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***ALL* FILTERS INCLUDED:** 4-position CW/SSB filter (150 Hz bandwidth with 3 selectable skirt contours) plus 8-pole Crystal filter (2.4 kHz bandwidth, 1.8 shape factor.)

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THIS MONTHS HORIZONS

The Green Keys Of RTTY

One of our oldest forms of communications — the printed word — is being used by countless Amateurs for rag-chewing, message handling, contest operation, and just plain noodling around. It's a fascinating part of our hobby that is still evolving from the mechanical wonder of the early days to the almost computer-like quiet and speed of today. Author Blakeslee explores the history of Amateur RTTY, shows you what makes the machines print, and gives you a hint of the future, starting on page 12.

Hilltopping In The Olden Days

This story by N4BZ is based on true incidents in the early 1960s, when 6-meter a-m was the "in thing" and mountains weren't littered with repeaters. The message: hams are pretty much the same as people who like people. Read and enjoy.

Low-Cost Filter

Some TV fm interference can be cured by simply attenuating the unwanted signal with a tuned trap. Here's one that is very low in cost, and easy to assemble. It's in the form of a twinlead sandwich to fit over the antenna lead to the TV set, and will take only a few minutes to build and tune. You might want to make several, and get rid of a lot of signals that bother your reception.

Flea Market

We've all suffered the agonies of uncertainty over those terrific buys at the Hamfest flea market, and many of us went for the deal anyway. How about you? Was the bargain a good one or a cause for regret? Or perhaps you haven't yet tried your hand at filling your shack with any of the goodies from the local club auction. Either way, these words of wisdom from author W8FX can make the experience less worrisome, and perhaps the equipment can be salvaged after all.

Leak Detector

Tubes, and equipment that uses them, will be with us for a while yet, but few Amatuers have a tester nearby to find the bad actors. Few troubles are as obvious as a filament that will not light; many problems are caused by internal high-resistance paths between elements — and here is a checker you can build which will locate a lot of troubles. It'll come in handy when you bring home the results of that "find" at a flea market, or when the old super-blooper is feeling poorly. It's an inexpensive gadget, too.

Those Mysterious Controls And Switches

Does the panel of that new piece of equipment seem to make as much sense to you as the cockpit of a jetliner? Relax . . . most of them are harmless, and they are easy to live with if you look at them and their purpose one at a time. Here's an alphabetical run-down of what they are supposed to do, and what part of the circuit they're in. Some controls even try to hide under several aliases, but author W1SL unmasks them too. Read about it on page 48, and approach your hamshack with new confidence.

The Cover

There's a current cliche in advertising that states in part "You've come a long way . . ." and it comes close to the mark in the RTTY field as well. From the early days of a noisy, clanking, house-shaking monster that endeared itself to people who loved things mechanical to the newest terminals that make scarcely a sound and need not a drop of oil is a brief span of years, but a tremendous bridge of engineering. Author N1RM talks about this transition of the "Green Keys," starting on page 12. Photograph by W1NLB.

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For $159.95 you can run up to 1.5 KW PEP and match everything from 1.8 thru 30 MHz: coax, balanced line, random wire. Built-in balun. SWR, dual range forward and reflected power meter. Flexible six position antenna switch. Outstanding value.

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The NEW MFJ-962 1.5 KW Versa Tuner III lets you run up to 1.5 KW PEP and match any feedline continuously from 1.8 to 30 MHz: coax, balanced line or random wire.

This gives you maximum power transfer to your antenna for solid QSO's and attenuates harmonics to reduce TVI and out-of-band emission.

An accurate meter gives SWR, forward, reflected power in 2 ranges (2000 and 200 watts).

A flexible six position antenna switch lets you select 2 coax lines thru tuner or direct, or random wire and balanced line.

A new all metal, low profile cabinet gives you RFI protection, rigid construction, and sleek styling. Black finish. Black front panel has reverse lettering. 5x14x14 inches. A flip down wire stand tilts tuner for easy viewing.

Efficient, encapsulated 4:1 ferrite balun. 500 pf, 6000 volt capacitors, 12 position inductor. Ceramic rotary switch. 2% meter.

Built-in quality. Every single unit is tested for performance and inspected for quality. Solid American construction, quality components. One year limited warranty.

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MFJ-961 1.5 KW VERSA TUNER III has balun, six position antenna switch. Matches coax, balanced line, random wire, from 1.8 to 30 MHz.

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Run 1.5 KW PEP. Match any feedline from 1.8 to 30 MHz: coax, balanced line, random wire.

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More details? Ad Check page 78.

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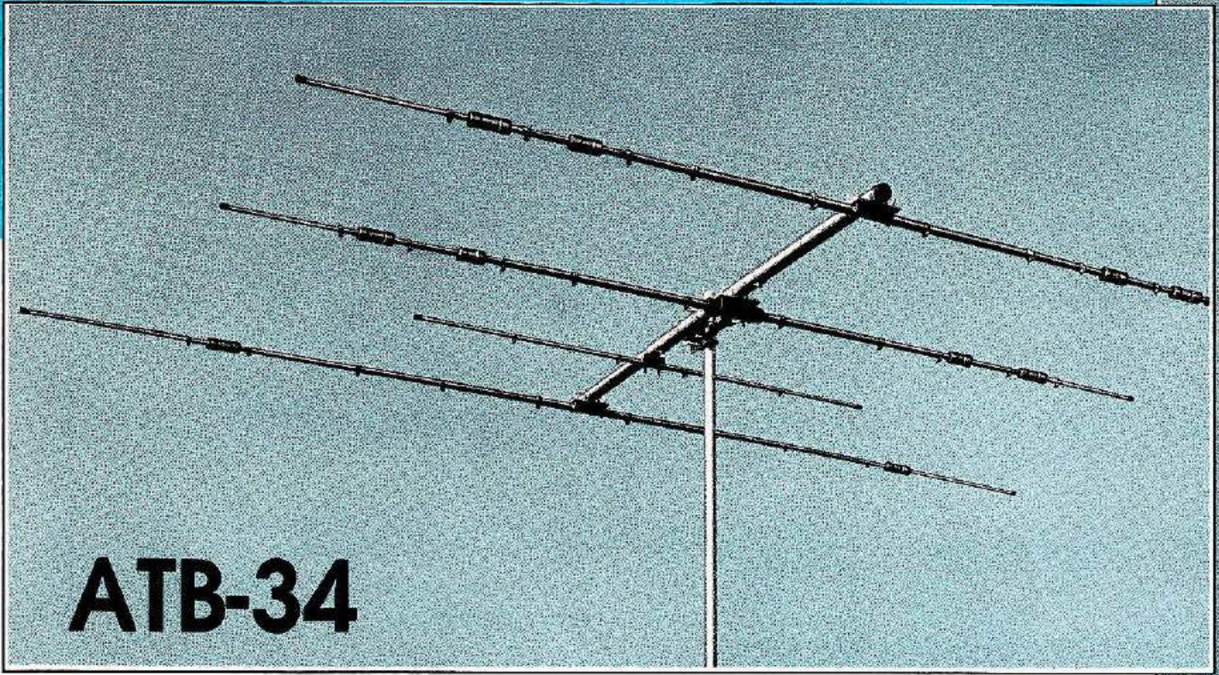

Punch through the pile-ups with an ATB-34. The only three band beam to give you real full size performance. Check ATB-34 element lengths, check the trap design and construction. Check the spacing and the specially developed balun. All of these features add up to the no compromise performance that you expect from Cushcraft.

SPECIFICATIONS

Gain	7.5dBd
F/B Ratio Avg.	24dB
3dB Beam Width	62°
Nominal Impedance	50 ohm
Power Handling	2000 Watts PEP
Boom Length	18′
Longest Element	32′8″
Turning Radius	18′9″
Wind Area	5.4 Ft.2
Weight	42 lbs.
Maximum Mast O.D.	2.5″

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Durability is guaranteed with double wall seamless aluminum base sections and fiberglass high Q traps. If you are interested in local contacts or long path DX communications, a Cushcraft vertical antenna is your best choice.

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10-15-20 Meters	10-15-20-40 Meters	10-15-20-40-80 Meters
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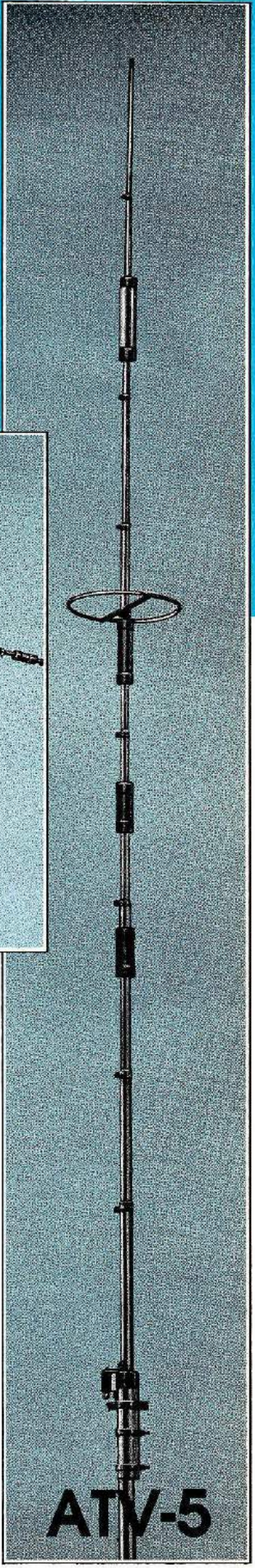

HAM RADIO HORIZONS

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CONTENTS

THE VIEW FROM HERE

Interference on the Amateur bands is something that most of us have learned to live with, at least to a certain extent, but in recent months I have noticed an increasing number of bad operating practices cropping up on our bands. Apparently other Amateurs have been troubled, too, because I have received a number of letters on the subject. None of these practices is new, but they're more offensive because the bands are much more crowded than they used to be. Deliberate interference, tuning up on net frequencies, playing music, calling CQ without listening first, offensive language, incorrect identification (or no identification at all), using a kilowatt when 100 watts is adequate, talking crosstown on 20 meters instead of using vhf-fm — the list could go on and on.

There's no question that our high-frequency bands are crowded, but deliberate and malicious interference, and discourteous operating tactics, aren't going to relieve the situation, any more than elbowing your way to the front of the checkout line at the local supermarket is going to get you anything more than a fat lip! In case you hadn't noticed, everything is more crowded today — the population has exploded, the expressways and turnpikes are jammed, homes are being built on smaller and smaller pieces of land, and even on the remotest trail of the high Sierras it's impossible to escape from the inevitable discarded beer can — practically everywhere you go you find a mass of humanity. It follows that we'll have more and more congestion on the Amateur bands, but congestion doesn't mean bedlam. Zeroing your kilowatt on a QSO or local net is not going to make them move. Why not join them? They'd probably be glad to have you.

Today, there is a net for almost every range of interest — they aren't restricted to handling traffic. Some of the groups that congregate on the bands are not really nets at all, but simply groups of hams who get together for a common purpose. There are DX nets, the county hunters, the early-morning groups on 75 meters, and various single-frequency gabfests. There are technical nets, satellite operators' nets, EME round tables, vhf nets, and, of course, a multitude of local and intercontinental traffic nets, if traffic handling happens to be your *forte*.

If you don't happen to care for net-type operation, fine; there are a good many Amateurs who don't. On the other hand, if there weren't any nets, imagine what the QRM would be like. There are thousands of Amateurs who congregate on particular net frequencies. Since they're a member of a net, they just "read the mail" a good deal of the time. If they didn't have the net, they would be calling CQ, fishing for a new county, or active in one of the horrendous DX pileups. So, when you hear a net in operation, don't use it for a tuneup frequency. Whether you know it or not, the most hedonistic of them will stand to handle emergency traffic if asked to do so. They *all* do a service to the Amateur community by minimizing interference with channelized communications.

Deliberate interference and incorrect identification are only two of the bad operating practices you will find on any band you listen to. You can also hear any number of stations working crosstown on 15 or 20 meters when they should be on 75 or vhf fm. I have often copied W/K stations on 20 meters, running well over S9 in New Hampshire, working their neighbors. With modern linear amplifiers, it's a simple matter to turn off the big box when you don't need it.

Why the big penchant for S9 signal reports, anyway, when you can maintain perfectly adequate QSOs with S6 or S7? You may need your linear for a long-haul DX QSO or for making initial contact, but once communication has been established, 95 per cent of the time you can turn your linear off with absolutely no effect on the QSO. Owning a linear is a bit like carrying an umbrella to work every day — there are times when it's a practical necessity, but just because you own one doesn't mean you have to use it all the time.

I've heard a lot of stations go QRT because of interference and poor operating practices; this is not the answer. If you hear an Amateur on the air with a bad signal, not identifying properly, causing unnecessary interference, or being generally obnoxious, tactfully tell him about it. Most Amateurs are gentlemen and will accept your suggestions with grace.

And, when you go on the air the next time, use operating finesse instead of brute force. Strive to be a first-class operator and encourage your friends to do the same. Let's promote good operating on our bands — discourtesy breeds pandemonium.

Jim Fisk, W1HR
editor-in-chief

Imagine All The Places You Can Tuck ICOM's Remotable IC-280. (Think small.)

The **IC-280** 2 meter mobile comes as one radio to be mounted in the normal manner: but, as an option, the diminutive front one third of the radio detaches and mounts by its optional bracket, while the main body tucks neatly away out of sight. Now you can mount your 2 meter radio in pint-sized places that seemed far too cramped before.

Measuring only 2¼"h x 7"w x 3⅜"d, the bantam-sized microprocessor control head fits easily into the dash, console or glove box of even the most compact vehicle. Or if those places are already taken by the rest of your "mobile shack," the **IC-280** head squeezes into leftover nitches under the dash, overhead, under the seat or even on the steering column.

But don't be misled by the petite size of this subdivided radio: the **IC-280** is jam packed with the latest state of the art engineering and convenience features. No scaled down technology here!

With the microprocessor in the detachable control head, your **IC-280** can store three frequencies of your choice plus the dial, which allows you to select from four frequencies with the front panel switch without taking your eyes off the road. These frequencies are retained in the **IC-280's** memory for as long as power is applied to the radio, even when power is turned off at the front panel switch. And if power is completely removed from the radio the ±600 KHz splits are still maintained!

The **IC-280** works frequencies in excess of the 2 meter band with ICOM's outstanding single-knob tuning, so you can listen around the entire band without fooling with three tuning knobs. With steps of 15 KC or 5 KC, the **IC-280** puts rapid and easy frequency change at your single fingertip and instantly displays bright, easy to read LED's.

Available Options:
- Touch Tone pad/microphone combination, which fits the mic plug on the radio face with absolutely no modification (Fits all ICOM 4-pin mic radios.)
- 15' unassembled cable kit for long distance remote mounting of the detachable control head

IC-280
2 meter FM, 4+MHz
Mobile Transceiver

If you are a newly licensed novice, send for ICOM's catalog and discount purchase coupon. Mail your name, call sign and date of license to your ICOM distributor (see the bottom of this ad).

All ICOM radios significantly exceed FCC regulations limiting spurious emissions.

Specifications subject to change without notice.

IC-280 Specifications: □ Frequency Coverage: 143.90—148.11 MHz □ Operating Conditions: Temperature: −10°C to 60°C (14°F to 140°F), Duty Factor: continuous □ Frequency Stability: ±1.5 KHz □ Modulation Type: FM (F3) □ Antenna Impedance: 50 ohms unbalanced □ Power Requirement: DC 13.8V ±15% (negative ground) □ Current Drain: Transmitting: 2.5A Hi (10W), 1.2A Lo (1W), Receiving: 0.630A at max audio output, 0.450 at SQL ON with no signal □ Size: 58mm(h) x 156mm(w) x 228mm(d) □ Weight: approx. 2.2 Kg □ Power Output: 10W Hi, 1W Lo □ Modulation System: Phase □ Max. Frequency Deviation: ±5 KHz □ Spurious Output: more than 60 dB below carrier □ Microphone Impedance: 600 ohms dynamic or electret condenser type, such as the SM-2 □ Receiving System: Double superheterdyne □ Intermediate Frequency: 1st: 10.695 MHz, 2nd: 455 KHz □ Sensitivity: 1 uv at S+N/N at 30 dB or better, Noise suppression sensitivity 20 dB, 0.6 uv or less □ Selectivity: less than ±7.5 KHz at −6 dB, less than ±15 KHz at −60 dB □ Audio Output: More than 1.5W □ Audio Output Impedance: 8 ohms

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FOCUS & COMMENT

I'm going to take this opportunity to thank a pretty thoughtful bunch of people — the many readers who took the time to do some research and then send me some answers to the mystery of "Smee," in the Maxwell poem in my February, 1979 *Focus and Comment.*

It seems that there are several "Smees." One crossword-puzzle fan noted that it was the four-letter answer to the question, "A German Admiral."

I received some letters and a telephone call with the information that Smee was one name for a particular type of small duck — a duck that did much of its fishing by swimming under water, and that the definition therefore was consistent with the line "Seething through all its depths, like Smee."

One reader sent a photocopy of some pages from an early *Encyclopedia Britannica,* 11th Edition, 1910, which gave a brief description of a "battery" invented by Alfred Smee in 1839. The Smee battery was used largely in telegraphy and electro-metallurgy, according to some pages from "Experimental Science," by Hopkins (Munn & Co., 1890), from the same reader. Other readers quoted different sources, confirming these same points. Marvelous! A sincere thank-you to each and every one.

Now . . . I would like to make an offer you cannot refuse.

Here's a chance to make yourself heard. Starting in one of the next two or three issues of *Ham Radio Horizons,* I would like to publish some "one-liners," if you'll send them in.

By "one-liners," I mean something that you would like to see in the Amateur Radio field. In fact, I think I'll headline these shorties "I would like to see them make . . ."

I'll sprinkle them throughout the magazine, wherever there is a bit of space to fit one or two or three of them in. They don't really have to be just *one* line — some ideas may take two — but that is the goal to shoot for. Certainly, most should be realistic in expectations, but an occasional "far-out" item will not be ruled out, either. You can never tell when someone may read an off-the-wall comment and rush to his laboratory and build the thing!

So, put your thinking caps on and send me some postcards or letters with your own one-liner. Let's see what is lacking in the world of Amateur Radio.

I'll start the ball rolling by saying, tongue-in-cheek, "I'd like to see them make . . . a gadget that would predict the chances of working that rare DX station *before* my alarm clock wakes me up at 4:00 AM.

Thomas McMullen, W1SL
Managing Editor

NOW YOU CAN HAVE BOTH

HIGH QUALITY & LOW COST!

The DS2000 KSR FROM HAL

HAL design experience now makes it possible to offer you an efficient, reliable, and cost effective terminal for your RTTY or CW station. Investigate the new DS2000 KSR from the people who KNOW HOW to build RTTY and CW equipment. See how you can get great performance and save money too!

- *Integrated keyboard and video generator*
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- *24 line display*
- *2 programmable "Here Is" messages*
- *Automatic carriage return and line feed*
- *QBF and RY test messages*
- *Word mode operation, full screen buffering*
- *All 5 standard Baudot speeds*
- *110 and 300 baud ASCII*
- *CW identification at the touch of a key*
- *Morse code transmit*
- *Morse code receive (optional) self tracking speeds from 1-175 wpm on a separate plug-in circuit board (Available June, 1979)*
- *All in a convenient, small cabinet (14.1" x 9.25" x 4.35")*

Price: $449.00

Optional Morse Receive Board: $149.00

Optional 9" monitor: $150.00

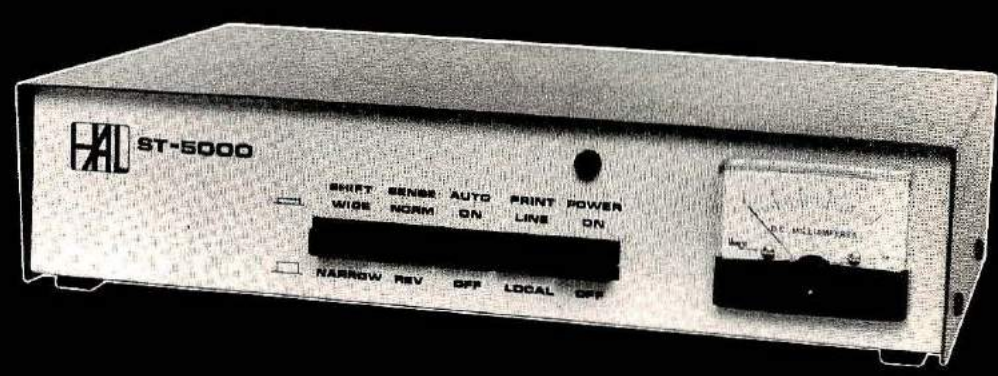
BIG PERFORMANCE

SMALL SIZE. . .SMALL PRICE

If you're looking for an RTTY demodulator with great performance on both the HF and VHF bands, take a look at the ST-5000 from HAL. The use of active filters with no phase-lock loop or 'single-tone' short-cuts ensure the kind of performance you expect. Full features in an attractive and conveniently small package make this demodulator a value that's hard to beat!

- *Hard limiting front end*
- *Active discriminator*
- *Active detector*
- *Wide and Narrow shift (850hz and 170hz)*
- *Normal and Reverse sense*
- *Autostart*
- *Self-contained high voltage loop supply*
- *RS-232C voltage output (direct FSK)*
- *Audio tone keyer (AFSK)*
- *Provision for external tuning scope*
- *Attractive, small cabinet (2.75" H x 8" D x 12" W)*
- *Fully assembled and tested*

Price: $225.00



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See what just some of the many satisfied Hams say about the Wilson Antennas.

THE Wilson GIVE-A-WAY

OFFER EXTENDED FOR 30 DAYS

Wilson Electronics announces a factory authorized rebate program. Here's how it works:

Purchase a TT-45 and a System Three at the same time and Wilson will give you a factory 5% rebate from the price you paid for the package. You can use this to pay for the concrete to install it, or buy the XYL a little something to keep her happy! Or . . we will give you, at no charge, a M-27, the best 7 element, 2M beam available today! The choice is yours to make!

Just send Wilson the receipt of your purchase from your dealer, showing your cost, and let us know what you want — 5% cash, or a M-27. But hurry! This offer expires midnight, May 31, 1979, and receipt must be mailed before July 1, 1979.

Don't wait! See your nearest dealer to take advantage of this great Give-A-Way!

SPECIFICATIONS

TT-45 TOWER

- Maximum height, 45'
- 800 lbs. winch with padlock feature
- 2800 lb. raising cable
- Totally freestanding with proper base
- Total weight, 189 lbs.
  Recommended accessories:
  RBRF-10, SBRF-10, CBRF-10.

The TT-45 is a freestanding tower. Ideal for installations where guys cannot be used. If the tower is not being supported against the house, the proper base fixture accessory must be selected.

SY-3 TRI-BAND ANTENNA

Band MHz	14-21-28	Turning radius	15' 9"
Maximum power input	Legal limit	Maximum mast diameter	2" O.D.
Gain (dBd)	8 dB	Surface area	5.7 sq. ft.
VSWR at resonance	1.3:1	Wind loading @ 80 mph	114 lbs.
Impedance	50 ohms	Assembled weight (approx)	37 lbs.
F/B Ratio	20 dB	Shipping weight (approx)	42 lbs.
Boom (O.D. x length)	2" x 14' 4"	Direct 52 ohm feed or balun	
No. of elements	3	Maximum wind survival	100 mph
Longest element	27' 4"		

M-27 - 7 ELEMENT 2M BEAM

Band MHz	144-148 MHz	Beam width @ 3 dB pt.	27 degrees
Gain	11 dB	Turning radius	37.13"
VSWR	1.2:1	Mast diameter (O.D.)	1" - 1½"
Impedance	50 ohms	Surface area	44 sq. ft.
Boom (O.D. x length)	1" x 64"	Wind loading @ 80 mph	5.5 lbs.
Number of elements	7	Shipping weight (approx)	6.5 lbs.
Longest element	40"	Assembled weight (approx)	3.5 lbs.

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WV-1 SPECIFICATIONS:

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- Taper swaged aluminum tubing
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- Mast bracket furnished
- SWR: 1.1:1 on all bands
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NEWSLINE

AMATEUR RADIO, along with the other services administered by Safety and Special Services, has been "shoved down" a notch in the reorganized "Private Radio Bureau" announced by the FCC. Bureau Chief remains Carlos Roberts, with Arlan van Doorn Deputy Chief. The four divisions making up the bureau are now Rules, George Petrutsas, Chief; Licensing, Richard Everett, Chief; Compliance, Gerald Zuckerman, Chief; and Policy, chief to be announced. Former Personal Radio Division Chief, John Johnston, is now Chief of the Personal Radio Branch of the Rules Division, a position parallel to the one he held under Prose Walker several years ago. With the shifting of the various Amateur Radio and CB responsibilities into the new divisions, only seven people, none of them Amateurs, remain in John's group.

ADDING A "PORTABLE" DESIGNATOR to a callsign has reportedly brought warnings to some Amateurs from FCC field engineers, but, if so, it's a misunderstanding of the rules. The rules change only eliminated the necessity for indicating portable or mobile status but did not prohibit the practice, which is required by some contest rules. Any Amateur cited or warned for signing portable should pursue the matter with the nearest FCC Field Office, or, if necessary, Washington.

AMATEURS WHOSE LICENSES EXPIRE now have five years, instead of one, in which to renew them without retaking the exam. The extended grace period applies only to the operator's license, however; station licenses can be renewed up to only one year after they expire, so any Amateur who waits more than a year after expiration to renew will receive a new callsign appropriate for his license class from the group that is currently being issued.
Code Exam Credit, which could formerly be "redeemed" only at the Field Office at which the test had been taken, can now be used at any Commission Field Office.

INTERNATIONAL SUPPORT for new Amateur HF bands at 10, 18, or 24 MHz seems to be building, with formal submissions supporting one or more of the new slots now confirmed from all three ITU regions. Don't be in too much of a hurry to swap off your present five or six band radios, however. Even if the WARC does authorize new bands for the Amateur Service next summer, it will likely be a matter of years before present users can be moved out and Amateurs will be permitted to move in.

8-BAND WAS has been achieved by K5CM, with — oddly enough — the last holes being on 10 and 40 meters. After finishing up a 2-meter WAS last summer, and already having WAS on 6, Connie realized that he was within striking distance of becoming the first Amateur to earn the WAS award on eight bands. He began working on it in earnest in mid-October, and within three months had all 50 cards for 160 in hand and only a few strays on other bands remaining to be cleaned up.

A NEW 2-METER DX RECORD was set February 13, when SV1DM made contact with ZS6DN in Pretoria at 1810Z over a 7117 km path. It didn't stand long, however, as SV1AB (on the north side of Athens) worked ZS6DN just three days later — February 16 — at about the same time to extend it another 10 km.

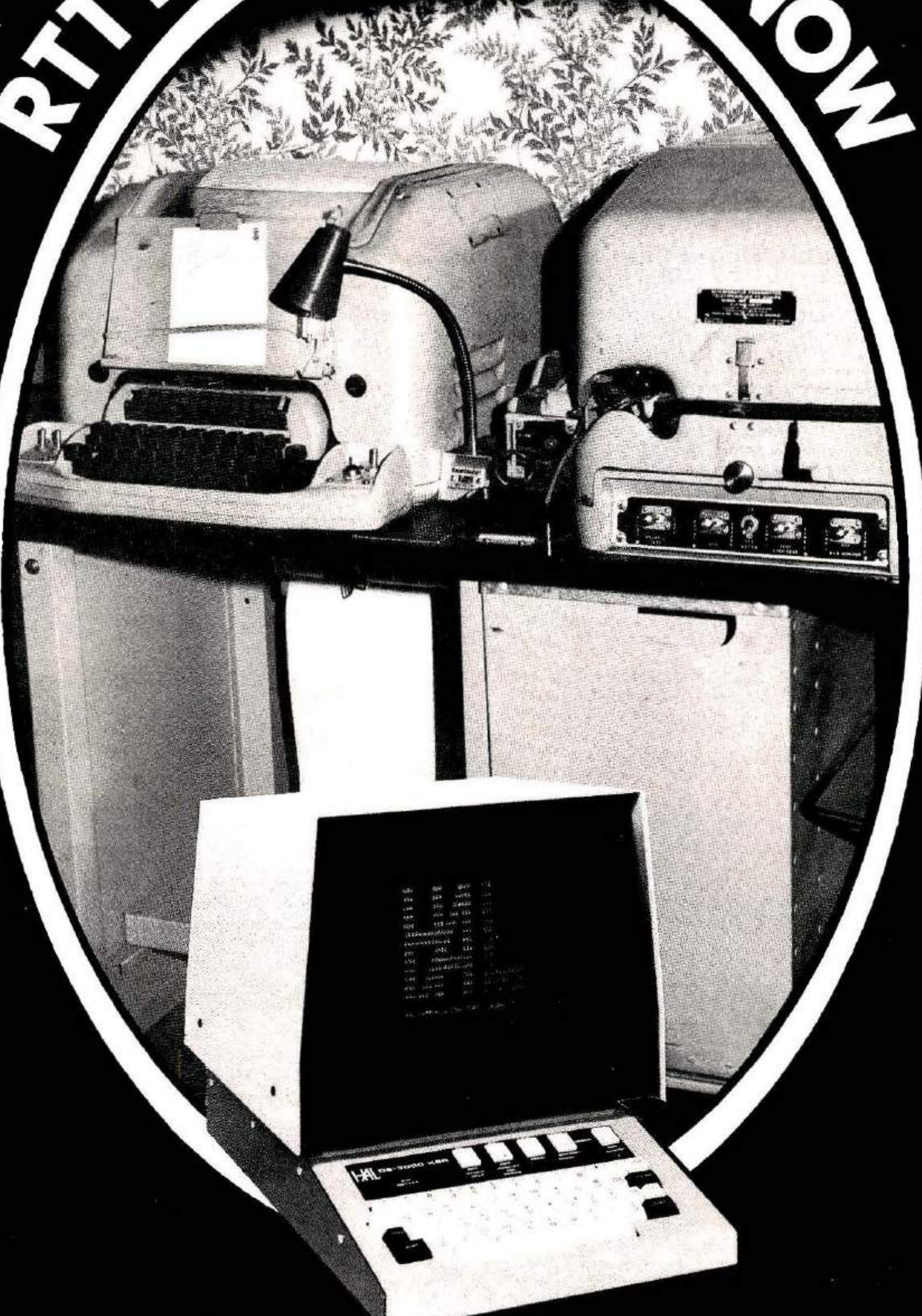
FIRST WORKED ALL CONTINENTS ON 2 meters was completed January 31 by GW4CQT, when he succeeded in working VK5MC via moonbounce at 1132Z. Congratulations on a fine accomplishment.

6-METERS CONTINUES to sound like a prime DXer's band, with PY2XB working six JAs and possibly HL9WI on February 28th, the same day W1QXX/KP4 heard ZL1ACL. On March 3rd JAs were heard working LUs, and 48-MHz South African video was heard in Texas and California. On the 4th, 5B4AZ, who now has an okay for 6-meter operation, worked ZS6LN with only 0.5W! Also on and worked during the lively period were HI8WPC, 3D2CM (who heard W5s), KZ5NW, K4ERO/HC1, KH6NS, ZL1AVZ, VP2SK, XE3FP, VK4RO, and FO8DR. ZS6ASO's beacon, ZS6VHF, is operational on 50.040 — he listens for responses on the 28.885 "6-Meter Net."

A 900-MHZ AMATEUR BAND will be enjoyed by Canadian Amateurs sometime later this year, possibly as early as this summer. An announcement by the Department of Communications of the reassignment of 420-430 MHz to another service is considered imminent, and at the same time the granting of 902-928 to the Amateur Service on a shared basis should be announced.
The Movement of that as yet unspecified "other service" to the presently Amateur 420-430-MHz slot is expected to take place rather quickly. When Canadian Amateurs will be permitted into their new frequencies is less certain.

AN "AMATEUR RADIO OPERATORS ONLY" chain letter seems to be spreading. Most copies seem to be going to DXers, and come from overseas Amateurs.
As Money Is Requested, this letter is strictly illegal under U.S. law. U.S. Amateurs are advised to ignore it.

RTTY - THEN AND NOW



BY DOUG BLAKESLEE, N1RM

For thirty years enthusiasts of *Teletype*,* known as RTTY in ham terminology (often pronounced "ritty"), have signed off with the phrase, "see you on the green keys." It's a sign-off among a group of Amateurs who in the past were noted for being a small, dedicated, super-enthusiastic gaggle of adherents conversing by means of the printed word. Today, new integrated-circuit technology, deregulation of Amateur Radio, and the application of microcomputer technology to data communications are changing the face of Amateur RTTY — forever — while bringing a flood of new operators to the mode.

Worldwide communication via RTTY does not require high power. WA1HUB works the world while running 100-watts output or less.

Amateur interest in printed communications is almost as old as ham radio itself. During World War II many Amateurs were exposed to the efficiency of communication via teleprinters in the military services. After the war, several Amateurs in New York obtained surplus teleprinters and started copying commercial RTTY stations. We'll never know the contents of those first messages, because radio regulations do not permit disclosure of third-party traffic. Soon, Amateurs received government permission to use RTTY, at first in a very restricted way. Restricted or not, a whole subculture within ham radio was launched. What they lacked in numbers, the RTTY enthusiasts made up in dedication and joy of operating. The typical RTTYer of the 1950s was a fellow surrounded by the machinery of teleprinting and by racks of gear for encoding and decoding the mode. Much of the coding equipment was homemade, as there were no commercial sources within an Amateur's budget. Later, the Military Affiliate Radio System (MARS) released tons of teleprinters and coding gear, which provided a start for many a Teletype enthusiast.

Today, many RTTYers have forgotten the machinery aspects of the mode. Using digital integrated circuits, which perform millions of operations per second, and often a microcomputer or two, an operator has efficiency and power in his equipment not even contemplated ten years ago. More often than not, the green keys are now IBM grey, on an electronic terminal.

Codes and conventions

One characteristic of most special-interest fields is a unique lingo. Super-sounding terms are tossed about which bewilder the beginner and beguile the neophyte. RTTY is loaded with lingo, much of which developed from the early days of commercial telegraph and, later, teleprinter communications. Before we discuss the practical aspects of ham RTTY, it's necessary to review the basics of the communications code used and the terms, abbreviations, and conventions relating to automatic data transmission.

Every Amateur learns Morse code when he enters the hobby. This code was originally developed for communication via a wired telegraph. Later, it was adapted to radio. The earliest telegraph receivers made ink marks on a piece of paper. Thus, when a signal was being received it was called a "mark." No signal was a "space." Soon, operators found that they could copy the code by listening to the inker mechanism as it operated. Before long the inker was replaced by a sounder. Then, the operator transcribed each message by hand.

The Morse code doesn't lend itself to automatic reception because three elements (dots, dashes and spaces) are used, and, in uneven amounts. One dot signifies the letter *E*, while five dots represent a numeral *5*. It takes a lot of electronic

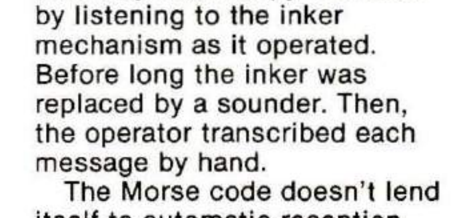


Fig. 1. The Baudot letter R. The code consists of a start pulse, five possible information pulses, and a stop pulse. The times shown are for 60-wpm transmission.

*Trade name of Teletype Corporation.

circuitry, often with a small computer, to sort out Morse code and convert it to some printing or display medium.

For automatic transmission, a simpler code with characters of uniform length is desirable. A five-unit code, Baudot, has long been the standard for Amateurs, military communications, weather transmission, and Western Union. Because it has five binary units, the code can have thirty-two possible combinations, not enough for the alphabet, numerals, and punctuation. So RTTY machines have an upper case function similar to that of a standard typewriter. The code uses a function called FIGS (for figures) to get into the upper case and LTRS (letters) to return to the lower case. All alphabetic characters are printed in capital letters.

Most Amateur RTTY operates at 60 words per minute (wpm). Speeds to 100 wpm are permitted, but as a practical matter few Amateurs can type faster than 60 wpm and many of the older machines operate only at 60. The five-unit code at 60 wpm uses pulses 22 milliseconds (ms) in length, as shown in **Fig. 1**. When a signal is being transmitted the printer is receiving a "mark" signal and is in its idle state. The Baudot code interrupts the mark signal for 22 ms to form each space pulse. Transmission is "serial," that is, one pulse at a time. Baudot can be transmitted in "parallel" using five frequencies, but such high-speed techniques are not authorized for Amateurs.

Any data communications network needs a timing function so that transmitter and receiver are synchronized. In some systems, timing information is continuously transmitted — called synchronous communication. Amateur RTTY uses asynchronous transmission where start-stop information is added to the basic code so no timing data need be sent. In essence, each character is a stand-alone packet of information. Each Baudot character has a start pulse of 22 ms added at the beginning of each code character and a 31 ms stop pulse tacked on the end. The use of a stop pulse longer than the other code units aids in re-establishing receiver

LTRS	1	2	3	4	5	FIGS
A	x	x				
B	x			x	x	
C		x	x	x		
D	x			x		
E	x					3
F	x		x	x		
G		x		x	x	
H			x		x	
I		x	x			8
J	x	x		x		
K	x	x	x	x		
L		x			x	
M			x	x	x	
N			x	x		
O				x	x	9
P		x	x		x	0
Q	x	x	x		x	1
R		x		x		4
S	x		x			
T					x	5
U	x	x	x			7
V		x	x	x	x	
W	x	x			x	2
X	x		x	x	x	
Y	x		x		x	6
Z	x				x	
CAR RET.				x		
LINE FEED		x				
LTRS	x	x	x	x	x	
FIGS	x	x		x	x	
SPACE			x			

Fig. 2. This chart shows the codes used for five-level (Baudot) transmission.

synchronization if the start pulse is missed because of a noise burst or interference. These start and stop pulses are shown in **Fig. 1**. **Fig. 2** gives the coding scheme for all Baudot characters.

Words per minute is not a very scientific definition of transmission speed because what a word consists of is subject to interpretation. (Generally, a word is five letters plus a space.) So engineers have established the *baud* as a standard for transmission speed. A baud is the length of the shortest transmission pulse divided into one. Thus, 60 wpm Baudot uses 22-ms pulses, and 0.022 divided into one is 45.5 baud. Many other baud rates are used. Even inexpensive video-display terminals can operate at transmission rates up to 9600 baud — far faster than the mechanical printers. Amateurs are currently limited to 100 wpm maximum (74.2 baud).

Teletype Corporation has built most of the mechanical teleprinters produced in this country. Their name has become synonymous with the machines, so all mechanical units are called "Teletypes," although purists perfer teleprinter. Raster-scan video displays, similar to a television set, are now popular, so the "printer" part of teleprinter is no longer accurate. The computer term "terminal" is probably the best choice to describe the box which provides the man/machine interface. Teletype transmission generally refers to Baudot code at 60 to 100 wpm. This is by no means the only way to send data. The rise of the computer industry has led to the development of other codes and formats, as Baudot was too restrictive. The most popular is ASCII (for American Standard Code for Information Interchange), an eight-pulse code with 128 characters. Many are nonprinting control functions for computers and graphics displays. ASCII terminals have gone through several generations of development, and older units have become available at surplus prices. These bargain terminals, plus the many home computers that use ASCII, have caused hams to ask the Federal Communications Commission (FCC) for authorization to use this code. As this article is being written, the FCC has announced that it intends to permit ASCII use by Radio Amateurs as soon as the details can be worked out.

Meantime, several circuits to

convert Baudot to ASCII and vice versa have been developed by hams wanting to integrate computers and ASCII terminals into their ham stations.[1] The standard scheme (for receiving) is to convert serial Baudot to parallel, code-convert in a memory matrix to eight-pulse ASCII, and then to convert the resulting parallel ASCII to serial. The reverse process is employed to use an ASCII-encoded keyboard for transmit. ASCII terminals typically operate at 100 wpm and 110 or 300 baud. The higher speed is no problem for reception, but it's possible to transmit data faster than 100 wpm, which is too fast for conversion to Baudot.

Much of the early Teletype transmission was by wire, so many of the old land-line terms remain. The receiver is sometimes called a terminal unit (abbreviated TU), although it is also referred to as a demodulator or decoder. The encoder portion of the RTTY station usually is named for the type of encoding. In the high-frequency bands RTTY is transmitted by frequency-shift keying (FSK). One frequency is employed for mark and another for space, with a separation of 170 Hz. Earlier, 850 Hz was standard for Amateurs, but it proved too susceptible to interference in the crowded high-frequency bands. On vhf, audio tones, one

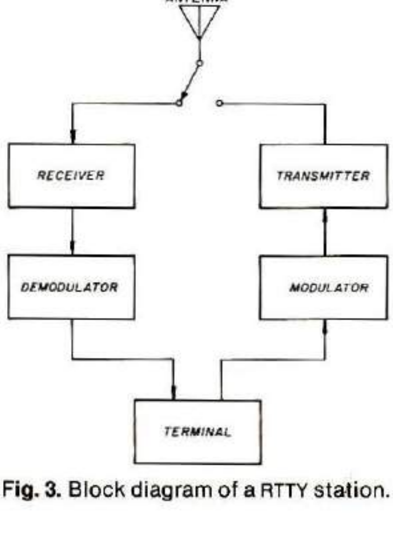


Fig. 3. Block diagram of a RTTY station.

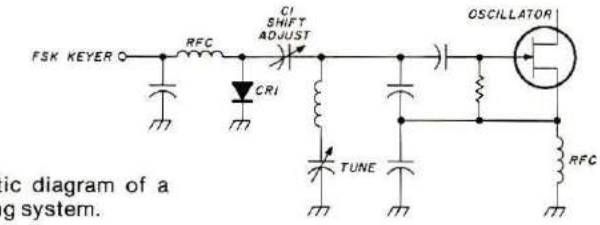


Fig. 4. Simplified schematic diagram of a direct frequency-shift-keying system.

for mark and the other for space, are employed. This is called audio-frequency-shift keying, or AFSK. So, the modulator in a RTTY station is referred to as an FSK or AFSK unit.

The teletype station

RTTY is a very demanding mode where your transmitter and receiver are concerned. A block diagram of a basic station is shown in **Fig. 3**. The data from the RTTY machine is encoded for transmission by a modulator. Its purpose is to convert the pulse information of the teleprinter coding into audio- or frequency-shift signals. Transmission of these signals is hard on the transmitter because FSK transmission is equivalent to holding the key down continuously during code (CW) transmission, and AFSK is the same as equivalent voice transmission on a-m or fm.

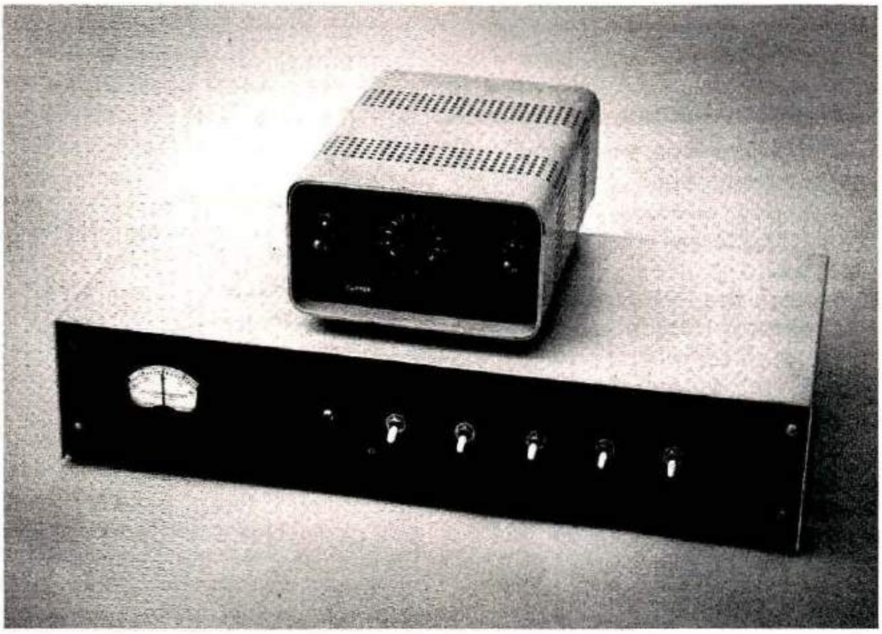
Many of today's high-frequency transmitters and transceivers are rated for high peak powers when using ssb or CW. But the power output stages are not designed to operate continuously at full input power. Often, more than a few seconds at full power causes excessive heating. Some of the newer rigs have published ratings for RTTY transmission. Good general rules of thumb are to operate the transmitter at 25 per cent of the rated ssb power input, or 50 per cent of the CW rating. If the unit has provisions for a fan or other cooling device, it should be added. Key-down operation such as RTTY produces heat in the transmitter final stages, and excessive heat is the mortal enemy of electronic equipment. So, anything that you can do to conduct the heat away will be to the good.

A receiver for Teletype must have sensitivity, selectivity, and ability to handle strong signals — the attributes of a good communications receiver. Selectivity is the key requirement, especially on the high-frequency bands. Because Teletype is an automatic-machine type of communications, reception of a data stream must be near perfect to produce intelligible copy. When you're using code or voice transmission, you can miss a letter or syllable now and then because of static or interference and still have full understanding of what is being said. Your brain acts to fill in the gaps. There are techniques which can be used to enhance a Teletype signal after reception, but, in general, it is vital to use the selectivity of the receiver to minimize interference.

Most ham receivers are designed for CW and ssb service. Older units have a-m capability, and fm has become popular on vhf. Very few Amateur receivers are designed for Teletype reception. Optimizing a receiver for RTTY may take some work. When 850-Hz shift is employed, CW selectivity is generally too narrow and ssb too wide. Some receivers designed for the military have a 1-kHz selectivity position and a variable beat-frequency oscillator (BFO) which allow easy setup for 850-Hz reception. The same receivers are easy to use for narrower shifts, which is why they remain popular with RTTYers. As 170-Hz has become the standard for Amateur high-frequency Teletype, the CW filters which are provided in, or can be added to, today's transceivers are close to the proper bandwidth. However, the detected audio tones are not of suitable frequency for most RTTY demodulators, which use the old land-line frequencies between 2 and 3 kHz.

In CW and ssb receiving systems, the filter bandwidth chosen is the minimum required for the transmission mode, typically 2.1 kHz for ssb and 250 to 800 Hz for CW. The BFO is offset to produce the desired audio range. For example, if the BFO is offset 500 Hz from the center of a 500-Hz bandwidth filter, the audio tone that you would hear would be 750 Hz (500 plus one half of 500, 250). Today's receivers use crystal-controlled BFOs which preset the audio output range, when using a CW filter, to between 750 and 1000 Hz. As we said before, most RTTY demodulators are designed for tone inputs between 2 and 3 kHz. Thus, there is a basic problem of incompatibility.

Changing the receiving frequencies of a Teletype demodulator generally rates somewhere between difficult and impossible. So the receiver is usually the part of the station which is modified. If CW is not used, the BFO crystal can be replaced with a unit which will produce audio tones in the desired range. Some transceivers have provision for additional filters and/or BFO crystals. Most Amateurs elect not to modify their receivers. The receiver is used in the ssb position and a bandpass audio filter is employed between the receiver and demodulator. It is axiomatic in receiver design to place a high selectivity filter as close to the antenna input as possible. Thus, an audio filter at the output of the receiver is a big compromise but one that can save chopping up an expensive transceiver.



Two RTTY demodulators are shown here. The large unit is an experimental a-m/fm unit built by the author, while the small cabinet houses a simple PLL demodulator.

Encoding RTTY

Teletype modulators generally take two forms, generators of direct FSK and generators of audio tones. Direct frequency-shift keying involves changing the frequency of an oscillator, which is a frequency-determining element in a transmitter. A typical scheme, as shown in **Fig. 4**, uses a diode switch to connect capacitor to a tuned circuit. When the diode, CR1, is not conducting, capacitor C1 is effectively not part of the tuned circuit. When the diode conducts, it provides a connection to C1. Introduction of the additional capacitance lowers the resonant frequency of the tuned circuit, and C1 can be adjusted to provide the desired frequency shift.

A direct FSK scheme is the only way to modify a CW transmitter for Teletype transmission. Older high-frequency CW and a-m transmitters used frequency multiplication schemes where the basic oscillator is operated on 160, 80, or 40 meters; the 20-, 15-, and 10-meter bands are achieved by multiplying the VFO. This introduces problems when such a transmitter is employed for RTTY, because it is necessary to reduce the shift applied to the basic oscillator by four if the frequency is multiplied by four, and different shift adjustments at the VFO are needed for different bands.

Direct FSK modulation is not so much of a problem in heterodyne transmitters where the variable-frequency oscillator (VFO) has a single range. However, modern heterodyne rigs have their VFOs housed in metal boxes to improve frequency stability and to reduce unwanted radiation which could interfere with other equipment. Such boxing and shielding makes the innards of the VFO difficult to modify for FSK.

All of the problems of direct FSK have led to increasing use of audio-tone RTTY modulators. For AFSK on vhf, the audio tones can be applied directly to the microphone input of an a-m or fm transmitter. The same method can be used with an ssb transmitter to produce FSK, if suitable precautions are taken. If a single audio tone is fed into an ssb transmitter, a single frequency carrier will be transmitted. Thus, two audio tones used alternately will produce an FSK signal.

Care must be taken when using an ssb transmitter for FSK transmission. All ssb rigs produce distortion products in the final amplifier stage. For voice transmission from a properly adjusted transmitter, these products are sufficiently below the desired signal in power output that they will not cause a problem. If the amplifier stage is overdriven, then the distortion products make a voice signal sound rough and may increase the width of the signal, causing interference on adjacent channels. The same effect occurs when the ssb transmitter is overdriven by

the frequency of an audio oscillator is changed by switching between two tuned circuits. The same effect can be produced in oscillators employing resistive/capacitive (R/C) frequency-determining elements by adding to or subtracting from an R or C value. The circuit shown in **Fig. 5B** uses two oscillators. At **C**, a high frequency oscillator — often crystal controlled — is used with digital-logic circuits which

place at zero, no discontinuity is introduced.

The newest, and probably best, technique is to use direct frequency synthesis. The code necessary to synthesize an audio tone is stored in a memory unit. The information in memory is used to generate a multitude of small steps to closely approximate a sine wave. The digital logic circuits used in a sine wave synthesis allow changing from one

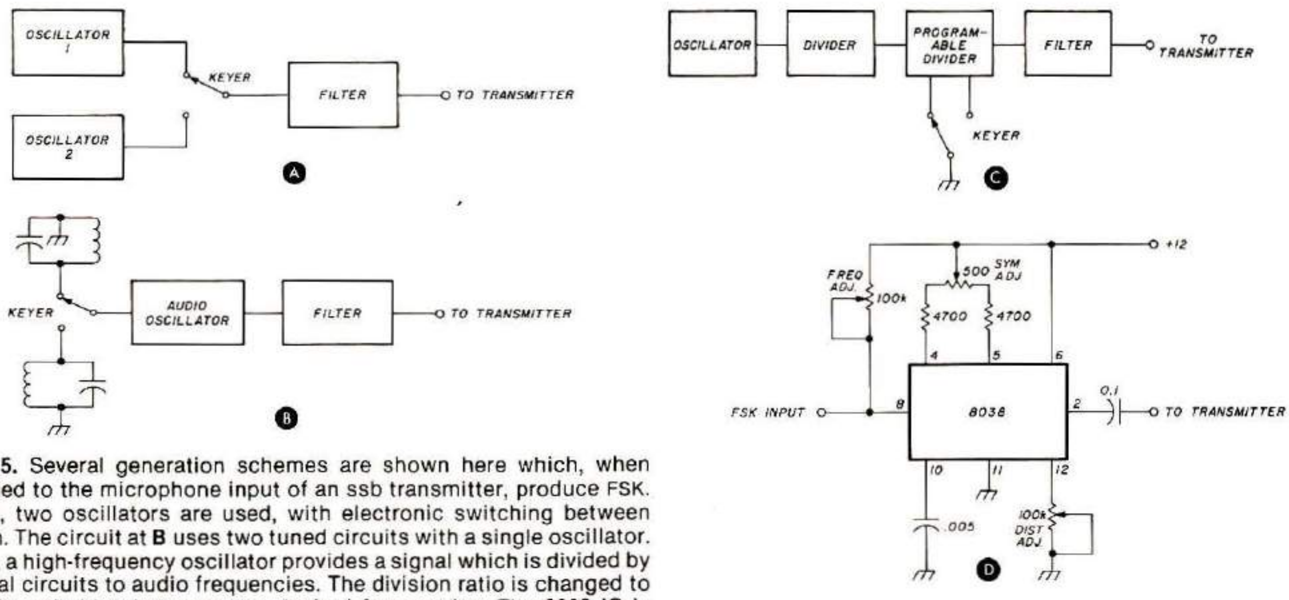


Fig. 5. Several generation schemes are shown here which, when applied to the microphone input of an ssb transmitter, produce FSK. At **A**, two oscillators are used, with electronic switching between them. The circuit at **B** uses two tuned circuits with a single oscillator. At **C**, a high-frequency oscillator provides a signal which is divided by digital circuits to audio frequencies. The division ratio is changed to obtain switching between two desired frequencies. The 8038 IC is used at **D** to provide audio FSK signals of low distortion from a single integrated circuit.

RTTY modulation tones. New frequencies are created around the desired two FSK frequencies, which interfere within the channel and with other nearby channels. In short, if you overdrive an ssb transmitter on RTTY you end up interfering with yourself. The solution is to be sure the ssb transmitter is always operated below its peak-power-output capability.

Ssb transmitters also cannot handle any very rapid discontinuity in the audio input signal. This limitation has led to a multiplicity of schemes for generating RTTY modulation tones, which most newcomers find very confusing. **Fig. 5** shows several schemes for generating RTTY tones. In **A**, **B**, and **C**, the switch is activated by the Teletype machine. At **A**,

produce a desired output tone by division of the oscillator frequency. Two tones are generated by changing the division ratio. All of these schemes require a narrow-bandwidth filter before the ssb transmitter input to "clean up" the audio signal and to remove any discontinuity caused by the switching process.

Fig. 1D shows the block diagram for a single integrated circuit (IC) employed as an audio-tone generator. This IC is a complete audio oscillator with provision for frequency-shift keying. Even more advanced circuits are being published in Amateur literature. One technique uses a detector to sense when the audio waveform is at a zero point and changes the frequency only at that point. If changes take

frequency to another with no discontinuity, at any point in the cycle.

Demodulating RTTY

FSK or AFSK signals must be demodulated into dc pulse trains to activate the terminal. An fm scheme has been popular for years. As shown in block-diagram form in **Fig. 6A**, an audio signal from the speaker terminals, or a radio-frequency signal from the intermediate-amplifier (i-f) section of the receiver is amplified in a section called the limiter. It removes any amplitude variation or modulation in the incoming signal. The discriminator section decodes the information in the FSK signal and provides an on-off signal to the keyer stage, which drives the terminal. Fm detec-

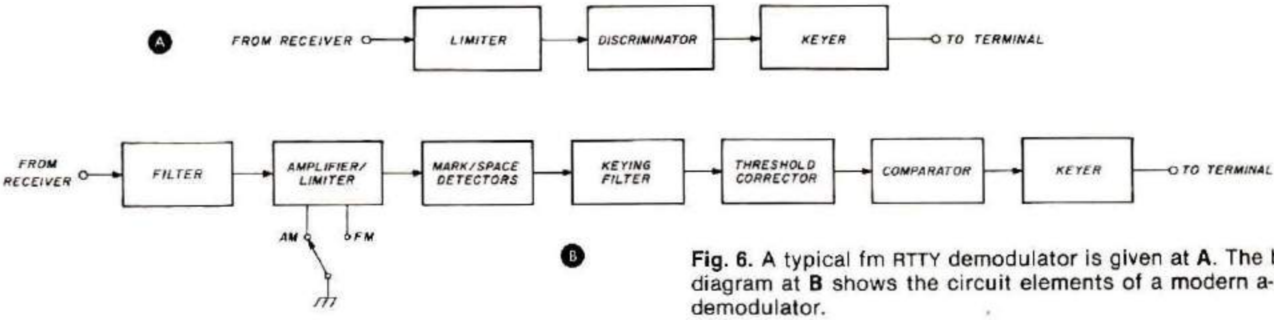


Fig. 6. A typical fm RTTY demodulator is given at **A**. The block diagram at **B** shows the circuit elements of a modern a-m/fm demodulator.

tion has the same characteristics you have come to recognize in fm entertainment — and perhaps two-meter — receivers. Fm systems perform poorly until the signal reaches a minimum level called the threshold, the point at which the limiter starts to work. Above the threshold, noise and low-level interfering signals are eliminated, just the desired effect for good printing of a Teletype signal. But, the desirable effects of fm reception are best when the bandwidth is wide, and they degrade as the shift is narrowed. Fm detection was the early standard for Amateur Teletype; other schemes are now becoming popular.

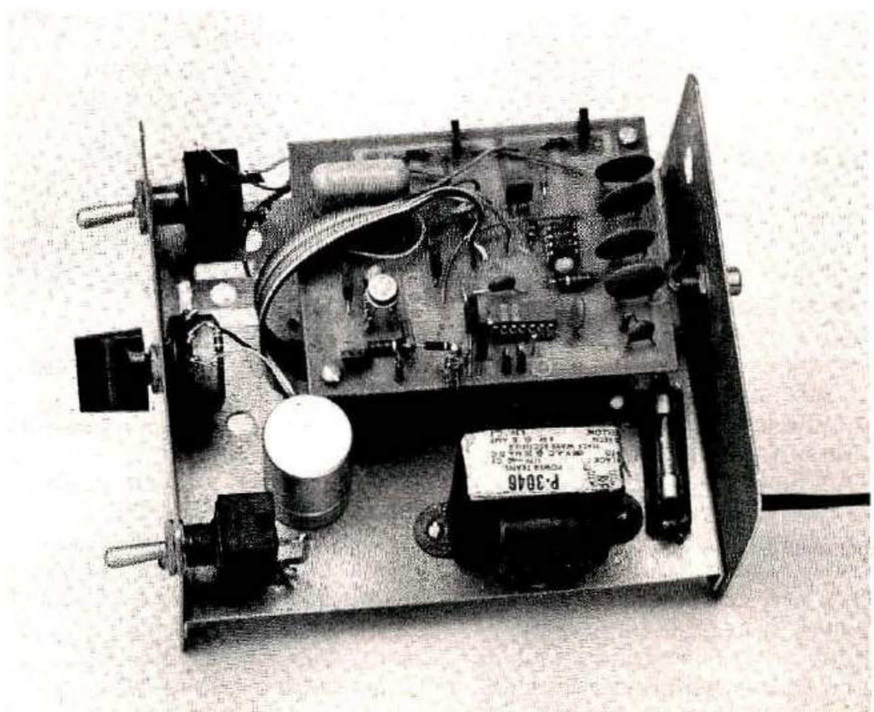
The two signals of an FSK transmission can vary independently in signal strength, which is called selective fading. Over a wide range of input signals, the discriminator of a fm demodulator maintains the output at a constant value. However, if one signal fades into the noise, erratic printing will occur. To combat this problem, a-m receiving techniques can be employed. No limiter is used, and a scheme of correction for varying strengths is used after the detector. Both the FSK signals contain identical information, and an a-m demodulator can copy one, the other, or both. Advanced demodulators usually contain both a-m and fm receiving capabilities, which can be selected by the operator to fit receiving conditions.

Another receiving technique uses a circuit arrangement called a phase-locked loop (PLL). The loop, as shown in **Fig. 7**, consists of a detector which, as the input frequency changes, produces a dc voltage which changes the frequency of a voltage-controlled oscillator until it matches that of the input frequency. The first PLLs used in the space program took many racks of equipment. Today they can be purchased in integrated-circuit form for a few dollars.

When the two frequencies of the FSK signal are applied to the PLL, the circuit alternately locks on one then the other. The dc output of the PLL detector is a reproduction of the Teletype code. Phase-locked-loop demodulators are excellent when receiving very weak signals. They don't work well when interference is heavy, however. The simplicity of the circuit — the complex items are in one integrated circuit — makes it an excellent choice for a beginner. A suitable circuit was recently described in *ham radio*.[2]

The first thing a beginner wants to do when he gets his terminal is to see it print something off the air. My own introduction to Amateur Teletype came when George Grammer, W1DF — the long-time technical editor of *QST*, now retired — was preparing Irv Hoff's classic series of articles about Amateur Teletype for publication.[3] George called me in one day and assigned the project of making up a simple demodulator, something that could be put together in one evening. The simple one-tube unit that evolved became very popular, and it was in the ARRL *Handbook* for many years.[4]

Inside view of the PLL demodulator.



This simple circuit, shown in **Fig. 8A**, took advantage of the fact that the *mark* signal contains all of the information necessary to operate the terminal printer. The receiver is set up to copy on the *mark* signal. An audio transformer steps up the signal from the receiver to a sufficient level so that after it has been rectified, it turns a keyer tube on and off. This tube creates a dc pulse train to operate the terminal. Very simple, and it works well on both Amateur and commercial signals.

A modern equivalent of this circuit is shown in **Fig. 8B**. Here a 567 PLL tone decoder is used. The idea is the same — to detect the *mark* tone and apply it to the terminal. The operating frequency of the 567 is adjustable, so it can be set to work with the selectivity characteristics of your receiver. For an advanced demodulator, Hoff's ST-6 is still the "standard."[5]

RTTY demodulators are fun to play with. Because they generally operate at audio frequencies, circuits can be built and rebuilt with only minor attention to layout and lead length. Demodulators can be constructed from linear and digital ICs costing under a dollar, each of which far outperform most of the commercial and military units still in use. My own demodulator uses a series of circuit-board mounts. The various sections of the demodulator are constructed on separate boards so that when I get a new idea or see a new circuit that I want to try, it can be quickly fitted in without extensive revision to the entire unit.

Those wonderful ICs

New ideas and new semiconductor devices present opportunities for RTTYers to improve their equipment. The coding pulses used in Teletype communication can be distorted during transmission and by narrow-bandwidth filters in the receiving system. If the distortion is severe, the signal will not print properly. Simple pulse-clean-up circuits can be built using discrete semiconductors.[6] A more exquisite scheme is to look at each pulse at the center of the time interval when it should be present, and, using the data obtained, construct a new pulse train with no distortion. A single integrated circuit, called the UART (Universal Asynchronous Receiver Transmitter) will do the job. Or, the entire code character can be reconstructed by means of a properly programmed microprocessor.

Teletype is best sent at maximum machine speed to minimize interference, but few Amateurs can type at 60 words per minute. One circuit now becoming popular uses first-in, first-out (FIFO) memory ICs to store characters as they are typed. When a few sentences have been stored, they are transmitted at machine speed. You will be able to quickly spot FIFO transmissions because they have long spaces where nothing is sent, interspaced with bursts of text sent at full speed.

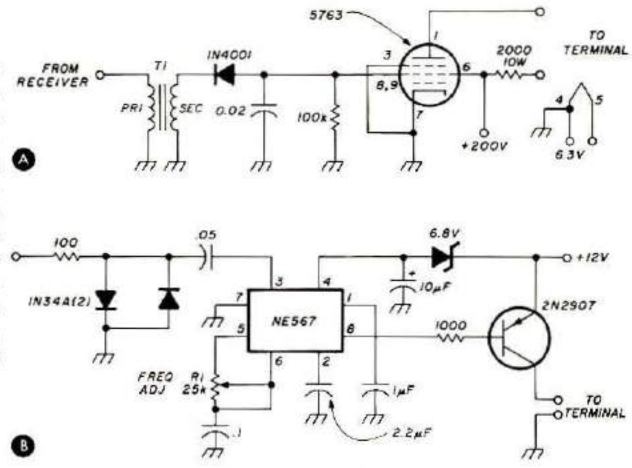
Several commercial demodulators are being sold which use microprocessor (microcomputer) elements, such as the Info Tech. These marvelous units will receive different codes and shifts, plus, they do a credible job of detecting and printing hand-sent Morse code. Software packages and interface hardware are available to turn popular home computers, such as the Commodore PET and Radio Shack RS, into RTTY terminals. The use of the pint-sized computers-on-a-chip is only beginning.

The machine

Ed Tilton, W1HDQ, the former vhf editor of *QST*, was fond of remarking that you could spot a RTTY enthusiast by the smell of his shack. To be sure, the pungent odor of grease and oil were all part of Teletype machines, as was the whirr of the motor and the clack of the lever mechanisms. While those hams inclined to mechanics still revel in the complexities of "the machines," others use all-electronic terminals where the loudest noise produced is the almost inaudible click of a keyswitch being depressed.

From the time of the invention of the manual telegraph, engineers and inventors sought ways to get rid of the operator. He wasn't fast, he made mistakes, and he sometimes didn't

Fig. 8. (A) The simple single-tube RTTY demodulator originally described in *QST*. T1 is an audio transformer with a 3.2-ohm input, 5000-ohm secondary. (B) A modern version of the single-frequency demodulator using the NE567 phase-locked-loop IC. A CW reception mode is used, with R1 adjusted to the mark frequency chosen.



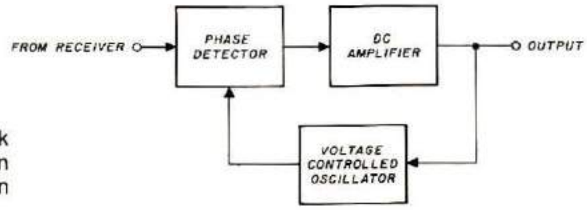
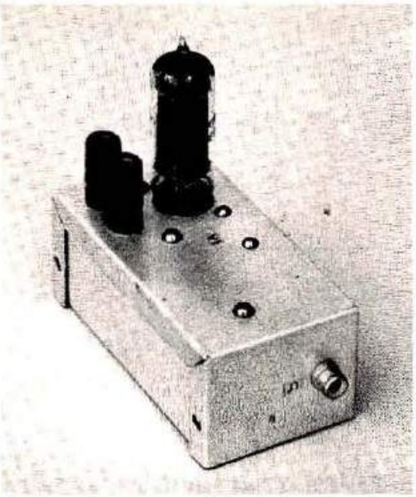


Fig. 7. The phase-lock demodulator is shown here in block-diagram form.



The single-tube RTTY demodulator described in the text.

show up for his stint at the key. The first truly automatic telegraph transmitter/receiver in the U.S. was invented in 1906 by Charles Krum. He joined with J. Morton (a member of the family which owned Morton Salt Company) to form a corporation which manufactured the machine. It was regarded more as a curiosity than a communications terminal until the Associated Press adopted their design. At about the same time Ed Kleinschmidt was manufacturing a terminal which bore his name. The two companies merged in 1925 and were later acquired by the Bell system, operating as a branch of Western Electric called Teletype Corporation. Their name was not only applied to their machines but later to the mode of communication. Because it is their trademark, we capitalize the first letter each time we use it.

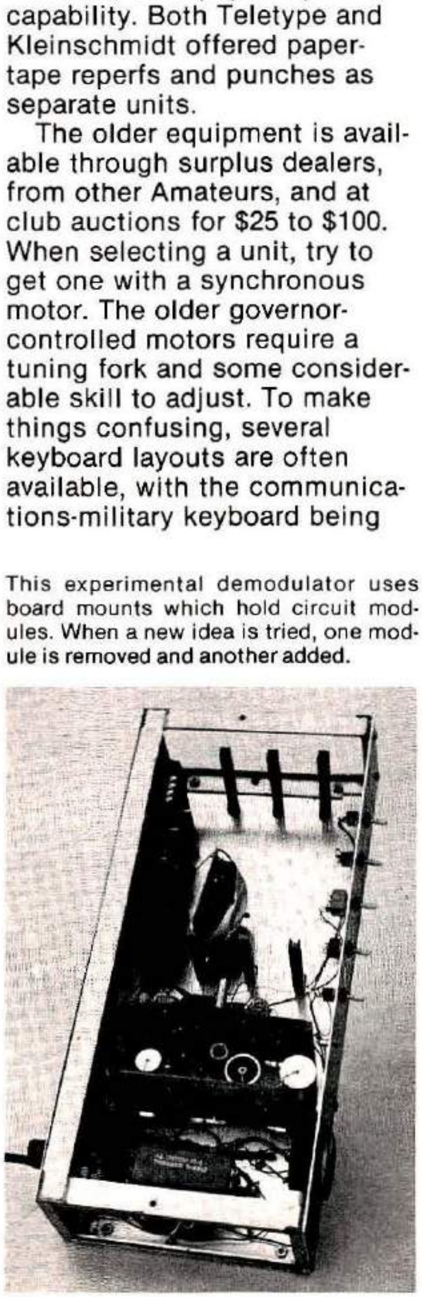
During World War II the U.S. government re-established Kleinschmidt in the business of making machines. Today, many of the military-surplus units bear his name.

Teletype Corporation machines have long been categorized by model numbers. For years the Model 15 was an Amateur standard, and 28s are now popular. The Amateur with a big budget often purchased a 32. The various Kleinschmidt machines are generally known by their military nomenclature starting with AN/TT.

A terminal can consist of several parts. Fully loaded, it has a keyboard, a printer, a paper-tape punch (called a reperforator), and a paper-tape reader (called a tape distributor, or TD). Some machines have just a printer, but most include a keyboard. The paper-tape capability is most useful because it allows you to store incoming data and to transmit data automatically — a good feature in any automatic communications system. Models 19, 28ASR and 32ASR, as well as several AN/TT versions, have paper-tape capability. Both Teletype and Kleinschmidt offered paper-tape reperfs and punches as separate units.

The older equipment is available through surplus dealers, from other Amateurs, and at club auctions for $25 to $100. When selecting a unit, try to get one with a synchronous motor. The older governor-controlled motors require a tuning fork and some considerable skill to adjust. To make things confusing, several keyboard layouts are often available, with the communications-military keyboard being

This experimental demodulator uses board mounts which hold circuit modules. When a new idea is tried, one module is removed and another added.



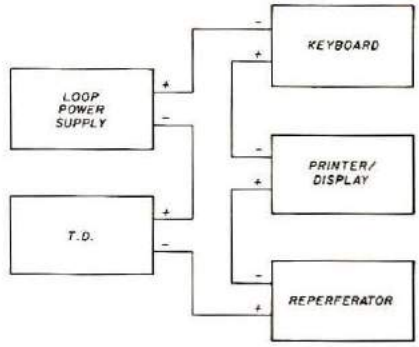


Fig. 9. The "local-loop" used for dc-pulse communication between RTTY units in the hamshack. Connections are in series. The loop current is typically 20 or 60 milliamperes.

the most popular for Amateur use. The Bell standard keyboard is somewhat different, but usable, as are Western Union machines which use a stop pulse of 22 ms rather than 31, giving a speed of approximately 65 words per minute. Other machines such as the Creed and Olivetti (made in Europe) are seen occasionally. They should be avoided unless you know them.

Model 28s and 32s are still in service with commercial users, so they command prices in the $200 to $400 range. For those who have, or can build, five-level to eight-level converters, there are a host of ASCII units intended for computer or message-service use. Included in the printing terminals (called "hardcopy" in computer lingo) are the Teletype models 33 and 35, the Digital Equipment DECwriter II (available from Heathkit outlets) plus several models manufactured by Anderson-Jacobsen. In video terminals — those that print on a video screen — the Heath and Lear-Segler kits are popular. Hal offers sophisticated units, tailored to ham use, which don't need an ASCII converter. For the RTTY novice, it is probably best to start with something inexpensive, such as a model 15 or a Kleinschmidt. In this way you can be sure that you will enjoy the Teletype mode of communication before making a substantial investment. And, when you move up to a better terminal, you can always sell the older unit to another beginner for what you paid for it!

Talking to yourself

Once you have your terminal in hand, you will want to try it. The simplest way to check it is to talk to yourself. The terminal should be connected so that the keyboard and the printer/display are in series. In this way you can type on the keyboard and read what you type on the printer. Older machines require a 60-mA current while newer units operate on 20 mA. The current is passed through what is called a "local loop." All of the elements of the terminal — printer, keyboard, reperf., and TD — are connected to the loop. The mechanical machines contain actuator magnets which produce a desirable snap action when a high voltage — typically 100 to 150 volts — is employed. The arrangement of the loop is shown in **Fig. 9**, and a typical power supply is shown in **Fig. 10A**. If a newer unit, or any of the electronic terminals, is used, a 20-mA constant-current source is needed, which can be obtained from a three-terminal regulator, **Fig. 10B**. Details of power sources and IC regulators appeared recently in *Ham Radio Horizons*.[7]

Before you get on the air with RTTY, you'll have to make provision to talk to the Federal Communications Commission. Because they don't always have a terminal available to copy RTTY signals, they require that the Amateur identify his transmission by using the Morse code. So, you must make arrangements for a key near your terminal so you can

Much of the new generation of teleprinter equipment does away with the "printer" part, and is often referred to as a "glass teletype." The message can be presented on a video terminal that is dedicated to this use only, or a modified TV set can be used as a display. In some units, the keyboard can be used for several different RTTY speeds, or it can be switched to work with Morse code. HAL Communications Corp., Urbana, Illinois 61801, maker of the units shown here, are noted for their versatility and engineering foresight. They'll be glad to send you a brochure describing their complete line of equipment.

let the FCC, and everyone else who doesn't have a RTTY setup, know who you are at the beginning and end of each transmission.

Operating RTTY

Once you have your gear connected and ready to go, the first task is to find RTTY signals to print. Popular frequencies are 3600 kHz on 80 meters, 7040 on 40, 14,090 on 20, 21,090 on 15, and 28,090 on 10. Before the rise of fm, 52.6 and 146.7 MHz were used on 6 and 2 meters, respectively. Now, the use of standard channels and repeaters has led to RTTY repeaters in major metropolitan areas. One sophisticated repeater near San Francisco transmits RTTY *under* normal voice signals in two notches reserved for AFSK. Thus, two separate conversations can be transmitted simultaneously through a single repeater.

When you are ready to go on the air, remember to observe a few simple operating conventions. After you send your CW identification, send letters (LTRS) four or five times to let the other fellow's machine settle down. At the end of each line you type, send two carriage returns, a line feed and the letters function. Providing two carriage returns allows time for the receiving printer to return to the left-hand side of the page. Also, it's an important function which must be received properly so your next line sent doesn't end up as a black gob on the end of the last line. Some Amateurs send multiple line feeds between lines of copy; paper is expensive, so this technique is greeted with the same enthusiasm as is a Novice CW operator who sends CQ by the minute without ever giving his call.

Procedures for calling and answering CQs are no different in the RTTY mode. Breaking into an exisiting QSO is more difficult. One technique is to send a series of LTRS functions

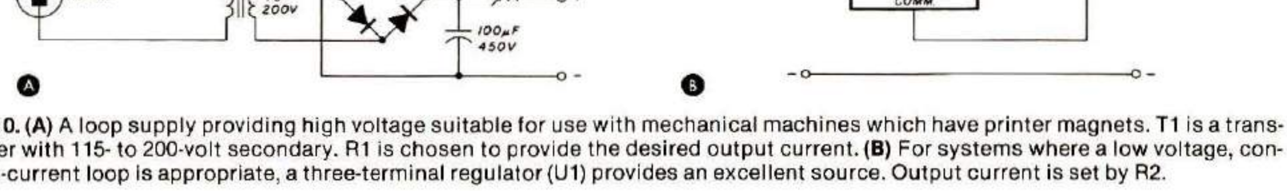
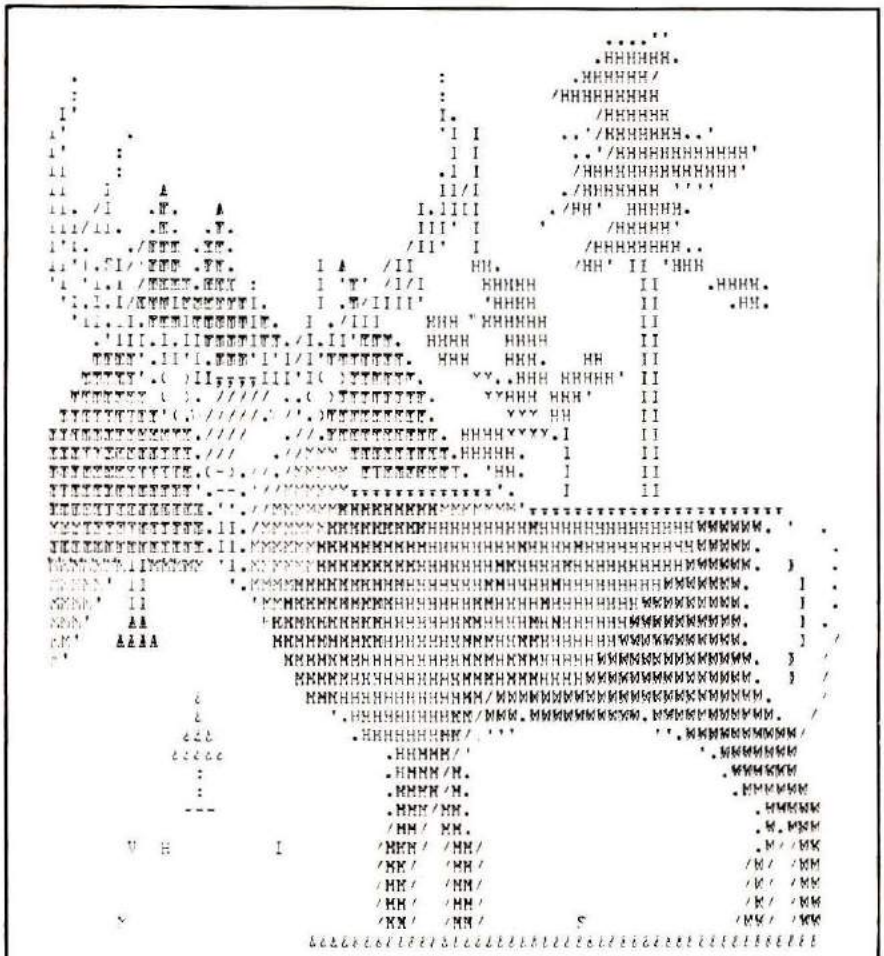


Fig. 10. **(A)** A loop supply providing high voltage suitable for use with mechanical machines which have printer magnets. T1 is a transformer with 115- to 200-volt secondary. R1 is chosen to provide the desired output current. **(B)** For systems where a low voltage, constant-current loop is appropriate, a three-terminal regulator (U1) provides an excellent source. Output current is set by R2.



Some Amateurs spend much time and use plenty of tape to make what is called RTTY art. This example uses two or more letters printed on top of each other to achieve degrees of shading — other operators simply use different letters to form a picture, but with less detail. Perforated tapes are used, and transmission sometimes takes from ¼ to ½ hour for the more complex designs. Preparation can take several hours.

while the station who is finishing his transmission is sending his CW ID. Remember, though, there are autostart net operations where the idle breaker is not always welcome. (Auto start is where a preset series of codes will produce a printout on a terminal that is unattended. It's a popular function on some 80-meter RTTY nets, generally populated by those sophisticated in the Teletype art.)

If you have paper-tape capability, it's best to send a pre-prepared tape with your name, location, station description, etc. When you talk to Harry in Des Moines, let him know that you are using a Grizley 5 transceiver at 60 wpm, rather than at hunt and peck speeds.

On CW, where 30 wpm is fast, it's great to abbreviate. On RTTY, excessive abbreviation, such as 4 U in place of for you, is taken as another sign of a "Novice accent." So, type things out. It's good practice for your next letter to your parents!

RTTY can be used for many of the activities popular on other modes: rag chewing, DX, contests, traffic handling. DX and contests are more difficult on Teletype because of the susceptibility to interference and fading. Thus, the "firsts" in international contests are true operating achievements. They require the best of both the operator and his station. RTTY is a natural for message transmission because it produces a finished copy, plus carbon copies if appropriate paper is used. It's ideal for communications during an emergency.

Best of all, RTTY is fun. The majority of hams on Teletype have some equipment that they have built themselves. They're super enthusiastic and fun to talk with. Jump in and try it! You, too, will soon be typing, "See you on the green keys."

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7. Douglas A. Blakeslee, N1RM, "Power to the Projects," *Ham Radio Horizons*, December, 1977.

RTTY Books

Beginner's RTTY Handbook. Order RJ-BH, $4.50 plus $1 postage and handling, from Ham Radio's Bookstore, Greenville, New Hampshire 03048.

RTTY From A to Z, by Durward J. Tucker, W5VU. Order CQ-RTTY, $5 plus $1 postage and handling, from Ham Radio's Bookstore, Greenville, New Hampshire 03048.

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Hilltopping with the old mountain goat

BY WALLACE H. PROVOST, JR., N4BZ

A story of what vhf hilltopping was like in the early 1960s

He played third base, stoked a boiler, drove a black locomotive, and ran the engine that pushed heavily laden barges up the canal to Syracuse. He was a towering giant of a man who didn't have to ask for respect. But age and disease had taken their toll. One leg stiffened up and the other threatened to follow. He put away the bat and glove and moved away from the iron rails and the Mohawk to a mobile home on a ledge outside the city, where the humid summer nights wouldn't rack his bones. He looked down upon the city and he took up Amateur Radio. His name was Henry.

In a world of incorporeal voices, a man's body is no longer a shackle. From Henry's lair high above the Hudson valley, he could reach out and visit such wondrous places as Boston and Providence and Manchester. From his vantage point, where breezes from the Helderbergs cooled the hot summer nights, he used a Gonset Communicator and a six-element Telrex to get out to places the flatlanders never heard of, unless they had tall towers or expensive low-band radios. There were hams in the valley who used high-priced sideband radios on 20 meters and worked Europe and Japan, but Henry preferred 6 meters, where he could prop his bad leg on a hassock, lean back in his easy chair, and gas as long as he wanted without everybody in the world trying to stomp on him.

Now there *are* places in the world other than Boston, Hartford, and Mount Agamenticus. There's Binghamton, New York, and Wilkes Barre, Pennsylvania, and Pompton Lakes, New Jersey; but from the eastern slopes of the Helderbergs, the Catskills get in the way, so you can't work down there.

Now you take a man like Henry, who hauled molasses out of Plattsburg and pushed a barge down Lake Champlain and up the Mohawk and the Erie Canal — you just don't tell him he can't talk to Pompton Lakes, New Jersey, or Wilkes Barre, because even with a stiff leg you just know he won't take no for an answer.

Henry called me on the air one night.

"Why can't I talk to Pompton Lakes, New Jersey?" he asked.

"You're not high enough," I told him. "The Catskill Mountains are in the way and they stick up four or five thousand feet."

"So what must I do?"

"Go higher."

"How much higher?"

"Two, three thousand feet."

"I'm serious."

"So am I. You want over these mountains on 6, you gotta get two-, three-thousand feet higher."

Anyway, I thought that was the end of it and I went back to working Schenectady, but on Wednesday he called me again.

"How about three thousand, seven hundred feet?"

"Three thousand, seven hundred feet of what?"

"That high enough to get into Pompton Lakes?"

"How you going to do that?"

"Mount Utsayantha."

"Mount what?"

"Look it up on your road map. It's down in Stamford. It's 3700 feet high. We're going there Saturday."

"Who's we?"

"You and me, that's who."

That was to be the first of many trips I took with the Old Mountain Goat, as Henry was dubbed by hams all over the Northeast. Sometimes we went alone, like the time he tied up to a convenient pole only to find it had an electric fence on it. Sometimes we went with others.

We went to Mount Everett in southwestern Massachusetts. As the night wore on we were met by others who came to see the Old Mountain Goat in person. One brought his wife and a banana-cream pie. Two came up from Connecticut. Conditions on the band were fantastic. We worked Auburn, Maine, that night.

Everett is a unique mountain; it's not exceptionally high, but there's nothing around it except Greylock, 40 miles north. Someone brought sandwiches and coffee. We got back well after sunrise the next morning.

The trip to Utsayantha was a first for us, and forever more that mountain would always have a special place in our memories. It wasn't our most popular place; fifty miles is a long way to travel to get to the foot of a mountain if you expect to drive back the same night. Our all-time favorite became Petersburg Mountain outside Cobleskill, only twenty miles away and blessed with propagation that delighted us with new and totally unexpected experiences on every trip.

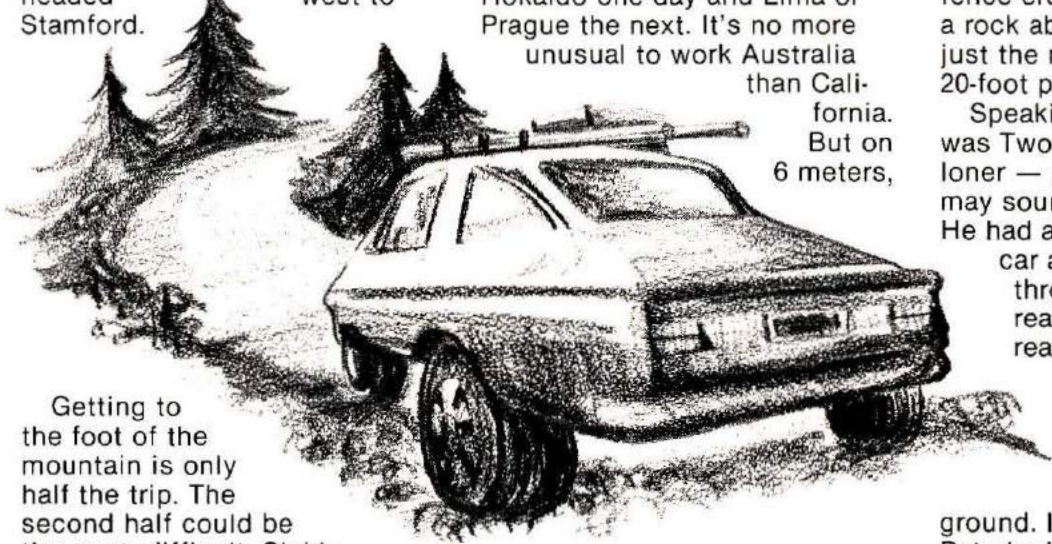
Henry kept talking it up all week on the band, and it looked like hams would be going up the mountain en masse — until word of the road up the mountain leaked back from down-country. The lure of distant cities and strange voices brought only four adventurous amateurs as we turned south on Route 30 while the sunrise was still a wish on the eastern horizon.

With Big John, Henry's friend, you could be absolutely sure that no matter how tough the going got, he would never back down. And you could be just as sure he would forget some crucial item — a line cord, antenna, feed line. Big John was a builder. You might not recognize what it was he built, but it always worked. You learned early not to point a finger at anything Big John built, no matter how ridiculous it looked.

One night on Sickle Hill, Big John was parked next to a city slicker using a brand spanking new commercially built hilltopper special. John had a contraption of box wood and coat hangers lying on a bushel basket atop his station wagon. The best the city slicker could do was Worcester. Big John worked Block Island while sitting right there next to him. The slicker packed up his fancy gear, went back to Albany, and was never seen again in the Helderbergs.

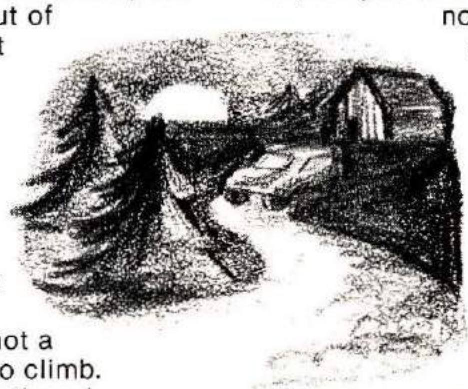
Chowhound frequently went mountain topping with Henry and Big John. If old Chowhound found something he liked, he bought it. For years he owned land right on top of Sickle Hill, but he never learned that you can't buy a mountain. He was never able to get a station working up there. Try he did; it just wouldn't work. But he was a welcome addition to any hilltopping trip, because he never went anywhere without a well-stocked larder.

That made four of us who headed down through Schoharie and Middleburg and past West Fulton, where John McGiver lives; and Blenheim and Grand Gorge, where the mighty Delaware River is a tiny brook, and on to Stamford at the foot of the mountain, where the Indian Princess Utsayantha threw herself to death because of her palefaced lover. Route 30 winds through the lower Helderbergs and the backside of the Catskills. It follows the Schoharie Creek down to its headwaters, where it picks up the Delaware. At Grand Gorge we let Route 30 go on to Roxbury and the Major Catskills, while we headed west to Stamford.



Getting to the foot of the mountain is only half the trip. The second half could be the more difficult. Sickle Hill has a smooth, hard road right to the top; but then it's only 1200 feet high.

A bright sunny day down in the valley can suddenly turn into a cold, wet drizzle if you happen to drive into a cloud at the peak. I can remember driving into a pea-soup fog on Mount Greylock that was so thick that I missed a turn, and when I came out of the fog I was at the bottom on the other side of the mountain.



If you have good tires and a first-rate cooling system on your car, Utsayantha is not a bad mountain to climb. The road is mostly red clay, and you have to wash your car when you come down. During wet weather it's better not to go. The only car whose driver's seat would move back far enough to accommodate Henry's stiff leg was a Saab. It took the hill admirably, but the Chowhound's Buick bottomed out several times, giving him and Big John, who rode with him, a few scary moments. When we reached the top we had to wait several minutes for the dust to settle before we dared open the door.

On 20 meters, signals bounce off the ionosphere and it's perfectly normal to talk to Hokaido one day and Lima or Prague the next. It's no more unusual to work Australia than California. But on 6 meters, signals normally travel in straight lines, with a little bending. As a result, how far you get out is determined by how high you are. So you can be down in a valley on 20 meters with the whole world at your feet and can always find someone to talk to. But on 6 meters, even 3700 feet in the air, it's just too normal to find nobody around on a Saturday morning.

Hilltopping antennas are a popular source for innovation. Get four dedicated hams together on a Saturday morning, with a light wind and a little nip in the air to spur them along, and you can assemble and erect almost any antenna system you want. But if a sudden squall comes up, or the band stays good till 3 AM and you have to get that thing down and packed with 40-mph gusts slapping rain into your face, you do want it to be simple!

Adam's Vista is a wide spot in the road on the east slope of Greylock, where the town of Adams is some 3000 feet straight down below you. It's a favorite spot for hilltoppers, because divine guidance, or maybe some unknown fence erector, put a hole in a rock about a foot deep and just the right size to support a 20-foot pole.

Speaking of antennas, there was Two-Meter Pete. He was a loner — not as unusual as it may sound among amateurs. He had a hole in the roof of his car and a mast sticking through it. When he was ready to go to work he'd reach behind the seat and push up that pole, slipping in five-foot sections until the antenna was some thirty feet off the ground. If it was a bit breezy, Pete had a set of guys that could be tied to convenient trees.

Most casual hilltoppers carried a portable beam and 20 feet of masting, which they tied to the car door handle. The Old Mountain Goat was a firm believer in big antennas. His hilltopper mast was 24 feet long, and he wasn't happy until it was 40 or more feet off the ground. Finding a spot to erect a monster like that became my job. I've been shocked by electric fences, raked by poison ivy, and soaked to the skin putting up and taking down antennas.

At some time in the past a tribe of Indians was kept on Mount Utsayantha for the tourist trade. They abandoned the mountain when it proved unprofitable, but they left behind their wickiup: a building of pine slabs some 40 feet long and 20 feet wide, with what looked like bunk beds along both walls and a hole in the center of the roof directly over a circular fireplace. I lashed the pushup pole to the center beam at the front door and guyed it to some trees. We set up just outside the lodge, ready to slip inside if the weather should suddenly turn sour. Big John took the generator down the western slope, where it wouldn't disturb picnickers, but where we could get at it to add gasoline at night. The Chowhound got a fire going and started to unpack the grub. Henry set up the Gooney box on a card table just outside the lodge, got the log book ready, and began perusing the band as soon as Big John powered him up.

Once I lived on the Westfield River about 40 miles out of Springfield, Massachusetts. It wasn't much of a village: a dozen houses and a run-down paper mill, but it was a favorite spot for fishermen. You can tell a lot about how a man handles his frustrations by the way he fishes. If he has good control he uses a worm, finds a quiet pool, and sits patiently waiting until a curious trout comes looking for a special treat for dinner. Others will plunk the worm in, wait a few minutes, then try again somewhere else, or they'll use a lure and cast it out constantly, winding it back in. Then there are fly fishermen, who keep busy between bouts by trying to lay that fly just where the big fish is lurking. It's a lot like that in Amateur Radio — particularly on 6 meters, where it isn't crowded and you can call for hours without getting a single answer. We all took turns calling. The lack of answers drove the Chowhound deeper into the ice chest. Big John was sure it was because he had forgotten his favorite mike, and the Old Mountain Goat kept asking me to fix what was wrong or show him how to make a contact. When the contact came, we were all excited because it was from a place we never heard of. Turned out to be only 20 miles away.

The classic propagation for 6-meter radio signals is line of sight. If that were strictly true, it would be a boring band and nobody would waste time operating on it. There's a layer in the ionosphere that's affected by magnetic storms. When it gets excited, 6-meter signals are reflected down some 1000 miles away. This may happen three or four times over the winter and can happen for days on end in early summer. However, when it happens, there's only one place you don't want to be: on a mountain. For four hours that Saturday afternoon we sat there with the Chowhound munching away and listened to all of our flatland friends working Cleveland, Detroit, and Yazoo City — and we couldn't even work back to Albany!

The sun was going down in a blaze of glory, a cold wind had come up, some nasty clouds had been building in the north. We'd worked one station in Oneonta, one in Schenectady, and one in Illinois, who didn't stay in long enough to even get the town. The Chowhound was ready to go home; the ice chest was getting bare. But the Old Mountain Goat was adamant. He came here to work Pompton Lakes and he wasn't going until he did, so we moved everything into the lodge just in time to miss the first drops of rain.

From Terra Alta to Burlington I've spent the greater part of my life climbing mountains. There's a place much worse to be during a storm than on top of a mountain — that's on your way down. The road washed right out from under my wheels in Rutland one day. A nice smooth road can turn into a mad torrent of water in a matter of minutes.

I came off Everett one night and got hit by a fog so thick I had to stop and wait it out, then I had to pull out a more courageous person, who drove off the road trying to make it in the fog. A mountain is a dynamic organism, and when it's attacked by weather disturbances its characteristics change drastically. You find yourself on a mountain when a storm hits, you stay right there until it settles down! The way down the mountain may not be the same way you came up.

There's a propagation condition called ducting, which occurs whenever a mass of cold air sneaks under a mass of warm air. We waited inside the wickiup while the storm pelted the mountain. The rain static on the antenna overrode any signals we might have heard; but after it passed, I listened around and could barely detect that swishing sound you get when you find yourself on the edge of a duct. We all recognized it immediately. Big John added some wood to the fire (it was getting nasty cold); the Chowhound had a mouthful of ham and cheese sandwich and stopped chewing; the Old Mountain goat, horizontally polarized on one of the bunks, snapped to attention.

You never know where one of these ducts will take you. I once worked Elmira from my place outside Albany with only one watt. We were only on the edge. Voices would pop in and out; we weren't sure where they were from. When one came in solid, he signed New Jersey, and Henry called from the bunk, "See if he's from Pompton Lakes." He wasn't. He was in Springfield, but he told us there was a YL over in Pompton Lakes, who was likely to be on any night.

As soon as they heard we were in Delaware County, New York, stations kept calling us from Passaic to Philadelphia, one after the other. We took turns answering them. The old logbook was really getting filled. This is what we came here for, and excitement was in the air. The half-eaten ham and cheese sandwich grew stale on the table. We even picked up a station in Wilmington, Delaware, and one in Frostproof, Maryland. Big John worked a solid half-hour with all of us hovering over his shoulder. Finally we landed one from Brandonville, West Virginia. We really celebrated after that one! The Chowhound went to the trunk and got out his emergency rations. I stoked up the fire. It was hard to believe, as the band died out, that it was already three in the morning.

"We didn't do it." Henry was looking over the long list of stations we had worked.

"We didn't do what?" I asked.

"We didn't work Pompton Lakes."

Big John was sacked out on one of the makeshift bunks. He acted like Henry had just awakened him. "What's so special about Pompton Lakes?"

"How would I know, I haven't worked it yet."

How can you combat that kind of logic? We'd lost our duct, but there was still some kind of inversion out there. Every once in a while voices would slowly emerge out of the noise until they were almost intelligible, then fade.

We did know that a YL named Hilda liked to work the band late at night. A dozen people had told us that she was the only active 6-meter ham in Pompton Lakes, so we had lots of hope. We took turns calling Pompton Lakes, hoping for a duct long enough to make it.

I want you to understand that most people who operate 6 meters work with modest stations in the valleys with modest antennas. The range seldom exceeds 30 miles or so. The population of 6-meter amateurs isn't too great. Most of the time you talk to the same people over and over, and if you don't enjoy people or don't have a friendly personality, you soon tire of it and eventually go to the low bands with the crowd. Those who are left are friendly folks who enjoy each other's company. Even when you're hilltopping, most operators will listen to see if you are the kind of person who would carry on an interesting conversation before they call you.

We worked a ham who lived some 15 miles from Pompton Lakes. He told us he hadn't heard Hilda on that night, which was unusual, because she was almost always on the air Saturday nights. She had a problem, he explained, that made it hard for her to sleep. We talked to him for two hours. Strangely enough we were getting anxious to meet Hilda. We had heard so much about her. It's hard to tell anything about someone if all you hear is her voice.

As a society, we're used to body signs along with voices, and you learn early in your amateur career not to put much faith in the picture your mind makes of anyone you meet on the air, even if you have talked to him weekly for a year or more. You get to know more about fellow amateurs from what others say about them, and we had heard nothing but good words about Hilda from Pompton Lakes.

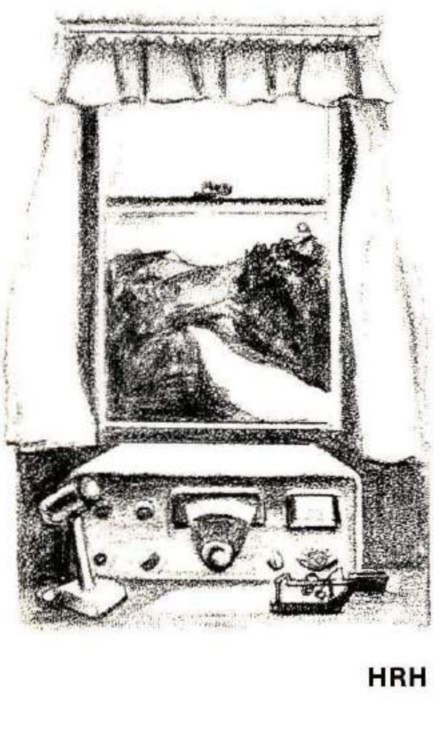
At 5 AM the eastern sky was starting to lighten. Big John and the Chowhound were sawing wood. I turned the controls over to the Old Mountain Goat and stepped outside to gas up the generator. The air was dry, but the wind was cold. When I came back in with a few logs in my arms, Henry was talking to Hilda.

Hilda had a mature voice with a pleasant lilt to it. She said she was going to the hospital in the morning, so she'd taken some sleeping pills — that's why she wasn't on during the night. There are some people who are simply easy to talk to. They're interested in you and are interesting themselves. We knew from earlier reports that Hilda was in her fifties, had been widowed several years, and was active in local amateur and youth groups — the kind of person whose whole life seems to be wrapped up in the people around her.

Big John and Chowhound got up, and we had breakfast while we talked to her until it was time for her to leave for the hospital.

The morning brought a hot sun to dry the road. We packed up and were down the mountain before anyone said anything. I guess there was nothing more to talk about. The whole night was sufficient unto itself, and no talking could improve it. In fact, it was more than a month later before we could talk about it — unusual, because normally whenever we returned from a hilltopping expedition it was the prime topic of conversation for weeks.

I worked Pompton Lakes, New Jersey, a month later on 75 meters. I asked about Hilda. Yes, she had gone to the hospital that morning for open-heart surgery. But Hilda never regained consciousness.



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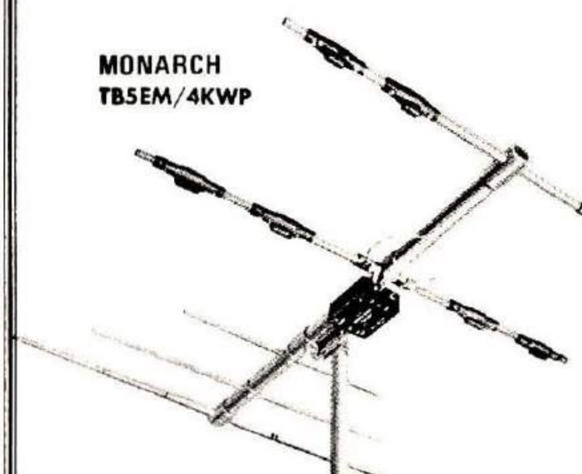

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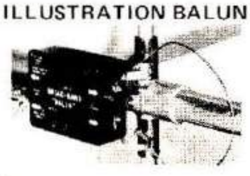

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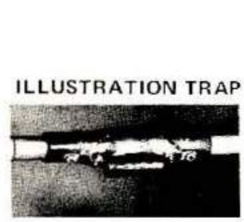

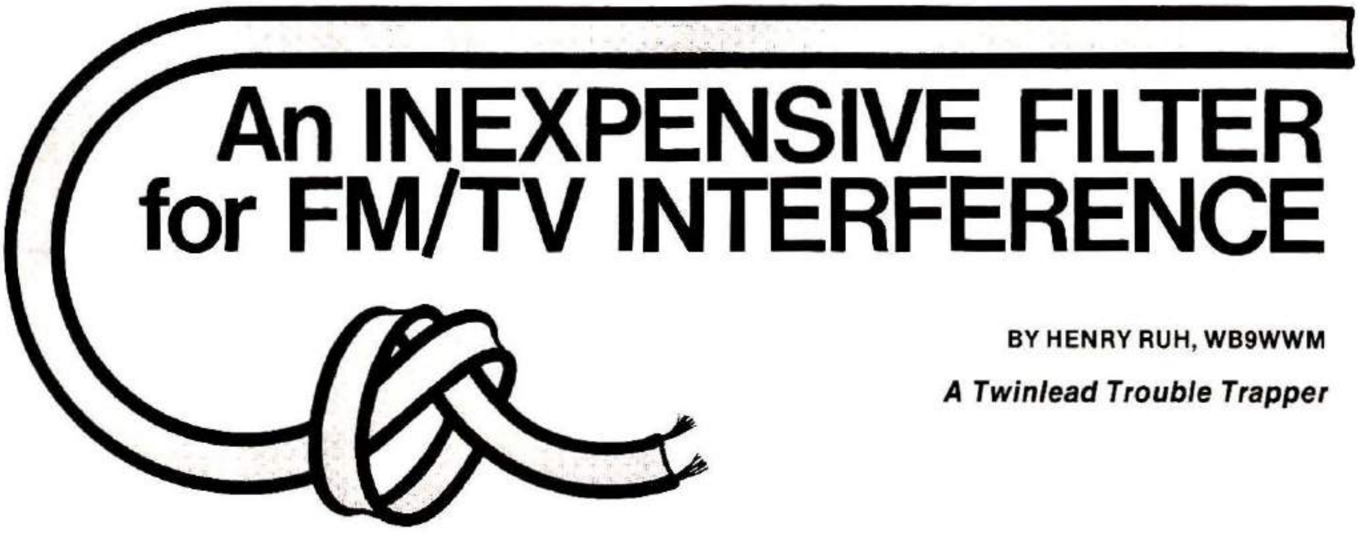

An INEXPENSIVE FILTER for FM/TV INTERFERENCE

BY HENRY RUH, WB9WWM

A Twinlead Trouble Trapper

One of the most disconcerting things to happen to some folks is to be living peacefully, watching TV, and then have an fm station (or other transmitter) move in next door, disrupting reception. Many viewers become irate and blame the new station. Of course, the real culprit often is the filterless TV and overload-susceptible receivers sold today. If this is your problem, or your neighbor's problem, take heart. Here is an effective filter you can build for less than $2. Materials required are a 25-pF silver-mica 50-volt capacitor, an Arco 402 (or 403) ceramic compression trimmer capacitor, and 14.6-cm (5.75-inch) pieces of twinlead such as Belden 8230.

The end result is a sandwich of two pieces of the twin lead, tightly taped and parallel to the antenna lead going to the set experiencing the interference. No direct connection is made to the TV/fm receiver or antenna. This is an absorption-type wave trap, and can provide more than 20 dB attenuation of the undesired signal. With appropriate lengths of twinlead, the same filter design will help eliminate interference from CB, fm, TV, taxi radios, mobile telephone, and the like. Here are the construction and tuning steps:

1. Cut lengths of flat twinlead, each exactly 14.6 cm (5.75-inches) long

2. Trim insulation from 6.5 cm (¼ inch) of each lead at one end

3. Fold the two bare wire ends toward each other, so that they lie flat against the end of the insulation

4. Solder the wires together

5. Cut 12 mm (½ inch) of insulation from the other end of the twinlead

6. Locate the compression trimmer. Bend the lugs out at a 45-degree angle from the body

7. Take two unprepared pieces of twinlead and the two prepared pieces and hold them together, sandwich style. The unprepared pieces of twinlead should be longer than the prepared pieces, with the ends protruding beyond the position of the trimmer. The purpose of these pieces is to act as a form, allowing easy assembly of the capacitors and the prepared twinlead. Twist the bare wires from both prepared pieces together, so the top and bottom pieces are parallel. These wires should both stick up on one side of the sandwich

8. Position the silver mica capacitor, and twist each lead around one set of the twisted twinlead wires. Solder each set of three wires together. Cut off the excess lead from the capacitor

9. Insert the soldered, twisted leads into the compression capacitor tabs which were previously bent outward. Solder the leads to the capacitor tabs

10. Remove the two unprepared wires from inside the bundle

11. Adjust the capacitor tuning screw one full turn from full compression

Adjustment

Final adjustment is accomplished in the following manner: momentarily remove the antenna lead from an fm receiver, and slide the completed filter over the lead. Reconnect the antenna lead, and tape the filter leads in place for a sandwich. Tune in the station or signal to be attenuated. The filter should be installed with the adjustment capacitor end of the filter closer to the receiver than to the antenna. Very slowly adjust the trimmer capacitor with an insulated screwdriver or tuning tool. When a dip in the signal is observed, carefully tune for maximum dip. Some additional attenuation may be obtained by sliding the filter back and forth along the antenna lead.

If the problem has been overload of the fm receiver, the adjustment is complete. If the problem has been fm overload of a TV receiver, remove the tuned filter from the fm receiver and place it on the TV lead-in wire. Position it at the same distance from the antenna leads of the TV set as was found to be best on the fm receiver. Because of stray capacitance, it may be necessary to adjust the filter once it is installed on the TV. To do so, tune in channel 6 (or 5 if there is no channel 6 in your area) and carefully adjust for minimum interference in the picture.

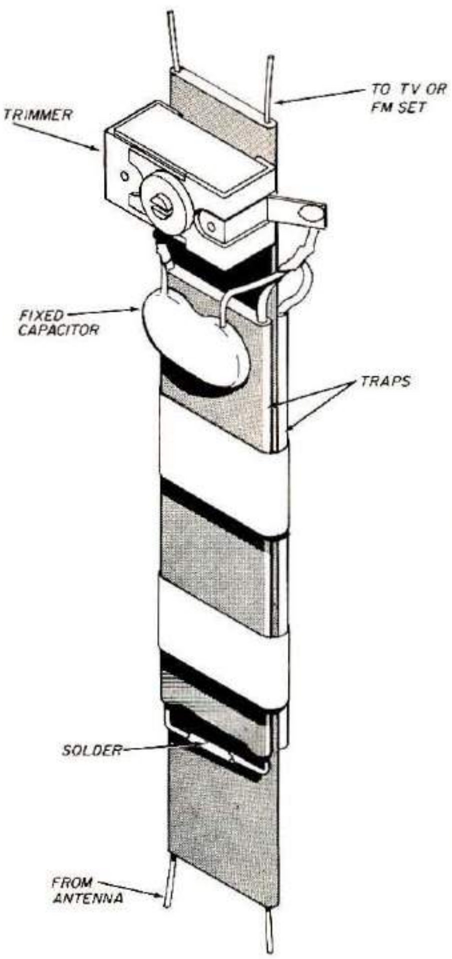

Fig. 1. The trap is in the form of two pieces of twinlead, one on each side of the antenna lead-in to the fm or TV set. Once the best position for signal reduction is found, the assembly is taped securely together. A fixed capacitor in parallel with a mica trimmer capacitor determines the resonant frequency of the trap.

In persistent cases, more than one filter may be necessary for complete elimination of the interference. If an improvement is noticed with one filter, try additional filters.

If the TV system has an antenna-mounted preamplifier, it may be necessary to place filters both before and after the amplifier. In some cases, the amplifier can be over-driven, and will generate additional interference on higher channels. As any engineer knows, the easiest way to generate harmonics is to overdrive an amplifier; thus, in extreme cases, there are likely to be many points of interference which will not be cured until the signal to the amplifier has been attenuated below its overload point. Usually no more than two traps before the amplifier and one at each output of the amplifier is necessary.

Comments

A filter trap of this design has a very high Q and therefore will effect a reduction in signal for only a few kilohertz on each side of resonance. Thus, if there is more than one station causing the interference, it will be necessary to build a filter for each station. This same filter can be used to reduce adjacent-channel sound interference. It is not a wideband filter, and will not eliminate a complete TV signal, but it can be used to selectively eliminate the carrier or sideband frequencies causing the most interference. Some loading of the filter to make it slightly broader can be accomplished by soldering a 300-ohm resistor across one end of one side of the twinlead loop. This, of course, also reduces the ultimate attenuation of any signal. HRH

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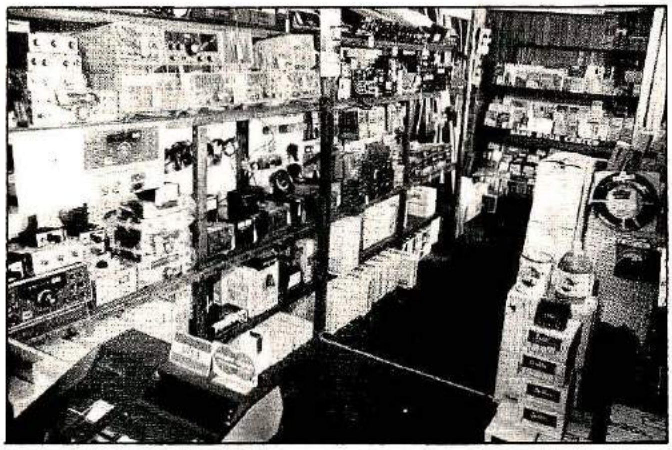

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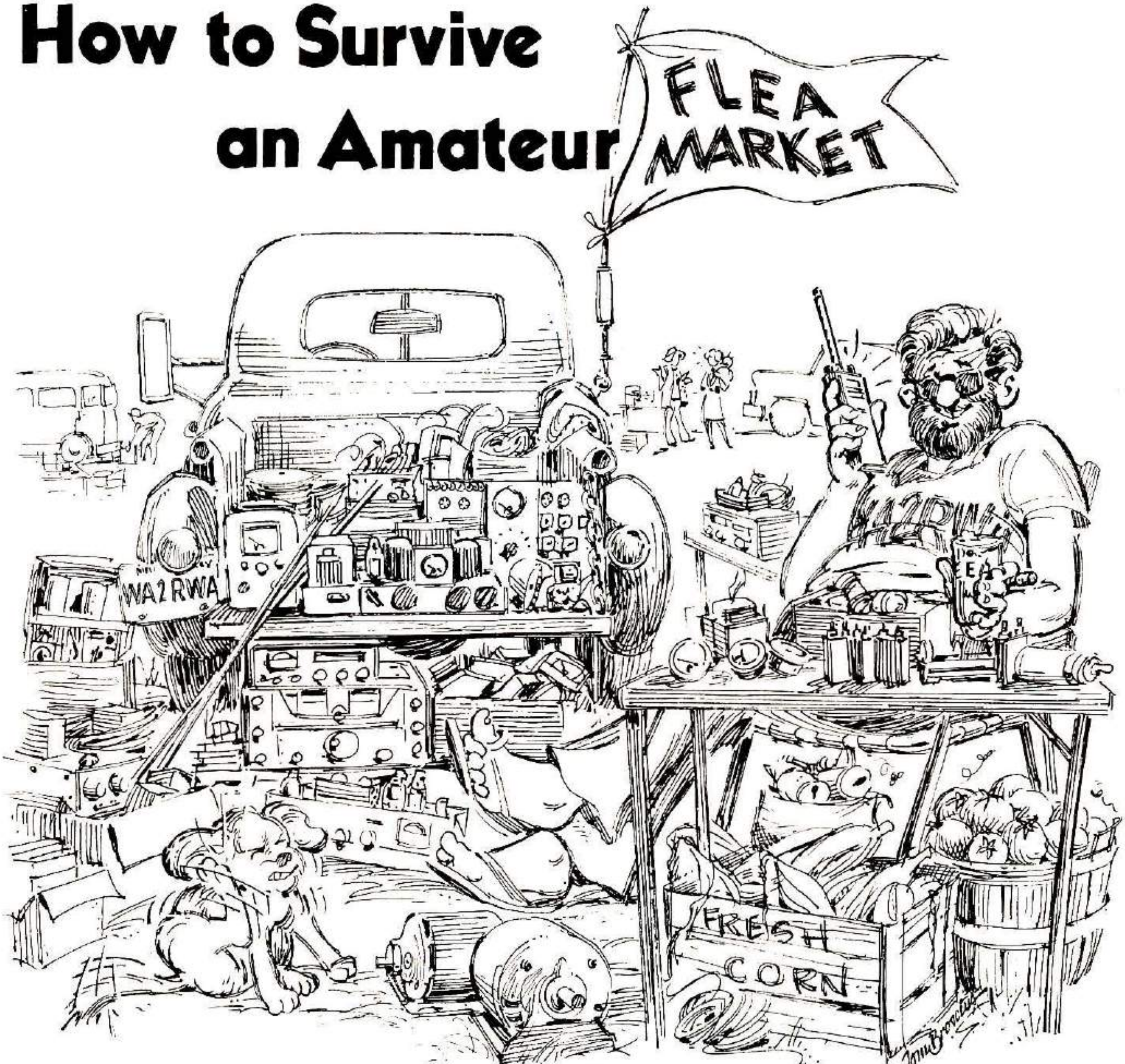
How to Survive an Amateur FLEA MARKET



BY KARL T. THURBER, JR., W8FX/4

The beginner in amateur radio can usually find some good bargains at the flea market. The flea market is usually the key activity at many amateur radio events, such as hamfests. It is just that — a sort of free-for-all open market that consists of fellow amateurs who have equipment and parts to sell, usually at bargain prices.

Before you venture into the flea-market world of pickup trucks, vans, and folding card tables loaded with stuff, be especially sure of what you have in mind. Impulse buying is a sort of universal disease. We all probably succumb to it at one time or another (as in the local supermarket, which offers irresistible items near the checkout stand).

In any event, when you enter the ham radio flea market, stick to your shopping list.

Being prepared

When venturing out, carry a few simple tools such as a small screwdriver set and pair of pliers; a pocket VOM (volt-ohm-milliammeter) to make continuity and short-circuit checks is also helpful. Try to *thoroughly* inspect anything you're thinking of purchasing. Open it up if at all possible to inspect for obvious damage, rust, corrosion, or butchered insides. Evidence of any of these is a definite no-no. Almost all flea-market deals are on a *caveat emptor*, you-got-it-buddy basis, so be sure that you're buying something in reasonably good shape or, at a minimum, that can be repaired. Give kits and homebrew gear a close look for good wiring and construction.

If a great deal of money is involved, ask to have the seller demonstrate the item if possible. This is a problem if the item requires ac power or must be used with something else, such as a linear amplifier. However, ac power is usually available somewhere close by (such as in the main exhibition area at hamfests) and a cooperative fellow ham may loan a transmitter from his swap table to test the linear. The point is: test it out *before* taking it home.

Expensive items such as transceivers and power amplifiers are best bought by arranging a thorough private checkout, if possible, with the seller at a later date. The risk of missing out on a one-time good deal is far outweighed by the cost of a $500 white elephant! In fact you may be better off buying any major pieces of used station equipment (receivers, transmitters and transceivers) from one of the large, well-known mail-order dealers who sell used gear (traded in on new equipment) with a 30-90 day warranty and, in some cases, a 10-day return privilege. At least you won't be stuck with a genuine lemon. Best to stick with accessories and parts at the 'fests.

Electronic parts are usually the best and safest buys. A small component you'll need in setting up operations, which may retail for $1.50 at your local franchised radio outlet, for example, may be found at one-tenth the price at the swap-fest.

In my opinion the bid table procedure that many hamfest sponsors promote is also a good thing, as opposed to auctioning equipment. The emotional factor usually entering into the auction process is largely missing from the bid table. It's also a good method for disposing of your excess gear when you don't have enough stuff accumulated to rent a flea-market space.

One of the joys of going to hamfests is brqwsing through the flea market. There's an almost infinite variety of goodies to pick and choose among, and the shrewd shopper can keep his shack and shop supplied for years this way.

Of course, always carry enough currency — most deals are on a straight cash-and-carry basis. Unless money is no object, don't carry more than you can really afford to spend and have *budgeted* for the purpose.

Clinching that deal

A few simple rules should be observed for making the swap-meet deal:

1. Arrive early enough to scout the area for comparative checks on price, quality, and availability of what you're after. In fairness to sellers, it's often hard to accurately price used gear and parts and you, as a buyer, will find a wide variety of prices and conditions for the very same items. Just be sure you have a handle on what's available before you deal, to avoid later regrets.

2. If you've located exactly what you want or have found an irresistible item of opportunity, and the price is within the ballpark, don't lose the deal by haggling over pennies — if the price is fair, buy it.

3. Don't deal with proxies. If the seller's wife or child is minding the store it's best to wait until he gets back from his lunch break or whatever. It's hard to get the facts and properly negotiate with someone other than the gear's owner.

4. Don't be in such a hurry that you can't devote the time to thoroughly inspect the gear. Look over the manuals. Ask about any quirks in the equipment. Discuss terms. Take the time the deal deserves.

5. Establish the identity of the seller, particularly if the deal is substantial, for two reasons: (**1**) the gear could possibly be stolen; and (**2**) if it doesn't work as stated, you can at least contact the seller for help or try to get your money back if you think you've been ripped off.

6. Above all, use good judgment and common sense in what you buy and how you buy it.

Transceivers, direction finders, antenna-matchers, vhf gear, telegraph apparatus, test equipment — it's all there, and you'll feel like the little boy in the penny-candy department when it comes to making up your mind about what to buy.

7. Finally, don't expect any sympathy from your wife if you goof and bring home a turkey! (Take her with you and solicit her opinion!)

Making it shipshape

Assuming you do make the plunge and bring home a super-duper Model 1 Early Prototype Sky-Shifter 6-Meter a-m and MCW transceiver or similar item, what are you going to do with it? Here are some tips on refurbishing your little gem.

Cleaning. It's best not to give the unit a smoke test until it's been thoroughly cleaned. This is to ensure that dust, grime, and even dead bugs don't short out any vital components. Despite what the seller may have said, the unit may have been gathering dust in a damp basement for some time.

After giving the unit a thorough visual inspection, the first thing to do is clean up the exterior case or cabinet, if necessary. In most cases, a good kitchen-type powder cleanser will clean up the exterior. Metal cabinets may be brought up to respectability with a very *light* buffing with a jeweler's polishing cloth or buffing cotton. Wooden cabinets can often be restored to like-new shape by application of a scratch-coating furniture polish, such as *Old English*.

Small spots of rust can be removed by sanding with fine sandpaper or by using one of the rust removing chemicals. (Radio Shack sells a moisture remover and penetrant that is effective in loosening rusted parts — though you really shouldn't have any rust on anything you buy!)

The chassis can be cleaned next using a vacuum cleaner and/or a small brush. (A toothbrush is good for the hard-to-reach places). Any grease, dirt, battery acid, or capacitor electrolyte can usually be removed with carbon tetrachloride.* Pitch can be removed with benzene or kerosene. Take the time to inspect the chassis for signs of broken or charred components and connectors, loose or frayed wires, and cold solder joints — the latter will cause you untold trouble in solid-state PC boards if not detected. Nail-polish remover is good for removing gummy residues from line cords and other cables.

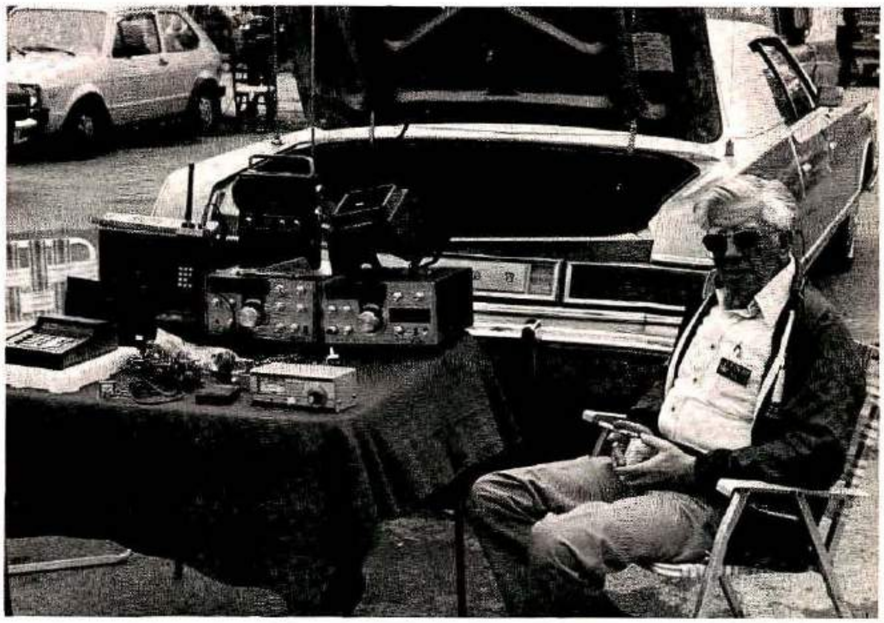
It's best to assume that all the switch contacts and potentiometers are going to be noisy — they usually *are*. Dirt and oxide can be removed by spraying a high-quality contact cleaner (such as the type used to clean TV tuners) onto the switch contacts and into the posts, rotating the shafts several times to make sure that the cleaner has a chance to work and make good electrical contact before it evaporates. Repeat the process several times for best results. Be

*Follow exactly the directions on the container.

You can find bargain rigs in one area, and often find needed accessories for them in another. Novice rigs that are crystal controlled are plentiful, and so are crystals to go with them. The wise shopper makes a couple of rounds through the tables, noting what's available, then goes back with a list that gets all the parts together.

careful, however, not to use excessive quantities of solvent to avoid flooding other components.

Air-spaced variable capacitors should be examined closely to see if dust and dirt have shorted out the plates; this is very often the case in older equipment that hasn't seen service for some time. The plates can be cleaned without bending them by using a pipe-cleaner that has been dampened with carbon tet or alcohol, and the pipe-cleaner can also double as a handy device to use when you have to clean areas that a larger brush can't reach.



For the seller, it's a chance to relax in the sun and display some unneeded equipment before a very large group of prospective customers. An added attraction is the numerous "eyeball" QSOs that are an inevitable part of a hamfest.

Replacing parts. Dial cords should be replaced if they show signs of wear. They should be removed carefully (noting the routing), measured, and replaced with a new cord. Old worn-out springs may also have to be replaced. Use only an oil *reducing* compound (such as Olson Electronics "Degreaser and Cleaner") on the tuning control wheel (if there is one, such as on a broadcast-band type variable) to avoid dial slippage; oil *only* the pulley shafts and other metal-to-metal moving parts. Inexpensive *3-in-One* brand oil, *WD-40*, or petroleum jellies such as *Vaseline* are good for these jobs. Radio Shack also sells a good silicon lube spray.

Remove and replace any broken parts and loose or frayed wiring, resoldering any potential cold solder joints. In an especially old piece of gear, particularly vintage tube-type receivers, it's a good idea to replace all of the paper bypass capacitors with high-quality ceramic or mylar types to avoid hard-to-troubleshoot problems with leaky, shorted, or open capacitors. This can wait, however, until you've finished initially checking out the equipment. Also, for safety's sake, be sure to replace any stiff, cracked, or frayed line cords before plugging in to ac power — the plastic and rubber cords tend to deteriorate after a few years. (Incidentally, if intermittents persist, you might try using one of the compounds known variously as *Freeze It* or *Freeze Mist* to chill capacitors or resistors suspected of being thermally defective).

Industrial surplus is often a real bargain. Top-grade components for your next project, at prices that are hard to beat. Take along a schematic diagram or parts list for the rig you want to build, and check off each needed item as you find it.

The moment of truth

After delaying the moment of truth as long as possible, it finally becomes necessary to actually try out the little gem, hoping for the best. With any luck, and prescreening *anything* that has been butchered or drastically rewired and modified, the unit should, hopefully, work as pitched by the seller. And if it doesn't?

There is usually no real recourse other than to try to fix the unit yourself (a possibly painful learning experience), checking first for the obvious, such as blown or missing fuses, bad tubes, poor connections, shorts, open circuits, and the like. Once this is done, and if problems still persist, try to contact the seller; he may be able to shed some light on the problem that may simply lie in your unfamiliarity with the gear. If you *still* can't fix it, ask for help from another ham, and write to the manufacturer for a service manual and/or schematic if one wasn't furnished with the equipment. Repairing any piece of electronic gear is next to impossible without a circuit diagram! (If you bought a unit that had been extensively modified by the seller, he should be able to furnish an updated diagram showing what the insides should look like *now* — if he can't, beware!)

For a professional-looking, neat unit — particularly if the gear has seen much hard service — you might want to mechanically tear down the equipment, carefully respraying the cabinet and relabeling all the external operating controls and jacks. *Dymo* label tape is very good for this purpose. However, refrain from doing this if there is any chance that you might want to sell the unit commercially or trade it in. A resprayed, relabeled unit rates about a zero on the commercial resale market, regardless of its improved appearance and good electrical condition.

Finally, broken or missing mounting feet can be replaced easily with adhesive-backed mounting feet, while older units can be given a classy look by installing modern instrumentation knobs.

Cleaning and restoring flea market purchases can indeed be fun, provided what you buy is restorable to start with. In any case, good luck — and see you at the next hamfest!

HRH

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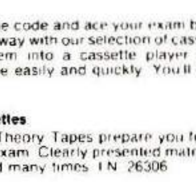

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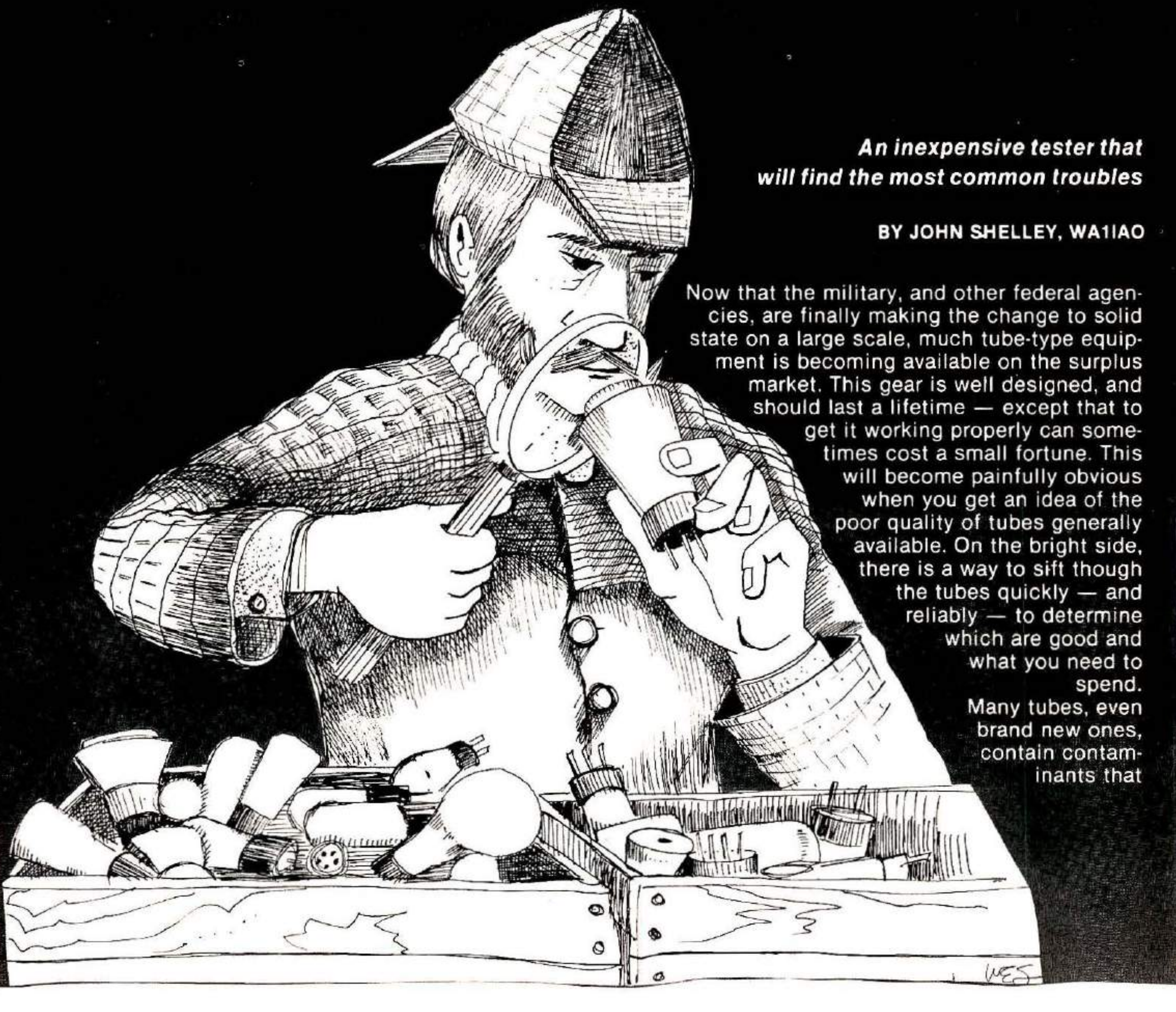

An inexpensive tester that will find the most common troubles

BY JOHN SHELLEY, WA1IAO

Now that the military, and other federal agencies, are finally making the change to solid state on a large scale, much tube-type equipment is becoming available on the surplus market. This gear is well designed, and should last a lifetime — except that to get it working properly can sometimes cost a small fortune. This will become painfully obvious when you get an idea of the poor quality of tubes generally available. On the bright side, there is a way to sift though the tubes quickly — and reliably — to determine which are good and what you need to spend.

Many tubes, even brand new ones, contain contaminants that

that bridge the gap between the elements. These bridges are rarely measurable with an ohmmeter of the common variety, but can be found by using a megger or high-potential meter. Fortunately, you do not have to use such exotic equipment to find these leakages. If you apply the proper voltage to the tubes, you can spot leakage in the hundreds-of-megohms range. A VTVM or solid-state voltmeter, with 11 megohms or so of input resistance, will serve as an indicator.

A resistance of 100 megohms may sound insignificant, but include with it some capacitance, some inductance, and some heat; now you have the most common source of malfunctions in tube-type equipment. For instance, connect a 100 megohm resistor from filament to grid and you have a 60-Hz buzz generator. Connect it from plate to grid and you have a saturated amplifier. A small leak in a mixer or converter tube can modulate the oscillator and distort the output signal. Another common problem is to have a grid on an agc line leaking to a plate or cathode, which pulls the line to some high or low voltage level. The result is little or no agc action.

It's my experience that, short of an open filament, or other element connection, this leakage checker will find better than 90 per cent of the most common tube troubles. Some tubes will fail from low emission, but this may well result from being biased to near cut-off by a resistance leak. The older octal and other large-base tubes don't show

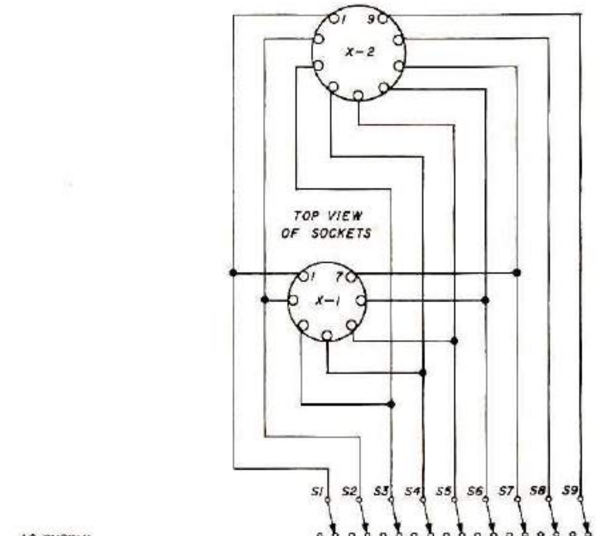

Fig. 1. Schematic diagram for the tube checker. You can use a pair of batteries to obtain operating voltage, or build the ac supply — the current requirement is only microamperes. The transformer, if used, should have a secondary of approximately 110 volts to provide 150 to 180 volts across C1. S1 through S9 are single-pole, single-throw, and S10 through S18 are single-pole, double-throw. Either toggle or slide switches may be used. S19 is a momentary contact push-button switch used to check the battery voltage. Use good quality sockets and wiring — any resistance path other than through the tube will cause an erroneous reading. You can build the unit in almost any metal box or enclosure that is large enough to hold the components. More sockets and more switches can be added to check tubes other than common 7- and 9-pin types.

leaks but will show gas in many cases.

When you have a used receiver with 20 or more tubes, it is not unlikely to find half of them bad. With a transconductance tube checker you might find most of them after setting it up and waiting for each tube to thoroughly warm up. But, unless it has a super leakage test, you will miss some. Conversely, I have found a radar i-f amplifier with many tubes that failed miserably on a transconductance check, yet it had a beautiful 10-MHz wide bandpass curve and good gain characteristics, and no leaks! A tube that has been in service for a year or more, and shows no leaks, is like gold and is likely to give good service for many more years.

The simplicity of the leakage check is its greatest virtue. The VTVM tries to measure the supply voltage through the empty space between the elements. The tubes must be cold, so you do have a waiting period while all conductance dies out. Turn the whole set off first, and do something else for five minutes. Don't grasp tubes in moist hands just prior to testing. If you clean them, which is a good practice, be careful not to wipe off labels. Use only water to clean off the spilled coffee, dust, *etc.*, then make sure they are bone dry — especially between the pins. Another discovery that I made is that tubes have varying amounts of photoelectric properties, so don't check them in sunlight.

The test unit is nothing more than a switch box with tube sockets and a voltage source (see **Fig. 1**). The only external items are a VTVM and some tubes to check. The switches are used to connect each element, in turn, for measurement. Disconnect switches are included to eliminate multiple paths to an element, and so that the VTVM can be used on a low scale without having to wait for it to recover each time a filament (or any direct connection to another pin) is encountered. All but one pin to each element is switched out of the circuit.

Construction

An enclosure of almost any style will suffice. Two batteries (or a small power supply giving 135 to 150 volts) are contained inside. A bracket should be made to keep the batteries anchored. Any style SPST and SPDT switches can be used as long as they fit the box and will not pass any of the voltage through their open contacts. Most of the small toggle and slide switches are adequate. A pair of meter jacks and tube sockets complete the list. Another socket for compactrons may be added if you desire this option. If so, additional switches must be added.

Here, more than in any other type of equipment, do not use any flux other than the rosin contained in your 60/40 alloy electronic solder. All of the plumber's and tinsmith's fluxes will show conduction, absorb moisture, and will gradually destroy your circuitry.

For anyone who doesn't own a VTVM there is a less sensitive alternative that is still quite useful. A 50-μA meter may be built in, with a 3 megohm resistor wired in series. A dead short in a tube will cause a full scale reading on the meter, if you use a 150-volt supply.

With all the test switches, S10 through S18, in the up (or **A**) position, insert the tube under test in a socket. The meter may show a small kick from stray capacitance. In the common seven-pin tubes the filament is connected to pins 3 and 4. So, disconnect either pin 3 or 4 (S3 or 4). On a 6AK5 tube there are also two pins connected to the grid — 1 and 7. If you disconnect pin 1 or 7 there shouldn't be any connections left to deliver 150 volts to the meter. Now, switch the meter to a scale that has good sensitivity but will not take too long to recover from the capacitive kick. On some meters you can use the 0.5-volt scale, but on others you might want to use the 3-volt scale because of too much time delay. With this in mind, start flipping the test switches down (to the **B** position), one at a time, observing the momentary high reading and decay to a residual level. Experience will dictate how much of a residual reading you can tolerate. Generally, I reject a tube that gives more than 10 per cent of full-scale deflection after decay of the capacitance reading. The tubes should be tapped with your fingers to find intermittent leaks. After a second or so, the switch should be returned to the up (**A**) position and the process repeated for each pin not disconnected. Sometimes diode properties due to contaminants are present between the elements and they show up better in one position than the other.

If you don't have a base diagram for some odd-ball tube, the meter should be first tried on the 150-volt scale, and each pin tested and compared with the battery voltage. Any pin that delivers full battery voltage is assumed to be connected to another and should be disconnected. Another tube of the same type will verify this.

This test may seem overly critical, but when you have a job to do without a full caddy for substitution, this is a valid method. You will have to establish your own criteria, but remember that it takes only a small leak from filament to grid to make an audio preamp tube cause severe hum. An rf stage is the most critical, with i-f tubes next. If you are on a budget, it may be prudent to move the poorest tubes nearest to the output, where their troubles will be amplified by fewer stages.

With this tube checker and a book of base diagrams, your troubles should boil down to merely money problems. **HRH**

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What are all those knobs for?

The phone rang just as I bit into a chunk of nice, hot, juicy steak fresh off the grill. (It always rings at dinnertime, no matter when that may be. I once delayed dinner until after midnight just to get out of phase with the telephone — it rang on the third bite.) Wife: "You may as well answer it, it'll be for you anyway."

"Yes?"

"Hi, Tom . . . this is Harold. Uh, got a minute?"

"I dunno, what's up?"

"Well . . . that equipment you told me I should order came in today, and I'm trying to hook it up. Can you come over this evening?"

BY THOMAS McMULLEN, W1SL

"Have you read the instruction books?"

"Yeah, but they're not speaking my language."

"Okay, I'll be over in about an hour."

"You aren't catching cold are you? You sound kinda muffled."

No comment.

Later, with the slightly cooled steak properly disposed of, a few evening chores out of the way, some odd bits of paperwork cleared up, and the stove amply stuffed with oak chunks for the evening, I gave my wife a "see-ya-later" wave and headed for Harold and his puzzle. As I crunched through the recent snowfall, I wondered what could be the matter. Probably stage fright, or maybe there really was a problem which a brand new ham wouldn't recognize. The Super-Boomer transmitter and Golden Ear receiver ("both used but working — no dents or scratches, straight key and headset included at no extra charge — must sell for college") have a reputation for durability, so I told him to answer the ad in the Flea Market section of a magazine. Oh, well, radio is radio, and how tough can the problem be, right?

"C'mon in . . . let me take your coat. Want some hot chocolate? It'll be ready in a jiffy."

Into the new hamshack. There they are — two venerable, solidly built pieces of equipment, tubes and dial lights glowing comfortably in the dim light. A piece of coax disappearing under the cracked-open window, key plugged in, earphones hissing and crackling contentedly.

"Hey, they're alive anyway. What's the trouble?"

"I can sum it up in one sentence," Harold said as he waved an arm at the pair of heavy-weight boxes, "WHAT ARE ALL THOSE KNOBS FOR?"

Now, that one caused me to take a moment to shift gears. I was prepared to discuss signal paths, power supply problems, relay and switch hang-ups, or the importance of a good ground, but explain all those knobs? Changing into the "pretend-you-never-saw-one-before" mode, I could see that we did, indeed, have a problem. Where to start? Well, here's a list of the most common controls found on Amateur equipment in use today, so if there's a mysterious control or function on your new rig, perhaps this will help clear up the confusion.

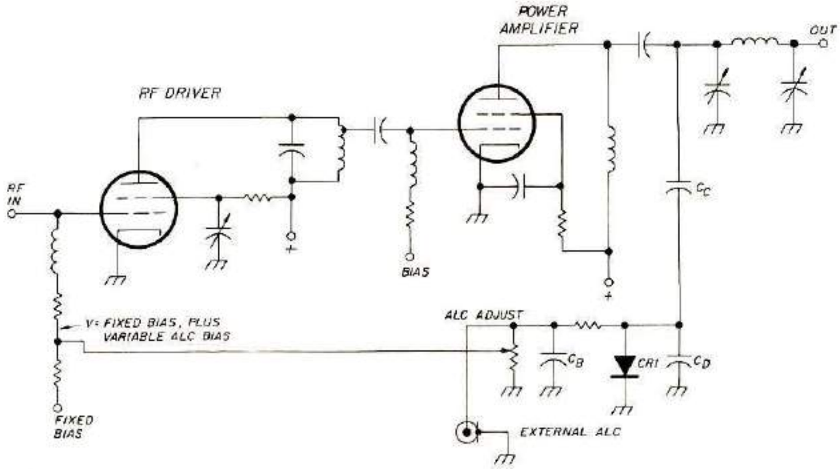
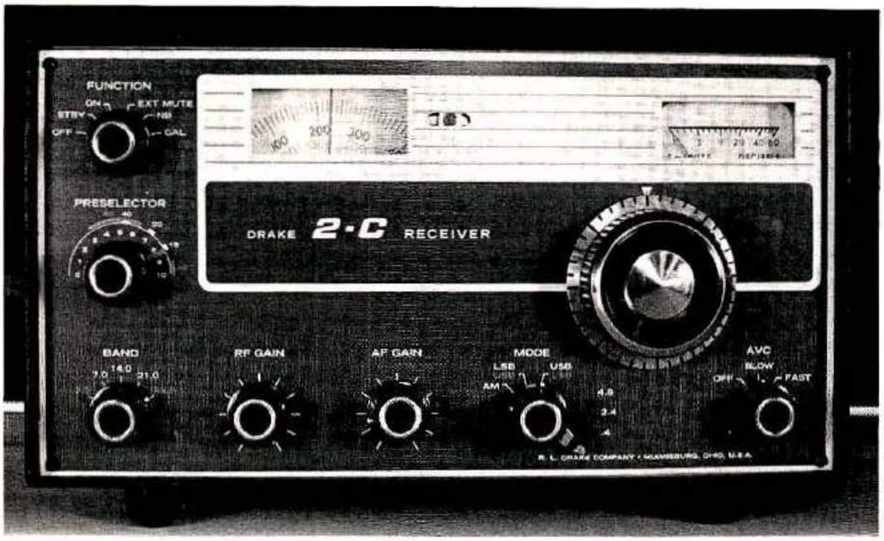


Fig. 1. The ALC circuit is a means of preventing overdrive and distortion in the output circuit of a transmitter. It's particularly useful for ssb work. In action, a small portion of the output rf voltage is picked off the amplifier plate by capacitor *Cc*, and coupled to a diode, *CR1*. Capacitor *Cd* is part of an rf voltage divider. Diode *CR1* rectifies the rf voltage, and the resultant dc is filtered by *Cb*, and appears across the ALC ADJUST control. This voltage is negative, with a value that depends upon the amount of power in the output circuit. The arm of the ALC ADJUST control is used to set the amount of this voltage that is applied to the grid of a preceding tube or tubes. It is applied in addition to the fixed bias that is necessary to protect the tube in case of trouble. When the rf voltage on the plate of the output tube reaches a predetermined level, the bias generated by *CR1* gets to the grid of the rf driver tube, and decreases its gain, thereby reducing the amount of voltage applied to the output stage. Most equipment has a jack to connect ALC voltage from an external amplifier so that it, too, may be protected.

AGC, sometimes called **AVC**; Automatic Gain Control, (Automatic Volume Control): A circuit designed to keep the audio output of a receiver at a somewhat constant level, regardless of the strength of the incoming signal. The control is usually a switch on the front panel of a receiver, by means of which you can select a "fast," "slow," or "off" function. The fast and slow refer to the response time of the circuit — a slow response will keep the gain lowered (turned down) for a second (or longer) after a very strong signal has ended. The "off" position disables the AGC circuit, which is good for trying to copy very weak signals. However, under these conditions, a very strong signal will appear to be badly distorted because it is overloading one or more stages in your receiver. Sometimes there is a variable control inside, or on the rear of, a receiver to allow adjustment of the AGC characteristics. If so, it should be set according to the manufacturer's instructions. AVC circuits seldom had any provisions for making adjustments, but some receivers did have a switch to disable this function — usually labeled AVC/OFF.

ALC, Automatic Level Control (sometimes Automatic Loading Control): This is a circuit in a transmitter, designed to prevent overloading (and distortion) in one or more amplifier stages. It's not needed for CW or fm, but is essential for proper ssb operation. Basically, a sample of the rf output (or the drive to a given amplifier stage) is rectified, and the resulting dc voltage is used to control the bias to an earlier stage, see **Fig. 1**. The changing bias controls the gain of the stage, which tends to keep the drive to the next stage(s) somewhat constant. The circuit usually has a control for adjustment, often located on the rear panel of a transmitter. It must be adjusted in accordance with the manufacturer's instructions. Often, there is a jack or connector pin to alloow connecting the ALC function to external amplifiers.

ANL, Automatic Noise Limiter: A receiver circuit to reduce the annoyance of impulse-type noise, such as ignition noise. Sometimes called **Clipper, Limiter**, or **Noise Limiter.** A few circuits were "automatic," being designed to start clipping noise-pulses at a level determined by the strength of



Many receivers have their front panels well laid out, providing plenty of room between controls which are clearly marked. This Drake receiver incorporates most of the controls talked about in the text, including a noise blanker (NB) on the function switch, a preselector to peak up incoming signals, a bandwidth selector (it's the lever that appears to be attached to the mode switch), and an AVC selector.

the incoming signal. Most, however, were simply diodes, sometimes with a small bias voltage applied, connected across the earphone jack, or some other part of the audio circuitry. Usually, there are no adjustments to be made, but many receivers have a switch to turn the ANL function on or off.

Attenuator, (Atten): A network of resistors, a variable resistor (potentiometer), or an electronic circuit designed to reduce the level (strength) of a signal. As most often used in modern receivers, it is a potentiometer (or sometimes a switch to select fixed-value resistors) wired into the signal path ahead of any amplifier stages. Its purpose is to decrease extremely strong signals to a point where they will not overload the receiver. Leave this control set at zero (minimum attenuation) unless a strong signal is bothering you, then adjust it for the best reception — sometimes you can copy a weak signal near a loud one if you decrease the loud signal to where it is only an annoyance but not "taking over" your receiver. Note that it attenuates *all* signals.

Band: This control is usually a switch, used to select the band of frequencies you want to tune across, or on which you wish to transmit. It is sometimes labeled in meters (80, 40, 20, etc.) and sometimes in frequency (MHz, or Mcs on older equipment) such as 3.5, 7.0 or 14. On some transmitters there will be two switches (or tuning controls) marked "band," and they must both be set to the same frequency for the rig to work properly. (An exception would be a very early transmitter with frequency doublers — you might have to set the oscillator to 3.5 MHz and the doubler, or output, stage to 7.0 MHz, for example.)

Bandpass, (Bandpass Tuning): This is one that's beginning to show up on some of the newer receivers. A bandpass circuit is one that will pass a specific range of frequencies — in a receiver the range is usually determined by the filters in the i-f (intermediate frequency) circuits. A bandpass tuning circuit would allow you to select a very small segment of that range, and to determine which part of the range that segment was in. This feature is very useful during crowded band conditions; by proper adjustment of the bandpass-tuning control, you can place an interfering signal outside the bandpass range, where it is of least bother to the signal you want to copy.

BFO, Beat Frequency Oscillator: Output from this oscillator is used to beat (heterodyne) with an incoming signal to produce a difference frequency in the audio range. This is usually done at the end of the i-f amplifier chain, in a stage called a *demodulator* or *product detector*. In most older receivers the BFO was a variable-frequency type, adjustable by means of a knob on the front panel. Modern receivers tend to use crystal-controlled oscillators to provide maximum stability for detection of CW and ssb signals. A different crystal is switched into the circuit for either upper or lower sideband.

Blanker: This is a more sophisticated noise-eliminating circuit than the ANL or clipper types. Noise pulses are received and amplified by a special circuit, then used to disable a portion of the receiver circuit (an rf amplifier, mixer, or i-f amplifier) for the duration of the pulse. It's quite effective for ignition-noise pulses, and for eliminating radar pulses in vhf receivers. There are seldom any controls you need to adjust for this circuit, but simply a switch to turn it on or off.

Cal, (Calibrate): This label is most often used to indicate an electronic circuit for generating a "marker" signal. However, a few receivers use this designation for the mechanical control that moves the fiduciary (pointer) on the tuning-dial system. In the marker-generator type, an oscillator provides an output at some standard reference frequency, such as 100 kHz. This frequency is then divided electronically to other useful checkpoints, such as 50, 25, or sometimes 10 kHz. You tune in these steady, strong, marker signals and note the error (if any) in the reading on the dial. Most receivers have a means of correcting the dial reading; if yours does not, you'll have to allow for the error when you use the receiver. The purpose of the mechanical adjustment of the dial-pointer is the same — you adjust it until the reading is correct for the standard, marker, or calibrate signal.

Clarifier, Delta Tune, Offset Tuning, RIT, RX OT: These are most often found on transceivers, and sometimes on a receiver that is designed to work with a transmitter in a transceiver-like fashion. It is a receiver-frequency control that is independent of the main tuning dial over a small range. **RIT** stands for Receiver Incremental Tuning. An example of the use of these controls would be to tune in a station who answered your call but was not exactly on your frequency. Rather than move your main tuning dial (which would change *your* transmit frequency), you adjust the RIT, RX OT, or whatever. The need for this control was brought about by the small differences in frequency-generating schemes in various transceivers. **Delta Tune** is a name borrowed from CB rigs, where the transmitters were all crystal controlled, but there was a need for receiver tuning to copy a signal that was off frequency by a small amount. Seldom needed for a-m, but very necessary for ssb.

Drive (Level), Carrier Level: Generally found on transmitters. A means of setting rf energy to the proper level for

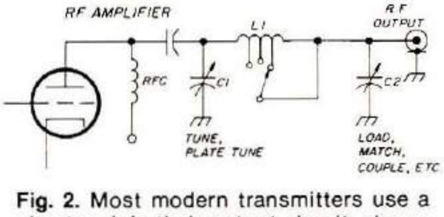
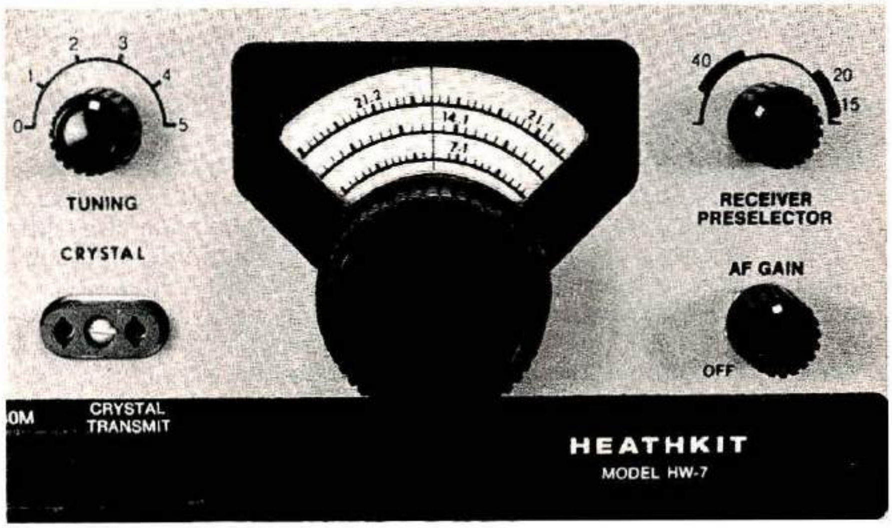


Fig. 2. Most modern transmitters use a pi-network in their output circuit, shown here in simplified form. The two important controls are the TUNE, or PLATE-TUNING *(C1)* and the LOAD, or MATCH *(C2)*. The plate tuning control tunes the plate circuit to resonance, as indicated by a dip in plate current. The load control matches the output-circuit impedance to that of the coaxial cable or antenna. The plate-circuit inductance, *L1*, usually has taps or sections, selected by means of a switch, to allow operation on the band of your choice.



When it comes to transceivers, it is hard to make it more simple than the panel of the HW-7. The tuning control (upper left) peaks up the transmitter output, and the receiver preselector peaks up the incoming signal. The ease of operation makes up for the lack of sophistication in the circuitry.

amplifier stages. On some transmitters, the control is adjusted to obtain a specified amount of grid current; others require a particular cathode- or plate-current reading. This control is very useful while you are tuning up a rig — you can tune and tweak the controls for maximum rf output while keeping the drive low enough that nothing becomes overheated. After all adjustments have been made, advance the drive control to obtain full output.

Forward (Fwd), Reflected (Refl), SWR, VSWR: These are terms that have more to do with antennas and transmission lines than with transmitters, but you'll find a few transmitters with a switch (or meter) so labeled. They refer to readings of rf energy on a transmission line, of course, and their main purpose is to let you keep track of what's happening after the signal leaves your rig. There's nothing you can do at your rig to change SWR (standing wave ratio) or the reflected-power reading, but at least if there is a sudden change you can take steps to prevent damage in your transmitter. You'll see these terms used on the switches and meters in some matching devices (Matchbox, Transmatch, "Antenna Tuner," or whatever).

Gain, Mic Gain: These controls are both in audio-amplifier circuits, but "gain" is usually associated with the loudness of audio from a receiver; it is sometimes called **Audio Gain**, or **AF Gain**. **Mic Gain** controls are found on transmitters, or in the transmit portion of a transceiver. It controls the amount of amplification your voice receives as it goes through the transmitter.

Load, Loading, Matching: This is a transmitter control. It is sometimes called **Coupling**, meaning that it adjusts the amount that the final stage is "coupled" or connected to the transmission line or antenna, see **Fig. 2**. The heavier the loading, or the tighter the coupling, the more energy will be transferred to the transmission line. If the loading is too heavy, the output stage in the transmitter can overheat and self-destruct. The coupling, loading, or matching circuit is a form of impedance matching network. Use this control to obtain the maximum rf output, but do not go above the manufacturer's recommendation for safe operating current.

LSB, USB, CW, AM, FM: These designate the mode of transmission or reception. In a transmitter they select the proper amplifiers and frequencies to generate lower sideband, upper sideband, code, amplitude-modulated, or frequency modulated signals. When this control is on a receiver panel, it selects the proper filters and BFO crystals to detect the mode desired. Some receivers have an additional filter and a switch position marked RTTY to provide improved reception of radio-teleprinter signals. The wiring of these selector switches can sometimes be confusing in that you may have to unplug a key to use any of the voice modes, or, you have to plug in a key to prevent a steady carrier from being transmitted in the CW position. These variations in switch functions make it a very good idea to insist on getting an operating manual with any new or used rig you buy.

Linear: This usually refers to a piece of equipment — a separate amplifier in most cases. However, some of the newer amplifiers have a switch to select between the "linear" mode for good reproduction of ssb voice signals, and the "C" or "Class-C" mode for either fm or CW. You may find jacks marked "linear" on the rear apron of transmitters, meaning that they are for making connections to a linear amplifier for such functions as keying, high-voltage switching, ALC voltage, and the like.

Lock Key, Tune: This control provides a third hand when you are trying to tune up a transmitter or matching circuit; it takes the place of having to hold the key or microphone switch closed. In many transmitters the tune position switches in circuit elements that reduce the power from the rig, thus preventing overload and heating during long tune-up sessions. Note: the "Tune" label is sometimes used for a different control on a transmitter, which I'll tell you about later.

MOX, VOX, ANTIVOX, VOX Delay, VOX Gain: These controls and labels all have to do with how the transmitter is turned on and off. Simply stated, MOX means manually operated transmit, VOX means voice-operated transmit. When using VOX, your voice, picked up by the microphone, is amplified and rectified into a dc control voltage. This voltage is applied to a relay circuit to turn the rig on and hold it on as long as you are speaking. ANTI-VOX is a circuit which uses part of the audio output from your receiver to prevent the rig from being keyed by the signal you are receiving. The VOX DELAY control adjusts the amount of time the transmitter stays on after you stop talking. And, of course, the VOX GAIN control adjusts the sensitivity of the circuit to your voice. It should be set so that your normal speaking voice turns the rig on, but the usual room noises around you do not.

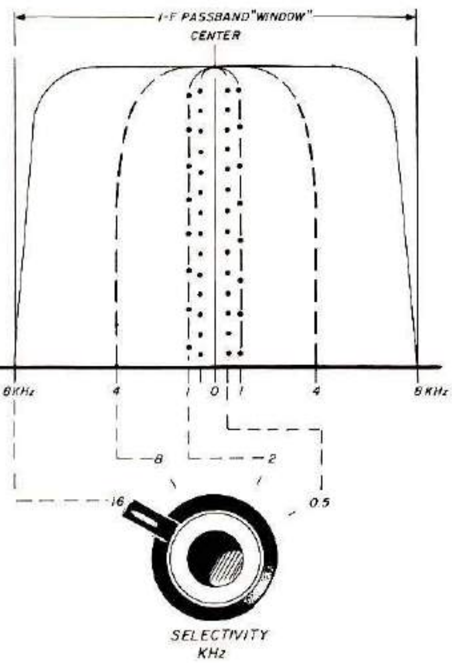


Fig. 3. The selectivity control on a receiver is a means of controlling the "window" in the receiver's intermediate-amplifier circuit. The selection can be done by switching in different crystal filters, mechanical filters, or a set of precise tuned circuits. Note that the window is symmetrical about the center frequency — when the selector knob is in the "16" position, the window is wide open; when it is at its most narrow, 0.5 kHz (500 hertz), only a small portion of the window is open, which allows only a very few signals to come through. Many receivers do not have this wide a range of selectivity — most of the average ones have only 2.1 or 3 kHz for ssb, and 0.5 for CW use. Wide selectivity would be needed for radio-teletype signals, amplitude modulation, and frequency modulation. Use the position that provides the best ratio between the signal you want and the noise and unwanted signals.

Preselector, Preselector Tune, Driver Tune: These can be found on transmitters, receivers, or transceivers. On a receiver, "Preselector" usually refers to the tuned circuit ahead of the first amplifier or mixer stage — it selects the frequency or band that the receiver will be most sensitive to. It is sometimes mislabeled "Antenna Tune." In a transmitter or transceiver, these functions are often performed by several resonant circuits in the low-power stages, connected together by a common shaft. In a transceiver, the same set of resonant circuits can be used to peak up incoming signals for the receiver, and to peak up the drive power to the transmitter final stage. They are switched automatically by the relays and circuits that change from receive to transmit.

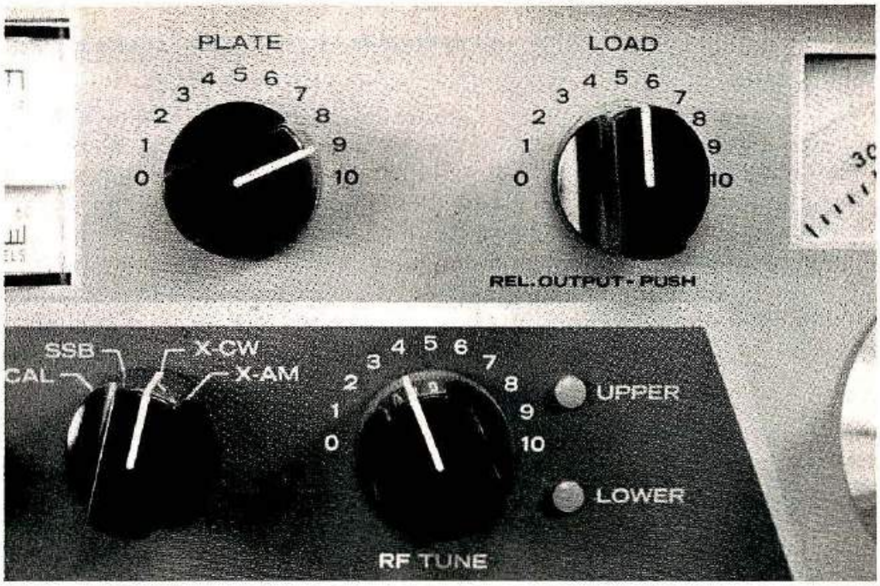
QSK: This is a Q-signal meaning "I have break-in operation," or "Do you have break-in capabilities?" As used with modern equipment, it means that you can hear the signal of the station you are working between the characters (dots and dashes) you are sending. QSK has begun to appear on the panel of recent rigs, notably those from Ten-Tec, in conjunction with "fast" and "slow" functions. This allows you to adjust the timing of the receiver's "listening" circuitry to your sending speed. A very useful function for message handling, in addition to long QSOs, where the other operator might want to interrupt you with a question.

Reject Tune, Notch Tune: This is a circuit in a receiver, designed to eliminate an interfering signal. There are various circuits that perform this function, but a very popular one was an accessory sold some years ago under the name *Select-O-Ject*. It had the property of being able to "cancel" an audio tone to which it was adjusted, while leaving all other tones unhindered. Many of the newer receivers have this feature built in. In use, you simply vary the control to eliminate the "big signal" that is making it hard to copy the one you are interested in. As long as the two signals are not producing the same audio note, the circuit is quite effective.

RF Gain: This control adjusts the gain (amount of amplification) of the receiver's rf and i-f stages, much in the same manner as the AF Gain control does for the audio stages. An RF Gain control is necessary to prevent overload of these sensitive, high-gain stages. For most purposes, the control should be set to the lowest value that will provide enough signal strength to copy. Running the gain control wide open makes noise louder, and lets the S-meter read higher, but it also introduces a lot of distortion on stronger signals, thereby making copy more difficult. Sometimes, the "thump" you think the other fellow has on his CW signal can be eliminated by reducing the setting of your RF Gain control.

Squelch: You'll find this on most fm rigs, some CB rigs, and a few Amateur ssb and a-m transceivers. It's simply a circuit that cuts off the audio output when there is no signal being received. For best sensitivity, adjust it just *slightly* beyond the quieting point when there is no signal present. If you wish to ignore weak signals but hear a strong one, continue past the no-signal cutoff point for a fraction of the control rotation. Listening to very weak signals requires that the squelch control be completely off.

Selectivity: This one shows up on modern receivers, as well as

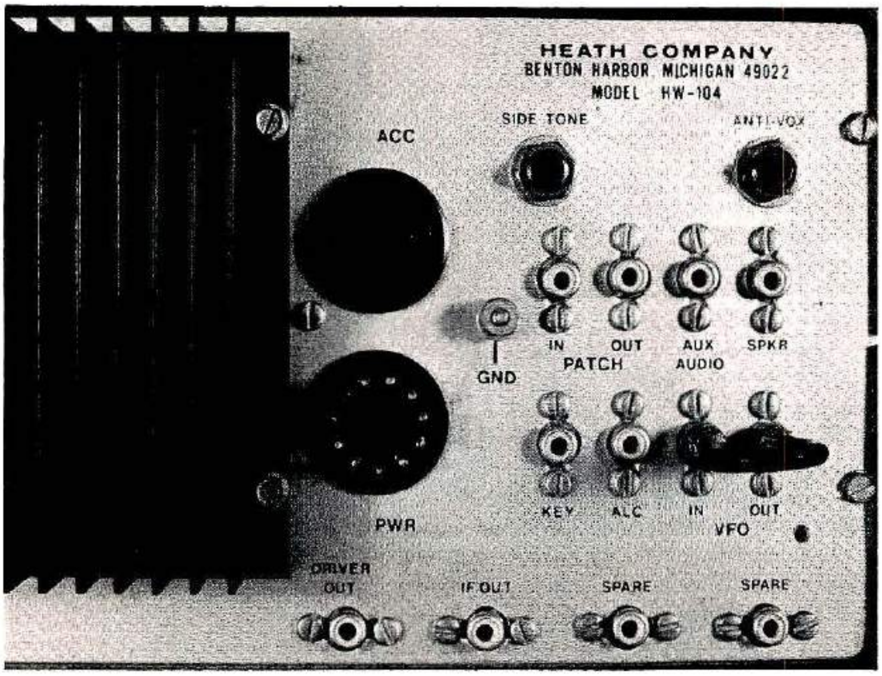


Many transceivers have controls that combine two functions in an effort to save space. The PLATE tuning control on this Drake TR-4C is clearly marked as its only function. However, the LOAD control knob also activates a switch that allows the meter to read relative output. The RF TUNE control serves as a preselector for the receiver portion, and as a driver (or exciter) peaking control for the transmitter section.

on some older models. The circuit is usually in the intermediate-amplifier (i-f) system, and the most common type of control is a switch that selects between two or three crystal or mechanical filters, each with a different bandwidth. Many older receivers, and lately some new ones, have a circuit that provides a smoothly variable selectivity. The width of the selectivity "window" is usually given in kilohertz (kHz), such as 2.3, 1.2, or 0.5, see **Fig. 3**. Some older sets had selectivity values as wide as 50 kHz, which was fine when there were only a few Amateur stations to contend with. To use, select the sensitivity that provides best copy for the mode you are using: 2.3 kHz is fine for ssb in uncrowded bands, with 1.6 or 1.2 better for crowded areas. CW can be copied easily with any of these wider "windows," but a narrow 0.5 kHz works better when the going gets rough. Some DX "Big-Guns" use very narrow selectivities such as 0.3 or 0.2 kHz (300 or 200 hertz) to dig out weak signals in a pile-up. One thing to keep in mind is that the narrower the window, the more stable your equipment must be — you are listening to a slot only a few hertz wide, and it doesn't take much instability to lose a signal.

Sidetone: This one appears on some transmitters and transceivers that have an internally generated tone for monitoring the code you are sending. Adjust the control for a comfortable volume level while you hold the key closed. In some rigs, you can disable the transmitter portion and use the audio tone alone for code practice. Check the book first, though — it's not nice to practice your code on the air (it can be embarrassing, too!).

Tune: This is the one I warned you about earlier; don't become confused between this one and the "Lock key/Tune" function. This particular **Tune** control is sometimes labeled "**Resonate**" as well. It's the plate tuning control in a transmitter or amplifier stage; adjust it for a *dip* in plate current; again, see **Fig. 2**. Tuning a transmitter output stage usually involves adjusting first for a plate-current dip with the Tune control, then adjusting the "Load" or "Coupling" control



Many rigs have several connectors on the back, most of which serve to connect auxiliary equipment to the transmitter or receiver. Only an instruction book can tell you the exact function of each, but it's usually a safe guess that one marked ANT can be connected to your antenna or tuner. Be careful of those marked external relay (EXT RLY), because some rigs provide a *voltage* to cause an external relay to close, and others merely provide a pair of contacts which actuate the relay. Additionally, the voltage, if provided, can vary from 6 or 12 volts up to the full 115-Vac line supply. Know what you have before you plug something into it.

for increased output (and this will cause the plate current to increase). Don't stop with just two adjustments, however; return to the Tune knob for a plate-current dip, then adjust the loading again. You may have to do this several times until you have the maximum output and the correct value of plate current. It's best to practice this into a dummy load until you get the feel of things — an antenna that isn't exactly right will cause the plate current and power output to respond in an erratic fashion, increasing your tune-up time, and possibly overheating your transmitter. You might find the "Tune" control labeled "Plate" on some rigs; it has the same function.

TX Offset: Many of the newer vhf fm rigs have this one. It selects the amount and direction that the transmitter frequency is offset from the received frequency. It is needed for work through repeaters — the standard offset on two-meter fm is 600 kHz, and it can be either up or down, depending upon which part of the band you are in. Some rigs have provision for a nonstandard offset such as 1 MHz, or whatever you provide crystals for.

VFO: Variable Frequency Oscillator; this is the frequency-control oscillator, usually the main tuning dial, of either a receiver or transmitter (or transceiver). It is simply an oscillator, usually mechanically and thermally stable, with provision for varying its output frequency either by mechanical (variable capacitor, variable inductor) or by electronic (voltage-variable capacitance diode) means. As you adjust the VFO frequency, its output heterodynes (beats, or mixes) with the incoming signal to produce an intermediate-frequency signal. The i-f system amplifies this signal and passes it along to the detector. A VFO in a transmitter can operate directly on the frequency you want to transmit, thus taking the place of a crystal, or, it can be heterodyned (mixed) with another signal to produce a third signal (either sum or difference) that is the one you want to transmit.

Zero Beat: You'll find this one on some transceivers and some separate receiver/transmitter setups. It is often a pushbutton switch that turns on a low-powered portion of the transmitter circuit — just enough to let you hear it and adjust the transmitter frequency to a selected spot on the receiver dial. Sometimes called the "Spot" switch. You'll use it to place your transmitter frequency in that clear spot in the band (if you can find one), or to "zero beat" the station you want to call.

That's the list, from A to Z, of most of the controls you'll find on equipment in use today. There will be some variations, of course, and some rigs will combine several features on one seemingly complex switch or control. Also, the modern trend is to use concentric shafts and knobs to save space. You might find the rf gain and audio gain nestled together, for instance. Just be sure you are turning the correct knob for the function you desire.

Only a few of the controls are critical, in that improper use will damage something or lead to illegal operation — the three most important of these being: 1, the VFO, main-tuning dial, or whatever controls the frequency of the equipment; 2, the PLATE-TUNING control; and 3, the LOADING or OUTPUT control. These last two can lead to overheating and damage to the transmitter, or to power output above the legal limit for your license class.

If you have an instruction book, by all means study it. If not, then I hope my "what's-it-for" guide will help you put that new station on the air with a minimum of confusion and worry. **HRH**

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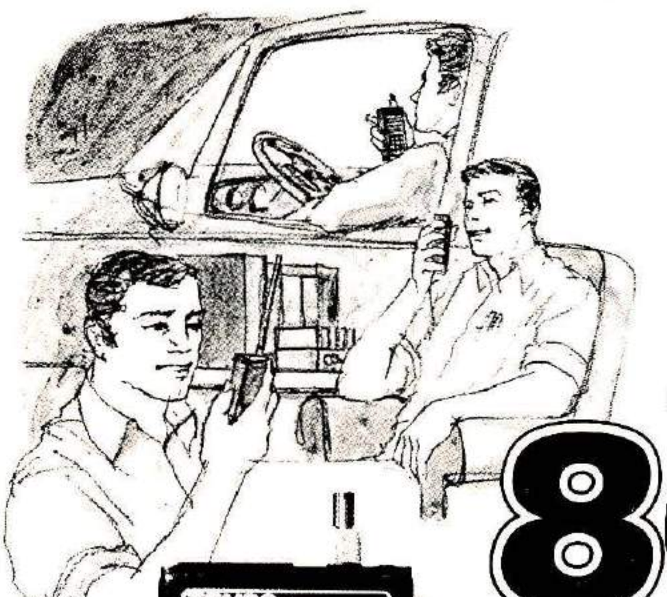

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Top view showing controls

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SPECIFICATIONS

Frequency Coverage:	144 to 148 MHz
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Power Requirements:	9.6 VDC
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Batteries:	8 pieces ni-cad battery included
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Telescoping whip antenna, ni-cad battery pack, charger.

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Touch tone pad: $55 • Tone burst generator: $29.95 • CTCSS sub-audible tone control: $29.95 • Rubber flex antenna: $8 • Leather holster: $16 • Cigarette lighter plug mobile charging unit: $6 • Matching 30 watt output 13.8 VDC power amplifier (S30): $89 • Matching 80 watt output power amplifier (S80): $169

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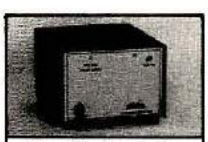
The PS-130 delivers 30 amps regulated and requires 117v or 220v, 50/60 Hz input.

Wide Frequency Coverage. On 80, 40 and 20 meters you get complete band coverage. Plus MARS frequencies without modification to the transceiver.

The Alda 105 covers all the 15 meter band, and from 28.5 to 29.0 MHz on 10 meters. Optional crystals are available for additional coverage on 10 meters, including the novice band.



The PS-115 delivers 18 amps unregulated and requires 117v or 220v, 50/60 Hz input.

Mobile Power. The transceiver requires a nominal 13.8 volts dc input at 20 amps. When you operate mobile, just connect the transceiver directly to the battery.

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Summary Specifications.

Frequency Coverage.... 3.50 to 4.05, 6.95 to 7.50, 13.95 to 14.50, 20.95 to 21.50, 28.45 to 29.00 MHz

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- With power from car or Alda PS-130.... 250 watts PEP or dc on 80, 40 and 20 meters, 200 watts PEP or dc on 15 and 10 meters
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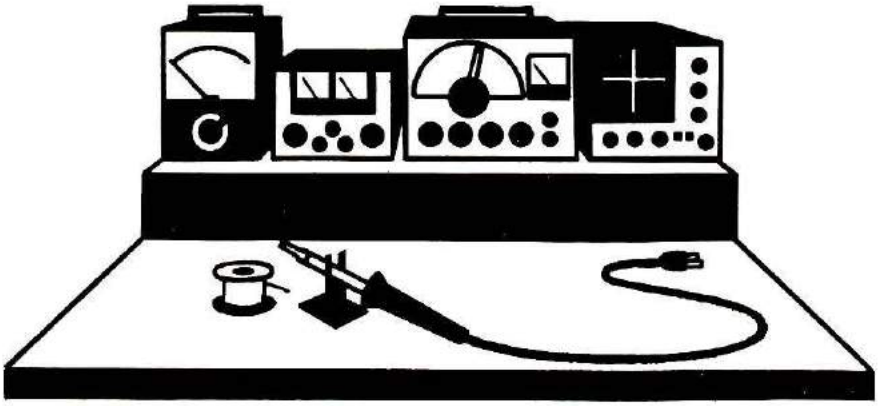


BENCHMARKS

Using Surplus Relays

Surplus 24-volt dc relays are often available to the amateur experimenter at attractive prices. Most of these relays are well designed (and originally very expensive), but hams tend to steer clear of them since a 24-volt dc power supply is required. Not so. I've been using these relays, powered off the ac line, for many years; not even a transformer is needed, just a silicon diode, a resistor and a filter capacitor.

Some of the late-model, hermetically sealed relays have a relatively high resistance, but most of the open-frame types have a resistance in the range from 150 to 500 ohms. With the circuit shown in **Fig. 1**, the dc output from the diode is 54 volts. If the resistor is chosen with the same resistance as the relay coil, 27 Vdc will be impressed across the relay. Use a 10-watt wirewound resistor. The filter capacitor only has to be large enough to keep the relay from buzzing; generally 100 μF will be more than enough. An electrolytic rated at 150 volts costs only a few cents more than one with a 50-volt rating, and the higher rating is worthwhile in terms of trouble-free operation.

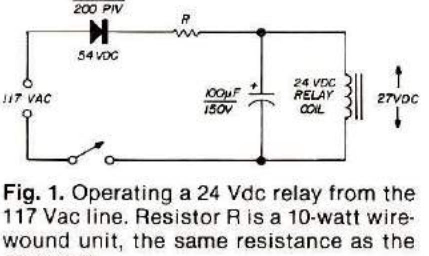
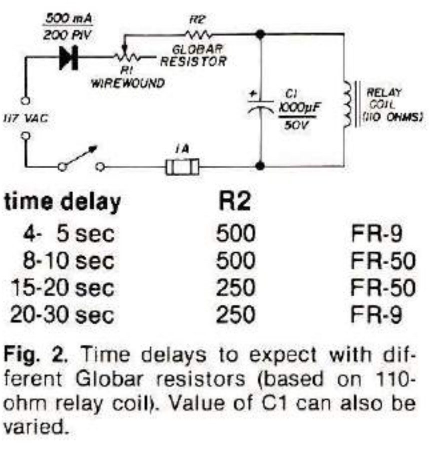


Fig. 1. Operating a 24 Vdc relay from the 117 Vac line. Resistor R is a 10-watt wirewound unit, the same resistance as the relay coil.



time delay	R2	
4- 5 sec	500	FR-9
8-10 sec	500	FR-50
15-20 sec	250	FR-50
20-30 sec	250	FR-9

Fig. 2. Time delays to expect with different Globar resistors (based on 110-ohm relay coil). Value of C1 can also be varied.

You can obtain a small time delay (that is, the relay will hold in for a small time after the switch is turned off) of one to two seconds by simply increasing the filter capacitor to 500 to 1000 μF. For this application a 50-working-volt capacitor is suitable. For longer delay periods — up to 30 seconds — use a Globar resistor in series with the coil as shown in **Fig. 2.** I tried two different types of Globar resistors, type FR-9 and FR-50. The FR-9 is used for replacement service in tv sets and is widely available. It works quite well with relays having 150 ohms coil resistance or less. The FR-50 works best with coils with greater than 150 ohms resistance. If you can't find an FR-50, it is interchangeable with type FR-100 and FS-800 (type numbers by Workman Associates, the distributor).

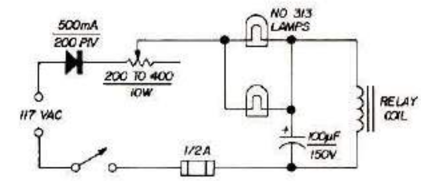


Fig. 3. Rapid armature pickup occurs in this circuit because of the low cold-resistance of the lamps, allowing an initial over-voltage.

Time delays can be roughly predetermined from **Fig. 2.** If a relay has too high a resistance for a particular application, it can be lowered by the simple expedient of putting a composition resistor in parallel with the coil.

The opposite effect — rapid pickup — can be obtained with the circuit shown in **Fig. 3.** The two No. 313 pilot lamps have very low resistance when cold, and this permits rapid relay pickup because of the initial over-voltage. Supply voltage is reduced to normal as soon as the lamp heats up and its resistance increases. An ordinary relay in this circuit, in parallel with 60 μF, was sufficiently responsive to follow keying at 20 words per minute.

Neil Johnson, W2OLU

Great-Circle Maps

A great many of the people who requested great-circle bearing computer printouts as a result of my "DX Antenna Pointing" article in the August issue of *Horizons* also inquired about obtaining the azimuthal equidistant maps that were described in the article. This prompted me to complete work on a computer program that I started several years ago to draw such maps.

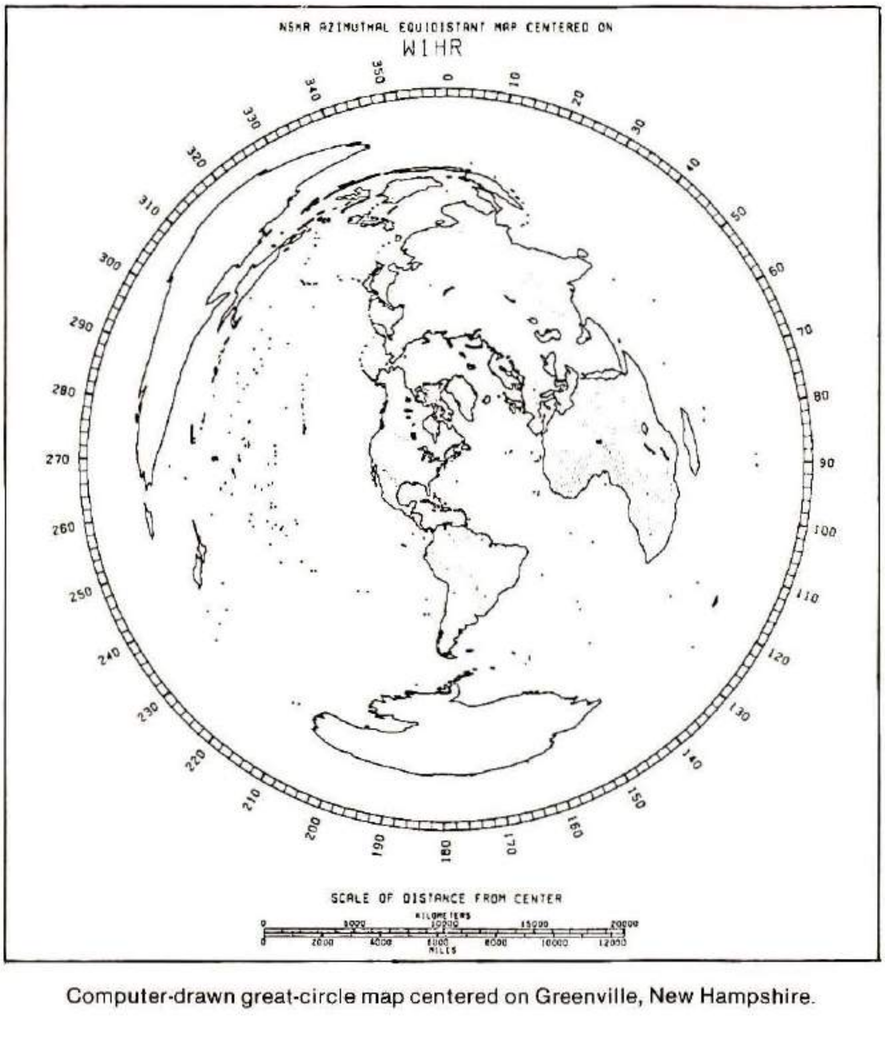
The program itself is straightforward, but the data base associated with it is truly staggering, consisting of almost 20,000 data elements. This is why I put off completing it for so long. The computer time required to process and draw each map is much more than that required for the standard great-circle printout, so the cost is slightly greater. The maps are printed on 11 × 14 inch paper; in addition to geographical data, all major political boundaries are shown, but no attempt has been made to label individual countries due to the enormous programming complexities it would entail, not to mention the additional cost.

I will supply custom-made azimuthal equidistant maps to interested *Horizons* readers according to the following price schedule:

$5.00	postpaid via 3rd class mail, worldwide
$5.75	postpaid via 1st class mail, U.S.A., Canada, and Mexico
$6.50	postpaid via Air Mail, worldwide

When ordering your map, be sure to include your mailing address and the location for which the chart is to be made. If you live in a rural area or a town of less than 10,000 population, carefully describe your location with respect to other nearby towns so your latitude and longitude can be determined.

Bill Johnston, N5KR
1808 Pomona Drive
Las Cruces, New Mexico 88001



Computer-drawn great-circle map centered on Greenville, New Hampshire.

TS-520 Dial-Drag Adjustment

The VFO dial on the Kenwood TS-520 uses a special planetary drive system for exceptional smoothness. If a rough spot develops, or if there seems to be undue backlash, the following steps may be taken to readjust the dial.

1. Remove the VFO knob and the 100-kHz dial plate
2. Remove the front bearing and the felt washer
3. With the sub-dial set at 300, turn the retaining collar on the planetary drive mechanism *counter-clockwise* slightly (1/8 of a turn at a time) until the shaft moves smoothly from end to end of the normal travel (0-600). Use a pair of long nose pliers to turn the collar

   NOTE: Do NOT turn the collar more than one turn counterclockwise or the center shaft will spring out of the planetary drive
4. Replace the felt washer and install the front bearing, leaving the two mounting screws approximately one turn from maximum tightness
5. Center the bearing carefully and tighten the two mounting screws
6. Check for smooth operation from 0-600 kHz. Repeat **step 5** as necessary
7. Replace the 100-kHz plate and the VFO knob

The TS-520 VFO dial should now operate smoothly over the entire dial range.

HRH

More details? Ad Check page 78.

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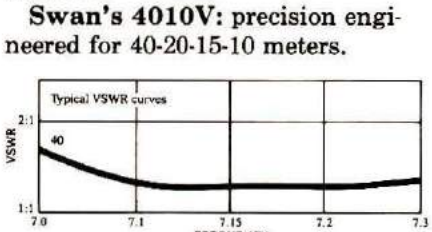
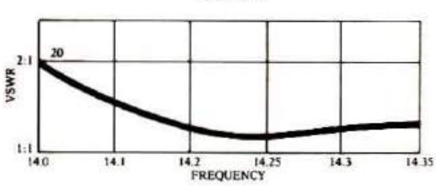
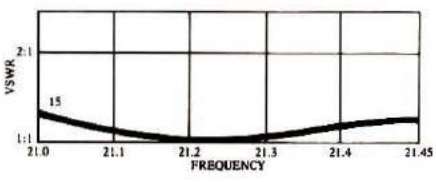
Swan's 4010V: precision engineered for 40-20-15-10 meters.







With slim-line traps, this 4-band vertical offers advanced lightweight construction *with* heavy weight performancé.

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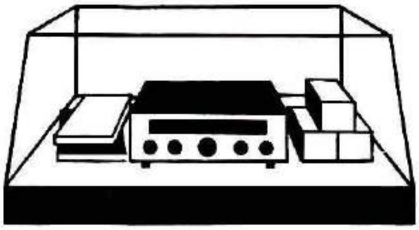
PRODUCT SHOWCASE



For literature on any of the Product Showcase items use our *ad-check* service on page 78.

DS3100 RTTY Terminal

HAL Communications Corp. is proud to announce a new standard of comparison in electronic RTTY terminals — the DS3100 ASR. The new terminal features full buffering of both received and transmitted data, thus permitting perparation of transmit text while receiving, as well as storage of up to 150 lines of received text and 50 lines of text to be transmitted. The terminal also features a new screen format with twenty-four 72-character lines split to show both receive and transmit buffers, line numbering for each buffer area, on-screen status indicators to show terminal code, rate, mode, *etc.*, and a new high-contrast green P31 phosphor screen for easier viewing. The screen also uses bright/dim intensity changes to differentiate between keyboard and received data.

A total of ten "HERE IS" programmable identifier messages are available, two of which can be saved even while power is removed from the terminal. An IDENT feature allows Morse identification, regardless of the terminal's selected data code. Other features include a real-time clock, programmable answer-back (WRU), upper and lower ASCII, ASCII speeds from 110 to 9600 baud, four keyboard operated output switches to control accessories, and a full 25 pin modem connector, for ASCII computer connections.

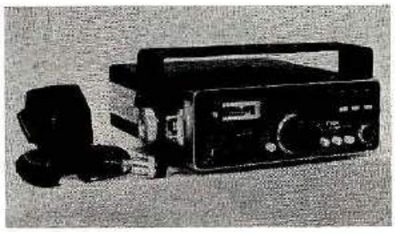
As in the previous DS3000 KSR V3 terminal, the new DS3100 ASR will send and receive all three data modes (ASCII, Baudot, and Morse), allows use of continuous, line, or word transmitting modes, and has synchronous idle, unshift on space, and word wrap-around. Both the electrical and mechanical features of the terminal have been completely redesigned to use a Z80 microprocessor, plug-in circuit boards, and allow easy service. A front-face legend has been added to the keytops to fully label all control functions of the terminal and simplify operation.

The keyboard and new streamlined cabinet are color coordinated in a new two-tone castle tan and chocolate brown finish. The terminal weighs 45 lbs (20.4 kg) net (55 lbs/25 kg shipping) and can be connected for use with 120 or 240 Vac, 50 or 60 Hz power mains. The cost is $1995.00 including shipping within the United States and deliveries of the first units will start by May 1, 1979. Contact HAL Communications Corp., Box 563, Urbana, Illinois 61801 (phone 217-367-7373) for further information.

NDI 800 Channel 2-Meter Transceiver

NDI, Incorporated, of Torrance, California, has announced the HC-1400, a new, high-performance 2-meter fm mobile transceiver of advanced design. This microprocessor-controlled, digitally synthesized unit has 800-channel capability within the Amateur 144-148 MHz band, and offers 5- or 10-kHz channel spacing. A fast-acting single-knob selector shifts LED digital frequency readout in 10-kHz steps; the HC-1400 also has a 100-kHz "speedup" button.

Transmit frequency offsets are preprogrammed, and are switchable to plus or minus 600 kHz. Simplex operation is also available. The HC-1400 can be programmed to hold three transmit-receive frequency pairs in memory, with the capability of instant recall. The transmitter delivers 25 watts output, and requires 13.8 Vdc for operation.



The receiver is sensitive, selective, and uses an FET front-end with three coaxial resonators. The dual i-f has a crystal lattice filter and multiple tuned circuits.

For more information write to NDI, Inc., 22125½ South Vermont, Torrance, California 90502.

Coil kits for Home Brewed Equipment

Most Amateur Radio equipment requires the use of coils or small inductances of some sort in their construction. These are often the most difficult items to find when you try to gather the parts for a project that catches your fancy.

Caddell Coil Corporation is now offering coil kits for the more popular home-brew projects. Their new list, No. 4C, covers dozens of the most popular types of equipment from Amateur literature over the past few years. The coil kits available cover Novice, miniature, and high- or low-power rigs from *ham radio*, *QST*, and the *ARRL Radio Amateur's Handbook*. Other projects covered include rf amplifiers, transverters, converters, preamplifiers, VFOs, transmatches, wattmeters, and more.

Caddell's kits include the wound coils or inductances specified in the construction article, and their list indicates the source of the article as well as the price for the kit. They stock standard values of rf chokes, inductors, and transformers, which are available in addition to kits or custom-designed components. For your copy of list No. 4C, write Caddell Coil Corporation, 35 Main St., Poultney, Vermont 05764.

Story of Electronics Comic Book

An all-new and updated edition of Radio Shack's popular educational comic book, "The New Science Fair Story of Electronics . . . the Discovery that Changed the World," is now available for free distribution to schools, clubs, youth groups, and interested individuals.

The 24-page, full-color booklet traces the development of electronics from ancient times to the present, focusing on the human interest side of science. Important discoveries and the people who made them are described in the easy-to-read narrative.

Topics included are magnetism, ancient use of batteries, electricity in nature, the development of "wireless" communications, TV, radar and the transistor, electronics in aviation and space exploration, the computer age, and much more.

Previous editions of the free booklet, of which more than 10 million copies have been distributed, found wide use as an educational tool, according to Radio Shack spokesmen.

Included within the new edition are coupons which may be used to request additional copies, a membership in Radio Shack's free-battery club, and a $1 gift certificate that can be used toward the purchase of any Science Fair or Archer kit at participating stores.

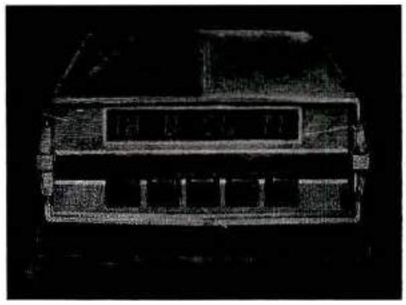
The New Science Fair Story of Electronics is available free from participating Radio Shack stores and dealers, nationwide.

Kantronics Morse code Teletype Reader

Kantronics' Field Day* is a tri-mode microcomputer system that reads and displays Morse code and radioteletype signals and computes Morse code speeds. It is a complete unit that doesn't require peripheral equipment or television monitors for use.

Field Day is lightweight and portable. A movable support arm tilts the unit to four different viewing angles and doubles as a handle for field use. The enclosure is sturdy and durable, but light and compact as well. Front-panel controls include ON/OFF, SPEED (display), EDIT, (word) SPACE, and RESET.

Field Day copies incoming or outgoing signals through the audio output of a receiver. (Outgoing signals are monitored through receiver sidetone provisions.) An internal speaker is enclosed, and volume is adjusted through the receiver audio gain potentiometer. If



Morse code is being copied, Field Day screens out unwanted signals with an active 200-Hz bandwidth filter. The 750-Hz center frequency signals are then entered into the microcomputer system, which uses an 8035 chip.

Once signals are converted to alphanumeric text, they are advanced from right to left across ten 14-segment displays. When in the code-speed mode, the two leftmost LEDs display the speed while text advances across the others.

Two Morse copying modes are accessed on the front panel. In the standard copying mode, fairly strict Morse specifications are applied to the incoming code. If spacing or weighting is incorrect, the unit will display a variety of mumbo-jumbo. This mode is good for copying good

*"Field Day" is a trademark of Kantronics, Incorporated. All rights reserved.

code, and acts as the perfect "judge" for practicing Morse sending.

When the code editor is engaged, Field Day processes the signals with a relaxed program that effectively analyzes and edits poorly sent code. The corrected version is then displayed. With the code editor in use, a majority of the signals found on the air were edited on 90 per cent accuracy levels in laboratory tests. These tests used random signals from all classes of Amateur bands.

In addition to code editing, a word spacing control is included on the Field Day front panel. This control determines the most likely word breaks and inserts spaces into bunched copy.

Field Day computes code speed with an accurate sampling program. This program is based on the basic Morse element, which is the duration of a single dit. The speed is tracked during the transmission, and changes are conducted and displayed on the LEDs. Morse code speeds are displayed at the touch of a front panel button. When not in use, all ten LEDs are devoted once more to code-text display.

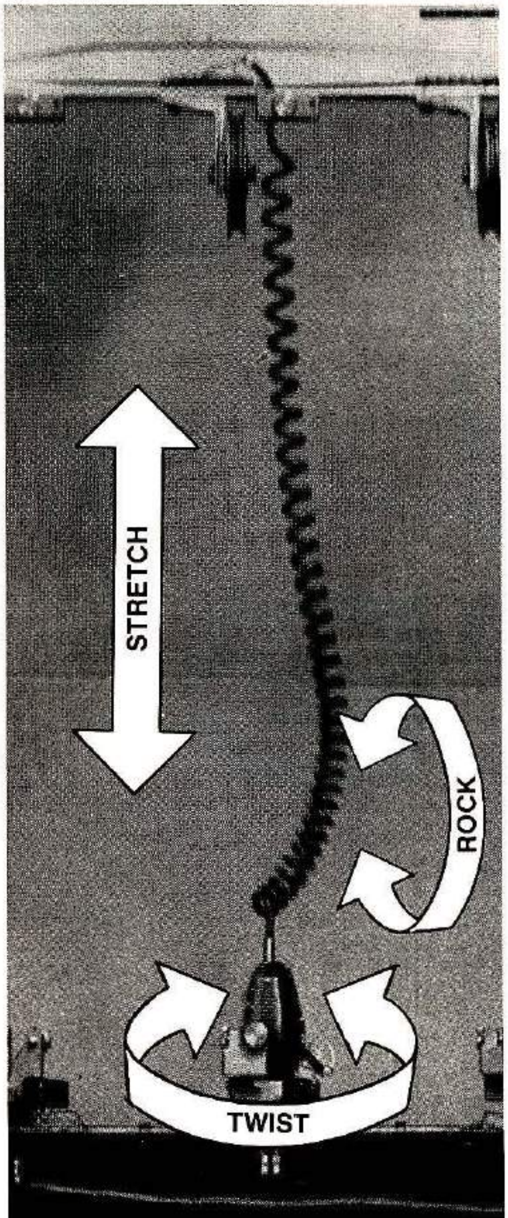
In RTTY mode, which is controlled from the back panel, the standard 60, 67, 75, and 100 words-per-minute Baudot teletype speeds are copied. With no other teletype equipment, the two-tone signals can be read as standard text. Also found on the back panel are terminals for audio input, TTL compatible inputs, TTL compatible demodulator output from the unit, and a phone jack for attaching headphones.

The Field Day enclosure is cream-colored with a brown, tan, and cream front panel. The 14-segment LED displays are red and are protected by a red polylens filter, laminated into the front panel.

For more information, contact Rick Link, WB0KDE, Advertising Manager, Kantronics, Inc., 1202 East 23rd Street, Lawrence, Kansas 66044.

More details? Ad Check page 78.

fact: our quality assurance is your performance insurance.

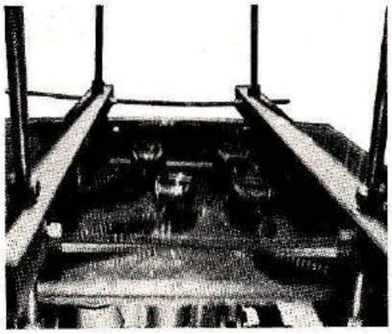


Originally designed for battlefield ruggedness, the microphone elements in Shure mobile and communications microphones offer unequaled reliability. Our quality control engineers anticipate the worst possible field conditions. These microphones have been subjected to the most rigorous tests in the industry, including six-foot drops onto hard floors; violent vibration tests; temperature variation tests ranging from a bitter -54°F. to a searing 185°F.; and 100% humidity tests. We've even dragged them behind automobiles on open roads and subjected them to a battery of corrosion tests. And yes, they really work after all that!

Exclusive Three-Way Flex Tester

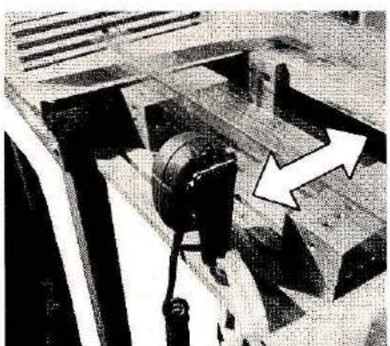
Shure knows that the single most common cause of microphone malfunction is failure of the cord. An exclusive Shure-designed story-and-a-half tall microphone cord tester dishes out more abuse than the average microphone gets in a lifetime.

Stretch, rock, and twist: first, the cord tester stretches the microphone to the full length of the cord. Then it simultaneously rocks the microphone 270° at the end of the cord while it gives the microphone a violent 90° twist in two directions. And this goes on day after day!



3-D Shake Tester

A microphone that fails spells disaster for a mobile communications system. Every Shure microphone is designed to withstand hours in our brutal 3D Shake Tester — simulating years of driving over rough, bumpy roads.



Million-Cycle Switch Tester

Another abused microphone component is the switch. Shure-designed long-life leaf switches operate with a wiping action that resists the buildup of corrosion and dirt. And Shure's ongoing tests show that they continue to make contact reliably and positively after *one million switching operations.*

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*Short wave reception will vary with antenna, weather conditions, operator's geographic location and other factors. An outside antenna may be required for maximum short wave reception.

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HORIZONS ad•scan

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HAMFESTS Sponsored by non-profit organizations receive one free regular classified ad (subject to our editing). Repeat insertions of hamfest ads pay the standard rate.

COPY No special layout or arrangements available. Material should be typewritten or clearly printed (not all capitals) and must include full name and address. We reserve the right to reject unsuitable copy. *HORIZONS* cannot check each advertiser and thus cannot be held responsible for claims made. Liability for correctness of material limited to corrected ad in next available issue.

DEADLINE 15th of third preceding month.

SEND MATERIAL TO: Ad Scan, Ham Radio Horizons, Greenville, N. H. 03048.

MASSACHUSETTS: NoBARC Hamfest July 21, 22 at Cummington Fairgrounds. Tech talks, demonstrations and dealers. Flea market, $1.00; advance registration $3.00 single, with spouse $5.00 to Tom Hamilton, WA1VPX, 206 California Avenue, Pittsfield, Massachusetts 01201 or $4.00/$6.00 at gate. Mobile talk-in on 146.31/91. Gates open at 5:00 P.M. on Friday for free camping.

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MARYLAND: Fifth Annual Easton A.R.S. Hamfest, 10 AM to 4 PM, May 20th, Easton Senior High School, Route 50 south of Easton at mile marker 66. Talk-in on .52 simplex and 146.445/147.045 repeater. Inside tables, refreshments. Room for tailgaters. Donation $2 plus $2 extra for tailgaters or tables. Write Charles C. Walgren, WA3ZWX, Box 7, Trappe, Maryland 21673 or Easton A.R.S., Inc., Box 781, Easton, Maryland 21601.

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ARKANSAS: Second Annual Ham-A-Rama, August 4th and 5th, 1979, Arkansas State Fairgrounds, Little Rock. Talk-in on 146.34/146.94. For more information contact Morris Middleton, AD5M, 19 Elmhurst Drive, Little Rock, Arkansas, 72209. (501) 568-0938.

CUSTOM Printed and photo QSL's, very economical; free samples, stamp appreciated. Stu, K2RPZ, Box 412, Rocky Point, N. Y. 11778. (516) 744-6260.

RADIO EXPO '79 September 15 and 16, 1979, Lake County Fairgrounds, Routes 120 and 45, Grays Lake, Illinois. Manufacturer's displays, flea market, seminars, ladies programs. Advance tickets $2.00. Write EXPO, P.O. Box 305, Maywood, IL 60153. Exhibitors inquiries: EXPO Hotline (312) 345-2525.

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MINNESOTA: Arrowhead Amateur Radio Club's annual Swapfest, Saturday, May 5, First United Methodist Church, 230 E. Skyline Parkway, Duluth. 11:00 AM to 3:00 PM. Admission: $1.50. Refreshments available. Auction — 2:00 PM. Talk-in 34/94 repeater. For info: Harold Simmerman, N9AMA, Route 1, Box 7, Lake Nebagamon, WI 54849. (715) 374-3231.

QSL CARDS 500/$10. 400 illustrations, sample. Bowman Printing, Dept. HRH, 743 Harvard, St. Louis, MO 63130.

CLUB CALL PINS — 3 lines 1¼ × 3¼ $1.55 each call, first name and club. Colors black, blue or red with white letters. (catalog) Arnold Linzner, 2041 Linden Street, Ridgewood, N. Y. 11227.

WISCONSIN: 3-F Amateur Radio Club Annual Swapfest, Saturday, May 5, 1979, 8 AM to 3 PM at the Neenah Labor Temple, 157 South Greenbay Road, just off Highway 41 at the Highway 114 or 150 exits, Neenah, Wisconsin. Large parking, indoor swap areas, free auction. Food and beverage available. Tickets: $1.50 advance, $2.00 at door; tables $1.50 advance, $2.00 at door. Reservations to: Mark Michel, W9OP, 339 Naymut St., Menasha, Wisconsin 54952.

NAMETAGS — 1½" × 2½" — One line $2.50. Each additional line $0.50. 12 colors. Tag-it Co., Box 2062, Indianapolis, IN 46206.

PENNSYLVANIA: Reading Radio Club Hamfest, Hamburg Field House, PA, 9 AM Sunday, May 27, 1979. Door prizes, food, tailgate sales, dealer space available. Talk-in on 31/91 and 146.52. Write the Reading Radio Club, Hamfest Committee, P.O. Box 124, Reading, PA 19603.

CODE PRACTICE OSCILLATORS, hand keys, electronics keyers, other products. Free catalog. Globalman (W6PHA) Products, Box 388-HO, El Toro, CA 92630. 714-533-4400.

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NORTH CAROLINA: Gastonia Hamfest, Sunday, May 6, 1979, Ashbrook High School on South New Hope Road, one mile south of T-85. Food, lodging, paved parking lot, indoor tables. Talk-in on 147.72/.12 Contact K4NYO, Mike Jackson, or Cy Rowe, W4FSA.

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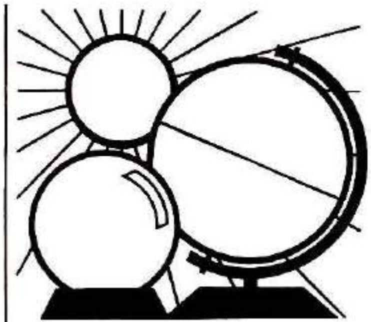

DX FORECASTER

Propagation Special

Look for unusual ionospheric activity, coupled with geomagnetic field disturbances — and possibly atmospheric storms — between May 3rd and 10th, concentrated around the 6th; and again between May 13th and 16th, concentrated around the 14th. Also, be alert for disturbances between May 26th and 31st.

The *Eta Aquarid* meteor shower will occur between May 4th and 6th, peaking on the evening of the 5th, with rates of about 20 per hour. Full moon will occur on May 12th, and perigee on the 18th. Stay on your toes for very good vhf openings on six and two meters around the dates of maximum predicted ionospheric disturbance; try some meteor-scatter work also.

Band-by-band conditions

Refer to the accompanying chart for times and paths of band openings. Except for severely disturbed periods, the bands will be usable as shown. The asterisk (*) means to check the next higher band at the times indicated.

Ten Meters will be very active worldwide. Also, short skip openings out to between 1200 and 2400 km (750-1500 mi) will be frequent during daylight hours.

Fifteen meters will probably be the best DX band this month, and will also provide short skip between 1000 and 4000 km (600-2400 mi).

Twenty Meters will also be good, but perhaps not as good as the higher frequency bands. This will be a good band to return to on those days and at those times when ten and fifteen meters go into their slump. Twenty will be open to one area or another of the world for almost twenty-four hours each day and, for those who haven't experienced such conditions before, it will be a real thrill. Long hours of daylight will provide excellent openings on all bands, and the short night hours will find only ten and fifteen meters closed down.

Static levels will be too high for comfort on *Forty* and *Eighty Meters* on many days of the month, hence DX will be hard to hear. Increasing absorption levels will also shut down the lower frequency bands for all except short skip much of each day.

We're approaching summertime DX conditions which are not quite as good as spring and fall conditions, but at present high sunspot levels, DX will be plenty good enough for everyone except the most jaded Radio Amateurs. Happy hunting!

HRH

MAY

WESTERN USA

GMT	PDT	N (Asia, Far East)	NE (Europe)	E (S. Africa)	SE (S. America)	S (Antarctica)	SW (New Zealand)	W (Oceania, Australia)	NW (Japan)
0000	5:00	15	—	15*	10	20	10	10	15
0100	6:00	15	—	15	10	20	10	10	15
0200	7:00	15	—	20	10	20	10	10	15
0300	8:00	10	10	—	10	—	10	10	15
0400	9:00	15	10	10	15	—	10	10	10
0500	10:00	15	10	15	15	—	10	10	10
0600	11:00	15	10	10	15	—	10	10	10
0700	12:00	15	10	10	15	—	15*	15*	10
0800	1:00	20	—	10	15	—	20*	15	15*
0900	2:00	20	—	10	—	—	—	—	15
1000	3:00	—	—	10	—	—	—	—	20
1100	4:00	—	—	—	—	—	—	—	—
1200	5:00	—	15	—	—	—	—	—	—
1300	6:00	20	15	—	—	—	—	—	—
1400	7:00	20	15	20	15	—	20	—	—
1500	8:00	15	10	15	15	—	20	20*	20
1600	9:00	15	15	15	15	—	20	15	20
1700	10:00	15	10	15	10	—	20	15	20
1800	11:00	15	10	15	10	—	20	15	20
1900	12:00	15	10	15	10	15	20	15	20
2000	1:00	10	15	15	10	15	15	10	15
2100	2:00	15	15	15	10	20	15*	10	10
2200	3:00	15	15	15	10	20*	10	10	10
2300	4:00	15	15	15*	10	20	10	10	10

MID USA

GMT	MDT	N (Asia, Far East)	NE (Europe)	E (S. Africa)	SE (S. America)	S (Antarctica)	SW (New Zealand)	W (Oceania, Australia)	NW (Japan)	CDT
0000	6:00	15	20	10	10	20	10	10	15*	7:00
0100	7:00	15	20	10	10	20	10	10	15	8:00
0200	8:00	15	20	15	15	20	10	10	20	9:00
0300	9:00	10	20	20	15	—	10	15	20	10:00
0400	10:00	15	20	—	15	—	15	15	—	11:00
0500	11:00	15	20	—	15	—	15	15	—	12:00
0600	12:00	20*	20	—	20	—	15	20	—	1:00
0700	1:00	20	20	—	20	—	15	—	—	2:00
0800	2:00	—	20	—	20	—	15	—	—	3:00
0900	3:00	—	—	—	—	—	20	—	—	4:00
1000	4:00	—	—	—	—	—	20	—	—	5:00
1100	5:00	—	—	20	—	—	20	—	—	6:00
1200	6:00	—	15	15	—	—	20	—	—	7:00
1300	7:00	20	15	15	—	—	—	—	20	8:00
1400	8:00	15	15	15	—	—	—	20	20	9:00
1500	9:00	15	15	15	15	—	—	20	20	10:00
1600	10:00	15	15	15	10	—	—	15	20	11:00
1700	11:00	15	10	15	10	—	—	15	20	12:00
1800	12:00	15	10	15	10	—	—	15	15	1:00
1900	1:00	15	10	10	10	15	—	10	15	2:00
2000	2:00	15	10	10	10	15	15	10	15	3:00
2100	3:00	15	10	10	10	15	10	10	15	4:00
2200	4:00	15	15	10	10	20*	10	10	15	5:00
2300	5:00	15	15	10	10	20	10	10	15*	6:00

EASTERN USA

GMT	EDT	N (Asia, Far East)	NE (Europe)	E (S. Africa)	SE (Caribbean, S. America)	S (Antarctica)	SW (New Zealand)	W (Oceania, Australia)	NW (Japan)
0000	8:00	15	15	20*	15	20	10	10	15
0100	9:00	15	15	20	15	20	10	10	15
0200	10:00	15	15	—	15	20	10	15	20
0300	11:00	20	15	—	15	—	15	15	20
0400	12:00	20	—	—	20	—	15	15	20
0500	1:00	20	—	—	20	—	15	20	—
0600	2:00	—	—	—	—	—	20	—	—
0700	3:00	—	—	—	—	—	20	—	—
0800	4:00	—	—	20	—	—	20	—	—
0900	5:00	—	—	20	—	—	20	—	—
1000	6:00	20	—	20	—	—	20	—	—
1100	7:00	20	—	15	—	—	20	—	—
1200	8:00	20	20	15	—	—	20	—	—
1300	9:00	15	20	15	20	—	20	20	20
1400	10:00	15	15*	15	15	—	20	20	20
1500	11:00	15	15	15	10	—	—	20*	20*
1600	12:00	15	15	10	10	—	—	20*	20
1700	1:00	15	15	10	10	—	—	15	20
1800	2:00	15	15	10	10	—	—	15	20
1900	3:00	15	15	10	10	15	—	15	20
2000	4:00	15	15	10	10	15	20	15	15
2100	5:00	15	15	10	10	15	15*	15	15
2200	6:00	15	15	10	15*	20*	10	15*	15
2300	7:00	15	15	10	15*	20	10	10	15

HAM CALENDAR May 1979

SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY
*All international events such as contests are shown on the GMT days on which they take place even though they may actually begin on the evening of the preceding day in North America. BISHOP HILL — BISKOPSKULLA RADIO EXCHANGE — Amateur Radio operators in Sweden and the United States will attempt direct radio contact between Bishop Hill, Illinois and Biskopskulla, Uppland, Sweden on the weekend of May 26 and 27, 1979. Bishop Hill was a communal settlement established in the 1840s by Swedish migrants and is now an historical site maintained by the State of Illinois. Led by DXers W9FKC and SM8FY, the groups will try to contact as many stations as possible over the scheduled weekend. Operation will occur on all bands, phone and CW, full period. Special QSLs will be issued. SASE or IRCs requested; all others via bureaus. The Biskopskulla team will use the call SK8MG. The Bishop Hill group will use W9FKC. QSL via WA9ADN.		AMSAT Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) **1**	West Coast Qualifying Run **2**	**3**	Hampden RA Fleamarket — Feeding Hills Congregational Church — West of Springfield, MA — WB1BZW MARAC-ICHN Convention — Albany, NY — W2UJ — 4-6 Shreveport ARA Hamfest — Louisiana State Fairgrounds — Shreveport, LA — 4-5 **4**	Arrowhead ARC Swapfest — First United Methodist Church — 230 E. Skyline Parkway — Duluth, MN Florida QSO Party — 1500Z 5/5 - 2359Z 5/6 LIARS 10-X International Net QSO Party — 0001Z 5/5 - 2359Z 5/6 New York State QSO Party — 1700Z 5/6 - 0500Z 5/7 — 1200Z - 2359Z 5/7 Southern Tier NY ARC Hamfest/Dinner — Lutheran Fellowship Recreation Center — 3.7 miles N. of NY Route 17, Exit 71 N. on Stella Ireland Road West Coast UHF Conference — Dunfey Hotel — San Mateo, CA — 5-6 3-FARC Swapfest — Neenah Labor Temple — Neenah, WI — W9OP **5**
Cass County ARC Hamfest — 4-H Grounds — Logansport, IN — K9DVL Kishwaukee RC and the DeKalb Co. ARC Hamfest — Notre Dame School — 3 miles S. of DeKalb and Highway 23 and S. 1st Street at Gurler Road — DeKalb, IL — WA9TKW North Hills RC Ham Swap — Machinists Hall — Rancho Cordova, CA Tamaqua PA Transmitting Society Hamfest — FOP Grove — Tamaqua, PA — W3CMA The Potomac Area VHF Society Hamfest — Howard County Fairgrounds (15 miles W. of Baltimore at Intersection of I-70 and Route 32) — WA3NZL Warminster ARC Fleamarket/Auction — Tennent Intermediate High School — Warminster, Bucks County, PA — K3KT **6**	FLORIDA HAM NEWS — SWAP NET By the Broward ARC 146.31-91 at 7:30PM GLENHURST RADIO SOCIETY Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB WEST COAST BULLETIN Edited & Transmitted by W6ZF 9PM PDST 3540 kHz, A-1, 22 WPM **7**	AMSAT Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) W1AW Qualifying Run **8**	**9**	**10**	Fresno ARC Hamfest — Sheraton Inn — Highway 99 at the Clinton Exit, Fresno, CA — 11-13 **11**	CQM Contest — 12-13 Daytona Beach Family Funfest — Holiday Inn Surfside — Daytona Beach, FL — WA4ZTI — 12-13 Fort Vancouver Hamfair — Clark County Fairgrounds — Vancouver, WA — W7DYX — 12-13 Frequency Measuring Test World Telecommunications Day Contest — Phone — 12-13 **12**
Arrow Repeater Association Swap N Shop — Fairgrounds — Saline, MI Milwaukee UHF Society, Inc. Swapfest — Waukesha Co. Expo Center Grounds — Waukesha, WI Wabash County ARC Hamfest — Wabash County 4-H Fairgrounds — Wabash, IN — W09BDZ **13**	FLORIDA HAM NEWS — SWAP NET By the Broward ARC 146.31-91 at 7:30PM GLENHURST RADIO SOCIETY Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB **14**	AMSAT Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) **15**	**16**	**17**	**18**	Armed Forces Day Observance — 1300Z 5/19 - 0245Z 5/20* Durham FM Association Durhamfest — South Square Mall — Durham, NC — 19-20 EME Competition — Part 2 — 19-20 Michigan QSO Party — 1800Z 5/19 - 0300Z 5/20 — 1100Z 5/20 - 0200Z 5/21* Radio Amateur Megacycle Society Antenna Measuring Contest — Flick-Reedy Corporation grounds — Bensenville, IL — WB9GOJ Wexaukee ARA Swap N Shop — National Guard Armory — Cadillac, MI World Telecommunications Day Contest — CW — 19-20 **19**
Breeze Shooters Hamfest — White Swan Park — Pittsburgh, PA — WA3LUM Eastern ARS Hamfest — Eastern Senior High School Cafetorium — Easton, MD — WA3ZWX Eastern Connecticut ARC Fleamarket/Hamfest — Point Breeze Restaurant — Webster, MA — K1SYI Humboldt ARC Hamfest — Shady Acres City Park — Trenton, TN — W4IGW Kentucky Ham-O-Rama — Boone County Fairgrounds — Burlington, KY Maryland Mobileers ARC Hamfest — Camp Barrett — Crownsville, MD **20**	FLORIDA HAM NEWS — SWAP NET By the Broward ARC 146.31-91 at 7:30PM GLENHURST RADIO SOCIETY Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB WEST COAST BULLETIN Edited & Transmitted by W6ZF 9PM PDST 3540 kHz, A-1, 22 WPM **21**	AMSAT Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) **22**	**23**	**24**	Rochester Hamfest — Monroe County Fairgrounds and the Marriott Inn — Rochester, NY — WA2KND — 25-27 **25**	CQ Worldwide WPX Contest — CW Portland Amateur Wireless Association and the University of Southern Maine RC Tailgate Fleamarket — Campus of the University of Southern Maine W1AW Qualifying Run **26**
Reading RC Hamfest — Hamburg Field House — Hamburg, PA **27**	FLORIDA HAM NEWS — SWAP NET By the Broward ARC 146.31-91 at 7:30 PM GLENHURST RADIO SOCIETY Transmits Amateur Radio News — 222.66/224.26 MHz via WR2APG and 21.400 MHz USB **28**	AMSAT Eastcoast Net 3850 kHz 9PM EDST (0100Z Wednesday Morning) AMSAT Mid-Continent Net 3850 kHz 9PM CDST (0200Z Wednesday Morning) AMSAT Westcoast Net 3850 kHz 8PM PDST (0300Z Wednesday Morning) **29**	**30**	**31**	See May 2, 5, 7, 12, 19, 21, 26 	"LUCKENBACK EXPEDITION" — An opportunity for hams all over the world to work a rare 1870s Texas cowtown — 0800Z 5/12 - 1200Z 5/13 continuous. Station call sign W5TEX. Frequencies and mode of operation: CW - 7.110 MHz and 21.220 MHz ± 5 kHz FM - 52.525 MHz, 29.600 MHz and 146.52 MHz SSB - 3.900 MHz, 7.235 MHz, 14.285 MHz, 21.360 MHz, 28.625 MHz, 50.110 MHz, 144.200 MHz — All ± 5 kHz

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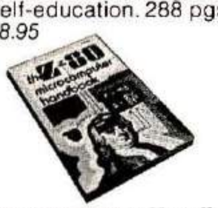

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MAY 1979

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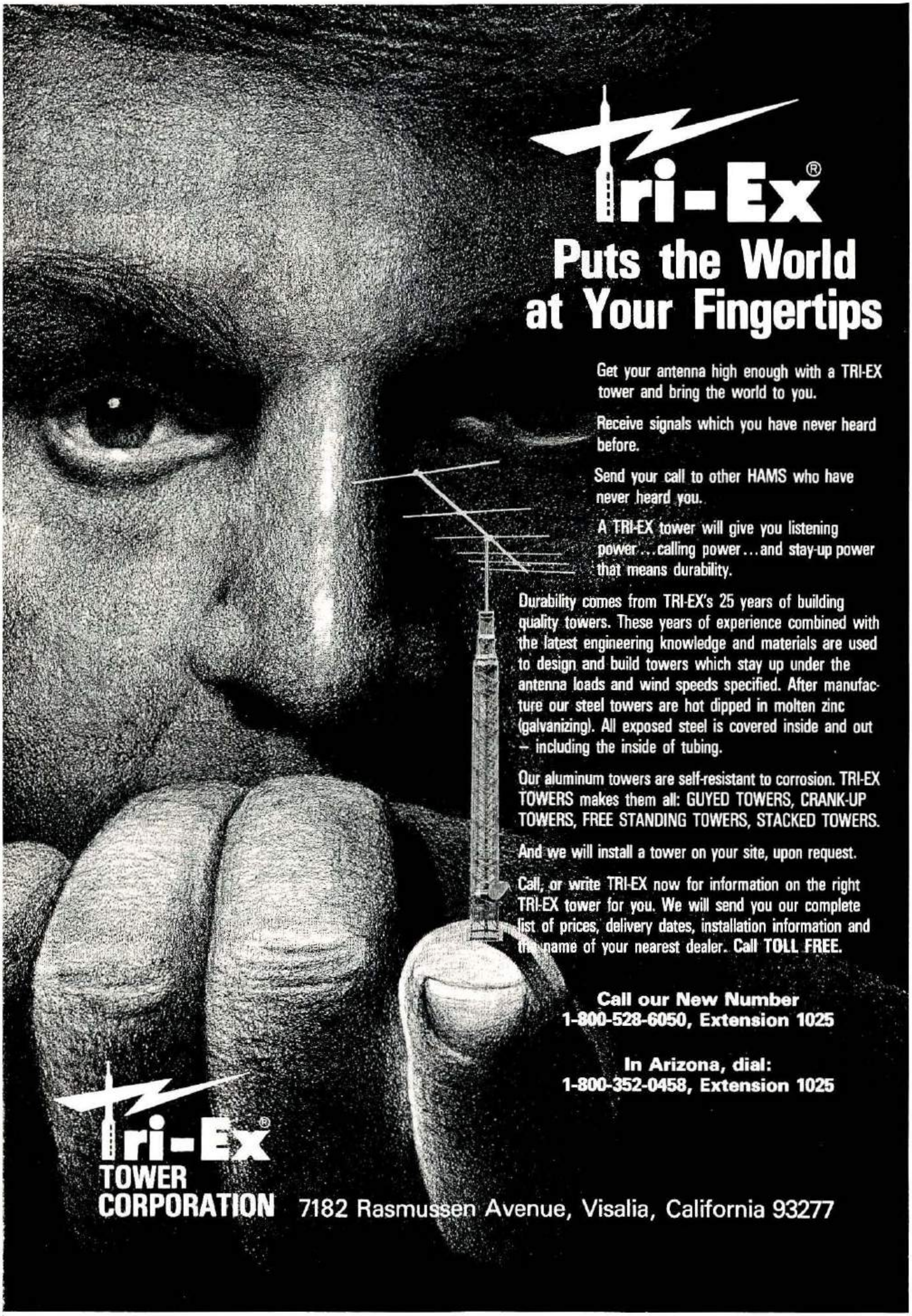
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Accuracy . . . that's the operational key to this rugged advanced design Model C1000 1GHz frequency counter . . . a significant achievement from DSI. That's because you get . . . **.1 PPM** 0° to 40°C proportional oven time base . . . Built in 25DB preamplifier with a 60DB adjustable attenuator . . . x10 & x100 audio scaler which yields .01 Hz resolution from 10Hz to 10KHz equivalent to 10 sec. & 100 sec.Gate Time . . . Selectable .1 & 1 sec. time base and 50 ohms or 1 meg ohm input impedance . . . Built-in battery charging circuit with a Rapid or Trickle Charge Selector . . . Color keyed high quality push button operation . . . All combined in a rugged black anodized (.125" thick) aluminum cabinet. The model C-1000 reflects DSI's on going dedication to excellence in instrumentation for the professional service technician, engineer, or the communication industry.

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- INCLUDES BATTERY PACK
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- AUTO DECIMAL POINT
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ALL NEW! All UNPARALLELED DSI QUALITY! The model C 700 700 MHz frequency counter features . . . **.2 PPM** 0° to 40° C proportional oven time base . . . 25db preamplifier with a 60db adjustable attenuator. Built in battery charger with a rapid or trickle charge selector . . . Combined in a rugged (.125" thick) aluminum cabinet makes the C700 ideal for the communication industry and professional service technician.

3600A OWNERS: Up date your 3600A frequency counter to a C 700 includes, new back board, **.2PPM** proportional oven, 25db preamplifier, rugged .125" thick aluminum cabinet, order 3600A-700. Unit must be returned to DSI factory for modification.

DSI — GUARANTEED SPECIFICATIONS — FACTORY ASSEMBLED — MADE IN USA

Model	Frequency Range	Proportional Oven Accuracy Over Temperature	50Hz To 75MHz	75MHz To 500MHz	500MHz To 1GHz	Number Of Digits	Size Of Digits	Power Requirements	Size
C700	50Hz to 700MHz	.2PPM 0° to 40°C	50MV	10MV	NA	8	.5 Inch	115 VAC-BATT 8 to 15VDC	3"H x 8"W x 6"D
C1000	10Hz to 1GHz	.1PPM 0° to 40°C	20MV	1MV	>50MV	9	.5 Inch	115VAC-BATT 8 to 15VDC	4"H x 10"W x 7½"D

— All Units Are Factory Assembled, Tested And Carry A Full 5 Year Limited Warranty —

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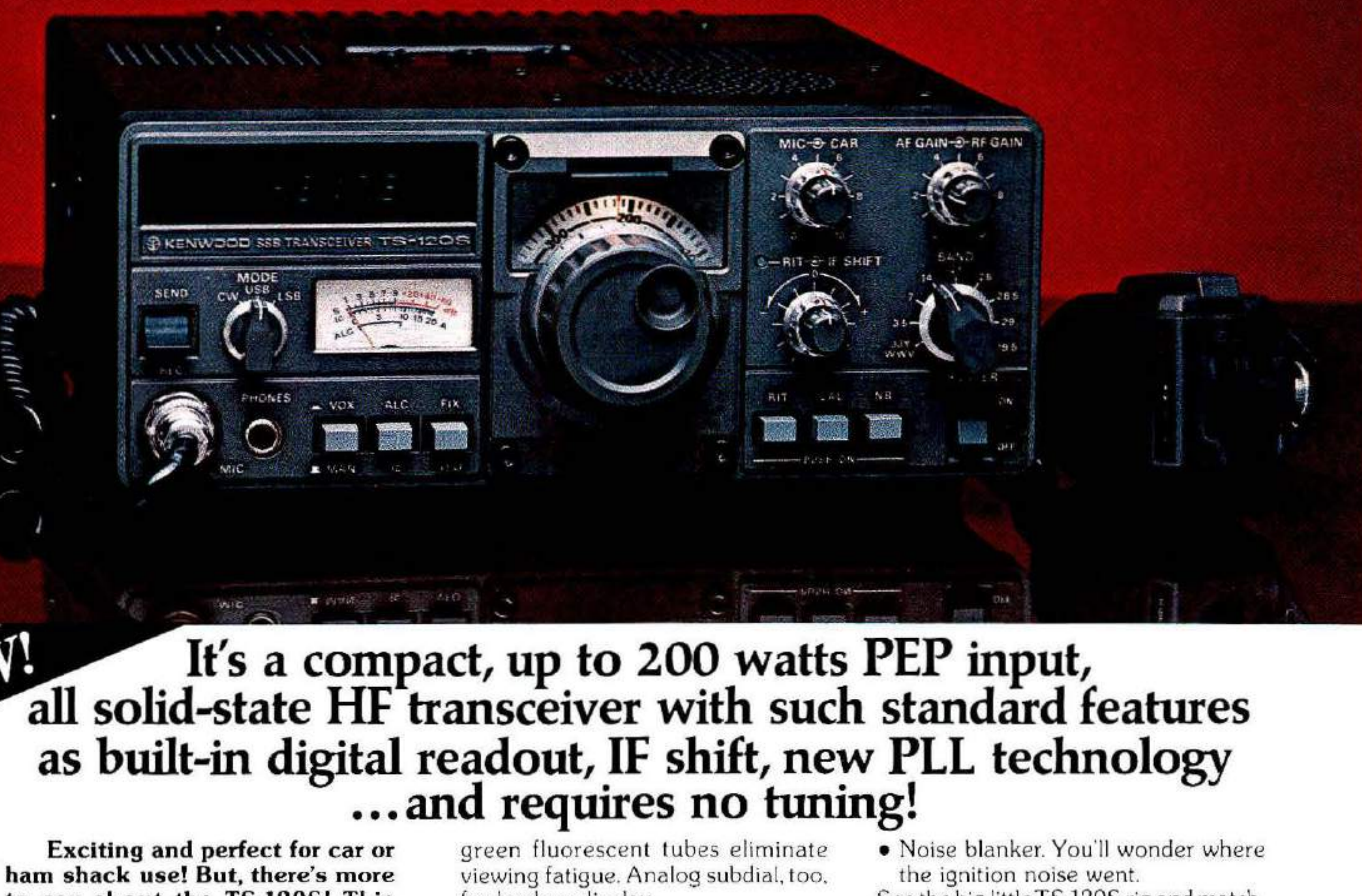
TS-120S...A big little rig.



NEW!

It's a compact, up to 200 watts PEP input, all solid-state HF transceiver with such standard features as built-in digital readout, IF shift, new PLL technology ...and requires no tuning!

Exciting and perfect for car or ham shack use! But, there's more to say about the TS-120S! This unique all solid-state HF, SSB/CW transceiver produces a hefty signal and also offers a lot of other great features in a very attractive, compact package.

FEATURES:

- All solid-state with wideband RF amplifier stages. No final dipping or loading, no transmit drive peaking, and no receive preselector tuning! *Just dial your frequency and operate!*
- Five bands, plus WWV. Transmits and receives on 80/75, 40, 20, 15, and all of 10 meters... and receives WWV on 15 MHz.
- 200 watts PEP (160 watts DC) input on 80-15 meters, 160 watts PEP (140 watts DC) input on 10 meters. LSB, USB, and CW.
- Digital frequency display (standard). 100-Hz resolution. Six digits. Special green fluorescent tubes eliminate viewing fatigue. Analog subdial, too, for backup display.
- IF shift (passband tuning), to remove adjacent-frequency interference and sideband splatter.
- Advanced PLL circuit, which eliminates need for heterodyne crystal element for each band. PLL lock frequency, CAL marker signal, and counter clock circuit use single reference frequency crystal. Simplifies circuitry, improves overall stability. Also improves transmit and receive spurious characteristics.
- Attractive, compact design. Measures only 3½" high X 9¼" wide X 13½" long, and weighs only 4.9 kg (11.7 lbs.). A perfect size for convenient mobile operation and rugged enough for either mobile or portable use. Also has all the desired features for optimum ham-shack operation at home.
- Noise blanker. You'll wonder where the ignition noise went.

See the big little TS-120S rig and matching accessories (VFO-120 remote VFO, SP-120 external speaker, PS-30 AC power supply, MB-100 mobile mounting bracket, AT-120 antenna tuner and YK-88C CW Filter) at your nearest Authorized Kenwood Dealer!

STILL AVAILABLE... KENWOOD TS-520S

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The HEATHKIT HW-101
it won't cost you an arm and a leg!

Chances are that getting on the air is pretty important to you. You may be a brand new Novice, a recent upgrade to General, or you're rejoining the Amateur ranks after years of inactivity. But the cost! $600, $700, in some cases $1000 and more. And that's just the price of a transceiver.... no extras! Pretty staggering, isn't it? There's a choice though.

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AM-362

For complete details on our entire line of quality Amateur Radio Products use the postcard, found elsewhere in this issue to send for your Free Heathkit Catalog, or write: Heath Company, Dept. 348-530, Benton Harbor, Michigan 49022