R3—470k, ½-Watt 5 or 10%
R4—47k, ½-Watt 5 or 10%
SW1—ac switch, part of R2 (Radio Shack 271-1740)
Q1—Motorola HEP-801 n-channel FET

Miscellaneous

Minibox—5-1/4" × 3" × 2-1/8" (Radio Shack 270-238)
Knob—Radio Shack 274-413
TB1—2-screw terminal strip
Solder terminal strip (see photo)
Transistor socket
Mounting hardware



Bottom view.

to miniaturize. It's small enough now to be handy but large enough to service easily. Notice that the leads are not as short as they could possibly be. It's neat, but there is room and length to work with.

The only part that might be a problem to buy is the toroid. They are still common mail-order items if you check the RTTY supply houses. Get a few; they're useful. Almost any of the other parts are common enough that you may be able to use some of them to make up a minimum order requirement.

I spent a little under $9 to build the signal generator. I had the toroid, transistor, and some of the small parts, but I bought the rest new to get the prices. I would estimate that it can be built for about $12 if you are careful, and within $15 without too much trouble.

Testing

When you have it put together, check for wiring errors and shorts. Put your milliammeter in the power lead and check the current as you turn it on. Don't forget to put some capacitance value at TB1 (C1) so there will be a complete LC circuit.

Use your scope or high-impedance headphones to check for a tone. If it works, use your scope or VTVM to measure the output voltage at both output jacks as it may vary between units. Don't try to use a VOM on the low-level output. It will load it down to almost nothing. Check for proper operation of the level control and the on-off switch. If you get past all that, you are in business.

The first time I tried mine it didn't work and I designed it! Here are the most likely troubles to look for:

1) Transistor inserted incorrectly in the socket, or you have the wrong pin configuration to the circuit.

2) Weak or dead battery. Check yours under load with meter.

3) Wiring error. Recheck schematic.

4) Coil doesn't make connection with rest of circuit. Unsolder and clean again. Ohmmeter might help here.

The signal should be at the gate of the FET. Lifting one lead of C2 will isolate the output circuit. If there is still no signal at the gate, then the trouble is in the oscillator circuit itself.

Performance

I checked the performance of mine with my usual assortment of ancient and out-of-tolerance test gear and got the following.

The output voltage varies only slightly over the supply-voltage range of 9 to 20 volts. This is a fringe benefit of R1. It holds the output voltage constant over a wide range of supply voltages.

The output drops off slightly with a supply voltage between 9 and 5 volts. At the design center of 9 to 12 volts, the drain current is about 2.2 mA.

The output voltage at the HI output jack (J1) is 15 volts peak-to-peak on the scope. At the LO jack (J2), it is 1.5 volts p-p. Pretty good for a rough and ready attenuator network.

The calculated rms voltage by formula was not what one meter showed. The VOM indicated 4.2 volts rms. The LO range was loaded down too much by the meter. The output across the "output" jack was about +15 dBm—enough for many purposes.

The minimum signal voltage available is about 0.01 volt p-p on the scope. The voltage is still controllable below this level, but you are at the extreme end of the range and there is a higher level of hum vs. signal. Some noise will get in from any test setup, but at very low levels, noise and crud are a higher percentage of your actual test signal.

Your performance measurements will probably vary from mine because of differences in the unit and test equipment used. The absolute values are not as significant as knowing the relative values as measured by your own equipment. This gives you a way to check the performance against a recorded value.

Always keep records on the operating characteristics of equipment you make when you complete it. Then you will have figures to use for comparison when you need them. It won't be guesswork or vague memory.

Odds and Ends

There are a few little odds and ends to really finish the project properly.

Make a full-size schematic diagram of the circuit showing all parts and values, voltage and current, and the actual output at both jacks (use scope if available). A clear drawing of the parts layout will help if you ever have to work on yours. You may not remember it that well in time. You might even make a copy of this article for your service package.

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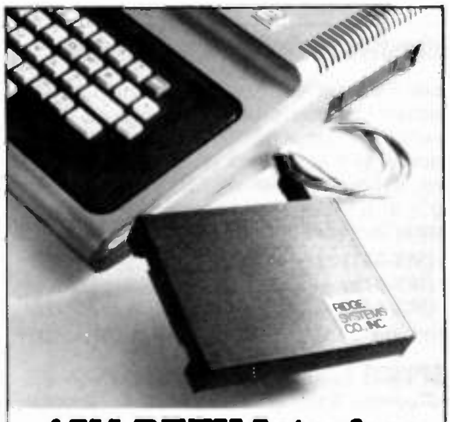

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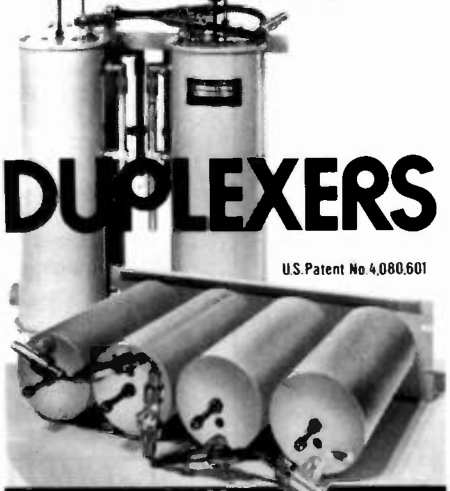

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Put all this in the file of service information you keep for your other gear. You do have one, don't you? Then it will be there when you need it. No guesswork.

This is one of the simpler pieces of test gear to use, but there are a few cautions I would like to stress.

If you have been used to working with transistor equipment, you may not be street-wise to the dangers of working in higher voltage tube circuits. This unit will help troubleshoot tube receivers and audio amplifiers, but make sure you observe all safety precautions for working with high voltage. Tube voltage levels are lethal.

Working with transistor equipment is a lot safer for you, but the oscillator has a husky output that easily can blow many transistor stages. Observe all safety precautions for working with transistor circuits, too.

As a general rule, set the controls of the unit under test as they would be for normal operation. Start with the lowest level signal you have and use the least signal that will do the job. You can damage a transistor stage with too much signal or even a static charge. It would be hard to damage a tube stage with this unit, but too much signal can cause distortion. You could be trying to fix a problem that you are causing while testing.

This unit will do a lot for you, but to use it safely and effectively you have to know what you are doing and why.

A good book or two on troubleshooting and repair will give you lots of ways to get the most out of your test equipment. Make sure your library covers both tube and solid-state gear.

A little hands-on experience working with this unit also will tell you a lot about its capabilities. ■

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Maximum Modulation for CB Conversions

Many CB rigs lack the gain for full modulation. This preamp will help.

If you have recently converted a CB for 10-meter operation or if your present ham rig has insufficient mike gain, you may be interested in building this simple microphone preamplifier. The majority of CB rigs in the lower to middle price ranges do not provide adequate mike gain for optimum modulation. Typical modulation levels obtained are from 30 to 60 percent. The addition of a preamplified mike can significantly increase the "talk power" of these rigs; just ask any CBer.

There are several commercially-available preamplified mikes on the market that will provide the added audio gain for a price tag of $25.00 to $50.00. A much cheaper alternative is the single field-effect transistor (FET) circuit shown in Fig. 1. I purchased all components for under $5.00 at a local Radio Shack store.

The circuit can be constructed in a separate minicabinet by using mating microphone connectors to match those used by your CB or it can be mounted inside the CB. When mounting within the CB, the additional mike connectors, switch, cabinet, and 9-volt battery are not required. You probably won't have enough room to install the potentiometer (R4) inside the CB, but it can be replaced with two fixed resistors once the proper mike gain adjustment level is established.

To provide similar circuit-operating parameters when installing inside a CB, substitute a 33k-Ohm resistor for R3 and connect it to a +12-volt power point in the CB. Also connect the common ground point of the preamplifier circuit to CB ground. Unsolder the existing microphone lead from the printed circuit board and connect it to the input of the FET circuit. Use a short piece of shielded wire to connect the output of the FET circuit to the printed circuit board and ground the shield to minimize hum pickup.

Adjustment is simply a matter of setting the potentiometer for optimum modulation level. This can be accomplished through the use of a modulation meter connected to the antenna feedline connector of the CB or during an actual QSO. Don't forget that the FCC limits the maximum permissible modulation level at 100 percent, so make sure that the gain setting used does not cause audio distortion or splatter.

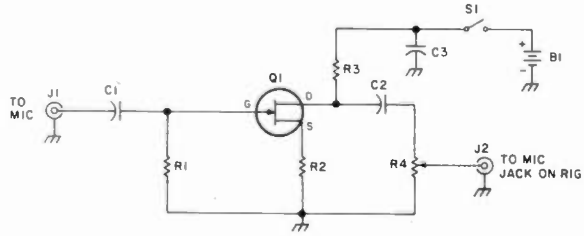


Fig. 1. Mike preamp circuit.

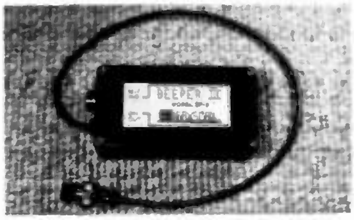
Parts List

B1—9-volt transistor radio battery
S1—SPST switch
Q1—FET, Radio Shack 276-2028
C1—0.01-μF capacitor
C2—0.1-μF mylar™ capacitor
C3—100-μF, 10-V-dc capacitor
R1—2-megohm, ½-Watt resistor
R2—3300-Ohm, ½-Watt resistor
R3—10k-Ohm, ½-Watt resistor
R4—50k-Ohm (or 100k) audio-taper potentiometer
J1,J2—Phone jacks to match equipment

When you have established the optimum level setting, the potentiometer can be replaced by two fixed resistors connected as a series voltage divider. To determine the proper resistor values, measure the resistance between the center lug of the potentiometer and each outside lug. Obtain two resistors having the same approximate values, connect them in series, and substitute these in place of the potentiometer. Connect the mike lead to the junction between the two resistors. Check that the resistors are installed in the circuit so that they have the same relationship as the measured resistance values on the potentiometer.

The circuit can be constructed on any suitable piece of insulating material. I used a piece of cardboard measuring about 1-1/2" by 3" and mounted the components on one half of the area. I then folded and taped the cardboard under to protect against possible shorting of the circuit connections. ■

"BEEPER III"



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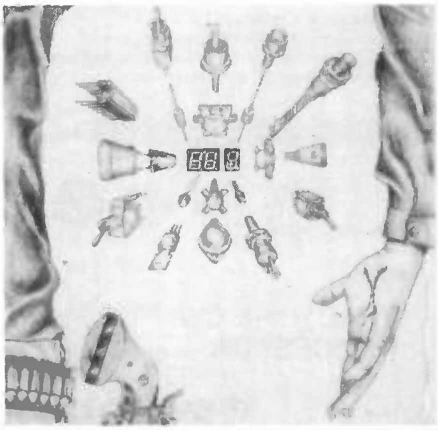

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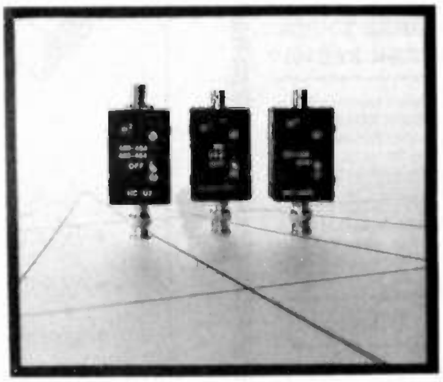

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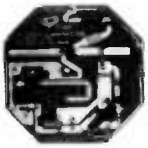

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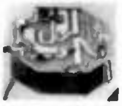

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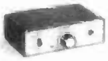

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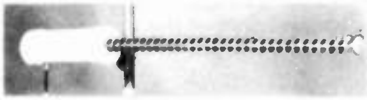

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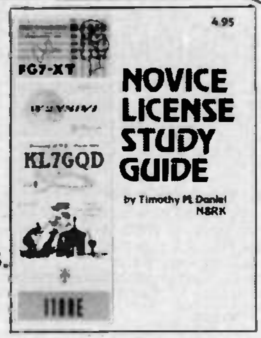

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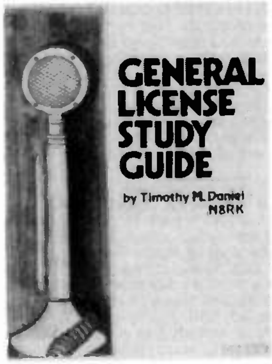

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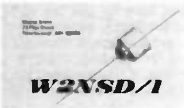

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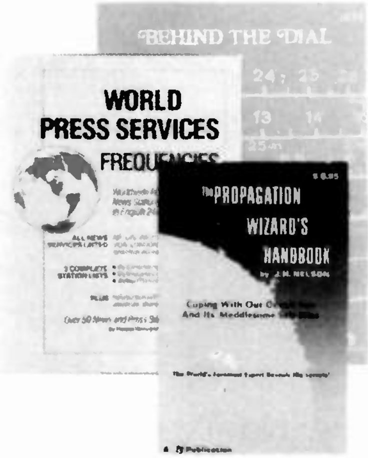

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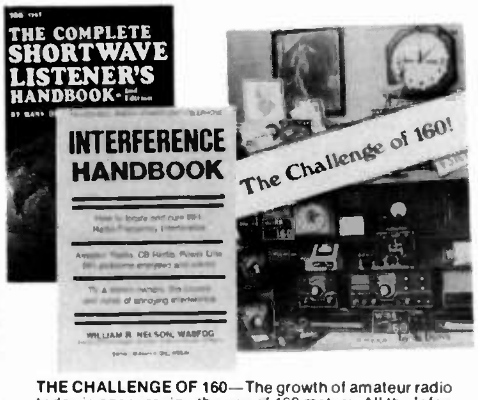

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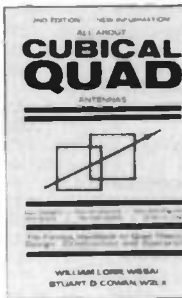

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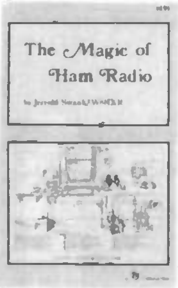

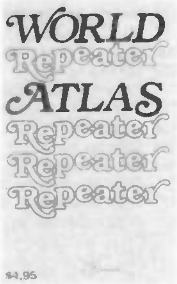

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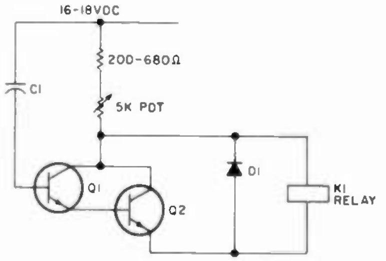

Fig. 1.

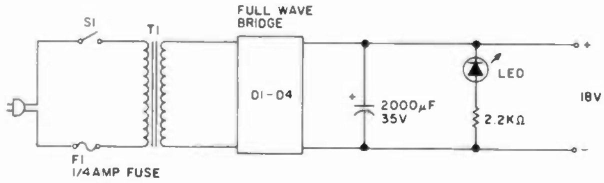

Fig. 2.

THE KEYLESS KEYER: This circuit can be used to key a transmitter with just a touch. In Fig. 1, Q1 and Q2 are any NPN transistors. C1 can be any disc capacitor. Make sure the leads are long enough so that you can touch them. When the leads are shorted by your finger, the small signal from your body makes the relay drop from 5 volts to less than one volt. The relay toggles. The SPDT leads of the relay can be used to key a transmitter. No dangerous voltages pass through the capacitor. Diode D1 suppresses any high inductive kickback and thus protects the transistors. Use either two 9-volt batteries in series or build the power supply shown. The LED and 2.2-kilohm resistor serve to indicate when the supply is on and to bleed off any dangerous voltages from the 2000-uF capacitor.—Alan Weinberg KR7D, Tucson AZ.

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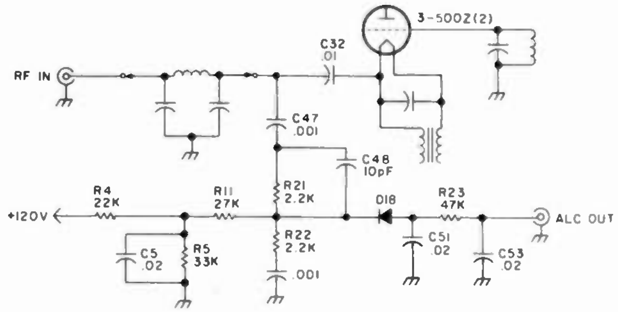

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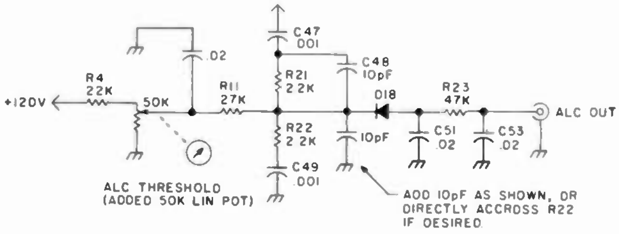

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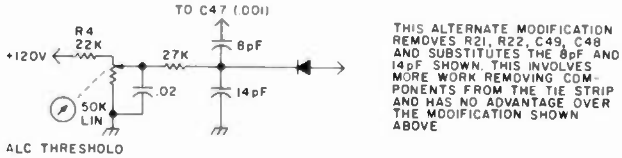

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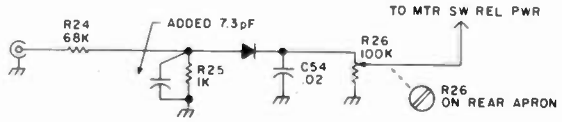

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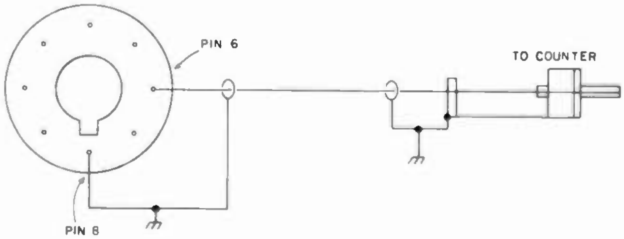
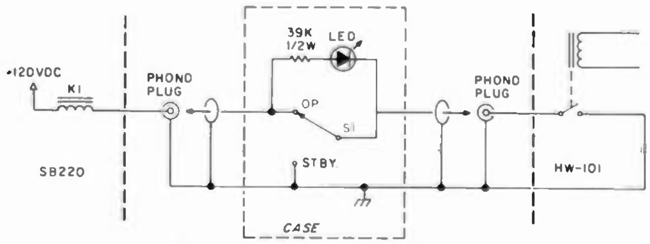


FREQUENCY ADJUSTMENT FOR THE YAESU FT-101: You can use an ordinary frequency counter to tell if your FT-101 is slightly off frequency. Pin 6 on the rig's accessory plug is connected to the vfo output, while pin 8 is ground. Connect a frequency counter to these two pins and check to see if the radio has the same frequency on transmit and receive. The counter will display the vfo frequency — between 8.7 and 9.2 MHz—not the frequency shown on the main dial. You can correct for any difference between the transmit and receive frequency by adjusting the control marked zero, located under the top cover.—Doc Hall W8ZJQ, Elyria OH.



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3-137 Champion St.
Christchurch, New Zealand

Wanted: an external vfo for the Sears 412.35730600 2-meter FM rig or a schematic of it. I will pay postage for the schematic.

SSG Gary E. Kohtala DA2XF
USAFS-A Box 1415
APO NY 09458

I am looking for a Hunter Bandit linear amplifier.

Ray Warner W7JU/K7JU
2200 Jamaica Cove
Riviera AZ 86442

STATEMENT OF OWNERSHIP, MANAGEMENT AND CIRCULATION (Required by 39 U.S.C. 3685). 1. Title of publication, *73 Amateur Radio's Technical Journal*. 2. Date of filing, Oct. 1, 1982. 3. Frequency of issue, Monthly. A. No. of issues published annually, 12. B. Annual subscription price, $25.00. 4. Location of known office of publication (Street, City, County, State and ZIP Code) (Not printers), 80 Pine Street, Peterborough, Hillsboro County, N.H. 03458. 5. Location of the headquarters or general business offices of the publishers (Not printers), 80 Pine Street, Peterborough, Hillsboro County, N.H. 03458. 6. Names and complete addresses of publisher, editor and managing editor. Publisher (Name and Address), Wayne Green, Peterborough, N.H. 03458. Editor (Name and Address), Wayne Green, Peterborough, N.H. 03458. Managing Editor (Name and Address), Jack Burnett, 12 C Granite St., Peterborough, N.H. 03458. 7. Owner (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given. If the publication is published by a nonprofit organization, its name and address must be stated.) Name, 73, Inc., Peterborough, N.H. 03458. Wayne Green, Peterborough, N.H. 03458. 8. Known bondholders, mortgagees and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages or other securities (if there are none, so state) Name, none. 9. For completion by nonprofit organizations authorized to mail at special rates (Section 411.3, DMM only). The purpose, function and nonprofit status of this organization and the exempt status for Federal income tax purposes (check one) Not applicable. 10. Extent and nature of circulation. (X) Average No. copies each issue during preceding 12 months. (Y) Actual No. copies of single issue published nearest to filing date. A. Total No. of copies printed (Net Press Run) (X) 69,828 (Y) 66,216. B. Paid circulation 1. Sales through dealers and carriers, street vendors and counters sales. (X) 11,858 (Y) 14,108. 2. Mail subscriptions (X) 47,906 (Y) 45,454. C. Total paid circulation (Sum of 10B1 and 10B2) (X) 59,764 (Y) 59,562. D. Free distribution by mail, carrier or other means, samples, complimentary, and other free copies (X) 446 (Y) 451. E. Total distribution (Sum of C and D) (X) 60,210 (Y) 60,013. F. Copies not distributed 1. Office use, left over, unaccounted, spoiled after printing (X) 6,355 (Y) 6,203. 2. Returns from news agents (X) 3,263 (Y) 0. G. Total (Sum of E, F1 and 2—should equal net press run shown in A) (X) 69,828 (Y) 66,216. 11. I certify that the statements made by me above are correct and complete. Signature and title of editor, publisher, business manager, or owner. Debra Wetherbee, Business Manager

SOCIAL 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 at 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 Street, Peterborough NH 03458.

FARIBAULT MN
DEC 4

The annual Handi-Ham Winter Hamfest will be held on Saturday, December 4, 1982, at the Eagles Club, Faribault MN. Registration will start at 9:00 am, followed by a Handi-Ham equipment auction, dinner at noon, and a program. Talk-in on .19/.79. For more information, contact Don Franz W0FIT, 1114 Frank Avenue, Albert Lea MN 56007.

HAZEL PARK MI
DEC 5

The 17th annual Hazel Park Amateur Radio Club Swap and Shop will be held Sunday, Dec. 5, at Hazel Park High School, Hazel Park MI. Hazel Park High School is located on Hughes Street at 9½ Mile Rd., 1 mile east of I-75. Tickets are $1.50 in advance or $2.00 at the door. Tables are $1.00 per foot. Doors open at 8:00 am. Plenty of food and parking will be available. Talk-in on 146.52. For tickets, table reservations, and information, send an SASE to Hazel Park Amateur Radio Club, PO Box 368, Hazel Park MI 48030 or telephone (313)-398-3189.

SOUTH BEND IN
JAN 2

A hamfest swap & shop will be held on Sunday, January 2, 1983, at Century Center, downtown on US 33 One Way North between the St. Joseph Bank building and the river, South Bend IN. Tables are $3.00 each in a carpeted, half-acre room. The Industrial History Museum is in the same building. Four-lane highways lead to the door from all directions. Talk-in on .52/.52, .99/.39, .93/.33, .78/.18, .69/.09, 145.43, and 145.29. For more information, contact Wayne Werts K9IXU, 1889 Riverside Drive, South Bend IN 46616, or phone (219)-233-5307.

RICHMOND VA
JAN 16

The Richmond Amateur Telecommunications Society will hold Richmond Frostfest '83, the annual winter ham radio and computer show, on Sunday, January 16, 1983, at the state fairgrounds, Richmond VA. General admission is $4.00. All flea-market and commercial exhibit spaces will be indoors in a 30,000-square-foot exhibit building.

✓See List of Advertisers on page 130

RTTY LOOP

Marc I. Leavey, M.D. WA3AJR
4006 Winlee Road
Randallstown MD 21133

For the past few days, I have been reading a book that has struck a responsive chord within me. Detailing some of the goings on behind the scenes of my favorite radio show, National Public Radio's "All Things Considered," the book describes how the show starts with the rudimentary outline first laid out in a morning conference, goes through edits and revisions, and then bursts upon the public at 5:00 pm sounding fresh and spontaneous.

The reason for the empathy I feel is the way RTTY Loop falls together each month. For the December issue, for example, I usually try to take a look at items which could be given as gifts to the ham involved in RTTY or computers, "'tis the season," and all that. Several rough outlines are penciled in over the months until now, when I try to assemble an exciting column.

Well, yes, Maryland (Virginia is a bit to my south), there is a Serendipity. For just as I was casting around, looking for something novel or unique, what comes in the mail but a packet from Tom Harrington of Universal Electronics, Inc.

Tom, you may recall, is the gentleman who produced the book *World Press Service Frequencies*, a tome reviewed in RTTY Loop back in August, 1981. For those who came in late, I shall explain. This publication, now in its third edition, covers the full specs on over 65 stations transmitting press information worldwide in English. Also covered is information on antennas, terminal units, and the like. Well, Tom has a few more goodies up his sleeve. A giant *List of Worldwide Radioteletype Stations in Frequency Order* contains 2198 frequencies of stations logged this year. The frequency, callsign, name of station, ITU country symbol, times of reception, and details are included. Over eighty press and news agencies are listed, along with weather, military, and other services using RTTY.

Not to stop there, Tom has another rather unusual offering. Did you know that there is a five-level code for Arabic, Cyrillic, Hebrew, Greek, and Korean—not to mention a six-level Japanese code? If we throw in Hebrew, Arabic, Cyrillic, Greek, and Japanese Morse codes and then top it all with over 500 identified Arabic words and station names in RTTY, would you be interested? Well, Tom's new work, *List of Special RTTY and CW Alphabets and Codes*, has all this, plus quite a bit more. Write to Tom at Universal Electronics, Inc., 1280 Aida Drive, Dept. L, Reynoldsburg OH 43068. Use order code "R" for the *Worldwide Stations* list, $12; order "P" for the *Press Service* list, $8; and "X" for the *RTTY and CW Code* booklet, $8. Be sure to mention RTTY Loop in the order, too, OK?

Before we leave Universal Electronics, and while we are on the subject of gifts, I think I have something for the high-powered RTTY types among you. Their Universal M-600 RTTY code receiver may be the ultimate demodulator on the market. This unit decodes signals using bit inversion, TOR, SITOR, and nonstandard shifts. Weather as well as standard format is supported with all speeds of ASCII, Morse, and Murray. Output is both standard video as well as ASCII or Murray printers, complete with a printer buffer of 2K. This brief description only summarizes the material I have in hand. I am sure that Universal would love to send you the full details if you drop them a note at the above address. At $799.95, this is quite a package.

If that's too much money for you, but you are looking for an object in the "sizable but not ridiculous" category, have you considered one of the new small microcomputers? For under $300, you can buy an Atari 400 (which has some of the finest graphics I have ever seen and can be expanded to a full system including disk), the TI99/4 (sold in many retail outlets), a Radio Shack Color Computer, or (pushing under the $100 mark), the Sinclair ZX-81, now marketed by Timex and widely discounted. These and other small computers can serve either as a first system or, as my Atari does, as an intriguing second computer for someone already afflicted with the computer bug.

Computers aside, and I will admit that it is becoming harder these days to put them there, there are quite a few products around that appeal to the RTTY buff. I don't know about your wife, but mine enjoys window-shopping during the holiday sale season. How do you window shop in a magazine? You look at the ads! Let's see what is available, right here in the pages of *73*. I must point out that information I have on some of these items is from literature or the advertisements themselves. If you want more details, write to the company, not to me. By the way, I recognize that many products covering a wide range are of interest to the amateur involved in RTTY, but let's look only at specific RTTY items. If you will follow me around the next corner. . .

I see that RCA is selling off old, used ASR-33 teleprinters. This is a usable terminal for ASCII circuits and would make a reasonable first start for the amateur interested in getting onto ASCII RTTY. We have covered the hookup of the ASR-33 in past RTTY Loops, and many hams have them on the air. Supporting uppercase ASCII only, these 110-baud machines include punched paper tape facilities. At $300, the price may be above what you would pay at a hamfest, but I presume the units are checked out and working. If you are interested, contact J. H. Bell at the RCA Service Company, Bldg. 204-2, Route 38, Cherry Hill NJ 08358.

Going from the earliest to one of the latest, Kantronics offers their "The Interface." For about $190, this box, plus software available separately, will put many popular microcomputers onto RTTY. Software for the Apple II computer is supplied on a diskette for about $30. Program boards, presumably containing ROMs, are available for the Atari 400/800 or VIC-20 for $50, or for the TRS-80C Color Computer for $60. Drop a line to Kantronics at 1202 E. 23rd Street, Lawrence KS 66044, for details.

Producing a fine stand-alone terminal, our old friend MicrOlog, located at 18713 Mooney Drive, Gaithersburg MD 20879 (just north of Washington DC), is still turning out their 6800-based systems. The ATR-6800, reviewed in this column some time back, is an expandable system which can be turned into a general purpose computer. Their newer ACT-1 (not to be confused with a simple computer terminal of the same name available a few years ago) is a dedicated RTTY/CW/SSTV computer. Both use the Motorla 6800 CPU, of which you all know I am quite fond, and appear to be very well engineered. The ACT-1 is a shade under $1000; I don't have a recent price on the ATR-6800. I'm sure the guys at Microlog would be happy to fill you in.

Another way to get onto computerized RTTY is with a package offered by Tufts Electronics, 61 Lowell Road, Hudson NH 03051. The experts up there will sell you the Kantronics Interface detailed above, with a VIC-20 computer, cables, speaker, and instructions for the package price of $499, as of this writing. Sounds like it might be worth a peek.

Another advertised system is the MFJ Super Keyboard. This box operates on CW, Murray, ASCII, and as a memory keyer and Morse practice machine. Two versions are available. The MFJ-494 features a 50-character buffer, 30-character memory, and automatic messages, and sells for about $280. For another $60, the MFJ-496 increases the buffer and message memory to 256 characters each and adds serial numbering and a repeat message function. Options of AFSK keying, loop keying, and clock module are also available. Drop MFJ Enterprises, Inc., a letter at Box 494, Mississippi State MS 39762, if you would like further information.

We can't forget our old friends IRL, at 700 Taylor Road, Columbus OH 43230. Their two converters, the FSK-1000 and FSK-500 (reviewed in this column in the past), remain excellent products. They also tell me that they can interface their terminal units to many popular computer systems. Just ask them a question—they say they have the answer.

A common question in the mail has been whether there is an adapter made just for the TRS-80C Color Computer for RTTY. Well, Ridge Systems Co., Inc., is advertising their 4511 RTTY Interface. Selling for about $170, this ROM board supports Murray and ASCII, a split screen, and messages stored to cassette tape. Drop them a note at PO Box 772, Acton MA 01720, for more information.

Xitek, one of the first companies out with a single-board terminal, is still featuring their SCT-100 ASCII/Murray terminal. Listing at $229, it may be of interest to some of you. Their mailing address is PO Box 2952, Garland TX 75041.

Speaking of originals, Macrotronics, Inc., 1125 N. Golden State Blvd., Turlock CA 95380, was one of the first with interfacing to microcomputers. Their "TERMINALL" is a hardware/software system for the Apple II or TRS-80 (Model I or III) that combines terminal unit, computer interface, and bells and whistles into one neat package. For about $500, this is quite a system, supporting ASCII, Murray, or Morse.

Another computer interface, the ROM-116, is available from Crown Micro-Products, 606 State Street, PO Box 892-R, Marysville WA 98270. This package requires an external terminal unit and includes facilities to save text to disk along with other features similar to other systems. Write Crown for a brochure and pricing details.

The TRS-80 remains the most often supported computer for the RTTY interface, with another one offered by Commtek. Their Contact-80 is available for Model III disk or tape systems, selling for $279 or $229, respectively. With split screens, canned messages, date and time, and identifiers from the computer, this looks like a versatile package. Write them at 4493 Orleans Drive, Dunwoody GA 30338, if you are interested.

Another item we will look at in the window-shopping tour is a window in itself. AEA's MBA-RC reader/code converter. This decodes Morse, Murray, or ASCII and displays the data on a 32-character internal display. Not only that, but it can convert between codes, so that an old Murray machine could speak ASCII or Morse on the air. Looks quite interesting, and full details are available from the manufacturer, Advanced Electronic Applications, Inc., PO Box C-2160, Lynnwood WA 98036.

Last, but not least—by any means—is old standby Hal Communications, whose name is almost synonymous with RTTY. You have a complete choice of station accessories and options. . . enough to build a complete RTTY system or any part of it. For example, the HAL DS3100ASR and ST6000, when combined with the MS03100 Message Storage Option and a hard-copy printer, give you a top-notch station. If you're not prepared at this time to spend all your money on a complete layout, what about the RTTY tuning scope? HAL's RS2100 gives you an accurate display of the signal amplitude and phase of the received signal and a flock of other internal goodies. If you're a travelin' man, you'd like the HAL CWR-6850 Telereader. . . the smallest RTTY and CW terminal available, according to their specs, and complete with CRT display screen. Communicate with Hal Communications at PO Box 365, Urbana IL 61801.

You know, I often say to mention both *73* and RTTY Loop when you write an advertiser for information or to order something. Let me tell you why. This is not just to toot our own horns. Advertisers spend thousands of dollars putting their name and product before you in various media. They want to know which ones work, and where you hear of them, so that they can better direct future campaigns. The better directed the ads, the less "wasted" money, and the more that can go into better products for you and me. So, you see, telling them that you "saw it in *73*'s RTTY Loop column" is a wise move.

Still stumped for a gift? How about the one that comes a dozen times a year? Less than twenty bucks will get you a one-year subscription to *73*, the magazine that brings the active ham so much more of what you read magazines for. Besides, you wouldn't want to miss the next installment of RTTY Loop, would you?

HAM HELP

I am a wheelchair-bound amateur in need of equipment capable of working the MARS two- and six-meter bands. Please telephone me at (417)-561-4685 or write me.

Edward L. Maranville KA9COJ/AAT7GX
PO Box 512
Rockaway Beach MO 65740

I need a schematic and manual for a Hallicrafters CRX-2 (152-174 MHz) receiver. Any information will be sincerely appreciated. I will pay all costs involved, but please advise me of same first.

L. E. Taylor K9REB
Box 420
Mount Prospect IL 60056

FUN!

John Edwards KI2U
78-56 86th Street
Glendale NY 11385

HAM GEOGRAPHY

I'm always amazed at the average ham's grasp of geography. As if it weren't enough that most of us are already experts on electronic theory, radio propagation, and telegraphy, we can also claim a knowledge of virtually every square inch of this tired old planet's surface. Who else but a ham is intimately acquainted with such places as East and West Kiribati, Bajo Nuevo, Bouvet, and Chagos? When Great Britain and Argentina began fighting over a forsaken bit of territory known as the Falkland Islands, most of the world ran for an atlas. For hams, VP8-land was an old friend.

This month, Fun! tackles the field of ham geography. Think you know it all? Read on.

ELEMENT 1—CROSSWORD PUZZLE

(Illustration 1)

Across

1) G-land (2 words)
7) From
8) Eastern European land
11) Western state (abbr.)
12) New England state (abbr.)
13) Austria prefix
14) African country
16) To borrow
17) Agency involved in extreme DX (abbr.)
18) Arab country
21) Xmas in France
22) Type of power measurement (abbr.)
24) China (abbr.)
25) 49th state (abbr.)
26) This column
27) Vermont flow product
28) Ø-land state (abbr.)
29) Green Mountain State (abbr.)
31) Soviet prefix
33) Midwest state (2 words)

Down

1) DL-land
2) Southern state (abbr.)
3) African country (abbr.)
4) Far East country (abbr.)
5) A ham radio commercial (abbr.)
6) Belonging to a group of northern states (2 words)
9) Face or type of cup
10) EP-land
13) Peru prefix
15) 6 down district number
19) EI-land
20) US York and Orleans
23) ____________New Guinea
26) ____________Lauderdale
29) India prefix
30) Chad prefix
32) Australia prefix

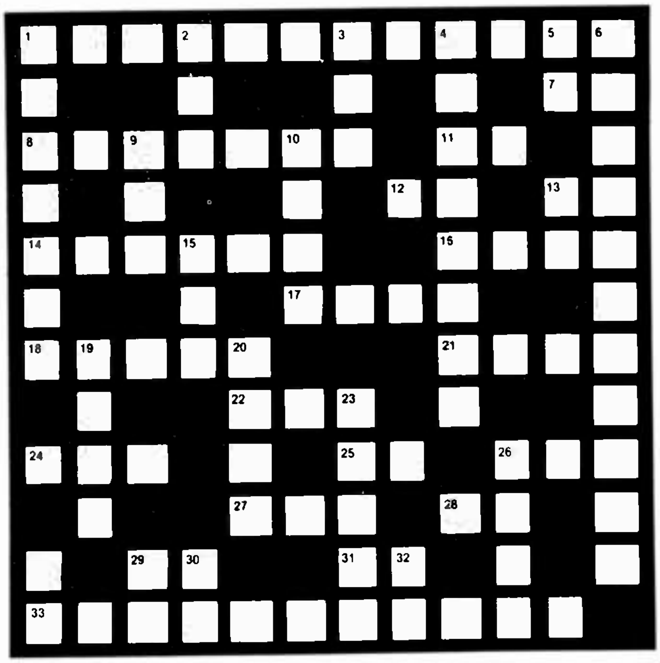


Illustration 1.

ELEMENT 2—MATCHING

Sure, you know all sorts of rare countries by prefix. But do you know their capital cities? Master this subject, and surprise your friend in Paraguay by asking him how things are doing in downtown Asuncion.

Column A	Column B
1) Malta	A) Bogota
2) Bulgaria	B) Reykjavik
3) Romania	C) Manila
4) Nepal	D) Tripoli
5) Maldives	E) Nicosia
6) Bhutan	F) Rangoon
7) Burma	G) Caracas
8) Philippines	H) Katmandu

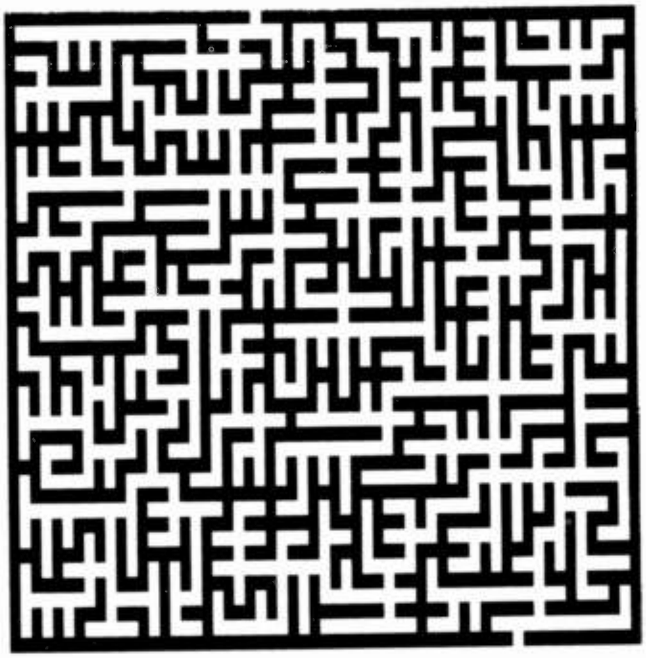


Illustration 2.

✓See List of Advertisers on page 130

9) Indonesia
10) Australia
11) Algeria
12) Senegal
13) Nigeria
14) Libya
15) Sudan
16) Angola
17) Venezuela
18) Colombia
19) Cyprus
20) Turkey
21) Iceland
22) Iraq
23) Pakistan
24) Fiji
25) Surinam

I) Baghdad
J) Lagos
K) Luanda
L) Islamabad
M) Sofia
N) Suva
O) Paramaribo
P) Djakarta
Q) Khartoum
R) Valletta
S) Dakar
T) Algiers
U) Bucharest
V) Thimphu
W) Ankara
X) Canberra
Y) Male

ELEMENT 3—TRUE-FALSE

	True	False
1) In 1977, the president of the Comoros (D6) had every dog in his capital city of Moroni killed.		
2) North Yemen (4W) used to be known as Aden.		
3) The movie *The King and I* is banned in Thailand (HS).		
4) In Tanzania (5H), wearing a wig is punishable by flogging.		
5) When visiting Nepal (9N), one can stop in government-approved hashish stores.		
6) Timbuktu is located in Mali (TZ).		
7) Half of the population of Kenya (5Z), is less than 16 years old.		
8) Paraguay (ZP) is the only country with two faces to its flag.		
9) In South Africa (ZS), only whites may hold ham tickets.		
10) Dueling is legal in Uruguay (CX).		

ELEMENT 4—MAZE

(Illustration 2)

You know, ham radio is a lot like a maze. Thousands of frequencies, dozens of modes, hundreds of antenna types—it can all get very confusing. Here's a much simpler maze. All it requires is a pencil and some time. No money or physical effort is needed. Thanks go to my Radio Shack TRS-80 Model II for creating it.

THE ANSWERS

Element 1: See Illustration 1A.
Element 2: 1-R, 2-M, 3-U, 4-H, 5-Y, 6-V, 7-F, 8-C, 9-P, 10-X, 11-T, 12-S, 13-J, 14-D, 15-Q, 16-K, 17-G, 18-A, 19-E, 20-W, 21-B, 22-I, 23-L, 24-N, 25-O.
Element 3:
- 1—False At his witch doctor's request.
- 2—False No, that was South Yemen.
- 3—True They believe the film presents a false view of their history. No Yul.
- 4—True Yul.
- 5—True Mount Everest ain't the only thing high in Nepal.
- 6—True Once a great city, it's now a town of about 6,000.
- 7—True Thanks to a very high mortality rate.
- 8—True Boon to flag manufacturers.
- 9—False Not officially, but what's the difference?
- 10—True Great way to settle frequency disputes.

Element 4: See Illustration 2A.

SCORING

Element 1: Twenty-five points for the completed puzzle or one-half point for each question correctly answered.
Element 2: One point for each correct answer.
Element 3: Two and one-half points for each correct answer.
Element 4: Twenty-five points for the completed puzzle.

How worldly are you?

- 1-20 points—Hermit
- 21-40 points—Recluse
- 41-60 points—Know where your area repeater is located
- 61-80 points—Armchair traveler
- 81-100+ points—Man of the World

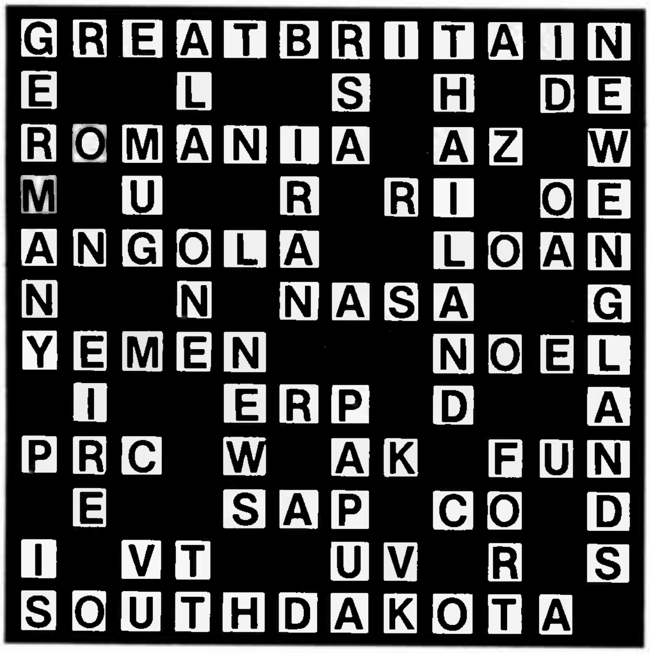


Illustration 1A.

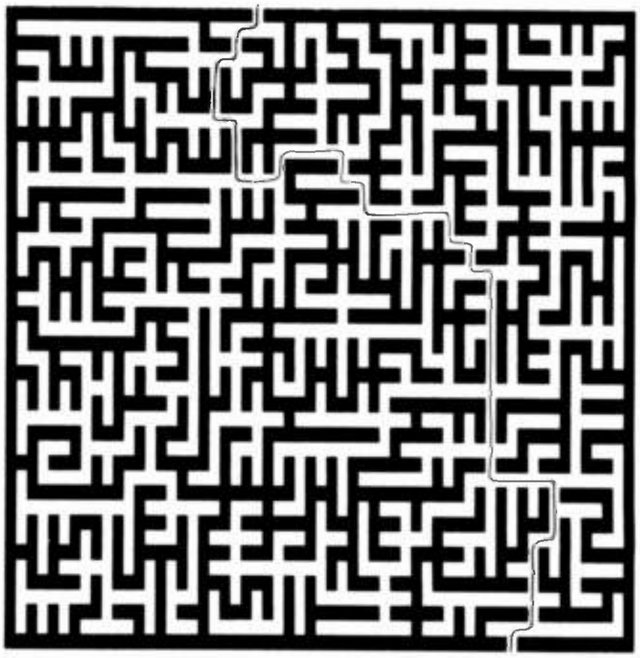


Illustration 2A.

LETTERS

TALK FAST

While reading your response to W6EOT's letter in the September issue, it dawned on me just why the "already-known techniques" for high-speed communication are not used in the ham bands.

You say we can communicate at 8,500 words per minute using these techniques. That would be great for traffic handlers (of which W6EOT is one) and maybe contesters if one could figure out how to program the system to be fast enough. One could conceivably work two or three thousand stations per minute!

However, you often expand on how nice good old rag chewing is. I can't understand how you propose to rag chew at 8500 wpm!

Some simple testing of my talking speed netted only 235 wpm. I sure can't talk coherently or even think at 1000 wpm, much less 8500 wpm!

Therefore, to communicate at 8500 wpm, I would have to preprogram some device at my own speed (say 200-400 wpm), contact another station, and punch the proper button to transmit my message at 8500 wpm. I could no doubt say everything on my mind at the time in less than thirty seconds, if I had 4000 words to say.

The other station's reply would then be transmitted to me at 8500 wpm, but I would have several minutes to wait while he programmed reply comments into his "super QRQ box." And, of course, he would have several minutes to wait for my next round of comments.

The fact that actual transmission time is very small and more stations can use the available spectrum is a nice idea but needs some human engineering, namely, a QRQ to QRS receive converter that would convert the high-speed transmission to normal talking speed with a voice synthesizer, either synced to the other station's voice tones or to a pleasing blonde (for OMs) or tall, dark, and handsome buck (for YLs).

The transmit converter would take a few dozen words spoken into the microphone and blip-transmit them at 8500 wpm, take a few dozen more and blip, and so on.

The receive converter takes the 8500-wpm transmission and begins "talking" to the receive operator at 200 or so wpm (adjustable of course).

And there you have a high-speed system compatible with us relatively slow humans.

Dennis Younker NE6I
Lancaster CA

So what's the difference if your transmitter is on the air, keeping anyone else from using a channel while you mumble inconsequentials at 200 words per minute? Why not have your processor save all that garbage up, put it into a compactor, and dump it at 8500 wpm? Then a bunch of other people could use the same channel. Dunno why we're talking about voice anyway... unless all of the code lovers have suddenly died. There are still a few old-time hams around, graduates of early American schools where reading and writing were taught. We could consider opening up classes in our ham clubs on the first two Rs so newcomers could cope with code and printed types of communications.—Wayne.

LETTER ACCELERATION

For some time I have been practicing CW just for the fun of it, as in the HK zone, code is required only for the first-class license.

When getting on the air I find many Novices eager to make the HK contact. They go at my speed when they are calling CQ, but surprise, surprise, once they get to their own callsign, their speed increases by several words per minute, so even if I know that they would immediately answer when they hear the HK coming back to their CQ call, I am not able to call them. Maybe you could write something about this in your magazine.

I usually try to answer CQ calls because when I call CQ with my HK there are just too many stations who come back on my call, even if I sign the HK only once.

I intend to keep you posted on my adventures in CW land.

Rudolf Aumann HK1ESU
Cartagena, Colombia

TOPFSHUTTLER?

My grandmother would say you are a Topfshuttler—a pot stirrer. Isn't that just what an editor is supposed to do? Make people think! You do that well. Obviously, you allow your writers the same freedom.

73's view from Olympus must be a heady one. However, the view is occasionally obscured. Could it be from too much looking down the nose at mortal hams?

A case in point is John Edwards' comment in his column in the July issue, page 123. Commenting on his question, "Do you own a microcomputer?" he stated, "I can't see how a technically-inclined person can be without one." That is editorial nailbuffing from a have to the have-nots and is anything but constructive.

Wayne, please tell the lesser gods at *73* that it ain't 'xactly necessary to have a microcomputer or the latest flamethrower from Japan in order to have fun (and fulfill our responsibilities under Part 97). Yes, *73* should tell us what is new and keep us up to date. But, too often, you promote the idea that the ham should be measured by his equipment when the equipment should be measured by the ham.

Robert F. Solon WD8LKI
Toledo OH

Never let it be said that I interfered with your inalienable right to be totally, thoroughly, ridiculously wrong.—Wayne.

WHAT'S THE FUSS?

You all wanted more teenagers in ham radio? Here I am! I'm 15 years old and just received my Tech ticket. I skipped the Novice test and was really surprised at how simple the FCC exam was. I finished my first year of electronics in high school, which provided all the theory I needed to know, but I had to learn Morse code on my own. I don't know what the big fuss is over learning Morse code. Anyone can do it. Even with the end of the school year approaching and final exams just around the corner, I was able to find time to study code. Everywhere I went I carried a set of phonetic flash cards with me. When I would finish an assignment in class, I would pull out my cards and study a group of letters. I even found time to study during my Spanish final exam! Nobody can use the excuse: "I just don't have the time to study code."

It took me two months before I was ready for the FCC code test. After I took the code test I continued to study Morse code. Within two days I was up to 13 wpm. It kind of made me wish I had held out one more week to take the General code test. I do plan to update to General or Advanced sometime in the near future.

I remember reading a letter in which someone said that the high price of ham gear was keeping kids out of the hobby. I say that is 100% untrue. I agree that prices these days are a little steep, but you do not have to own gear to be a ham. My ham shack consists of a DX-302 receiver and several dipole antennas. My school has a transmitter/receiver combination but we do not have a ham radio club, so I cannot use the equipment. I do plan on starting a club at school but that will take some time. In the meantime, I am asking any ham in the Springfield, Va., area to get in touch with me at 455-1490; I'm dying to get on the air.

I would like to thank the hams who work 3999 kHz at night. I never miss a night listening to this frequency. The more I listened to these fellows, the more I wanted to get my license. Unfortunately, I can't tell them this because I cannot work 75-meter phone. Oh well, this just gives me more incentive to update to Advanced.

Jim Jones N4HQC
Burke VA

STILL BUILDING

Having been involved in ham radio for half a century, I look back at what ham radio was and what it is today.

In the "Good Old Days," the talk during a QSO was largely technical, dealing with home-made projects. Traffic was handled in an era when telephones were considered a luxury. Parts for your favorite projects were always available at "downtown" distributors. A less affluent society made hams more ingenious in their needs.

Today's QSOs are far different! Each new contact allows the ham to list his Japanese-made appliances as if owning a $3,000 layout reflected on his technical ability. But let a transistor or IC go bad, and the appliance is quickly returned to a "repair depot."

The irony is also that, even for those few hams who can handle difficult repairs, manuals for said appliances lack sufficient information or cost fairly large amounts of money!

It is indeed fortunate for current hams that *73 Magazine* is alive and kicking today! For myself, now 65 and retired, the many construction articles have given me many enjoyable evenings. At the same time, local newcomers (age 12-80) likewise were able to discover the "joys of building" via *73*.

Perhaps many readers may disagree with my viewpoints, but I bet the old-timers who remember building a Bearcat receiver or a 47-46-46 push-pull transmitter will agree, the golden years of hamming are past.

Gerald Samkofsky N4ZB
Holiday FL

Oh, guano, Gerald. I started in 1938 and I visited every active ham I could find. They were a bunch of turkeys, just like today. Nothing has changed except your memory. Remember that the first ham contact with Europe was made by a pirate and we never found out who it was. If you've read any 30s ham magazines (or still survive those days) you know that QRM is no better today than it was fifty years ago. Yeah, the old-timers did build, but they didn't know what the hell they were doing and as often as not blew out the filaments by hooking them to the plate voltage. Gerald, I get on 20m and talk with DX that wasn't even imagined 50 years ago and I do it without a lot of trouble. I had a 20-minute contact this morning with a chap in Apia, Western Samoa... then a shorter one with a chap in Colombo, Ceylon... followed by a nice long chat with HS1ALV. We've never in the history of ham radio had it this good!—Wayne.

DESTINATED

After a few years of operating K1OIQ/R at the summit of Mount Washington, and then this recent summer of traveling about the countryside, I have the following observations and comments to make. This letter was originally a reply to one that I received after criticizing a fellow's operating habits. I would like to give this opinion wider coverage, as it is meant for the entire amateur community.

I apologize only for the way I sometimes come across; tact is one of the things I am still learning. Really, Bill, those of us here are not trying to impose "custom" on anyone's operating habits. Some of it is rather complex—some, kind of stupid I suppose; but I would like very much to get a cheery reply when I call CQ, CQ, rather than some jerk's admonishment: "That's not the way we do it on this repeater." No logic, no conversation, just "that's not the way..." Here, at least you get some logic, advice, and conversation as well.

I submit that most hams, like most of the public, are being Madison Aved into an abortion of the language. I am not opposed to such a word as "destinated" (though I hear from a lot who are). I don't know of a shorter, more to the point way of saying, "I'm at to where I'm goin'." The coining of such new words is how our language grows; some day Mr. Webster may even include it in his book. However, I do object to the misuse of language (words and grammar), the sometimes cliquish use of words and phrases, the double question to which one can always answer yes and/or no and still be right, and the long-winded, nonstop monolog method of two-meter operation when, as I think, it should be more like face to face (eyeball, hi hi) or telephone like. Not to mention the editorial we—and the sometimes never ending ID.

Now that I've got this started I shall continue (might even send this in to my friend Wayne Green, hi hi—I might even write a book).

Handel (?)... no, I think that's supposed to be handle... yes that's better; "handle" is bad enough... Is for pots... is made of wood... the vandals stole my handles so I have to use my name (hope you don't mind)... Have you been asked for your "personal"? "...the personal here is..." "What's a personal?" said I in reply; and the new ham apologized for having been a CBer. "No apology expected nor required." I said. "Some of my best friends used to be CBers; a lot of us have taken that same promotion. No ham shack is complete if it doesn't have a working CB radio. But let us try speaking English here, not some silly dialect."

And then there is the editorial we. *We* did this and *We* did that and *We* are going and *We* are using... I was listening in one day (needless to say I've got LISTENERS NET LISTENING CERTIFICATE #1) when a friend of mine replied to one of those we-we-we monologs by saying how it was "...so wonderful that you and your wife can do everything together..." The we didn't even respond. What ever happened to I? Is it taboo or something to say "I did this..."?

And the never ending ID. Bad enough again, what with ID required only once every ten minutes, that two hams will ID back and forth after every speech...

"...WWW this is ZXC and back to you before I time this thing out. Ya ZXC this is WWW fine business... blah blah and OK on this, that, and the other thing... ZXC this is WWW. OK WWW, ZXC right back..." and on it goes. But when there are four or five of 'em and each one has to say the calls, in proper turn mind you, they spend more time blowing all the horns than they do in any meaningful conversation.

SO! if one wants to "listen" or "monitor," calling out and announcing same once a day should be sufficient. Also, I feel it should be a "custom" that one who has previously announced that he is "listening" should announce "not listening" when not.

ABC signed on "listening." A minute or so later ZXC announced he was "listening." ABC "listened" again a short time later and before the tail dropped, ZXC "listened" a little louder. Finally, after a pregnant pause, ABC *called* ZXC and the usual "...fine business, nice to meet you, hope to see you further on down the log..." QSO followed. Now tell me Bill, was that a "customary initiation of QSO" or was that a "power struggle"?

If what one really wants is to QSO, then I respectfully submit that what one should do is call. Call, as in CQ, CQ. Or, if that is too straightforward and meaningful, then at least something like "Hullo radio!..."

In this arena I am not concerned with custom; I am not trying to promote any particular way over any other way; I merely want people to say what they mean, be concise, and not be afraid to say "I" once in a while so that when they say "we" you'll *know* there is more than one of them.

However, I'll turn right around and fall back on custom when it comes to bad-mouthing the shortcomings of the tourists. I know it is the tourist money that "helps keep New Hampshire green." But I also know what it is to be a tourist . . . and hear all the speed demons from Massachusetts griping about being behind a slow-moving farmer.

I censor neither what nor who gets talked about on this repeater. I encourage and even incite lively debate. It seems to me that most of the folk on the receiving end of these barbs are so serious and uptight about their inanities that they fail to see the humor in a serious debate.

If only I could run the repeater on all this hot air.

Al Oxton K1OIQ
Mount Washington NH

Feel better now?—Wayne.

THE $1.98 LICENSE

I just finished reading the code vs. no-code gangfight letters in the October issue. Frankly, I felt like throwing up. Such lack of imagination; such lack of perception. What we need is negotiation. You know what negotiation is: that's where them what have agree to give all or part of it away in return for return of a hostage, or not getting their heads busted, etc.

In the spirit of negotiation, let me suggest that no one has tried to unite all the factions of this argument by proposing an amateur radio licensing program with something for everyone. Let me then address it from that standpoint.

First, we need to set a goal; hell, anyone familiar with success can tell you that you must establish a goal. The goal must be reasonable—one you can expect to be able to fulfill by a certain time.

Amateur radio's goal then should be to find the method by which everyone will be licensed within 3 years . . . Change that: everyone who wants to be a ham; we don't want anyone bitching about how we forced him or her to become a ham.

I hear it already: someone saying, "Where would we put them all?" We have literally millions of amateur radio frequencies which are relatively unused. No one said everybody had to be on 20 meters.

The reason for not proposing to include any life forms in other galaxies is twofold. First, it is unreasonable, and the goal must be kept reasonable to be feasible. Second, although the life form known as "slime" must be integrated into amateur radio if we are to meet our goal (a belief in the "inherent goodness of man" being implicit), we do not know whether or not we would want to share our frequencies with other life forms. Between slime and upright man, we should be able to bring enough hams into amateur radio to make it worthwhile for manufacturers and others with pecuniary interests, thereby assuring the future of our bands.

It thus being established that our goal should be to make available an amateur radio operator's license to anyone and everyone who desires one within 3 years, let's look at how to accomplish our goal.

First, the US should lead the way and show the rest of the world how it's done. Wayne Green has stated many times that the FCC has stifled the growth of amateur radio here. Anyone familiar with the doldrums which followed the incentive licensing system imposed back in the 60s should require no further proof. Anyone, though, who needs more proof as to whether or not the FCC should administer the amateur radio service, is reminded of the Citizens Band class-D service and the monumental FCC mismanagement there. Clearly, we do not need the FCC, and responsibility for amateur radio management should be moved to the private sector. More recommendations on that later.

The big hang-up seems to be inflexibility by all parties. I would remind you, if you admit you are inflexible, that when it became apparent Johnny could not read, rather than universities going out of business they provided new innovation. Their goal remained unchanged: to pass out the degrees. Only the requirements changed. Rather than being compelled to submit to remedial reading classes, colleges gave credits for music appreciation, penny pitching, ant watching, etc. This innovation, coupled with sports scholarships and the introduction of new specialties in the liberal arts, kept the degrees flowing. It didn't do a damn thing about Johnny's reading difficulty, nor technically staying ahead of the Russians, but the universities remained open.

US hams are accustomed now to the multiple-choice examination style. Our solution lies in going a step further. We should allow the amateur radio aspirant the greatest possible latitude in the entry requirements for our fraternity, within certain reasonable limits necessary to protect the integrity of amateur radio, lest someone succeed in obtaining a license for his dog, etc. There is enough bitching without that. An either-or testing format would allow the aspirant to choose only subjects they feel confident in.

As an example: Code is a requirement for the HF bands, but, as letter writer Roger E. Berube points out in the October *73*, code is our link to nostalgia. Machines can now send and receive code, usually faster and cleaner than humans. If an inability to learn code is the only obstacle keeping out an aspirant, then he should be allowed to demonstrate some other skill in lieu of sending and receiving code by hand. Perhaps he is a skilled typist, or could learn to type easier than he could learn to copy code. If so, he should be allowed to appear for testing with his computer keyboard and digital code readout under his arm. Provided he successfully operates his machinery and has ample reading skills, he should pass the code test without investing in the *73 Magazine* code tapes.

We could also simply fail to honor our commitment to ITU and drop the code requirement, as some countries do, upon demonstration that the aspirant has finely tuned his "money" skills. An aspirant with money should be permitted to substitute money for code skill. This would just be a liberalization of a policy popular in the Third World . . . or perhaps there is some other explanation why many of their phone (or phony) ops clutter up the bands which gentlemen have long reserved for CW only, ending each sentence with "Roger, QSL?" and refer to the CW underneath them as "portadoras" (carriers?). *Alguien nos esta poniendo una portadora* . . . Roger, QSL? (Someone is putting a carrier on us. Roger, QSL?)

The Roger, QSL? kind of operator, when allowed a reciprocal license to operate in the US, is the subject of considerable anguish at the FCC, which threatens to stop third-party traffic for all reciprocal licensees (if not all US hams). Further evidence that the FCC should not be involved in administering amateur radio! Our fraternity should be turned over to the private sector for administration and the second step after the abolishment of code should be to strike out the requirement that amateur radio communications be noncommercial. No other aspect of amateur radio is noncommercial; why shouldn't we allow tow-truck dispatchers to use it and foreign visitors to conduct their financial dealings via amateur radio? Nets could even be set up to allow hams to manage their stock transactions right on ham radio, since eventually our goal is to license everyone on Wall Street as well.

People are basically good; everyone will behave himself or herself. Remember that. If they won't, we can just legalize the offense.

Or, perhaps the trouble is not with the code at all, but with the theory, or the rules. We can be flexible here as well. If a person can copy 20 wpm, but can neither read nor write coherently and without moving his lips, he should not be denied access to an amateur radio license so he may participate in our fraternal brotherhood. In lieu of a theory or rules examination, he should be permitted to demonstrate some other skill, or possess money. Such substitute skills should of course be radio-related: wire splicing, tube replacement, etc.

Now the big question about who should replace the FCC in administering amateur radio. If the job were turned over to the ARRL, then *Ham Radio, 73 Magazine*, and perhaps CQ (is there still a CQ?) would cry foul. I submit that the federal government should, as an expedient to our reaching our goal in 3 short years, sell the management of amateur radio to the highest bidder in the free enterprise market, to be operated as a concession.

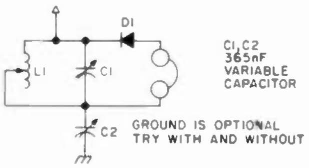
Cereal companies have an inherent edge here, since they have the box-top and $1.98 marketing technique down to a science. Providing an aspirant can demonstrate the ability to properly fill out the coupon, locate the proof of purchase seal on the package, and has the requisite $1.98 or equal value in food stamps, nobody should have any difficulty in becoming a genuine radio amateur, state of the art.

A test frequency has been set aside where this is essentially the licensing technique. If you care to listen, it's 27.185 MHz.

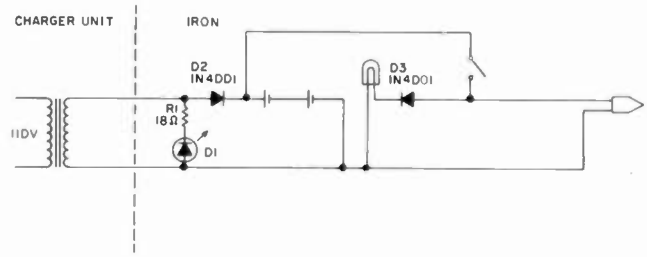
Robert G. Wheaton W5XW
San Antonio TX

Thank you, you've been most helpful. Now, does anyone else have any more gasoline to throw on this here fire?—Wayne.

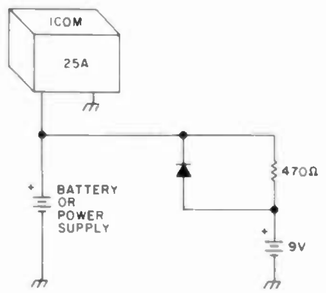
CIRCUITS



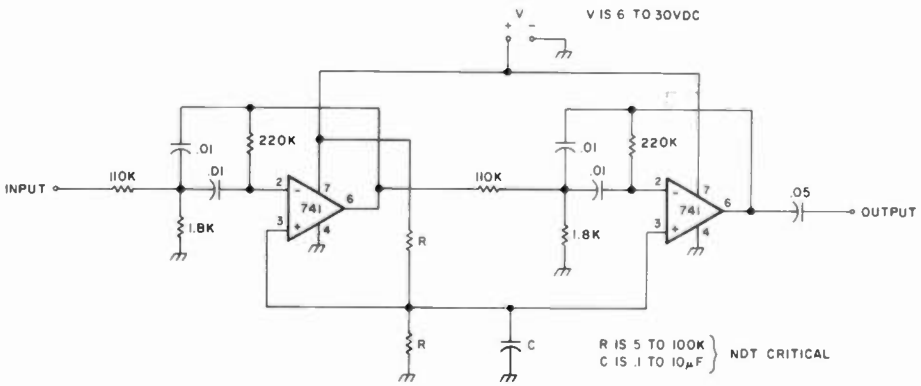
AM BROADCAST RECEIVER: Here is a neat project for a first-time builder. The gimmick is the coil L1. By using an alligator clip at the various taps on the coil, stations are shifted to the lower frequencies on the capacitor. This enables you to separate the stations more easily. D1 is a 1N34A—don't use a cheap diode. C1 and C2 are both 365-pF variable capacitors. A good earth ground is required (the finger-stop on a dial telephone is ideal).—Jim Burtoft N3BQH, Washington PA.



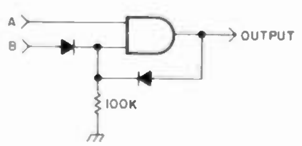
SOLDERING IRON MODIFICATION: To have a better rechargeable soldering iron, remove the diode from the charging unit and install it on the soldering iron. Because the nicads in the iron will now be isolated from the charging pins, it will be impossible to short out. By placing an LED with a current-limiting resistor into the iron, you will get a visual indication every time the battery is charging. Installing the circuit shown here will enable you to charge your battery from either ac or dc. By installing a power diode in the headlamp circuit, the lamp is protected against accidentally burning out when the battery is at full charge.—Richard J. Molby WB7NZG/DA1DB, APO NY.



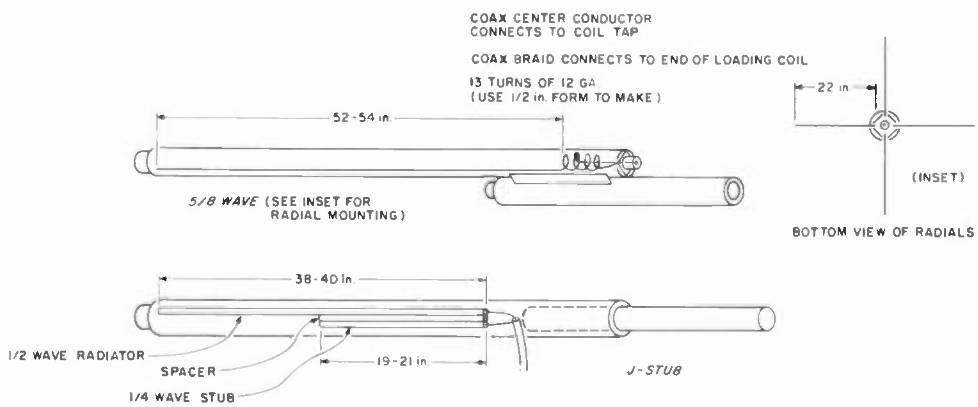
IC-25A BATTERY BACKUP: Here is a simple but effective battery backup for retaining memory when the rig is temporarily removed from the power supply. In tests, the battery retained the memory over eight hours.—Francis J. Piraino WA3KKM, Pocono Summit PA.



TWO-STAGE ACTIVE FILTER: This filter passes an 800-Hz signal. A single section has a bandwidth of about 150 Hz; the two-stage version's bandwidth is approximately 100 Hz. Gain is close to unity at the passband center. The circuit should be added in a low-drive-level section of the audio amplifier if a 12-volt power supply is used.—Penn Clower W1BG, Andover MA.



SIMPLE AND/OR LATCH: This circuit can be used to trip a repeater relay in a timer circuit. For example, if A is high and B is pulsed by a timer, the output will latch high until the input signal ceases. The high output can be used to disable the transmitter. This eliminates the necessity of having a timer which remains high until well after the desired count is reached. A brief pulse is all that is required. The resistor is needed to hold the B input low since the diodes isolate the input. An OR gate could be used in place of the diodes, but the diodes work well. The gate is a CMOS 4081 or a 4011 NOR gate coupled to an inverter at the output.—John Ackermann AG9V, Green Bay WI.



THE PVC PRINCIPLE VHF ANTENNA: Take one 6' and one 9' piece of 12-gauge copper wire and pull each piece until both are slightly longer. This serves to stiffen the copper. Wind the 6' piece 13 turns on a ½-inch form. Leave ½ inch unwound to make a connection. Remove the coil form and cut the "one piece" radiator as shown. Solder one end of a short length of 28-gauge copper wire to the center terminal of an SO-239 and the other to an alligator clip. Attach the clip to the coil about 2 turns from the radiator. Cut the 9' piece into four equal lengths (2¼') and attach them to the SO-239 as shown. Hang the antenna so that you can trim it for vswr adjustment. Vswr is adjusted by 1) coil tap position, 2) spacing of coil turns, 3) radiator length, and 4) length/angle of radials. After vswr is optimum, solder the coil tap in place. The trimmed antenna can be slid into PVC pipe and epoxied into place. To make the J-stub, take three pieces of RG-8 coax, two 19-21 inches and one 38-40 inches. Carefully remove the outer insulation and braid. Lay the three pieces on a flat table and tape them together temporarily. Solder the coax to the antenna, and connect it to the radiator and the braid to the stub. The radiator/stub assembly can be slid into a PVC pipe. Unsolder the coax, thread it through the hole, and solder it back. The end can be capped and coax putty applied.—Jack Sammarco KC2FS, Union NJ.

NEW PRODUCTS

16-DIGIT DTMF DECODER

Palomar Engineers has announced a new low-cost 16-digit decoder, model P-411. The decoder features high-input impedance so it does not load the line, crystal control for long-term stability and operation over a wide temperature range, dual bandpass filters ahead of the detector, and digital logic that makes it almost entirely free of false outputs. The P-411 operates from + 12 volts dc and has a 16-line output as well as BCD code and strobe on 5 lines.

For further information, contact *Palomar Engineers, 1924F W. Mission Road, Escondido CA 92025; (714)-747-3343.*

PORTABLE EARTH STATION

The first completely portable, battery-powered Earth station for receiving satellite transmitted television has been introduced by Gillaspie and Associates, manufacturers of state-of-the-art satellite equipment. The system can be tossed into a station wagon or recreational vehicle and used by campers to watch up to 105 channels of TV. The product also has more serious applications because of its ability to provide visual and audio information and data to remote, communications-poor areas.

The system can provide nine to ten hours of television before the batteries have to be recharged, so it could be used to communicate in civil defense emergencies or natural disasters and in areas susceptible to power outages. The system consists of an 8- or 10-foot metalized-fabric dish antenna that collapses like an umbrella, and a battery-operated satellite receiver complete with a five-inch screen. It can be hooked up to a battery-powered television set if a larger picture is desired.

The portable unit, like the larger home systems, collects microwave beams sent from satellites circling 23,000 miles above. It electronically amplifies less than one Watt of power more than 10,000 times to produce clear, undistorted picture and sound.

Additional information may be obtained through *Diane McNutt, Donald J. Sherman & Associates, 4300 Stevens Creek Boulevard, San Jose CA 95129; (408)-247-7300.* Reader Service number 489.

LOW-COST WIND POWER

Thermax has announced a new wind generator design for small power systems. The TC25WG helius rotor kit was developed as a low-cost battery charger for remote sites and applications, including power for camping, boats, radio operation, RVs, cottages, experimentation, and emergency power. The patented helius design offers several advantages: It responds to winds from any direction and is self-starting. The TC25WG rotor operates at low rpm and avoids overspeed problems common in propeller designs. Virtually no maintenance is required, and the Lexan® vanes resist sun, snow, sleet, and extreme temperatures. Assembly is easy with regular hand tools.

A free information package and further information are available from *Thermax Corporation, One Mill Street, Burlington VT 05401.* Reader Service number 481.

The helius rotor kit by Thermax for low-cost wind power.

SUPER-RATT SOFTWARE

With the Super-Ratt radioteletype and CW program for the Apple II, you can have your own RTTY RBBS station on line quickly and easily, according to Universal Software Systems. Super-Ratt is the lowest-priced RTTY/CW program which also contains a full radio bulletin board system.

The program will operate in ASCII as well as Baudot at any speed from 40 to 300 baud. CW speeds range from 5 to 100 wpm, with an automatic speed adjust on receive.

The program may be run in either manual or RBBS modes. Extensive use of disk files permits storage of "canned" material for manual operation. In the RBBS mode, the system automatically saves nearly one hundred user messages to the disk. There are thirty-five different commands on the RBBS. They are all simple English words—and quite memorable.

Almost any modern terminal unit or converter, such as IRL, Flesher, Kantronics, HAL, or others can be used with Super-Ratt as well as such devices as the "RADCOM" card by AF6W. The program is not protected against copying. The Basic portion may be listed and modified to suit your tastes. (The registered owner's call is installed in the machine code by the factory.)

A free one-year subscription to the user newsletter, *The Ratt's Nest*, is included in the purchase price of $59.95, which also covers shipping via UPS or first-class mail.

For a complete data sheet or other information, write or call *Universal Software Systems, Inc., 9 Shields Lane, Ridgefield CT 06877; (203)-438-3117.* Reader Service number 488.

The portable Earth station—in operation.

The portable Earth station from Gillaspie and Associates—ready to put up.

The Synchronar 2100 solar watch.

SOLAR WATCH

Riehl Time Corporation has just announced a new technological breakthrough in wristwatches, the Synchronar 2100, powered by the sun and programmed to the year 2100 with no resetting required, even for daylight saving time or leap-year adjustments. Miniature silicon solar cells automatically gather and store energy from the sun, daylight, or even an ordinary lightbulb, and this energy is used to drive a complex integrated circuit. The solar cells also measure the ambient light and adjust the brightness of the readout so that it may be viewed under any lighting conditions ranging from full sunlight to total darkness. Synchronar's system totally eliminates the problem of battery replacements, and even if left in a drawer for months, it will continue to operate.

Synchronar 2100 has dual time zones and is available in either standard or international time modes or a combination of both. It is guaranteed accurate to within plus or minus four seconds per year. An exclusive self-calibration system enables the wearer to adjust the watch to run faster or slower, should environmental extremes require recalibration.

A discrete alarm system, or "polite" alert, is provided which, at a prescribed time, causes the display to flash on and off for a period of one minute. Synchronar 2100 features a patented, totally-sealed construction in which all electronic systems are encapsulated within a transparent Lexan* module which can withstand shocks up to 25,000 G and water depths up to 750 feet.

Light enters the top surface of the transparent module and charges the solar cells, and the lighted display shines out through the edge above the band, providing a naturally-positioned side view. Control switches are magnetically operated from outside the watch, meaning that the seal of the module is never broken.

For further information, contact *Riehl Time Corporation, 53 South Jefferson Road, Whippany NJ 07981.* Reader Service number 485.

RADIO RACK

The Guild Radio Rack comes in finished solid ash. No assembly is required. Guild's rack comfortably holds Kenwood's TS830S/VF0230/SP230 or TS820 series, or any similar rigs. Exact measurements are (overall) 16-7/8" W times 14-3/4" H times 14-1/2" D; (top compartments) 7-1/2" W times 6" H, and (bottom compartment) 15-5/8" W times 7" H. It is also fully vented.

For more information, contact *Guild Radio Rack, 225 West Grand St., Elizabeth NJ 07202; (201)-351-3002.* Reader Service number 487.

TRIBAND BEAM

TET Antenna Systems has announced that their top-of-the-line HB35T triband beam is now available. This is a 5-element dual-drive antenna for 20, 15, and 10 meters. With the dual drive concept, both the radiator and the reflector are driven with a phase difference that provides extra gain and improved front-to-back ratio.

The beam has only one pair of traps per element for simplicity and reliability. The trap capacitors are coaxial rods mounted inside the elements to give low losses and weatherproof operation.

The HB35T has a 25' boom, weighs 50 lbs., and provides excellent gain for DX work.

For further information, contact *TET Antenna Systems, 1924E W. Mission Road, Escondido CA 92025.* Reader Service number 480.

HAMTRONICS FM REPEATER

Hamtronics, Inc., has announced the availability of the REP-100 line of complete repeater packages, including all the hardware and controls.

The REP-100 is constructed on a 7-inch rack panel, with an uncluttered control arrangement. Electrical features include excellent sensitivity (0.15 uV at VHF and 0.2 uV on UHF), both 8-pole crystal filter and ceramic filter for ± 12 kHz at −100 dB, afc and hysteresis squelch to lock onto drifting or fading signals, a clean, easy-to-tune transmitter, and up to 20 Watts output. A proportional-controlled crystal oven option provides 2 ppm frequency stability down as low as −30° C (−22° F), if needed.

The REP-100 repeater is available for the 6m, 2m, 220-MHz, and 440-MHz bands and adjacent frequencies. It is available also in configurations for remote linking and crossbanding, including 10 meters. The 2m and 220-MHz models employ a 3-section helical resonator in the receiver front end. The UHF version uses 6 tuned lines in the receiver. (That is important if you share a site with other transmitters.)

A complete catalog on the REP-100 repeater, and other information, is available from *Hamtronics, Inc., 65-F Moul Rd., Hilton NY 14468-9535; (716)-392-9430.* (For overseas mailing, please enclose $1.00 or 4 IRCs.) Reader Service number 491.

The Guild Radio Rack.

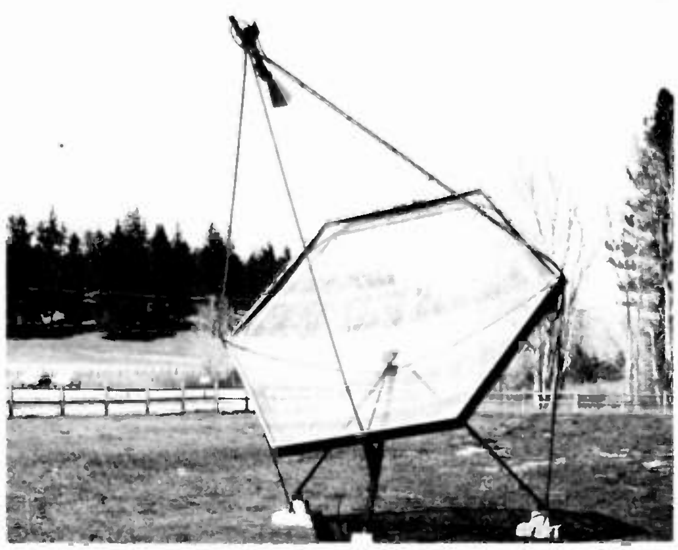
SATELLITE TV ANTENNA KIT

Ghost Fighters, television antenna specialists, has announced the Space Cowboy P-600 series of parabolic antenna kits.

The Space Cowboy P-610 is a 10-foot hexagonal parabolic microwave antenna specifically designed to receive signals from all the domestic satellites, with over 60 channels of video and audio programming to choose from. It tracks the satellite orbit belt on a polar mount and changes from satellite to satellite in seconds. This kit is for the home-video enthusiast who wants to save money and have the satisfaction of building.

The P-610 model, compared with most 10-foot fiberglass dishes, has a surface-intercept area 10% larger and a longer-than-average focal length. Surface accuracy is proofed-on-site and fully tunable over the entire surface on a point-by-point basis (patent pending) for maximum gain and good picture quality. The surface is heavy-duty galvanized steel screen. The P-610 is a true parabolic reflector with at-

The Hamtronics REP-100 repeater.



The Space Cowboy by Ghost Fighters.

DenTron's MLX Mini transceiver.

tached feedhorn assembly and adjustable polar mount for easy selection of satellites.

The kit comes complete with all materials pre-cut and ready for assembly. Some portions of the assembly will require two persons. Assembly and installation of the antenna can be accomplished by the average homeowner in a weekend or two. The polar mount is set on three concrete footings requiring 4 to 6 bags of pre-mix concrete.

Other models in the P-600 series include the P-613 and P-616 (13- and 16-foot antennas respectively).

For further information, contact *Ghost Fighters, TV Antenna Specialists, Route 2, Box 136-B, Stevensville MT 59870; (406)-642-3405.* Reader Service number 479.

NEW MICRO SIDEBAND TRANSCEIVER

DenTron Radio Company has announced production of its new mini-sized, mono-band transceiver. Titled the MLX Mini, it operates at 25-W PEP and 20-W CW with an LED frequency readout of ± 100 Hz accuracy. Available in models from 160-6 meters, the MLX Mini has selectivity of 2.1 Hz with sensitivity better than .35 uV for 10-dB signal-to-noise ratio. Receiver design is the single-conversion superheterodyne type with total power requirements of 12-14 V dc.

For more information contact *Tim Neill, Technical Sales Representative, DenTron Radio Company, Inc., 1605 Commerce Drive, Stow OH 44224; (216)-688-4973.* Reader Service number 482.

GLOBAL'S DIGITAL PULSER KIT

The DPK-1, a new digital pulser kit designed for use as a pulse injector in stimulus/response testing of digital circuitry, has been introduced by Global Specialties Corporation.

This pulse generator is a portable test instrument featuring multi-logic-family compatibility: It operates on both TTL and CMOS circuits. Its pulse width is 1.5 seconds ± 30% for TTL and 5-V CMOS and 3.0 seconds ± 30% for 15-V CMOS.

One touch of the pulse button and the DPK-1 attempts to inject a positive pulse, then a negative pulse. One of these pulses is ignored, depending on the logic state the DPK-1 output is biased at (determined from node under test). Keep the pulse button depressed and after one second the DPK-1 delivers a continuous pulse train of positive and negative pulses at a rate of 150 pulses per second. In the same manner as the single-shot event, one of these pulses will be ignored, leaving a positive- or negative-going pulse train at a 75-pulse-per-second rate.

An LED indicator flashes once to confirm single-pulse output and remains on for continuous pulse train confirmation.

Pulse voltage level is determined by the current requirements of the node under test. The DPK-1 output pulses are capable of sinking or sourcing up to 100 mA, which is sufficient drive to permit forcing most nodes to an opposite state without desoldering.

This digital-pulse generator offers short-circuit protection. High impedance output (minimum, 20-megohm) when not pulsing allows the DPK-1 to pulse into a short circuit continuously without damage.

The DPK-1 is circuit-powered at 5–18 V dc from Vcc of the circuit under test. A power cable, wired directly into the unit, terminates in two color-coded vinyl-jacketed alligator clips.

The DPK-1 digital pulser comes as a complete kit, including all parts, solder, wire, PCB, etc., and a comprehensive construction and operating manual. Kit construction and testing can usually be completed in one to three hours. Its dimensions are 5.8" × 1.0" × 0.7", and it weighs 3 oz.

For further information, contact *Global Specialties Corporation, 70 Fulton Terrace, PO Box 1942, New Haven CT 06509; (203)-624-3103.*

Global's digital pulser kit.

AIDS FOR THE BLIND AMATEUR

Although many textbooks have been translated into braille and onto recorded media, blind hams, technicians, and scientists are faced with the continual frustration of obtaining current and supplemental materials.

The Rehabilitation Engineering Center publishes a newsletter quarterly in braille, large print, and recorded form which will serve as a guide to the current technology as applied to the needs of the blind and persons with impaired vision. The newsletter, called *Technical File*, facilitates the pursuit of electronics interests among technically-oriented, visually-impaired persons by serving as a reference source, a teaching tool, and a hands-on guide for construction projects through lists of materials already transcribed, catalog abstracts, data on integrated circuits, manufacturers' applications notes, and construction details, to list just a few of the contents.

General interest, do-it-yourself descriptions of such processes as soldering, project layout on circuit boards, and the use of power tools focus directly on techniques used by the blind. The articles in *Technical File* are submitted by readers, training-facility personnel, and other interested professionals and non-professionals.

In the Winter, 1982, issue, for example, "Soldering, Part IV," "Singing Chips," "A Tactile Read-Out for Digital Instruments," "Earphones for the Blind Traveler," and "Vocational Aids Catalog" were among the features. Bill Gerrey's "Editor's Corner" and "Editor's Crystal Ball" are always popular.

For your subscription to the Braille Edition ($12 per year), the Large Print Edition ($12 per year), or the Talking Book Edition ($6 per year for half-track cassette, 15/16 IPS) contact *Bill Gerrey, Editor, Smith Kettlewell Eye Research Foundation, 2232 Webster Street, San Francisco CA 94115.* Reader Service number 476.

The Icom IC-45A synthesized UHF mobile.

PROHAM'S FASTRAK ELECTRONIC KITS

Proham Electronics, Inc., has just introduced a new line of electronic kits dubbed the Fastrak* series, wherein each kit is a functional building block that can be assembled in less than one evening. Fastrak modules are for the novice and experienced home-brewer alike, providing not only versatility but complete documentation as well. Each module is built on a commercial-grade printed circuit board that conforms to the HAM (Hardware Application Module) Standard described in the May, 1982, issue of *QEX* magazine, and is uniform in size. Exact board dimensions are governed by the amount of space required to accomplish the intended electronic function, but connector arrangements, bus wiring, and PC-board form factor are uniform and constant for simplicity of assembly and interconnection between units.

Fastrak modules feature a top-down system design, making it easy to configure and assemble complete receivers, transmitters, controllers, and instruments from standard "family" members. Ten Fastrak modules are available, with another ten coming within six months. Functions performed range from basic voltage-regulator and audio-amplifier modules to a 2-chip DTMF decoder and a 1-chip TV.

Fastrak kits come with complete documentation and use readily available components. For more information, write *Proham Electronics, Inc., 34620 Lakeland Boulevard, Eastlake OH 44094.*

ICOM IC-45A SYNTHESIZED UHF MOBILE

Icom has announced availability of the IC-45A, providing FM mobile coverage of 440-450 MHz. Major features are its small size (2" H × 5½" W × 7" D), easy-to-read LEDs, 5 memories, priority channel, band and memory scan with automatic resume, memory backup provisions, 1-MHz up-button for quick QSY, and variable duplex offsets. The touchtone™ microphone is included.

For more information, contact *Icom America, Inc., 2112 116th Ave. NE, Bellevue WA 98004; (206)-454-8155.*

MOBILE ANTENNAS

Valor Enterprises, Inc., introduced a new series of mobile high-frequency antennas at the Chicago CES Show last June. These HF mobile antennas for the professional and amateur operator are approximately 8 feet in length, and are of a heavy-duty, slim line construction designed for HF amateur bands on 75, 40, 20, 15, and 10 meters. Heavy-gauge copper wire wound on ½" fiberglass with nickel-chrome brass fittings, and 17-7 taper ground stainless-steel whips ensure dependable mobile operation. The 4' stainless-steel whip is field-tuned for lowest vswr and double-locked with stainless-steel set screws. The antennas feature 3/8–24 ferrules to fit standard mobile mounts and are power-rated at 500 Watts PEP for top mobile performance.

For further details, contact *Valor Enterprises, Inc., 185 W. Hamilton St., West Milton OH 45383.* Reader Service number 484.

RETICON ACTIVE FILTER

Applied Invention is the source for the recently introduced Reticon R-5620 programmable active filter—a complex MOS integrated circuit. The R-5620 uses switched-capacitor technology to synthesize a two-pole pair active filter that requires no external components and operates over the range of 0.05 to 25 kHz.

The five basic filter types: low-pass, high-pass, bandpass, band reject, and all-pass can all be implemented by the R-5620, and a programmable sine-wave oscillator is also possible.

Switched-capacitor filters (SCFs) are analog filters in which fixed resistors are replaced by time-division-variable switched capacitors, resulting in very stable filters that can be tuned with a variable clock source.

The simple programmability of this new SCF makes it attractive for computer-controlled synthesizers and other analog/digital systems applications.

For additional information, contact *Applied Invention, RFD #2, Route 21, Hillsdale NY 12520.* Reader Service number 483.

YAESU'S ACTIVE ANTENNA

Yaesu Electronics Corporation recently announced the introduction of the FRA-7700 active antenna for the FRG-7700 deluxe HF receiver.

The FRA-7700 utilizes a four-foot (1.2-meter) whip in conjunction with a low-distortion MOSFET preamplifier, providing short-wave reception for receiver owners unable to erect an outdoor antenna. The FRA-7700 includes front-panel gain control, tuned-circuit peaking, and a preamplifier on/off switch for maximum versatility.

For details on the FRA-7700, contact *Yaesu Electronics Corp., PO Box 49, Paramount CA 90723.* Reader Service number 486.

RT-1100 MULTIMODE TERMINAL

DGM Electronics has just introduced the RT-1100 receive terminal for Baudot, ASCII, and Morse. The RT-1100 converts the audio from your receiver, decodes it, and displays the words on a video monitor or TV set (using rf modulator). The RT-1100 incorporates an active filter demodulator with scope-tuning outputs. It will copy 170-, 425-, and 850-Hz-shift RTTY signals at speeds of 60, 66, 75, and 100 wpm on Baudot and 110 baud on ASCII. The unit will copy 6-60 wpm Morse signals using automatic or manual speed tracking. The RT-1100 has a parallel ASCII printer output for hard copy. The video output provides 16 lines of 32 characters per line with 2 pages. The second page is stored in memory and can be recalled by using the page 1-2 switch on the front panel. The unit has a built-in 110-V-ac power supply and is housed in an attractive 3" x 10" x 10" case with brushed, anodized front and rear panels. The cover is a gray wrinkle finish. The unit comes with a one-year warranty on parts and labor.

For more information, contact *DGM Electronics, Inc., 787 Briar Lane, Beloit WI 53511; (608)-362-0410.* Reader Service number 477.

MOBILE ANTENNA CONVERTER

JL Industries has just announced their new X-Panda-Five mobile antenna adapter, which enables the owner of a Hustler, Hy-Gain, or similar mobile antenna to convert his antenna to a five-bander by adding resonators.

The X-Panda-Five consists of a precision-machined aluminum hub fitted with five rustproof 3/8" by 24" studs made from high-tensile-strength carbon steel. The hub is attached to the antenna mast, and each of the five resonators screws onto the hub. One resonator is mounted vertically and four are mounted horizontally.

When the adapter is installed on your antenna, you can use either regular or super-size resonators and change bands without leaving the driver's seat. This assumes, of course, that you pre-tune each resonator to your favorite operating frequency in that band. No antenna tuner is required.

The X-Panda-Five also makes a good antenna for apartment houses and condominiums when fitted with the appropriate resonators and ground planes. It can be

DGM Electronics' RT-1100 receive terminal.

used to make a multiband antenna system for vans, campers, motor homes, and travel trailers.

For more information, contact *JL Industries, PO Box 030413, Fort Lauderdale FL 33303.* Reader Service number 490.

ANTENNA COUPLER

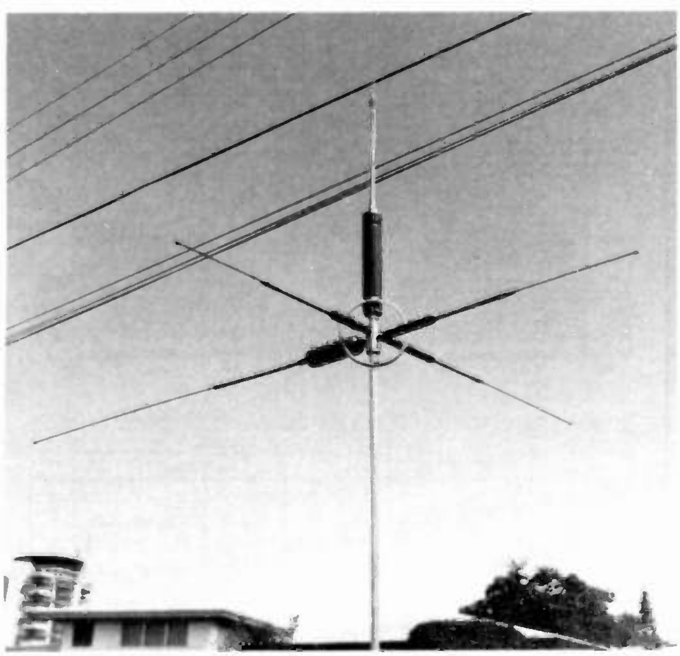
Wayne Research & Development has announced the availability of a new antenna coupler that replaces the center insulator of a balanced rf antenna system. The Wayne B-T-L antenna coupler contains an air balun, a tapped inductor, and a variable capacitor. The coupler is housed in an ABS plastic box with a removable lid for inspection and servicing. The strain insulator is made of Delrin® plastic.

With the aid of graphs in the instruction booklet (supplied) and an swr meter, the user can design a matching network to match the low impedance of his wire beam or the high impedance of his loop antennas. Using the network as a T or an L, the Wayne B-T-L antenna coupler will match impedances over a frequency range from 1.8 to 30 MHz.

The insertion loss is not more than −0.006 dB from 1.8 to 25 MHz, and minimal from 25 to 30 MHz. The introductory price is $49.95. For further information, contact *Wayne L. Jamison W5FJS, Wayne Research & Development, PO Box 75144, Houston TX 77234.* Reader Service number 478.

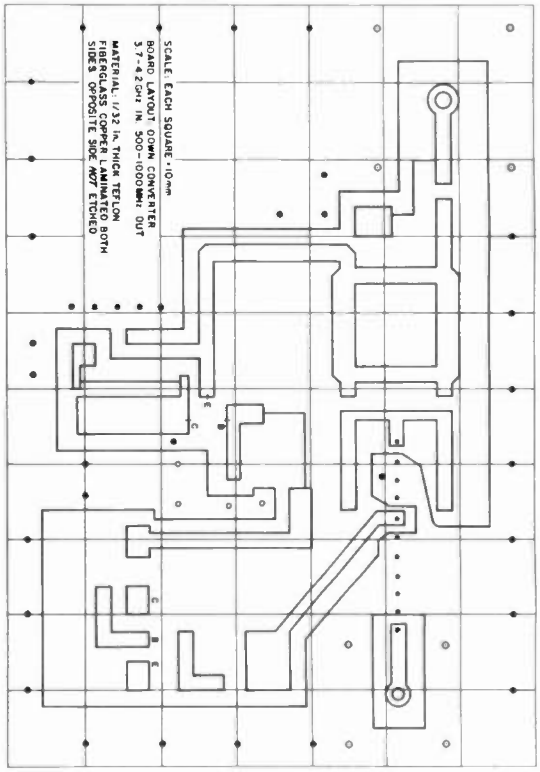
The Wayne B-T-L antenna coupler.

Yaesu's FRA-7700 active antenna.



The X-Panda-Five mobile antenna adapter by J. L. Industries

CORRECTIONS



G. W. Legel's (N6TO) article "Dissertation Upon Roast Pig" (October) offers an interesting and useful suggestion for transformer salvage, but ignores an extremely important personal caveat.

Old transformers were frequently filled with polychlorinated biphenyls (PCBs). This is a dangerous, toxic material that should be dealt with by trained professionals. Old, oil-cooled transformers must be presumed contaminated. Unless they bear a green certification sticker, they should not be handled by amateurs under any circumstances.

Tom Archer KC8MR
Huron OH

The $100 TVRO receiver is a real winner. I'm going to build one, except for one small detail. The August issue of *73* (on page 64) has the layout of the downconverter used in Rex's "Cheap Trick." The only problem is that in Fig. 4 the scale is 10mm per division. The printed version is 128mm long when it should be 100mm. I'm sure that was done for clarity, but it is hard to interpolate 128mm to 100mm. I'm also sure that you know the dimensions at the frequency are critical.

What I'm asking is if you have an actual-size drawing from Steve Gibson, could you print it in the next issue at 1:1? Please??

David Lawson WA1YMC/5
Dallas TX

Here you go.—Ed.

Fig. 1 in "The Vertical Deuce," on page 81 of the September issue, was drawn incorrectly. As drawn, closing the relay would put a short across the center conductor and braid of the feedline. Instead, the braid should be connected directly to ground and the center conductor should be hooked up to the coil at the opposite end from the antenna.

Avery Jenkins WB8JLG
73 Staff

HAM HELP

I need the manual and/or schematic for a Knight T150 transmitter. I am willing to pay a reasonable amount for any information.

J. W. Roberson W5RDI
745 Willow St.
Hurst TX 76053

Anyone out there have a schematic for an Ameco six-meter type CN VHF converter? Expenses will be reimbursed.

H. S. Robb AFØW
Box 17
Bird Island MN 55310

I would appreciate information on using the Interact computer in amateur radio applications.

George W. Moran W2DGZ
950 Erlen Drive
York PA 17402

I need a schematic for a Majestic Fairfax model 200 superhet broadcast receiver. I will pay copy/mail costs.

Dan Sindorf KSØC
11937 McCoy Drive
Omaha NE 68123

✓ See List of Advertisers on page 130

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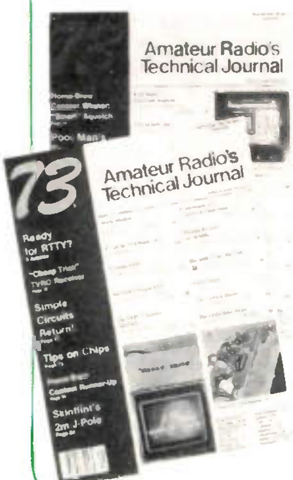

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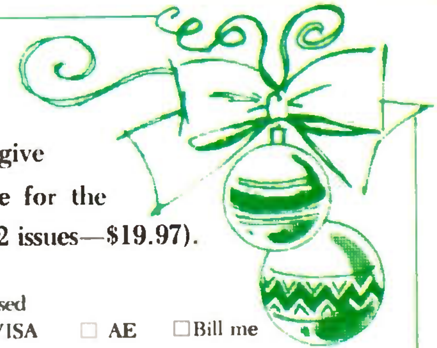

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REVIEW

THE HF 10/160 SOLID-STATE PLL TRANSCEIVER

The voice at the other end of the telephone line belonged to Bruce Stwertnik, president of National Communications Group, Inc., importers of that nice little NCG 15-meter monoband rig which was reported on in the July, 1981, *73*. Now, it isn't unusual for Bruce to call and chat, but I sensed that he had something special up his sleeve this time. After the usual chit-chat, he dropped the other shoe: "Jim, I've just got a new rig in from Japan; how'd you like to put it through its paces?"

At the hint of something new and possibly different, my mind began racing with questions such as what kind of rig? For which bands? How much power? What does it look like? How does it play? What features? You know the kind of things I mean. . . but I barely managed to get a few of them across to Bruce as I quickly stammered a "Sure, I'd be delighted!"

Bruce hastened to explain that this rig would be a scoop for *73* since there are only two in the States at the moment, but a lot more on the way. I was to get the first one to test and Bruce was to keep the other for himself. As a matter of fact, the English-language manuals weren't quite ready yet, he said, so I could expect only a spec sheet and a brief translation of some of the features, operating hints, and comparisons with similar rigs currently on the market.

The NCG HF 10/160 transceiver is much as one would expect. It is definitely a new-generation transceiver, with solid-state circuitry and PLL frequency synthesis. And apparently, if one can judge from the pictures in *CQ-Ham Radio*, the Japanese amateur radio magazine, it has been in use in Japan for some time.

Physical Description

The transceiver is manufactured by Matsushita Electronic Industries Company Ltd., a parent company of Panasonic, among others. It measures approximately 13 inches wide by 5-1/2 inches high by 16 inches deep (if you count the massive rear-panel heat sink) and weighs just shy of 21 pounds. . . but wait a minute: that includes both ac and dc supplies—built in! No need for an external supply, whether you are mobile or fixed. The usual tilt bail on the bottom to raise the rig to a comfortable angle for viewing the front panel is provided, and there is the side carrying handle intended to make the rig conveniently portable. The case is dull black and has a vaguely military, i.e., functional, look. Perhaps the first thing you notice is the centrally-located spinner dial on the front panel, just below the large digital readout frequency display whose green alphanumerics are nearly one-half inch high and are easy to read. There are prefix letters ahead of the numbers when the rig is operated in its various modes: "C" for CW, "U" for upper sideband, and "L" for lower sideband.

The VOX sensitivity, VOX delay, and anti-VOX controls are on the left-hand side of the rig, and the VOX sensitivity control knob has a concentric switch for the 100-kHz frequency marker provided in addition to the synthesized readout, because this permits the on-board phase-locked-loop circuitry to be zeroed against WWV, for example.

The new bands are provided for as well, and the rig covers all amateur frequencies with generous overlap on the ends for MARS or other use. The S-meter dial is in the upper left-hand corner, and indicates relative power output or ALC (your choice) in the transmit mode and S-meter readings in the receive mode. As a matter of fact, I think you would be particularly pleased with the S-meter, as it doesn't seem to be particularly scotch or particularly generous. Somehow, I have the feeling that it is about right—and consistent—from band to band.

The power on-off switch is a toggle in the upper left-hand corner; below the meter is a row of switches that control receiver functions such as noise blanker, meter scale, fast-slow agc, and tuning rate. The tuning device is an optical chopper which permits simple dial lock to a desired frequency simply by disengaging the manual dial. There is a tuning-rate switch that permits you to tune each band in 25-Hz, 100-Hz, or 1-kHz increments. Right next to that manual selector is an auto-tuning switch that functions in the *up* or *down* modes, and changes frequency at the rate selected by the adjacent rate switch. I never thought I would need—or want—such a device, but it's handy and I use it a lot.

Below the switches just mentioned are the microphone connector (standard Japanese 4-pin) and the phone jack (standard 1/4-inch diameter) right next to it. Then comes the key jack, which uses the smaller-diameter plug of the size used to plug in speakers and the like (I believe it is .168" diameter). Fortunately, another rig I tested recently had this size key jack, so I was ready, but on the *front* panel? Why there of all places? The answer is simple—convenience; I realized that as I recalled the many times I have fumbled around the back of a rig in the dark trying to find the key jack.

The HF 10/160 has a built-in speaker placed on the bottom plate of the rig, and a jack for an external speaker should you wish to use one. I found the audio quality to be quite good, even with the small enclosed speaker. . . and that certainly is the way to go for portable/mobile. . . unless or until you wear headphones, of course. An external speaker is normally used in my shack, however, so I used that for the evaluation.

Next to the key jack is the mode-selector switch—permitting wide or narrow CW and upper or lower sideband. . . you have to choose which. On the dial escutcheon you will find two small push-buttons that activate the dial lock (left button) and the TX/RX REV switch. On the upper right-hand side of the panel you will find the Delta F switch and the RX offset switch (RIT).

The Delta F control corresponds to the receiver incremental tuning control (RIT) on the other rigs. By pushing the switch, a red LED comes on to show that the circuit is activated. Now, by varying the Delta F knob, you can adjust the receive frequency higher or lower than the dial-set frequency by about 1 kHz.

The TX/RX REV control permits further adjustment of the transmit or receive frequencies separately. When the switch is depressed, a red LED is illuminated to show that the circuit is active. Here's how it works. Suppose you want to leave your transmit frequency where it is but wish to change the receive frequency. Push in the TX/RX REV switch to lock the transmitter frequency on the existing dial setting. Now the receive frequency can be adjusted by the main tuning dial. This gives the effect of a dual vfo, and permits you to set the transmitter "up five," for example, when working DX on a split frequency, and then use the receiver and main dial to tune the DX station. If you wish to listen to *your* frequency momentarily, turn the TX/RX REV switch off, and presto, you're back on the transmit frequency with the receiver.

The memory-selection push-buttons are next, and require a separate discussion—so we'll come back to them later. You should know, however, that you can store up to four different frequencies and scan between any part of them at a variable rate, using "autowatch."

If you really want to get fancy about all this, you can use all these features in concert: TX/RX REV, Delta F, and memory select. I am sure that an accomplished dial twister and button pusher could really play a symphony on this rig after a few evenings of practice. Versatility is the name of the game with the HF 10/160 from NCG, and it's unlikely you will run out of permutations and combinations to try.

The main control knobs of the transceiver lie below the switches, and include in the top row: transmit frequency variation (Delta F), i-f tuning (± 1 kHz) and the audio/rf gain controls on concentric shafts for the receiver; and in the bottom row: the mike gain/CW carrier-control knob, the audio-compressor/speech-processor control, and finally the bandswitch covering 1.8-29.7 MHz.

I found that all controls fall more or less conveniently to hand, and that if you have used any of the modern solid-state rigs from Japan, you will find everything about where you expect it. I was impressed with the nice manual tuning feel and the utter simplicity of using the rig.

Electrical Description

The NCG HF 10/160 contains 30 integrated circuits, 6 FETs, and 124 diodes/transistors. Power consumption is nominally 50 Watts on receiving in the ac mode, and 0.6 Amperes current drain in the dc mode. Transmitting consumes 550 Watts in the ac mode, and 20 Amperes current drain in the dc mode. Nominal dc voltage requirements are 13.8 volts (negative ground) at 20 Amps—enough to require that you have a battery charger, if portable, or a good alternator system if mobile and operating at the full-power capability. Ac requirements are the usual 120 volts, 50 cycles.

Band Coverage

The HF 10/160 covers 1.8-2.0 MHz in the 160-meter band, 3.5-4.0 MHz in the 80-meter band, 7.0-7.3 MHz in the 40-meter band, 10.0-10.5 MHz in the 30-meter band (providing some general reception, too), 14.0-14.35 MHz in the 20-meter band, 18.068-18.168 MHz in the 17-meter band, 21-21.45 MHz in the 15-meter band, 24.89-24.99 MHz in the 12-meter band, and 29.0-29.7 MHz in the 10-meter band.

Stability is given as less than ± 200 Hz within one hour and less than ± 20 Hz after one hour. A comment about the extraordinary frequency stability was received from a ham on 40 meters who had been listening to me for a half an hour. He mentioned that my frequency as measured on his frequency meter had not changed one cycle during the entire time he had been monitoring! This means that both voltage and temperature stability is excellent. The comment, by the way, was unsolicited.

Transmitter Description

The final-stage input is 200 Watts (160-12 meters) and 100 Watts on 10 meters. Balanced-type modulation is used, and carrier suppression is more than 40 dB. Sideband suppression is more than 50 dB, and spurious radiation is at a level below −40 dB. Microphone impedance is about anything you want, and a range of 600 to 50k Ohms is acceptable. The output connector for rf is the usual 50-Ohm UHF type SO-238.

NCG's HF 10/160 transceiver.

SOME FEATURES COMPARED

Feature	NCG 10/160	TS-830	FT-101
Tuning	PLL-synthesized	Vfo (capacitor)	Vfo (capacitor)
Power Supply	Ac/dc built in	Ac	Ac (dc optional)
Weight	21 pounds	30 pounds	32 pounds
Dimensions (H × W × D)	5.2 × 2.68 × 12.44	5.24 × 13.11 × 13.11	6.18 × 13.58 × 12.83
Frequency memory	Yes	No	No
Autoscan	Yes	No	No
Dual vfo	Yes	No	No
Tuning rate	3-step	N/A	N/A
Passband tuning	No	Yes	Yes
I-f tune	Yes	Yes	No
Notch filter	No	Yes	Yes
CW/af	Yes	No	Yes
Tone Control	No	Yes	No
Drift-free tune	Yes	No	No
All solid state	Yes	No	No

Receiver Description

The receiver is a single-conversion superheterodyne of the type well known for its good sensitivity and lack of images, yielding a factory-measured sensitivity figure of less than −12 dB (.25 V) at 10-dB S/N ratio. The i-f frequency is 9.0007 MHz on CW and 9.000 MHz on phone. Selectivity on SSB or wide CW is 2.2 kHz at −6 dB, less than 3.0 kHz at −20 dB, and less than 6 kHz at −60 dB down, for a shape factor of about 2.7. On narrow CW, the figures are 400 Hz at −6 dB, 1 kHz at −20 dB, and 1.6 kHz at −60 dB, respectively. This gives a shape factor of about 4:1 for narrow CW. The narrow CW option could not be observed at the time of testing because the sharp filter had not yet been received.

Spurious images are down more than 60 dB, i-f rejection is likewise more than 60 dB, and other spurious response is down more than 70 dB.

With the built-in speaker (nominal 8-Ohm impedance), the audio output power is 0.5 Watts (10% THD) and with an external speaker, the audio output power is 1 Watt (10% THD).

Using the Rig

This report is necessarily a preliminary and admittedly sketchy evaluation because the manual I have is in Japanese. The English versions should be available (along with the rigs) by the time you read this. In spite of, or perhaps because of, the lack of an English-language manual, I found that I paid more careful attention to the drawings and photos than usual. These are abundantly clear, and it would be almost impossible to set up the rig incorrectly if you have had any experience at all in putting a "transceiver-from-the-box" on the air.

Carefully unpacking the rig from the usual sanitary plastic bags and foam-sheltered security of the container, I found a separate bag containing the microphone and still another small box with the ac and dc power cords inside. Selecting the ac cord, I plugged it into the polarized multi-pin socket on the back. My ground wire was put on the terminal, underneath the usual washer and wing nut. The microphone plugged into the usual 4-pin front-panel connector.

One obtains a first impression of any rig as it comes from its cocoon, and this one was no exception. Its general appearance, weight, and feel lend the impression that it is functional and business-like, with its matte black finish and vaguely military look.

Being a CW man at heart, I wanted to try that mode first, so I plugged my electronic keyer into the rig, switched the operate switch to VOX, and set the sensitivity control and delay control for comfortable semi-automatic break-in. Keying the rig produced a fine sidetone—pleasant to the ear—and my power-output meter showed a power output of approximately 70 Watts on 40 meters. A quick twist of the Mic Gain/CW CAR control brought the output to 100 Watts. The stations I worked on 80, 40, 20, and 5 meters all reported fine keying and good solid signals with a nice CW note.

The only small objection I had was from an operator who claimed that on the initial make (when the relay came on) there was a slight frequency warble which disappeared once the relay held in. (This will be corrected in subsequent production rigs.) However, if you choose to set the VOX delay to a long duration, there will be only one little warble at the beginning of the first character. This would also be true, of course, in the manual mode, and thereafter you should hear no complaints. Not having heard this myself, I can only report what that one operator told me. Significantly, perhaps, no one else mentioned it.

I was somewhat bothered by the lack of a narrow-CW filter, but I found that I could operate in all but the worst of crowded conditions by using the i-f shift control to move the i-f window into a better location with respect to the carrier. This gave the impression of an improved selectivity by removing part of the bandpass through which extraneous signals could slide. All in all, I found CW operation very satisfactory, and was delighted to be able to work about anything I could hear. Although I did not find the sidetone pitch and volume controls which are internal, I must confess that I didn't search for them either. Once the English-language manual arrives, it will be a snap to adjust them to one's own special comfortable listening level and tone. With earphones on, I found everything to be exactly right, so I didn't bother trying to change them.

Single-sideband operation is where this rig really shines. I am not much of a phone operator, and because of this I was perhaps a bit overconcerned about the modulation and signal levels that I would be able to produce. I needn't have worried; each report was outstanding.

The first evening of sideband operation went something like this: "W1XU, this is W—; you are five by nine here. By the way, what rig are you running? The audio is outstanding!" (Mic Gain control positioned at 10 o'clock.)

"W—, this is W1XU right back. Thanks, OM, for the fine report. The rig is a new one undergoing test for *73*. I'm not at liberty to tell you the make and model just yet, but I can tell you it is nominally a 100-Watt-output rig, made offshore."

(Breaker)"W1XU, this is K—; what kind of rig did you say you were running? The audio is superb. Are you running a processor?"

"K—, thanks for the good report. I appreciate it. Can't tell you what the rig is, but you'll read about it in *73* one of these months."

(Breaker) "W1XU, this is W—. I just wanted to tell you that I have been listening to you for half an hour, and your frequency is rock steady. You haven't varied by one cycle since I started listening. I also wanted to tell you that your rig is super, whatever it is."

(Later that evening) "W1XU, this is WA—. Your audio certainly doesn't sound any better with that compressor in your circuit. In fact, it sounds better without it. Are you sure you don't have some audio processing? It's crystal-clear and has magnificent 'punch.' "

Rather than bore you with further reports of the same or similar content, I'll just mention that *every* report has been outstanding. I have been very careful about avoiding requests for an audio quality report, and each one was unsolicited. In spite of the fact that I consider myself a dyed-in-the-wool CW operator, this rig has gone a long way to turn me back to SSB. Maybe it will help to understand that when I admit that my voice is one of those mid-range voices that could be described as soft-spoken. It does not "talk up" a rig like many that you hear. In fact, I usually use a mike amplifier to help out . . . but with this rig it surely isn't necessary and probably is not desirable.

Of course, being solid-state, no tune-up is required, and full output is achieved into a matched antenna. I did not notice any swr shutdown protection at swr values up to about 1.5 to 1. Inadvertently, I once attempted to transmit with the antenna shorted to ground. Obediently, the finals shut down, and—fortunately—no damage was done. This was immediately obvious by the power output meter, which didn't even flicker. Not having any swr values in the 3:1 range, I can't be sure at what point shutdown began, but I would guess that 3:1 would result in a power output of about 50 Watts or less . . . in other words, a progressive protection. Nice.

The memory function had me a bit perplexed, but I got brave enough to finally give it a whirl. I dialed in two frequencies about 50 kHz apart and committed them to memory as follows: 14.007 on dial, punch the Write button, followed by button 1. 14.007 is now in memory 1 and also displayed on the screen. (Punch the vfo button and you are able to dial in another frequency.) This time, I dialed up 14.012, depressed Write and button 2, followed by vfo. 14.012 was now in the memory 2 location. Next, I wanted to put in two more frequencies in memories 3 and 4 . . . which I did, according to the previously described method. Now, by merely selecting any of the four memory buttons, I could instantly recall the frequency in memory. Nothing special, you'll agree —and about like any transceiver with memory.

Now, what about the autowatch function? Well, I pushed it—and guess what? The receiver goes into a scanning mode and scans between the two frequencies in memories 3 and 4! It scans very slowly—I would guess no faster than about 10 Hz/second. When it reaches the top frequency it returns to the lower one and begins scanning again. Although I don't have any particular need for that feature at the moment, I can visualize a few occasions when it might be very worthwhile to have. For example: Suppose you are looking for a friend on a particular frequency, "plus or minus QRM." Just set two frequencies above and below the intended frequency and punch autowatch! When your friend comes on, you'll hear him because the scan rate is slow enough to permit call identification before it moves on. Neat.

Frankly, I have not used audio compression except on some DX contacts, where the reports have indicated an improved readability—perhaps because of the higher average power output. There were no adverse comments as there had been on local contacts.

So far, I've not been able to find the time to install the rig in the car . . . but may do so in time to drive to a hamfest this coming weekend. It's a longish trip—about 400 miles each way—so that should provide ample opportunity to give the rig a real mobile shakedown. I have no reason to believe that it will perform other than spectacularly.

Is this rig for you? Well, of course, it depends upon what you are looking for. Certainly it has many nice features, including some that aren't available in the run-of-the-mill modern transceiver, and it is rugged and functional. The price is competitive, as it is squarely in the range of similar transceivers. I felt the dial was very satisfactory, and the knobs, switches, and controls equally so. The only picky-picky complaint I have (and this wouldn't bother anyone else, I'm sure) is that the small knobs have skirts that are decorated with a plastic trying to simulate metal . . . and it *looks* like plastic, not metal. If I were the manufacturer, I'd forget trying to dress it up with this charade. Leave 'em all black, and they'll be that much better for it.

You may find there is enough information available on the metering modes; all you get is rf output, S-meter, and ALC information. Upon further consideration, what more do you really need?

With this article is a handy comparison chart for you, between the HF 10/160 and two other contemporary rigs in the same price class. Look it over and decide for yourself whether you're interested. If you're like me, I think you will be . . . very much so!

For more information, contact *NCG Company, 1275 North Grove Street, Anaheim CA 92806*. Reader Service number 492.

Jim Gray W1XU
***73* Staff**

ICOM IC-290A/E ALL-MODE 2-METER TRANSCEIVER

The Icom IC-290A/E (A is the American version and E is the European model) is just what the doctor ordered if you are looking for an all-mode 2-meter rig. It has all the features a 2-meter op could want, and even a seasoned VHF operator would be pleased with the unit. The capabilities of the IC-290 are astounding for its small size. It operates USB, LSB, FM, and CW from 143.8 MHz to 148.2 MHz. In addition to two completely independent vfo's the 290 features five memories and a flexible band-scanning system. Yet, at 64 mm (H) × 170 mm (W) × 218 mm (D), it is smaller than many FM rigs.

On the Road

I had been wanting to try 2-meter SSB mobile for years, and finally had the chance the day the IC-290 arrived. So, I installed the radio and headed out on a business trip from Peterborough NH to New York. Before leaving, I programmed the memories for five of the repeaters I might encounter enroute and put vfo A on 144.200 MHz, the calling frequency for SSB. I set vfo B on 146.52 and set the scanner for memory scan. This allowed me to scan all seven frequencies.

Although SSB during the day is not as busy as FM, there is still a considerable amount of activity, with new stations on the air every day. I could leave the rig in FM scan, and when a station came on 144.200 MHz the squelch would open and all I had to do was switch to USB to see who was calling. This system worked very well. I worked several stations between New Hampshire and New York. The added range on 2 SSB and the lack of beepers, timers, and kerchunkers is truly a pleasure. My friends on "the low end" may be upset by my publicizing their secret, but there is plenty of room for everyone. It reminds me of a bumper sticker seen on a car up here in New Hampshire after a particularly large influx of "flatlanders." "Keep NH a Secret," it read. Well, it's hard to keep a secret about something so great, and 2-meter SSB is the same.

Technical Highlights

The rf amplifier and first mixer circuits of the IC-290 use MOSFETS which allow for a receiving system that is more sensitive than any other 2-meter multi-mode rig I have tried. Unlike other transceivers, the 290 does not need a preamplifier for successful operation. I took the rig with me on a trip to Boston and tried to work a repeater in NH while in the back yard of another that was 15 kHz away. Contrary to other receivers that I had put through the same test, the IC-290 came through with flying colors. The receiver features selectable agc in SSB and CW plus a noise blanker that worked very well in removing ignition noise that was being radiated by my auto and adjacent vehicles as well.

The Icom 290 has two continuous-tuning vfo's. What this means is that when you get to the end of the tuning range (i.e., 148.200) the vfo automatically switches to the bottom edge (143.800). This feature saves a lot of time if you are on 147.51 MHz and you want to QSY to 144.220 MHz. In the SSB and CW modes, quick tuning in 1-kHz steps is available or, with a push of the front panel tuning rate switch, fine tuning in 100-Hz steps. On FM, the tuning rates are 5 kHz and 1 kHz. The tuning knob has click stops which allow for eyes-on-the-road tuning. A priority switch allows you to sample any one of the memory channels every five seconds, regardless of whether the scanner is on or another frequency is being listened to. The S-Meter/Rf-Output indicator is of the currently-popular LED-bar type.

The transmitter in the IC-290 has a high output of 10 Watts. By pulling out on the squelch knob, you are in low power which comes through from the factory set at 1 Watt and is internally adjustable. Transmitted audio reports that I received were all favorable. The repeater offsets are controlled by two front panel switches. To the left of the main tuning knob is a three-position offset switch, selecting either up, down, or simplex. The offset frequency is selected by placing the mode switch in the Off-set/Write position and dialing the main tuning knob to the desired offset frequency. Then you return the mode switch to the FM position and your offset is set until you change it. Internal transmitter controls include everything you should need from deviation-adjust in FM to CW sidetone-adjust.

Icom has provided an excellent operating manual. It includes inside photographs with all internal adjustments very well labeled. In fact, the manual is so good that Jeff DeTray WB8BTH used it to describe to me over the phone where the deviation pot was located. The manual with all its descriptive pictures was at his house and the rig was on my bench. He found the pot and described to me exactly where it was in just a matter of seconds. There is no need for an extra-cost service manual just to make adjustments.

With the IC-290A/E, Icom has once again demonstrated its ability to pack many features into an extraordinarily small package. And yet they've done it without sacrificing operator convenience. As the sunspot cycle declines and all-mode rigs proliferate, we can expect to see more and more SSB and CW activity on 2 meters. Radios like the IC-290 will bring lots of new blood to the low end of two.

For further information, contact *Icom America, Inc., 2112 116th Ave. NE, Bellevue WA 98004; (206)-454-8155.*

Bob Cunningham K1XR
73 Staff

HF ANTENNAS FOR ALL LOCATIONS

L. A. Moxon G6XN scarcely needs an introduction to at least two generations of antenna enthusiasts. His fascinating descriptions of antennas of all kinds, ranging from beams to vertical and from wire antennas to space-saving and "hidden" antennas, have inspired thousands of radio amateurs in this country and abroad to try their hand at just one more antenna. More often than not, the G6XN antenna will exactly fit the requirements and will perform at least as well as—and sometimes better than—whatever you may have tried before.

Les Moxon's articles, sketches, and ideas have appeared in the RSGB publications, in *QST*, and in collections and manuals everywhere. Now, at last, we have the man all by himself in a book that is bound to become a must for the bookshelf of every right-thinking antenna experimenter: *HF Antennas for All Locations*, published by the Radio Society of Great Britain, 35 Doughty Street, London WC1N 2AE, England ($12).

Here is a book you can really get your teeth into—one that you can use to answer questions you may have about a particular aspect of theory or to build a practical antenna from a concise sketch with exact dimensions for the frequency of your choice. Not only that, the English seem to have a unique way of making difficult subjects seem very simple, and Moxon's book is no exception. His explanations and drawings of the ionosphere, for example, are quite fascinating, and show a three-dimensional space in two dimensions by some very clever art work.

Let's for just a moment peek into the contents and see what's there that may interest you and have application to your particular situation. (I'm convinced that Les has something for every antenna taste and persuasion.) The book is divided into two basic parts. Part I is titled "How antennas work," and covers in ten chapters the following subjects: Taking a new look at HF antennas; Waves and fields; Gains and losses; Feeding the antenna; Close-spaced beams; Arrays, long wires, and ground reflections; Multiband antennas; Bandwidth; Antenna design for reception, and The antenna and its environment.

Part II covers "Theory into practice," and includes these chapters: Single-element antennas; Horizontal beams; Vertical beams; Large arrays; Invisible antennas; Mobile and portable antennas; What kind of antenna?; Making the antenna work, and Antenna construction and erection.

As you can see, there's enough material there to fuel your winter's needs for reading matter, and sufficient practical "how to" information to occupy several year's worth of summertime building frenzy.

Take the first chapter in Part I, for example, which invites the reader to take a *new* look at HF antennas. Just what does Les Moxon mean by a *new* look? Well, let him speak for himself.

"Amateurs have been using HF antennas for 60 years or more so that some slowing down in the rate of progress might be expected. As evidence of this, some of the best antennas in use today were designed 20 to 30 years ago yet, impelled by strong incentives, the search for the 'better' ones continues unabated. At times of slow progress it is not a bad idea to look at problems from new angles, and a possible first step is to erase from one's mind the picture of 'things as they are' and concentrate, for a few moments at least, on the way one would *like* them to be. Listing the reasons why they are not and challenging each in turn can be good fun; moreover, before accepting once again the status quo, one feels entitled to convincing evidence that there are no alternatives.

"In the following pages the reader will find few such proofs but instead several challenges to existing beliefs and practices, 'proof of impossibility' being reserved mainly for the antenna gain figures frequently claimed by authors and advertisers."

Les then goes on to explain that weight, size, and cost of beam antennas must be considered to be fair game for investigation and that a reduction in these values *without compromising performance* is a worthy goal. Another goal is minimizing interfering signals, and G6XN questions whether that goal is incompatible with the goal of increased gain. Today's thinking suggests that there is no answer, but Les points out a new and striking possibility: Why not change the antenna characteristics between transmitting and receiving?

In fact, the contents of the book suggest that the desired objectives can be met with *dipole* elements only, and that loops or other configurations are not necessary—provided that one doesn't think that a *straight* dipole is necessary!

Well, this is just a taste of what the book holds, and it goes into great detail explaining how new configurations can be achieved, what they might look like, and what may be possible.

In Part II, there are some concrete examples given on the construction of minimum-size antennas that more or less fulfill the promise of the earlier portion of the book. Whatever your antenna problem may be or however limited your space or budget, G6XN has something for you.

No one suggests or would dream of suggesting that *HF Antennas for All Locations* is a panacea for antenna problems, but it is interesting and requires some study. I'd be willing to bet that seventy-five percent of us could greatly improve our HF antenna installations by reading what Les Moxon has to say. Ask your book dealer today to get you a copy. Reader Service number 493.

Jim Gray W1XU
73 Staff

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

CALENDAR

Dec 4-5	ARRL 160-Meter Contest
Dec 4-5	Connecticut QSO Party
Dec 11-12	ARRL 10-Meter Contest
Dec 19	CARF Canada Contest
Jan 8	*73 Magazine* 40-Meter World SSB Championship
Jan 9	*73 Magazine* 80-Meter World SSB Championship
Jan 15	World Communication Year Amateur Radio Activity
Jan 15-16	*73 Magazine* 160-Meter World SSB Championship
Jan 15-16	Hunting Lions in the Air Contest
Jan 15-16	QRP CW Contest
Feb 19-20	YL ISSB QSO Party—CW
Feb 26	RTTY World Championship Contest
Mar 12-13	YL ISSB QSO Party—Phone

CONNECTICUT QSO PARTY

Starts: 1100 GMT December 4
Ends: 1100 GMT December 5

Sponsored by the Candlewood Amateur Radio Association (CARA). Phone and CW are considered to be the same contest. Stations may be worked once on each band and each mode.

EXCHANGE:

Send QSO number and ARRL section or Connecticut county.

SCORING:

Out-of-state stations multiply total QSOs by the number of Connecticut counties worked (8 maximum). Connecticut stations multiply total QSOs by the sum of ARRL sections and provinces. Additional DX contacts count for QSO points but only one DX multiplier overall is allowed. W1QI, the club station, will be operating CW on the odd and SSB on the even hours, and counts as 5 points on each band and mode. Novice contacts count as 2 points each and OSCAR contacts count 3 points each.

FREQUENCIES:

CW—40 kHz up from the bottom of each band.

SSB—3927, 7250, 14295, 21370, and 28540.

Novice—3725, 7125, 2119, and 28125.

ENTRIES & AWARDS:

A Worked All Connecticut Counties certificate will be awarded to each station working all the counties. Other awards given as usual, minimum of 5 QSO points! Logs must show category, date/time (GMT), stations, numbers, bands, QSO points, and claimed scores. Enclose a large SASE for results. Logs must be postmarked by January 2nd and sent to Steve Grouse KA1ECL, 3 Queens Court, Danbury CT 06810.

CANADA CONTEST

Starts: 0000 GMT December 19
Ends: 2400 GMT December 19

Sponsored by the Canadian Amateur Radio Federation (CARF), the contest is open to all amateurs and everybody works everybody. Entry classes include single-operator allband, single-operator single band, and multi-operator single-transmitter allband. There are separate single-operator QRP (5 W dc, 10 W PEP out) and single-operator non-Advanced amateur classes.

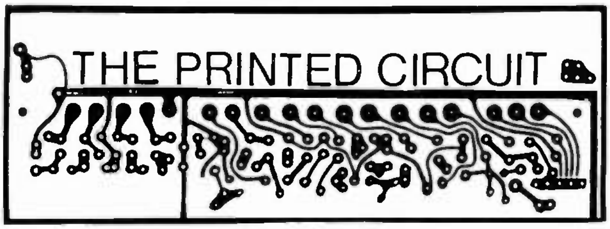
Use all bands from 160 to 2 meters on CW and phone combined. All contacts with amateur stations are valid. Stations may be worked twice on each band, once on CW and once on phone. No crossmode contacts, and no CW contacts in the phone bands are allowed.

EXCHANGE:

Signal report and consecutive serial number starting with 001; VE1 stations also should send their province (NS, NB, PEI).

SCORING:

Score 10 points for each contact with Canada, 1 point for contacts with others. VE0 counts as Canada. Score 10 points for each contact with any CARF official news station using the suffix TCA or VCA. Multipliers are the number of Canadian provinces/territories worked on each band, on each mode (12 provinces/territories × 8 bands × 2 modes for a maximum of 192 possible multipliers). Contacts with sta-



NEWSLETTER OF THE MONTH

This month's winning newsletter is the *Printed Circuit*, published by the Lubbock Amateur Radio Club in Lubbock, Texas.

As well as its unique masthead, the *Printed Circuit* offers a variety of features not found in most newsletters. For example, one issue features a full-page profile of a local old-timer, which was followed by a column on personal computers.

Not leaving out other areas of interest, the editors of the *Printed Circuit* included a story on amateur participation in a recent disaster drill and devoted another full page to DX news and propagation predictions.

And that's not all—There is also a regular technical column, public service announcements, repeater update, puzzles, and a monthly activity calendar.

One sure way of divining the success of a publication is by the activity of its letters section, and the *Printed Circuit* is not lacking in that area, either. Many newsletter editors must dream of getting the number of letters received by the *Printed Circuit*.

To top it all off, the *Printed Circuit* publishes a Q & A session with "The Old Ham." The Old Ham addresses timely and pertinent subjects, such as what to do in a Toronado warning and how to tell a Toronado from a Chevy.

Hats off to Becky Swann WD5KBO and her staff for putting out a newsletter with more stuffed into it than a five-flavor banana split.

73 encourages clubs to send in their club newsletters. Just address them to *73*, Pine Street, Peterborough NH 03458. Keep us up to date with what is happening in your area, and maybe even win the Newsletter of the Month contest.

tions outside Canada count for points but not multipliers.

FREQUENCIES:

Phone—1820, 3770, 3900, 7070, 7230, 14150, 14300, 21200, 21400, 28500, 50.1, and 146.52.

CW—1810, 3525, 7025, 14025, 21025, 28025, 50.1, and 144.1.

Suggest phone on the even hours (GMT), CW on the odd hours (GMT). Since this is a Canadian-sponsored contest, remember to stay within the legal frequencies for your country!

AWARDS:

A plaque will be awarded to the highest score single-operator, allband entry. Certificates will be awarded to the highest score in each category in each province/territory, US call area, and DX country.

ENTRIES:

A valid entry must contain log sheets, dupe sheets, a cover sheet showing claimed QSO points, a list of multipliers, and a calculation of final claimed score. Cover sheets and multiplier check lists are available. Entries should be mailed within one month of the contest, with your comments, to: CARF, PO Box 2172, Stn. D, Ottawa, Ontario K1P5W4, Canada.

Results will be published in *TCA*, the Canadian amateur magazine. Non-subscribers may include an SASE for a copy of the results.

RESULTS

1982 *A5 MAGAZINE* WORLDWIDE DX SSTV CONTEST

1st DX	FM7CD	1622 pts.
1st US	KE1Y	810
2nd	VE4ADG	453
3rd	KB6WP	410
4th	VE3JW	368
5th	WD9IPX	331

(63 entries total were received)
Next SSTV contest is the WAS SSTV in January.

2ND ANNUAL 40-METER WORLD SSB CHAMPIONSHIP

Starts: 0000Z January 8
Ends: 2400Z January 8

SPONSOR:

73, Peterborough, New Hampshire 03458.

MISCELLANEOUS RULES:

Work as many stations as possible on 40-meter phone during the specified times of allowable operation. The same station may be worked once. Crossmode contacts will not count. Single-operator stations may operate a total of 16 hours. All the multi-operator stations may operate the entire 24-hour period. Off periods must be noted in your log(s) and on your summary sheet. Off periods are no less than 30 minutes each.

OPERATOR CLASSES:

(A) Single operator, single transmitter, phone only. (B) Multi-operator, single transmitter, phone only.

EXCHANGE:

Stations within the continental 48 US states and Canada transmit an RS report and state, province, or territory. All other stations, including Alaska and Hawaii, transmit RS report and DX country.

POINTS:

1 QSO point is earned for each station worked in the continental 48 US states and Canada or within your own country. All other contacts are two points each. List points for each contact on your logsheet.

MULTIPLIERS:

1 multiplier point is earned for each US state (48 maximum), each Canadian province or territory (13 maximum), or DX country worked.

FINAL SCORE:

Total QSO points times total multiplier points equals claimed score.

CONTEST ENTRIES:

Each entry must include a contest log, a contest summary, and multiplier checklist. We recommend that contestants send for a copy of the contest forms. Send an SASE to the contest address listed below.

CONTEST DEADLINE:

Each entry must be postmarked no later than February 12, 1983.

DISQUALIFICATIONS:

Omission of any required entry form, operating in excess of legal power, manipulating of contest scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification.

AWARDS:

Contest awards will be issued in each operator class in each of the continental 48 US states, Canadian provinces and territories, and each DX country represented. A minimum of 5 hours and 50 QSOs must be worked to be eligible for contest awards.

CONTEST ADDRESS:

To obtain entry forms or to submit an entry, forward an SASE to: 40-Meter Contest, Billy E. Maddox, 468 Century Vista Drive, Arnold MD 21012.

2ND ANNUAL 80-METER WORLD SSB CHAMPIONSHIP

Starts: 0000Z January 9
Ends: 2400Z January 9

SPONSOR:

73, Peterborough, New Hampshire 03458.

MISCELLANEOUS RULES:

Work as many stations as possible on 80-meter phone during the specified times of allowable operation. The same station may be worked once. Crossmode contacts will not count. Single-operator stations may operate a total of 16 hours. All the multi-operator stations may operate the entire 24-hour period. Off periods must be noted in your log(s) and on your summary sheet. Off periods are no less than 30 minutes each.

OPERATOR CLASSES:

(A) Single operator, single transmitter, phone only. (B) Multi-operator, single transmitter, phone only.

EXCHANGE:

Stations within the continental 48 US states and Canada transmit an RS report and state, province, or territory. All other stations, including Alaska and Hawaii, transmit RS report and DX country.

POINTS:

1 QSO point is earned for each station worked in the continental 48 US states and Canada or within your own country. All other contacts are two points each. List points for each contact on your logsheet.

MULTIPLIERS:

1 multiplier point is earned for each US state (48 maximum), each Canadian province or territory (13 maximum), or DX country worked.

FINAL SCORE:

Total QSO points times total multiplier points equals claimed score.

CONTEST ENTRIES:

Each entry must include a contest log, a contest summary, and multiplier checklist. We recommend that contestants send for a copy of the contest forms. Send an SASE to the contest address listed below.

CONTEST DEADLINE:

Each entry must be postmarked no later than February 12, 1983.

DISQUALIFICATIONS:

Omission of any required entry form, operating in excess of legal power, manipulating of contest scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification.

AWARDS:

Contest awards will be issued in each operator class in each of the continental 48 US states, Canadian provinces and territories, and each DX country represented. A minimum of 5 hours and 50 QSOs must be worked to be eligible for contest awards.

CONTEST ADDRESS:

To obtain entry forms or to submit an entry, forward an SASE to: 80-Meter Contest, Billy E. Maddox, 468 Century Vista Drive, Arnold MD 21012.

2ND ANNUAL 160-METER WORLD SSB CHAMPIONSHIP

Starts: 0000Z January 15
Ends: 2400Z January 16

SPONSOR:

73, Peterborough, New Hampshire 03458.

OBJECT:

To work as many stations as possible on 160-meter phone in a maximum of 30 hours allowable contest time. Multi-operator stations may work the entire 48-hour contest period. Stations may be worked only once.

ENTRY CATEGORIES:

(1) Single operator, single transmitter, phone only. (2) Multi-operator, single transmitter, phone only.

EXCHANGE:

Stations within the continental US and Canada transmit an RS report and state, province, or territory. All other stations, transmit RS report and DX country.

POINTS:

All valid two-way contacts score five (5) QSO points each.

MULTIPLIERS:

1 multiplier point is earned for each US state (48 maximum), each Canadian province or territory (13 maximum), and DX country outside the continental 48 US states and Canada.

FINAL SCORE:

Total QSO points times total multiplier points equals claimed score.

CONTEST ENTRIES:

Each entry must include logsheets, dupesheet for 100 or more contacts, a contest summary sheet, and a multiplier checksheet.

ENTRY DEADLINE:

Each entry must be *postmarked* no later than February 19, 1983.

DX WINDOW:

Stations are expected to observe the DX window from 1.825-1.830 MHz as mutually agreed by top band operators. Stations in the US and Canada are asked not to transmit in this 5-kHz segment of the band. During the contest all stations are requested to utilize those frequencies from 1.808-1.825 and 1.830-1.900 MHz.

DISQUALIFICATIONS:

Operator omits a required entry form, operates in excess of legal power authorized for his/her given area, manipulates operating times to achieve a score advantage, or fails to omit duplicate contacts which reduce the overall score more than 2%.

AWARDS:

Contest awards will be issued in each entry category in each of the continental US states, each Canadian province and territory, and each DX country represented. A minimum of 5 hours and 50 QSOs must be worked to qualify.

CONTEST ADDRESS:

To obtain entry forms or to submit a contest entry, forward an SASE to : 160-Meter Contest, Billy E. Maddox, 468 Century Vista Drive, Arnold MD 21012.

2ND ANNUAL RTTY WORLD CHAMPIONSHIP CONTEST

Starts: 0000Z February 26
Ends: 2400Z February 26

SPONSORS:

73 and *The RTTY Journal.*

MISCELLANEOUS RULES:

The same station may be worked once on each band. Crossmode contacts do not count. Single-operator stations may work 18 hours maximum, while the multi-operator stations may operate the entire 24-hour period. Off periods are no less than 30 minutes each and must be noted in your log(s).

OPERATOR CLASSES:

(A) Single operator, single transmitter, phone only. (B) Multi-operator, single transmitter, phone only.

ENTRY CATEGORIES:

(A) Single band. (B) Allband, 10-80 meters.

EXCHANGE:

Stations within the continental 48 US states and Canada must transmit an RST report and state, province, or territory. All other stations, including Alaska and Hawaii, transmit RST report and consecutive contact number.

QSO POINTS:

1 QSO point is earned for each valid contact.

MULTIPLIER POINTS:

1 multiplier point is awarded for each of the 48 continental US states, Canadian provinces or territories, and DX countries worked on each band.

FINAL SCORE:

Total QSO points times total multiplier points equals claimed score.

CONTEST ENTRIES:

Entries must include a separate log for each band, a dupesheet, a summary sheet, a multiplier checklist, and a list of equipment used. Contestants are asked to send an SASE to the contest address for official forms.

ENTRY DEADLINE:

All entries must be postmarked no later than March 26, 1983.

DISQUALIFICATIONS:

Omission of any required entry form, operating in excess of legal power, manipulating of contest scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification.

AWARDS:

Contest awards will be issued in each entry category and operator class in each of the US call districts and Canadian provinces and territories, as well as in each DX country represented. Other awards may be issued at the discretion of the awards committee. A minimum of 5 hours and 25 QSOs must be worked to be eligible for awards.

CONTEST ADDRESS:

Send an SASE to RTTY World Championship Contest, c/o *The RTTY Journal,* PO Box RY, Cardiff CA 92007.

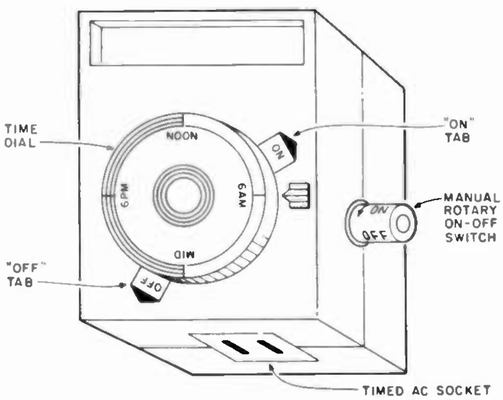
WORLD COMMUNICATION YEAR

Next month's World Communication Year amateur radio activity will be using the 75 ITU zones for scoring multipliers. Be sure you use the correct ITU zones and not the ARRL zones for this contest. Copies of a world map and prefix list showing the ITU zones can be obtained from the contest sponsors, the Potomac Valley Radio Club, by sending an SASE or an IRC to: PVRC, PO Box 337, Cromsville MD 21032. Complete rules will appear here in my January column.

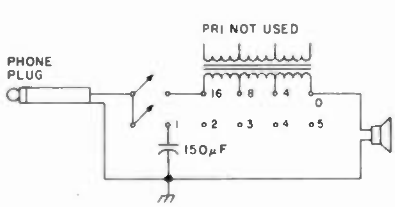
CIRCUITS

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.

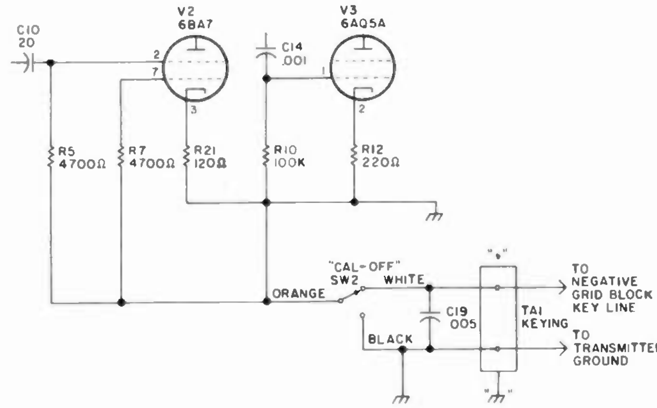
In exchange for these technical gems, 73 offers you the choice of a book from the Radio Bookshop, *to be sent upon publication. Submit your idea (and book choice) to: Circuits, Editorial Offices, 73* Magazine, *Peterborough NH 03458. Submissions not selected for publication will be returned if an SASE is enclosed.*



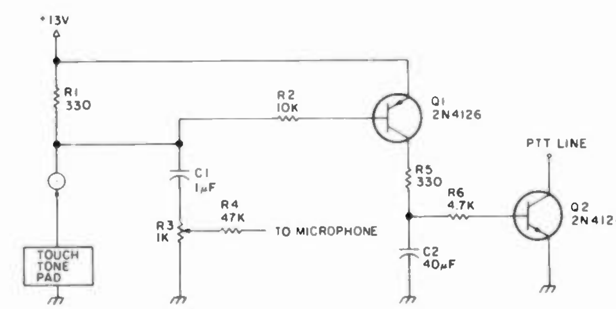
OVERTIME PROTECTION FOR NICADS: Nicad batteries are prone to damage if the batteries are charged for more than 12 to 16 hours. Unfortunately, most timers don't have a timer. To protect your batteries from possible overcharge and venting, you can add an outboard timer and thus protect your batteries. 24-hour appliance timers are available for less than $10. The timers have sliding "on" and "off" tabs which trip a switch when the dial rotates. There is also a rotary-type override switch on the back or side of the unit. To use this timer for your nicad charger, first disassemble the timer. Remove the tab from the "on" switch. To use the modified timer, set the dial to noon and set the "off" switch to a time 16 hours later. This would be 4:00 am. Plug in the charger to the timer, and turn the timer on with the manual override switch. If you have to interrupt the charging cycle and move the unit into another location, your unit will have a "memory" and the charging cycle will resume at the same time when you reconnect the unit.—John F. Sehring WB2EQG, Oradell NJ.



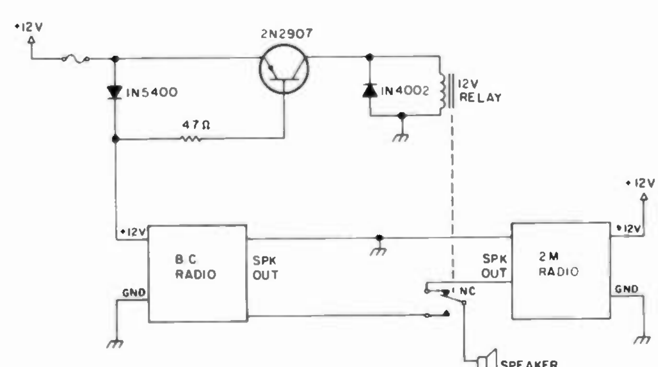
SIMPLE FILTER SPEAKER: There is nothing magical about this circuit. It consists of a universal output transformer which is secondary-tapped at 4, 8, and 16 Ohms, a 150-uF paper capacitor, and a two-deck five-position rotary switch to select combinations as shown. The clockwise position goes straight through to the speaker and each step to the left cuts more high frequencies in the manner of a typical tone control on a broadcast receiver. There is some attenuation of the overall signal (chiefly above the male voice range), so you can reduce the heterodynes from Radio Moscow and the adjacent channel sideband QRM to a tolerable level. You could use a transformer with more taps or more than one capacitor if that is what your junk box offers.—W. B. Cameron WA4UZM, Tampa FL.



HALLICRAFTERS HA-5 GRID-BLOCK KEYING CONVERSION: The Hallicrafters HA-5 vfo is cathode-keyed. This conversion will enable the rig to be grid-block-keyed with a minimum of surgery to the unit. Begin by disconnecting cathode resistors R12 and R21 from the orange lead of the "Cal-Off" switch, grounding them to chassis. Open R22 at the TA1 keying terminal strip. Disconnect R5, R7, and R10 from chassis, and connect their junction to the orange lead of the "Cal-Off" switch. To reconvert to cathode keying, disconnect the ungrounded ends of R5, R7, R10, and R22, leaving them bent out, while installing new R5, R7, and R10 resistors whose long leads will more readily reach to the orange "Cal-Off" switch lead. The grid-block transmitter lead (negative) then connects to the terminal marked "+", and the transmitter ground connects to the terminal marked "ground" on the vfo keying terminal strip.—Tuckerman S. Jalet AA1C, Stamford CT.



TOUCHTONE™ TECHNIQUES: This circuit allows for one-hand operation of any surplus-type touchtone pad. Q1 and Q2 form a high-low switching circuit controlled by R1. When any key is depressed, Q1 will conduct, applying 12 volts to the pad. Then Q2 conducts, keying the transmitter. After you have completed dialing, the keying circuit returns to the "rest" mode and the transmitter must be keyed by the PTT. Delay time is controlled through selection of C2 and R6. Component values are not critical.—Joseph A. Taylor W9JO, Green Bay WI and Hugh Kelley WB9NON, Rhinelander WI.



SUPER AUTOMATIC SPEAKER SWITCH: This circuit will switch a speaker between your broadcast radio and your two-meter rig, depending on which radio is turned on at the time.—Haim Sandel KB2IV, Flanders NJ.

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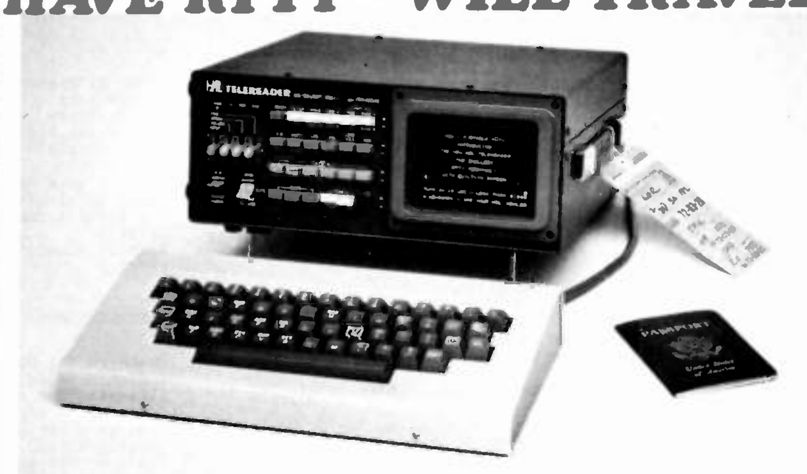

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HAM HELP

I need a manual or a copy of it for the Globe Scout model 680-A. I will gladly pay all costs.

Dennis Cornell
7835 Captain St.
Millington TN 38053

I am looking for the following: MK 731/ARC-51X, H-157/AIC, H-158/AIC, ME-57/U, USM 281E, ME-11/U, URM-120, URM-127, O-1131/GRC, URM-103, AN/AIC-25, PRC-49, PRC-90, URC-10, ARA-50, SRD-7, URD-4, OA-3633/ORC, R442/VRC, RT524/VRC, PRC-74B, RT-662/GRC, R1051/VRR, 61BT, ARC-159. I also need modules for the following: ARC-58, SG-179A, AM1528B/URC, CV465C/URC, RE-284/URC, 0-655/URC, MC-286B/URC, KY-305/URC, CV-466A/URC, CV-987/GRC-110A, AM1525/URC, AM-476C/AIC-10 unpotted, CU786/TRC-75, CU749/TRC-75, C2848/TRC-75, URM-124, MK-500/U, 878L-3, GRM-21, GRM-10, CU-523/ARC-58, C-1939/ARC-58, R1149/ARC-58(v), C-1940/ARC-58, R-1283/GRC, R484/APR-14, APR-13, URT-23(v), AM-1780/VRC, H-250/U, RT834/GRC, R1123/ARC-73, C-4074/RC-73, C-3940/ARC-94, URM-205, VRM-1, and USM-223. I am also seeking any documentation on the ARC-58, TRC-75, and ARC-159, and I would like to hear from anyone using the TRC-75.

Leroy Ritta
PO Box 102
St. Marys 5042
South Australia
Australia

I need the 20-meter heterodyne oscillator coil (part no. 40-771) for my Heath SB-301 receiver.

George Savino KV2V
368 N. Monroe Ave.
Lindenhurst NY 11757

I would like a schematic for an Allied Star Roamer receiver, number 22-3993-710042-713.

Joe Hustak WA5ZNO
6821 NW 27th St.
Bethany OK 73008

I am in need of videotapes (VHS format) of Novice- and General-class theory material. I also need good audio tapes for mastering Morse Code.

Robert M. Gallery
9214 Weathervane Place
Gaithersburg MD 20879

I need a 3CV1500 tube for my Alpha Vapor amplifier.

David Ornee KA9JKQ
4615 Howard Ave.
Western Springs IL 60558

I need help correcting a severe drift problem in the lmo/vfo of my Heath SB-102. Anyone with information on this problem or who can fix it, please write.

Harold Wright K4MFN
Rt. 1 Box 259
Chancellor AL 36316

I am trying to find a 3-inch picture tube, type C6407, for a Symphonic model TPS-30 television. I would also be interested in buying the entire set if the picture tube is good.

Al Duester
179 Woods Hole Rd.
Falmouth MA 02540

I am badly in need of the manual or schematic for Navy surplus receiver R808/GRC-14, a unit of radio set AN/GRC14.

Lee A. Grunewald K5JGZ
1020 K St. NW
Miami OK 74354

I need the construction manual and schematic for a Dycomm 2-meter linear amplifier. I will pay for the original or copying costs and postage.

Marvin Rosen N3BQA
20 W. Madison St.
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Parker CO 80134

✓See List of Advertisers on page 130

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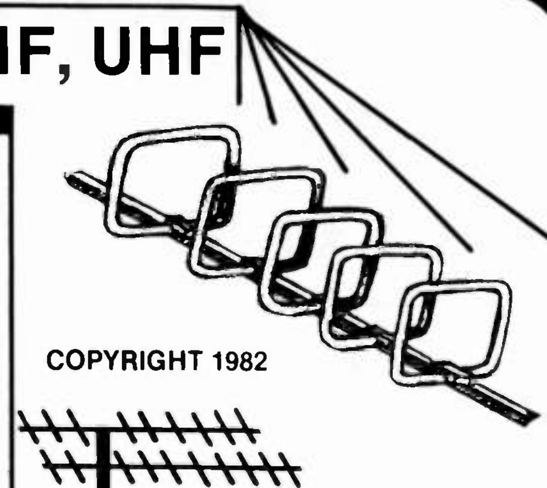

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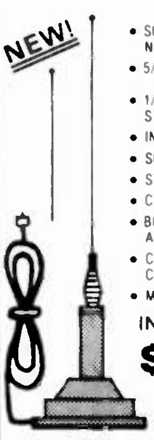

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The Fox Tango filters are notably superior to both original 2.7KHz BW units but especially the modest ceramic 2nd IF; our substitutes are 8-pole discrete-crystal construction. The comparative FT vs Kenwood results? VBT OFF — RX BW: 2.0 vs 2.4; Shape Factor: 1.19 vs 1.34; 80dB BW: 2.48 vs 3.41; Ultimate Rejection: 110dB vs 80. VBT SET FOR CW at 300Hz BW — SF 2.9 vs 3.33; Insertion Loss: 1dB vs 10dB.

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Another first from AEA. The Woodpecker Blanker, WB-1 really works. This unit effectively blanks the pulsing interference of the Russian Woodpecker. Two versions are available, the WB-1 for use with communication receivers and WB-1C for use with all popular transceivers.

This extremely useful accessory is designed for direct insertion between your receiver (or transceiver) and the antenna. It is both MORE EFFECTIVE than I.F. type blankers and requires NO MODIFICATIONS to your receiver! The unit operates from a 13 VDC ± 2 VDC power source at less than 575 mA. (AEA AC wall unit AC-1 will operate the blanker.)

The blanker works well on both CW and SSB modes that are being interfered with by a woodpecker. Controls on the front panel include; four push button switches, a synchronize control and a width control The WB-1 also features a low-noise untuned broadbanded 6 db gain pre-amp which can be selected with or without the blanker enabled. The WB-1C uses the same circuitry but includes a carrier operated relay (COR). This provides protection to the receiver section during transmissions from the attached transceiver.

For more details, write for our latest catalog or visit your favorite dealer.

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✓2

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✓See List of Advertisers on page 130

AWARDS

Bill Gosney KE7C
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LMRE AWARDS

Here are the details of an awards program recently instituted by the Liga Mexicana de Radioexperimentadores (LMRE) and open to all amateurs anywhere; there are currently four awards offered.

6Z6 Award

Available for confirmed contact with any 6 Mexican stations after January 1, 1980.

American Award

Requires confirmed contact with 40 countries in the Western hemisphere (ARRL DXCC list) plus 10 contacts with XE stations.

Mexico Award

Requires confirmed contacts with 20 stations in Mexico.

Worked All XE (WAXE)

Requires 25 confirmed contacts, 15 with XE1, 5 with XE2, and 5 with XE3 stations.

Awards cost US $3.00 or 10 IRCs each and require that either the QSL cards or a list certified by the awards secretary of the local league be submitted to the LMRE of Mexico City. If QSL cards are submitted, be sure to include sufficient funds for return of same via international registered air mail. The address for applications is: LMRE Awards Manager, c/o Manuel De Lera, PO Box 907, Mexico 1, DF, Mexico.

JOLIET AMATEUR RADIO SOCIETY

The Joliet Amateur Radio Society is sponsoring the JARS award. Illinois stations must contact 10 JARS members. Continental US stations must contact 5 JARS members. No repeater contacts. An updated membership list is available on request for an SASE or 2 IRCs. Send list of log information and $1.00 (DX station may send 3 IRCs) for the award to: Paula Franke WB9TBU, Certificate Chairman, PO Box 873, Beecher IL 60401.

THE IOWA AWARD

An award will be issued to any amateur who has worked 19 Iowa counties. Cost will be $1.00. Each additional 20 counties will earn a new award. QSLs not required. Send usual log information and statement by two other amateurs or one club officer to the Mississippi Valley Radio Club, 3518 Columbia, Davenport IA 52804.

THE PLANET EARTH AWARD

The South West Ohio Repeater Club (SWORC) takes great pleasure in presenting the Planet Earth Award. To qualify, applicants must submit proof of QSOs with 10 different stations on the planet Earth. There are no restrictions, but QRP operations will be noted. Send your list of contacts along with the award fee of $4.00 or 12 IRCs with an SASE to the Awards Chairman, South West Ohio Repeater Club, PO Box 18005, Cincinnati OH 45218.

WORKED ALL MORTON AWARD

The Morton Amateur Radio Club has announced its new award program. The Worked All Morton award is issued to those hams who have had QSOs with five members of the Morton Amateur Radio Club, or hams living in Morton, Illinois. Only contacts made on or after January 1, 1981, will count. To receive the award, applicants should send log information listing at least five Morton contacts along with a large SASE to Morton Amateur Radio Club, 701 Columbus Avenue, Morton IL 61550.

The club operated a special events station, W9EEB, during the Annual Morton Pumpkin Festival. An attractive certificate for the Pumpkin Award will be sent to all who QSL. The operation was held September 16 through 18, 1981, on 7.280, 14.280, 21.380, and 28.680 MHz. The award will be issued on receipt of QSL and a large SASE by W9EEB, 701 Columbus Avenue, Morton IL 61550.

In an effort to restore good operating practices to the amateur bands, a group of Morton Amateur Radio Club members have undertaken the sponsorship of the All American Alligator Award. This probably least-coveted certificate will be issued to those stations which exhibit acts inconsistent with the spirit or laws of amateur radio. We hope the award will be received in the same spirit with which it is being issued.

TEN-METER FM AWARDS

Sponsored by the North Whidbey Island Repeater Association (NWIRA), all contacts must be made on or after January 1, 1981. Crossmode contacts do not count. Contacts must be two-way ten-meter FM. Special endorsements include All-Mobile, All-Simplex, Single-Frequency accomplishments, and contacts made within a single day, week, month, or year. *Do not* send QSL cards; forward your list of contacts showing the date, time, and frequency of each QSO and provide a brief station description. Send with the fee of US $4.00 for each award to the attention of: Ten-Meter FM Awards Program, 2665 North Busby Road, Oak Harbor WA 98277.

Worked All Districts

To qualify, applicants must work one ten-meter FM station in each of the ten US call districts.

Worked All States

Applicants must work a minimum of 50 US states on ten-meter FM.

Centurion

This award requires the applicant to work a minimum of 100 stations on ten-meter FM.

DX Decade

Applicants must work a minimum of ten DX stations outside the fifty US states and Canada on ten-meter FM.

North American

To qualify, applicants must work all ten US call districts, a minimum of six Canadian provinces and/or territories, and at least four DX countries within the North American continent (other than the US and Canada) on ten-meter FM.

OTHER AWARDS

3rd Call District Maryland

Worked all Bowie ARC in two classes. First figure US stations, second, DX stations: class 1 = 4/2; class 2 = 2/1. Log data, SASE. No charge. To: John Rouse KA3DBN, PO Box Drawer M, Bowie MD 20715.

4th Call District Florida

Florida Skip Certificate of Merit issued on recommendation of two other amateurs for outstanding service. $1.00. Send to: Florida Skip, Box 501, Miami FL 33166.

XYL Award by Florida Skip

Only requirement is to render aid and comfort to your husband in and out of the shack. $1.00 or 4 IRCs to: Elizabeth Clark W4GGQ, 41 Lenape Drive, Miami FL 33166.

Three Thousand DX Award

North Florida ARS. Work three or more stations 3,000 miles or more distant, rag-chew-type QSOs only. Two certificates will be awarded, one to you and one to the DX stations. $2.00 to: Dale Mann N4AWI, 5433 Glorianne Circle North, Jacksonville FL 32207.

Worked Broward County Cities

Broward ARC. Stations in the Florida counties of Broward, Colliers, Dade, Glades, Henry, Lee, Martin, Monroe, or Palm Beach must work all 29 cities: others, 15. Work mobiles in Broward county. No awards for your mobile. GCR, US $1.00; DX, 10 IRCs, to: WD4RAF, 1921 NW 41st Street, Oakland Park FL 33309.

6th Call District

CHC Worked All Counties California. Issued in five classes: Class D = 20 to 28; class C = 30 to 38; class B = 40 to 48; class A = 48 to 57; class AA = 58; GCR, SWL. $3.00 endorsements. $1.00 to: Scott Douglas KB7SB, PO Box 46032, Los Angeles CA 90046.

7th Call District

CHC awards, to: Scott Douglas KB7SB, PO Box 46032, Los Angeles CA 90046.

Washington State Counties Award. Issued in five classes: Class D = 10 to 15 counties; class C = 15 to 20; class B = 20 to 30; class A = 30 to 43; class AA = 44.

Oregon State Counties Award. Issued in four classes: Class C = 10 to 15 counties; class B = 20 to 25; class A = 30 to 35; class AA = 36.

Nevada State Counties Award. Issued in three classes: Class C = 8 to 10 counties; class B = 10 to 15; class A = 15 to 17.

Utah State Counties Award. Issued in three classes: Class C = 7 to 10 counties; class B = 18 to 24; class A = 22 to 29.

Wyoming State Counties Award. Issued in three classes: Class C = 7 to 10 counties; class B = 15 to 20; class A = 20 to 23.

Idaho State Counties Award. Issued in four classes: Class C = 15 to 20 counties; class B = 20 to 30; class A = 30 to 43; class AA = 44.

Montana State Award. Issued in five classes: Class D = 15 to 20 counties; class C = 20 to 30; class B = 30 to 40; class A = 40 to 55; class AA = 56.

GCR, SWL, $3.00; endorsement, $1.00.

Morocco

CN8 Award by AREM. Work 15 CN8 stations on 1 band, 12 stations on 2 bands, or 8 stations on 3 bands. GCR and 3 IRCs to AREM, PO Box 2060, Casablanca, Morocco.

Diploma De La Ville Rabat by Assoc. Royale Des Radio Amateurs De Maroc, c/o CN8OB, PO Box 299, Rabat, Morocco. Work 10 stations in Rabat after January 1, 1968. All others, 5. SWL 10 IRCs, list.

India

Worked Republic of India, by ARSI, Box 534, New Delhi, India. Contact 50 different VU stations after January 16, 1950. QSLs, list, 12 IRCs.

The Gateway of India Award, by ARS of India, Western Zone. Work VUs in the Western Zone after November 9, 1957. Asia stations work 10; others, 5. GCR, 6 IRCs. To: Dady Major VU2MD, 85 Sleater Road, Petit Mansion, Bombay 7, India.

Lebanon

By Lebanese RAA, PO Box 1217, Beirut, Lebanon. Work 10 stations after July 1, 1958; with endorsement seals additional 10. No charge, GCR.

Spain

Spanish Diploma, by URE, Apartado De Correos, Num 220, Madrid, Spain. QSLs from 125 Spanish stations on CW with 60 on 3.5 or 7 MHz, 10 on 28, 15 on 21, and 10 on 14 MHz. After January 1, 1952. Send 40 QSLs, list, and return postage.

125 EA Award: By URE, Hortaleza 2, Apartado 220, Madrid, Spain. Work 125 EA stations after January 1, 1952, including all Spanish call areas. At least three contacts must be made with each (EA1 through EAØ) counting EA9 and EAØ as one area. QSLs, list, and return postage.

Romania

"YO-AD" All Districts Award. Work YO districts as follows: First figure is the number of districts to be worked, second is the number of QSOs per district. Applicants in zones 15, 16, 20: class I = 8/10; class II = 6/6; class III = 3/3. Applicants in zones 14, 17, 21, 33, 34: class I = 8/6; class II = 6/4; class III = 3/2. Applicants in all other zones: class I = 8/3; class II = 6/2; class III = 3/1. 144 MHz: class I = 4/1; class II = 3/1; class III = 2/1. There are 8 YO districts in all.

Canary Island

Work EA8 stations after April 4, 1971. QSLs, SWL, 10 IRCs to: URE, PO Box 860, Las Palmas, Canary Islands, Spain. EA and LX stations work 30, rest of EU, Central and South America work 20, North America and Africa work 10. Asia, Oceania, VHF and UHF, work 5.

Austria

WAOE Diploma. Work OE districts all CW, all phone, or mixed after January 4, 1954. Austria and adjoining countries work three stations each in OE districts 1 through 9 (with OE4 and OE9 counting as one district) using at least two different bands. At least one contact per OE district must have been made on 40 or 80 meters. Rest of EU stations: Same as above but without 40- or 80-meter requirements. GCR stations outside EU. Work one OE station station in each OE district on any band (8 QSLs). GCR. Same station may be worked on all bands. WAOE SWLs for 8 districts. Send list and 10 IRCs.

Colombia

100 HK3 Award: by LCRA. Third HK zone. Coordinator for contacts with 100 HK stations after January 1, 1960. SWLs, no charge, GCR, list in alphabetical order and send full log data to: HK3VV, AP 584, Bogota, Colombia.

Double Call Award: Work HK stations with double- or triple-letter calls. Three

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32DR6M

classes: Class C = 10, class B = 20, class A = all 26 double calls (AA to ZZ); AAA counts in lieu of AA, BBB for BB, etc. Contacts after January 1, 1960. No charge, GCR, log data to: HK3VV, AP 584, Bogota, Colombia.

CHK Award: by LCRA. Work HK stations. HK stations work 100 other HK stations, stations in Americas work 50, others work 25. HKs send QSLs, others send certified list authenticated by club official. QSLs must have been sent and received. To: LCRA, AP 584, Bogota, Colombia.

ZHK Award: by LCRA. Confirmed contacts with HK zones. HKs send QSLs from all 10 zones. Americas work 9, rest of the world work 8. All except HKs send list certified by club official. To: LCRA, AP 584, Bogota, Colombia.

(No charges given for any of the LCRA awards.)

HK7 Award: by RC Santander, PO Box 222, Bucaramanga, Colombia. Work 7 HK stations, either all CW or all phone, after January 1, 1962.

10 HK1 Award: by RC Del Atlantico, Apartado Nacional 184, Barranquilla, Colombia. Work 10 HK1 stations post World War II. GRC—certified by club officer. (No costs given.)

HK5 Award: by LCRA. Work HK5 stations after January 1, 1957. American countries work 12, Colombian stations work 20, rest of the world work 8. GCR list to: Box 6149, Cali, Colombia.

US Navy Award

Work 5 US Navy ships. To: Office of Naval Communications, Director, Navy MARS (OP945N), The Pentagon, Washington 25 DC 20301.

Radioman Submarine Award: Work 2 amateur radio stations on board submarines of Submarine Squadron Twelve plus club station W4YVS or any station on board the *Bushnell*. After January 1, 1961. Notarized log information with statement that the information is true and accurate to: Radio Amateur Club, Submarine Squadron 12, Naval Station, Key West FL 33040.

ARGONNE ARC

The Argonne Amatuer Radio Club plans to operate the club's memorial station, W9QVE, to commemorate the 40th anniversary of the first controlled nuclear chain reaction experiment conducted at the Alonzo Stagg field on the University of Chicago campus. Two stations will operate from 1500 GMT December 4 through 2400 GMT December 5.

Frequencies: phone and CW—20 kHz up from lower edges of the General portions of the 80-10m bands; Novice—40 kHz up; 2m—145.19/144.59, 146.52, and 147.42; RTTY—14.090 and 146.70. Send a business-type SASE or $1.00 for an 8" × 11" unfolded certificate to AARC, PO Box 275, Argonne IL 60439.

BETHLEHEM WV EXPEDITION

The Triple States Radio Amateur Club will operate daily from Bethlehem, West Virginia, December 9 through December 12, from 1400 to 2300 UTC. Operating frequencies for WD8DDL/8 will be 7.275, 14.325, 21.425, and 28.550 MHz on SSB, and 7.110, 14.075, 21.110, and 28.110 MHz on CW. A special holiday certificate will be sent to all those contacted who send an SASE to TSRAC, 26 Maple Lane, Bethlehem, Wheeling WV 26003.

CHRISTMAS VILLAGE

The K1BCI C/Q Radio Club will operate a special event station honoring the 35th anniversary of the Christmas Village located in Torrington, Connecticut. The club will operate from the Christmas Village from December 11 through 19, 1982, on 10, 15, 20, 40, and 80 meters. Certificates of this event will be issued for contacts made. For further information, contact Jim WA1YZA or Nellie WB1DVC.

SANTA CLAUS

The Pike County Amateur Radio Club of Winslow, Indiana, will operate a special events station from Santa Claus, Indiana, from 1700Z December 18 through 1700Z December 19, 1982. The callsign will be W9CZH. Operating frequencies will be (plus or minus QRM) 21.395, 14.305, 7.265, 3.925 phone, 7.133 CW, 14.093 RTTY, and 146.52 FM. Certificate for QSL and SASE to Santa Claus, PO Box 111, Ireland IN 47545.

CHESTER GREENWOOD DAY

The Sandy River ARC will operate KA1CNG on Saturday, December 18th, 1500Z, to Sunday, December 19th, 2100Z, in celebration of Chester Greenwood (inventor of the earmuff) Day. We will also operate mobile from the Chester Greenwood Day Parade and related activities on Tuesday, December 21st, 1400Z to 2100Z. Frequencies: 5 to 10 kHz from bottom of General band edges and 3940 kHz. Certificate for your QSL card and two first-class stamps (no envelopes please) to KA1CNG, 5 Franklin Ave., Farmington ME 04938.

HONG KONG ACTIVITY

The Hong Kong Amateur Radio Transmitting Society (HARTS) is pleased to announce that once again there will be a VS6 activity day between 0001G Saturday, April 2, 1983, and 2359G Sunday, April 3, 1983. As in previous years, many VS6 stations will be active on all bands/modes.

1983 is World Communications Year (WCY), and during 1983 the special callsign VS6WCY will be in use by the HARTS club station. Special QSL cards will be issued for QSOs with VS6WCY. QSLs for WCY station should be sent to the Hong Kong QSL Bureau Manager, PO Box 541, Hong Kong.

WORKED ALL NORTH POLE

The Borealis ARC will present, upon receipt of the request with the callsigns and dates worked of a minimum of three BARC members and $2.00, a Worked All North Pole certificate. Operating time will be from approximately 0400-0900Z, 30 kHz up from the lower edge of the Novice and General bands, plus or minus QRM. The club member whose callsign appears on the largest number of certificate requests during the month of December will win a prize. Certificate requests should be sent to: Borealis ARC, c/o Wendall Keller, SR Box 80343, Fairbanks AK 99701.

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

THE TEN-METER BAND

Many DXers abandon the 10-meter band as sunspot numbers fall. But 10 meters provides DX excitement even at the bottom of the sunspot cycle. Not as much, to be sure, as when 10 is wide open to three continents at once, but, still, there is plenty of action. Because 10 meters lies at the dividing line between HF and VHF, it displays some of the propagation features of each part of the spectrum. By learning to recognize the different modes of propagation and practicing the operating patterns unique to each propagation mode, the DXer can quickly improve his success on 10 meters. The second weekend of the month of December provides a fine opportunity to practice this skill, in the ARRL 10-Meter Contest.

Let's look at the various ways DX signals get from here to there, and how the DXer should modify his operating techniques to take full advantage of each propagation mode.

HF Spectrum

Most DX contacts are made via the F2 ionization layer of the ionosphere. The F2 layer is ionized by radiation from the sun and tends to be strongest near the middle of the day. Thus, 10 meters will open up to the east in the morning. As the Earth turns, the band opens farther south, and then it swings around to the west in the late afternoon. The DXer can recognize F2 propagation because it is so widespread, with signals from a large part of the world coming in all at once. This propagation mode is quite steady, building rather slowly and fading gradually. Normal DXing techniques will be successful: Aim your beam at the station and make your call.

Ten meters is not always "open" via F2 propagation. So some DXers will quickly tune across the band with the beam aimed east, hear nothing, and drop to 15 meters. However, even when the ionization is not strong enough to provide east-west propagation, it often is strong enough for north-south contacts. The equatorial region receives more solar radiation than latitudes farther north and often gets enough radiation to open the 10-meter band. Instead of the normal sequence of the band opening up in the east and swinging around to the west, around midday or a little later the band opens up just to the south.

WA1KID used to take advantage of this phenomenon during contests with a 4-element 10-meter beam fixed south. He could switch quickly to that antenna to watch for the trans-equatorial openings and nab the CEs, LUs, and other South Americans. The only trick to working DX via trans-equatorial propagation is to know when and where to look; if your beam is aimed east, for example, you might never hear the South Americans.

This same ionization over the equatorial regions provides one of the more interesting propagation modes on 10 meters: back scatter. Strong signals aimed south can reflect off the ionization layer over the equator and bounce down to earth, and some small portion of the signal then bounces back along the same path. Not much of a signal gets through, to be sure, since most of the energy is lost or absorbed in the multiple bounces, but directional signals will be scattered enough by the ground at the other end of the hop to send some energy back north.

This means that it is possible to work other stations north of the equator by pointing your beam almost due south! Backscatter signals are very weak, so both stations must point their beams toward the ionization to the south. If you hear a European signal while your beam is aimed south but the signal fades as you swing your beam up to the northeast, you are probably receiving back- or side-scatter signals. You can recognize these signals because they are weak and peak to the south, no matter in what direction the station is located.

If you hear a scatter signal, resist the temptation to swing your beam according to the beam-heading chart; the signal will disappear. (If it gets louder, you're not hearing a scatter signal!) Instead, swing your beam across the south, listening for the loudest direction, the direction of the most intense ionization, and, therefore, the most scatter. Note that both stations must be beaming south. If the DX station hears your signal and swings his beam up to the west to work you, the contact is lost.

Explaining this under the weak signal strengths of scatter contacts can be frustrating. I remember spending 20 minutes once trying to convince a station that we could make contact only if *both* of us pointed our beams south and not at each other! Whenever this W4 heard my call from New England, he would swing his beam north and lose it.

Side scatter is very similar to back scatter. The radio waves reflect off the side of the ionization region, not the underside. Again, you swing your 10-meter beam back and forth, listening for the loudest signal without regard to the direction of the other station. If you can convince the DX station to do the same thing, you can have a satisfying DX contact.

VHF Spectrum

Since the 10-meter band is near the VHF region it exhibits some of the exciting propagation modes of VHF bands, including meteor scatter and E-skip. These short-range propagation modes don't often provide much DX, but it helps to learn how to recognize and operate under each mode.

Meteor scatter is radio propagation off the ionized trails left after a meteor rips through our upper atmosphere. Since the Ten-Meter Contest coincides with a major meteor shower, you might well hear such signals then. Meteor-scatter signals last only a few seconds because the ionization region quickly dissipates. Your contact must be very short; giving your call three times probably will use up the entire opening! Listen for randomly-occuring, quite loud signals which appear and disappear very quickly. If you start a contact on one meteor burst, you may well be able to complete the contact on another burst a minute of two later if you stay on the same frequency and beam heading. Don't expect to exchange much more than a signal report, however, as meteor-scatter QSOs are extremely short.

E-skip enlivens the 10-meter band quite often. The E ionization layer is much lower than the F layer, and the maximum communication distance on a single hop is about 1200 miles, compared to twice that with F2 propagation. But multiple-hop E-skip can provide some DX contacts, thus injecting some life into a "dead" band.

Because the ionization regions in the E layer are much smaller than those in the F layer, the E-skip propagation is much more restricted in area. You might hear only one or two states or countries at a time, for example. E-skip signals can be very loud as well as very directional, but often you can work stations around the fringes. Say you work a few G stations but don't hear anything else. Try a call for EI, GM, GD, etc. People are always listening, and a direct call can pull them out of the woodwork. E-skip propagation is notoriously fickle, appearing and disappearing rapidly. Don't be surprised if your contact fades away in mid-sentence.

QSL Card Errors

However your signal gets from here to there, you will probably want a QSL card to confirm the QSO. And you had better fill your card out properly if you expect a return QSL. Almost 25% of all QSLs I have received are not filled out properly, yet there are only a half-dozen pieces of information that need to be entered. And any QSL which is improperly filled out can delay the return QSL or even end up in the circular file! Let's look at the common mistakes and how to avoid them.

The callsign. A surprising number of QSLs arrive without the DX station's call in the appropriate place. If the callsign is anywhere but in the "confirming QSO with" or "radio station" box, the QSL is invalid for awards. Don't confuse the QSL manger's call with that of the DX station.

The date. Almost every country in the world except the United States uses the sequence day/month/year for the date. 12/2/82 is February 12, not December 2. To remove all ambiguity from the date, use Roman numerals for the month, or English abbreviations: 12II82 or 12 Feb. 82. Make sure you changed the date at 2400 UTC, which occurs in the middle of the evening before local US time. I can't tell you how many cards arrive with the date one day off.

The time. There is no excuse for using anything but UTC on DX QSLs. Local time is for local QSOs only. And if you try to convert your local-time log to UTC for the QSL card, sooner or later you will make a mistake. Keep your log in UTC and keep a UTC clock in the shack. And keep your clock accurately set to WWV. A DX station or DXpedition operating "contest style" might fill a 50-entry log page in less than 10 minutes. If the time on your QSL is off by more than 5 minutes, the QSLer might have to search through several pages of logs for your contact.

Frequency. Be careful not to put the *band* in this box—"Frequency 20," for example. If you change bands often (during a contest, for example), watch your log. It is very easy to change bands to work a station and forget to log the band change. Then the card has the wrong band. I always prefer to receive a card with the *exact* frequency, such as, 14205. Since I log my exact transmitting frequency, this can help to find a QSO with the wrong date or time.

Mode. If your QSL has this box labeled "2X," just write in the mode. If the box is labeled "mode," write "2X CW" or "2X SSB."

RST. Honest signal reports in DX are as rare as Albanian contacts. I always prefer honest reports, but usually get 59 even if the other station can barely hear me.

QSL. Always *ask for* the QSL if you want it. I get thousands of cards which I may assume are requests for my card, but nowhere does the station specifically request my card. If things get a little behind, I may assume these cards are answers to cards I sent, and I don't answer them. And if you need a card for a particular reason, say so: "Need 3 more cards for my DXCC, please QSL." or "Please QSL for 5BDXCC."

Other things to remember: If you work a DX station during a contest with consecutive numbers as part of the exchange, write the *other station's* QSO number on the card: "your number 1024." Don't put your own number on the card, as the DX station could care less. His consecutive number will locate your contact quickly in a long log.

Speaking of contests, be sure to mention that the contact was made during a contest, if it was. Many stations keep separate logs for contest and non-contest operations because of the special logs that contests require. So include "CQ WW SSB contest," as appropriate.

Always send a card for *each* QSO. Although it is tempting to put all your contest QSOs with a single DX station on one card, it often will slow up your response. The DX station might QSL one band at a time or, as in the case of major DXpeditions, have separate managers for each band. Splurge, and send separate cards.

Finally, write legibly and accurately. Numerous QSLs have the information so badly written that it is almost impossible to read. Or the information is mis-copied from the log. These QSLs end up in the "do tomorrow" file or the circular one. And I still have cards from five years ago in my "do tomorrow" file . . .

And now a special treat for you loyal readers of this DX column. Send me your QSL card by the end of the year and I'll put them all in a hat and draw out three cards. The lucky winners will receive: a 1983 DX Callbook, a one-year subscription to *The DX Bulletin*, the most prestigious of the DX bulletins, or a one-year subscription to the W6GO QSL List, a list of more than 5000 QSL managers which is updated every two weeks (more about this prize next month)!

So send in your cards to the address at the head of this column, right away. No cost, no obligation; just mail me your QSL card and I'll notify the lucky winners immediately. Include a slide or black-and-white photo of your shack, and I'll use the best shots. Thanks for being such devoted readers of this column.

HAM HELP

Do you need help in getting your Atari computer on RTTY or ASCII? Drop me a line, and I'll be more than happy to get you started.

Bob Holstl K7ZJD/KH2
PO Box 4426 AAFB BR
Yigo, Guam 96912

I would appreciate a copy of a schematic for an RCA #WA 504-A sine/square wave audio generator. I will be glad to pay postage and the cost of copying.

A. B. Wells WA5COH
PO Box 50
Tunica LA 70782

SATELLITES

Ariane Takes a Dive

The amateur radio space program suffered another setback on September 10. On that date, a European Space Agency (ESA) Ariane rocket fell into the Atlantic Ocean instead of achieving orbit as planned. It was the second failure in five launches for Ariane, the vehicle which was scheduled to carry the Phase IIIB amateur satellite aloft in early 1983.

This time, the Ariane carried no amateur birds, but two multi-million-dollar communications satellites on board were lost. Apparently, the rocket dove into the ocean when a third-stage fuel pump failed. If the problem turns out to be specific to the unit that failed and not a design flaw, the Phase III launch schedule may be only slightly affected and the amateur satellite could still be launched sometime this spring. Amateur satellite enthusiasts can only wait patiently for ESA to work out bugs.

Incidentally, the Ariane failure is a serious blow to ESA, which is in head-to-head competition with NASA and the Space Shuttle in the satellite launching business. With Ariane's success rate running only 60%, some ESA customers are getting edgy and may take another look at what the Shuttle has to offer.

MARECS: 0 for 2

One of the satellites lost in the ill-fated September launch was MARECS B, the second Maritime European Communications Satellite. What makes the loss particularly devastating is that the first bird in the series, MARECS A, failed in orbit without ever becoming operational. The bottom line is $250,000,000 spent without a single positive result for MARECS backers. Space flight remains an expensive business.

Thanks to *AMSAT Satellite Report*.—Jeff DeTray WB8BTH, *73* Staff.

Amateur Satellite Reference Orbits

	Date	OSCAR 8 UTC	OSCAR 8 EQX	RS-5 UTC	RS-5 EQX	RS-6 UTC	RS-6 EQX	RS-7 UTC	RS-7 EQX	RS-8 UTC	RS-8 EQX	Date
Dec	1	0041	87	0127	2	0011	346	0010	343	0009	342	1
	2	0045	88	0122	2	0154	14	0000	343	0006	342	2
	3	0050	89	0116	2	0138	11	0150	12	0003	343	3
	4	0054	90	0111	3	0123	9	0140	11	0000	344	4
	5	0059	92	0106	3	0108	7	0130	10	0157	15	5
	6	0103	93	0100	3	0052	5	0121	9	0154	16	6
	7	0108	94	0055	3	0037	2	0111	8	0152	17	7
	8	0112	95	0050	4	0021	0	0101	8	0149	17	8
	9	0116	96	0044	4	0006	358	0052	7	0146	18	9
	10	0121	97	0039	4	0149	25	0042	6	0143	19	10
	11	0125	98	0034	5	0134	23	0032	5	0140	20	11
	12	0130	99	0028	5	0119	21	0023	4	0137	21	12
	13	0134	100	0023	5	0103	18	0013	3	0135	22	13
	14	0138	101	0018	5	0048	16	0004	2	0132	23	14
	15	0000	76	0012	6	0032	14	0153	32	0129	23	15
	16	0004	77	0007	6	0017	12	0143	31	0126	24	16
	17	0009	78	0002	6	0002	9	0134	30	0123	25	17
	18	0013	80	0156	37	0145	37	0124	29	0120	26	18
	19	0017	81	0150	37	0129	35	0114	28	0118	27	19
	20	0022	82	0145	37	0114	32	0105	27	0115	28	20
	21	0026	83	0140	37	0059	30	0055	27	0112	28	21
	22	0031	84	0134	38	0043	28	0046	26	0109	29	22
	23	0035	85	0129	38	0028	25	0036	25	0106	30	23
	24	0039	86	0124	38	0012	23	0026	24	0104	31	24
	25	0044	87	0118	38	0156	51	0017	23	0101	32	25
	26	0048	88	0113	39	0140	48	0007	22	0058	33	26
	27	0053	89	0108	39	0125	46	0156	51	0055	33	27
	28	0057	90	0102	39	0110	44	0147	51	0052	34	28
	29	0102	91	0057	40	0054	42	0137	50	0049	35	29
	30	0106	92	0052	40	0039	39	0128	49	0047	36	30
	31	0110	93	0046	40	0023	37	0118	48	0044	37	31
Jan												
	1	0115	94	0041	40	0008	35	0108	47	0041	38	1
	2	0119	95	0036	41	0151	62	0059	46	0038	38	2
	3	0124	96	0030	41	0136	60	0049	46	0035	39	3
	4	0128	98	0025	41	0121	58	0039	45	0032	40	4
	5	0132	99	0020	42	0105	55	0030	44	0030	41	5
	6	0137	100	0014	42	0050	53	0020	43	0027	42	6
	7	0141	101	0009	42	0034	51	0010	42	0024	43	7
	8	0002	76	0004	42	0019	49	0001	41	0021	44	8
	9	0007	77	0158	73	0004	46	0150	70	0018	44	9
	10	0011	78	0153	73	0147	74	0141	72	0016	45	10
	11	0016	79	0147	73	0131	72	0131	69	0013	46	11
	12	0020	80	0142	73	0116	69	0121	68	0010	47	12
	13	0025	81	0137	74	0101	67	0112	67	0007	48	13
	14	0029	82	0131	74	0045	65	0102	66	0004	49	14

HAM HELP

Wanted: a relay for the Heathkit HW-12 monoband transceiver. Please send price info on how I can get one. Thank you very much.

Rick Dill WA0EDH
3007 S. 44th St.
Lincoln NE 68506

I'm looking for a 40m QRP SSB transceiver for mobile use. If anyone has a 40m QRP rig or info on converting a CB to 40, I would appreciate it if they would contact me.

Roosevelt Hamilton WD4PSW
1112 Lownde Ave.
Pensacola FL 32507

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 8

But this pursuit is a totally selfish one. There are no benefits to the hobby . . . to society. The world is not inched ahead one whit by these chaps. The League has let loose a monster on the world of amateur radio with their Honor Roll.

My own solution to this problem was to work hard and have fun as I worked toward 300 countries. Once I got to that level, I stopped counting. Today, when I hear a new one, I'll take a few minutes to get him in the log . . . preferring to talk with him if at all possible. If things are too frantic, I have better uses of my time . . . a lot better. I haven't the vaguest idea of how many countries I've worked and I don't intend to try to count 'em up. Perhaps, if the League would let newcomers to DXing get credit for countries worked up to 300 . . . with no further listings after that . . . we might be able to put a stop to this thing.

Remember that working DX and getting up on the Honor Roll requires mainly that one be able to spend enormous amounts of time at it. This is not time spent in learning anything or in developing a skill of use to the world. Once you have a decent station, you can make a contact anywhere in the world, so it's just a question of sticking around, being there at the right time, and then bludgeoning your way through.

One of the supposed purposes of amateur radio is to help develop world friendships. Show me a hint that DX pileups and the badgering of ops in rare countries for instant contacts and a QSL generates anything but a disdain. Much of this is aimed at Americans, who are by far the worst in this regard, though at times I find the Germans pushing us hard for bad manners awards. Oddly enough, those hundreds of thousands of no-code Japanese hams are about the best-mannered operators in the whole world . . . and they have almost one million licensed amateurs today!

Those no-code hams, trained by their local ham clubs, often make *us* look like the CBers. They put most Americans to shame when it comes to real operating skills. And I don't think we can excuse our behavior on the air by explaining that learning the code made us crazy. I know that a lot of hams use the Morse Code as an excuse for being such terrible operators, but I don't believe that something that simple could explain what happens when a PY0 comes on the air.

And I don't think we can shrug our shoulders and put the whole thing down to basic cultural differences. The Japanese may bow when they meet, but they knock you around in the subways and in stores just as hard as you get bumped in America. No, the difference is, I believe, in basic ham training . . . in their club-trained hams. That's where they get across the concept of pride in being a ham and the responsibility of being a good operator.

Or, as old and good friend Bob Sullivan used to say, "I may not be wrong, but I'm not far from it."

SMALL HAMFEST CATASTROPHE

Some years ago, a disgruntled ham almost got the New England ARRL Convention closed down. The problem hinged around the breaking of federal laws having to do with the advertising of lotteries through the mail. You can't, yet most hamfests and conventions continue to do this, ignoring the federal laws they are breaking.

Please note that it is presently against the law for any hamfest or convention to send a brochure through the mail which promises prize drawings if there is a charge for attendance . . . and there always is. Further, it is illegal for any magazine or other publication which uses the mails to mention that prizes will be given where there is a charge for attendance.

If you want to give prizes, fine . . . but it is illegal for you to mention that in anything which is going to be sent through the mails. You cannot send flyers or posters with this information on them through the mail. Got it?

No one has ever determined just how much prizes build up attendance at hamfests. As far as I know, every hamfest gives prizes, so no one *could* yet have tested the concept. With the veil of secrecy on prizes being lowered by the post office (*we* have heard from them in no uncertain terms), it may get a whole lot more difficult to get cooperation from manufacturers in the way of donated equipment.

Before the "incentive licensing" debacle of '63, it was much easier to get prizes. The ham industry was growing rapidly, meeting the needs for the then-new sideband equipment, so they were happy to donate nice prizes for our hamfests. Today, with only a handful of American firms left, most of the hamfest prizes have had to be bought, so the munificence has not been awesome. If hamfest committees decide to spend less on prizes, this would leave them

UNCLE WAYNE WANTS YOU!

When was the last time you wrote an article for *73*? Never??!! Then it is time you got started.

We are going to make 1983 the best year ever for fun, exciting articles in *73*. To do this, we'll need articles on many different topics. That's where you come in. Even if you've never written an article for us before, we want to hear from you.

What Do I Write About?

Ham radio is really about two dozen hobbies all rolled into one, so there is no shortage of interesting topics. Here are just a few:

- Antennas. Almost every ham experiments with antennas. Whether you've built a 2-meter yagi, an 80-meter quad, a helix for Phase III, or a multiband dipole, other hams can't wait to try your design. Tell 'em all about it in *73*.
- DX. Been on a DXpedition? We all enjoy reading about exotic people and places. Here's a chance to recount your adventure.
- Special Events. Hams get involved in some wacky and wonderful activities. Like Field Day from a floating raft or operating from hot air balloons. If it's worth a story, let us here from you.
- Reviews. New ham gear is released every week, so how does anyone know what to buy? You can help by writing reviews of your new equipment for other hams to read. Check with us first though; we don't want you to duplicate the efforts of someone else.
- Accessories and Gadgets. Home-brewing small projects is an amateur radio tradition. If your latest preamp, digital clock, or electronic sock warmer is a good performer, the rest of us want to hear about it.
- Major Projects. The design and construction of a transmitter, receiver, or power amplifier is a task requiring knowledge and skill. We want to publish the details so that other hams can enjoy the satisfaction of building a big project.
- Test Gear. Hams love to save money. That's why they'll be interested in your homemade test equipment. We'll have room for lots of transistor checkers, capacitance meters, logic probes, diode testers, and the like during 1983.
- Satellites. Whether it's OSCAR, RS, or TVRO, hams want to know more about building their own satellite gear. Downconverters, antennas—you name it and our fellow amateurs are eager for plans and information.
- Digital Communications. Microcomputers make RTTY neat and simple, but we can do so much more. If you are experimenting with higher baud rates, packet radio, new TU designs, coherent CW, or any of a host of other possibilities, you can tell the amateur world about it by writing articles for *73*.
- Computers. Microcomputers are fast becoming a fixture in many shacks. What are you doing with yours?

Those are just a few of the many ideas for articles. You'll think of more if you work at it.

What's In It for Me?

Cash. Unlike some ham magazines, *73* pays for the articles we publish. It may not buy you a new tower, but it might get you that new beam.

Prestige. Just imagine how impressed your friends and relatives (not to mention your boss) will be when they see your article published in an international magazine!

Enthusiasm. When you write for *73*, you help to generate the excitement that makes ham radio so much fun. Both simple and complex articles find an eager audience.

What to Do Next

For a full description of the nuts and bolts of article preparation, send for the *73* Author's Guide. If you can't wait that long, double space your manuscript, leave generous margins, carefully organize your diagrams and photos, and send the whole package to us. Our address is: *73*, Peterborough NH 03458.

Now, don't just sit there—*start writing*!

✓See List of Advertisers on page 130

with some cash to invest in better speakers.

It's been my observation that hams will drive for hundreds of miles to hear someone interesting talk about their favorite subject. I don't know of anyone crazy enough to drive a couple hundred miles for 1/10,000th chance at an HT. You know, *you* can help. Hamfest committees really don't know who to ask to come talk at their shows. If you'd take the time to write a short review of any interesting talks you've attended at hamfests, this might get the word around.

The fact is that we do have a number of hams who get to fascinating DX spots and go through all kinds of remarkable hell in the process. Some of these chaps are most interesting, if we could only hear about it. Please take the time to pass the word to us here at *73* . . . and we'll get your material into the letters column as guidance to other hamfests.

The opposite side of the coin is that a few of our best known DXers are turkeys. It is most incredible how someone can go through some of the adventures these chaps have and be able to make it sound so incredibly dull to hear about. I once fell asleep at the dinner table trying to get anything of even the slightest interest out of two very well-known DXpeditioners.

There are plenty of interesting people around our hobby. Why not get one of our well-known ham publishers to tell about how he got his ham ticket in the '60s without knowing diddly squat about either the theory or the code? I'll bet we'd love to hear about his trip to northern Maine to get a "Conditional" license and his later trials with the FCC when they found out.

Then there is Jean Shepard K2ORS, with two successful PBS films to his credit and a third in production. Jean is by far the best humorist we have in the hobby and our hamfests should grab him when they can. I understand his latest film, "The Great American Fourth of July . . . and Other Disasters," is up for an award. If you do get him to speak, be sure to tape it and send me a copy. Shep isn't inexpensive to get, but he will pull 'em in . . . and be worth every dollar you spend.

No one really interesting is going to be cheap to get. That's the law of supply and demand. And, as Shep found out long ago, few people really appreciate anything they get for nothing.

My own experience has been that when I speak for free I often find a lack of support by the hamfest committee which results in two or three dozen in attendance. If I cost $1,000 plus all travel expenses (first class), you can bet they will be doing everything they can to get people to listen to me. Then I find myself facing two to three thousand in the audience instead of dozens. Between my already-made show commitments and trying to run my steadily-growing publishing firm while keeping up with two fast-growing industries, I'm not fishing for more work. If I do have extra time, it goes for writing, consulting, and even a touch of hamming. Most hamfests are on weekends, which is prime writing time.

In addition to getting interesting speakers for hamfests, with the no-longer-useful prize money, committees might look into putting on some really good demonstrations of new ham communications modes. I suspect that many amateurs would love to see some good slow-scan demonstrations. They'd also like to see fast-scan television. Then there is a growing interest in packet communications. But, for heaven's sake, watch out for some of the super turkey "experts" who flaunt their *doctor* titles. Several of these birds are crashing bores. Hamfest committees might, if they don't have personal recommendations on the "experts," ask for an audio tape preview and judge it as they might a radio audition.

If you have some hamfest committee members who are enthusiastic about the Morse code, why not try to inspire hams to accept code as a fun activity instead of merely something the government forces them to learn . . . and run code-copying contests, with certificates for the winners to display in their shacks. You can help bring some pride to knowing the code, something sadly lacking today. How can one have pride in something which is mandated by the government? Some of the prize money can go for awards for code skills. There's no lottery aspect to *that*.

You might get some of your more fanatic DXers to bring in their rare cards for a display . . . and for a talk on how to get the darned things. That is an art in itself. A big board for attendees to pin up their cards, with a QSL contest (also not a lottery, obviously), won't hurt.

I realize that bribery and greed are time-honored movers of people, but let's try to cope with the post office laws and find alternate ways of getting hams to come to hamfests.

THE GREAT AMERICAN HAM CLUB . . . DISASTER

When I see the Japanese ham magazine each month, with a whole section devoted to club activities . . . often with 70 or more pages of news about the clubs and pictures of their activities . . . I think of how little our clubs are doing . . . and reporting. I don't think we could generate that much news in a year, much less every month.

Even the best of our ham clubs seem to have their ups and downs. One thing that might help would be an updated series of articles on how to run a ham club. I did run such a series nearly twenty years ago and it was very well received. It's about time for an updated series, eh?

Running a ham club is show business, which many of us seem to forget. Many club presidents gather weak people around them to help make the club go. They do little to organize exciting meetings and often let business intrude on the fun . . . only to find that in a few months they have little left of the club.

I'd like to see some articles on how to make ham clubs succeed. I believe that the real strength of amateur radio lies in the strength of the clubs, not in a small group of professionals who are, for the most part, working for their own benefit first and ours second. How about some pictures of club groups and reports on club activities?

With amateur radio being a keystone, to my way of thinking, as far as providing our country with emergency communications, we're talking about club organization, not just individuals. Clubs can help get amateur radio set up so that it will be able to keep going after any kind of disaster. This means cooperative efforts to have both personal and mobile portable equipment, emergency repeaters, automated relaying, low-band interlinks, and—above all—experience. The duty is there, we already have the technology, and the work will be both fun and of help to tie us together, strengthening our clubs and our own value to our communities and country.

Then there is the responsibility of clubs to help amateur radio grow. This means devising schemes to interest teenagers in the hobby through talks at high schools, demonstrations at shopping malls, service for local groups, and participation in things like the March of Dimes. It means making sure that club activities are properly exploited with the local media. When there is a Field Day exercise, the local newspapers and television stations should get the word and be offered cooperation on the story.

Just getting the interest of teenagers isn't enough. Clubs should try to work with school officials to see that there is a radio club in the school which meets at least weekly. Schools have a serious problem about this which clubs can help solve. Any school activity has to have an adult advisor on hand. Since few schools have the budget to pay a teacher for this after-school work, the result has been a serious cutting down of after-school clubs. By providing the needed adult advisor, the local ham club could encourage the development of the school radio club.

Then there is the growing need for license classes to be put on by clubs. One of the really sad results of the Bash cheatbook approach to getting a ham ticket has been the lack of ham club members with even the small technical background it takes to teach the rudiments of theory required for the Novice exam. In some clubs, it is a case of those with scant information trying to teach newcomers, spreading confusion.

All of these problems have been solved by many clubs, so I'd like to see some letters and articles on these subjects for possible publication.

See List of Advertisers on page 130

FACIT 4555 SERIAL PAGE PRINTER

The Facit 4555 alphanumerical serial printer is complete. Equipped with RS232C Interface, printing mechanism, control electronics, drive electronics, power supply and character generator. The adaptation electronics can be modified in four versions:Bit-parallel data transfer, CCITT (EIA, RS232C) for bit-serial data transfer and the current loop (TTY) interface also for bit serial data transfer. The Facit 4555 prints on ordinary paper and is adjustable for different paper widths and formats, 9.5" paper width with 66 lines per page or DIN A4 with 70 lines per page.

SPECIFICATIONS

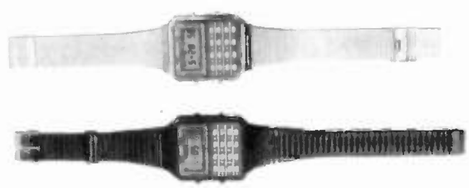
Print speed	up to 60ch.s.	Char. spacing	2.54mm/1/10" 80ch/line 1.55mm/0.06" 132ch/line
Printing mode	Incremental.		
Max. # of ch/line	80 alt. 132.	Char. Code	ECMA-6 7-bit coded char. set
Matrix	7 X 5 dot matrix.	Char. Set	63 Char. various national versions.
Char. Size Height	2.7mm/1/8"		
Char. Size Width	1.3mm/0.05" 132ch/line 2.1mm/0.083" 80ch/line	Feed mechanism	Sprocket feed.

THESE UNITS WERE PULLED OUT OF SERVICE IN GOOD WORKING CONDITION. WE CHECK EACH UNIT ON A RADIO SHACK TRS-80 COLOR COMPUTER.

PRINTER ONLY $129.99

Printer with linecord, box of paper, inter-connect cable for TRS-80 COLOR COMPUTER.
$149.99

GENEVA CALCULATOR WATCH



This attractive watch has the following modes:
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Chronograph,
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HEP170	1000vdc	2Amps	20/$2.00	100/$15.00
1N3209	100vdc	15Amps	$2.00	10/ $15.00
BYX21/200	200vdc	25Amps	$2.00	10/ $15.00
1N2138A	600vdc	60Amps	$5.00	10/ $40.00
DS85-04C	400vdc	80Amps	$10.00	10/ $80.00
1N3269	600vdc	160Amps	$15.00	10/$120.00
275Z41	300vdc	250Amps	$20.00	10/$175.00
7-5754	300vdc	400Amps	$30.00	10/$250.00
RCD-15	15KVDC	20ma.	$3.00	10/ $20.00
SMFR20K	20KVDC	20ma.	$4.00	10/ $30.00
1N4148	signal		30/$1.00	100/ $3.00

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Electronic Specialty Co./Raven Electronics FSN 5985-556-9683 $49.00
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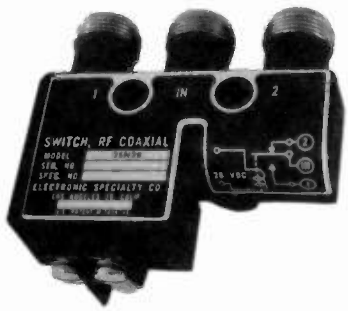
26Vdc Type N Connector, DC to 1 GHz.



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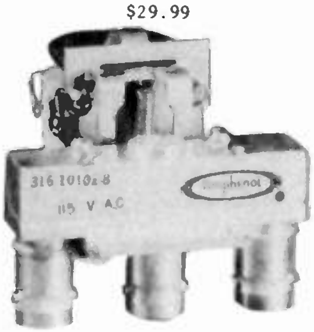

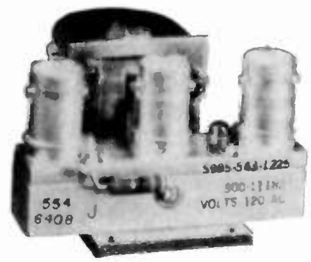

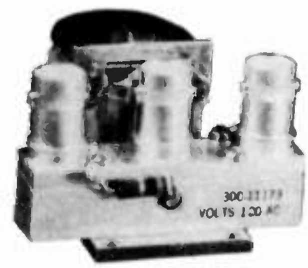

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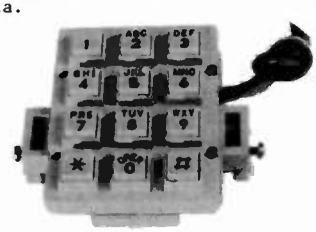

$9.99 or 10/$89.99

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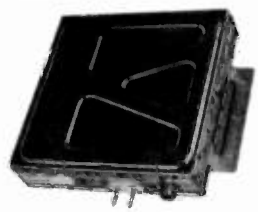

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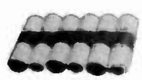

holiday greetings!

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"SOCKETS AND CHIMNEYS"

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SK600	Socket For 4CX250B,BC,FG,R,4CX350A,F,FJ	51.00
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SK806	Chimney For 4CX1000A,4CX1500B	40.00
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SK900	Socket For 4X500A	300.00
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124-111/SK606	Chimney For 4CX250B,BC,FG,R, 4CX350A,F,FJ	$ 10.00
122-0275-001	Socket For 3-500Z, 4-125A, 250A, 400A, 4-500A, 5-500A	(pair)15.00
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1.1pf	15pf	120pf	510pf
1.4pf	18pf	130pf	560pf
1.5pf	20pf	150pf	620pf
1.8pf	22pf	160pf	680pf
2.2pf	24pf	180pf	820pf
2.7pf	27pf	200pf	1000pf/.001uf*
3.3pf	33pf	220pf*	1800pf/.0018uf
3.6pf	39pf	240pf	2700pf/.0027uf
3.9pf	47pf	270pf	10,000pf/.01uf
4.7pf	51pf	300pf	12,000pf/.012uf
5.6pf	56pf	330pf	15,000pf/.015uf
6.8pf	68pf	360pf	18,000pf/.018uf
8.2pf	82pf	390pf	

PRICES: 1 to 10 - .99¢ 101 to 1000 .60¢ * IS A SPECIAL PRICE: 10 for $7.50
11 to 50 - .90¢ 1001 & UP .35¢ 100 for $65.00
51 to 100 - .80¢ 1000 for $350.00

WATKINS JOHNSON WJ-V907: Voltage Controlled Microwave Oscillator $110.00

Frequency range 3.6 to 4.2GHz, Power ouput, Min. 10dBm typical, 8dBm Guaranteed. Spurious output suppression Harmonic (nf_0), min. 20dB typical, In-Band Non-Harmonic, min. 60dB typical, Residual FM, pk to pk, Max. 5KHz, pushing factor, Max. 8KHz/V, Pulling figure (1.5:1 VSWR), Max. 60MHz, Tuning voltage range +1 to +15volts, Tuning current, Max. -0.1mA, modulation sensitivity range, Max. 120 to 30MHz/V, Input capacitance, Max. 100pf, Oscillator Bias +15 +-0.05 volts @ 55mA, Max.

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MHz electronics

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TUBES

TYPE	PRICE
2E26	$ 5.69
2K28	100.00
2X1000A	300.00
3B22	19.75
3B28/866A	7.50
3-500Z	102.00
3-1000Z	400.00
3CX1000A/8283	428.00
3CX1500A7/887	533.00
3X2500A3	200.00
3CX3000A7	490.00
4-65A/8165	45.00
4-125A/4D21	58.00
4-250A/5D22	75.00
4-400A/8432	90.00
4-400C/6775	95.00
4-1000A/8166	300.00
4B32	22.00
4E27A/5-125B	155.00
4CS250R	146.00
4X150A/7034	30.00
4X150D/7035	40.00
4X150G/8172	100.00
4X250B	30.00
4CX250B/7203	45.00
4CX250F/G/8621	55.00
4CX250K/8245	100.00
4CX250R/7580W	69.00
4CX300A/8167	140.00
4CX350A/8321	83.00
4CX350F/J/8904	95.00
4X500A	282.00
4CX600J/8809	607.00
4CW800F	625.00
4CX1000A/8168	340.00
4CX1500B/8660	397.00
4CX5000A/8170	932.00
4CX10000D/8171	990.00
4CX15000A/8281	1260.00
4PR60A	100.00
4PR60B/8252	175.00
4PR400A/8188	192.00
5CX1500A	569.00

TYPE	PRICE
KT88	$ 20.00
DX362	50.00
DX415	50.00
572B/T160L	49.00
592/3-200A3	144.00
807	7.50
811	10.00
811A	15.00
812A	35.00
813	50.00
829B	38.00
832A	28.00
4624	310.00
4662	80.00
4665	585.00
5675/A	25.00
5721	200.00
5768	85.00
5836	100.00
5837	100.00
5861/EC55	110.00
5876A	25.00
5881/6L6W	6.00
5893	45.00
5894/A	50.00
5894/B	60.00
5946	258.00
6080	10.00
6083/AX9909	89.00
6098/6AK6	14.00
6115/A	110.00
6146	7.00
6146A	7.50
6146B/8298A	8.50
6146W	14.00
6156	66.00
6159	15.00
6161	233.00
6291	125.00
6293	12.00
6360	5.00
6524	53.00
6550	10.00

TYPE	PRICE
6562/6974A	$ 50.00
6832	22.00
6883/8032A/8552	7.00
6897	110.00
6907A	75.00
6939	15.00
7094	125.00
7117	17.00
7211	60.00
7289/3CX100A5	34.00
7360	11.00
7377	67.00
7408	4.00
7650	250.00
7695	8.00
7843	58.00
7854	83.00
7868	5.00
7894	12.00
8072	65.00
8117A	130.00
8121	60.00
8122	100.00
8236	30.00
8295/PL172	506.00
8462	100.00
8505A	73.50
8533W	92.00
8560/A	65.00
8560AS	90.00
8608	34.00
8637	38.00
8643	100.00
8647	123.00
8737/5894B	60.00
8873	260.00
8874	260.00
8875	260.00
8877	533.00
8908	12.00
8930/651Z	71.00
8950	12.00

6BK4C	6.00
6DQ5	5.00
6FW5	6.00
6GE5	6.00
6GJ5	6.00
6HS5	6.00
6JB5/6HE5	6.00
6JB6A	6.00

6JM6	6.00
6JN6	6.00
6JS6B	6.00
6KG6/EL505	6.00
6KM6	6.00
6KN6	6.00
6LF6	6.00
6LQ6 (GE)	6.00

6LQ6 (Sylvania)	7.50
6LU8	6.00
6LX6	6.00
6ME6	6.00
12BY7A	4.00
12JB6A	6.00
6KD6	6.00
6JT6A	6.00
6KD6	6.00

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"TVRO BOARD LIST"

70 MHZ IF BOARD: This circuit provides about 43dB gain with 50 ohm input and output impedance. It is designed to drive the Demodulator. The on-board bypass filter can be tuned to bandwidths between 20 and 35 MHz with a passband ripple of less than ½ dB. Hybrid IC's are used for the gain stages.

SINGLE AUDIO BOARD: This circuit recovers the audio signals from the 6.8 MHz frequency. The Miller 9051 coils are tuned to pass the 6.8MHz subcarrier and the 9052 coil tunes for recovery of the audio.

DUAL AUDIO BOARD: Duplicate of the single audio but also covers the 6.2 range.

DC CONTROL BOARD: No description.

DUAL AUDIO BOARD		PRICE EACH
	Printed Circuit Board	$ 25.00
2	3pf sm	1.00
2	12pf sm	1.00
2	50pf sm	1.00
2	68pf sm	1.00
4	91pf sm	1.00
5	.001mfd	.35
6	.01mfd	.35
2	.047mfd	.35
1	.47mfd 25vdc	.35
2	1mfd 10vdc	.59
4	4.7mfd 35vdc	.59
1	470mfd 25vdc	1.29
2	220K 1/4w	.15
2	150K 1/4w	.15
2	6.8K 1/4w	.15
2	3.3K 1/4w	.15
2	2.2K 1/4w	.15
4	1K 1/4w	.15
2	10 ohm 1/4w	.15
2	50K pots	1.00
1	5K pot	1.00
2	CA3065	2.16
1	LM380	1.56
1	7812 Voltage Reg.	1.17
5	2N2222	.50
4	Miller 9051	5.99
2	Miller 9052	5.99
	TOTAL KIT PRICE	97.62

DC CONTROL BOARD		
	Printed Circuit Board	15.00
2	470mfd 25vdc	1.29
2	4.7mfd 25vdc	.59
1	1meg 1/4w	.15
3	10K 1/4w	.15
1	3.3K 1/4w	.15
3	2.2K 1/4w	.15
1	1K 1/4w	.15
2	5K 10 turn trimpot	1.00
4	10K 10 turn trimpot	1.00
1	10K 10 turn with dial	10.00
1	7815 Voltage Reg.	1.17
1	LM324	2.50
1	5 pole rotary switch	2.50
1	SPDT switch	1.00
1	DPDT swich	1.00
1	0-1ma meter	5.00
1	18 to 24vdc at 1 amp power supply	24.99
	TOTAL KIT PRICE	74.27

DEMODULATOR BOARD		PRICE EACH
	Printed Circuit Board	$ 40.00
1	1mfd 35vdc	.59
13	.01mfd 50vdc disc	.35
1	470mfd 25vdc	1.29
2	100mfd 16vdc	.69
2	22mfd 35vdc	.59
3	4.7mfd 35vdc	.59
1	4300pf sm	2.00
1	330pf sm	1.00
1	100pf sm	1.00
1	91pf sm	1.00
2	3pf sm	1.00
1	2 to 8pf ceramic trimmer	1.00
1	100uh choke	1.50
1	4.7uh choke	1.50
1	2.7uh choke	1.50
4	100K 1/4w	.15
1	51 ohm 1/4w	.15
1	27K 1/4w	.15
5	10K 1/4w	.15
1	8.2K 1/4w	.15
2	4.7K 1/4w	.15
1	2.2K 1/4w	.15
1	1.2K 1/4w	.15
3	1K 1/4w	.15
3	560 ohm 1/4w	.15
1	470 ohm 1/4w	.15
1	390 ohm 1/4w	.15
1	300 ohm 1/4w	.15
1	270 ohm 1/4w	.15
1	150 ohm 1/4w	.15
1	41 ohm 1/4w	.15
1	10K pot	1.00
1	NE592/LM733N	2.50
1	NE564	5.00
1	MWA120 (Motorola)	7.80
1	7812 Voltage Reg.	1.17
1	7815 Voltage Reg.	1.17
3	2N2222	.50
2	1N34/38	.50
1	HP5082-2800	2.20
1	5 to 7 volt Zenner	1.00
	TOTAL KIT PRICE	92.25

COMPLETE KIT WITH DUAL AUDIO $923.23
COMPLETE KIT WITH SINGLE AUDIO 880.77

LESS 10% ON ALL COMPLETE KIT ORDERS

BOARDS AND PARTS MAY BE PURCHASED SEPERATELY AT THE PRICES LISTED ABOVE.

ALL PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!

TVRO BOARD DESCRIPTION AND PARTS LIST

DUAL CONVERSION BOARD: This board provides conversion from the 3.7-4.2 band first to 900 MHz where gain and bandpass filtering are provided and, second, to 70 MHz. The board contains both local oscillators, one fixed and the other variable, and the second mixer. Construction is greatly simplified by the use of Hybrid IC amplifiers for the gain stages.

DEMODULATOR BOARD: This circuit takes the 70 MHz center frequency satellite TV signal in the 10 to 200 millivolt range, detects them using a phase lock loop, de-emphasizes and filters the result to produce standard NTSC video. Other outputs include the audio subcarrier, a DC voltage proportional to the strength of the 70 MHz signal, and AFC voltage centered at about 2 volts DC.

DUAL CONVERSION BOARD		PRICE EACH
	Printed Circuit Board	$ 25.00
6	47pf chip caps	1.00
2	4.7mfd 35vdc	.59
2	.01mfd 50vdc disc cap	.35
4	1.5 to 8pf piston trimmer cap	5.99
2	470 ohm 1/4w	.15
2	MWA320 (Motorola)	8.65
1	7815 Voltage Reg.	1.17
1	VTO8090	150.00
1	VTO8240	156.25
2	1N4005	.39
1	DBM500/1100 (Varil)	125.00
1	MLP102 (Engleman)	25.00
8	SMA Male Connector	5.00
	TOTAL KIT PRICE	572.64

70 MHZ IF BOARD		
	Printed Circuit Board	25.00
3	MWA120	7.80
7	.01mfd 50vdc	.35
2	4.7mfd 35vdc	.59
1	10pf sm	1.00
5	22pf sm	1.00
1	18pf sm	1.00
1	33pf sm	1.00
2	330 ohm 1/4w	.15
5	J.W. Miller 4500-4	4.99
1	7815 Voltage Reg.	1.17
	TOTAL KIT PRICE	86.45

SINGLE AUDIO BOARD		PRICE EACH
	Printed Circuit Board	$ 15.00
1	3pf sm	1.00
1	12pf sm	1.00
1	50pf sm	1.00
1	68pf sm	1.00
2	91pf sm	1.00
3	.001mfd	.35
3	.01mfd	.35
1	.047mfd	.35
1	.47mfd	.35
1	1mfd 10vdc	.59
3	4.7mfd 35vdc	.59
1	470mfd 25vdc	1.29
1	220K 1/4w	.15
1	150K 1/4w	.15
1	6.8K 1/4w	.15
1	3.3K 1/4w	.15
1	2.2K 1/4w	.15
3	1K 1/4w	.15
1	10 ohm 1/4w	.15
1	50K pot	1.00
1	5K pot	1.00
1	CA3065/MC1358P	2.16
1	LM380	1.56
1	7812 Voltage Reg.	1.17
3	2N2222	.50
2	Miller 9051	5.99
1	Miller 9052	5.99
	TOTAL KIT PRICE	55.16

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"CHIPS"

FAIRCHILD VHF AND UHF PRESCALER CHIPS		PRICE
95H90DC	350MC Prescaler divide by 10/11	$ 8.50
95H91DC	350MC Prescaler divide by 5/6	8.50
11C90DC	650MC Prescaler divide by 10/11	15.50
11C91DC	650MC Prescaler divide by 5/6	15.50
11C06DC	UHF Prescaler 750MC D Type Flip Flop	12.30
11C05DC	1GHz Counter Divide by 4 (Regular price $75.00)	50.00
11C01FC	High Speed Dual 5/4 Input NO/NOR Gate	15.40
82S90	Presettable High Speed Decade/Binary Counter used with the 11C90/91 or the 95H90/91 Prescaler can divide by 100. (Signetics)	5.00
11C24DC	This chip is the same as a Motorola MC4024/4324 Dual TTL Voltage Control Multivibrator.	3.37
11C44DC	This chip is the same as a Motorola MC4044/4344 Phase Frequency Detector.	3.37

GENERAL ELECTRIC CO. GUNN DIODE MODEL Y-2167
Freq. Gap (GHZ) 12 to 18, Output (Min.) 100mW, Duty (%) CW, Typ. Bias (Vdc) 8.0, Type. Oper. (MAdc) 550, Max. Thres. (mAdc) 1000, Max. Bias (Vdc) 10.0. **$39.99**

VARIAN GALLIUM ARSENIDE GUNN DIODES MODEL VSX-9201S5
Freq. Coverage 8 to 12.4GHz, Output (Min.) 100mW, Bias Voltage (Max.) 14vdc, Bias current (mAdc) Operating 550 Typ. 750 Max., Threshold 850 Tup. 1000 Max. **$39.99**

VARI-L Co. Inc. MODEL SS-43 AM MODULATOR
Freq. Range 60 10 150MC, Insertion Loss 13dB Nominal, Signal Port Imp. 50ohms Nominal, Signal Port RF Power +10dBm Max., Modulation Port BW DC to 1KHZ, Modulation Port Bias 1ma. Nominal. **$24.99**

AVANTEK CASCADABLE MODULAR AMPLIFIERS	Model UTO-504	UTO-511
Frequency Range	5 to 500 MHz	5 to 500 MHz
Gain	6dB	15dB
Noise Figure	11dB	2.3dB to 3dB
Power Output	+17dB	−2dB to −3dB
Gain Flatness	1dB	1dB
Input Power Vdc	+24	+15
mA	100	10
	PRICE $70.00	PRICE $75.00

HEWLETT PACKARD MIXERS MODELS	10514A	10514B
Frequency Range	2MHz to 500MC	2MHz to 500MC
Input/Output Frequency L & R	200KHz to 500MC	200KHz to 500MC
X	DC to 500MC	DC to 500MC
Mixer Conversion Loss (A)	7dB	7dB
(B)	9dB	9dB
Noise Performance (SSB) (A)	7dB	7dB
(B)	9dB	9dB
PRICE	$49.99	PRICE $39.99

FREQUENCY SOURCES, INC MODEL MS-74X MICROWAVE SIGNAL SOURCE
MS-74X: Mechanically Tunable Frequency Range (MHz) 10630 to 11230 (10.63 to 11.23GHz) Minimum Output Power (mW) 10, Overall Multiplier Ratio 108, Internal Crystal Oscillator Frequency Range (MHz) 98.4 to 104.0, Maximum Input Current (mA) 400.

The signal source are designed for applications where high stability and low noise are of prime concern. these sources utilize fundamental transistor oscillators with high Q coaxial cavities, followed by broadband stable step recovery diode multipliers. This design allows single screw mechanical adjustment of frequency over standard communications bands. Broadband sampling circuits are used to phase lock the oscillator to a high stability reference which may be either an internal self-contained crystal oscillator, external primary standard or VHF synthesizer. This unique technique allows for optimization of both FM noise and long term stability. List Price is $1158.00 (THESE ARE NEW) **Our Price—$289.**

HEWLETT PACKARD 1N5712 MICROWAVE DIODE
This diode will replace the MBD101, 1N5711, 5082-2800, 5082-2835 ect. This will work like a champ in all those Down Converter projects. **$1.50 or 10/$10.00**

MOTOROLA MHW1172R LOW DISTORTION WIDEBAND AMPLIFIER MODULE.
Frequency Range: 40 to 300 MHz., Power Gain at 50MHz 16.6min. to 17.4max., Gain Flatness ±0.1 Typ. ±0.2 Max. dB., DC Supply Voltage −28vdc, RF Voltage Input +70dBmV **PRICE $29.99**

GENERAL ELECTRIC AA NICADS
Model #41B905HD11-G1
Pack of 6 for $5.00 or 60 Cells, 10 Packs for $45.00
These may be broken down to individual cells.

ORDERING INSTRUCTIONS

DEFECTIVE MATERIAL: All claims for defective material must be made within sixty (60) days after receipt of parcel. All claims must include the defective material (for testing purposes), our invoice number, and the date of purchase. All returns must be packed properly or it will void all warranties.

DELIVERY: Orders are normally shipped within 48 hours after receipt of customer's order. If a part has to be backordered the customer is notified. Our normal shipping method is via First Class Mail or UPS depending on size and weight of the package. On test equipment it is by Air only, FOB shipping point.

FOREIGN ORDERS: All foreign orders must be prepaid with cashier's check or money order made out in U.S. Funds. We are sorry but C.O.D. is not available to foreign countries and Letters of Credit are not an acceptable form of payment either. Further information is available on request.

HOURS: Monday thru Saturday: 8:30 a.m. to 5:00 p.m.

INSURANCE: Please include 25¢ for each additional $100.00 over $100.00. United Parcel only.

ORDER FORMS: New order forms are included with each order for your convenience. Additional forms are available on request.

POSTAGE: Minimum shipping and handling in the US, Canada, and Mexico is $2.50 all other countries is $5.00 On foreign orders include 20% shipping and handling.

PREPAID ORDERS: Order must be accompanied by a check.

PRICES: Prices are subject to change without notice.

RESTOCK CHARGE: If parts are returned to MHZ Electronics due to customer error, customer will be held responsible for all extra fees, will be charged a 15% restocking fee, with the remainder in credit only. All returns must have approval.

SALES TAX: Arizona must add 5% sales tax, unless a signed Arizona resale tax card is currently on file with MHZ Electronics. All orders placed by persons outside of Arizona, but delivered to persons in Arizona are subject to the 5% sales tax.

SHORTAGE OR DAMAGE: All claims for shortages or damages must be made within 5 days after receipt of parcel. Claims must include our invoice number and the date of purchase. 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
NO INFORMATION WILL BE GIVEN. 1-800-528-0180.

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.

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, customers will be held responsible for any charges incurred, plus a 15% restock charge on returned parts.

CREDIT CARDS: WE ACCEPT MASTERCARD VISA AND AMERICAN EXPRESS.

DATA SHEETS: When we have data sheets in stock on devices we do supply them with the order.

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(602) 242-8916
2111 W. CAMELBACK ROAD
PHOENIX, ARIZONA 85015

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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 post cards and odd-sized scraps of paper. Please type or print your request (neatly!), double spaced, on an 8½" x 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.

Does anyone have information on RTTY software for a TRS-80 Model I Level II?

Gary Hansen KAØJUM
Route 1 Box 103
Deerwood MN 56444

I am looking for hams with RTTY equipment who would like to help deaf students attending school in Washington DC communicate with their families back home.

Jeffrey A. Meyer N8AHA
26366 Greythorne Trail
Farmington Hills MI 48018

I am looking for a used LCR bridge such as the Leader LCR 740.

Jim Buckwalter WA6FGM
3212 Millcreek
Visalia CA 93291

I need a service manual and schematic diagram for a Hy-Gain Galaxy GT-550-A SSB transceiver. I will pay reasonable copying costs or copy and return.

Jose Sanabrais
Av. Hidalgo No. 99
Queretaro, Qro.
76000 Mexico

I would like to buy the following WWII surplus receivers, in at least good used condition (they need not include power supply, dynamotor, etc.): ARB, RBB (0.5 to 4.0 MHz), and BC-946 (broadcast band ARC-5 receiver).

Meyer Gottesman W6GIV
3377 Solano Avenue, #312
Napa CA 94558

I am blind and bedridden and searching for someone to donate a Kenwood 600 receiver or any other shortwave receiver.

Richard Jastrow
Long Beach General Hospital
2597 Redondo Ave.
Long Beach CA 90806

My club's 5-page Novice-class study guide is offered in exchange for your club's Novice- and/or General-class handouts. Ours is a brief description of the items listed in the current FCC syllabus and has a 95% pass rate in our classes.

Jim Koski KT6W
1714 Austin Avenue
Los Altos CA 94022

ramsey the first name in Counters!

9 DIGITS 600 MHz $129.95 WIRED

PRICES

CT-90 wired, 1 year warranty	$129.95
CT-90 Kit, 90 day parts warranty	109.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC Adapter/Charger	12.95
OV-1, Micro power Oven time base	49.95
External time base input	14.95

The CT-90 is the most versatile, feature packed counter available for less than $300.00! Advanced design features include: three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10mHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally, an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 10 MV to 150 MHz Less than 50 MV to 500 MHz
Resolution:	0.1 Hz (10 MHz range) 1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	9 digits 0.4" LED
Time base:	Standard-10.000 mHz, 1.0 ppm 20-40°C. Optional Micro-power oven-0.1 ppm 20-40°C
Power:	8-15 VAC @ 250 ma

7 DIGITS 525 MHz $99.95 WIRED

SPECIFICATIONS:

Range:	20 Hz to 525 MHz
Sensitivity:	Less than 50 MV to 150 MHz Less than 150 MV to 500 MHz
Resolution:	1.0 Hz (5 MHz range) 10.0 Hz (50 MHz range) 100.0 Hz (500 MHz range)
Display:	7 digits 0.4" LED
Time base:	1.0 ppm TCXO 20-40°C
Power:	12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as: three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

PRICES:

CT-70 wired, 1 year warranty	$99.95
CT-70 Kit, 90 day parts warranty	84.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC adapter/charger	12.95

7 DIGITS 500 MHz $79.95 WIRED

PRICES:

MINI-100 wired, 1 year warranty	$79.95
AC-Z Ac adapter for MINI-100	3.95
BP-Z Nicad pack and AC adapter/charger	12.95

Here's a handy, general purpose counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

SPECIFICATIONS:

Range:	1 MHz to 500 MHz
Sensitivity:	Less than 25 MV
Resolution:	100 Hz (slow gate) 1.0 KHz (fast gate)
Display:	7 digits, 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	5 VDC @ 200 ma

8 DIGITS 600 MHz $159.95 WIRED

NEW READ RECEIVER FREQUENCY

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 25 mv to 150 MHz Less than 150 mv to 600 MHz
Resolution:	1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	8 digits 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

PRICES:

CT-50 wired, 1 year warranty	$159.95
CT-50 Kit, 90 day parts warranty	119.95
RA-1, receiver adapter kit	14.95
RA-1 wired and pre-programmed (send copy of receiver schematic)	29.95

DIGITAL MULTIMETER $99.95 WIRED

PRICES:

DM-700 wired, 1 year warranty	$99.95
DM-700 Kit, 90 day parts warranty	79.95
AC-1, AC adaptor	3.95
BP-3, Nicad pack +AC adapter/charger	19.95
MP-1, Probe kit	2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include: 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3½ digit, ½ inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

SPECIFICATIONS:

DC/AC volts:	100uV to 1 KV, 5 ranges
DC/AC current	0.1uA to 2.0 Amps, 5 ranges
Resistance:	0.1 ohms to 20 Megohms, 6 ranges
Input impedance:	10 Megohms, DC/AC volts
Accuracy:	0.1% basic DC volts
Power:	4 'C' cells

AUDIO SCALER

For high resolution audio measurements, multiplies UP in frequency.

- Great for PL tones
- Multiplies by 10 or 100
- 0.01 Hz resolution!

$29.95 Kit $39.95 Wired

ACCESSORIES

Telescopic whip antenna - BNC plug	$ 7.95
High impedance probe, light loading	15.95
Low pass probe, for audio measurements	15.95
Direct probe, general purpose usage	12.95
Tilt bail, for CT 70, 90, MINI-100	3.95
Color burst calibration unit, calibrates counter against color TV signal	14.95

COUNTER PREAMP

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

- Flat 25 db gain
- BNC Connectors
- Great for sniffing RF with pick-up loop

$34.95 Kit $44.95 Wired

ramsey electronic's, inc. VISA master charge

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✓See List of Advertisers on page 130

AT LAST — A REPEATER YOU CAN AFFORD!

For years, Hamtronics ® Modules have been used by individual hams and manufacturers to make repeaters. Now, in the Hamtronics tradition of top quality and superb value, we are proud to offer a complete repeater package.

JUST LOOK AT THESE PRICES!

Band	Kit	Wired/Tested
6M,2M,220	$595	$745
440	$645	$795

Both kit and wired units are complete with all parts, modules, hardware, and crystals.

CALL OR WRITE FOR COMPLETE DETAILS.

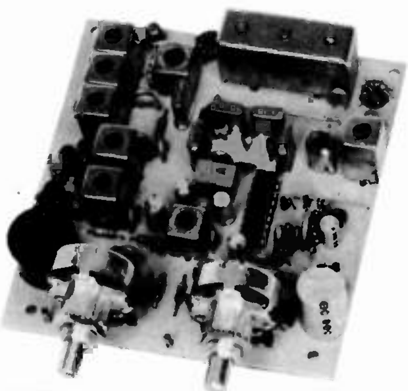
Also available for remote site linking/crossband & 10M.

FEATURES:

- SENSITIVITY SECOND TO NONE; TYPICALLY 0.15 uV ON VHF, 0.2 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.

HIGH QUALITY MODULES FOR REPEATERS, LINKS, TELEMETRY, ETC.

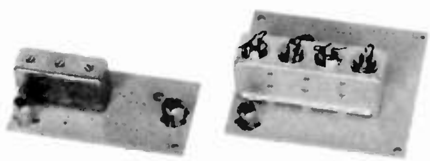
INTRODUCING — NEW 1983 RECEIVERS



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 (curves at left). AFC incl., xtal oven avail. Kit only $119.95
- **R451 FM RCVR** Same but for uhf. Tuned line front end, 0.2 uV sens. Kit only $119.95.
- **R76 FM RCVR** for 10M, 6M, 2M, 220, or commercial bands. As above, but w/o AFC or hel. res. Kits only $109.95. Also avail w/4 pole filter, only $94.95/ kit.

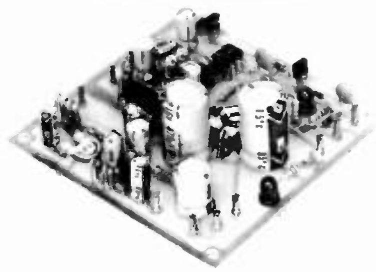
- **R110 VHF AM RECEIVER** kit for VHF aircraft band or ham bands. Only $84.95.
- **R110 UHF AM RECEIVER** for UHF uses, including special 296 MHz model to hear SPACE SHUTTLE. Kit $94.95.



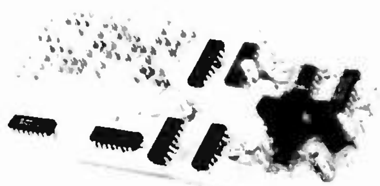
- **HELICAL RESONATOR FILTERS** available separately on pcb w/connectors.

HRF-144	for 143-150 MHz	$34.95
HRF-220	for 213-233 MHz	$34.95
HRF-432	for 420-450 MHz	$44.95

(See selectivity curves at left.)



- **COR KITS** With audio mixer and speaker amplifier. Only $29.95.
- **CWID KITS** 158 bits, field programmable, clean audio. Only $59.95.



- **A16 RF TIGHT BOX** Deep drawn alum. case with tight cover and no seams. 7 x 8 x 2 inches. Only $18.00.

TRANSMITTERS AND ACCESSORIES

- **T51 VHF FM EXCITER** for 10M, 6M, 2M, 220 MHz or adjacent bands. 2 Watts continuous. Kits only $54.95

- **T451 UHF FM EXCITER** 2 to 3 Watts on 450 ham band or adjacent. Kits only $64.95.
- **VHF & UHF LINEAR AMPLIFIERS.** Use on either FM or SSB. Power levels from 10 to 45 Watts to go with exciters & xmtg converters. Kits from $69.95.

↙33

hamtronics®

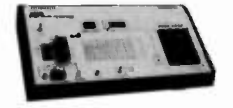
2708,2716,2732 & 2764 EPROM Programmer

JE664 EPROM PROGRAMMER

8K TO 64K EPROMS — 24 AND 28 PIN PACKAGES

Self-Contained — Requires No Additional Systems for Operation

NEW!



• Programs, validates, and checks for properly erased EPROMs • Emulates PROMs or EPROMs • RS232C Computer Interface for editing/program loading • Loads data into RAM by keyboard • Changes data in RAM by keyboard • Loads RAM from an EPROM • Compares EPROMs for content differences • Copies EPROMs • Power Input: 115VAC, 60Hz, ≈ 10W power consumption • Enclosure: Color coordinated, light tan panels w/molded mocha brown end pieces • Size: 15-5/8"L x 8¾"D x 3½"H • Wt.: 5¾ lbs.

JE664-A EPROM Programmer **$995.00**
Assembled & Tested (Includes JM16A Module)

JE665 — RS232C INTERFACE OPTION — The JE665 RS232C Interface Option implements computer access to the JE664's RAM. Sample software written in BASIC provided for TRS-80® Model I, Level II Computer. Baud rate 9600. Word Lgth: 8 bits - odd parity. Stop bits: 2. Option may be adapted to other computers.

JE664-ARS EPROM Prog. w/JE665 Option **$1195.00**
Assembled and Tested (Includes JM16A Module)

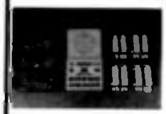
EPROM JUMPER MODULES — The JE664's JUMPER MODULE (Personality Module) is a plug-in Module that pre-sets JE664 for proper programming pulses to the EPROM & configures EPROM socket connections for that particular EPROM.

Part No.	EPROM	EPROM MANUFACTURER	PRICE
JM08A	2708	AMD, Motorola, National, Intel, TI	$14.95
JM16A	2716, TMS2516	Intel, Motorola, National, NEC, TI	$14.95
JM16B	TMS2716	Motorola, TI (+5, -12, +12)	$14.95
JM32A	TMS2532	Motorola, TI	$14.95
JM32B	2732	AMD, Fujitsu, NEC, Hitachi, Intel	$14.95
JM64A	MCM68764, MCM68L764	Motorola	$14.95
JM64B	2764	Intel	$14.95
JM64C	TMS2564	TI	$14.95

CONSUMER PRODUCTS

SECURITY ALARM SYSTEMS

Home Alarm System



• Self-Installation • Presettable w/individual 3-digit code — no key nec. • Instant or 10-sec delayed warning system • Alarm system incl. window & door contacts • One 9V battery required (not incl.) Low power consumption (0.01mA) • Loud audible alarm (90db) • Delayed exit feature • System complete w/one control station with built-in siren and test button; 4 magnetic contact sets & connecting wires for entire system

ST-05 Home Alarm System **$59.95**

Door Security System

• Coded door alarm • Instant or 7-second delay system • Alarm activated as door is opened • Can be de-activated by pressing personal code • Power: One 9V battery (not incl.). • System includes one personal coded keyboard and one magnetic sensor.

ES-07 Door Alarm **$29.95**

Anti-Theft Auto Alarm System

• Audible horn is activated when door or trunk is opened • Alarm sounds for 3 min. — unless turned off by secret 3-digit code. • Wire cutting will not deactivate alarm. • Code set by owner • Uses only 0.01mA power. • System complete w/one black-box control unit; one personal coded keyboard, 2 sets of sensors, one audible horn, & wiring (incl. one 10A fuse)

CA-06 Auto Alarm **$59.95**

DIGITAL QUARTZ TIME PEN

• 5-Function: Hours, Minutes, Seconds, Month, Day • Liquid Crystal Display • 1/8" digits • Battery included • Uses standard Parker ink refills • Ultra-slim design (5¾" x ⅜")

77ILK	Black/Gold Trim	$9.95 each
77ISG	Stainless Steel/Gold Trim	$9.95 each
77ILR	Red/Gold Trim	$9.95 each

STICK-ON CLOCK

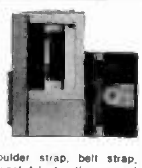
5-Function LCD Quartz Digital

• Hours • Minutes • Seconds • Month • Day • Flashing Colon • Ideal for car, kitchen, bathroom, office, etc. • 1/4" digits • Runs 2 years on 1 battery (incl.) • Size: 1-3/8" Round. Specify color: Red/ST-001R; White/ST-001W; Black/ST-001B

#ST-001 ______ (Specify letter) .... **$4.95 each or 2/$8.95**

Stereo Cassette Player

with FM Stereo Tuner Pack



• Lightweight Headphones
• Cr02/Metal/Normal Tape Selector
• Anti-Rolling Mechanism

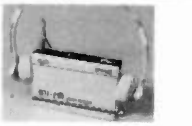
FEATURES: • Blue carrying case, shoulder strap, belt strap, lightweight headphones, FM stereo tuner pack & instruction manual • Talkline • Tone selector • Cr02/Metal/Normal tape selector • LED operation indicator • Built-in microphone • Stop/eject, play, rewind/review, fast forward/cue, tape/radio selector functions • Vol. control • Ext. power input jack • Headphone jack • Auto-stop mechanism (shuts off player when tape ends) • Anti-rolling mechanism (prevents sound from quivering when walking, jogging, etc.) • Weight: 13 oz. • Requires 4 AA batteries (not included) • Size: 6"L x 4"W x 1-1/8"H

Model TWF-802 .... **$69.95**
AM3-4 AA Alkaline Batteries .... 4/$3.95

UTIC

Mini Stereo AM/FM Receiver

WITH HEADPHONES
For Joggers, Cyclists, Skaters & Sports Events



FEATURES: Lightweight headphones. Left/right balance control. Full fidelity stereo sound. Additional black soft carrying case and shoulder strap. Belt clip (hands free). Operates on 3 AA cell batteries (not incl. - see below). Compact size: 3-1/8"H x 4-7/8"L x 1"D. Wt. 6 oz.

Model 2830 .... **$29.95**
AM3-3 AA Alkaline Batteries .... 3/$2.95

KEYBOARDS — POWER SUPPLIES

16⅝"L x 5¼"W x 1⅝"H

MICRO SWITCH 69-KEY KEYBOARD
Data Entry Keyboard, Encoded Output: 8-bit Parallel EBC DIC. Switching: Hall Effect, 24-pin Edge Card Connection. Complete w/Pin Connection. Can easily be modified to ASCII code.
Part No. KB69SD12-2 (Fits into DTE-20 Enclosure) .... $19.95 each

23"L x 5¾"W x 1-3/8"H

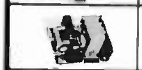
MICRO SWITCH 85-KEY KEYBOARD
Word Processing Keyboard, 26 Pin Edge Card Connection. Supply Voltage +5VDC. Main Keyboard is QWERTY. Additional Key Pads for Cursor and word processing functions.
Part No. 85SD18-1 .... $29.95 each

18⅛"L x 5¾"W x 1⅞"H

MICRO SWITCH 88-KEY KEYBOARD (PARALLEL)
Data Entry Keyboard used in a Diablo 1640 Terminal. Supply Voltage: +5V, -12V. Switching: Hall Effect — 10-pin Edge Card Connection. Schematic included. Uses 8048 Encoder Chip.
Part No. 88SD22 (Fits into DTE-20 Enclosure) .... $69.95 each

POWER SUPPLY +5VDC @ 1 AMP REGULATED *Transaction Tech*
Output: +5VDC @ 1A (also +30VDC) reg. Input 115VAC 60Hz. 2-tone (black/beige) self-enclosed case. 6 ft., 3 cond. black power cord. 5½"W x 7"D x 2¼"H. Wt. 3 lbs. Data sheet incl.
Part No. PS51194 .... $19.95 each

POWER SUPPLY +5VDC @ 1 AMP REGULATED *B Industries*
Output: +5VDC @ 1 amp, +36-42VDC adj. 400mA or less. 30VAC (Isol.) @ 1.5 amp. Input 115VAC 60Hz. Circ. brkr. re-set button. Blk. self-encl. case w/4 rubber feet. 6 ft. 3 cond. blk. pow. cord. On/off switch. 6¾"W x 7¼"D x 3-7/8"H - wt. 7 lbs. Data sheet included.
Part No. PS407D .... $24.95 each

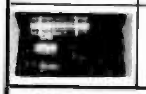


POWER SUPPLY +5VDC @ 3 AMP REGULATED *Oaltron*
Input: 115VAC, 47-440Hz. Output: 5VDC Adjustable @ 3 amp, 6VDC @ 2.5 amp. Adjustable current limit, Ripple & Noise: 1MV rms, 5MV p-p — 2 mounting surfaces. UL recognized. Size: 4"W x 4½"L x 2-7/16"H - wt. 2 lbs. Data sheet included.
Part No. OPS-1 .... $29.95 each

MULTI-VOLTAGE POWER SUPPLY +5, +12, —12VDC REGULATED
Input: 105-125VAC, 47-63Hz/205-250VAC, 47-63Hz. Output: +5VDC @ 2 amps Adj., 5VDC @ 50mA Fixed, +12VDC @ 1 amp Adj., —12V @ 2 amp adj. Overvoltage protection. Size: 12½"L x 4-7/8"W x 3¾"D. Data sheet included.
Part No. RA0250 .... $39.95 each

POWER SUPPLY +5VDC @ 7.5 AMP, 12VDC @ 1.5 AMP SWITCHING
Input: 115VAC, 50-60Hz @ 3 amp/230VAC, 50Hz @ 1.6 amp. Fan volt./power supply select switches (115/230VAC). Output: 5VDC @ 7.5 amp, 12VDC @ 1.6 amp. 8 ft. blk. pow. cord. 11½"W x 13¼"D x 3¾"H. Wt. 6 lbs.
Part No. PS94V0 .... $49.95 each

POWER SUPPLY 4-Channel Switching Power Supply
Microprocessor, mini-computer, terminal, medical equipment and process control applications. Input: 90-130VAC 47-440Hz. Output: +5VDC @ 5A, -5VDC @ 1A; +12VDC @ 1A, -12VDC @ 1A. Line reg.: ±0.2%. Ripple: 30mV p-p. Load reg.: ±1%. Overcurrent protection. Adj: 5V main output ±10%. 6-3/8"L x 1-7/8"W x 4-15/16"H. Wt. 1½ lbs.
Part No. FCS-604A .... $69.95 each



POWER SUPPLY Adjustable Switching 4-24VDC to 5 Amps
Adj. 4-24VDC; 5VDC @ 5A, 6VDC @ 4.8A, 9VDC @ 4.1A, 12VDC @ 3.3A, 18VDC @ 1.9A, 24VDC @ .5A. Overvoltage Protection. Input: 115VAC 50/60Hz. Output variations within 20mV. 8.25"L x 4.25"W x 2.25"H. Wt. 3.25 lbs.
JE224 Kit .... $79.95 each
JE224A Assembled & Tested .... $99.95 each

SORENSEN Regulated Power Supplies

SOC 2-8 (Pictured)

Sorensen's open construction (SOC) power supplies are series-regulated solid-state systems, designed to provide reg. DC voltages at 6 levels (2-28 v/range). These units are open-framed on sturdy black anodized aluminum for excellent mounting.

FEATURES: 115/208/230VAC input @ 50-63Hz. Low Ripple: 1.5mVrms, 5mV P-P maximum. Adjustable current limit. Voltage adjustment control. All schematics and specifications supplied with unit. Series A,B,C,E have three mounting surfaces (Series F, bottom mounting only).

Part No.	Series	Output Voltage Adjustment Range min.	max.	Output Current (Adc) 40°C	50°C	60°C	Size (inches)	Weight	Price
SOC 2-8	B	1.9	2.1	8.0	4.9	3.8	8.62 x 4.88 x 2.80	4.2 lbs.	[illegible]
SOC 2-75	B	1.9	2.1	25.0	21.5	17.6	16.00 x 4.88 x 4.26	[illegible]	[illegible]
SOC 5-18	C	4.26	5.25	18.0	15.0	12.0	16.00 x 4.88 x 2.76	12 lbs.	[illegible]
SOC 5-28	B	4.26	5.25	28.0	21.8	17.6	16.00 x 4.88 x [illegible]	16 lbs.	[illegible]
SOC 12-11	B	11.4	12.6	11.0	9.2	6.6	14.00 x 4.88 x 1.82	13 lbs.	[illegible]
SOC 18-5	C	14.25	18.75	8.0	6.2	2.8	7.00 x 4.88 x 2.37	6.6 lbs.	[illegible]
SOC 18-8.5	B	14.25	18.75	9.6	7.6	5.6	16.00 x 4.88 x 1.82	12 lbs.	[illegible]
SOC 18-13	B	14.25	18.75	13.0	10.8	8.0	16.00 x 4.88 x 4.88	[illegible]	[illegible]
SOC 28-8.8	B	26.6	29.4	8.8	6.4	[illegible]	[illegible]	[illegible]	[illegible]

BUG BOX™ — 30 individual compartments • Stores 60 8-pin or 30 14- or 16-pin DIPs • Heavy duty injection molded plastic • Clear plastic cover slides & locks • Cover marked w/numbers 1-30 • Compartment size: 1" x 3.75" x .5" deep • Box size: 4.9" x 3.3" x .6" • Weight: 1.75 oz.

BUG BOX™
Please specify color code: (B) Blue, (R) Red, (W) White, (Y) Yellow

Part No./Color Code	QTY	PRICE
BGX-001-( )	1	$ 2.29
BGX-010-( )	10	19.99
ANTI-STATIC		
BGX-001-( )AS	1	$ 3.29
BGX-010-( )AS	10	28.89

BUG CAGE™ — 12 locations store Bug Boxes, Big Bug Boxes or Bug Trays • Modular and interlocking • Heavy duty injection molded plastic • Each cage has 6 slip-on locations • 2 cages per pkg. • Cage size: 5-1/8" x 5" x 3-7/8" • 4 colors available — please specify color code (B) Blue, (R) Red, (W) White, (Y) Yellow

Part No./Color Code		Price
BGC-001-( )	2 Cages (6 loc. ea.)	$11.95/pkg.

BUG TRAY™ — Stores in Bug Cage • Molded plastic • Three styles: Open (1 compartment 3.05" x 4.6" x .6"); Vertical (5 compartments .5" x 4.6" x .6"); and Horizontal (8 compartments .4" x 3.95" x .6") • Ideal for tools, hardware, components, etc. • Tray size: 3.55" x 5.05" x .6" • Black color only

PART NO.	DESCRIPTION	PRICE
BTH-001	Horizontal Bug Tray	$1.95
BTV-001	Vertical Bug Tray	1.95
BTO-001	Open Bug Tray	1.95
BTX-003	1 of each Bug Tray (3)	4.98

BUG BOX™ STORAGE SYSTEMS

BUG CAGE™ (BGC-001-___) with Bug Boxes

LSI BIG BUG BOX™ — Designed to store large IC's, Resistors, Capacitors and Diodes • Divided into three compartments measuring 1" x 4.15" x .5" deep • Three vertical and three horizontal dividers included • Heavy duty injection molded plastic • Box size: 4.9" x 3.3" x .6" • Weight: 1.75 oz.

LSI BIG BUG BOX™
Please specify color code: (B) Blue, (R) Red, (W) White, (Y) Yellow

PART NO./COLOR CODE	QTY	PRICE
BLX-001-( )	1	$ 3.29
BLX-010-( )	10	28.79
ANTI-STATIC		
BLX-001-( )AS	1	$ 4.29
BLX-010-( )AS	10	37.89

BACK PACK™ — Self-adhesive labels for the back of ICs • Shows exact internal logic in relation to IC pins • 532 labels in each package (including several blank labels) • Each package for 8, 14, 16, 24, 28 and 40-pin ICs • Combo package includes 1,068 labels for TTL and CMOS ICs • Microprocessor package contains 744 labels

Part No.	Description	Price
BPT-012	TTL	$7.95
BPC-012	CMOS	8.95
BPM-012	Combo	14.95
BPU-012	Microprocessor	9.95

JUMPER AND CABLE ASSEMBLIES

Custom Jumpers! *Custom Cables!*

STANDARD DIP JUMPERS

All jumpers use low profile dip plugs with heavy duty pins for repeated disconnect applications.

JAMECO Part No.	AP Cross-Reference	No. Pins	Description	Wire Length	Price
DJ14-1	924102 12	14	single end	12"	$1.79
DJ14-2	924102 24	14	single end	24"	2.05
DJ14-3	924102 36	14	single end	36"	2.35
DJ14-1-14	924108 12	14	double end	12"	2.95
DJ14-2-14	924108 24	14	double end	24"	3.19
DJ14-3-14	924108 36	14	double end	36"	3.49
DJ16-1	924112 12	16	single end	12"	1.89
DJ16-2	924112 24	16	single end	24"	2.19
DJ16-3	924112 36	16	single end	36"	2.59
DJ16-1-16	924116 12	16	double end	12"	2.95
DJ16-2-16	924116 24	16	double end	24"	3.29
DJ16-3-16	924116 36	16	double end	36"	3.59
DJ24-1	924122 12	24	single end	12"	2.69
DJ24-2	924122 24	24	single end	24"	3.19
DJ24-3	924122 36	24	single end	36"	3.59
DJ24-1-24	924126 12	24	double end	12"	4.49
DJ24-2-24	924126 24	24	double end	24"	4.95
DJ24-3-24	924126 36	24	double end	36"	5.39
DJ40-1	924132 12	40	single end	12"	5.39
DJ40-2	924132 24	40	single end	24"	6.19
DJ40-3	924132 36	40	single end	36"	6.89
DJ40-1-40	924136 12	40	double end	12"	9.49
DJ40-2-40	924136 24	40	double end	24"	10.29
DJ40-3-40	924136 36	40	double end	36"	10.95

STANDARD DB25 SERIES CABLES

Now you can order DB25 P or S connectors with the cable necessary to fit your application. Choose from our standard flat cable in 4 foot lengths. **Call today.**

STANDARD CABLES

Part No.	Cable Length	Connectors	Price
DB25P-4	4 feet	1-DB25P	$7.95
DB25S-4	4 feet	1-DB25S	8.49
DB25P-4-P	4 feet	2-DB25P	13.49
DB25P-4-S	4 feet	1-DB25P/1-DB25S	13.75
DB25S-4-S	4 feet	2-DB25S	13.95

$10.00 Minimum Order — U.S. Funds Only
California Residents Add 6½% Sales Tax
Postage — Add 5% plus $1.50 Insurance
Send S.A.S.E. for Monthly Sales Flyer!

Spec Sheets — 30¢ each
Send $1.00 Postage for your
FREE 1983 JAMECO CATALOG
Prices Subject to Change

Mail Order Electronics • Worldwide

Call for Quantity Discounts

Jameco ELECTRONICS

NEW! Telex Number Telex 176043

1355 SHOREWAY ROAD, BELMONT, CA 94002
PHONE ORDERS WELCOME — (415) 592-8097

12/82 ✓38

5¼" Mini-Floppy Disc Drive

FOR TRS-80 MODEL I (Industry Standard)

Pertec Computer Corp.

Features single or double density. Recording mode: FM single, MFM double density. Power: +12VDC (±0.6V) 1.6 amps max., 5VDC (±0.25V) 0.8 amps max. Unit as pictured at left (does not incl. case, power supply or cables). 30-page data book included. Weighs 3½ pounds. Size: 5¾"W x 8"D x 3¼"H

Limited Quantity!

Part No.	Price
FD200	$179.95
Single-sided, 40 tracks, 250K bytes capacity	
FD250	$199.95
Double-sided, 35 tracks, 438K bytes capacity	

EXPAND YOUR TRS-80

to 16K, 32K, or 48K

**Model 1 = From 4K to 16K Requires (1) One Kit
Model 3 = From 4K to 48K Requires (3) Three Kits
Color = From 4K to 16K Requires (1) One Kit

**Model 1 equipped with Expansion Board up to 48K Two Kits Required — One Kit Required for each 16K of Expansion —

TRS-80 16K Conversion Kit

Kit comes complete with 8 each MM5290 (UPD416/4116) 16K Dynamic RAM (*ns) and documentation for conversion.

TRS-16K2 *150ns $14.95
TRS-16K3 *200ns $12.95
TRS-16K4 *250ns $10.95

TRS-80 Color 32K or 64K Conversion Kit

Kit comes complete with 8 ea. 4164-2 (200ns), 64K Dyn. RAMs & conversion documentation. Converts TRS-80 color computers from 4K-32K Memory or 16K-64K Memory.

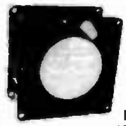
TRS-64K2 (200ns) $54.95

Universal Computer Keyboard Enclosure

"DTE" Blank Desk-Top Enclosures are designed for easy modification. High strength epoxy molded end pieces in mocha brown finish. Sliding rear/bottom panel for service/component access. Top/bott. panels .080" thick alum. alodine type 1200 finish (gold tint color) for best paint adhesion after modification. Vented top & bottom panels for cooling efficiency.

DTE-20 Panel width 20" **$34.95**

Sprite-style Fan



• 36cfm free air delivery
• 3.125" sq. x 1.665" depth
• 10 yrs. cont. duty at 20°C
• 115V 50/60Hz
• For Apple users

Metal Frame

PWS2107U Cleaned & tested (used) .... $ 9.95 ea.
*PWS2107F New .... $14.95 ea.

Muffin-style Fan

• 105cfm free air delivery
• 4.68" sq. x 1.50" depth
• 10 yrs. cont. duty at 20°C
• Impedance protected, ambients to 70°C
• 115V 50/60Hz 14W Wt. 17 oz.

Metal Frame

MU2A1-U Cleaned & tested (used) .... $9.95 ea.
*MU2A-1N New .... $14.95 ea.

JOYSTICKS

JS-5K (Pictured)

JS-5K	5K Linear Taper Pots	$5.25
JS-100K	100K Linear Taper Pots	$4.95
JS-150K	150K Linear Taper Pots	$4.75
JVC-40	40K (2) Video Controller in Case	$4.95

UV-EPROM Eraser

8 Chips — 51 Minutes

1 Chip — 37 Minutes

Erases 2708, 2716, 2732, 2764, 2516, 2532, 2564. Erases up to 8 chips within 51 minutes (1 chip in 37 minutes). Maintains constant exposure distance of one inch. Special conductive foam liner eliminates static build-up. Built-in safety lock to prevent UV exposure. Compact — only 9.00" x 3.70" x 2.60". Complete with holding tray for 8 chips.

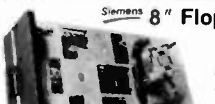
UVS-11EL Replacement Bulb **$16.95**
DE-4 UV-EPROM Eraser **$79.95**

Wall Transformers AC and DC Types

AC250 (Pictured)

Part No.	Input	Output	Price
AC 250 (above)	117V/60Hz	12VAC 250mA	$3.95
AC 500	117V/60Hz	12VAC 500mA	$4.95
AC1000	117V/60Hz	12VAC 1 amp	$5.95
AC9004	117V/60Hz	9.2VAC 2.5 amp	$3.95
DC 800	120V/60Hz	8VDC 400mA	$1.95
DC6912	120V/60Hz	6,9,12VDC 300mA	$8.95
DC5490	117V/60Hz	9.5VDC 275mA	$2.95
DC900	120V/60Hz	9VDC 500mA	$3.95
DC1200	120V/60Hz	12VDC 300mA	$2.95
DV9200	117V/60Hz	9VAC 200mA	$3.25

Siemens 8" Floppy Disk Drive



• Single-Sided
• 77 Tracks
• 400/800K Bytes Capacity
• Industry Standard

The **FDD100-8 8" Floppy Disk Drive** (Industry Standard) features single or double density. Recording mode: FM single, MFM double density. Transfer rate: 250K bits/sec. single density; 500K bits/sec. double density. The FDD100-8 is designed to work with the single-sided soft sectored IBM Diskette I, or eq. disk cartridge. Hard-sectored option available. Power: 115/230VAC @ 50-60Hz, +24VDC @ 1.7 amps max., +5VDC @ 1.2 amps max. Unit as pictured above (does not include case, power supply, or cables). Size: 8.55"W x 14"L x 4.5"H. Weighs 12 lbs. Incl. 96-pg. manual.

Part No.		Price
FDD100-8	Buy 1 for	$269.95 each
FDD100-8	Buy 2 for	$259.95 each
FDD100-8	*Buy 10 for*	**$249.95 each**

✓See List of Advertisers on page 130

PROPAGATION

J. H. Nelson
4 Plymouth Dr.
Whiting NJ 08759

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	7A	7	3A	3A	3A	7	7	14	14	21	21A
ARGENTINA	14	7	7B	7B	7B	7	14	14	21A	21A	21	21
AUSTRALIA	21	14	7B	7B	7B	7B	7B	14B	14A	21	21	21A
CANAL ZONE	7	7	7	7	7	7	7A	14	21	21A	21	14
ENGLAND	7	7	7	3A	7	7B	14	14A	21A	14A	7A	7
HAWAII	21	7A	7B	7	7	7	7	7B	14	14A	21	21A
INDIA	7B	7B	7B	7B	7B	7B	14	14A	14	7B	7B	7B
JAPAN	14A	14B	7B	7B	7	7	7	7B	7B	7B	14B	14
MEXICO	14	7	7	7	7	7	7	14	14A	21A	21A	21
PHILIPPINES	14A	7B	7B	7B	7B	7B	7B	7B	14B	14B	14B	14
PUERTO RICO	7A	7	7	7	7	7	7A	14A	21A	21A	21	14
SOUTH AFRICA	7A	7B	7B	7B	7B	7A	14	21	21A	21A	21	14A
U.S.S.R.	7	7	3A	3A	7B	7B	14	21A	14A	14	7B	7
WEST COAST	14A	7A	7	7	7	7	7	14	21	21A	21A	21

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14A	7	7	3A	3A	3A	7	7	7A	14	21	21A
ARGENTINA	14	14	7	7B	7B	7	7A	14	21	21A	21A	21
AUSTRALIA	21	14	7B	7B	7B	7B	7B	7B	14	14	21A	21A
CANAL ZONE	14	7	7	7	7	7	7	14	21	21A	21A	14
ENGLAND	7	7	7	3A	7	7	7B	14	21A	14	7B	7B
HAWAII	21A	7	7	7	7	7	7	7	14	21	21A	21A
INDIA	7B	7B	7B	7B	7B	7B	7B	14B	14B	7B	7B	7B
JAPAN	21A	14	7B	7B	7B	7	7	7	7B	7B	14	21
MEXICO	14	7	7	7	7	7	7	14	14A	21A	21A	21
PHILIPPINES	21	14	7B	7B	7B	7B	7B	7	7B	7B	14B	14
PUERTO RICO	14	7	7	7	7	7	7	14	14A	21A	21A	14A
SOUTH AFRICA	7	7B	7B	7B	7B	7B	7	14	21A	21A	21	14
U.S.S.R.	7B	7	3A	3A	7	7B	7B	14A	14A	14B	7B	7B

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21A	7A	7	3A	3A	3A	3A	3A	7	14	21	21
ARGENTINA	21A	14	7	7B	7B	7B	7B	14	21	21	21A	21A
AUSTRALIA	21A	14	7A	7	7B	7B	7B	7B	14	14	21	21A
CANAL ZONE	21	14	7	7	7	7	7	14	14	21A	21A	21
ENGLAND	7B	7	7	3A	7	7	7B	14B	21	14A	14B	7B
HAWAII	21A	14	14	7	7	7	7	7	14	21	21A	21A
INDIA	7B	14	7B	7B	7B	7B	7B	7B	7A	7B	7B	7B
JAPAN	21A	14	7B	7B	7	7	7	7	7	7B	14	21
MEXICO	21	14	7	7	7	7	7	7A	14	21A	21A	21
PHILIPPINES	21A	14	7B	7B	7B	7B	7B	7B	7B	14	14	14
PUERTO RICO	21	7	7	7	7	7	7	14	21	21A	21A	21
SOUTH AFRICA	7	7B	7B	7B	7B	7B	7B	14	21	21A	21	14
U.S.S.R.	7B	7B	3B	3B	7B	7B	7B	7B	14	14B	7B	7B
EAST COAST	14A	7A	7	7	7	7	7	14	21	21A	21A	21

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
 # = Chance of aurora.

NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST.

DECEMBER

SUN	MON	TUE	WED	THU	FRI	SAT
			1 F/F*	2 F/F	3 F/G	4 F/G
5 G/G	6 G/G	7 G/G	8 G/G	9 G/G	10 G/G	11 F/G
12 G/G	13 G/G	14 G/G	15 G/G	16 G/G	17 F/F	18 F/F*
19 P/P*	20 P/F*	21 P/F	22 P/F	23 F/G	24 F/G	25 F/G
26 F/F	27 F/F	28 F/F	29 F/F	30 F/G	31 F/G	

World Class Performance and Features

The FT-ONE is the culmination of an all-out design project by Yaesu's top engineering team. Working without the usual cost constraints, Yaesu's design group is proud to unveil the instrument they "always wanted to design," a revolutionary blend of computer and RF technology.

GENERAL COVERAGE, ALL SOLID STATE

The FT-ONE is a full-coverage all-mode transceiver, equipped for reception on any frequency between 150 kHz and 29.99 MHz, with transmit coverage on all nine present and proposed amateur bands. In countries where permitted, the FT-ONE may be programmed to transmit throughout the 1.8-29.99 MHz range.

KEYBOARD FREQUENCY ENTRY

Fully digitally synthesized, the FT-ONE uses a front panel keyboard for initial frequency entry. Frequency change is then accomplished via the main tuning dial or the pushbutton scanner, with tuning in either 10 Hz or 100 Hz steps possible. Truly the contester's dream, the FT-ONE permits extremely fine tuning and instantaneous band change with equal facility.

DUAL VFO SYSTEM

Ten digital VFO's with memory are provided, in conjunction with an A-B selection scheme that allows instant recall of any transmit, receive, or transceive frequency desired. For split-frequency operation, such as on 7 MHz SSB, the operator may select TX on VFO-A and RX on VFO-B, automatically storing the calling and listening frequencies for each pile-up. For net operations, a non-volatile memory board is available as an option, to eliminate the possibility of dumping memory.

FULL CW BREAK-IN

Recent advances in solid-state technology have finally made full CW break-in reliable enough to be incorporated into a Yaesu product. Now you can select traditional semi-break-in (for use with amplifiers not equipped for full break-in) or full high-speed break-in. When using amplifiers so equipped, the keyer output lead may be interrupted via a rear panel jack and routed to the break-in sequencing input on your amplifier.

SWITCHING REGULATOR POWER SUPPLY

Extremely compact and light in weight, the switching regulator power supply reduces substantially the space required to produce the operating voltages used in the FT-ONE. Highly efficient and uniquely stable, the switching regulator supply provides superb reliability in a field of design long neglected by amateur manufacturers.

ELITE CLASS PERFORMANCE FEATURES

In addition to the full break-in and superb receiver filters, Yaesu's design team packed the FT-ONE with subtle virtues that others might have overlooked. Rear panel jacks allow the use of both an external receiver and an independent receive antenna, such as a 160 meter Beverage. While scanning, automatic halting on a received signal may be programmed. . . perfect for watching a band for openings. If you're a DX-peditioner, an optional Curtis 8044 keyer board is available, so you won't need an external keyer that only wastes suitcase space. And if your amplifier fan is louder than it should be, there's even a microphone squelch (AMGC) to reduce background noise pickup between words and sentences!

ONE YEAR FACTORY WARRANTY

Because of the level of attention to design detail, parts selection, and factory quality control, your FT-ONE is backed by a one-year *factory* warranty for the original purchaser at retail. Prompt and meticulous attention to your warranty needs will be provided by our Ohio And California Service Centers. In addition, all units sold in the United States will be inspected and tested after clearing Customs, and will include a Service Manual in the puchase price.

GAIN/INTERCEPT OPTIMIZED RECEIVER FRONT END

Utilizing up-conversion with a first IF of 73 MHz, the FT-ONE RF amplifier stage uses push-pull power transistors configured to produce a typical output intercept of +40 dBm. The first mixer utilizes a diode ring module followed by a low noise post amp, for optimum noise figure consistent with modern day intercept requirements. The result is a receiver with a typical two-tone dynamic range well in excess of 95 dB (14 MHz, CW bandwidth). Additional gain tailoring is provided via a PIN diode attenuator controlled from the front panel.

FILTERS READY FOR COMPETITION

Three filter bandwidths are available for CW operation (two for FSK!), using optional 600 Hz or 300 Hz crystal filters. Filter insertion losses are equalized for constant IF gain. Both IF Shift and Variable Bandwidth are provided, and two CW filters may be cascaded, for competition-grade selectivity. For SSB work, the Variable Bandwidth feature eliminates the need for costly 1.5 kHz or 1.8 kHz filters, as any intermediate bandwidth may easily be programmed using the standard, cascaded SSB filters. To top it all off, a high-performance audio peak and notch filter is standard equipment.

EXPANDED OPERATING DISPLAYS

Digital displays for the VFO Frequency, memory channel, and RIT offset are provided for quick frequency identification. The large front panel meter provides easy viewing of transceiver operating parameters, including final transistor collector current, input DC voltage, FM discriminator center tuning, speech processor compression level, and forward/reflected relative power.

NOT AVAILABLE AS OPTIONS

It's hard to believe that other manufacturers still insist on making such essential items as a noise blanker or speech processor extra-cost options. We find that these are less expensive to incorporate and more reliable in operation when installed on our assembly line. No AC power supply is available as an option for the FT-ONE, either; it's equipped for operation from 100/110/117/200/220/234 volts AC or 13.5 volts DC. And it goes without saying that there will not be an external VFO offered for the FT-ONE — we're confident that ten VFO's are quite enough!

**Experience the FT-ONE in your Authorized Yaesu Dealer's showroom today.
This may be the last Amateur transceiver you will ever own.** ✓83

Warranty policy available upon request. SASE, please.

Specifications subject to change without notice or obligation.