February 1983 $2.49½
Issue #269

73®

Amateur Radio's Technical Journal

A Wayne Green Publication

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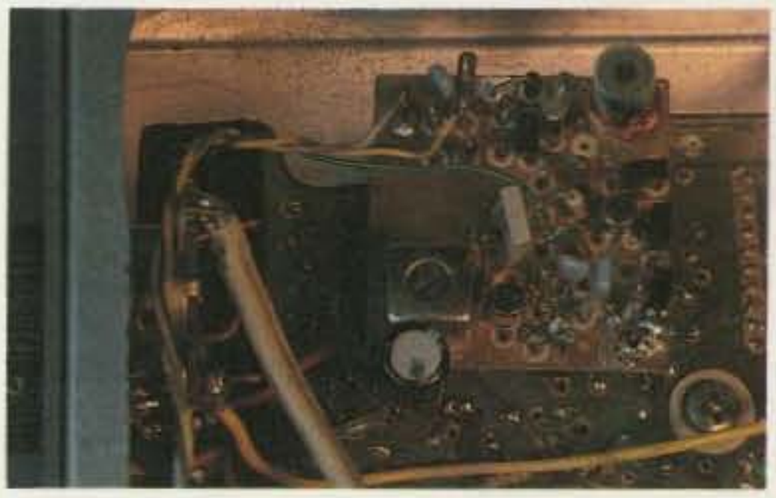

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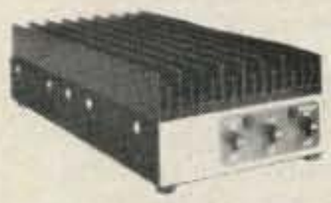

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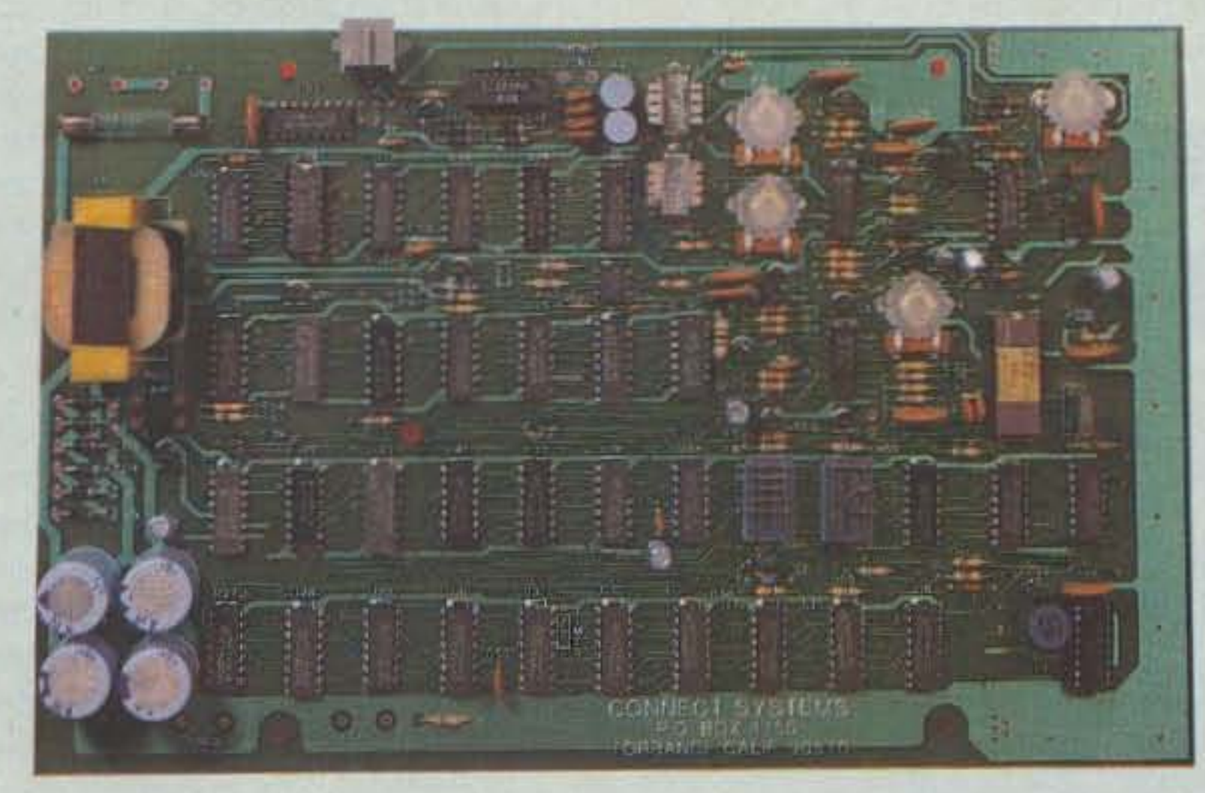

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NEVER SAY DIE
editorial by Wayne Green

SABAH!

One of the reasons I got into publishing a ham magazine had to do with a rather serious character flaw on my part, one which dictated that whenever I found something really fun to do I was not satisfied until I shared my fun with others. Thus, when I found out what a blast playing with ham RTTY was, I just couldn't be satisfied until I got others to share my fun and enthusiasm. This got me started publishing a RTTY newsletter and gradually brought me to my present situation with *73* and some other magazines, mostly for enthusiasts.

Well, I'm in a tiny country called Sabah and you really should be here to be sharing my fun with me. The capital city is Kota Kinabalu, which few people have ever heard of. Much to my surprise, I arrived here from Brunei and found a surprisingly large city. The biggest hotel, the Hyatt, is 14 floors high; unlike in America, it has a 13th floor. Being not far from the equator, it is hot during the middle of the day. That's a nice time for a nap or to sit around a swimming pool writing postcards to those of less adventurous spirit.

Hassan 9M6MA met Sherry and me at the airport and drove us into town to the Hyatt. Later, he picked us up and drove us to his house, which is built on stilts over the water. Hassan expected me to be surprised, but I merely felt at home. When I was a teenager, my folks had a summer house built on stilts out near Floyd Bennet Airport in Brooklyn. We reached the house by walking over about a quarter mile of boardwalk; it was perhaps three feet wide and six feet over the mud flats and a couple of feet above the high tides. Some of the full moon tides would bring water up to the boardwalk. And I'll never forget the hurricane of 1938 when the extra high tides and storm washed away most of the boardwalks and some of the houses. We lost a dock and our rowboat, and my family just barely made it across the narrow walk as the storm hit. They had to use sticks to keep from being swept off the long walk. I missed out on that drama, being busy at home listening to 20 meters and the unusual propagation which the storm brought. No, Hassan's house wasn't a bit strange for me. We were joined by Ian 9M6MH, Mohamed 9M6MO, and his brother Ali, an SWL. We had quite an interesting little hamfest. None of them is really a DXer and they would prefer, as would most of the hams in rare spots around the world, to be able to get on the air and talk with people. They want, like every other person to whom English is a second language, to have a chance to improve their English. They'd like to get to know their fellow hams, yet every time they get on the air they are hounded by hams who "need" their remote country and have little respect for the interests of the DX operator. Many hams get very nasty if deprived of their "right" to a new country. This is the bane of most hams in rare spots and often drives them off the air. As long as we hams continue to support the ARRL Honor Roll, I'm afraid that this is going to be a problem. It isn't DXCC that's doing it, just the Honor Roll. Dare we call it a Dishonor Roll and anger the dozens of poor souls who have decided to devote their lives to keeping on top of this blight? What a waste of lives which might otherwise be productive.

A year ago, I wrote an editorial telling you that I was going to be going to Asia and asking you to come along. Well, you sure goofed this time. You not only missed out on consumer electronics shows in Tokyo, Taipei, Seoul, and Hong Kong, but also you missed a great ham convention in Bangkok, with about 150 hams coming in from all over the world, plus interesting visits to weird places such as Sarawak, Brunei, and Sabah. These places are really off the tourist trails, and yet they are each different and fascinating. Sarawak has but one active ham. What a spot for a DXpedition, eh? Well, there was one here recently which knocked off 10,000 contacts and still didn't cut down the pileups. I think you could DXpedition once a year for a week or so to Sarawak and be kept very busy. One of the main topics of discussion in Sarawak during my visit was a 25-foot crocodile which has been eating people. They'd flown in a medicine man to try to catch this bugger . . . somewhere up the Sarawak River. No, I didn't go for a swim in the river, which went right by our hotel.

There not being much of a tourist trade, there are very few stores aimed at tourists. There are hundreds upon hundreds of stores selling things for the local people, plus huge markets. I wandered around one bazaar and saw perhaps fifty stalls selling shoes. There were another fifty selling fruits, an acre or two selling vegetables, and so on. I can't tell you about all these things; you're just going to have to break loose and come with me on one of these trips and see everything for yourself. Oh, I've been taking slides by the hundreds, but even that can't really come close to an actual visit.

Kota Kinabalu is so far out in the sticks that neither McDonald's nor Kentucky Fried Chicken have found the place! Now, that's remote! Oh, they do have a McDonald's-like fast food store which serves hamburgers, fried chicken, sundaes, and even breakfasts. The prices are about the same as in the US.

These Asian tours are surprisingly inexpensive. Commerce Tours has been arranging them for several years and they have them down pat. They take you to the best of hotels. They include most of the breakfasts and a lot of dinners. If you eat only what is provided on the tour, you will put

QSL OF THE MONTH

This month's winning QSL from Roger Schultz NG6P is the result of a family effort. Roger's XYL, Diane, designed and stitched the original needlepoint for the card. Her work then was reproduced with a clarity that permits you to count the stitches, giving the impression of depth to the QSL card. The variety of stitches she used keeps the eye busy, and the border surrounding the design gives the card definition that many other cards lack.

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

Watt's new...on 2 meters?

All mode (FM/SSB/CW) 25 watts, plus...!!!

TR-9130

The TR-9130 is a powerful, yet compact, 25 watt FM/USB/LSB/CW transceiver providing increased versatility of operation on the two meter band. It features six memories, memory scan, memory back-up capability, automatic band scan, all-mode squelch, CW semi break-in, and incorporates microprocessor technology. It is available with a 16-key autopatch UP/DOWN microphone (MC-46), or a basic UP/DOWN microphone.

TR-9130 FEATURES:

25 Watts RF output
All modes, (FM/SSB/CW), utilize a new high power linear module, for more reliable FM operation and increased DX on SSB or CW.

FM/USB/LSB/CW all mode operation
For added convenience in all modes of operation, the mode switch, in combination with the digital step (DS) switch, determines the size (100 Hz, 1 kHz, 5 kHz, 10 kHz) of the tuning step, and the number of digits displayed.

Six memories
On FM, memories 1 through 5 for simplex or ±600 kHz offset, with the OFFSET switch. Memory 6 for non-standard offset. All six memories may be operated simplex, any mode.

Memory scan
Scans memories in which data is stored. Stops on busy channels.

Internal battery memory back-up
With 9 volt Ni-Cd battery installed, (not KENWOOD supplied), memories will be retained approximately 24 hours, adequate for the typical move from base to mobile. A terminal is provided on the rear panel for connecting an external back-up supply.

- **Automatic band scan**
  Scans within whole 1 MHz segments (ie., 144.0-144.999 MHz), for improved scanning efficiency.
- **Dual digital VFO's**
  Incorporates two built-in digital VFO's, selected through use of the A/B switch, and individually tuned.
- **Transmit frequency tuning for OSCAR operations**
  On SSB or CW, the tuning knob or UP/DOWN buttons on the microphone may be used to adjust the transmit frequency during transmission.
- **16-key autopatch UP/DOWN microphone version**
  The TR-9130 is available with the MC-46 16-key autopatch UP/DOWN microphone, or with the basic UP/DOWN microphone. Manual UP/DOWN scan of entire band possible using either microphone.
- **Squelch circuit on all modes (FM/SSB/CW)**
  The squelch circuit is effective on SSB, CW, and FM.
- **Repeater reverse switch**
  For checking signals on the repeater input, on FM.
- **Tone switch**
  For activating a tone device, (not KENWOOD supplied).
- **CW semi break-in circuit with sidetone**
  Built-in, for convenience in CW operations.
- **Digital display with green LED's**
- **High performance receive-transmit design**
  The use of a low-noise dual-gate MOSFET plus two monolithic crystal filters in the receiver front-end results in excellent two signal characteristics. Care in transmitter design assures clean signals in all modes.
- **Compact size and light weight**
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- **Extended frequency range**
  Covers 143.9 to 148.9999 MHz, which includes certain MARS and CAP frequencies.
- **Transmit offset switch**
- **High performance noise blanker**
  Suppresses pulse-type noise on SSB and CW.
- **RF gain control**
  For all modes of operation.
- **RIT (Receiver Incremental Tuning) circuit**
  Useful during SSB/CW operations.
- **Amplified AGC**
  Enhances SSB and CW operation. The AGC time constant is automatically optimized for each mode of operation.
- **HI/LOW power switch**
  Selects 25 or 5 watts RF output on FM or CW.
- **Accessory terminal**
  A four pin accessory terminal is provided for use with a linear amplifier or other accessory.
- **Quick release mounting bracket** (Supplied)

More information on the TR-9130 is available from all authorized dealers of Trio-Kenwood Communications
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Accessories:

- KPS-7 Fixed station power supply.
- TK-1 AC adapter for memory back-up.

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on weight. The electronics shows are one of the best opportunities for you to find some little product to import and get your own mail-order business going. Or, if you are in the electronics business, this is a way to find an Asian partner to do some of your manufacturing for you. More and more firms, even smaller ones, have an Asian "plant" which is helping with circuit boards. Just one connection on a trip like this will pay for the trip several times over. The cost of the tour for the last three years has been around $2,500. . . which includes all airfares, first-class hotels, and a lot of the meals. That's one of the best tour bargains I've seen.

After the organized part of the tour, you can add some extra countries on at surprisingly little extra cost. The tour ended with the Hong Kong Electronics Show, but from there we went on to visit Singapore, Kuching, Bangkok, Bandar Seri Begawan, Kota Kinabalu, and Manila, all for about $500 extra in airfare.

There is going to be a big celebration in Brunei in a bit over a year when the country goes independent. The VS5 calls will change to a new prefix

Continued on page 108

LONG-DELAYED ECHOES

A former Los Alamos National Laboratory scientist has been honored by the Soviet Academy of Sciences for his explanation of long-delayed radio echoes. Robert W. Freyman received the Commemorative Medal of the Polar Geophysical Institute, the first time the Institute had honored anyone from outside the Soviet Union, according to the Oct. 7 issue of *Machine Design*.

Three- to 30-second delayed echoes of radio signals have been observed since 1927, and Freyman conducted a series of experiments aimed at solving the riddle of these echoes. He believes the signals are delayed because they are caught up in ducts of plasma in the solar wind surrounding the Earth. The wind blends with the Earth's magnetic field some 45,000 miles above the surface.

Radio-wave ducts in the blended plasma often stream toward the sun, Freyman says. "If radio signals encounter a duct, they are transported into space. They bounce back when the duct collapses, thus accounting for the delay."

The Soviets duplicated and confirmed Freyman's research. His work had special significance for the Soviets because they have pursued intensive investigations of long-delayed echoes since a 1979 multinational experiment produced the phenomenon over Soviet territory.—Thanks to reader Jacques M. Percourt F2YS/W2, Millbrook NY.

Well. . . I Can Dream, Can't I?

by Bandel Linn K4PP

"We heard you have a ham radio outfit on board, so we're going out of the way to a rare island from which nobody has ever broadcast!"

More Transceiver

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

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

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

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

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

MORE MICRO CONTROL

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

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Unleash the TS-900

A rig like this deserves more room than 2 meters can give. Get on HF (including WARC bands) with this transverter.

After using my new TS-900 for a few months, I realized that with the exception of its dedicated 2-meter coverage, it had all the features found in the best HF transceivers. It seemed wasteful to keep it caged on 2 meters when all I needed was a transverter for operation on one of the HF bands. At about this same time, the three new WARC bands were announced and this furthered my desire to put the TS-900 on HF.

After considerable research on the subject of synthesizers and conversion techniques, I managed to design a transverter that is a definite engineering overkill. This box will take any switch-selected 1-MHz band from 0 to 30 MHz and upconvert it for receive to the 144-to-145-MHz range. In the transmit mode, the 2-meter transmit signal is translated down to the exact frequency as on receive.

Since I already had a 100-Watt broadband amplifier, I designed the unit for 5 Watts output. This is only 2 S-units below that of the popular 200-Watt PEP input transceivers and is certainly plenty of power for many contacts. If you want more power, I recommend either the 100-Watt-output transistor amplifier described in the ARRL *Handbook* or the unit described in Motorola's Engineering Bulletin EB63 (this is what I used).

What Can You Use It For?

With this transverter, I can operate anywhere in the HF range, transmit or receive, all modes. Unfortunately, the transmit output drops off below 1 MHz, but I don't need to talk to WCBS anyway. The transverter works with any multimode transceiver in the 10-Watt class and has a built-in attenuator to handle the full transmitter output power. There is a bypass relay to permit instantaneous operation on either HF or 2 meters without any cable switching. This also provides an OSCAR mode of operation that automatically switches between 2-meter transmit and 10-meter receive.

Since my TS-900 has FM capability, I have made extensive use of the transverter on 10-meter FM. The dual-vfo feature makes selection of any repeater offset possible. I have also made many contacts on 10-meter AM. Of course, I can operate CW and SSB on any of the 160- through 10-meter bands and listen to plenty of activity on commercial frequencies in between It is also great for MARS and CAP frequencies that are outside the normal overlap coverage of HF transceivers. If you are interested in BCB DX, the 100-Hz readout and super sensitivity are ideal. There is also plenty of interesting VLF activity in the 50-to-200-kHz region, including the 1750-meter band.

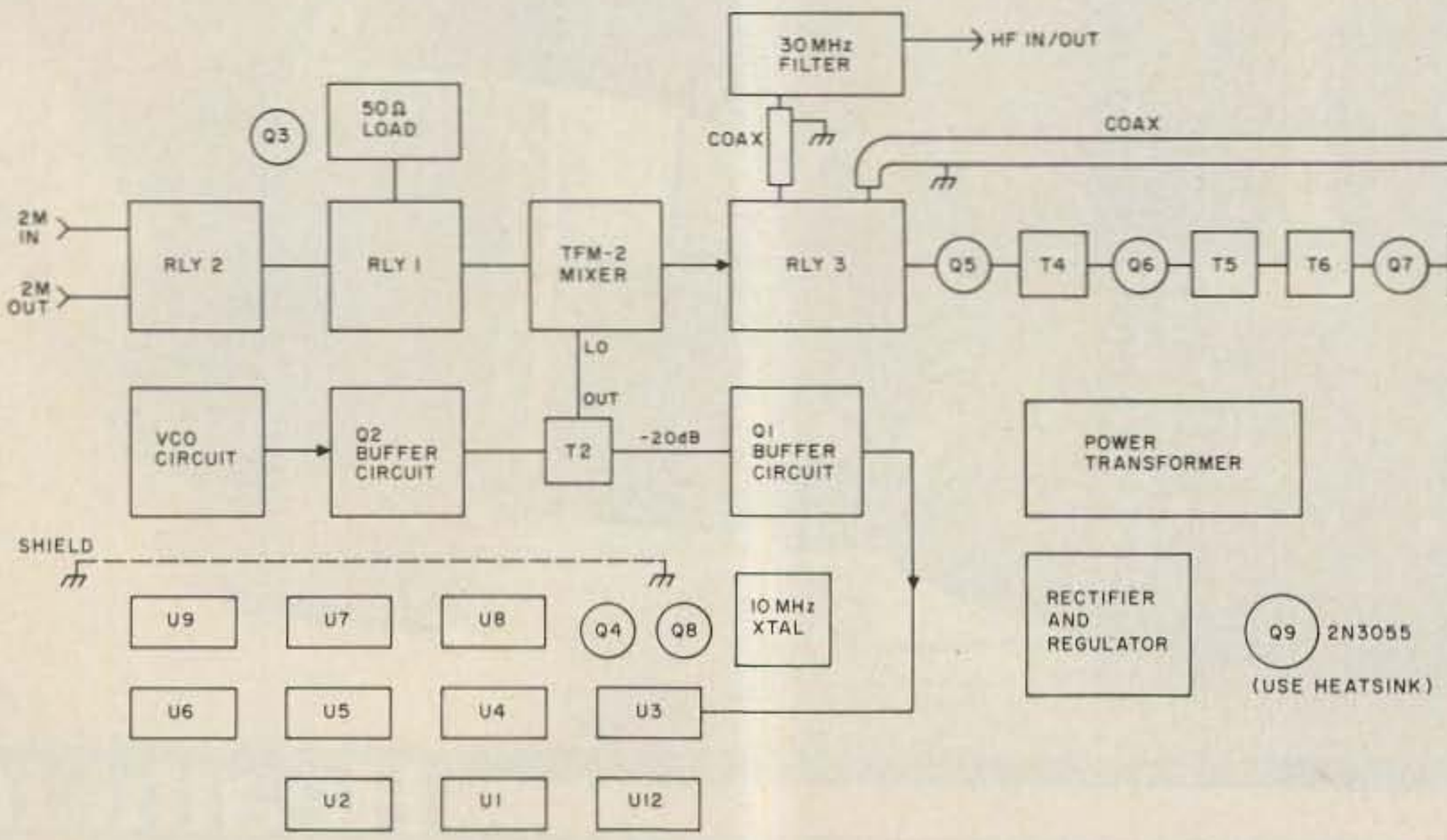


Fig. 1. Suggested layout of the HF transverter for 2-meter multi-modes.

Construction

The design uses readily-available components. Most are available from *73* advertisers and my old faithful parts store, Radio Shack. The design has been successfully duplicated by 5 other locals and has worked every time. Total

cost with new parts should be under $150.

I didn't use a PCB layout since I was only building one unit, although the layout could be put on a PCB. If anyone is interested in such a project, I would be happy to give some recommendations on a layout.

My unit was built using the "dead-bug" technique and point-to-point wiring. ICs are mounted upside down on the copper side of a sheet of single-sided PCB, and all interconnections between ICs use #30 insulated bus wire. Where possible, components such as disc bypass capacitors are used as tie-points; one lead is soldered directly to the ground plane and the other, free end, supports other common circuit parts. To keep digital noise down, a 1000-pF disc is soldered to the Vcc lead of each IC. This connection along with direct soldering of the ground lead of each IC serves to secure the ICs.

I used a sheet of 8"×11" PCB that also serves as the top cover for an 8"×11" aluminum chassis. This provides excellent shielding and is really not an unattractive method. Fig. 1 shows a layout of various sections and critical components of the transverter. Fig. 2 provides details on winding the various transmission line transformers used in the transverter.

Theory of Operation

Fig. 3 shows the block diagram of the transverter. The key to the versatility of the unit is the synthesizer. It covers 115 to 144 MHz in 1-MHz steps and drives the bilateral mixer at about +7 dBm. As an example of the conversion scheme, to cover 17 to 18 MHz by tuning from 144 to 145 MHz, the synthesizer outputs a signal at 127 MHz (144−127=17).

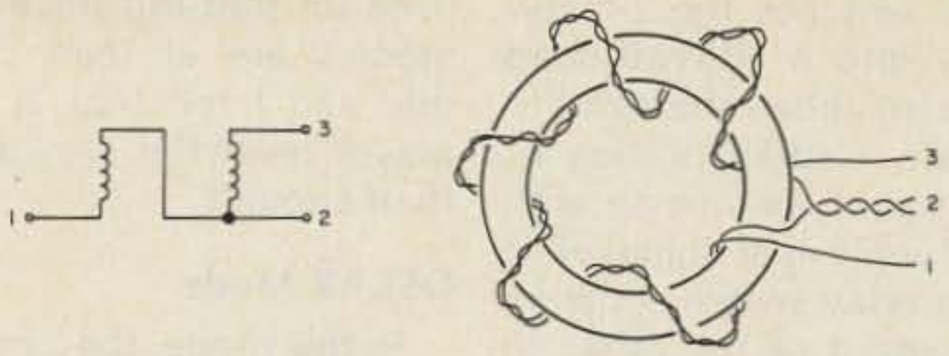
I chose to upconvert in 1-MHz segments and restrict the 2-meter coverage to the 144-to-145-MHz range for two reasons. It greatly simplifies the synthesizer design and also eliminates any problems in reading the frequencies on the transceiver dial. You simply ignore the 144 reading and mentally replace it with the MHz reading on the transverter thumbwheel dials. The other digits are the same.

Using the above example, 17.2366 MHz would read 144.2366 on the transceiver. A second benefit to tuning the 144-to-145-MHz range is that there are fewer strong repeaters operating there that might feed through the converter. However, this is not a serious problem since the design has over 80 dB of suppression of such signals.

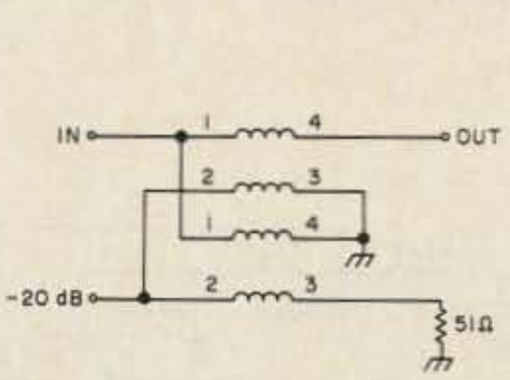
In the receive mode, incoming signals pass through the transmit relay through a 30-MHz low-pass filter. They are mixed with the signal from the synthesizer in the balanced mixer. The output of the mixer at 2 meters passes through the T-R relay attenuator circuit and transverter bypass relay to the 2-meter transceiver. The overall loss through the converter is about 7 dB, so the typical 0.25-μV sensitivity of a multi-mode will be 0.5 μV on HF. This makes for a very sensitive HF receiver that can hear anything that the best HF transceiver can hear.

The scheme used for upconversion results in an overall receiver that is free from spurious responses without the need for elaborate multi-pole front-end filters. All of the newer-generation commercial and amateur equipment uses some form of VHF i-f range to eliminate problems with hard-to-suppress mixing products. This design has no spurious responses anywhere that can't be easily attenuated by the 30-MHz low-pass filter.

When the 2-meter transverter is keyed, the input from its external relay contacts activates two relays in the transverter. The first



Transformer	Turns	Core Material	Wire Size
T1	4	F-50	#28
T3	4	F-50	#28
T4	4	F-50	#28
T5	5	F-87	#26
T6	5	F-87	#26
T7	5	F-125	#24



Transformer	Turns	Core Material	Wire Size
T2	4	F-50	#28

Only one winding shown for clarity. Second winding is connected to first as indicated below.

Function	1st Winding	2nd Winding
Input	1	1
−20 dB	2	2
Ground	3	4
Output	4	no connection
51Ω	no connection	3

Fig. 2. Coil-winding specifications. All cores are mix Q1 from Palomar Engineers, Box 455, Escondido CA 92025. All windings are made with two pairs of wire twisted five crests per inch.

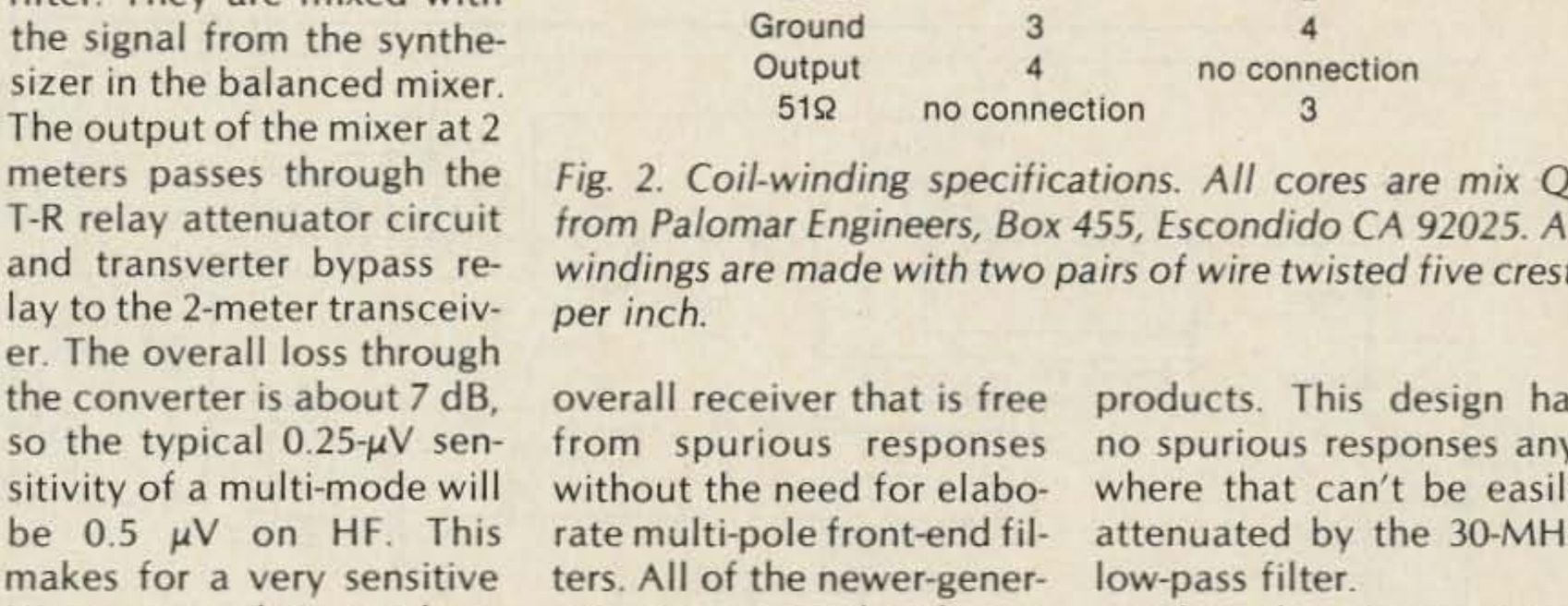


Fig. 3. HF transverter block diagram.

relay switches the 2-meter input into a 10-Watt load and also allows the mixer to sample a small portion of this signal for mixing with the synthesizer signal. The other relay switches the input/output of the mixer to the power amplifier chain. The output of the mixer is about −10 dBm PEP. This is amplified to the 5-Watt level by 3 broadband amplifiers in the power amplifier. Other than the 30-MHz filter, no low-pass filters are used for transmit since harmonics are at least −30 dBc and I felt that at this power level this was more than enough.

OSCAR Mode

In this mode, the 2-meter transceiver is automatically bypassed to the 2-meter antenna whenever the transceiver is keyed. The dual-vfo feature of most multimodes makes OSCAR operation extremely simple. The only disadvantage is that you cannot monitor your own signals, but I have never found this to be a serious disadvantage.

Options

If you don't want or need transmit capability, you can delete the associated relays and power amplifier circuits. The 30-MHz low-pass filter should connect directly from the HF antenna to the mixer. If you delete the 2-meter transfer relay and load, make sure you don't ever key the 2-meter transceiver while connected, or the mixer will be damaged. With the power amplifier eliminated, you can use a much smaller and cheaper power transformer —see parts list for details.

Circuit Operation

Fig. 4 shows the schematic of the transverter. At first glance, the circuit may look complicated, but it is really quite simple and straightforward. The voltage con-

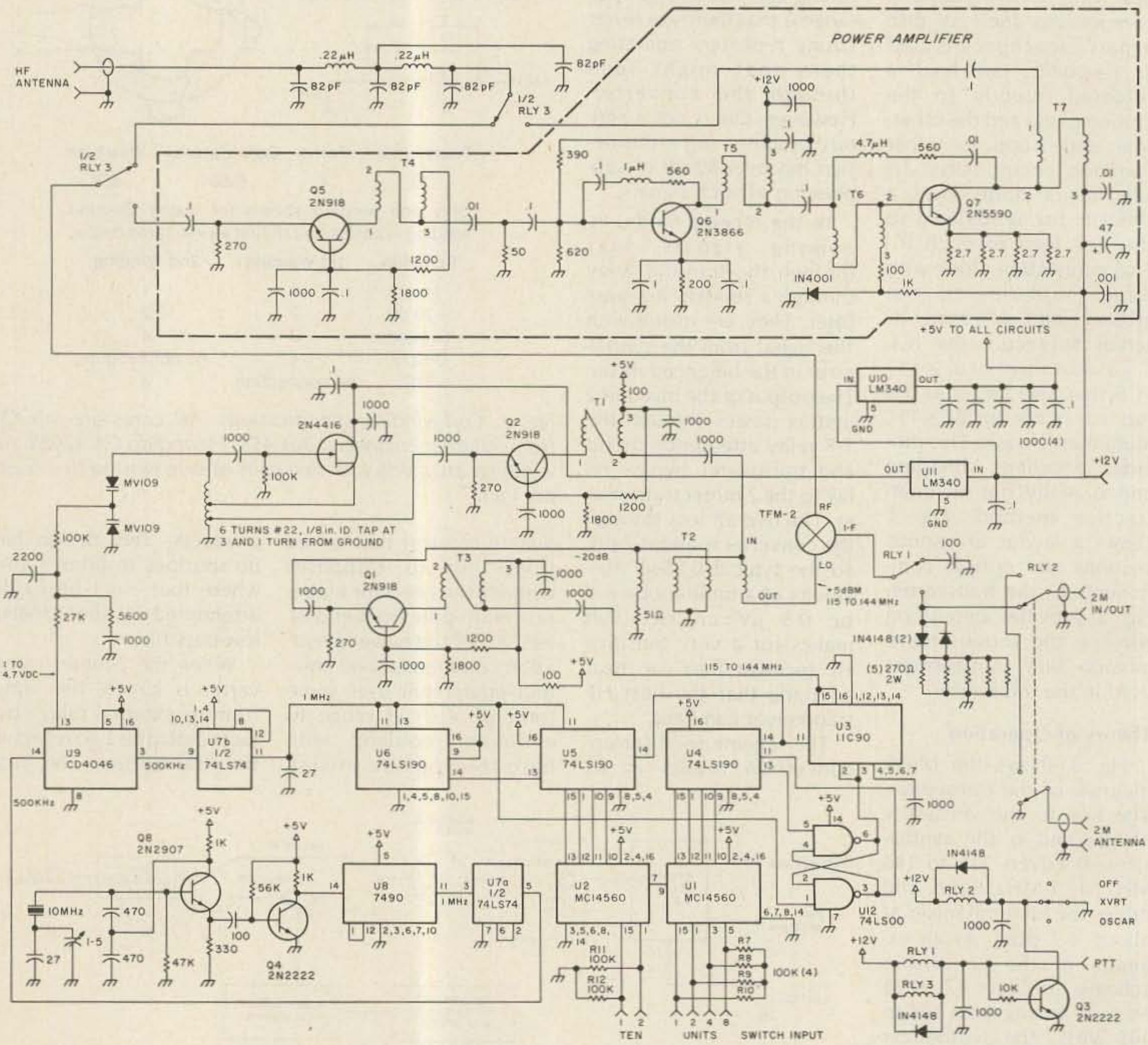


Fig. 4. HF transverter schematic diagram. All resistors 1/4-Watt, 10%, specified in Ohms unless otherwise noted. All capacitors are in pF, disc ceramic, 50-volt minimum unless noted. Pull-up resistors on BCD inputs are connected to ground or +5 volts, depending on use of positive or negative switch logic. Relay 1—Radio Shack 275-003; relays 2 and 3—275-214.

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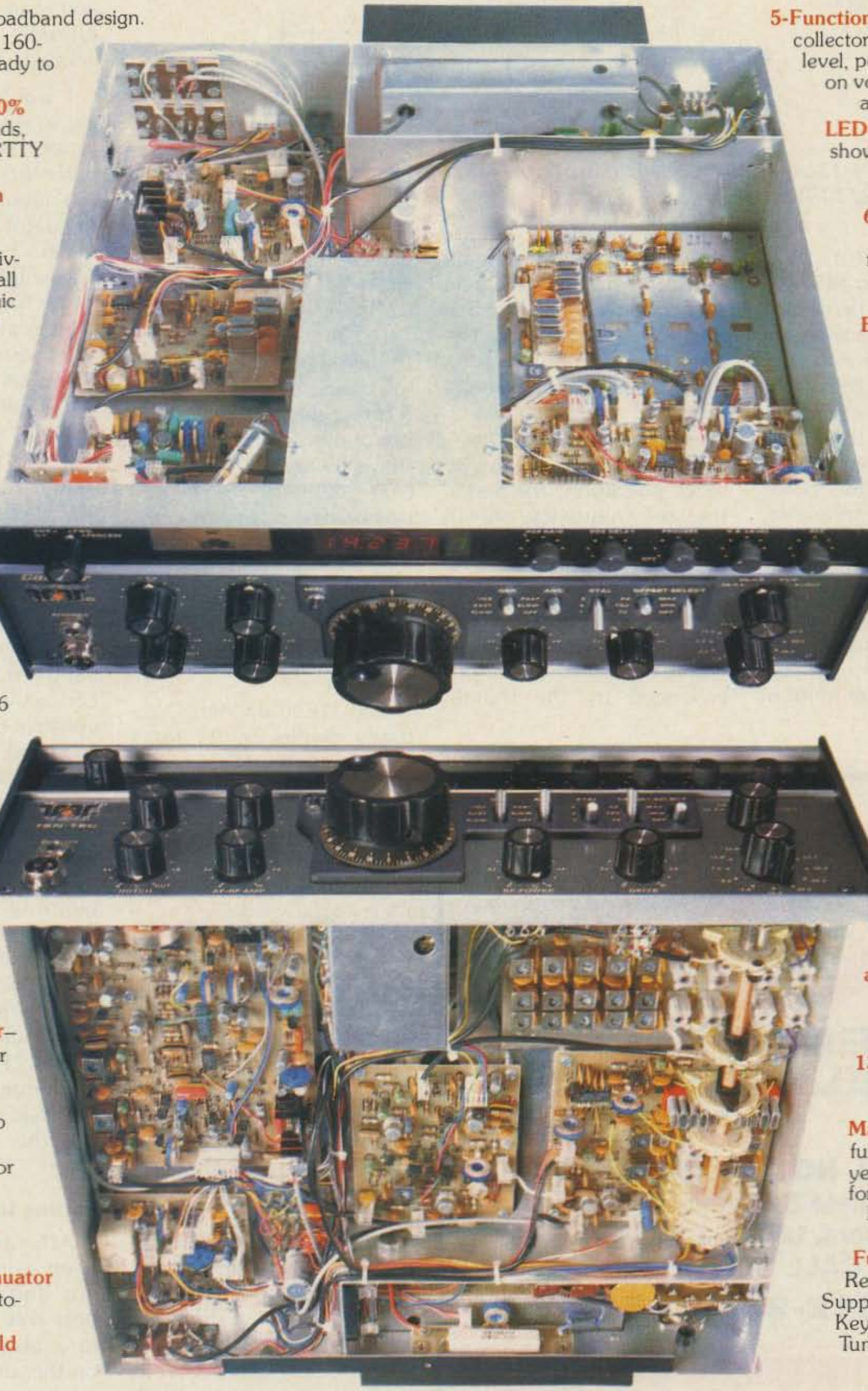

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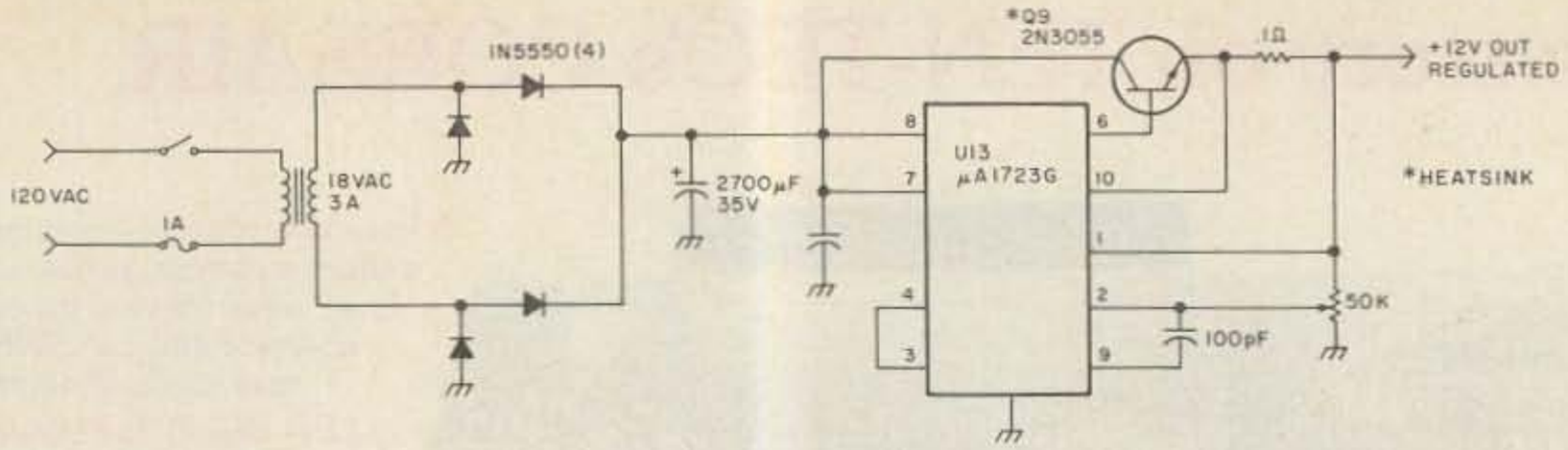

Fig. 5. Regulated +12-volt supply. Power transformer is Radio Shack 273-1514. For receive-only, substitute 273-1515.

trolled oscillator (vco) tunes from 114 to 145 MHz with a 1-to-4.8-V-dc control voltage. There are two common-base isolation amplifiers—one feeds the vco to the balanced mixer and the other, coupled through a 20-dB coupler, buffers the output to the divider chain. Since the desired frequency steps are in 1-MHz increments, the 10-MHz crystal-controlled reference is divided by 10 to produce 1 MHz for one input of the CD4046 frequency/phase detector. The other input of the CD4046 comes from the output of the divider chain that produces 1 MHz when the loop is locked. The phase detector output is filtered and frequency-compensated to deliver a dc control to the vco.

As an example of the divider operation, for a synthesizer frequency of 115 MHz, which corresponds to a range of 29-30 MHz, the thumbwheels are set to 29. The two MC14560 ICs (U1 and U2) are adders that add a constant 66 to the values produced by the thumbwheel input. This sets the first 74LS190 upcounter (U4) to 95. The second 74LS190 (U5) is hard-wired to divide by 8 so the resulting divide ratio is 895 (read left to right). Since this is an upcounter divider, the actual divide ratio is 115: (100−89)+(10−5). I used upcounters instead of downcounters due to the "backwards" relationship of thumbwheel setting to synthesizer frequency and to simplify design of the adders.

The 11C90 divider IC actually divides by 11 for a portion of the rf input period and by 10 for the remainder. Its operation is controlled by the 74LS00 and the output of the first 74L190 dividers.

The phase detector actually operates at 500 kHz, but since both the 1-MHz reference and the variable divider output have identical divide-by-2 circuits, the vco is stepped in 1-MHz increments. I had to operate the CD4046 phase detector at 500 kHz since 1 MHz was too high in frequency for reliable operation with a 5-volt supply. Also notice that the reference frequency is divided from a 10-MHz crystal. This was done for stability reasons since any error or drift at 10 MHz is multiplied by a factor of 14. This also gives reduced noise output of the synthesizer since noise of the reference is multiplied by a smaller amount than with a 1-MHz crystal. A conventional regulated +12-volt supply (Fig. 5) powers the power amplifier and 5-volt regulator for the logic. The circuit is capable of 3 Amps and can be simplified if transmit operation is not needed.

I would recommend using a smaller power transformer, as shown in the parts list, and replacing the 723 regulator and 2N3055 regulator by a simple 3-terminal +12-volt regulator. This will be more than adequate to power the remaining circuitry. Note that for receive-only operation you don't really need RLY 1, and if you don't mind disconnecting cables, you also can eliminate the 2-meter bypass relay, RLY 2, and all associated circuitry.

The 5-Watt power amplifier chain is a collection of various circuits that I've used in the past and I don't take any credit for designing them. There is little that can go wrong if normal rf construction practices are followed. Be sure to use short leads on all components, and keep inputs and outputs separated and physically in a straight line. Refer to Fig. 2 for details on winding the broadband transformers. Also note that the 2N5590 final transistors will require some form of small heat sink attached to the mounting screw. I used a 3″ × 3″ square of .060″ aluminum mounted on the underside of the PCB used for the power amplifier chain.

Putting It on the Air

After all the circuits have been wired and checked out and are working, the best way to tell what kind of a job you did is to put it on the air. The only adjustment is to adjust the vco coil for about 4.8 V dc when set to 00 MHz (144 MHz actual).

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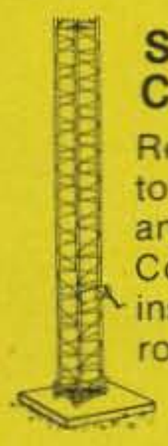
	HG-37SS	2	37 ft. 11.3 m	20.5 ft. 6.2 m	13.75 in. 349.3 mm	9.5 sq. ft.-50 mph .88 sq. m-80 km/h	265 lbs. 120 kg
	HG-54HD	3	54 ft. 16.5 m	21.5 ft. 6.6 m	19.53 in. 496.1 mm	16 sq. ft.-60 mph 1.5 sq. m-96 km/h	575 lbs. 261 kg
	HG-70HD	4	70 ft. 21.3 m	21.5 ft. 6.6 m	22.63 in. 574.7 mm	16 sq. ft.-60 mph 1.5 sq. m-96 km/h	1100 lbs. 499 kg
SIDE-SUPPORTED	HG-33MT2	4	33 ft. 10.1 m	11.5 ft. 3.5 m	13.75 in. 349.3 mm	8.5 sq. ft.-50 mph .79 sq. m-80 km/h	210 lbs. 95 kg
	HG-50MT2	3	50 ft. 15.2 m	21 ft. 6.4 m	11.5 in. 292.1 mm	6.0 sq. ft.-50 mph .56 sq. m-80 km/h	290 lbs. 132 kg
	HG-35MT2	2	35 ft. 10.7 m	20.5 ft. 6.2 m	9.25 in. 235 mm	9.5 sq. ft.-50 mph .88 sq. m-80 km/h	187 lbs. 85 kg



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Memory Channels	10	10	10
Memory of Offsets	YES	NO	NO
Memory Backup	YES, Capacitance	Yes, Lithium Batt.	Yes, Lithium Batt.
Scan (mem. & band)	YES	Yes	Yes
Search Mode	YES	NO	NO
Step Size	5-100 kHz	5 or 10 kHz only	Any 5kHz multiple
Battery	Quick Change Pack 500 ma-hr, 9.6 V	Quick Change Pack 450 ma-hr, 10.8 V	Slide-on Pack 400 ma-hr, 8.4 V
Frequency Coverage	142-148.995 Tx (149.995 optional) 142-149.995 Rx	143.5-148.495 Tx/Rx	143.9-148.995 Tx/Rx
Power (max)	3.5 W High 1.0 W. Med. 0.1 W Low	2.5 W High 0.2 W Low	2.5 W High .3 W Low (approx.)
Priority	YES (in Mem/Scan)	Yes (Priority Ch.)	NO
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D-15	15	22	26.95	22.95
D-10	10	16	25.95	21.95
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SD-40	40	45	32.95	28.95
Parallel dipoles				
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PD-4010	40,20,10,15	66	37.95	33.95
PD-8040	80,40,15	130	39.95	35.95
PD-4020	40,20,15	66	33.95	29.95

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Four-Tone Audio Oscillator: A Potent Troubleshooter

For any test that requires a tone, this oscillator does the job. It can also be computer-controlled.

Howard F. Batie W7BBX
12002 Cheviot Drive
Herndon VA 22070

The versatile four-tone audio sine-wave oscillator described here can be used to test originate/answer modems, to generate RTTY tones, for two-tone testing of SSB transmitters, for aligning tone decoders, for analyzing audio filters and discriminators, and for many other audio applications. Its TTL-compatible controls even allow it to operate under software control by virtually any

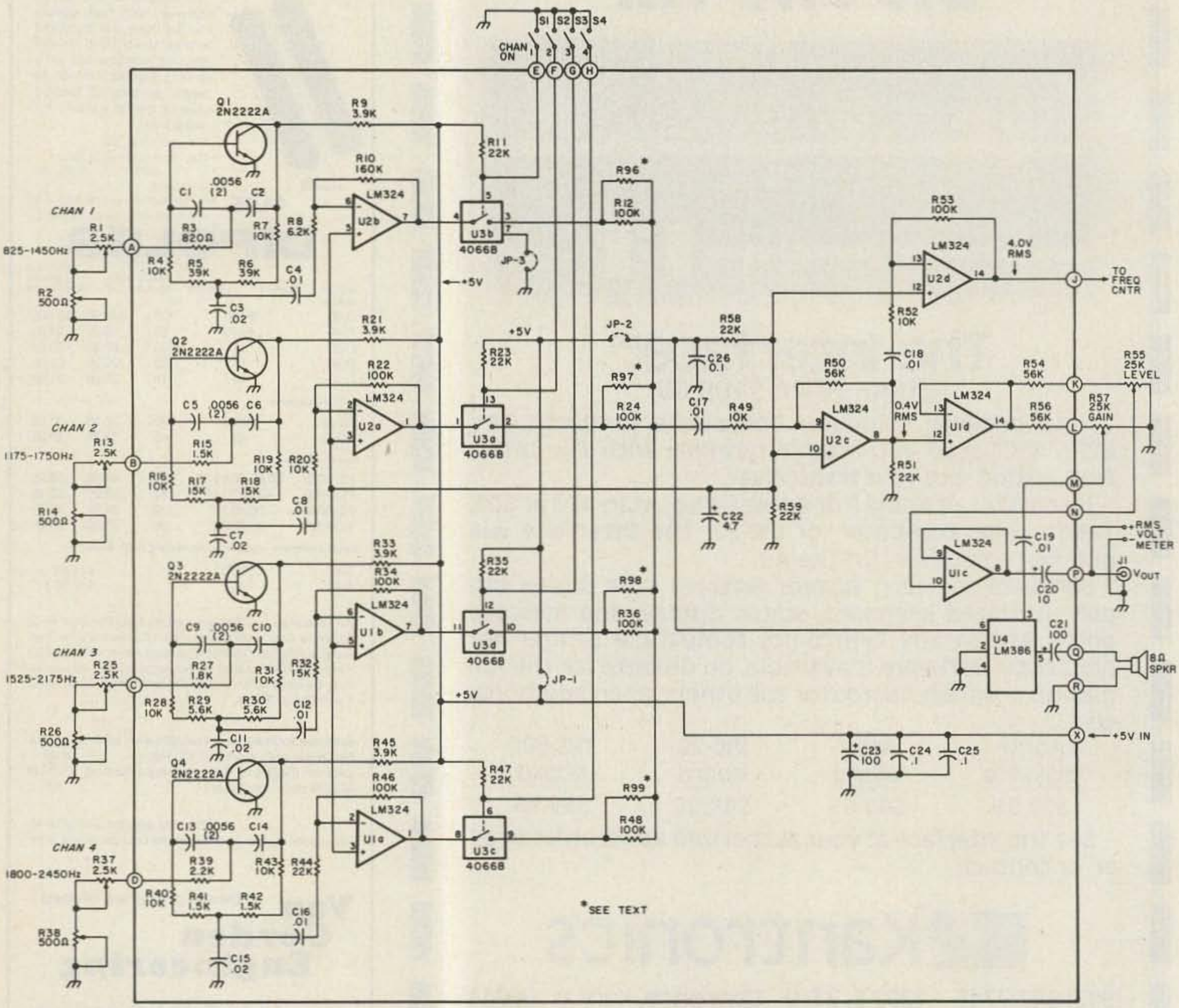

Fig. 1. Oscillator PC board schematic. (©1981, HFB Enterprises)

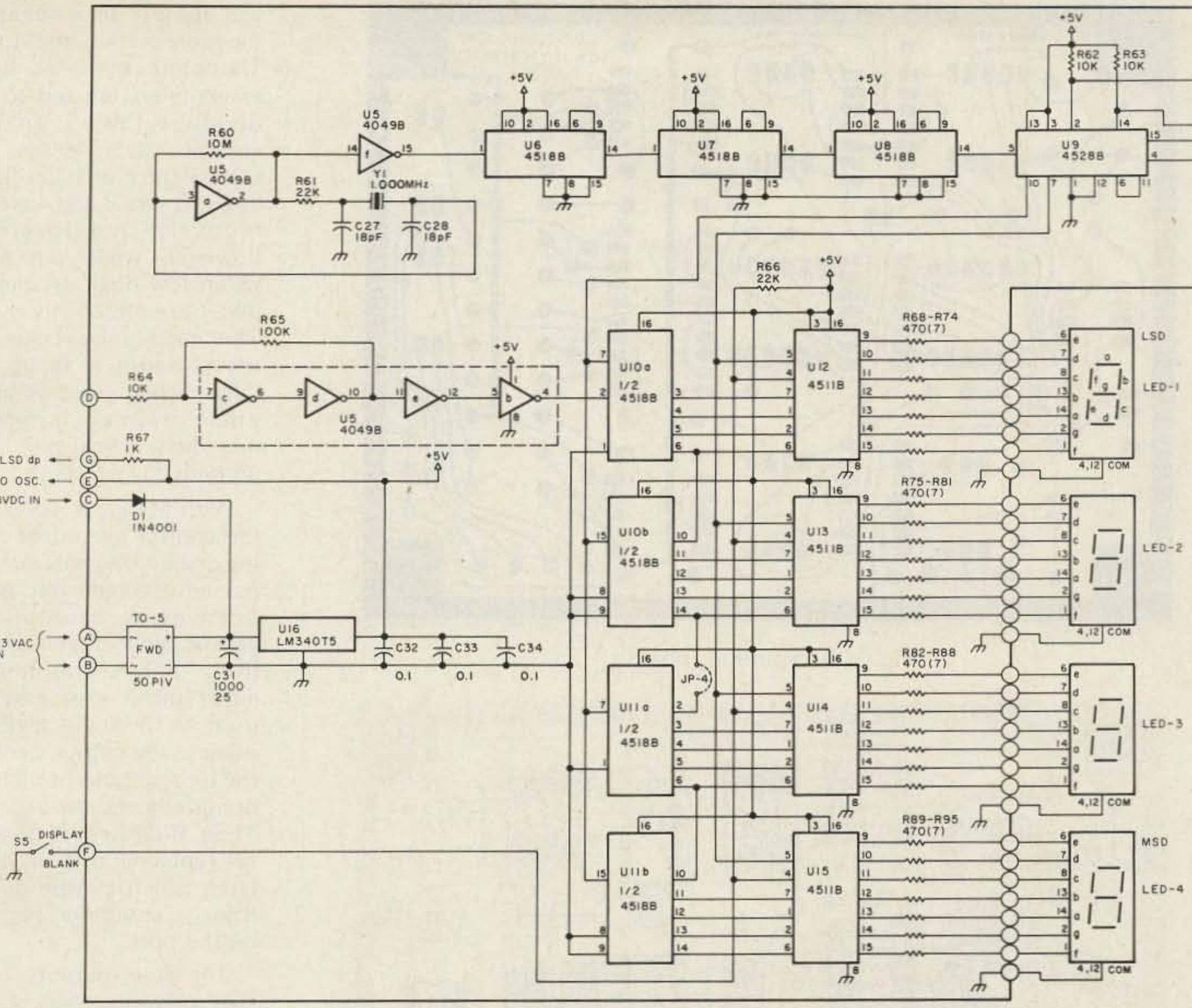

Fig. 2. Frequency counter PC board schematic. (©1981, HFB Enterprises)

computer. Also featured is an integral, direct-reading, 4-digit frequency counter with on-board regulated supply and an on-board audio amplifier. Individual signal-output level and audio-volume controls are provided, and the output signal can supply more than 1 volt rms to a 50-Ohm resistive load.

Low-power CMOS digital integrated circuits and operational amplifiers are used to keep current consumption to a minimum. The four-tone oscillator and frequency counter each are assembled on a 3" × 4" printed circuit board. About 300 mA is required from a 9-15-volt-dc supply when the frequency counter display is on; provisions also are included to blank the display to reduce cur-

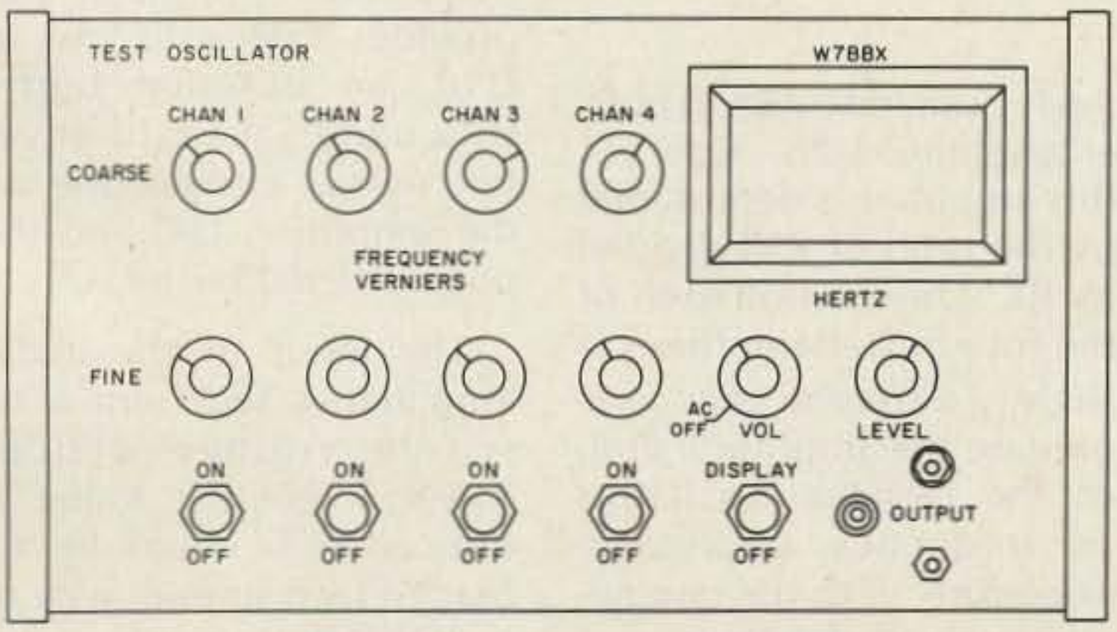

Fig. 3. Front-panel layout.

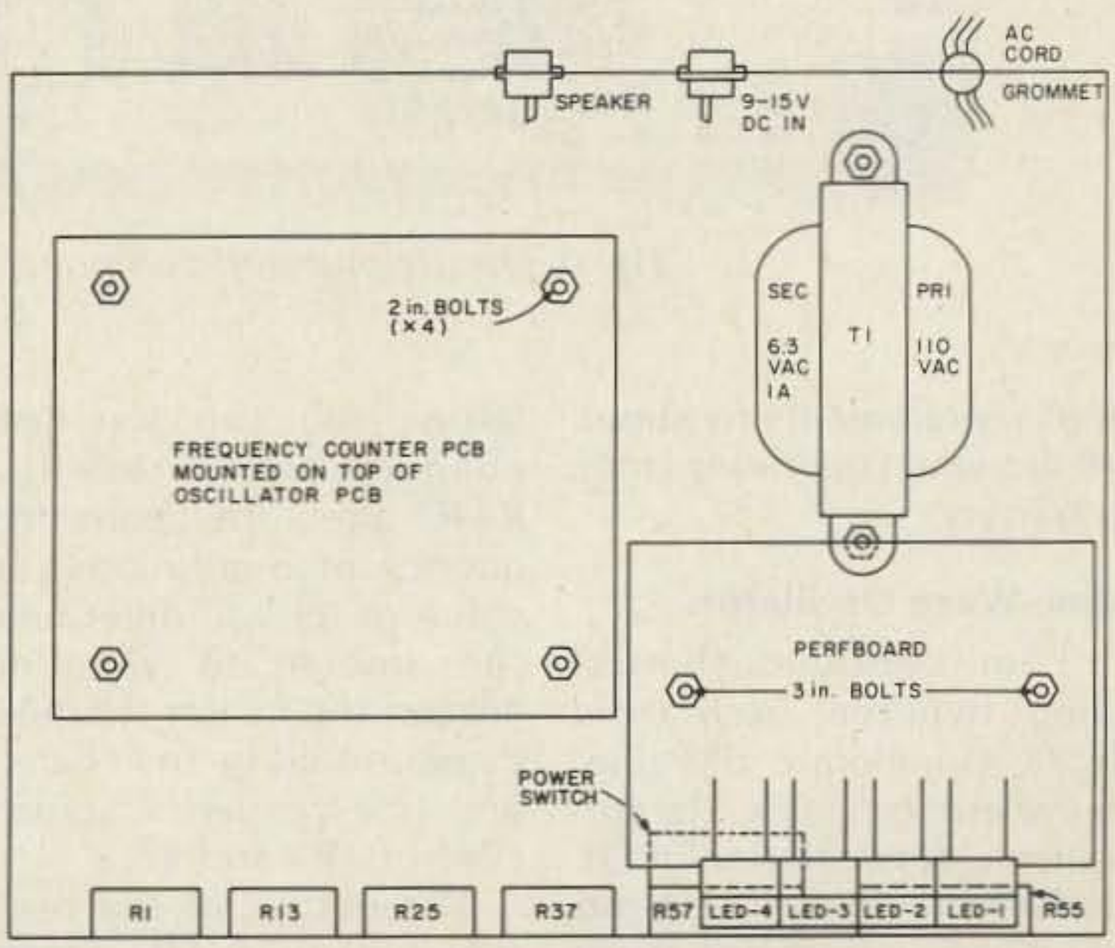

Fig. 4. Chassis layout.

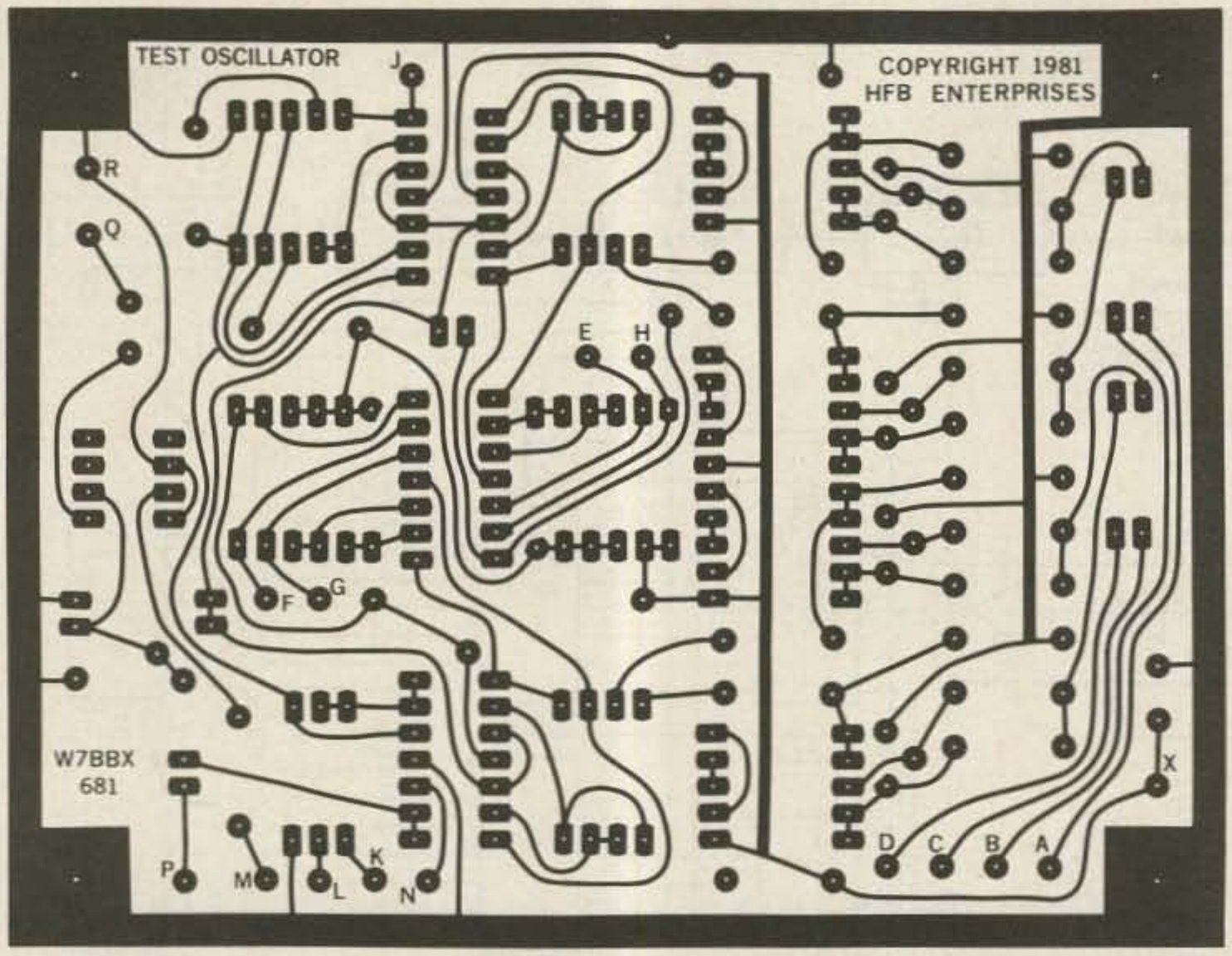

Fig. 5. Oscillator PC board.

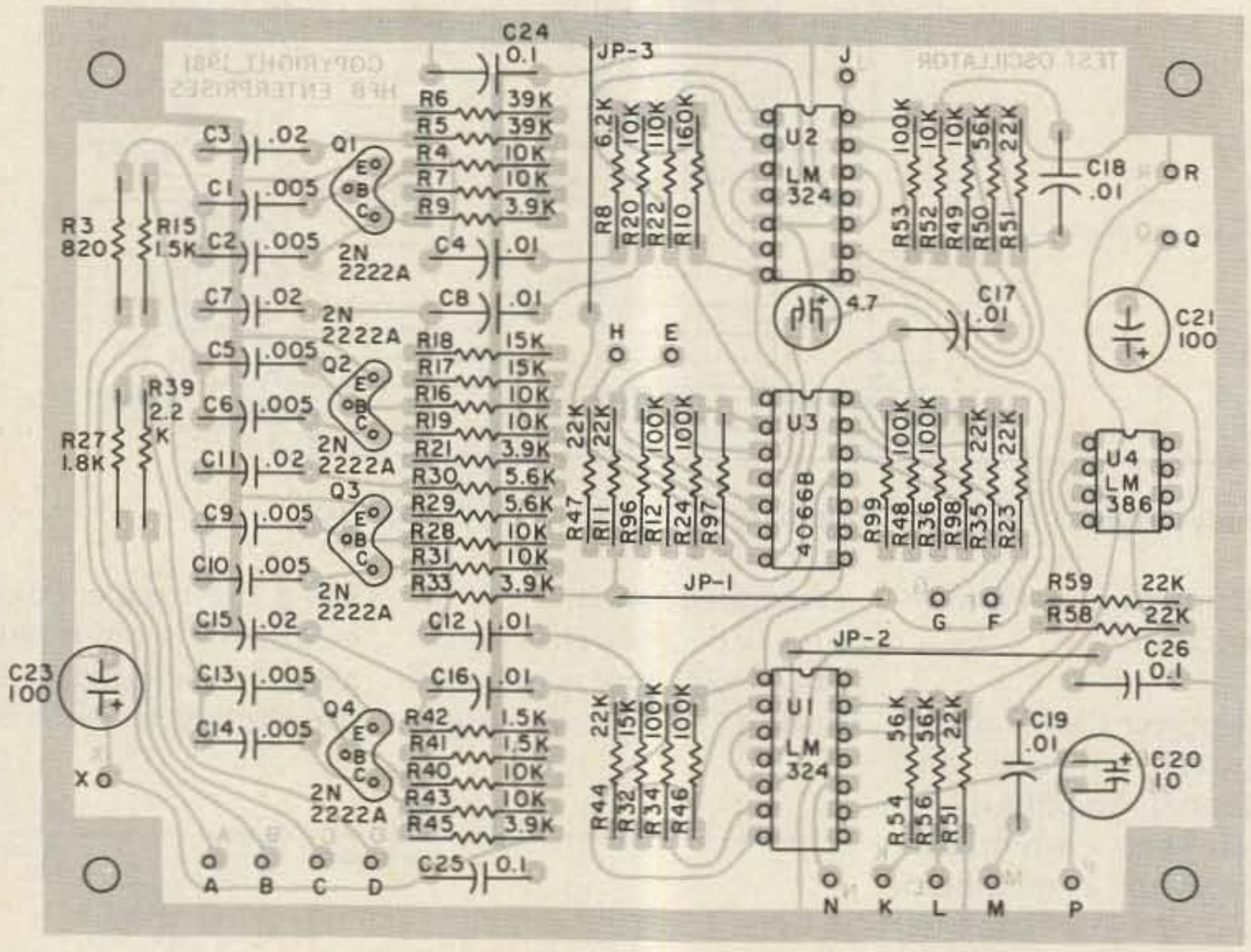

Fig. 6. Oscillator board component layout.

rent requirements to about 40 mA when operating from a battery.

Sine-Wave Oscillators

Four continuously-running twin-tee oscillators (Q1-Q4) generate the sine-wave audio signals. The frequency of oscillation of Q1 is determined by C1-C3 and R1-R7; by comparing these values with the Q2-Q4 oscillators, you can see how changing only resistors R4-R7 alters the center frequency of oscillation. The value of R3 will determine the amount of variation around the center frequency permitted by the coarse- and fine-frequency vernier controls, R1 and R2.

The output of the twin-tee oscillator is taken from the top of C3 and capacitively coupled by C4 to buffer/amplifier U2b. Gain of this amplifier is determined by the ratio of R10 divided by R8. The gain of each of the four buffer/amplifiers is slightly different to accommodate the amplitude drop of the twin-tee oscillators as frequency decreases. Therefore, with the component values shown, pins 1 and 7 of both U1 and U2 will furnish approximately the same output amplitude. The outputs of the four buffer/amplifiers are fed to individual CMOS analog switches (U3). When the control pin 5 of U3b is high (logic 1), pins 3 and 4 are effectively tied together; however, when pin 5 is taken low (logic 0), pins 3 and 4 are effectively open. The resistance between pins 3 and 4 is about 300 Ohms when pin 5 is high, and several hundred megohms when pin 5 is grounded.

With a logic 1 signal on the control pin, either analog or digital signals may be passed through the gate; furthermore, because the gate is bidirectional (effectively only a resistance), either pin 3 or 4 may be used as the input and the other as the output. Each of the four sections of U3 is individually controlled by S1-S4. If desired, S1-S4 may be replaced with a quad latch which can be driven from a computer parallel output port.

The four outputs from the solid-state switch, U3, are then resistively mixed by R12, R24, R36, and R48 and capacitively coupled by C17 to an audio mixer, U2c. The amplitude of each of the four signal lines is equalized by placing an appropriate value resistor (R96-R99) in parallel with R12, R24, R36, or R48. The gain of mixer U2c is set by the ratio of R50 divided by R49. With the components shown, pin 8 of U2c provides 1.08 volts rms to U1d, an isolation buffer with unity gain. U1d drives two output circuits, the audio amplifier, U4, and the output signal buffer, U1c.

The input to the audio amplifier is fed from a resistive voltage divider R56-R57. Neither value is critical; R56 could be replaced by a jumper wire or a 100k-Ohm resistor, and R57 can be any audio taper

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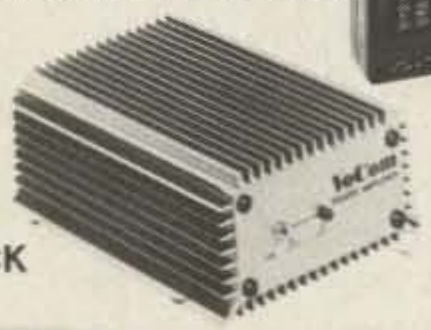

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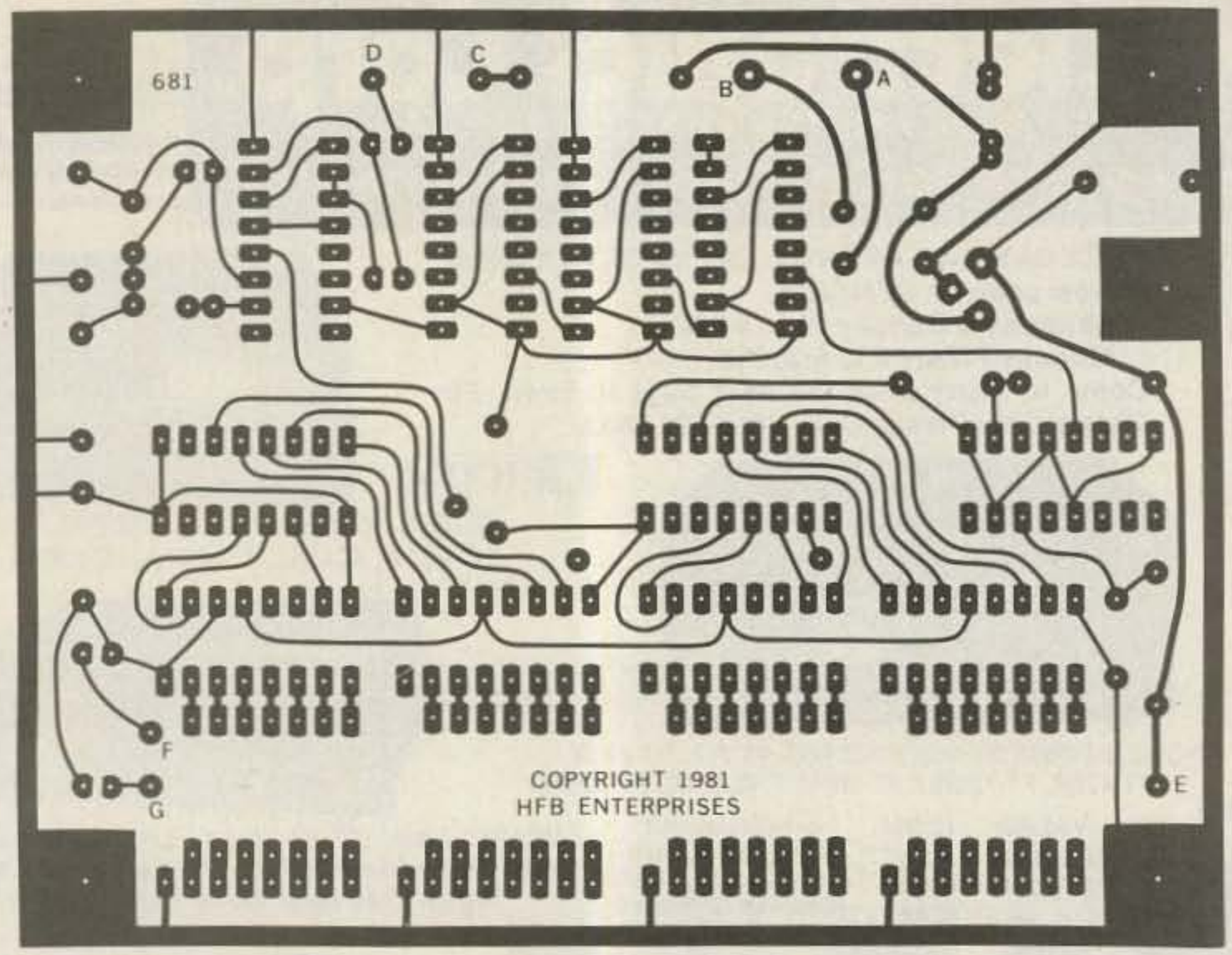

Fig. 7(a). Frequency counter PC board (top).

pot with a value of from 10k to 100k Ohms. R56 is included here only to limit the input level to U4 so that it is not accidentally overdriven. The output of U4 is coupled through C21 directly to an external speaker with an impedance of 8 Ohms or greater. For convenience, you may want to mount the speaker inside the test-oscillator cabinet.

The output test signal buffer, U1c, provides final isolation and can, with the components shown, provide a maximum output of 0.5 volts rms (no load), 0.43 volts rms to a 600-Ohm load, or 0.32 volts rms to a 50-Ohm resistive load. If required, additional output can be gained by reducing the value of R54.

In addition to driving U1d, the U2c audio is capacitively coupled through C18 to a separate buffer/amplifier, U2d. The gain of this section is purposely high both to ensure CMOS transition in the following stage and to clip the audio signal peaks to provide some preconditioning prior to being fed to the frequency counter input.

Frequency Counter

The audio signal from point J on the oscillator board is fed to point D on the frequency counter board (see Fig. 2). U5c and U5d form a Schmitt trigger whose output is further conditioned by the CMOS transition characteristics of U5e and U5b. The output of U5b is a digital stream of TTL/CMOS-compatible pulses with approximately a 50% duty cycle; the pulse repetition rate (digital "frequency") of the stream is the same as the analog frequency of the input to U5c.

A 1-MHz oscillator is formed by U5a and U5f. This signal is divided by 100 in each of U6, U7, and U8 to yield a 1-Hz gating signal for the frequency counter. The number of pulses in one second from U5b pin 4 is counted by U10 and U11, decoded by U12-U15, and displayed by LED1 through LED4. At the end of the 1-second counting interval, U9 resets the U10/U11 counters to zero while retaining the previous 1-second interval's count in the U12-U15 latches for a continuous, flicker-free display. Grounding point F will blank the display to conserve power. Point G of the frequency counter board is connected to the lower right-hand decimal point of the least significant LED display to serve as a power-on pilot light.

Power for the entire unit can be supplied either from the ac line or an external battery. Polarity protection diode D1 is included to prevent accidental damage caused by incorrectly connecting the battery. The +5-volt regulator, U16, provides power for both the frequency counter and, through point E of Fig. 2 to point X of Fig. 1, the oscillator board.

Construction

The four-tone oscillator of Fig. 1 is constructed on a 3" × 4" single-sided PC board, and the frequency counter of Fig. 2 is on a 3" × 4" double-sided board. A Ten-Tec MW-8 cabinet (8"W × 4¼"H × 6"D) was selected to allow enough panel room for the frequency verniers, control switches, and frequency counter display bezel. The front panel is shown in Fig. 3. The frequency counter PC board is mounted above the oscillator PC board on 2" bolts up through the chassis floor.

The oscillator PC board is installed first and wired to the panel controls. Don't make the hookup leads so short that you can't lift it off the bolts if required. At this point, you'll have two wires from the oscillator board unconnected, the +5-volt lead (X) and the audio input to the frequency counter (J). With a speaker connected to the rear jack, connect the wire from Point X to a 5-volt power supply and check the operation of each audio channel individually and for mixing of two or more channels. With an ac voltmeter connected to the front-panel terminal posts, check the output level at the center frequency of each of the four audio channels. If the mid-range voltage differs significantly, the channels with lower voltage can be raised to that of the highest-voltage channel by installing an appropriate value resistor at R96-R99.

Disconnect the power supply. Now wire the LED display for the frequency counter; I used a perfboard with 90°-angle IC sockets and color-coded wires soldered to the appropriate LED pins. The same color-code wire should be soldered to the same-numbered pin on each IC socket. Mount the LED display perfboard on 3" bolts so that the LED display is positioned in the center behind the bezel. Lastly, mount the frequency counter PC board on top of the oscillator board and connect to the LED display perfboard, transformer, and oscillator board.

Applications

The Radio Amateur's Handbook contains an excellent section on the test-

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Built-in 4:1 balun for balanced lines. 1000V capacitor spacing.

Works with all solid state or tube rigs.

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Operate all bands with one antenna.

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Tunes out SWR on dipoles, vees, long wires, verticals, whips, beams, quads.

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Run up to 1.5 KW PEP, match any feed line from 1.8-30 MHz.

Built-in SWR/Wattmeter has 2000 and 200 watt ranges, forward and reflected.

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4:1 balun. 250 pf 6KV cap. 12 pos. inductor. Ceramic switches. Black cabinet, panel.

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MFJ-10, 3 foot coax with connectors, $4.95.

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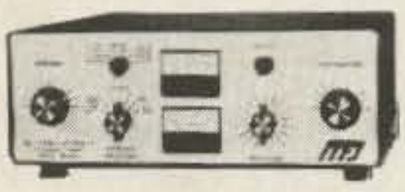

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Up to 3 KW PEP and it matches any feedline, 1.8-30 MHz, coax, balanced or random.

10 amp RF ammeter assures max. power at min. SWR. SWR/Wattmeter, for./ref., 2000/200W.

18 position dual inductor, ceramic switch.

7 pos. ant. switch. 250 pf 6KV cap. 5x14x14".

300 watt dummy load. 4:1 ferrite balun.

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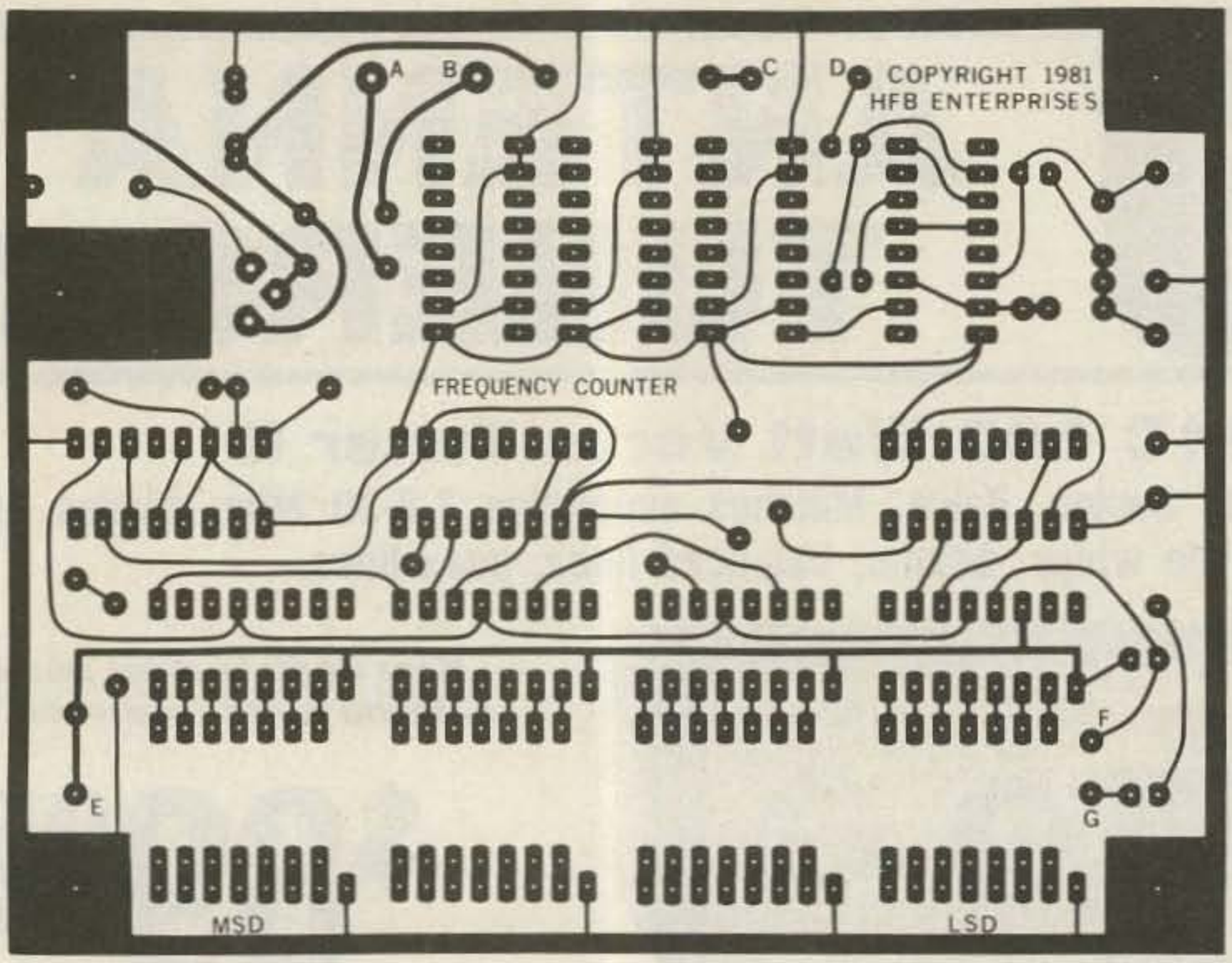

Fig. 7(b). Frequency counter PC board (bottom).

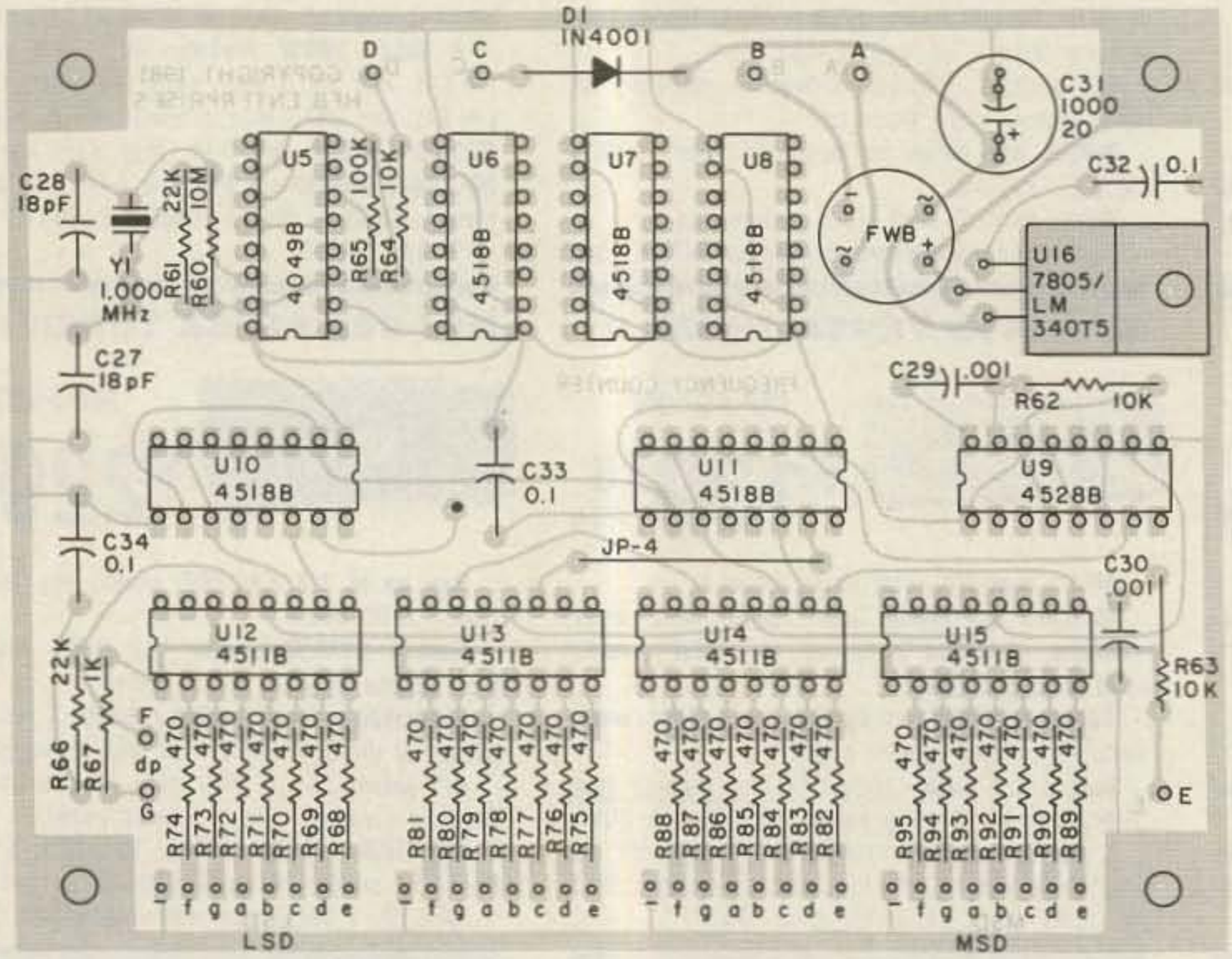

Fig. 8. Frequency counter board component layout.

ing of SSB transmitters using a two-tone test signal to approximate a speech signal. If you have an oscilloscope or modulation display/monitor, the transmitter-modulation waveform can easily be monitored and the modulation level set to get the maximum PEP (peak envelope power) without distortion or "flat-topping" of the audio signal. The four-tone audio oscillator described here is an excellent piece of gear to use for these tests since from two to four independent sine waves can be mixed to form a composite audio test signal. The four-tone oscillator output may be connected directly to the transmitter microphone input since it has a capacitively-coupled output.

Another excellent application is the testing of acoustically-coupled telephone modems for use with computers. The four audio channels can be set individually to the frequencies of the desired mark-space tone pairs for both the originate and answer modes. When connected to the modem inputs, each tone can be enabled separately to fully test the modem without having to reset the oscillator frequencies between mark and space. Simply set each audio-channel frequency vernier to the desired frequency and switch back and forth using S1-S4.

The same procedure can easily be used to test RTTY demodulators. In this case, only two audio channels would normally be required because of the simplex nature of RTTY; the same audio-tone pairs are used in both the transmit and receive directions. In both the computer modem and RTTY cases, you may want to replace S1 and S2 with a single-pole double-throw switch with the center grounded, one side of the SPDT switch going to point E on the oscillator PC board, and the other side of the switch going to point F. With this arrangement, toggling the single switch would then alternate between the preset mark and space tones.

If you're going to use the four-tone oscillator for aligning audio filters or analyzing their audio passbands, you'll appreciate the relatively constant output amplitude across the vernier range of the oscillator. Although there may be some slight variation in amplitude, it can easily be corrected by R55 if a high-impedance (10k Ohms-per-volt or greater) ac VOM or VTVM is used at the audio-oscillator output terminals between point P and ground on the oscillator PC board. With a separate ac VOM or VTVM, you can monitor the audio-filter output voltage easily as a function of the constant-voltage input as the oscillator is swept through the audio range.

You may also want to alter the frequency-determining components of one or more of the twin-tee oscillators for your own particular application. Tone

decoders in the subaudible range and a significantly increased maximum frequency for audio-amplifier testing are only two that come to mind. The twin-tee oscillator design is very versatile in its range as long as both sides of the capacitance and resistance arms remain equal (C1 = C2 and R4 + R5 = R6 + R7). This also ensures minimum distortion of the sine wave. The resistance and capacitance to ground (R1 + R2 + R3 and C3) also will play a part in determining both the center frequency of the oscillator and the range over which it can be tuned. An oscilloscope connected to the oscillator output will be a big help in selecting the right components for minimum distortion.

Parts List

Resistors (¼ W)
28—470 Ohm
1—820 Ohm
1—1k
3—1.5k
1—1.8k
1—2.2k
4—3.9k
2—5.6k
1—6.2k
14—10k
3—15k
10—22k
2—39k
3—56k
9—100k
1—160k
1—10 megohm

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1—25k aud w/Sw
1—25k lin

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7—.01 disc
4—.022 mylar
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1—10 uF 'lytic
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1—1000 uF 'lytic

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1—LM386
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1—1 MHz crystal
1—2½" bezel
1—4" 8-Ohm speaker
5—SPST toggle switches
3—RCA phono jacks
1—6.3-V ac, 1-A transformer
1—Ac cord
1—8-pin IC socket
3—14-pin IC sockets
11—16-pin IC sockets
4—14-pin 90° IC sockets
10—Knobs
Misc. mounting hardware

Conclusion

This handy piece of equipment is in near-constant use to test and align other on-going projects. Since the frequency counter reading will be accurate when only one tone is present; tones may be set individually to within 1 Hertz and then mixed to form a composite test signal. One easy-to-include option for additional flexibility is the insertion of an SPDT switch between the oscillator board point J and frequency counter board point D. This allows counting the frequency of an external signal and direct display of its last four digits. ■

See List of Advertisers on page 114

RECEIVE WEATHER CHARTS IN YOUR HOME!

You can DX and receive weather charts from around the world.

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Assemble ALDEN's new radiofacsimile Weather Chart Recorder Kit, hook it up to a stable HF general-coverage receiver, and you're on your way to enjoying a new hobby activity with many practical applications. Amateurs, pilots, and educators can now receive the same graphic printouts of high-quality, detailed weather charts and oceanographic data used by commercial and government personnel.

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Only $995 for the complete ALDEN Weather Chart Recorder Kit. To order, fill out and mail the coupon below. For cash orders enclose a check or money order for $995. Add $5 for shipping and handling in the U.S. and Canada (for Massachusetts delivery, add $49.75 sales tax). To use your MasterCard or Visa by phone, call (617) 366-8851.

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ACCOUNT # (ALL DIGITS)

EXPIRATION DATE

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MICROLOG

INNOVATORS IN DIGITAL COMMUNICATION

AMATEUR RADIO COMMUNICATION AT ITS FINEST

Both Systems Provide

- **SIMPLE DIRECT CONNECTION to your Transceiver.**
- **COMPLETE SYSTEM, built-in Demodulator & AFSK Modulator with keyboard programmable tone pairs.**
- **SPLIT-SCREEN operation with keyboard selectable line location.**
- **LARGE, TYPE AHEAD text buffer.**
- **TEN, programmable message memories, plus ID's WRU & SELCALs.**
- **RANDOM CODE generator & hand key input for practice.**
- **Baudot 60 to 132 WPM.**
- **ASCII 110 & 300 baud.**
- **SYNC-LOCK MODE for improved ASCII operation.**
- **RECORDER INTERFACE FOR "BRAG-TAPE" or recording off-the-air.**
- **CODE CONVERTED Printer output in Baudot or ASCII.**
- **SSTV/GRAPHICS transmit.**
- **FULL 63 KEY Computer grade keyboard.**

You won't find as much well thought out programming, circuitry, and features anywhere, at any price! The ATR-6800 combines the best of both worlds, an easy to use video system for CW/RTTY/SSTV with automatic station control **and** a stand-alone computer with expandable memory & full instruction set in Motorola assembly language. Add the BASIC language option package and you'll have the unique combination of an RFI proof computer and ultimate RTTY/CW HAM station. And don't forget "easy to use." All of us at Microlog are RADIO ACTIVE on RTTY, so there's a lot of personal attention to detail and ease of operation. "Stick-on" command listing and video status display will get you on the air quick and sounding like a pro.

There's a certain thrill to using efficient, reliable digital communications equipment on the air. That's the fun of RTTY. Spice up your Amateur Radio operation with the silent video system that does it all, the Microlog ACT-1. Even if you own a home computer and are considering an outboard interface/program, remember, we've put it all in one RFI tight enclosure that's ready to go as soon as you power up. And, with the "Battery-backed" memory option, you won't even lose your pre-programmed messages if there's a "blink" in the A.C. The ACT-1 has features that the competition doesn't even have on the drawing board! Check for yourself, you could spend a lot more and still come up short.

ATR-6800 vs ACT-1

The most often asked question we hear is "What's the difference between the ATR & the ACT-1?" The ACT-1 is a dedicated system for RTTY/CW/SSTV. It provides all the functions and features you need for a multi-mode station. Along with this superior "ON-the-AIR" performance, the ATR-6800 extends your operation into the realm of automatic station control and computer programming. Plug-in applications modules expand the ATR's memory to add new HAM oriented programs which are enabled by simple keyboard commands. By adding the BASIC option package, you'll have pre-programmed full community mailbox, contest dupe sheet, personal station log, message editor, BASIC computer language and 16k of battery-backed (non-volatile) memory. We also provide a subroutine list so that you can write programs to directly control the ATR-6800 in easy to use BASIC language. The ATR-6800 then is the expandable, "do everything" system where your imagination is the only limit! The ACT-1 is designed for the HAM who needs the essentials of a complete video system for digital communications.

TECHNICAL SPECIFICATIONS ATR-6800 & ACT-1

INPUTS

Speaker Audio	100mv min.
Digital*	TTL, Keyer, Hand Key
**RS232	±12V, 330 Ohm Source

OUTPUT TO TRANSMITTER FOR CW/RTTY/SSTV

+Voltage Keying	+40VDC @ 300ma Max.
–Voltage Keying	-150VDC @ 50ma Max.
**Mercury Relay	200VDC or 2 amp (20VA Max.) N.O. & N.C.
T/R Change Over	ATR — Relay ±30V @ 2 amp N.O. & N.C. ACT-1 — Transistor +12VDC @ 300 ma. GND on XMT
AFSK Tones, Range	Keyboard Programmable 500 Hz to 3000 Hz
AFSK Tones, Level	Mic Compatible 30-50mv Audio
Slow Scan	Mic Compatible Audio. Sync 1200 Hz, Black-1500 Hz, White-2300 Hz

MISCELLANEOUS CONNECTIONS

RS 232	±12VDC, 330 Ohm Source Impedance, Negative Mark
Printer Driver	ATR — • Hi-speed RS-232 upto 2400 Baud • Slo-speed Baudot & ASCII Floating Relay for Current Loop Switching ACT-1 — • Slo-speed Baudot & ASCII Transistor Switch +40VDC @ 100 ma. • Optional Hi-speed ASCII RS232 @ 2400 Baud.
Tape Recorder "Brag Tape"	Mike = 100 mv Audio Speaker = 200 mv Audio
Scope	Horizontal and Vertical Outputs to Scope for RTTY Tuning Aid
Morse Speed Tracking	Automatic or Speed Lock

VIDEO OUTPUT

1 Volt Peak to Peak, Negative Sync Composite Video (American Standard) European standard available upon request.

VIDEO FORMAT

Normal	24 lines, 40 characters per line
Zoom	12 lines, 20 characters per line
Black on White or White on Black	Keyboard selectable
Display Split Screen	Any location Line 0 (Off) to Line 20, Keyboard selectable
SSTV	3 lines, 6 characters per line + graphics

TEST MESSAGES: Quick Brown Fox and RYRY's in Baudot, U*U* in ASCII, VVV in Morse.

SYNC: Transmits "Blank-Fill" in RTTY and BT in Morse when Text Buffer is empty and unit is in transmit. Keyboard command on/off.

UN-SHIFT on Space: Automatically shifts back to "LETTERS" upon receipt or transmission of space. Keyboard command on/off.

REAL-TIME CLOCK: Keyboard set, always on screen display, hours, minutes, seconds. Can also be inserted in transmit text buffer by keyboard command.

WORD WRAP AROUND: Prevents splitting words at the end of a line. Works in receive as well as transmit.

CODE PRACTICE: Random 5 char generator sends at any speed you set via the keyboard. Hand-Key input allows use in code practice oscillator that will also read your sending!

STATUS DISPLAY can be called up to show the condition and control commands for 20 programmable parameters, such as AFSK tone freqs, UNOS, printer, etc. Useful as a "HELP" command in case you misplace the manual. There's also a constant "TOP-LINE" display of Time, Mode, Speed, & Code in use.

DETECTION MODES

Direct	Phase correlation detector with AGC controlled bandpass filter (100 Hz nominal width — 800 Hz center frequency)
Demodulator	Computer program enhanced dual tone demod. Primary tones fixed @ 2125/2295 Hz, Secondary tones variable @ 500 — 3000 Hz.
**Terminal	RS232 compatible half duplex or full duplex up to 9600 Baud

DATA RATES

Morse	5-199 WPM Keyboard selectable in 1 WPM steps. Auto speed tracking or speed on receive
Baudot	All standard 45, 50, 57, 74, 100 Baud (60, 66, 75, 100 and 132 WPM)
ASCII	110 & 300 Baud normal & synclock using internal Modem. ATR adds speeds up to 9600 Baud.
Slow Scan	8 seconds per frame

OUTPUT OPERATING MODES

Symbol	Character ouputs when typed
Word	Words sent after "Space Bar"
Line	Line sent after "Return"
Buffer	Send entire contents of text buffer

TUNING INDICATORS

Audio Ref. Tone	800 Hz Keyed Regenerated
Visual	LED on Mark (Keydown)
Scope	Tuning ellipse for RTTY

PROGRAMMABLE MEMORIES

Here is:	10-40 character messages (400 total) or *10-80 character messages (800 total) battery backed
ID:	15 characters maximum in standard ID and 17 in RTTY ID
WRU:	Up to 15 characters
Selective Call:	ATR — 4 memories, up to 15 characters each. ACT-1 — 2 memories for printer on and printer off

COMPUTER CAPABILITY

Memory	Standard unit has 4000 bytes of RAM for user program. Basic package adds 16K.
Language	Basic or Motorola M6800
Commands	Input; Output; Load; Go with Break Point; or Normal Basic
Tape Interface	Store Programs on Audio Cassette

POWER

115 VAC, 60 Hz 60 VA Max, Act-1, 30 VA Max (230 VAC, 50 Hz optional)
12 volt version available
External input for charging expanded battery backed memory. 6-15VDC @ 10 ma. max.

MECHANICAL

ATR-6800:	
Size	14¾"W x 12¼"D x 4"H
Weight	15 lb.
ACT-1:	
Size	17.8 W x 3H x 9.5D
Weight	7 lb.
ATR-6800 & ACT-1:	
Color	Beige Top, Black Base
Material	AL5052 Aluminum Alloy

*Standard on ATR, Optional on ACT-1
**Standard on ATR, Not available on ACT-1

✓See List of Advertisers on page 114

Thomas P. Krohn K3IJ
558 Forest Hill Drive
Hazleton PA 18201

Superman's Repeater Control System

This simple system offers four independent on/off outputs. Just duck into any phone booth to use it.

In order to comply with FCC regulations, all repeaters must have incorporated within them a means of control. If the machine is located in the control operator's shack, the control system can be as simple as the switch on the repeater itself. However, the repeater is usually remotely located well away from the operator's reach, so other means of control must be contrived.

Many types of control systems are in use today, from some as simple as a wire pair to exotic UHF links with tones used as the command medium. The disadvantage of this system is, of course, cost. A control receiver and antenna is needed at the site and every control operator must have a control transmitter which usually isn't as portable as the HT on your belt.

However, let's brighten up the picture a bit. There is a way using resources at hand. The Bell System and friends have provided us with a remarkable communications system which is available to anyone (for a nominal fee) almost anywhere.

There have been many control systems developed using the telephone, and here is one that's inexpensive, easy to build with readily-available parts, and has some very interesting features. For example, this system needs no direct connection to the phone line, has four independent on/off controlled outputs, uses TTL devices needing only a +5-volt supply, and control can be accomplished from any phone, anywhere, at no cost to the user. Now you must admit, this is pretty neat. Fig. 1 shows how we go about it.

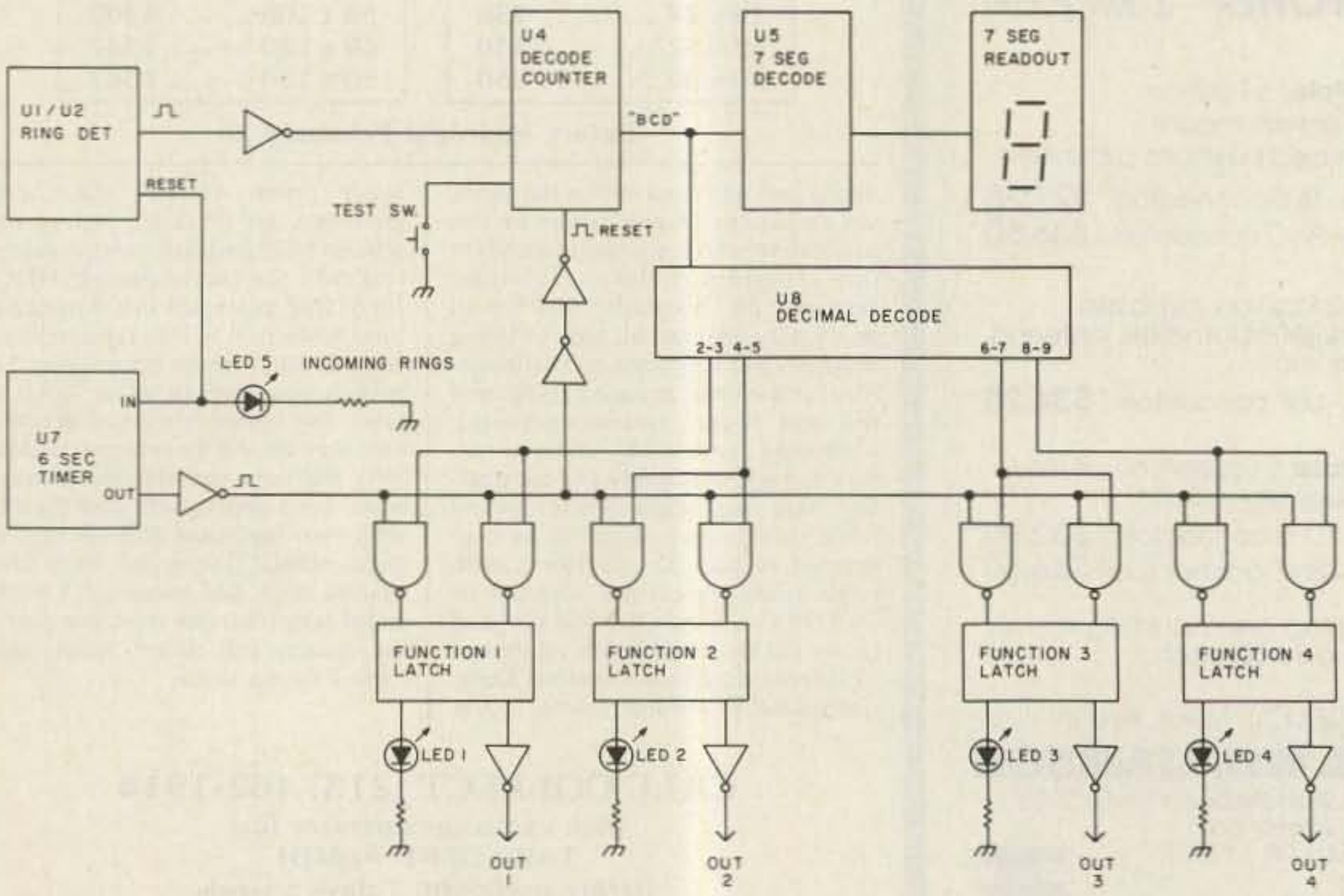

Fig. 1. Wireless-wire remote control system block diagram.

Theory of Operation

In operation, the circuit monitors the phone line, waiting for an incoming ring. When received, the ring is sensed by inductive

coupling to the telephone's internal transformer. The ring-detector circuit converts the rings into a series of logic pulses, one for each ring. These pulses are then counted and stored by a 7490 decade counter. The output from the counter is decoded twice, first by a seven-segment decoder which drives a front-panel readout indicating the status of the counter, and again by a BCD-to-decimal decoder which provides an output on an individual line with each successive pulse.

Another job for the ring detector is to reset a timer circuit with each ring. This timer (a good ol' 555) will fire every six seconds, provided it does not receive a reset pulse from the ring detector. This prevents the timer from firing during a series of incoming rings.

The output lines from the decimal decoder are inverted and connected to one input of individual NAND gates. The remaining gate inputs are paralleled and receive an inverted positive pulse from the timer.

Now we can see that as rings are received, one of the eight used outputs from the 7442, U8, when inverted, will put a high level on its particular output gate. It will remain there until another ring pulse is received, advancing the counter. Or, if the ring stops, the timer is allowed to time out and upon firing, an output will be generated from one of the output gates which will either set or reset the particular output latch.

The latch outputs are isolated from the board outputs by NAND gates connected as inverters. This prevents any noise picked up by the output wiring from getting back into the latches to cause headaches.

Circuit Description

Perhaps the most interesting circuit in the system is the ring detector. It is unique because it needs no direct connection to the phone company wiring.

The whole show starts with a simple tape-recorder pickup coil available at Radio Shack for a few dollars. It comes with cord, plug, and a handy suction cup for sticking it to the telephone.

The coil is connected to the board where it feeds a 741 op amp, U1, wired in a differential configuration (see Fig. 2). This mode reduces the effect of stray rf or noise pickup to a minimum. The output of the op amp feeds Q1, a PNP transistor that converts the output voltage to a level handy to drive the 7413 Schmitt trigger, U2. R1 and C1 serve as a low-pass filter to smooth out the 20-Hz ring voltage, providing U2 with a slowly dropping voltage during the duration of the ring. Diodes D1 through D3 are 1N914 or equivalent.

The Schmitt trigger acts as a NAND gate and provides hysteresis of the input signal. Its output is a clean TTL level of either a high (+5 volts) during a ring or a low (0 volts) between rings. This point is monitored by LED 5, located on the card front, to visually indicate the incoming rings. A push-button test switch, S1, also is mounted on the card and is connected to one of U2's inputs to simulate incoming rings for local control and test purposes. The positive pulse from U2 is coupled to the base of Q2 through limiting resistor R2. The incom-

Number of rings	Command
2	Function 1 on
3	Function 1 off
4	Function 2 on
5	Function 2 off
6	Function 3 on
7	Function 3 off
8	Function 4 on
9	Function 4 off

Table 1. Operating code.

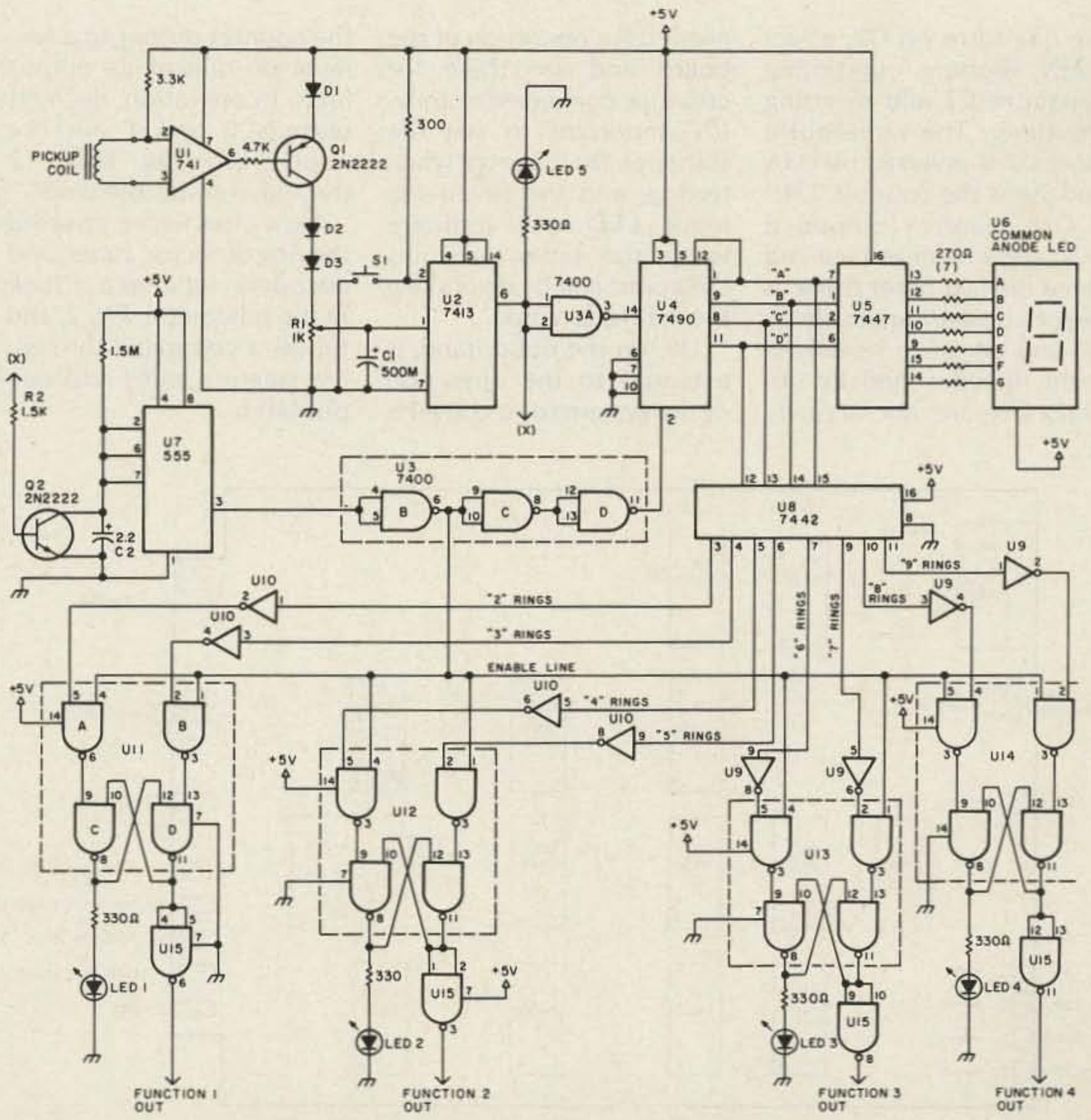

Fig. 2. Schematic diagram of system.

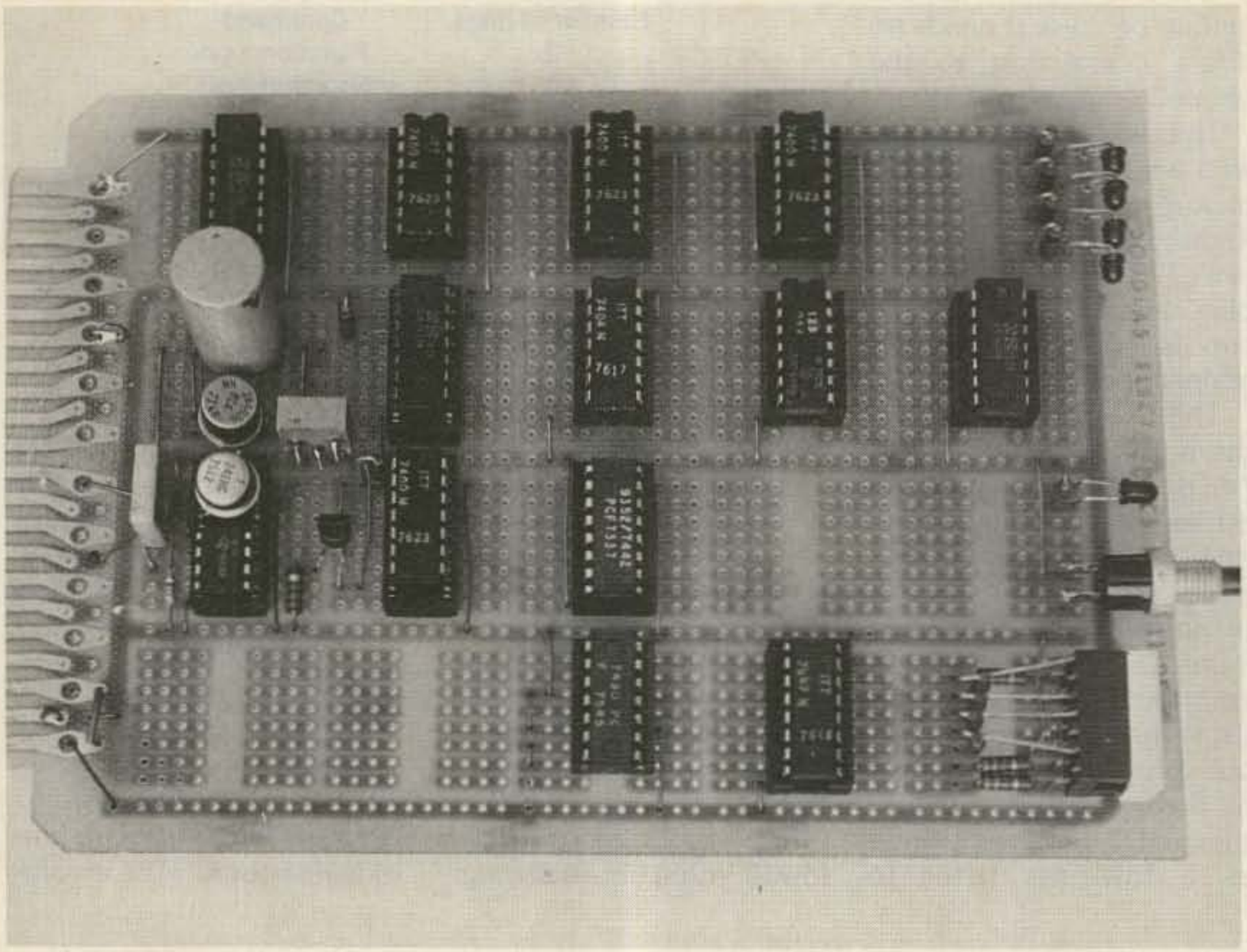

Photo A. Top view of board.

ing ring turns on Q2, effectively shorting out timing capacitor C2 and resetting the timer. The same pulse from U2 is inverted by U3A and steps the counter, U4.

The counter's output, a BCD total of rings received since the last timer firing, is decoded simultaneously by U5 and U8. U5, a seven-segment decoder, and its display, U6, are not actually needed for operation of the board and are there for creature convenience only. It's important to see the status of the counter when testing, and the seven-segment LED will indicate when the timer executes the command by displaying the return to zero.

U8, on the other hand, is essential to the operation of the system for it converts the counter output to a low level on one of its output lines. In operation, decimal outputs 0 and 1 are not used, leaving lines 2 through 9 to do the work.

Now that we've covered the ring detector, timer, and decoders, let's take a look at the schematic, Fig. 2, and follow a command through the steering gates and output latch.

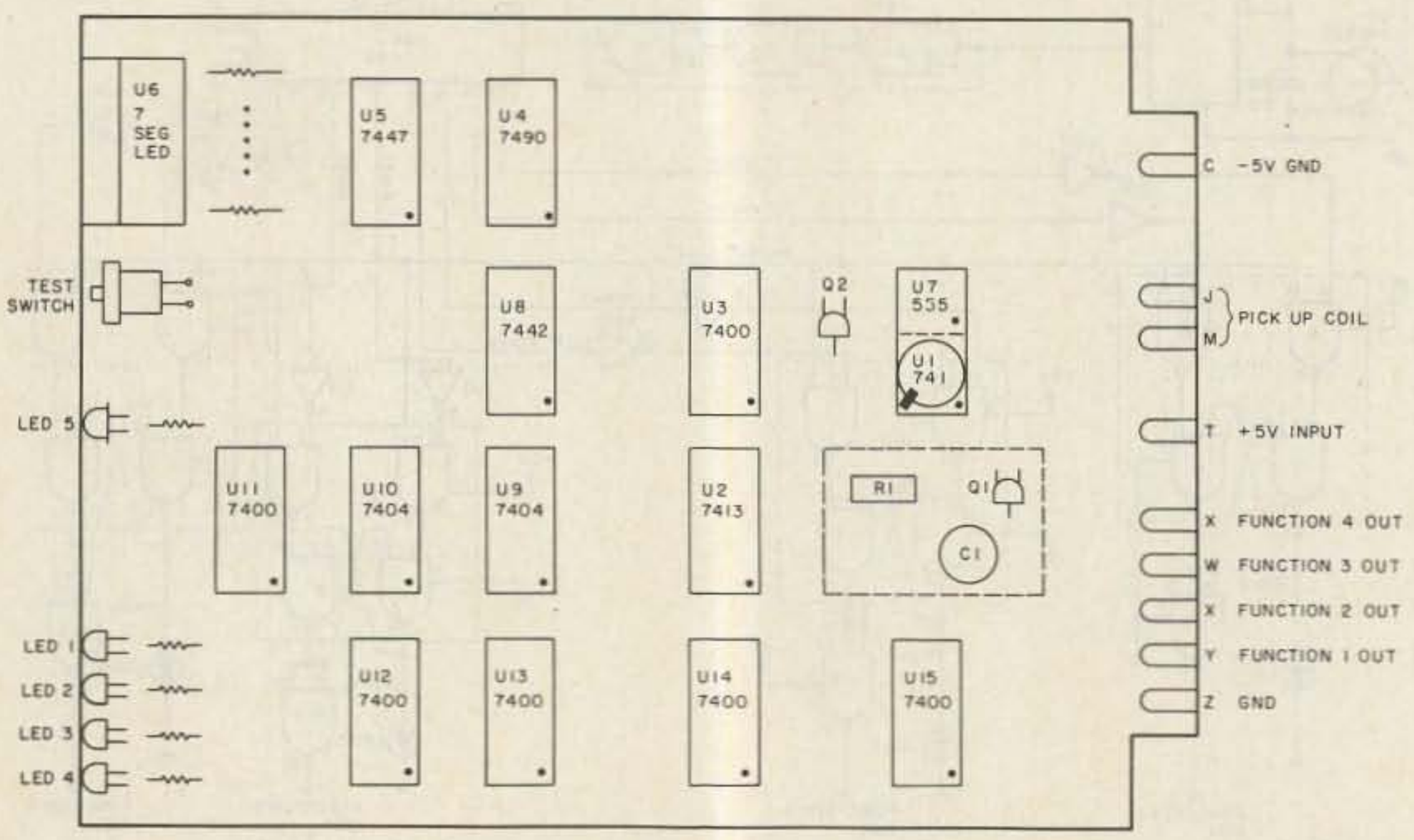

Fig. 3. Parts placement.

Let's assume the phone starts ringing. The first ring resets the timer and advances the counter to BCD 1. U5 and U6 decode and display the 1 count on the LED. The second ring enters and also resets the timer and advances the counter to BCD 2. At this time, the caller hangs up the phone, the ringing stops, and the timer, which is not being reset by the incoming rings, fires after about 6 seconds. Its output, inverted by U3B, puts a positive pulse on one input of each steering gate. Remember, now, that there are two rings racked up in the counter so the LED displays 2 and only the decimal 2 lead (pin 3) from U8 is low. This signal is inverted and applied to U11A, pin 5. The level here is high and sets the gate up to pass the command pulse from the timer. When the timer fires, the high-going pulse is applied to the other input of U11A, pin 4. During the duration of the timer pulse, both inputs are high, so the output on pin 6 goes low, setting the RS-configured sections of U11C and D. When set, pin 8 of U11 goes high turning on LED 1, a front-panel indicator of latch 1 status. The complementary output from the latch, pin 11, is inverted by U15 and provides an isolated logic-high output at edge-connector channel 1 output which can be used to activate whatever function 1 interface you choose.

If the phone is allowed to ring 3 times, decimal 3 output of U8 (pin 4), after inversion, will activate gate U11B. U11B's output is connected to the reset side of the function 1 latch thereby turning off function 1 when the timer fires.

Note that the timer pulse from U3B continues through U3C and D and is used to reset the counter back to zero. The double inversion is necessary to de-

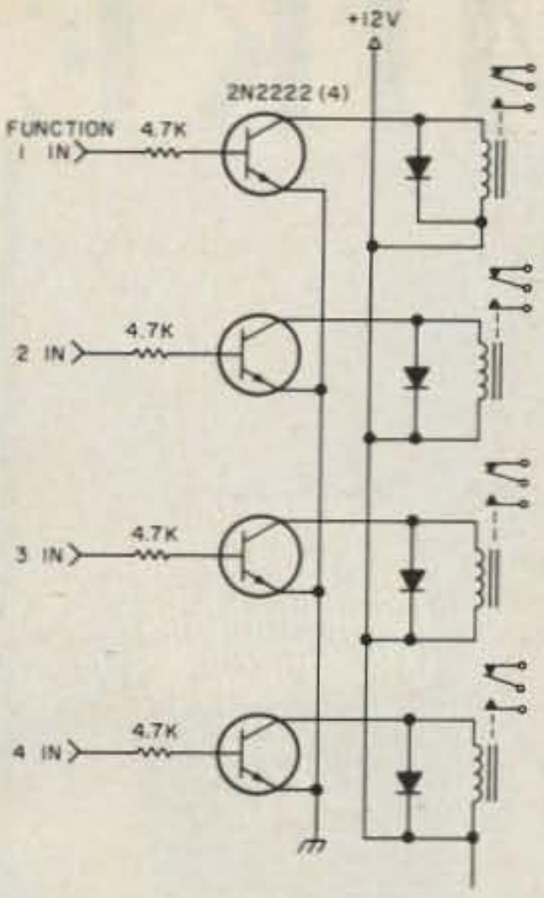

Fig. 4. Relay-control interface circuit.

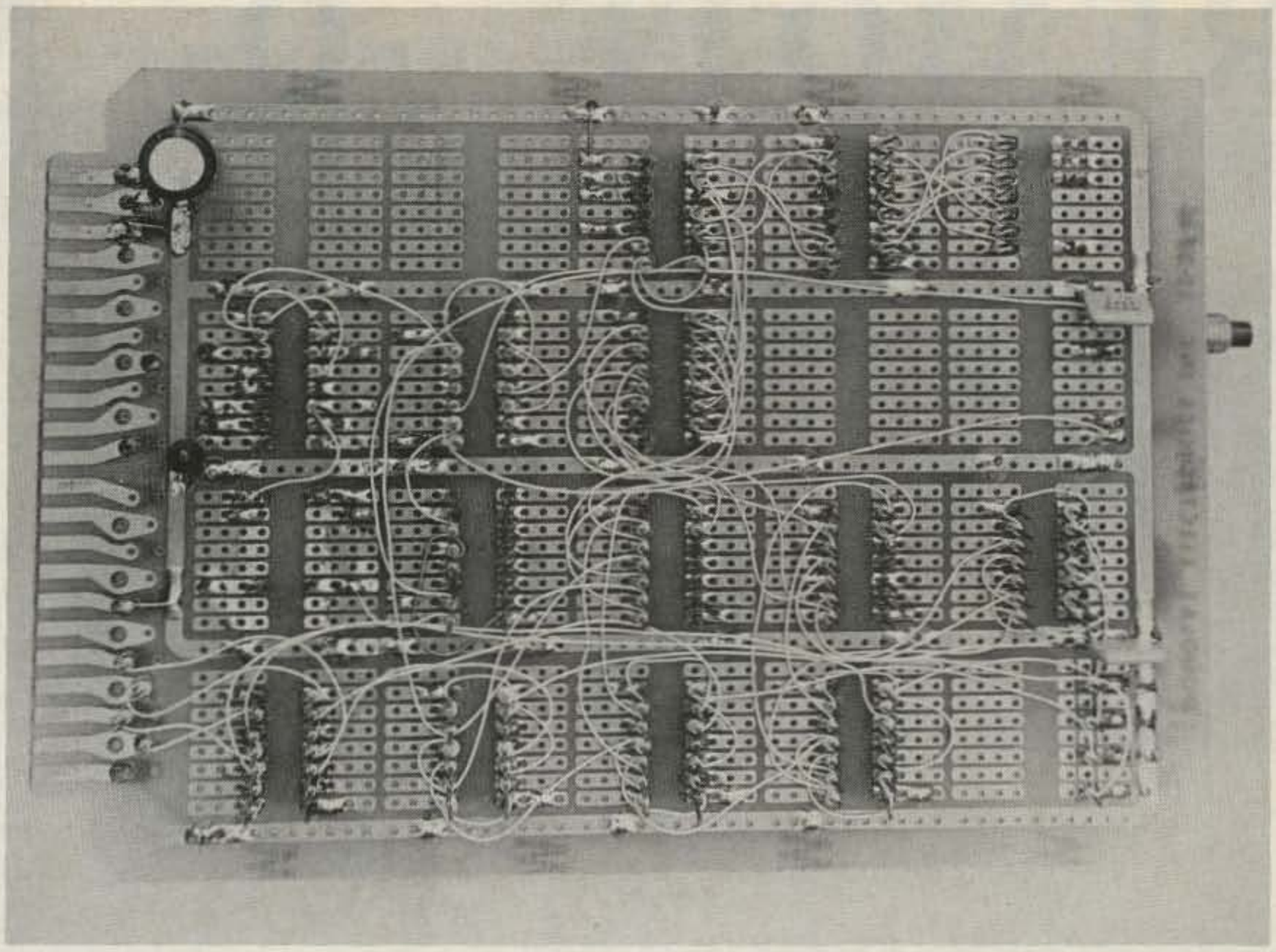

Photo B. Bottom view of board.

lay the reset pulse to the counter to ensure that the command is executed before the count is canceled.

Operation of the three additional function latches is identical except for the amount of rings necessary to select the particular command lines. Table 1 shows the operating code.

Construction

My board was wire-wrapped on a standard 4½"×6" glass board with edge connector attached. I used a board manufactured by Douglas Electronics, 718 Marina Blvd., San Leandro CA 94577. Made of excellent quality material, including gold-plated edge connections, it has room for 20 16-pin DIPs and a convenient power bus arrangement so no Vcc line runs will be over an inch. Designated type 11-DE-6, it's a bit expensive at $16.00, but you get what you pay for.

Parts placement is not critical. My layout is shown in Fig. 3. As with all TTL projects, be sure to scatter a few 0.1-μF disc caps around the power bus to soak up the spikes.

Interfacing

The TTL levels can be used directly from the controller if your operating system is TTL-compatible. If not, some type of interface will be required.

I use a simple relay control circuit, Fig. 4. The relays and accompanying driver transistors are located on another card placed alongside of the controller in the card cage. Some types of miniature reed relays can be driven directly by TTL levels, and if you're really a purist and desire to switch the repeater primary power, a solid-state relay driven directly by TTL can be used.

Phone Requirements

It's obvious that this type of system has some drawbacks. It cannot differentiate between control-operator calls and wrong numbers. We've had no problems in the time this system has been in use, but there are a few things to keep in mind when ordering your phone. Get an unlisted number for obvious reasons and ask for a new number, one that has never been issued. Imagine the frustration possible if you get a reissue of a number used by recently defunct "Pietro's Pizza Palace." It's also good practice not to use the same phone line for autopatch and control because the control operator who tries to dump a nuisance patch will get greeted by a frustrating busy signal.

Wrap-Up

Although the inductive ring detector is new, this system has been in use for about five years with excellent results. Previously, we used a direct connection to the phone line which also worked well. However, we worried what Ma Bell would say if she knew.

When powering the controller, use a well-regulated supply good for about an Amp to be safe. Another good idea is to float the input to the regulator on a battery, as momentary power interruptions quickly upset the output latches.

Hookup and Adjustment

Pot R1 must be set to put the input to the Schmitt trigger just above the trigger level, about 1.5 volts measured at pin 1 of U2. Action of the ring detector can be adjusted by bringing the pickup close to the body of a transformer-type soldering gun while triggering it. You may be surprised at how far the pickup can be from the gun and still get reliable action. Attach the pickup to the phone case using the suction cup. Exact location can be determined by moving it around the phone while it is ringing and watching the "incoming ring" LED.

What to control is left up to your imagination. Some of the control functions we use are: function 1—repeater on-off; function 2—autopatch on-off; function 3—brag-tape disable; and function 4—squelch adjust.

So get your wire-wrapper out and get going. When you're done, you will have a versatile and reliable addition to your system.

Thanks go out to Jim W3BBS for his encouragement and Joe N3JD for the photography. ■

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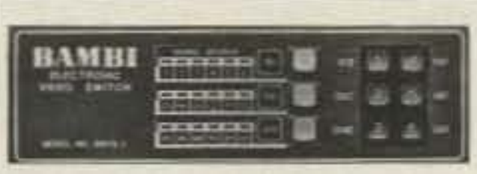

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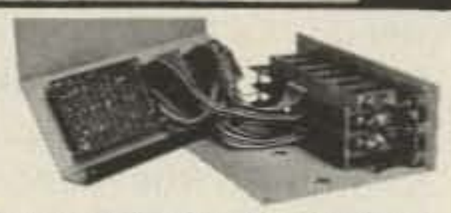

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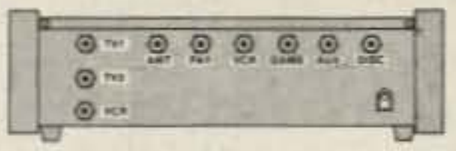

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Up and Coming: Direct-Broadcast Satellites

The only thing not up in the air in this business is the satellites, so this budding technology is not just pie in the sky.

Ask three different people about direct-broadcast satellites (DBS) and you are likely to get three different answers. First, there are the entrepreneurs. To them, DBS is the golden opportunity of the 80s, a chance to make big bucks. Next, there are the local broadcasters and cable TV operators. They consider television direct from the satellite to be a threat, especially since the spacecasters will have limited local responsibility. Finally, there are the engineers. The slide-rule and soldering-iron set consider direct broadcasting to a be a noble challenge requiring powerful transmitters and low-cost yet sensitive receivers.

What does DBS mean to you? That depends. But don't go on to the next article in hopes that DBS will go away. Why not find out a bit more as *73* enters its second year of satellite TV coverage?

Before going too far, it is only proper that we acknowledge that a form of satellite broadcasting already exists. But any substantial similarity between the current TVRO craze and DBS ends there. Gone is the need for a 10-foot dish in the backyard and a $1000 receiver in the living room. Central to the concept of 1990s-style DBS is low cost and small size. That way, spacecasters hope to attract an audience as broad as the country itself.

Just about the only aspect of DBS not up in the air are the satellites themselves. Even though this is an industry in its infancy and today's plans could very well line tomorrow's wastebasket, several things can be said with a good deal of certainty.

The direct-broadcast service will use geosynchronous satellites, meaning that like today's TVRO birds, they'll appear fixed in the sky. All that a US viewer will have to do is point his or her dish to the appropriate point on the southern horizon. No tracking or movement of the antenna will be required once it is locked onto the selected satellite.

We also know that the DBS signals will be in the 11-12-GHz region, where frequencies have been allocated for such purposes. This will require new technology since relatively little is available in the way of low-cost consumer electronics at those frequencies. The choice of the 12-GHz "Ku" band almost makes the present day 4-GHz satellite-TV gear look like it is meant for dc!

A third "fact" is that DBS offerings are expected to supplement rather than replace the current system of local broadcasting and cable television. You might want to wait a while before climbing up on the roof to take down the old VHF-UHF aerial.

Pie in the Sky

Imagine a business with 20 million customers, each of whom spends $500 for a receiver and shells out an additional $10 per month for the privilege of unscrambling signals. It doesn't take a calculator to figure out that DBS equals big money, probably in the billions of dollars per year. And, as you might expect, a lot of people are already looking for a piece of the action. Participants in the DBS free-for-all range from big guns like RCA, CBS, and Western Union to a handful of basement tinkerers bent on building a better mousetrap, receiver style. Someplace in the middle are outfits like Advance, Inc., and Home Broadcast Television, hardly household names—at least not yet.

Money-making methods vary. Firms like RCA and Western Union, already experienced in satellite technology, would like to act as

DBS: IS THERE A DISH IN YOUR FUTURE?

Shortly after this article was written the FCC granted approval to Satellite Television Corporation's plan to construct a direct-broadcast satellite-television system.

Satellite Television, a subsidiary of Communications Satellite Corporation, was the first firm to apply for spacecasting rights and is the first firm to get approval. The STC proposal, which calls for four satellites, suggests that three channels of scrambled programming could be activated by 1986.

Eight other applications for direct-broadcasting service were scheduled for FCC action by the end of 1982. A September 24, 1982, *Wall Street Journal* report goes on to say that no DBS hopeful will receive orbital or frequency assignments until after a hemispheric conference in mid-1983.

US Home Earth-Station Sales

	1982	1984	1987	1990
Backyard Terminals				
Unit Sales (thousands)	25	75	120	5
Installed Base (thousands)	41	161	506	611
Revenues ($ millions)	175	375	360	15
Rooftop Terminals				
Unit Sales (thousands)	—	216	2000	5000
Installed Base (thousands)	—	290	3582	15582
Revenue ($ millions)	—	650	1420	2270

(Source: International Resource Development, Inc.)

Fig. 1. International Resource Development, Inc., shows a growing market for "backyard" TVRO terminals through the mid-1980s. By the end of the decade, the "rooftop" terminals will begin to predominate.

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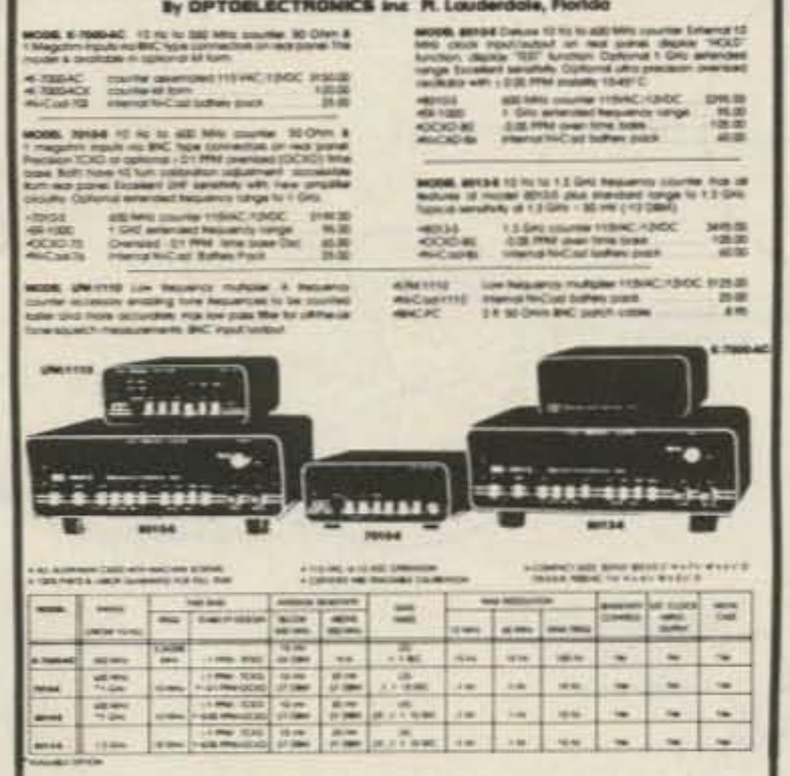

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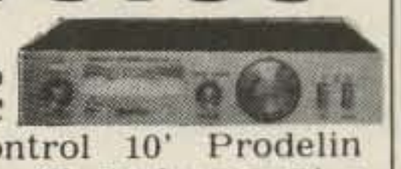

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carriers, leasing satellite transponders to broadcasters. Other groups, like United States Satellite Broadcasting Co., will need to seek out technical partners to complement their skill in producing programs and selling advertising. A third segment of DBS hopefuls would like to act in a manner similar to cable-TV suppliers. They would purchase most of their programming and generate income from rent on decoder boxes or royalties paid by local distributors.

The markets for direct broadcasting are as varied as the potential suppliers. CBS has requested three channels. One slot would serve as a feed to local CBS stations and individuals unable to receive local broadcasts. The remaining two channels are needed to distribute programming directed at businesses like cable TV and movie theaters. CBS signals would, in all likelihood, be scrambled to prevent unauthorized reception.

Other proposals, like the one from National Christian Network, suggest reaching a large audience with costs offset by advertiser support. In this instance, there is little to be gained by scrambling the signal.

Crystal Balls

Giving a precise estimate of the size of the DBS pie and how it is to be divided is as difficult as it is foolhardy. You can get a general idea by turning to expert researchers. For example, after consulting the woolly worms, International Resource Development stated, in a release for a $985 market report, that "over 15 million US homes will have rooftop DBS terminals by the end of the decade." An announcement publicizing a $1500 report from Strategic Incorporated is slightly more conservative, predicting (1) that DBS won't get a firm start until 1985-1986, and (2) a 1990 sales figure of 160,000 antennas for DBS.

Fig. 1, from International Resource Development, Inc., shows not only the forecasted growth of DBS, but also the effect that it will have on the TVRO industry. Sellers of the backyard terminal can expect a growing market through the mid-1980s but will feel the DBS pinch by 1990. Graphics from Strategic Incorporated (Fig. 2) show that home antennas may constitute a whopping 96 percent of the small Earth stations sold in 1990 yet make up only 45 percent of the dollar volume as a result of the much lower per-unit cost of DBS terminals.

Whither TVRO?

Where does this leave the potential backyard owner and the dozens of firms currently in the TVRO market? There have been no signs that distributors currently using the 4-GHz satellites will abandon them in the near future. To do so would place an enormous burden on the cable-TV industry.

The home TVRO market, which insiders pegged at about 50,000 terminals in 1982, should continue to grow through the mid-1980s. Potential growth stoppers would be federal regulations restricting or prohibiting "unauthorized" reception or a widespread move towards scrambling signals. So far, few suppliers have considered it worthwhile to invest in encryption to lock out the home segment. With time, the suppliers may overcome their reluctance to "deal direct" with the home viewer and offer some sort of plan for authorized home reception.

The entrepreneur who sees the rosy market predictions and wants to join the home-terminal fray faces a tough road. Garage and basement operators are quickly falling by the wayside as firms grow and attract outside capital. The homemade dish on the back of a pickup and the marginal receiver that characterized many early dealers just don't hack it anymore. Ambitious selling and truly innovative products will still catapult the small-time operation upward, but the days of quick profit, if there ever were any, are now over.

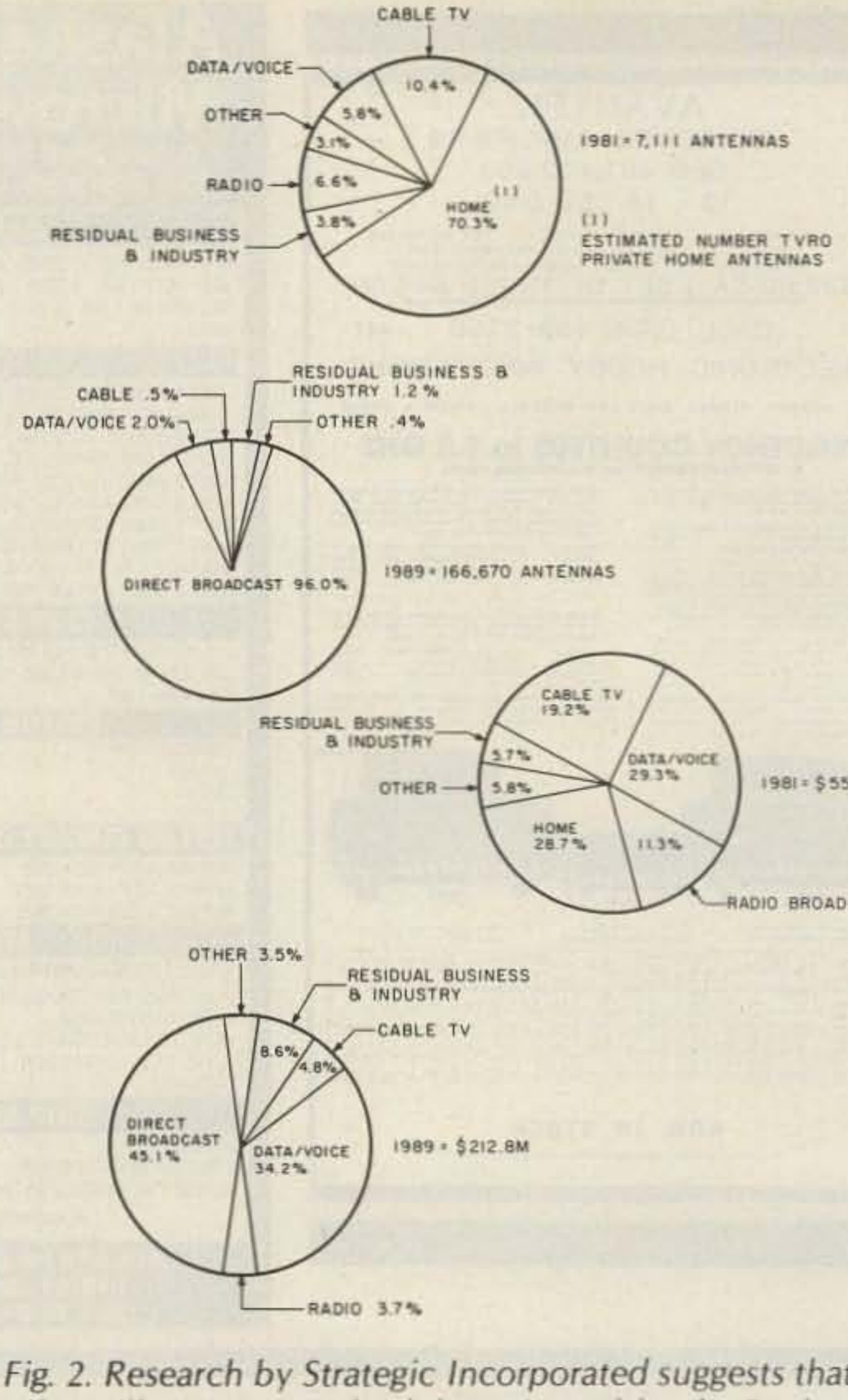

Fig. 2. Research by Strategic Incorporated suggests that DBS sales will capture much of the unit total for the Earth-station industry but consist of less than half of the dollar total.

Jobs

Dismiss all those dreams of the big bucks? No, not necessarily; just recognize that DBS is not going to be an "afterthought" industry with the hobbyist roots that the present-day TVRO field has. A number of the manufacturers have already caught on to this and are claiming that their antennas, designed for 4-GHz reception, will work just fine at 12 GHz. A few companies are even tinkering with Ku-band circuitry. But no matter what technical standards are finally accepted for DBS and no matter who the program suppliers are, there will be a good market for knowledgeable engineers and technicians. After all, someone has to design, install, and maintain those twenty million terminals. ■

References

1. "Strategic Incorporated," press release for Small Satellite Earth Stations: US Market Opportunities, 1981-1989; October, 1981.
2. "International Resource Development, Inc.," press release for Direct Broadcast Satellite Systems, September, 1982.
3. "Fourteen Seek Direct Broadcast Rights," *Aviation Week & Space Technology*, August 10, 1981.
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Part II of this article, next month, will focus on the technological challenge of DBS.

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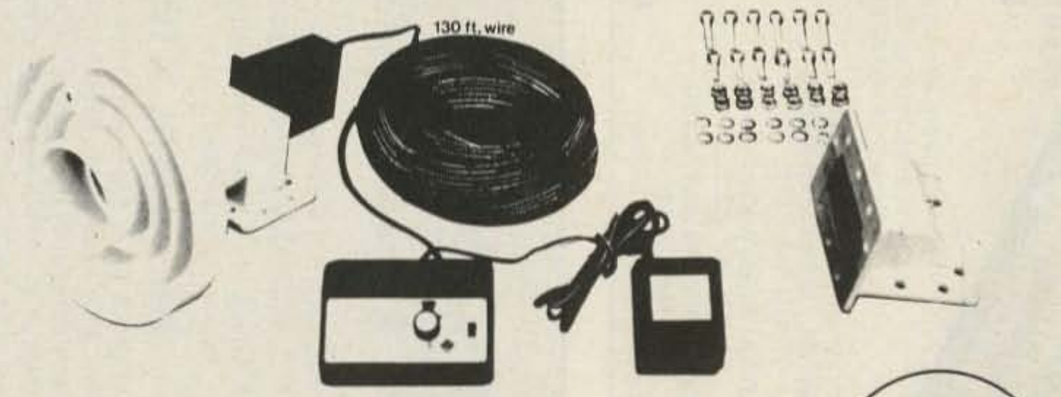

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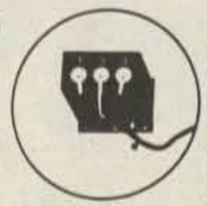

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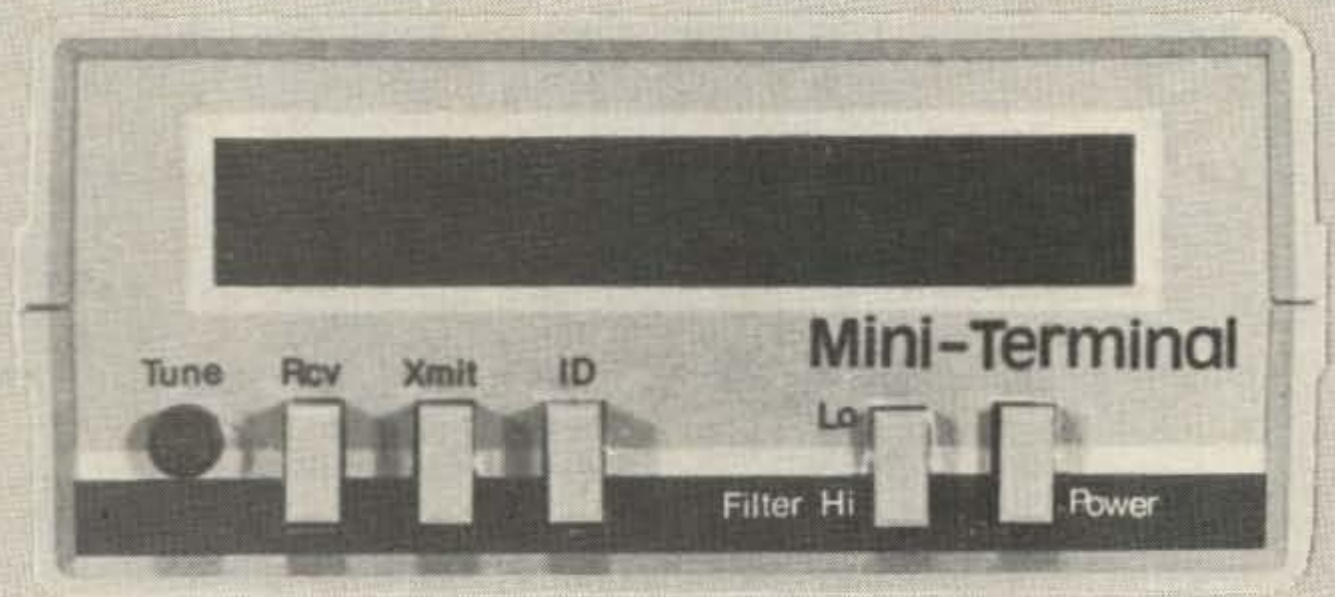

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Work the Russian Robot Ops

The robots aboard Russia's two new satellites are cantankerous and challenging. Here are some tips on how to work them.

The recent addition of several Russian spacecraft into the amateur radio satellite program truly has created a flurry of excitement on the HF and VHF bands. In addition to introducing many newcomers to amateur satellite activities, these birds are also renewing widespread interest in mode A communications (2-meter SSB/CW uplink, 10-meter SSB/CW downlink). If you would like to relive the sheer fun and enjoyment of your early days in ham radio—those times when every contact held special meaning and gave you a feeling of accomplishment—you've only to join the action on our amateur radio satellites.

The staggered orbits and comparatively high altitudes of RS (Radio Sputniks) spacecraft afford a communications range and pass-operating time roughly equivalent to the now-classic OSCAR 6 and OSCAR 7 satellites: approximately 1700-km altitude and 25 minutes. Numerous intercontinental QSOs have been conducted each day via the RS satellites, and you can join this excitement with a minimum of effort.

The RS satellites exhibit very high sensitivity, eliminating the need for sophisticated antenna systems or high-power uplink signals. As an example, I recently made fine contacts during an RS pass while using low power (10 Watts) and a J vertical for 2 meters. Mode A communications are the easiest way for HF-laden amateurs to join today's space activities, and the automatic QSOing robots aboard RS5 and RS7 are an absolute blast to contact.

Amateur satellite setup at K4TWJ includes Icom 202 and 40-Watt amplifier for uplink, Icom 730 for downlink. 12-volt power for the 40-Watt amplifier is pulled from the Icom 730's PS15 power supply. SSTV capability included. The programmable Morsematic keyer was used for contacting RS5 and RS7 robots. SF radio desk with upper shelf holding 2-meter gear proves a great convenience for satellite operations.

RS Satellites and Orbits

Two prime attractions of the RS satellites are their straightforward band-to-band frequency relations and their orbital-calculation simplicity. As shown in Fig. 1, each satellite receives signals within a 50-kHz spectrum of 2 meters and linearly relays them within a 50-kHz spectrum of 10 meters.

Each spacecraft's beacon can be used for determining when that bird is within communications range and for indicating when its translator is on/off. The beacon continuously transmits a series of letters and numbers, called information channels. Transmissions containing K00 indicate the transponder is off; K05 to K99 signify that the transponder is operational. Equipped with his own copy of the previously-mentioned frequency-relation chart for

RS5 and RS6		RS7 and RS8	
Uplink (MHz)	Downlink (MHz)	Uplink (MHz)	Downlink (MHz)
145.910	29.410	145.960	29.460
145.920	29.420	145.970	29.470
145.930	29.430	145.980	29.480
145.940	29.440	145.990	29.490
145.949	29.449	145.999	29.499
Beacon	29.450	Beacon	29.500

Fig. 1. Frequency-relation chart which can be used for guiding operations during a satellite pass. An RS6 uplink signal on 145.928 MHz, for example, would be relayed on 29.428 MHz (± Doppler). Allow ±3 kHz on all RS downlinks for Doppler shifts.

a particular RS satellite, the operator is well on his way to enjoying some exciting space-age communications.

The next item of consideration is an orbital-calculation method for accurately plotting a specific satellite's pass. As a matter of convenience, I suggest rounding out each craft's orbital period from 119.xx minutes to an even 2 hours, and each orbital incrementation from 29.xx to an even 30 degrees. These changes are of minor consequence provided they are used in conjunction with reference-orbit information listed each month in the amateur magazines. An OSCARlocator (with RS curves) is also highly desirable, especially when attempting to catch early morning north-to-south passes in the United States.

Assuming a satellite enthusiast is located in the mid-US, his no-problem communications range falls between 70 and 110 degrees. (This information is shown on most world maps.) Assuming a particular day's reference orbit for a selected bird is listed as 220 degrees at 0630 GMT, simply subtract 2-hour and 30-degree steps until the craft falls within range: 220−30 = 190 at 0430 GMT, 190−30 = 160 at 0230 GMT, 160−30 = 130 at 0030 GMT (almost within range), and 130−30=100 degrees at 2230 GMT (the previous GMT day): a perfect afternoon pass.

Finally, an antenna placement/operating chart is drawn for the selected pass. Since a typical "high in sky" pass lasts approximately 25 minutes and since a couple of minutes can be expected between equator crossing (EQX) and acquisition of beacon signals (AOS), a typical chart will look like Fig. 2. This chart and the frequency-relation chart are then used to "automatically" direct operator actions during the pass (spotting frequencies, incrementing beam-antenna position, etc.). The operator is then free to enjoy communications fun.

Time	Activity	Beam Position
2230	EQX	South
2232	AOS	South
2234	CW	SSW
2236	CW	SW
2238	SSB	West
2240	SSB	West
2242	PASS MIDDLE	West
2244	CW/SSB	WNW
2246	CW	WNW
2248	CW	NW
2250	CW	NW
2252	LOS	NW

Fig. 2. A typical antenna placement/operating chart drawn for a planned RS pass, indicating planned activity and antenna movements. Since this information will be used only one time it can be written on a piece of scrap paper. The uplink antenna in this example is tilted approximately 30 degrees to bypass dual rotor needs.

As RS satellites are quite sensitive, they require only a few Watts ERP (Effective Radiated Power) for successful operations. *Please, gang, bear that fact in mind and control your 2-meter power accordingly!* Transponders on some RS satellites have been continuously knocked off by amateurs running excessive 2-meter ERP. In order to prevent agc clamping and attenuation of others' signals, your satellite-returned signals should *always* be slightly weaker than the beacon (approximately 40-Watts ERP).

Working the Robots

Two of the Russian satellites, RS5 and RS7, carry automatic QSOing robots which conduct separate amateur radio activities approximately 100 kHz below their spacecraft's transponder—see Figs. 3(a) and 3(b). The robot will call CQ, ID (either RS5 or RS7), announce its 2-meter CW listening frequency, and stand by for calls (bedlam, which I will discuss presently).

Satellite	Uplink Receive	Downlink Transmit
RS5	145.826 MHz	29.331 MHz (± Doppler)
RS7	145.835 MHz	29.341 MHz (± Doppler)

Fig. 3(a). Frequencies used by the RS robots for contacts with Earth-based amateurs. Frequencies may vary ±3 kHz with Doppler shift.

Robot:	CQ de RS5 QRU on 145.826 MHz AR
Amateur:	RS5 de K4TWJ AR
Robot:	K4TWJ de RS5 R QSO Nr 740 RST579 OPR
Robot:	Robot...etc...K
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Amateur:	Dave...etc...K
Robot:	K4TWJ de RS5 QSL 73 CQ de RS5 QRU...
Robot:	etc...AR

Fig. 3(b). QSO format used for contacting robot operators aboard RS5 and/or RS7 satellites. Speed must be between 16 and 20 wpm, and keying must be exact.

Assuming an amateur contacts the robot, he receives a signal report and QSO number, etc., which can be used for QSLing the unique space-type contact. Following a subsequent reply and exchange of 73s, the robot again calls CQ and begins further QSOs. As this article is being written, heavy pileups and ill-informed operations on the robot's 2-meter listening frequency are causing jamming and confusion. Simply stated, *all* stations must take turns calling and working the robot. Transmissions *must* be held to one station at a time, otherwise Morse transmissions become a series of unintelligible dashes or continuous carriers.

The robot's receiving bandpass is approximately 5 kHz, yet any (or all) signals load into memory and are relayed on 10 meters with the same pitch. Thus you can hear the 2-meter input exactly as the robot hears it. If all stations attempting to contact the robot use FM-repeater tactics (transmit only when other stations are not transmitting—an easy task since satellite operations are full duplex), confusion is eliminated and all can enjoy contacts.

Even with those situations dealt with, robot contacts are yet a challenge: RS5 may tell you to send faster (QRQ) or send better (QSD). Despairingly, you load the complete QSO format into a programmable keyer of variable speed and plot a wee-hour pass to avoid QRM. That time, RS5's robot only listens (you hear your 10-meter-relayed signals, but where's the robot?), and RS7 follows a few minutes later calling CQ! The Russians can truly be proud of their designing and programming of these robots. They're clever, inspiring, challenging, aggravating, and fun. If you manage to wrangle a contact, you're a fairly good operator.

Satellite Equipment

There's a good chance you already possess the basic equipment for RS-satellite operations, namely an HF rig with full 10-meter coverage and an all-mode 2-meter rig. You've only to combine these units at one operating location to join the excitement of amateur space communications. Although the RS satellites usually produce a slightly stronger downlink signal than OSCAR 8, a relatively sensitive receiver is desirable (TS-830, TS-130, IC-730, FT-102, etc.). An outboard receiving preamplifier is also quite beneficial, but

not mandatory. Some of the presently-popular 2-meter rigs suitable for RS activities are Yaesu's FT-480R, Kenwood's TR-9130 and Icom's IC-251A. Portable units such as Yaesu's FT-290R or Icom's IC-202 are also grand, although non-QRP enthusiasts may want to add a high-gain antenna or small rf amplifier (operating power can be borrowed from the HF transceiver's 12-volt supply, since very low current is used when that unit is receiving).

The most popular antennas for 2-meter satellite operations are twist or crossed yagis which contain an equal number of horizontal and vertical elements plus a phasing harness for circular polarization. Due to the sensitivity of the RS satellites and the gain of vertical J antennas, however, I've recently experienced quite acceptable results while using KLM's new JV-2 J antenna. That thing really works! Most amateurs merely use crossed dipoles or their triband beam for receiving 10-meter satellite signals. In fact, the RS birds can easily be worked mobile if desired!

Conclusion

The RS amateur satellites represent a true era in both space-age communications and Phase II (low orbit) operations which can be enjoyed by almost every radio amateur. If you're just getting started in amateur satellite activity, I suggest operating RS6 and RS8. The transponders aboard these satellites are somewhat better than RS5 or RS7, and they exhibit less heavy fade. Whichever way you go and whatever gear you use, you will find satellite communications a refreshing new experience in amateur radio. It is indeed tomorrow's frontier in today's world. ■

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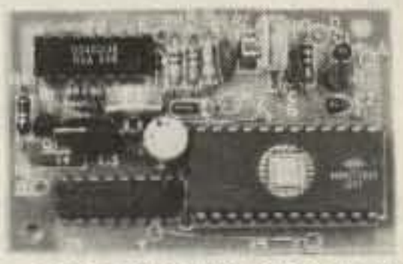

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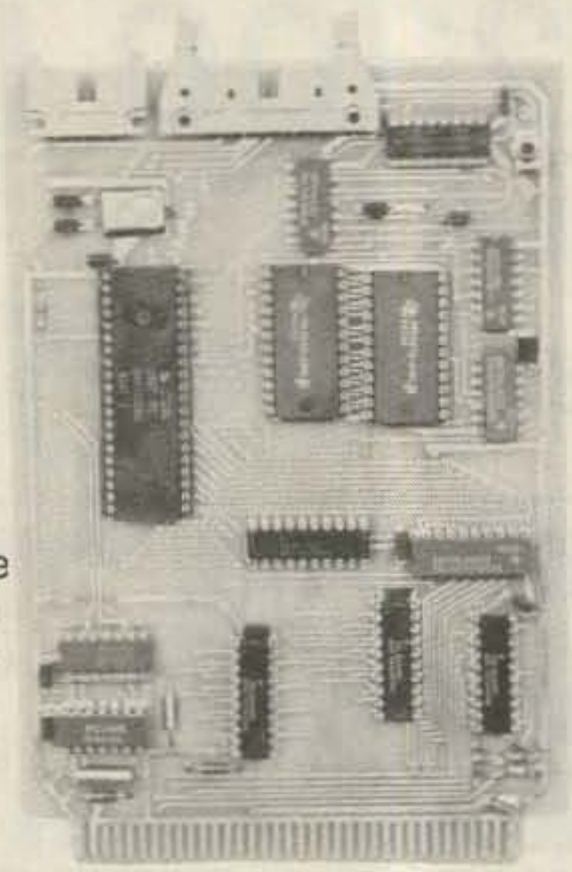

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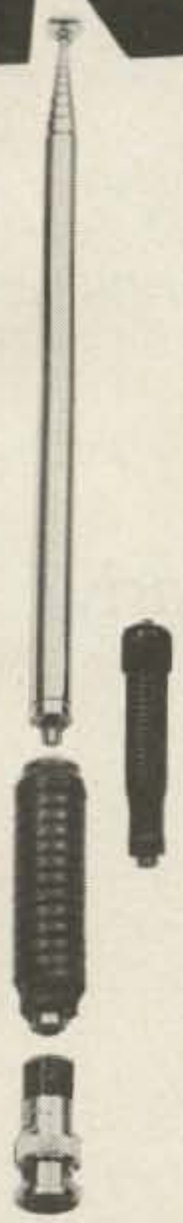

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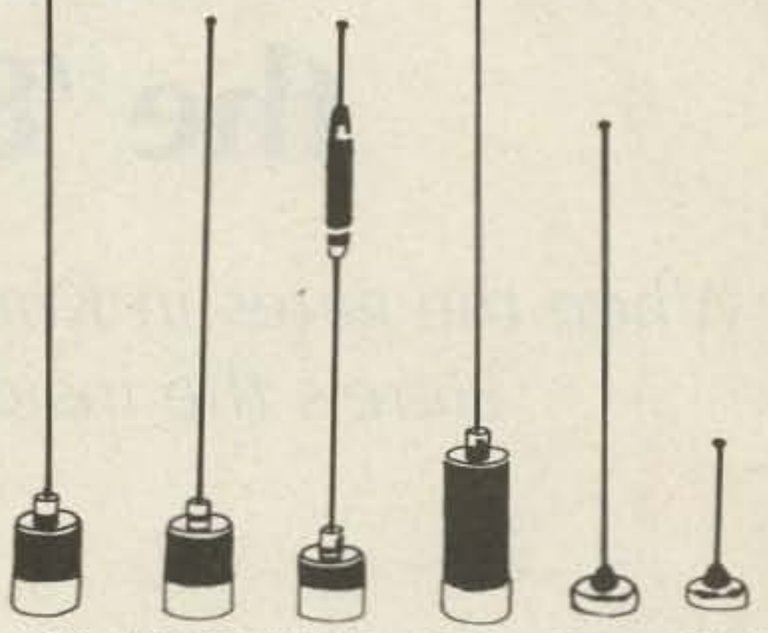

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Ham Radio Hits the '82 World's Fair

When the gates in Knoxville opened, would WA4KFS be ready? Here's the inside story of the World's Fair station.

John M. Clark N4AQI
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Photos by WD4MQQ

While the health pavilion was being finished, local hams installed two towers, tribanders, a 2-meter antenna, and dipoles.

The theme was energy, and amateur radio generated plenty of it—rf and human—during a successful six-month run at the 1982 World's Fair in Knoxville.

SSTV contacts to Europe, the opportunity to send radiograms to the folks back home, rag-chewing on RTTY, and a lot of conversation about the excitement of ham radio were among the activities fair visitors found at the Tennessee Wireless Association exhibit.

Thanks to the tireless work of a group of East Tennessee hams and the generosity of US amateur radio dealers and manufacturers, our worldwide, high-technology hobby continued in Knoxville the long tradition of ham radio at world's fairs.

Officials of the City of Knoxville's health pavilion, where the amateur station was located, estimated as many as half the fair's approximately 11 million visitors could have seen the amateur radio exhibit during the May to October exposition. It was a magnificent showcase for amateur radio.

Plans for bringing amateur radio to the '82 fair began about a year before the event opened. Many of the original group that met at the Knoxville and Oak Ridge hamfests early in 1981 to talk about the idea of ham radio at the fair went on to assume major responsibility for the effort.

The group incorporated itself as the Tennessee Wireless Association, a nonprofit organization char-

Operators from throughout the US and many foreign countries stopped by to operate the station. A commemorative certificate and QSLs were available from the Tennessee Wireless Association.

George Child N4BCS installed the 2-meter antenna atop one of the two crank-up towers in the shadow of the Sunsphere.

tered for the sole purpose of sponsoring an amateur radio exhibit at the fair. Under TWA president Ed Dunn W4NZW, the group's first order of business was to approach fair officials about obtaining a site for the station. Virgil Davis KA4RPA, a TWA officer, talked with Knoxville mayor Randy Tyree and secured a location in the city's health pavilion. Health care under emergency conditions was the theme of several exhibits in the pavilion, and the mayor and city officials felt the station would be appropriate there because of the emergency-communications aspect of the amateur service.

The site was superb. The health pavilion was a striking geodesic dome in the center of the fair site, near the Sunsphere, the fair's theme structure. An additional benefit was being located in a high-traffic area near the pavilion's entrance.

With the exhibit space tied down, TWA officers turned their attention to lining up equipment which would demonstrate the diversity of amateur radio. Ten-Tec, Inc., located in nearby Sevierville, was asked to supply HF rigs for three stations. The company agreed, and Tom Salvetti WD4FVU of Ten-Tec accepted the job as equipment coordinator for TWA.

Amateur dealers and manufacturers responded generously to Salvetti's calls, and approximately $20,000 worth of state-of-the-art gear was loaned and soon on its way to Knoxville.

L. B. Cebik W4RNL, who has written a book on station design, was called on to produce a layout making the most efficient use possible of the 105-square-foot space. Three stations, two designated for general operating and one for specialized communications, were planned.

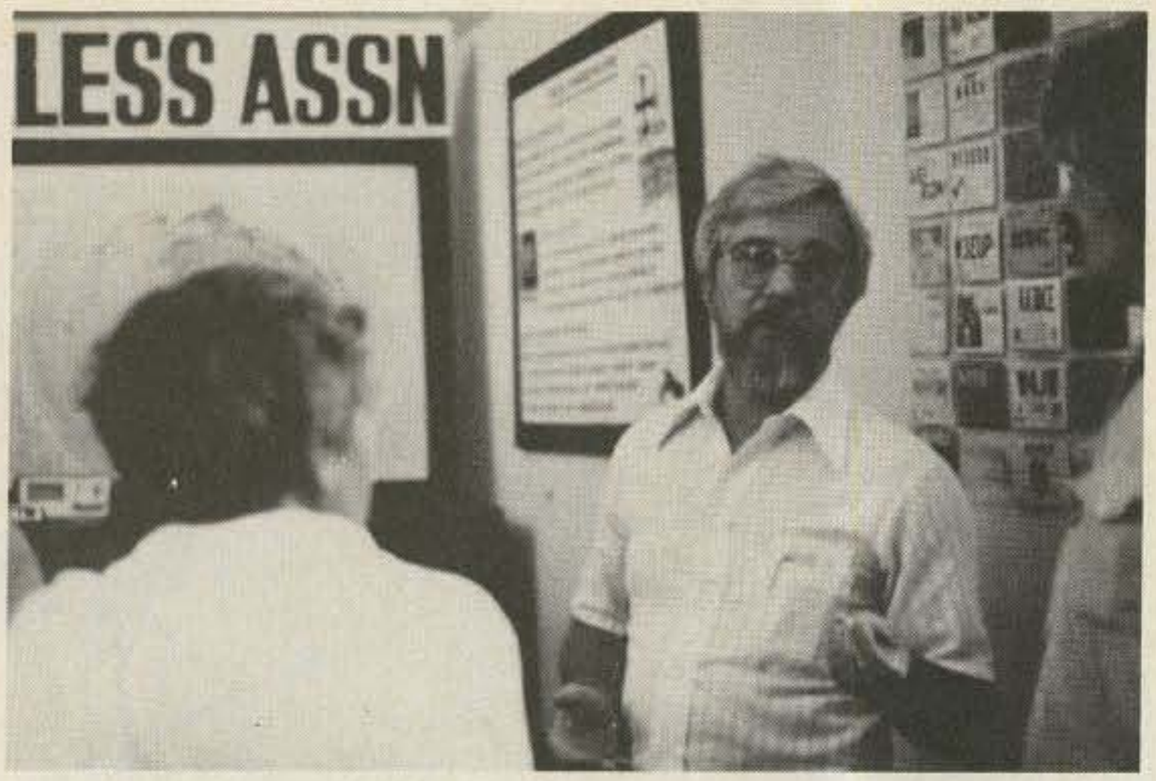
Although equipment needs were largely met by dealers and manufacturers, funds for installation and operation of the station were needed. Eleven area radio clubs and more than 60 individual amateurs responded, and Jerry Goodchild K4DZR, TWA secretary/treasurer, reported that approximately $2000 was donated to support the station.

Jerry also accepted, with the help of station trustee Chip Coker KD4C, the job of scheduling control operators for the station. About 40 hams each month worked shifts of three to eight hours as control operators. The station was staffed almost all of the 12 hours per day the six-month fair was open.

TWA directors talked about asking the FCC for a special callsign for the station, hoping that Knoxville's hosting the first world's fair in the South would persuade the commission to relax regulations on special calls. Deciding that prospect was dim, Chip KD4C offered the use of WA4KFS, for which he is trustee. Perfect—the phonetics would be "Knoxville Fair Station."

A year-long planning effort by TWA paid big dividends when the time came to install the station. Construction at the fair site was on a tight schedule, with several buildings being ready only hours before the May 1st opening. While work continued on the health pavilion, TWA erected its two 50-foot towers and rotors from Hy-Gain/Telex and Texas Towers. Aboard were a Hy-Gain TH-3 and a V-2 for 2 meters and a KLM KT34A. Dipoles

Three complete HF stations with SSTV and RTTY made up the amateur radio exhibit at the Knoxville World's Fair. Information on amateur radio for non-hams was available at WA4KFS.



With QSLs in the background, Charlie Price WB4VFP explained the many facets of amateur radio to the public.

for 40 and 80 meters were cut, and feedlines from Times Wire and Cable Company were strung and ready to be hooked to the rigs.

The three stations were built around Ten-Tec Omni C transceivers and Hercules solid-state linear amplifiers. Matching tuners, vfo's, keys, and mikes were from Ten-Tec, with MFJ providing memory keyers and clocks. KDK Distributing of Nashville supplied KDK 2036 transceivers for 2 meters. All the gear was housed in stylish consoles from S-F Amateur Radio Services of California.

The latest RTTY equipment was sent to Knoxville by Hal Communications, and SSTV gear came from Robot Research. Both slow-scan and Teletype® attracted a lot of attention from non-hams who stopped by the exhibit.

RCA and Smith-Victor Sales supplied the SSTV camera, monitor, and tripod, and Overman International, which has a manufacturing plant in Knoxville, provided chairs for the station, which was fully accessible to handicapped operators.

A crowd of 82,000, including President and Mrs. Ronald Reagan, enjoyed opening day ceremonies on May 1st. Shortly after the official festivities, WA4KFS went on the air. Pileups were common, as hams around the world wanted an '82 World's Fair QSL card or a special certificate for working the station and 10 other Tennessee hams from May to October.

Amateurs coming to Knoxville were provided with World's Fair information via ham radio. A 2-meter information station was built and placed on the air by Robin Rumbolt WA4TEM. By keying the station on simplex and giving their call, hams received information on parking, shuttle bus service, and lodging. Area repeaters were monitored by operators who could give directions and answer questions about East Tennessee and the fair.

Many amateurs heard of WA4KFS from the 2-meter information station, but a large number said they knew about the exhibit before coming to Knoxville, thanks to the work of publicity director Steve Kercel AA4AK. Some hams spotted the tribanders and followed the coax into the pavilion. All visiting amateurs were asked to sign the guest log at the reception counter and were given the opportunity to operate the station.

And operate they did—all modes, all bands. Some kept skeds they'd made in advance, others checked into nets, some looked for DX. Many added considerable skill to the art of rag-chewing.

Control operators answered thousands of questions from non-ham fair visitors and helped hundreds fill out radiograms, which were moved by Anita Teffeteller NG4J, one of the nation's top traffic handlers. Brochures about the station with tips on how to become a ham were given to those who stopped by for a chat.

Several control operators said they found conversations with fair visitors—American as well as foreign—interesting and educational. The foreigners came from Australia, South America, New Zealand, South Africa, Europe, and many other parts of the world.

If you worked the World's Fair station and want a QSL, send an SASE to Harvey Cross W4PKM. You can get the special certificate for working WA4KFS and 10 other Tennessee stations by sending $2 and log confirmation to Sarah Hickey N4EFA.

TWA, the 1982 World's Fair, and the amateur community express their gratitude to the manufacturers and distributors who made the "Knoxville Fair Station" possible. Those firms were: Hal Communications, Hy-Gain/Telex, KDK Distributing, KLM Electronics, MFJ, Overman International, RCA, Robot Research, S-F Amateur Radio Services, Smith-Victor Sales Corp., Ten-Tec, Inc., Texas Towers, and Times Wire and Cable Co.

Thousands of people at the fair saw amateur radio at its finest, and East Tennessee hams who served as control operators and repeater monitors threw in a large dose of southern hospitality for good measure.

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One of the simplest ways to add the bfo function to a converted CB set was described in my article, "CB to CW?—converting the Hy-Gain board," in the July, 1982, issue of *73*. That technique is to leave the transmitter carrier oscillator on during receive so that it beats against the received signals. It is cheap and easy, but does have the drawback of reducing the receiver dynamic range since the bfo signal travels through the entire i-f path before reaching the detector. The rest of that rig turned out so well that the project really deserved a proper bfo to bring the receiver performance up to par. The circuit described here did that job nicely and should also be of interest to anyone wanting to add CW or SSB reception ability to a converted AM-type CB set having a 455-kHz i-f.

The modified circuit consists of a straightforward 455-kHz bfo and buffer used together with a simple product detector in lieu of the existing diode AM detector. "Before" and "after" testing at my home QTH and several local CB hot spots showed a dramatic improvement. The receiver is still capable of copying a .1-μV signal, but the occasional spurious responses are gone. In addition, the bfo frequency is adjustable and can be used for variable receiver offset. The transmitter carrier oscillator provides a signal for transmit frequency spotting and the separate bfo circuit has even made it possible to reconnect the S-meter. One philosophical drawback is that the bfo is a free-running oscillator that introduces the possibility of drift to an otherwise crystal-controlled receiver. The circuit components were chosen so that the warm-up drift is only several hundred cycles; that isn't objectionable given the ability of accurately spotting the transmitter frequency. The transmitter itself is still fully crystal-controlled and (pardon the pun) rock stable.

Photos by W1GSL

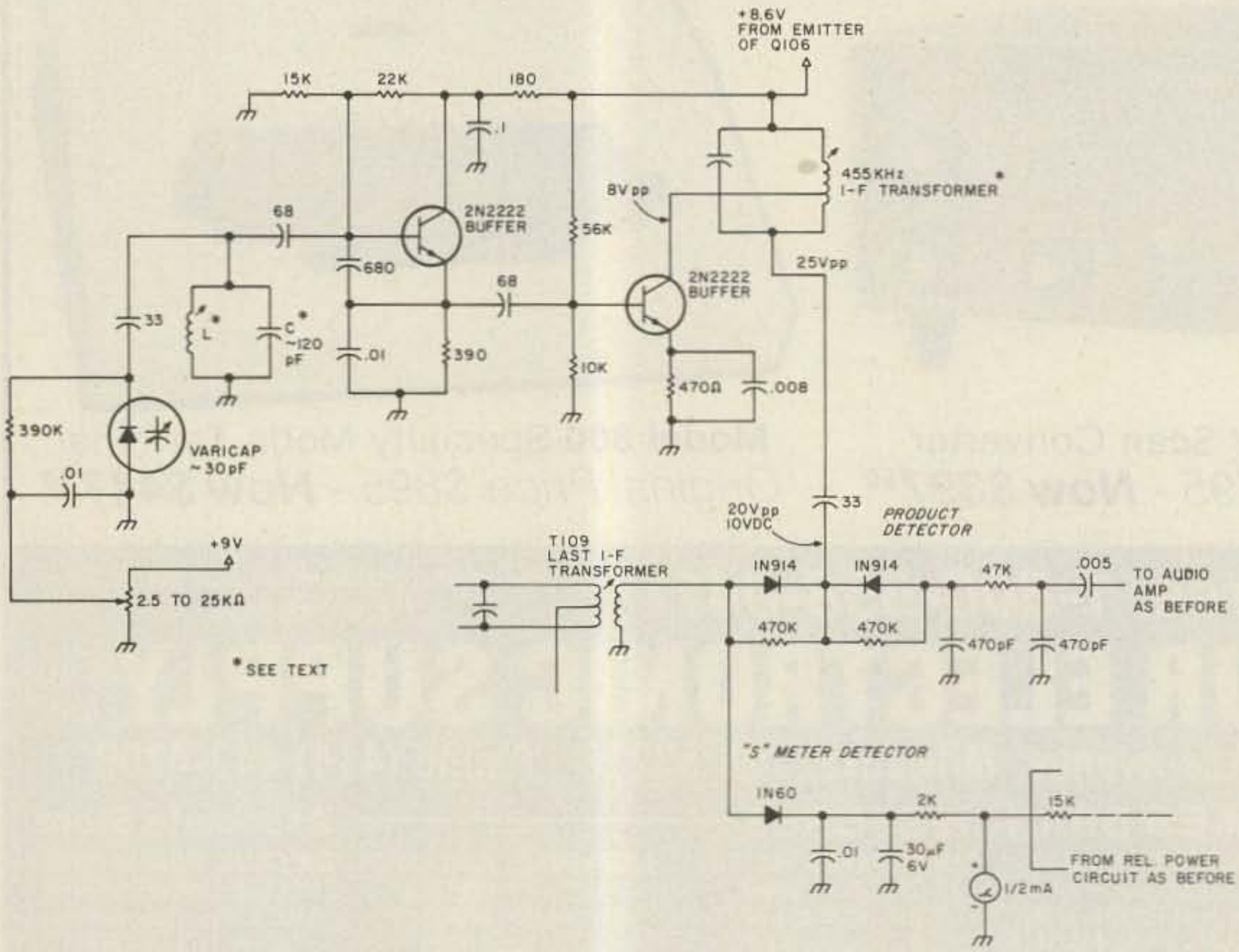


Fig. 1. Schematic diagram of bfo and detector circuits.

The Circuit

The circuit diagram for the bfo and detector is shown in Fig. 1. 2N2222 transistors were used in this version, but any NPN i-f transistor from an old transistor radio should work just as well. It is a rare transistor these days which won't work at 455 kHz.

The oscillator coil is fashioned from part of an old tube-type i-f transformer. At first, a miniature 455-kHz i-f can was used as the tank circuit, but the thermal stability was terrible. Simply placing a fingertip on the side of the shielded coil introduced enough temperature change to cause a several kHz frequency shift.

Assuming the temperature coefficient of the ferrite core was at fault, I turned to the older style large i-f can since the inductance there is achieved by using more wire and less ferrite. The top section of the transformer was removed for use as a coil as shown in the sketch of Fig. 2. The coil was paralleled with enough capacitance (120 pF in my case) to get a 455-kHz oscillation with the slug almost backed out of the coil. That step ensures that any change in the slug permeability with temperature will have minimum influence on the oscillator frequency.

In addition, most of the capacitors in the oscillator are polystyrene dielectric types used because of their reputed stability. This step may not really be necessary from a drift standpoint, but it certainly doesn't hurt. The 10-minute warm-up drift of the receiver is only 300 cycles, and that includes drift due to several crystal oscillators as well as the bfo. The bfo frequency can be shifted over a 3-kHz range with a variable capacitance diode controlled from a front-panel potentiometer.

The oscillator is followed by a buffer stage tuned by one side of the miniature i-f transformer. The transistor collector drives a tap on the coil and the detector drive is taken off at one end. This steps up the available drive signal from 8 to 25 volts peak-to-peak. The drive level is not critical, but in general the bfo injection should be about 10 times the expected signal level. If a number of transformers can be salvaged from old radios, a suitable one can be selected with the aid of a simple voltmeter circuit like that suggested in Fig. 3. Use an ohmmeter to find which windings have a tap, then put that coil in the circuit and check the output voltage with the meter. Don't forget to try swapping the dc feed and output ends of the coil to find which hookup gives the most output level. Any drive above 10 to 15 volts peak-to-peak (3.5 to 5.5 Vrms) will be satisfactory.

The two-diode product detector works like a pair of SPST switches which make and break the connection between the i-f output and the following audio amplifiers at a 455-kHz rate. The 33-pF coupling capacitor charges up to the peak value of the bfo sine wave and that makes the final buffer tuning easy—just hang a high impedance dc voltmeter on the junction of the two diodes and tune the buffer for maximum. The larger this voltage, the more signal the detector can handle without overloading and the less you will have to use the i-f gain control.

Since now only off-the-air signals are coming through the i-f stages, a simple envelope detector is incorporated to drive the S-meter. With the .5-mA meter and the resistor values shown, the sensitivity seems about right. Since there is no agc in use, the meter reads in a linear instead of logarithmic fashion. That limits its usefulness somewhat but didn't seem serious enough a problem to merit the complication of a meter amplification circuit. For those interested in a more accurate meter action, I would recommend looking into agc operation as well.

Construction

It is best to place the bfo circuit close to the detector physically. In my rig, the above-board space in that

The bfo control (labeled RIT) is mounted where the sidetone level pot used to be. That control (now called MONITOR to save space) is mounted just below and left of the meter.

area was occupied by the active audio filter modification, so the bfo circuit was built on a small board and mounted underneath the chassis. The product detector circuit is easy to fit on the main board and the connection to the bfo can be made short and direct. This helps to prevent the bfo from coupling back into an earlier section of the 455-kHz i-f strip.

As shown in the photograph, the bfo frequency adjust pot (labeled RIT) is mounted in the hole formerly occupied by the sidetone level control. That control is replaced by a miniature pot and knob mounted at the former location of the transmit offset switch. The circuitry for offsetting the transmitter is removed from the 10.695-MHz oscillator, as now the receiver can be offset by means of the bfo control. The bfo pot used has a pull-on, push-off switch attached and that is used to turn the 10.695 oscillator on to permit spotting the transmitter frequency with the receiver.

There is a frequency inversion in the receiver conversion process; be sure to wire the bfo pot so that a clockwise rotation lowers the control voltage (and

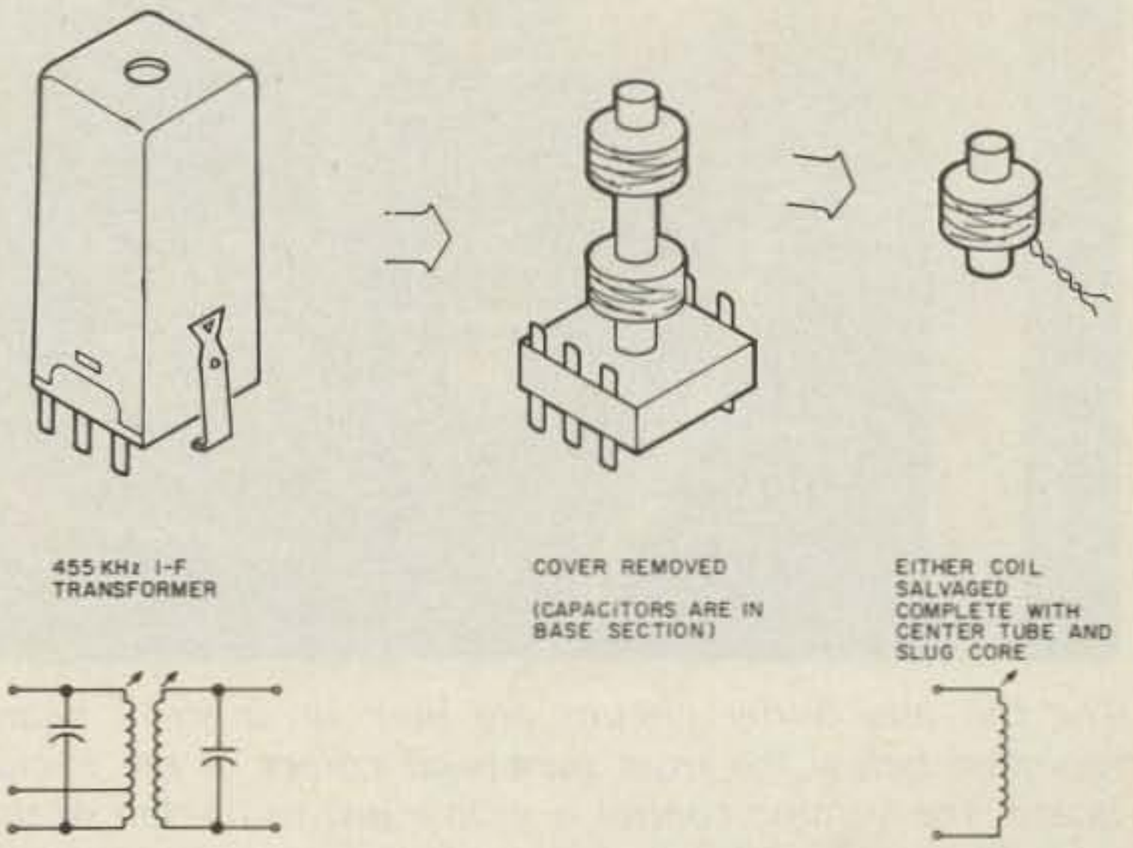
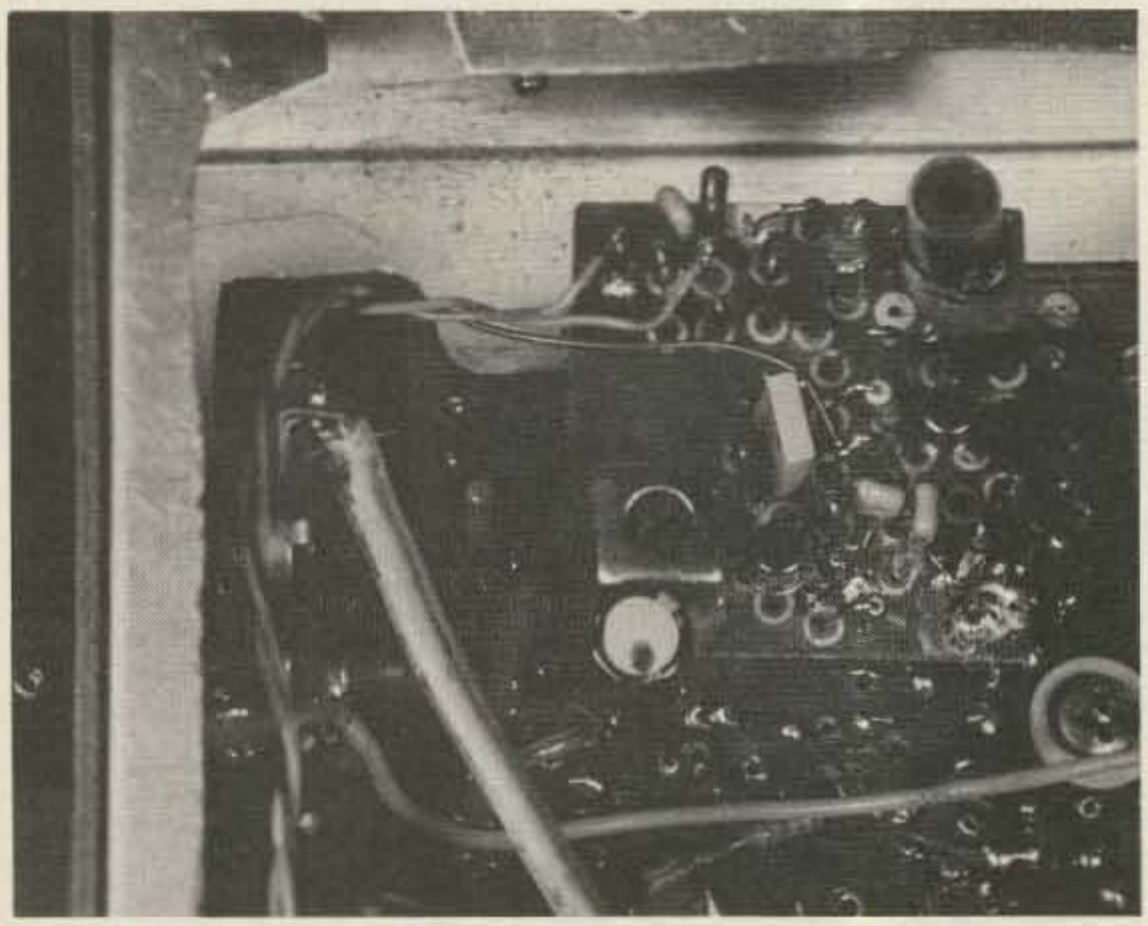


Fig. 2. Details of salvaging the coil from an old 455-kHz transformer.

with it the bfo frequency). This will result in clockwise knob rotation moving the receiver up in frequency as you would normally expect.

Operation

There was a time when the typical amateur receiver had a different calibration scale for each band. Now just about every receiver has a single 500-kHz tuning range which is switched to cover each band. These tunable i-f receivers contain a set of crystal-controlled frequency converters which move the selected segment of the radio spectrum to the input tuning range of a single-band receiver. In this 10-meter receiver, the bfo tuning provides exactly the same tunable i-f feature on a smaller frequency scale. Because the i-f passband of this receiver was designed for AM reception, it is about 10 kHz wide and can pass quite a few CW signals. The bfo and product detector can be thought of as the front end of a direct-conversion receiver which is able to tune across this 10-kHz band segment and pick out the desired signal. In the complete CW transceiver, the transmitter frequency always appears exactly in the middle of the i-f tuning range, so in practice most transceiver tuning is done with the channel switch and delta tuning control while the bfo control is used to provide a RIT (*R*eceiver *I*ncremental *T*uning) function.



The bfo and buffer circuits are built on a small board mounted below the front right-hand corner of the circuit board. The volume control is visible just to the left of the added board. The disgraceful saw marks on the lower lip of the main chassis happened when the chassis top was removed to mount the main board.

Most contacts are made with both stations on the same frequency; the receiver is easily set for this condition by pulling out the RIT knob (that's how I labeled the bfo control) to turn on the transmitter carrier oscillator. The RIT control is then turned to tune in the transmitter frequency and produce a desired tone in the audio output. The knob is pushed back in to turn off the spot signal; when an incoming signal is tuned via the channel selector and delta tuning controls so as to produce the same beat note, the transmitter will automatically be zero beat with that received signal. There is one caution to remember when using this procedure. As with all direct-conversion receivers, the detection process will produce a note on either side of zero beat, so a little care is necessary to ensure that the proper side is chosen. Actually, this is quite easy. If the RIT knob was rotated clockwise (or counterclockwise) from being zero beat with the spot signal, then the delta tuning control should also be rotated clockwise (or counterclockwise) from being zero beat with the received signal. Generally, the bfo will be offset 800 Hz from the transmitter by peaking the beat note in the audio filter. Then the RIT control is only used as necessary to dodge QRM or follow the other fellow's frequency drift.

Conclusion

This last modification makes a good rig even better. The independent receiver tuning is appreciated at least as much as the freedom from occasional CB overload. The bfo addition also opens the door to one last area of interest: i-f derived agc. Either the S-meter detector or one similar to it could be used to control the gain of the receiver in much the same way as Hy-Gain intended. A possible drawback of this scheme would be agc action caused by signals adjacent to the desired one in the wide i-f passband. Perhaps some readers will enjoy experimenting along this line. ■

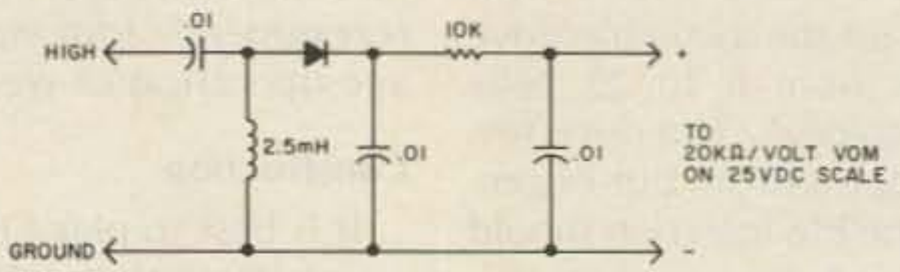


Fig. 3. Simple rf voltmeter which can be used to measure detector drive level.

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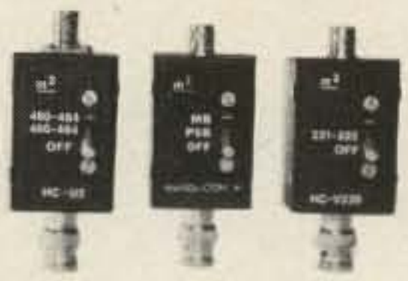

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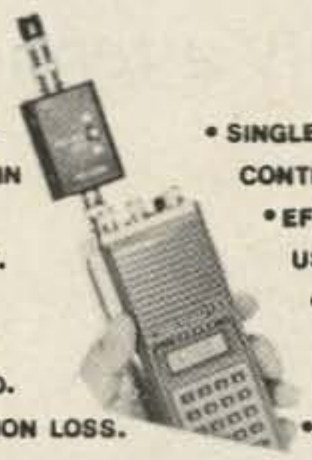

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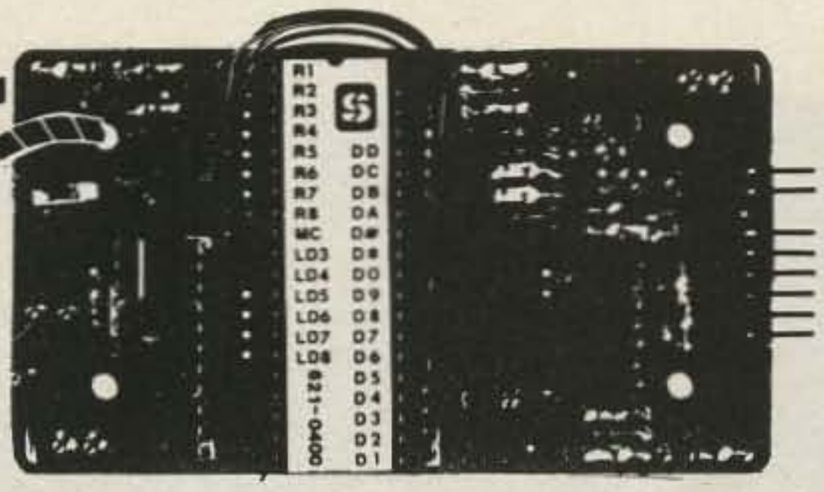

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The Denali Connection

Disaster struck these two hams in the backcountry of Alaska. Only a tenuous radio link to civilization could save them.

Although I passed my Novice code test and exam in November of 1980, my first contact was not until April, 1981, five months later. Even when it happened, I had no real enthusiasm about being on the air. I felt a sense of grim despair, perhaps, but no enthusiasm.

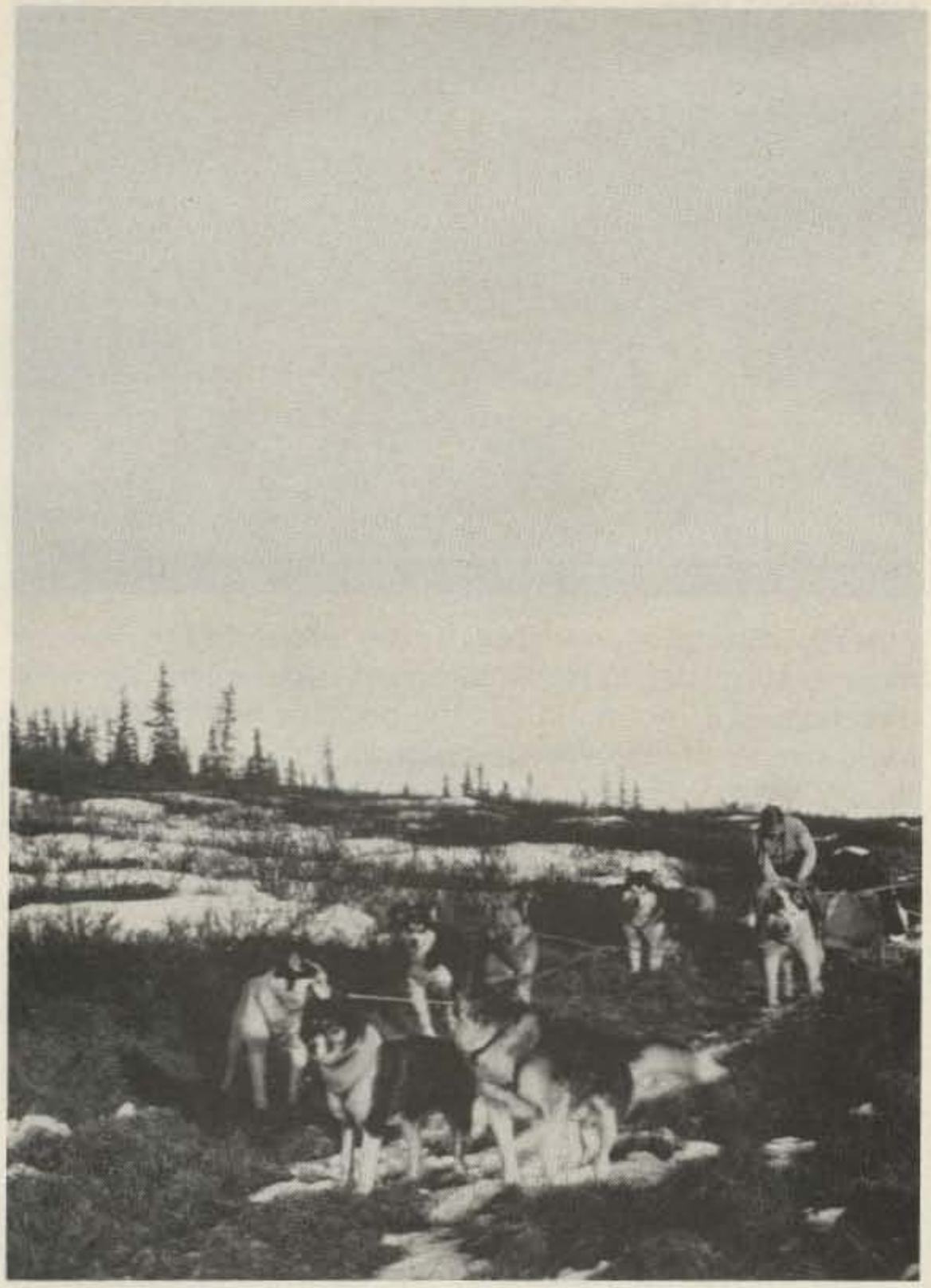
This may seem peculiar to the many hams who turned on their rigs and dove into the airways the minute they received the anticipated envelope from the FCC. Well, when I got my letter, I glanced at it and stuffed it casually into my pocket before wandering on home from the post office. That little stroll took nearly two hours, for the post office is six miles from my home. I was on foot with a heavy pack, I was breaking trail through the snow, and it was 35 degrees below zero.

Photos by Miki Collins WL7AOM

Our home in central Alaska is located on a remote lake north of Denali. The big log cabin is studded with various radio antennas which my father has set up.

I have lived in the Alaskan bush all my life, and with no telephone and once-weekly mail, instant communication can be an extremely precious commodity. Hence, the radio license is the most feasible and dependable means to find help in an emergency, to relay your whereabouts to your anxious family, or to let the folks know you just shot a moose and the winter's meat is hanging.

Unfortunately, the simple fact of the matter is that I just wasn't cut out to be a ham. I didn't have much trouble picking up the code. but copying frustrated me and the bookwork



Miki Collins WL7AOM gives the dogs a break while she ties down the load in the sled. Bouncing over bare tundra like this was only part of the pile of troubles we had on this ill-fated trip through Denali National Park.

As far as the eye can see, there is nothing but snow and mountains. Spend a few days in a place like this and you forget civilization can still exist.

We had a good team, but after a few days they began to grow run-down. We rested them often, especially while climbing over passes. Stony Hill is in the background.

really got me. I didn't have friends or instructors; I just taught myself from books. When you start out hating math, despising physics, and abhorring electrical principles, you aren't doing so hot.

Once I began to understand it a little better it was a lot more interesting, but even so . . . I just wasn't cut out for it even though both my parents and my brother have ham licenses. I didn't become a ham because I wanted to. I did it because I had to.

I was attending college when I got my license and had no use for it at that time. It sat in my pocket, its privileges not exercised. Until, that is, that fateful day in early April when my sister Miki and I ran out of time.

Generally speaking, around here running out of time is synonymous with running out of dog food. On this particular occasion, we were embarked on a 10-day dogsled trip through Denali National Park. (Denali is the Alaskan name for Mt. McKinley.) With something like 150 miles to go with our 8-husky team, it was naturally quite a disappointment to break one of our only pair of skis the first day out, for this would considerably diminish our speed.

Undaunted, I set up our tiny 80-meter rig, stringing the long antenna through the scrubby spruce bordering the Teklanika River with the intention of letting our folks know that our progress might be delayed. My first contact! Or was it?

All the suspense and exhilaration of getting on the air crashed down when the tuning knob broke off in my hand and, as it was nearly dark, I could not hope to fix it that night. By morning, my already dampened enthusiasm for the wide world of radio had plummeted and I resolved to leave the nasty set in the bottom of a tattered burlap bag.

On the third day out, we used the broken ski to jury-rig a broken sled runner. The fourth day, our eight sled dogs got wind of a grizzly bear fresh out of hibernation and led us on a tumultuous chase for two miles along the glare ice of a creek before we pulled them under control.

Six more days of increasingly difficult travel saw us less than 100 miles out. Blizzards, deep soft snow, and open creeks slowed our progress as much as the broken sled runner. By the tenth day, we were quite out of dog food. The sled was shot, broken from crashing down 30-foot snowbanks, sliding down steep gullies, and crossing rocky glacial outwash plains. The snowshoes were shot, making trailbreaking nearly impossible, and the dogs were shot—tired, run-down, hungry, and discouraged. We were shot. The trip was shot.

Miki and I pulled off the broad creek we had been on and set up camp in a grove of spruce. My sister built a fire. I dug out the radio.

The 80m call for help.

The 20,320-foot Mount Denali rises about 17,000 feet up from a fairly flat base on the north side where we were traveling. This mountain has the peculiar ability to reflect radio signals so that any two points that can see a particular face of the mountain can communicate by 2 meters; a knife-edge effect allows communication across the top of the mountain.

I swear I didn't believe I could make it work. I am by no means an electrical genius. Aside from this, my sister and I had been totally alone for 10 days. We didn't even know President Reagan had been shot and seriously wounded nearly a week before. We had spoken to no one but each other.

When you are alone in the woods or on the tundra for any length of time—even as little as ten days—and when you are surrounded not by humanity but by natural wonders, when the dominant theme in your life is the magnificently towering Mount Denali, then you begin to suspect that you are the only human being in existence. You are nothing but a bit of human dust floating through the broad expanse of natural wonders—you are alone, dependent on yourself, your ingenuity, and your strength to keep you alive. There is no one else—no one else at all. Civilization and the magic of radio just don't exist.

That's why I didn't place one jot of faith in my ability to communicate with the outside world. Inwardly, I cursed the great and powerful FCC for giving me the privileges of using a medium I felt I knew nothing about. I was, in my humble estimation, unqualified, incompetent, and inadequate. But I had no choice. If I didn't make contact, we could well have another 50 miles to go with hungry dogs, breaking trail at one mile an hour or less through snow that was knee- to hip-deep.

So I tried. For one horrible instant it occurred to me that I might have forgotten my callsign, but no, I was WL7AOL, and my father, whom I was calling, was KL7IS. For another horrible moment, the battery seemed dead, but no, after warming it by the fire, it sparked to life.

The line from the radio to the antenna was just a couple of feet long, so I stood up in the dogsled holding the radio near the antenna. Jamming the tiny plug into my ear, I began awkwardly poking the tiny button-key. I had to use my thumb since the fingers of one hand were occupied with the earplug which kept slipping out, and those of my other hand were supporting the radio. *KL7IS, KL7IH*... oops...*KL7IS*...uh...*DE* ...Good heavens! What was W? Oh yes! *WL7AOL*. I pushed the switch to receive, my thumb icily cold.

I planned to listen a minute or two before calling again, and again, and again, for five or ten minutes before giving up until nightfall when I was more likely to raise someone. But hardly had I turned over the switch when to my astonishment there was a prompt reply! Glory be! It was a faint signal but steady, sneaking softly from the earplug into my ear.

The radio was slipping from my fingers and the earplug from my ear, but I was so stunned I could only choke and sputter. When I had recovered from my shock, I shoved the radio hastily to Miki, snatched up a map—the only available piece of paper—and with trembling fingers scribbled madly on the back. Daddy was sending slowly, but the best I could do was take down the dits and dahs as such and translate later. Then, shoving the map to Miki and snatching back the radio, I painfully sent out my message, not only to Daddy but to hams all over the great outside who might be monitoring.

The following day we were picked up by bush plane and flown home with our dogs. And that is the story of my first contact. It epitomized the very reason I went for my license—so that I could communicate in times of need.

It will never be a hobby with me; I will never enjoy DXing, bunny hunts, or other ham sports, but ham radio will serve a purpose for me just as it does for many hams in less isolated areas: the purpose of communication. ■

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In a previous article ("Computers and HF," *73*, January, 1981), I discussed the direction I thought amateurs should go in developing inter-computer data communications techniques on the amateur bands. (By "data" here I mean 8-bit ASCII characters which may be making up formal messages, a digital TV image, computer graphics, or anything else.) In my opinion, the best course is to pursue frequency shift keying schemes since diversity reception of the mark and space frequencies may be used to gain interference immunity. Since small computers are to be used at each end of the communications link, error-detecting or error-correcting codes should be used to allow error-free reception of the basic data even over a communications channel which produces transmission errors. Central to the success of these schemes will be block coding of the basic data and the ability of the receiving computer to request retransmission of data blocks that were garbled.

In this article I will discuss in some detail one implementation of an automatic repeat request (ARQ) inter-computer link using error-detecting block coding. This discussion is intended to form a basis for conducting experiments with this technique (with special FCC approval).

Background

We are trying to design a system that will allow error-free transmission of data over a radio channel degraded by noise, fading, and interference from other stations. The most important characteristic of this channel is that we can *expect* it to produce transmission errors. We must therefore design our system to recognize when errors have been encountered and to somehow correct them. We will assume that our channel is at least good enough to allow error-free reception *occasionally*. The computers will then keep trying to transfer their data and retransmit that data destroyed during periods of interference on the channel. Though we will be able to get our data transferred without errors even on a very degraded channel, many retransmissions may be required. This means that the worse the channel is, the longer it will require to transfer (without errors) a given size file.

Error-Detection Coding

The first thing we must be able to do is transmit our data in such a way that the receiving computer can positively determine when it has received it correctly and when it has not. We do this by error-detection coding. There are a number of schemes for doing this, and I will not attempt to explain all of them. Each scheme has its own advantages and disadvantages, but in my opinion, the best scheme for our purposes is the "checksum" method.

With this method, the sending computer breaks down the data into blocks with a certain number of characters in each block. Then it numerically adds all the characters together (thinking of them merely as 8-bit binary numbers). This 8-bit sum, called a "checksum," is then transmitted at the end of the data block. When the block is received by the receiving computer, it adds together all the characters in the block as *it* received them and compares this sum to the checksum that it received over the link. If the two sums match, the receiving computer can be fairly sure that it received all the characters with no errors in the block, but it cannot tell which characters have been garbled.

Automatic Repeat Request

Once we have the capability to determine when we have received good data blocks and when we have received garbled data blocks, the next step is to get the sending computer to retransmit the garbled ones. This is done by a system called automatic repeat request (ARQ).

The sending computer will normally send a number of data blocks in one transmission. At the end of its transmission, the sending computer waits for response from the receiving computer which will indicate if it needs any of the blocks retransmitted due to errors. The sending computer will then begin a new transmission and include at the beginning a repeat of blocks requested by the receiving end. These repeated blocks will be followed by new data. This process continues until all data has been transferred.

During the reception of the data blocks, the receiving computer keeps track of the blocks that are received error-free. At the end of the transmission, it sends a short message back to the sending computer acknowledging the blocks that it received correctly (an ACK message). The sending computer then assumes that all other blocks were not received correctly and repeats these in its next transmission.

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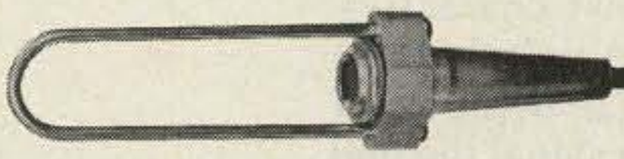

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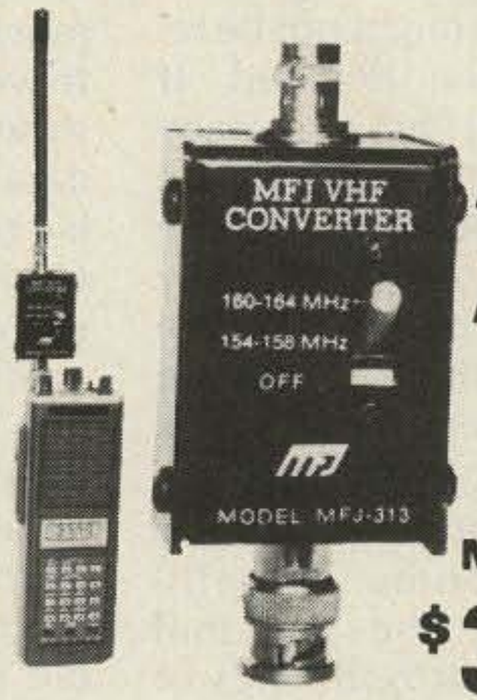

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If for some reason the ACK message back to the sending computer is garbled, the sending computer will simply assume that all blocks in the previous transmission were garbled and will repeat them all. This is safer than allowing the possibility that some garbled data blocks might not be repeated when required. If blocks that have already been correctly received are again encountered by the receiving computer, they simply will be ignored. The important thing is that we receive every data block correctly at least once.

This process obviously requires some "intelligence" in the terminal equipment at both ends of our communications link. This will take the form of a computer and suitable program to accomplish the required arithmetic, buffer storage, and record keeping. These tasks will not be difficult to do with a small computer, but they are much beyond the capability of an ordinary TTY machine. (This is why straight TTY machines are referred to, with no disrespect intended, as "dumb" terminals.)

Block Length

We need to be careful about the chosen length of our data blocks. If, for example, our channel on a given day is producing errors about twice per minute on the average and we have chosen a block length that requires 3 minutes to transmit one data block, it is obvious that we may never be able to receive even one block error-free. The sending computer will be forced to continually repeat the first data block of the file, and the file may never be completely transferred. (Our communications system, in this instance, would have broken down.) On the other hand, if we chose data blocks to be so short that they only required 100 milliseconds to transmit, we would be able to transfer many data blocks error-free over our example channel.

If we make the blocks too long, we find that we seldom receive error-free blocks and we spend too much time retransmitting. If we make the blocks too short, our overall rate of data transfer ("throughput") is reduced under good channel conditions because we are spending too much of our time transmitting checksums instead of data characters. If we could reliably predict what our channel would be like all the time, it would be possible to find a block length that was the most efficient all the time. But on some days you may have a telephone-quality channel, and on other days the interference may be severe.

For this reason, I am recommending that the block length be variable and under the control of the sending computer (and/or operator). This will allow the block length to be optimized from one transmission to the next, if desired, simply by experiment. One would normally want to begin with a fairly short block length (perhaps 16), and then increase it if few retransmissions are necessary. If, at another time, the retransmission rate gets too high, the block length could simply be shortened on the next transmission.

Signal Format

There are a few other details we must consider in order to make our scheme workable. We require three types of data structures: (1) a block of text characters, (2) an acknowledgment block, and (3) a block of characters to signal the end of transmission.

Fig. 1 shows how a text block would be constructed. It may be preceded by any number of ASCII SYN characters as fillers. The STX (ASCII Start of Text) character flags the start of the block. Following STX are a variable number of 8-bit data bytes. The number of bytes may vary between individual blocks in a given transmission, but it may not exceed 256. The end of data in a block is signalled by the ETX (ASCII End of Text) character. Immediately following the ETX is the 8-bit checksum and then the 8-bit block label.

The checksum is formed by numerically adding together each data byte and discarding any register overflow. Each data block of a transmission must be uniquely identifiable, so we add the block label. The sending computer will sequentially assign 8-bit labels to each data block it sends. These will allow the receiving computer to identify the blocks it has received correctly, and also allow it to properly sequence the data blocks after they have all been received correctly.

Fig. 2 shows how an acknowledgment block would be constructed. It also may be preceded by any number of SYN characters. An ACK (ASCII Acknowledge) character flags the start of an acknowledgment block. The contents of the block are the block labels of the text blocks received correctly during the previous transmission. We will allow a variable number of labels, up to 256, in one ACK block. The end of the block is flagged by an ETX character. No error-checking will be done on the ACK blocks, so no checksum or block label is transmitted.

Fig. 3 shows how an end of transmission would be indicated. The ASCII ETB (End of Transmission Block) character will be used to indicate to the receiving computer that it may begin transmitting. To ensure that at least one ETB is received even with interference, it will be sent 5 times. After recognizing the ETB character, the receiving computer will wait until the loss of receive signal is detected and then begin transmitting.

We want to allow the use of many different types of computers to process this code. Since different computers will require different amounts of time to perform the arithmetic and bookkeeping operations necessary to process data blocks, we cannot know for sure how much time must be allowed between blocks. To make sure we don't make it impossible for some computers to keep up, a vari-

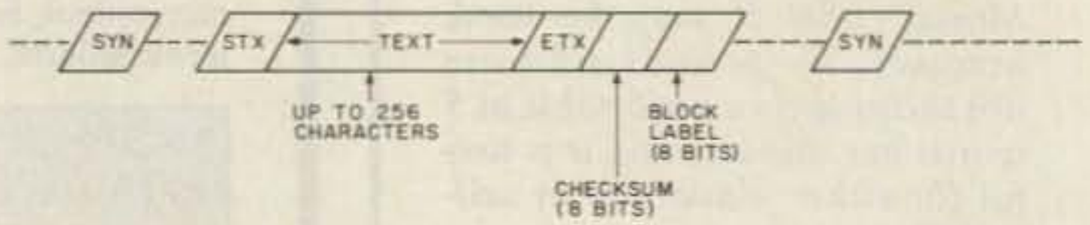

Fig. 1. Text block.

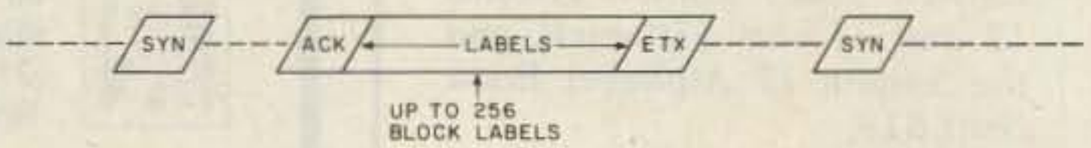

Fig. 2. ACK block.

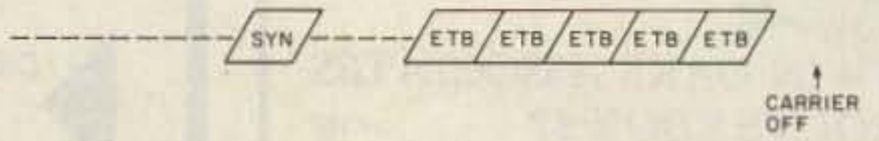

Fig. 3. Transfer of link control.

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able number of SYN characters will be transmitted between data blocks. Depending upon the speed of the receiving computer, any number between 1 and 10 SYN characters might be required to allow adequate processing time at the receiver. The number of SYN characters transmitted between blocks can be varied to suit the sending or receiving operators. A certain minimum number of characters will be necessary to allow the receiving computer enough processing time, but any number of additional SYN characters will not disrupt the scheme, since the receiving computer will simply wait until it encounters an STX character to start processing the next data block. The only effect of sending more SYN characters than actually needed will be to reduce data throughput below the optimum for that combination of computers.

Another reason to allow varying the number of SYN characters is that we want to be able to use this scheme over a variety of actual data rates. Since the computer processing time will remain fixed while the character transmission time may change considerably, it will be advantageous to use fewer synchronizing characters at the lower data rates and more at the higher data rates to allow the same processing time at the receiving computer.

This system does not lend itself well to informal conversation at low typing speeds and would primarily be of use after initially establishing contact with another station and mutually deciding that a large block of data (perhaps 100 formal messages) is to be transferred. At this point, both stations would switch to the block-encoded mode to transfer the data.

Once in the block-encoded mode, we would begin a transmission with a leader of SYN characters perhaps 5 seconds long. The remainder of the transmission would consist of ACK or text blocks. We will require that the text blocks be transmitted sequentially, but we will allow the ACK blocks to appear anywhere during the transmission. Since we will not be using error-detection on the ACK blocks, it will be a good idea to send the ACK blocks more than once to make sure they are received correctly. Between blocks any number of SYN characters may be transmitted. The last block of the transmission will be followed by several SYN characters and then the five ETB characters to signal the end of transmission.

Diversity

How can diversity operation help us in this scheme? If a receiving interface is available where the mark and space frequencies can be detected independently, the receiving computer can treat the two frequencies as separate signals, and we get *two* chances for each data block to be received correctly. If either the mark or space channel produces an error-free block, the receiving computer can ACK that block. This can greatly reduce the number of retransmissions under moderately degraded conditions and greatly increase throughput.

Summary

I have described one of several possible methods to achieve error-free transmission of digital data over a very imperfect radio channel by using error-detecting coding, ARQ, and computers at each end of the radio link. I hope these ideas will help to get some experimenting underway in this direction. ■

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Drive-Time SWLing

This simple car radio converter will open up a whole new world of driving.

Tired of rock music on your car radio? Then listen to the BBC, Voice of America, Radio Canada, and other shortwave broadcast stations. Only a 2-transistor converter is required.

The circuit converts the 16-, 19-, 25-, or 31-meter bands to AM standard-broadcast frequencies. Simply insert the converter between your car antenna and antenna input.

Maybe you prefer your shortwave listening indoors. Then you will need a low-cost surplus car radio (Olson Electronics, 260 S. Forge St., Akron OH 44327) and a 12-volt power supply (Radio Shack). The car radio is well shielded and will not pick up AM standard-broadcast interference.

The converter schematic is shown in Fig. 1. The simple Pierce oscillator circuit uses a 2N5397 JFET to restrict oscillator output noise. No tuned circuits, other than the crystal itself, are used in the oscillator. The 3N204 MOSFET mixer provides low noise, good dynamic range, and moderate gain. Mixer gain must be high enough for antenna noise to mask the car radio internal noise. On the other hand, mixer gain must be low enough so that overloading of the car radio by strong signals is not a problem. Thus, the higher-gain 3N211 is not recommended here.

Temperature tests show the converter performance to be virtually constant over the range −40° C to 85° C. Oscillator frequency drift, for a 16.3-MHz AT-type crystal, is less than ±1.5 kHz over this temperature range.

Crystal* frequencies are selected so that one crystal can be used for two shortwave bands. Signals from these two bands do not overlap. The mixer input circuit selects one of the two bands. Table 1 lists the values of L1, L2, and the crystal frequency for each band.

The values of L1 should work well with GM windshield antennas. Regardless of the antenna type, L1 should be selected for maximum signal strength at center band. L1 and C1, in addition to matching the antenna to the mixer, act as a low-pass filter at TV and FM broadcast frequencies. This filtering function is very important since unattenuated signals from powerful VHF stations can produce undesirable mixer products at the converter output.

A 19-meter version of the converter is mounted under the dashboard of my Chevrolet. Standard broadcast

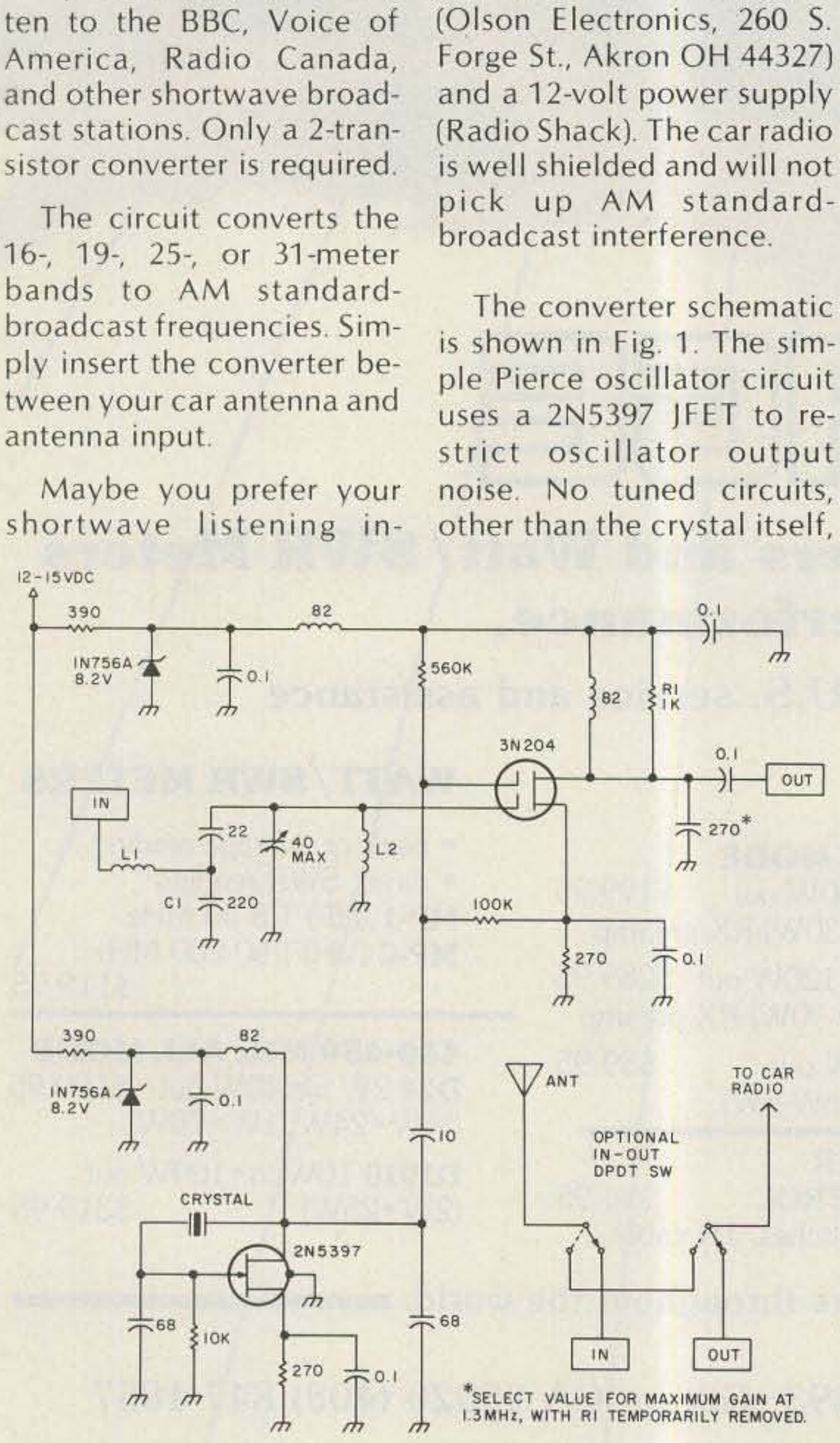

Fig. 1. Schematic for the converter for shortwave listening.

*AT-element, fundamental mode, parallel-resonance, 32-pF load capacitance. Jan Crystals, PO Box 06017, Ft. Myers FL 33906. Cost is approximately $5.00.

SW Band	Xtal Freq.	L1	L2
16m	16.3	1.5	1.8
19m	16.3	1.8	2.2
25m	11.0	2.7	3.9
31m	11.0	3.9	5.6

Frequency in MHz.
Inductance in microhenries.

Table 1.

feedthrough causes no significant interference with shortwave signals. More specifically, a 1-kW station at 1.1 MHz is not detectable beyond a half mile from the station antenna. For negligible feedthrough, the converter must be contained in an aluminum box. Also, a shielded cable (Radio Shack) must connect the converter to the car radio. To avoid generator/alternator whine, the converter box must be securely fastened and grounded to the metal frame of the dashboard with sheet-metal screws. To control ignition noise, resistor-type spark plugs must be used in the car engine.

The converter circuit is constructed on top of an unetched, copperclad PC board. No etching or cutting of the board is required. Circuit grounds are soldered directly to the board. A few ¼-Watt, 4.7-megohm resistors, with one end of each soldered to the PC board, are used as standoffs. The crystal socket is epoxy-glued to the board. Inductors must be at least one inductor diameter from the PC board. All inductors must be separated by at least two inductor diameters. Naturally, all circuit leads are kept short.

All resistors in the schematic are ¼-Watt carbon with values in Ohms. All inductors are molded rf chokes, unshielded type, with ¼-inch-length bodies and values in microhenries. Integer values of capacitance are in pF, and the corresponding capacitors are ceramic or dipped mica. Decimal values of capacitance are in μF, and the corresponding capacitors are ceramic.

One final note. Experience indicates that, after installing the converter, one should tune the car radio while keeping one's eyes on the road. ■

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Stop That Heist!

What would you say about an alarm that's portable, inexpensive, and goes off when a thief just touches the doorknob? We say build it.

Dennis Pharr WD5JWY
3521 SE 45th Street
Oklahoma City OK 73135

This article will describe a low-cost alarm circuit that is activated by a simple touch of the hand. Its operation depends upon a source of 60-Hz signals that is present in virtually all homes wired with standard 110 V ac. The sensitivity of the alarm is adjustable and easily varied to suit the particular 60-Hz environment. The alarm requires no installation; it is simply hung on the doorknob by a hook formed from heavy-gauge copper which is connected to the input circuit. When the doorknob is touched, the alarm will sound.

Circuit Operation

Operation of this circuit is fairly simple. Referring to Fig. 1, when the doorknob is touched, a 60-Hz signal is applied to the gate of FET Q1. This signal is then amplified a small amount and applied to the trigger terminal (pin 2) of U2, which acts as a one-shot. The output of U2 then goes high, causing the output of the Set/Clear flip-flop, which consists of U3A and U3B, to go high also. The high on the output of the Set/Clear flip-flop enables audio oscillator U4 which acts as the alarm. The alarm will continue to sound until it is reset by depressing push-button S2.

Also built into the circuit is a delay feature which will allow the alarm to be used while you're away from your house or apartment. The delay portion of the circuit, made up of Q2, U1, and U3C, allows you to activate the alarm and go out the door while still handling the doorknob.

Operation of the delay circuit is also quite simple. When power is initially applied to the circuit, a trigger pulse is generated by Q2 which causes the output of U1 to go high. The high on the output of U1 is inverted to a low by U3C and applied to pin four of U2. This low on pin four of U2 disables the alarm for approximately thirty seconds, with the components specified. This should be plenty of time to exit the door. If you don't wish to include the delay feature, simply leave out Q2, U1, and U3C and connect pin four of U2 directly to Vcc.

Quiescent current drain of the circuit is about fifteen milliamperes with the nine-volt battery specified; therefore, two nine-volt batteries in parallel or six penlight cells in series should be used for powering the alarm.

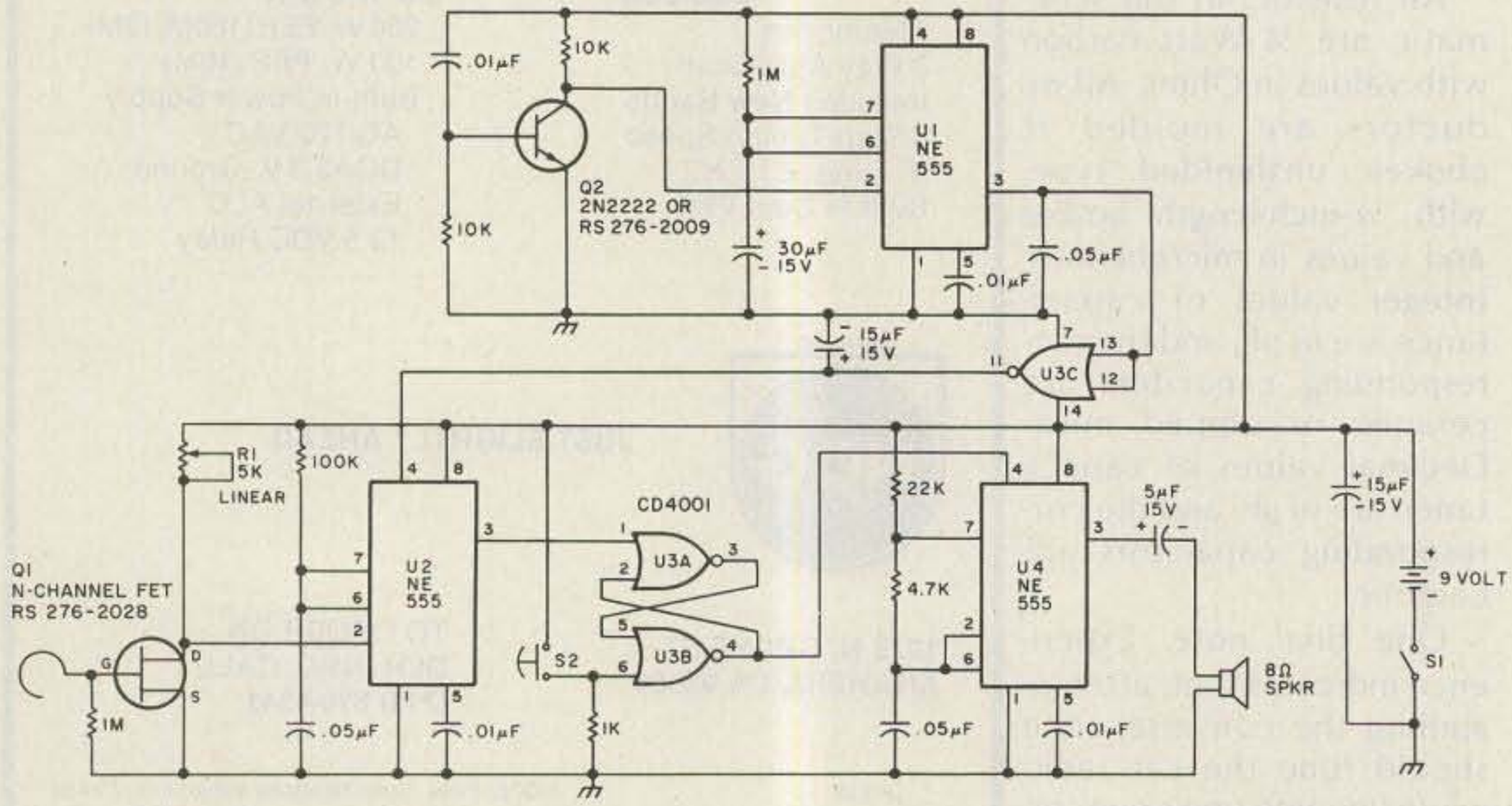

Fig. 1. Schematic diagram of touch alarm.

Construction

The circuit can be built most easily using perfboard-type construction. Sockets should be used for all the ICs, should replacement become necessary. A plastic case similar to those sold by Radio Shack can be used for housing the unit, and a piece of #14 gauge, or heavier, bare copper wire may be used for the touch element. The wire should be bent into a hook shape for hanging on

the doorknob. R1, the sensitivity adjustment resistor, should be a panel-mount-type potentiometer instead of a trimpot mounted on the perfboard, as this will greatly ease adjustment when the alarm is to be used.

Test and Adjustment

The alarm may be tested for proper operation without hanging it on a doorknob. To do so, first adjust sensitivity control R1 for minimum resistance and then apply power. If you have included the delay circuit, you will have to wait approximately thirty or forty seconds before the alarm will arm itself. Now, while touching the pickup element, adjust R1 towards maximum resistance. At some point, while adjusting R1, the alarm will trigger and go off. To reset the alarm, momentarily depress S2. I must mention here that depressing S2 will only reset the alarm; it will not activate the delay. To reactivate the delay, power must be momentarily interrupted by opening and closing S1. Also, after the sensitivity has been increased, the alarm will sound when power is applied. To prevent this, hold down the reset button while applying power. R1 will have to be readjusted when the alarm is hung on the doorknob, as this changes the sensitivity of the input circuit.

Summary

This alarm would probably be most useful to those living in apartments and could easily be thrown into a suitcase for use in motel or hotel rooms when away on trips. But, wherever used, it will provide a sense of security otherwise unknown.

If you have any questions or comments concerning the operation of the alarm, an SASE to me will bring a prompt reply. ■

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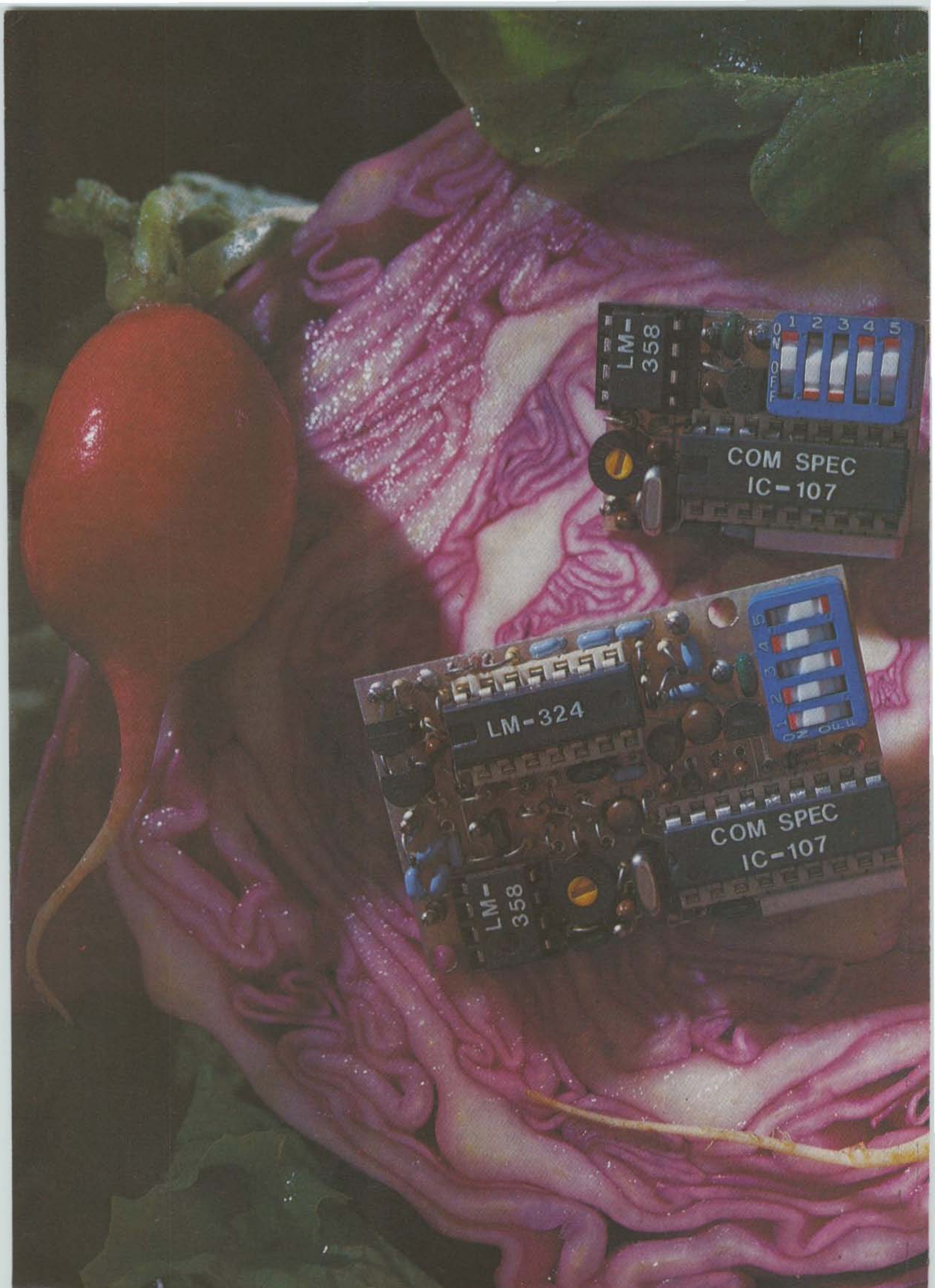
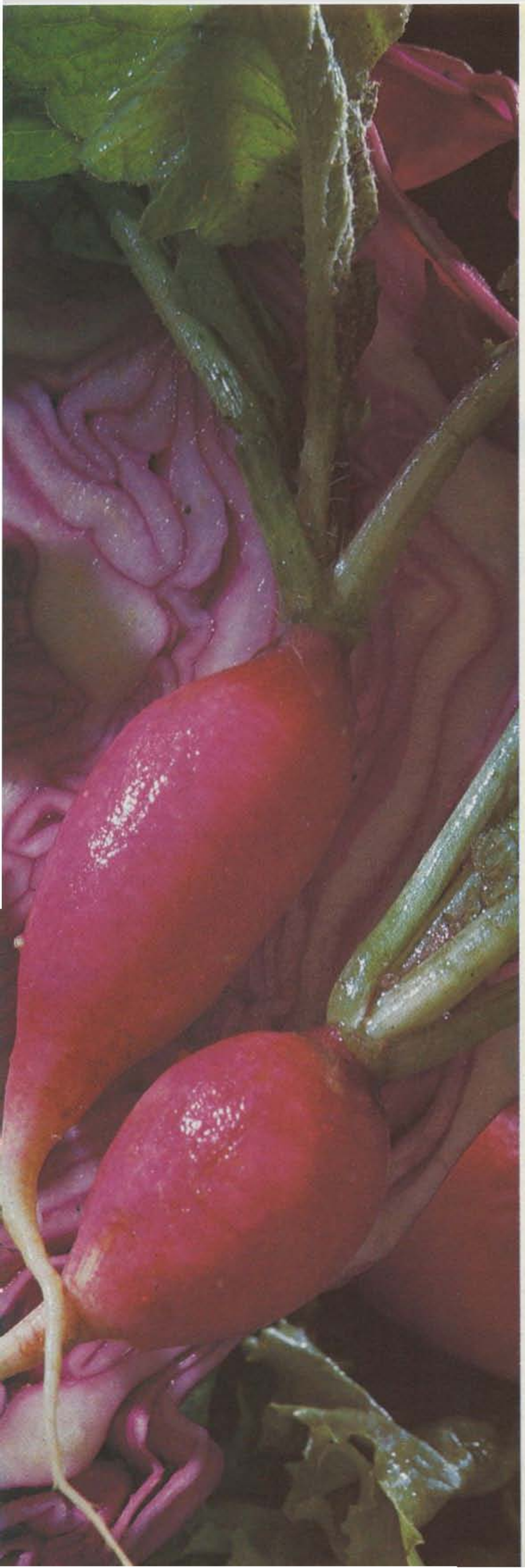

LM-358
ON OFF 1 2 3 4 5
COM SPEC
IC-107
LM-324
LM-358
COM SPEC
IC-107



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SS-32

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79.7 SP	103.5 1A	136.5 4Z	179.9 6B
82.5 YZ	107.2 1B	141.3 4A	186.2 7Z
85.4 YA	110.9 2Z	146.2 4B	192.8 7A
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Get the DX Edge

There are ways to stand out in the pileups for Spanish-speaking stations. One is to speak their language.

Do your present operating activities make your heart beat faster and your nerves tingle from excitement? If not, you could be in a bit of a rut.

Novices seldom have this problem, but many other hams later find that they need to try other avenues of their hobby. Operating an exotic mode like slow-scan television is one approach; another is chasing certificates. My choice is talking with hams of the Spanish-speaking countries.

Why try the Spanish language? For openers, the Spanish-speaking people are among the most gracious people in the world and are very patient with beginners speaking their language. They bend over backwards to overlook errors and always enthusiastically encourage beginners. A knowledge of Spanish gives you an edge in working Mexico, Central America, South America, the West Indies, Spain, the Canary Islands, the Balearic Islands, and the North African cities of Ceuta and Melilla. (These are Spanish enclaves on the coast of Morocco.) And that constitutes a lot of DX!

Spanish is a good beginner's language. It often is pronounced nearly as it is spelled. For example, the F sound is always spelled with an F. It does not have spelling nightmares as does English, in which an F sound can be represented by gh (in enough) or by ph (in phone). Another advantage is that when the other operator hears you attempting to use his language, he often will try his hand at speaking English. It's a bit like fishing—you throw out your lure in the form of spoken Spanish and reel in your catch in the form of a contact in English.

Most hams begin their hobby as Novices working other Novices, and this is a good way to begin using Spanish. The Novices from Spain are licensed to use voice communication from 29,000 kHz to 29,100 kHz. Their callsigns begin with EC instead of EA. During the fall, spring, and winter months, they can often be worked from about 1200 UTC until 2000 UTC in the midwestern United States.

Spanish Novices exhibit that universal trait of Novices everywhere—enthusiasm. A contact with them is not the usual one of "You are 5 × 9 in Madrid, QSL via the bureau and QRZed." They usually will answer with an excited tone in their voices, often with a rapidly spoken "OK, OK, OK!" For many this may be their first DX contact, and they will QSL direct. Their QSLs are often beautiful postcards of their QTH, with the technical information stamped on the back. I always look forward to checking my mail for a new postcard with interesting stamps. They may also send a red ribbon with a yellow center stripe, which represents the Spanish flag.

After working a stateside Novice station, you always enjoy working that same station again when he has upgraded. You will get an even bigger kick doing this with Spanish Novices. One day I called CQ in Spanish on 15 meters and was answered by an EA whom I had worked several months earlier when he was a Novice EC. He remembered me, described my QSL card, and noted what a great pleasure it was to have another contact. You don't get that from a DX pileup!

If you have ever wanted to be a DX station but you live in Chicago or Los Angeles or Detroit or operate low power with something less than a gain antenna, take heart; the Spanish Novices consider

Reader Service for facing page ↙5→

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you to be good DX. I know, because one day after returning home from work I found 10 meters to be open into Spain. I answered a CQ in Spanish, and at the end of the contact I had a new experience: Several Spanish stations shouted my callsign! It was a bit nerve-wracking at first, but I got used to being a hotly sought-after DX station. In one hour I worked about a dozen stations, exchanging complete QSL information, and could have worked more, but the band went dead.

If you enjoyed the challenge of working all 50 states in the US, why not try your luck at working all 50 provinces in Spain? When you have all 50 confirmed, you can apply to the U.R.E., Box 220, Madrid, Spain, for a certificate. If you are having a hard time working the EA9s from the North African Spanish enclaves of Melilla and Ceuta, you might try the EC9s in the Novice bands. There also are quite a few EC6s from the Balearic Islands and EC8s from the Canary Islands. They might even consider you to be DX, especially if you know Spanish.

Incidentally, if you are a person with a bit of imagination, get an atlas and a guide book or travel book about Spain and look up the cities in Spain that you work. It's like an inexpensive vacation. I use the guidebook by Baedeker which lists the main cities in alphabetical order with color pictures, a short description, history, and a list of fiestas and events. It's a bit expensive at about $11.00. Rand-McNally has a good pocket-size one for about $4.00. Both are available at most bookstores.

Also on the 10-meter band from 28,900 kHz to 29,000 kHz are the Novices and Intermediates from Argentina, and they are allowed to use voice communication here. They can be worked almost anytime that 10 meters is open, and their operating hours are close to ours, since their local time is 3 hours behind UTC. The calls of Argentine Novices begin with LU, as do the calls of higher-licensed Argentine stations.

You can start working these Spanish-speaking stations with just a few basic words and phrases. First, most consonants are pronounced similar to ours. The vowels are pronounced clearly and distinctly. Pronounce A like the English *ah*, E like our *ay* in *say*, I like the i in *machine*, O like our *oh*, and U like *oo* in *cool*.

You already know the Q signals and have only to pronounce them as letters of the Spanish alphabet. QSB is pronounced *coo-aysay-bay*; QSL is *coo-aysay-aylay*; QTH is *coo-tay-ahchay*; QRM is *coo-airray-aymay*; QRA (which means "my name is . . .") is *coo-airray-ah*.

Know the numerals 0 to 9 and a few useful phrases (see box). A typical contact might go thus: *Esta es W1AW*, this is W1AW; *gracias*, thanks; *su reporte es cinco nueve*, your report is 59; *QRA Hiram*, name is Hiram; *hay QRM*, there is QRM; *QTH Newington, estado de Connecticut*, location is Newington, state of Connecticut; *habla despacio*, speak slowly; *cambio*, over.

This article touches on only the essentials, and its main purpose is to promote interest in working Spanish-speaking stations. Several aids have appeared recently which are shortcuts to a proficiency in using Spanish on the ham bands. *The Radio Amateur's Conversation Guide* by OH1BR and OH2BAD lists, in eight languages, 147 sentences relating to ham talk, and this is available from Transelectro-America, 2301 Canehill Avenue, Long Beach CA 90815. It has a dictionary listing ham-related words, also in eight languages. For example, if you need to find the Spanish phrase for "frequency shift keying," just look it up in this dictionary.

The book has quite a few spelling mistakes, at least in the Spanish section, and is a bit expensive, but it has some interesting cartoons and the dictionary is unique. Tapes in each language are available for $6.00 each, and buying the Spanish one certainly would be a wise investment. Another tape, "Hola CQ" is available with 15 pages of text from the ARRL for $7.00.

The basic goal is not to learn a lot of grammar and a large general vocabulary. When you are on the air, you likely will not be asking a Spanish repairman the cost of a new carburetor for your car, but you would be informing a Spanish-speaking operator that his modulation is good or bad. Learn a little grammar and a small specialized vocabulary and have a good time.

I did study Spanish about 15 years ago for two years and had some success with the written language, but the spoken language would drive me to find the nearest interpreter for anything more complex than "Buenos Dias." I have been using Spanish over the air for over a year now, and with the help of the conversation guide, I can make it through a contact even if I don't understand everything. Much like learning the code, practicing Spanish makes perfect.

The FCC says one of the reasons that the Amateur Radio Service exists is "the continuation and extension of the amateur's unique ability to enhance international goodwill." I think I know what these words mean. One day after eight hours of hassles and harassments at work, I came home and turned on the rig. I made contact with a Novice from Argentina. We made the usual exchanges of name, QTH, and reports. Then I heard some words that I had not heard at work that day which translated into: "Magnificent, I congratulate you for your very good Spanish!"—the first kind words I had heard all day! And I knew that my goodwill had certainly been enhanced that day.

I hope that your goodwill also will be enhanced as a result of talking with Spanish-speaking countries; besides, it's a lot of fun! *Siete tres!* ■

Spanish Words and Phrases

Spanish	Pronounced	English
cero—	*say-roh*	zero
uno—	*oo-noh*	one
dos—	*dose*	two
tres—	*trace*	three
quatro—	*kwah-troh*	four
cinco—	*sink-ho*	five
seis—	*say-iss*	six
siete—	*see-ay-tay*	seven
ocho—	*oh-cho*	eight
nueve—	*noo-way-vay*	nine
hay	*eye or I*	there is
gracias	*grah-see-ahss*	thanks
habla despacio	*ah-blah des-pah-see-oh*	speak slowly
codigo postal	*koh-dee-goh poh-stal*	zip code
apartado postal	*ah-par-tah-doh poh-stal*	PO Box
cambio	*kam-bee-oh*	over
direccion	*dee-rek-see-own*	address
su reporte es	*soo ray-por-tay ess*	your report is
mi	*mee*	my

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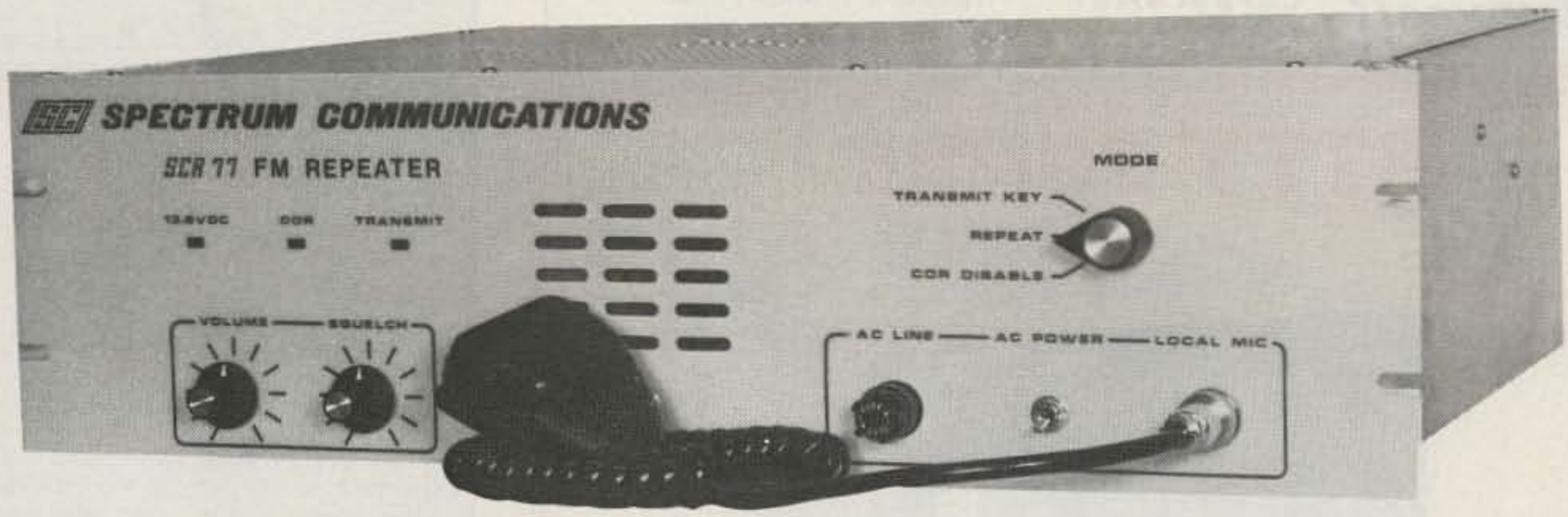

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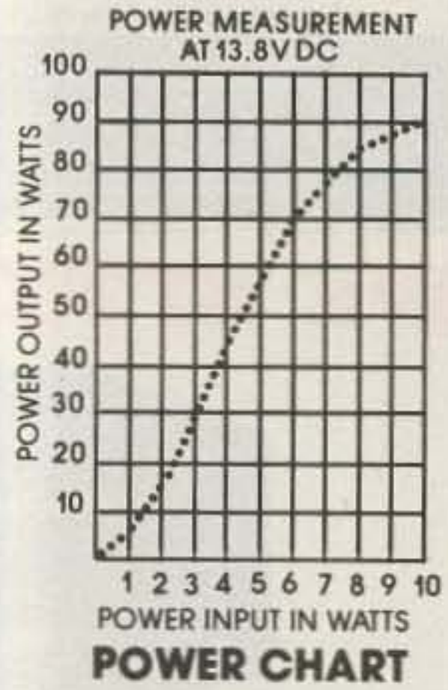

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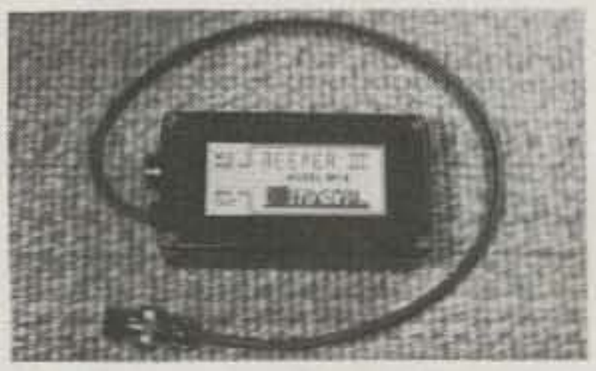

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Power-Line Protection: The Weak Link

Solid-state equipment may be extremely reliable, but just microseconds of overvoltage can change that.

Most amateurs take precautions to prevent damage to their homes and equipment from lightning strikes or near strikes on their antennas or towers. Few of them, however, are as well protected from the other common source of problems—power-line surges. These surges frequently result from strikes on power lines and can cause transients of thousands of volts in ordinary 110/220 household systems in the vicinity of the strike.

Pulling the plug on ham equipment during electrical storms has been one way of solving the problem. However, many hams participate in weather nets during severe storms, so pulling the plug on the rig is not the answer. Also, pulling the plug on everything in the house is a difficult way to live. It's much better to put one of the new transient voltage suppressors on your line, relax, and know you are safe from anything except a direct hit.

Most amateurs who grew up in the vacuum-tube era have paid little attention to transients as most electrical and electro-mechanical devices with tubes can withstand large instantaneous overloads with little apparent damage.

The advent of the solid-state age has brought with it a new set of problems. Solid-state equipment is extremely vulnerable to transients. Voltage surges above rated values, even though only microseconds in duration, will destroy this circuitry. Many baffling failures of solid-state equipment, when thoroughly investigated, have been found to be due to transients which no one knew existed.

Fortunately, the technology that brought us these solid-state wonders has also brought us protective devices to compensate for their weakness. The devices, called transient or surge protectors, are basically metal-oxide varistors. Recent improvements in composition and fabrication have allowed the development of a whole family of devices for overvoltage protection.

Surge protectors designed for home electrical systems are now available at most electrical supply houses. The units are intended for use in service-entrance boxes and fit into standard knockout holes. They will provide protection for household circuits against surges capable of damaging common electrical equipment.

The protection unit is connected across the line as shown in Fig. 1. Connection is simple; anyone with a basic understanding of electricity can connect it. Open the main breakers when installing the unit. The protector remains in a non-conducting state under normal conditions. Voltages exceeding 175 V cause the unit to conduct, diverting the transients to ground. The action is somewhat similar to that of the common zener diode. The unit returns to a non-conducting state when the voltage returns to a level below its critical breakdown value.

Not only ham equipment, but also most of the new things we buy for our homes, from clocks to ranges, now include solid-state devices. So a suppressor on your incoming line could save more than just your ham gear.

Manufacturers recommend placing a protection unit as far ahead of your household wiring as possible for maximum protection. However, your local power company may have ideas on placement. Mine would not allow placing the protector ahead of the main breakers. You can argue with them, but camp lanterns are tiring and they won't run our refrigerator or my ham rig. So, do what they say. Connected this way, a severe surge could wipe out the main breakers but the individual circuits are still protected. It's a small investment in peace of mind. ■

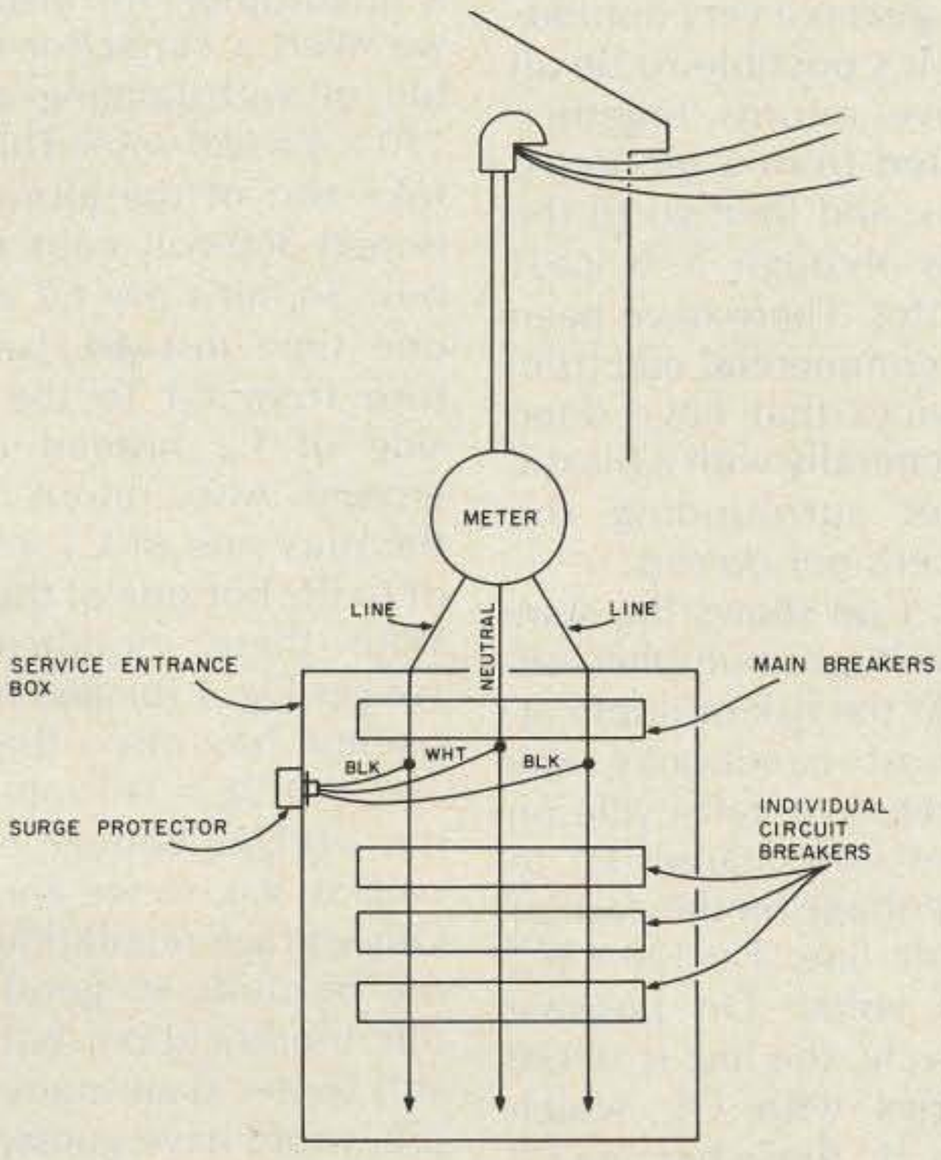

Fig. 1.

Reference

General Electric, *Transient Voltage Suppression Manual*, 2nd Edition.

Bob Baird W7CSD
3740 Summers Lane
Klamath Falls OR 97601

Higher Voltage, Less Weight

A voltage quadrupler that weighs ounces? You bet—and cheap surplus capacitors make it possible.

Voltage doubler, tripler, and quadrupler circuits were in the books way back in the days of vacuum-tube rectifiers. But with the vacuum tube, we had problems of separate insulated filament supplies and/or limited insulation between an indirectly-heated cathode and its filament. Solid-state diodes took care of this problem very neatly, but the day of the high-capacity capacitor for a reasonable price had not yet arrived. So, the admonition always was, "This is a good circuit for a very limited load. The voltage vs. load characteristic is terrible!"

Well, all of the above shortcomings have been pretty well overcome. Six-hundred-uF, 360-working-volt photoflash capacitors have appeared on the market recently at various bargain prices. I was able to buy 10 for $7.50.

Now we have all of the necessary ammunition. Let's see what we can do with it. First of all, in the interests of safety, we need a circuit where the ground side of the ac line is also the negative terminal to our power supply, if there is to be no transformer. This rules out the full-wave doubler and any quadrupler that might be derived from it. The full-wave doubler has been a favorite for converting a 700-volt TV transformer to 1500 volts dc. With a transformer, you can earth ground at any point you want, but with just the ac line, one side already is grounded. A floating ground in electronic gear is a very dubious thing. It's possible to tie all negative returns together, insulated from a grounded chassis, and then go to the chassis through a by-pass capacitor. There have been some commercial electronic devices that have done this, generally with a plastic cabinet surrounding the unit. *Let's not do this!*

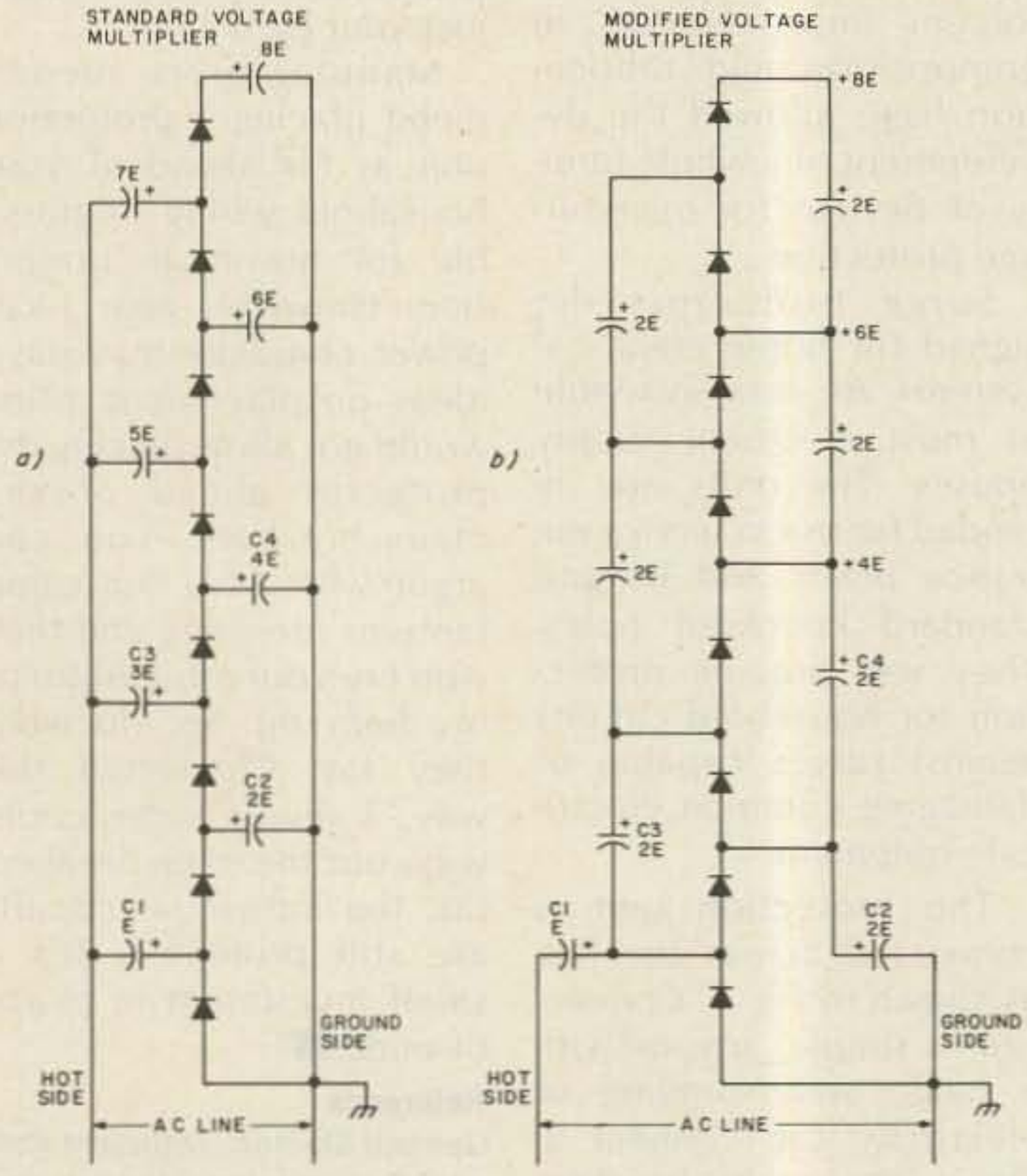

Fig. 1.

Fig. 1 (a) shows the standard-voltage multiplier circuit. At the risk of duplicating most handbooks, the first negative half cycle on the hot side charges C1 to peak voltage (in the case of 120-volt line, $E = 120 \times \sqrt{2} = 170$ volts). On positive half cycle, the line is +170 in series with C1, which makes 2E, thus charging C2 to 2E. The next half-cycle ground side is +E with respect to the hot side. This is in series with C2 and the third diode, thus charging C3 to 3E. The next half-cycle hot side is +E with respect to ground and in series with C3 to make 4E, and C4 is charged to 4E, etc. This can go on indefinitely as long as no current is drawn from the supply, but if the capacitors are large enough, you can get close to the no-load value with considerable load.

Now, it will be noted that we need capacitors with increasing voltage values. For a quadrupler, for instance, we need a capacitor capable of withstanding about $170 \times 4 = 680$ volts. This will take two of the aforementioned 360-volt caps in series. So, let's use C2 a second time instead. Just return from C4 to the plus side of C2 instead of to ground. Also, return C3 to the plus side of C1 instead of to the hot side of the line. With these modifications we get Fig. 1 (b), and no capacitor has more than 2E across it. $2E = 340$ volts, and the working voltage of the caps is 360, so we are safe. Our voltage regulation may not be quite so good with this modification, but it is still better than many people would have guessed.

Fig. 2 shows the charac-

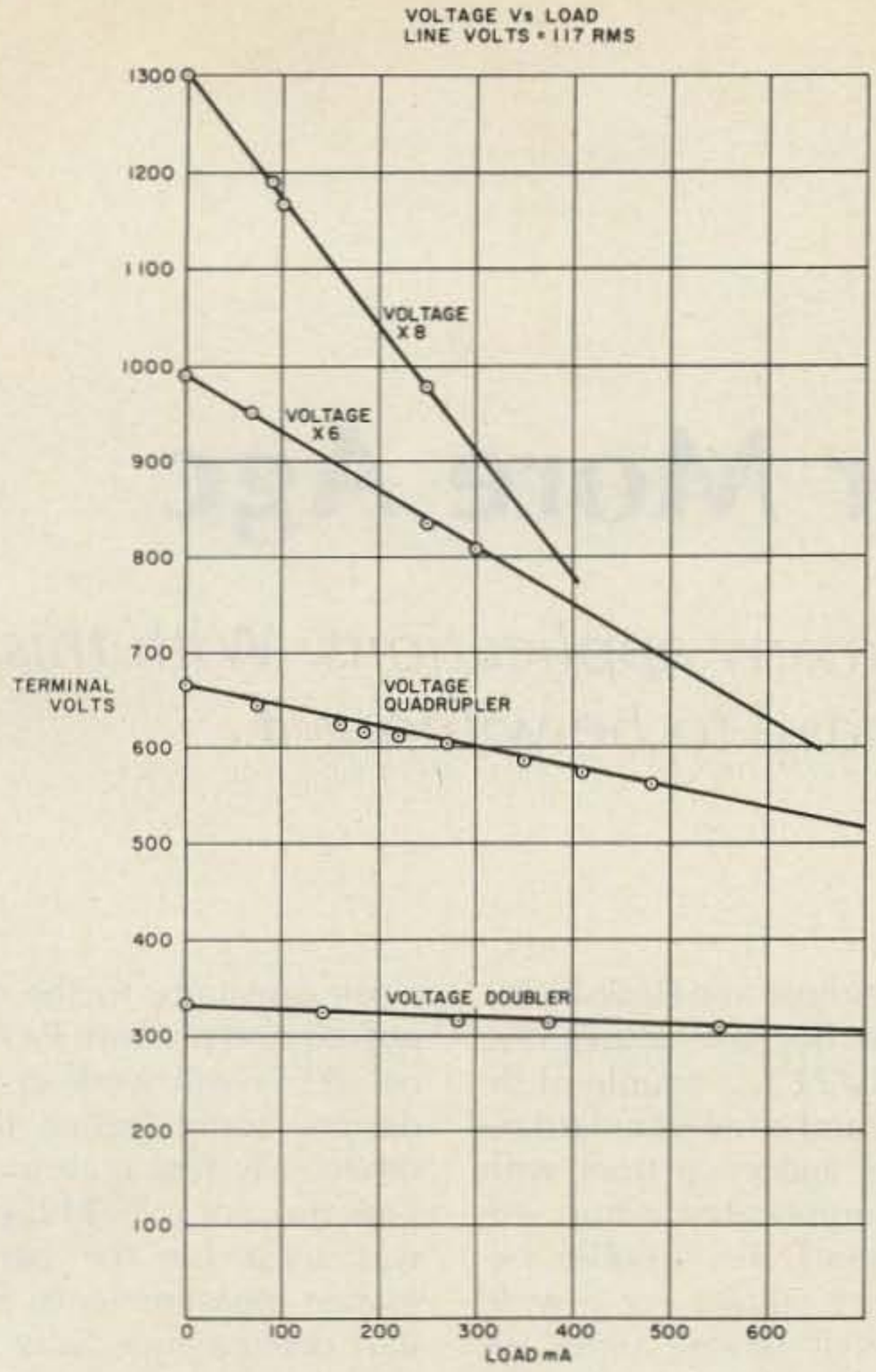

Fig. 2.

teristics of voltage vs. load for a doubler, a quadrupler, times six, and times eight. The quadrupler seems most interesting. This voltage would be enough for a sizable linear and, with speech peaks to half an Amp, might not go much below 600 volts. The times eight supply would deliver about a quarter of an Amp at 1000 volts. This might fit someone's needs. This is a power supply weighed in ounces!

Now let's look at a few practical aspects. How do you get this thing fired up? I used 1000-piv, 2.5-Amp diodes because I had them. Then I brought the voltage up slowly with a variac to run the tests. Once you are up to line voltage you are in business, but don't throw it on the line point blank or the surge current of the capacitors will wipe out your diodes.

On a second power supply, a quadrupler, I put 250 Ohms in series to charge up the capacitors and then shorted it out with a switch before putting any signal into the linear amplifier I used for a load. But you *must* remember to open that switch before you turn on the power the next time! A 30-second thermal time delay could be installed to take care of this.

A second must is that you must carefully polarize your power plug. If you have three-pronged plugs in your wall, determine which pin is hot and which is cold. An NE51 can be made into a tester very easily. Solder a short piece of hookup wire to the center contact. Hold the brass base in your fingers and insert the wire into one pin of the wall plug. If the neon lights, that is the hot side. (Of course, a light bulb wired between one pin and the earth ground will tell you the same thing.)

The same procedure goes for two-pin plugs, but you *must* mark them and always plug in in the proper way. If you are going to plug the supply in in several places, you need to check each plug. Journeymen electricians have been known to get the hot and cold wires reversed even in modern three-pin plugs.

The advantages of the transformerless power supply are obvious. In addition to the savings in bulk and weight, you can mount the whole thing on a piece of perfboard and put it inside the unit you wish to use it with—600 volts for something like $5.

If you live in ZL-land or some country that has two-wire service with 240 volts to ground, a voltage quadrupler has possibilities for something pretty big. ■

Original Data

Doubler		Quadrupler	
mA	**Volts**	**mA**	**Volts**
0	330	0	663
140	323	75	643
280	316	160	623
375	313	185	616
550	308	220	611
		270	602
		350	585
		410	573
		480	561

x6		x8	
mA	**Volts**	**mA**	**Volts**
0	987	0	1300
70	950	104	1170
250	834	90	1190
300	807	250	976

Table 1.

See List of Advertisers on page 114

Ed C. Miller N7APE
306 W. Court St.
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Make Room for More Agc

Automatic gain control is useful in many applications. With this simple circuit, you'll never have to be without it.

What with avc, alc, agc, etc., we have some form of automatic control over the gain or output of a lot of circuits. Still, there is a place where there's room for some more automatic gain control. That's in a speaker amplifier. There are many times when we use a small speaker amplifier to up the level of an output designed for headphones, where the amplifier is used to monitor two or more circuits, or where the amplifier is used with some special equipment that has large output variations. In these cases, manual gain can have a drawback or two—forgetting we've cranked the volume down or up, missing something, or shocking our eardrums.

Here's a circuit for a small speaker amplifier with automatic gain control that is both simple and flexible. It's simple because it uses one IC, one FET, a couple of diodes, and a few standard resistors and capacitors, with no complicated setup adjustments. It's flexible because it allows for a wide range of release times set only by a resistor and/or capacitor.

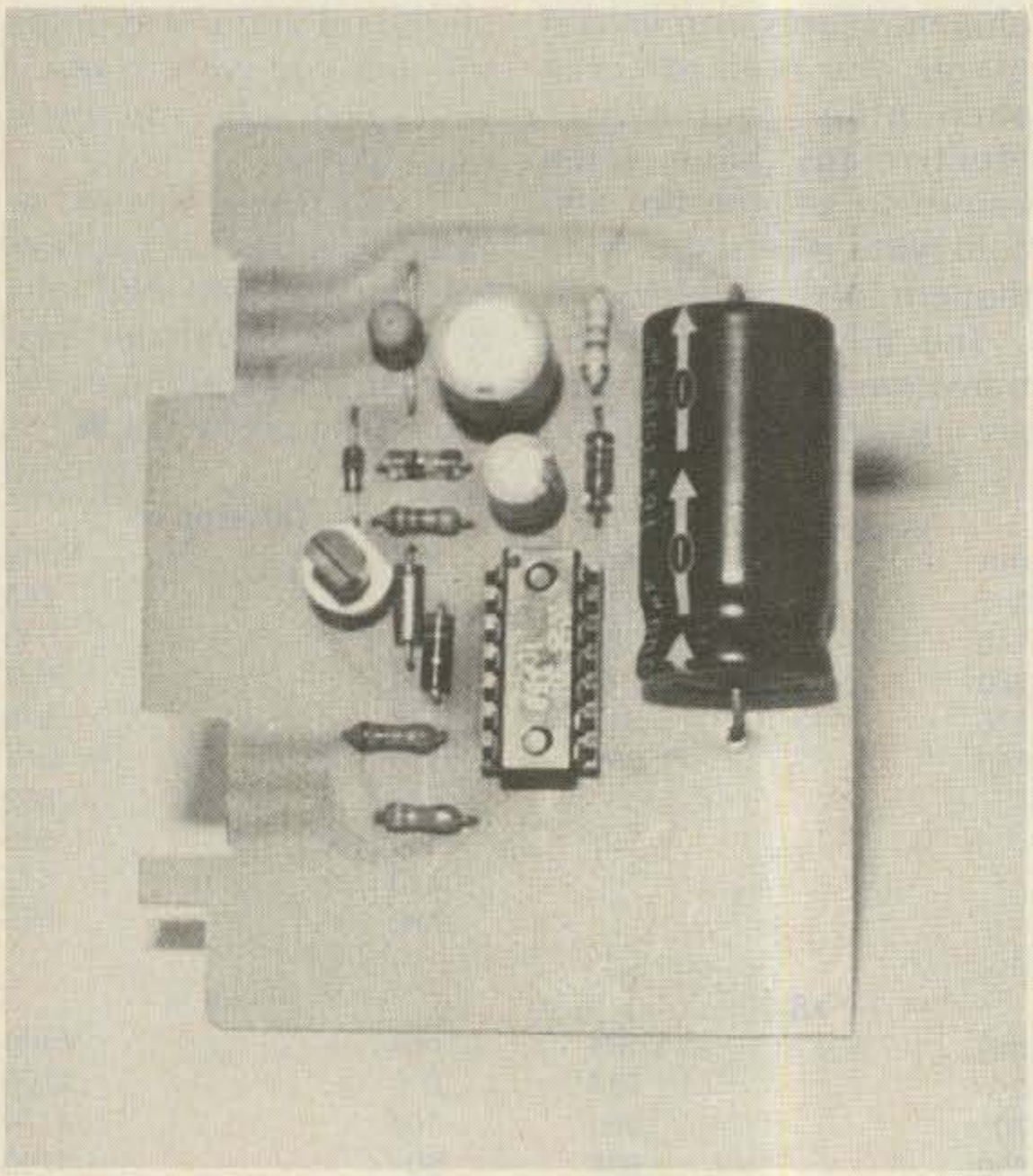


Fig. 1. This photo shows the simplicity of the speaker amplifier to be used in a modular receiver.

There are two primary methods to automatically control the output level of an amplifier stage. One is to vary the gain of the amplifier (remember the 6L7 tube); the other is to operate the amplifier at normal gain and introduce a variable loss pad at its input or output. The latter is the simplest when many of the parts may be coming from the junk box. In the unit shown, the loss pad is at the input to the amplifier where the signal level is small. This reduces the distortion introduced by the variable impedance leg of the pad—in this case, an FET. Distortion is further reduced by applying a proportional signal through the FET to the inverting input of the amplifier.

Layout is not too important. It should be remembered that the LM-380 is a high-gain IC and the input wires should be as short as possible and not be run in close proximity to the output circuitry. Most P-channel JFETs will work in this design—some better than others. My first grab in the junk box got a T-1812, so it was used for the performance measurements. Similar performance was obtained with several other types that were tried. JFETs with pinch-offs that are considerably removed from those of the T-1812 might require another value for the zener diode.

Note that diode D1 is germanium and D2 is silicon. Germanium is used at D1 because it requires less voltage to conduct, increasing the first step voltage of the voltage doubler signal rectifier. This same characteristic would be desirable for D2, the voltage doubler's second stage, but even more we need a diode with high reverse resistance. In order to get a release time of about 4 seconds, we need a large RC combination. To keep the attack time short, C should be less than 3 uF, which means an R value of about 2 megohms. The reverse resistance of D2 should be some 5 to 10 times this value. Almost any silicon signal diode such as the 1N914 or 1N4148 will meet this criterion.

Figs. 3, 4, and 5 show the

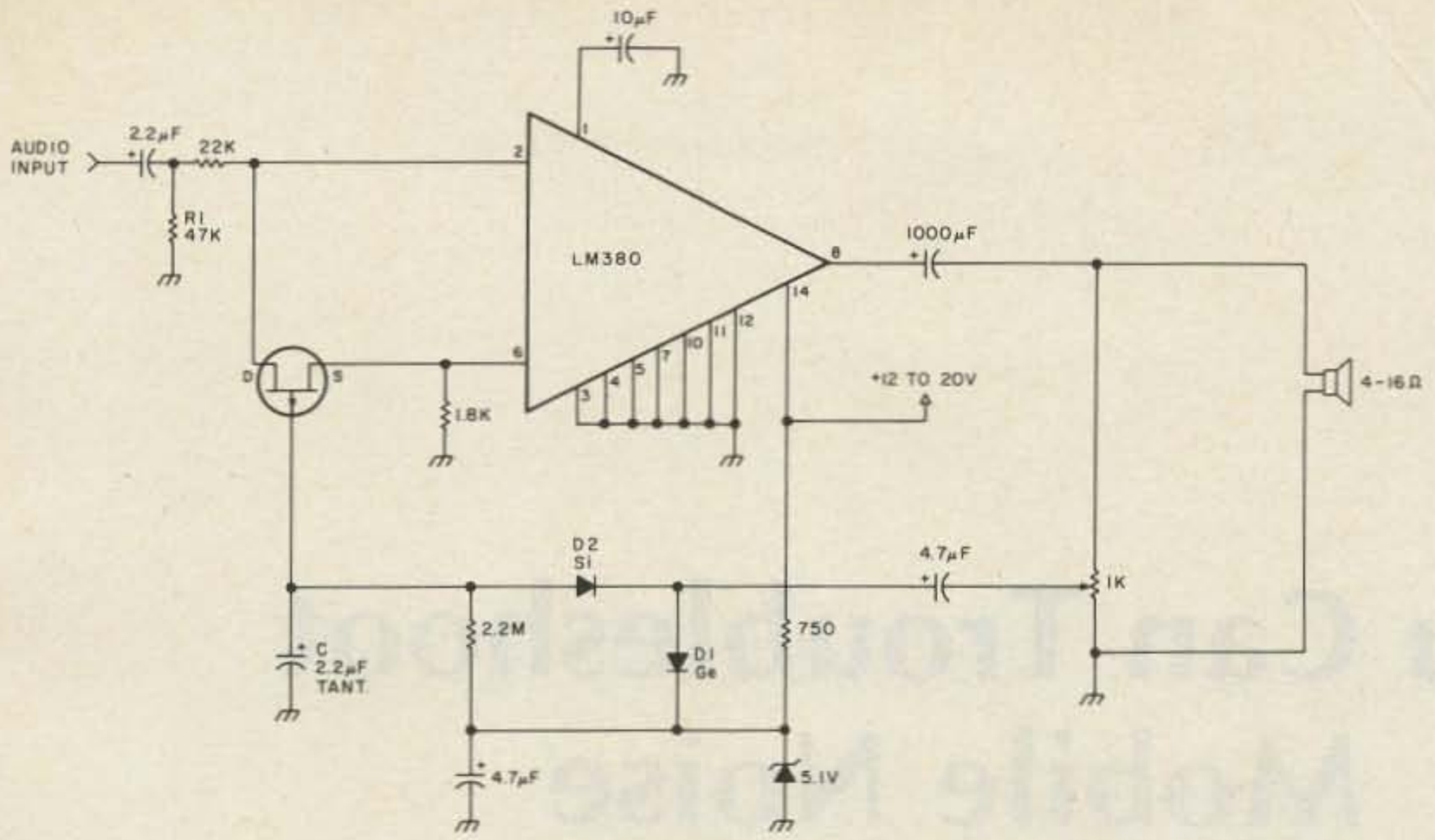


Fig. 2. Schematic.

frequency response, compression characteristics, and distortion at various levels of compression. These were all measured at 125 mW output, which seemed to drive a 6-inch-high efficiency speaker at the volume I wanted in my shack.

The potentiometer sets the output level at which compression starts. When its arm is at the ground end, the compression circuit is, in effect, disabled. Although no input control is shown, one could be inserted by replacing R1 with a 50k pot to permit monitoring a variety of levels greater than the compression range of the amplifier. If the output is too much with the FET you're using, a resistor in series with the speaker is the simplest way to bring it into line. It will affect the fidelity a little, but not enough to bother in communications service. The resistor value can best be determined experimentally and probably will be between 4.7 and 100 Ohms. A variable speaker pad also would work well.

There are many reasons why it pays to build this compression circuit into almost any audio amplifier that uses an LM-380. For one, it takes nothing away from its normal operation—when the arm of the pot is at the ground end, you have a standard amplifier. The small amount of time, money, and space that it takes to add this circuit gives big rewards in keeping the output at a consistent, comfortable level.

Try it. You'll like it. ■

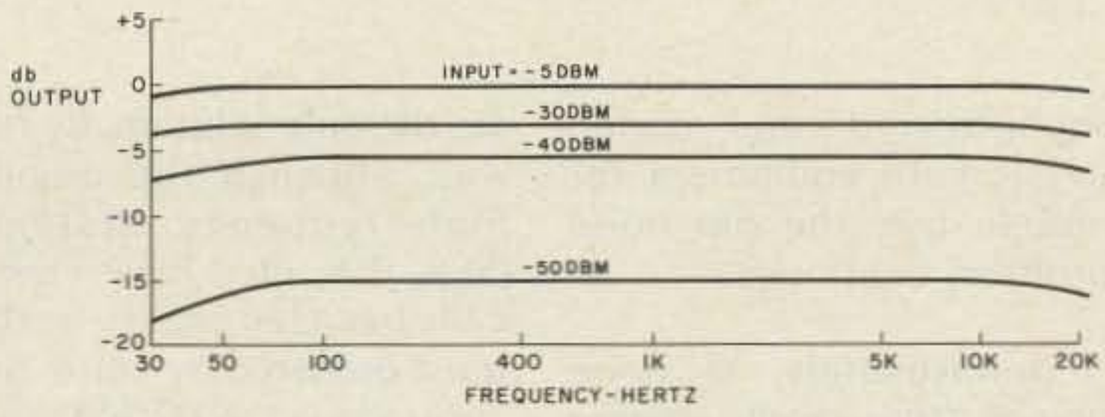


Fig. 3. Frequency response vs. input.

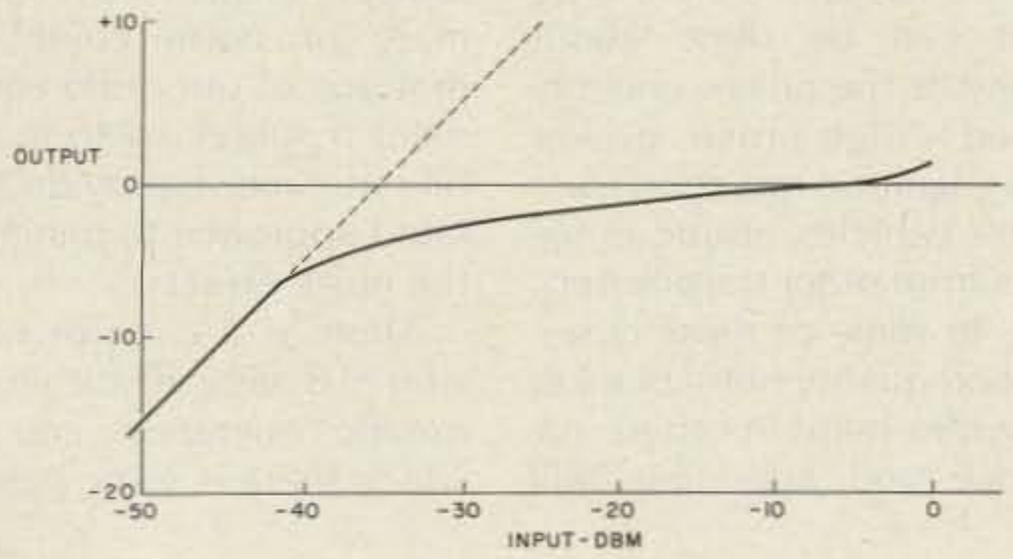


Fig. 4. Compression characteristics.

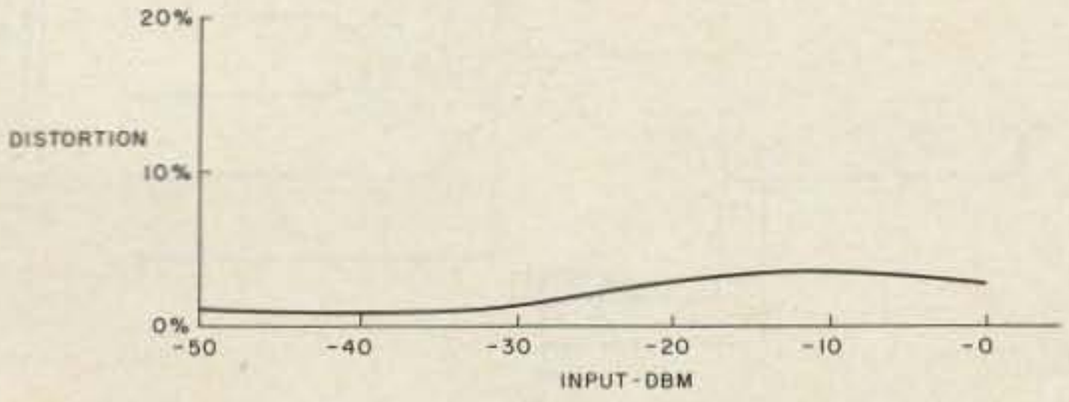


Fig. 5. Distortion.

See List of Advertisers on page 114

Donald G. Wiseman K5CA
4816 33rd Street
Dickinson TX 77539

You Can Troubleshoot Mobile Noise

K5CA tells what to do when a signal is 5-7 and the noise is 5-9.

Over the years ham radio interests, along with methods and equipment, have continued to evolve. Early in ham radio history the desire to convert heavy fixed-station receiving and transmitting gear to use in vehicles appeared, resulting in the first "mobile" operations. This modification process was difficult enough considering weight, size, and power requirements, but along with these came a whole new realm of problems.

Fixed-station operation has always had problems with the noise and interfering signal environments. Great as these problems have been, at least they are generally consistent and geographically contained. Mobile operation, however, not only is affected by all these noise problems, but also adds the new dimensions of vehicle-generated noise and noise from changing locations. Although today we have developed much more reliable, more sophisticated, and easier-to-integrate equipment for mobile use, the old noise problem continues.

Unfortunately, rf noise comes from many sources and when in motion, practically all of these come into play at one time or another. To be honest, there's little that can be done about many of the noises encountered—high-noise power lines, ignition radiation from other vehicles, spurious signals from other transmitters, etc. In some of these cases, a good-quality noise blanker provides help. In others, patience and operating skill are the only solution. By the way, although the mobile high-frequency systems (SSB, CW, etc.) have classically been the ones to be the most bothered by noise, the "noise-free" VHF/FM systems so popular today also have their share of noise problems. This article attempts to provide a summary of noise conditions that any of our radio equipment is subjected to in mobile use and to provide a related approach to minimize the noise effects.

There is a class of noise which is very disturbing in mobile operation and for which there is some reason-

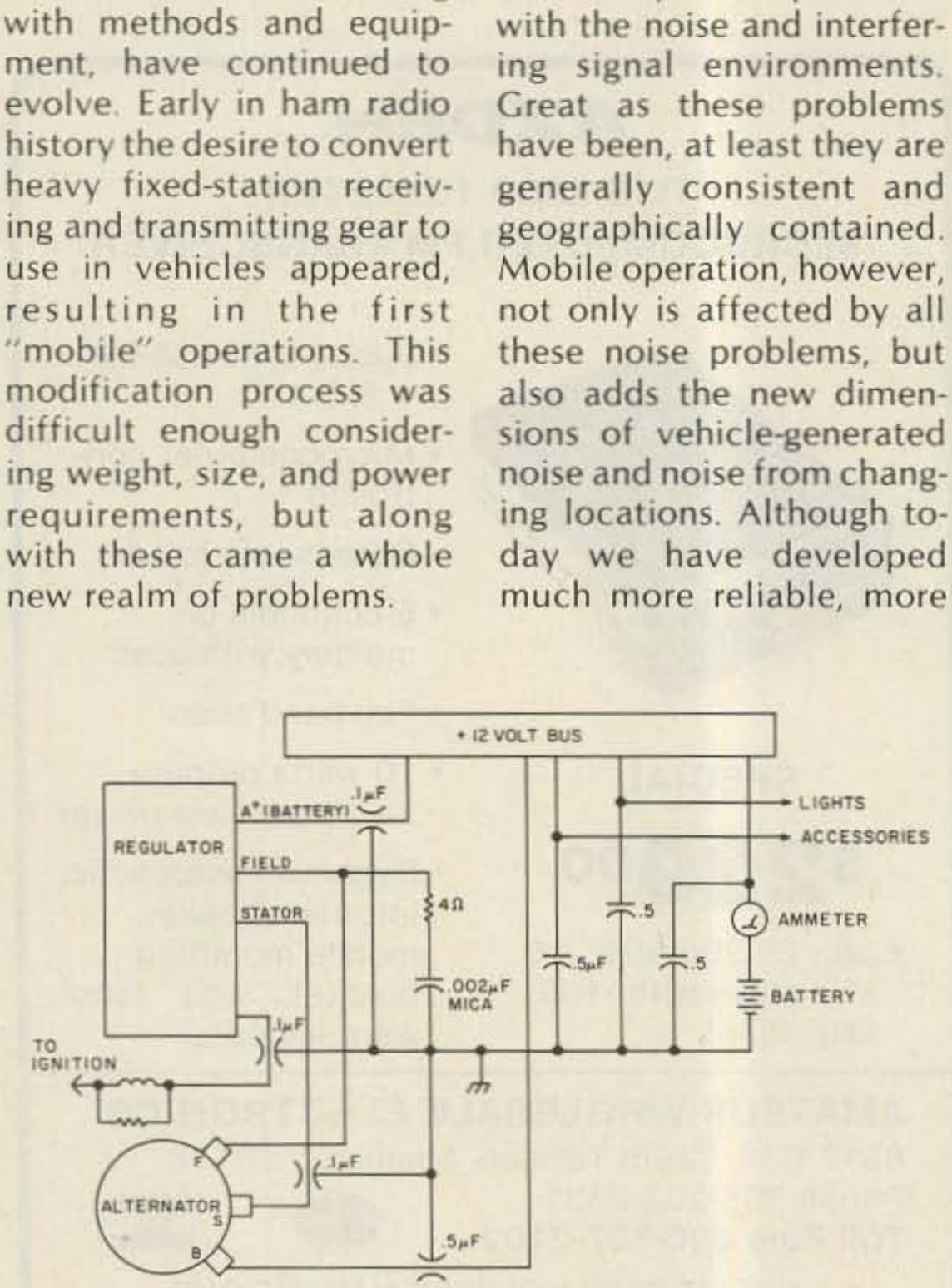


Fig. 1. Electrical power system.

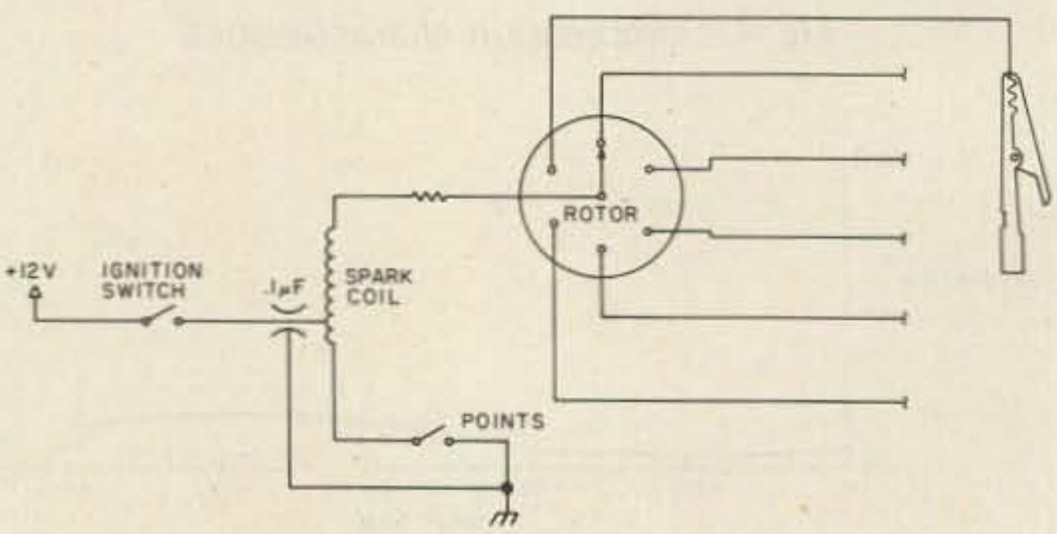


Fig. 2. Ignition system.

able solution. This class of noise is that generated within the vehicle where the station is installed. Right off the top, even using the best equipment and techniques, some noise may persist. However, to wage a solid battle against the aggravation of vehicle noise, the approach outlined here may be of real value. This approach is not new; many publications have presented such information in the past, and several were consulted in putting this article together.

The secret to lowering rf vehicular noise levels is:

- Identify the noise and the noise source.
- Eliminate the noise at the source if at all possible.
- Minimize noise-conducting and/or radiating paths.

When working on noise problems, you may find several distinct noises present. Work on these starting with the loudest/strongest first, then proceed downward through the list by next strongest one at a time. The following approach may help to identify the source of each noise.

Perform a vehicle-in-motion test. Run the vehicle in an area large enough to maneuver, but away from fixed noise sources (buildings, power lines, etc.).

Run the auto at moderate speeds; while moving, place the transmission in neutral and turn the ignition switch to accessory. If the noise goes away as you coast, it's most likely coming from the ignition system. (Be careful with this test, especially if you have power steering.) If the noise is a varying-pitch whine and stops with the ignition off, it's probably coming from the alternator. If the noise has a clicking or popping sound without any particular frequency and it disappears with the engine at idle or off, it's probably produced by the voltage regulator. A hash that has some variation with engine speed but doesn't come from the charging regulator indicates you have a Ford (Ford uses an electromechanical instrument regulator which is a notorious noise source).

In normal driving situations, the following noises and related sources may be noticed. While in motion, a sharp popping noise which doesn't seem to vary with engine speed probably comes from "tire static." (This may come and go as the road surface changes.) A rushing noise with an associated popping indicates a general auto high-static condition. This generally occurs when close by a thunderstorm. A jiggly, scraping noise indicates the production of body static caused by metal elements of the vehicle not electrically connected and rubbing together.

In order to put some systematic approach into play to help identify and combat these noises, prepared. In addition, Table 1 was to outline the typical auto electrical system, Figs. 1 and 2 were developed. These schematics indicate the particular components and hookups which may require attention.

Good luck in identifying and eliminating or reducing your particular vehicle noise problem. Keep in mind that although noise is an aggravation for us in mobile operation and the fixes may take some time and effort, the result is well worth it. Happy motoring! ■

Noise Sound	Possible Source	Steps
Popping changing to hash as engine speed increases	Ignition	Use new resistor spark plugs. Check all ignition cable for loose or poorly-crimped connections (solder where possible). Install resistors in distributor/coil lines and spark-plug lines. Use resistance ignition wires if available. As a last resort, install shielded ignition system (kits available, listed in *QST*).
Whine which changes pitch with engine speed	Alternator	Use a 0.1-uF coaxial capacitor in series with the alternator armature (A) lead. For "hard" cases, place a parallel tuned trap (with heavy wire) in series with the A lead. Tune to the operating frequency.
Irregular clicking	Regulator	0.1-uF coaxial capacitor in series with battery (B) and armature (A) leads. A series .002-uF mica capacitor and a 4-Ohm carbon resistor from the field (F) terminal to ground.
Irregular clicking	Vehicle wiring	0.1 coaxial capacitor in series with battery lead to ammeter; .5-uF coax capacitor in lead to gas gauge; .5-uF coax capacitor in lead to oil signal switch; .5-uF capacitor across headlight and taillight leads and other accessory lines.
Popping noise which changes with road material	Wheel static	Install front wheel hub static discharge springs (from auto parts houses).
Same	Tire static	Inject anti-static powder in tires.
Popping, scratching noise following jolts as the auto moves	Body static	Tighten all screws and bolts. Bond major auto elements to each other with heavy braid and lugs (engine, firewall, frame, fenders, hood, exhaust pipe, etc.).
Hashy Fords	Instrument regulator	Replace with 5-volt electronic module regulator.

Table 1. Mobile noise reduction.

Louis I. Hutton K7YZZ
12235 S. E. 62nd Street
Bellevue WA 98006

Electronics vs. Creepy Crawlers

Build this ultrasonic oscillator and drive pests crazy. Your pet hamster, too.

One thing you will find out when you become interested in electronics or have ham radio as a hobby is that eventually your curiosity will expand to investigating all sorts of electronic devices. This includes accessories for the ham shack, microwave downconverters, radar speed detectors, cable TV gadgets, and other interesting items. This article describes a gadget which has recently appeared on the electronics scene and really caught my attention as something I needed very badly in my ham shack.

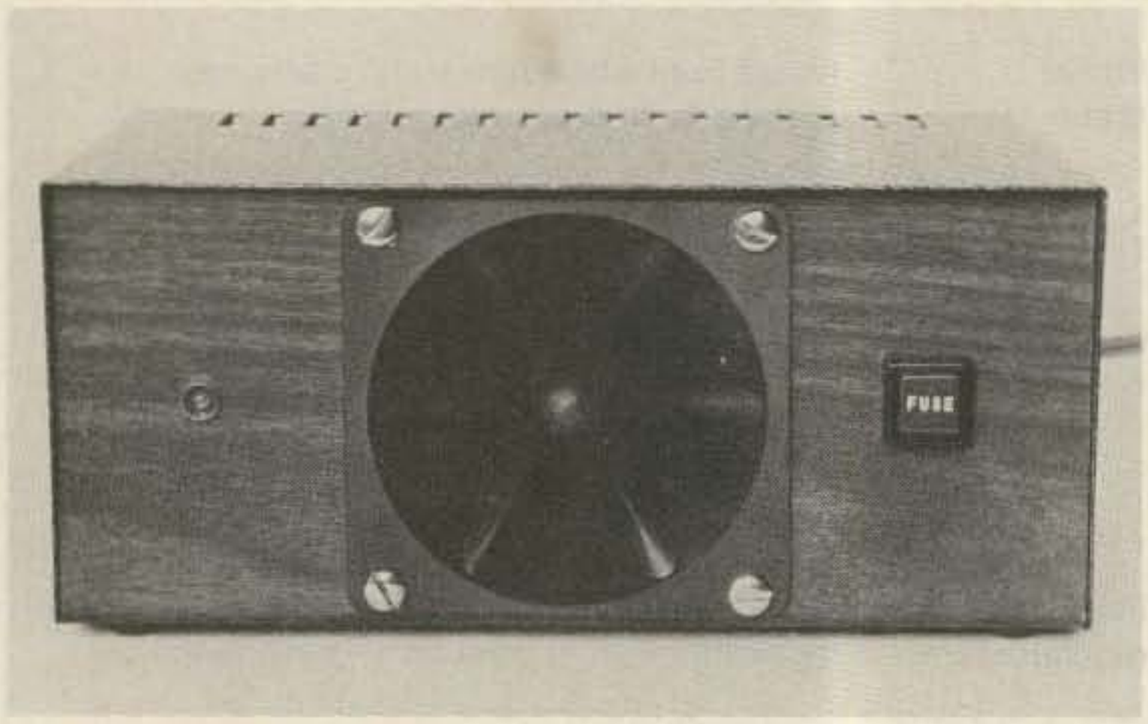
Now, I don't know about your ham shack, but mine is firmly delegated to a room in the basement of my house. The only problem is that since it is at ground level, all sorts of unwanted creepy crawlers invade my shack and take up residence in my ham gear. For many years, pet supply and garden stores have sold all sorts of products to rid a home of those pesky bugs and such. Well, now the electronics industry has taken on the challenge and thinks this is the answer on how to run those bugs out of my ham shack.

Circuit Description and Construction Notes

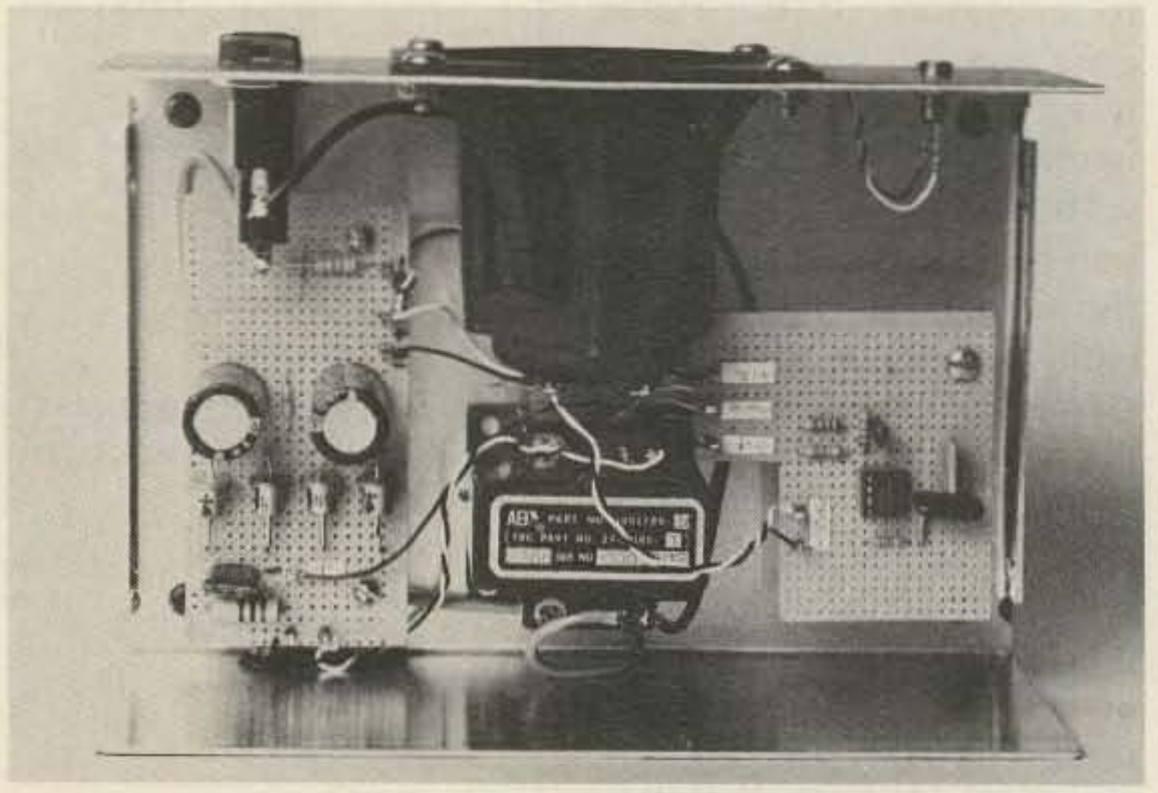
Low-intensity ultrasonic sound waves have been used to repel insects and small rodents. Square waves and pulsed waves have been tested and square waves are reported to be most effective in the 30-45-kHz frequency band. The ultrasonic sound waves are intended to damage the insects' nervous systems. The goal is to drive those creepy crawlers right out of the house. The ultrasonic sound waves are shifted in frequency 60 times per second to cover all of the communication frequencies of the most common pests (how about that—legal jamming!).

The ultrasonic sound emitted by the unit is above the hearing range of people, dogs, cats, and birds. It is reported as not affecting plants, TVs, and radios, but will bother gerbils, ham-

Photos by Betty Hutton



Front view of unit.



Component layout for the ultrasonic bug-chaser.

sters, and other pet rodents.

Several commercial models of bug-chasers have recently appeared on the market (see box). The schematic diagram shown is typical of such units and is designed to generate a swept square wave from 30 to 45 kHz. The LM555 IC is wired as an ultrasonic oscillator driving a piezoelectric speaker of the hi-fi super-tweeter type. The output of the oscillator is swept by a 60-Hz signal from the ac input of the bridge rectifier. The LED acts as a pilot light to let you know the power is on, as the only noise you will hear when this unit is running is a slight buzzing noise coming from the speaker.

An oscilloscope is necessary to observe the square-wave signal on pin 3 of the LM555 oscillator. My unit is built in a cabinet 3-1/2" × 7-1/8" × 5-11/16" (Radio Shack #270-269). The speaker is a 3.5-inch Piezo Super Horn (Radio Shack #40-1381). The oscillator and power supply were built on two small perfboards and bolted on metal standoffs to the chassis floor. No effort was made to design a PC board or to miniaturize the design. The front, bottom, and rear of the cabinet were covered with simulated wood-grain shelf paper to improve the appearance of the unit.

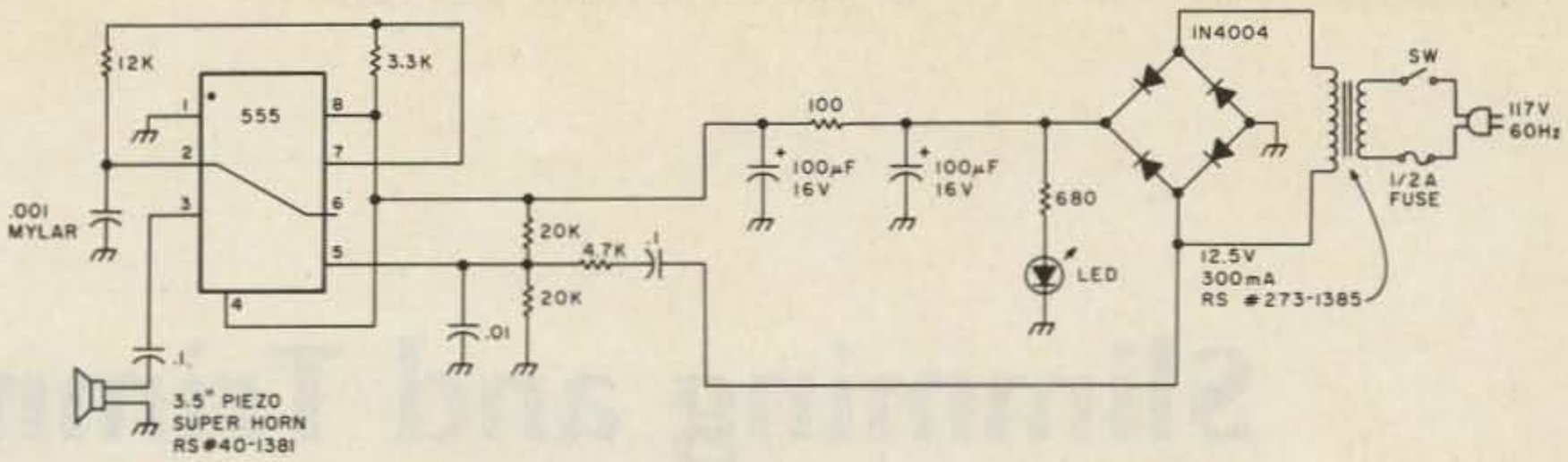


Fig. 1. Ultrasonic bug-chaser schematic.

Operation

I set my unit in one corner of my ham shack facing out into the room so that the ultrasonic sound waves would fill the room by bouncing off the walls, floor, and ceiling. Things like curtains, rugs, and upholstered furniture will absorb the sound waves. You should expect it to take several weeks before the full effect of the irritating ultrasonic sound waves will get to the bugs. I have had several visitors in the shack and they soon note the slight buzzing noise coming from that strange-looking box on the shelf. When told what it is, they unanimously say they want to build one for their own ham shack. Try it; the only thing you will have to lose is those pesky creepy crawlers. ■

COMMERCIAL BUG-CHASERS

"Pest Free," Joe Weiss Co., Rancho Palos Verdes CA 90274.

"Scram," American Acoustics Labs, 629 West Cermak Road, Chicago IL 60616.

See List of Advertisers on page 114

Slimming and Trimming the R-1000

In crowded conditions, the 6-kHz filter may not cut the QRM. Here's the way out.

Milton Ertelt 5Z4CL/K5PAW
PO Box 30514
Nairobi, Kenya

Living overseas and not being able to have at your disposal the type of news and entertainment available in the United States causes many to try shortwave listening to receive news features from home. Our family's habit is to listen to broadcasts of the Voice of America and the Armed Forces Radio and Television Service (AFRTS) in addition to broadcasts from other countries for news and information about current events in the States.

Being in East Africa and tuning the shortwave bands, one quickly notices that Africa is the focal point for hundreds of powerful shortwave broadcasts which result in crowded band conditions and interference between rival programming. Sometimes it is almost impossible to separate from pileups weaker signals like AFRTS not normally beamed to East Africa.

With this background, I purchased the Kenwood R-1000 communications receiver for shortwave listening. The R-1000 is an advanced general-coverage receiver providing continuous coverage from 200 kHz to 30.0 MHz. It features a PLL synthesizer and a digital display for both frequency readout and the built-in clock and timer. It also includes an rf attenuator, a noise blanker, and capabilities for receiving LSB/CW, USB, and AM. For AM, either ceramic filters for 6-kHz or 12-kHz bandwidth are selectable for AM-narrow or AM-wide reception.

Crowded band conditions here in East Africa preclude the use of the 12-kHz filter; the 6-kHz filter is sufficiently wide for good fidelity for shortwave music programs. However, a narrower bandwidth is required for many AM situations, and it is to this end that circuit changes were made.

The plan is to utilize the 2.7-kHz SSB ceramic filter for both the SSB and AM-narrow modes, while the 12-kHz filter normally used for the AM-wide mode is replaced by the 6-kHz AM-narrow filter. The 12-kHz filter will be left on the receiver circuit board, but will not be used. These changes can be made by the addition of one silicon diode (1N914 type) and one wire and the removal of two existing wires. These changes can be accomplished in less time than it takes to explain. No holes are drilled, so the R-1000 can be returned to its original configuration at any time.

Here, then, is a step-by-step record of these changes:

1. First, remove both the top and bottom covers from the receiver. The speaker leads can be easily slipped off the speaker terminals.
2. Remove 2 wires, white/brown and white, from terminal #1 of the AMW mode switch, and tie these leads off, taping the ends to prevent shorts. Terminal numbering (on the Mode switch) is derived from the R-1000 Service Manual and is not clearly marked on the switches themselves. However, terminal #1 on the

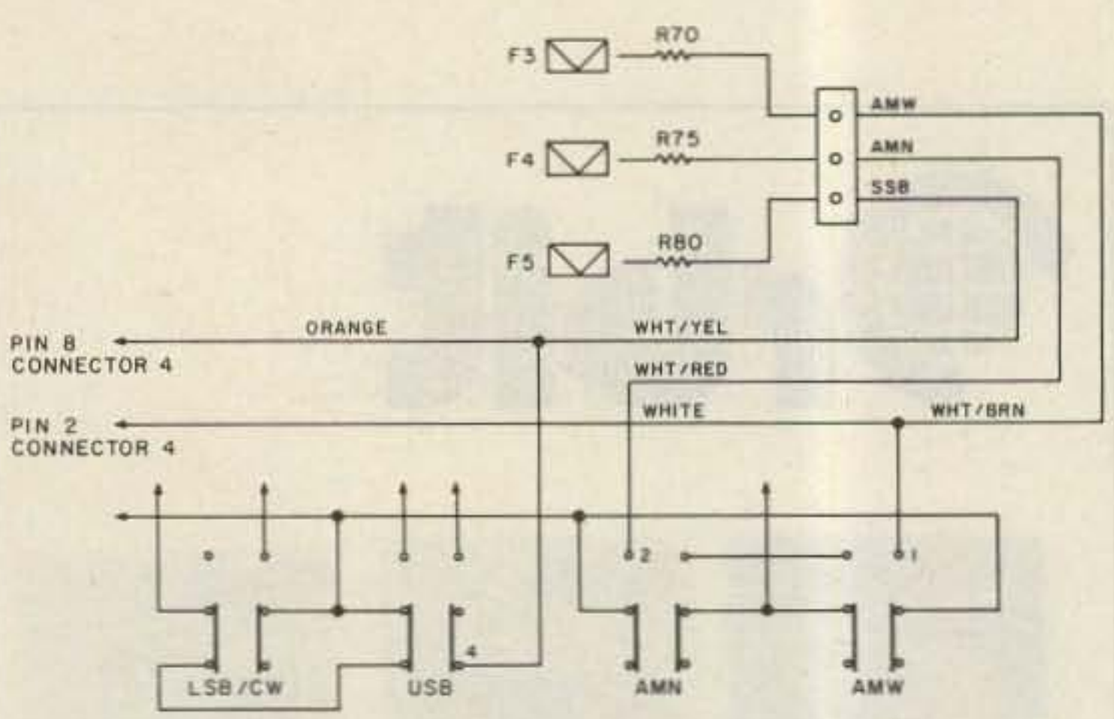


Fig. 1. Before modification.

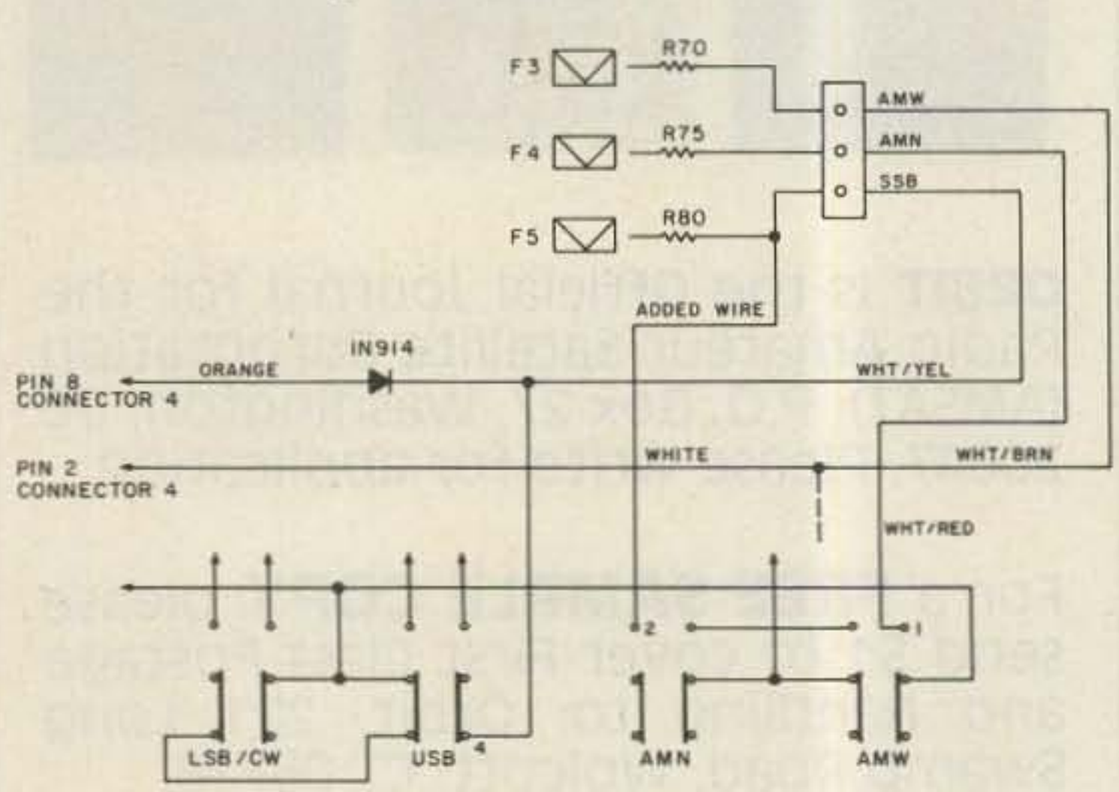


Fig. 2. After modification.

AMW mode switch is the one to which the wire pairs white/brown and white are terminated.

3. Remove the white/red wire from terminal #2 of the AMN mode switch and solder to terminal #1 of the AMW mode switch. Again, identify terminal #2 as the one to which the white/red is terminated.

4. Add a wire from terminal #2 of the AMN mode switch now vacant as a result of step 3 above, and dress it near the vfo case, running it through the slot formed between the vfo case and the receiver circuit board to the top side of the chassis. Connect this new wire to resistor R80. The connection should be made on the lead of R80 nearest to connector #3 (see Fig. 3). There should be enough room between the surface of the circuit board and the insulated portion of R80 to make the solder connection.

5. On the bottom side of the receiver, locate, within a bundle of wires running from the Mode switch near the Band (megahertz) switch, the orange wire running between terminal #4 of the USB mode switch (this is the only orange wire on the USB Mode switch). Then find terminal #8 of connector #4 on the top of the chassis. Pull the orange wire away from the wire bundle at a point near the Band (megahertz) switch and cut the wire at a point just behind the Band (megahertz) switch. Strip about ¼" of insulation from both ends of this wire and solder a 1N914 or equivalent diode between the two ends of the orange wire. The cathode should be closest to the USB Mode switch and the anode facing terminal #8 of connector #4 (see Fig. 2).

6. Replace the leads on the terminal of the speaker and install the top and bottom covers of the receiver.

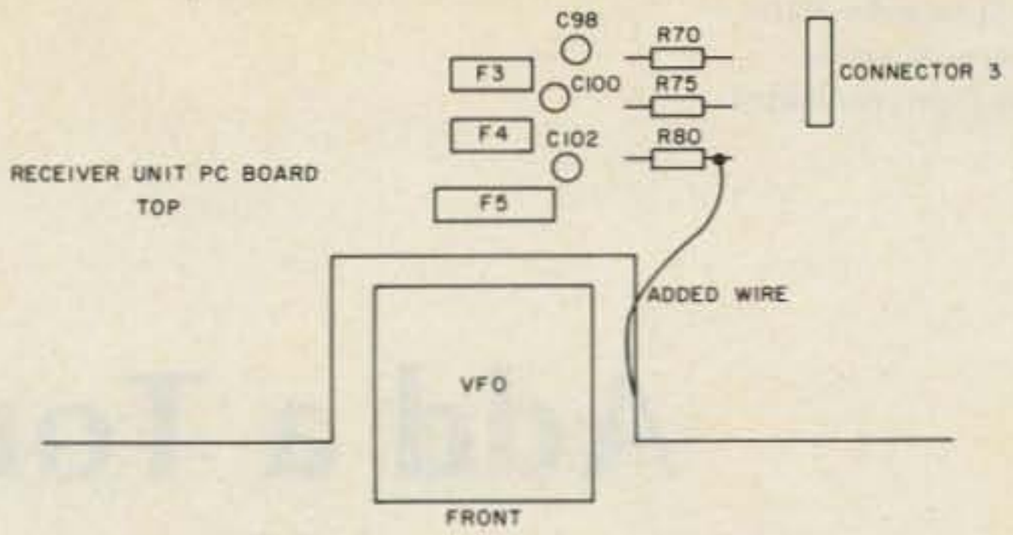


Fig. 3. Receiver unit PC board (top view).

Pressing the AMW position on the Mode switch now selects the 6-kHz bandwidth filter for AM-wide reception. Pressing the AMN position selects the 2.7-kHz bandwidth filter for AM-narrow reception, while the SSB position remains as before.

The end result is a receiver with bandwidth sufficiently wide for good fidelity during listening periods when interference is light. During periods of high interference or in crowded band conditions, the bandwidth of the new AM-narrow mode is extremely sharp, providing an increased ability to separate closely bunched signals. The SSB operation of the receiver is unaffected by these changes.

There are other ways to accomplish the same modification. One could purchase from Kenwood an additional SSB ceramic filter and substitute it for the currently installed AM-narrow filter. But this would be more expensive, and, I believe, more work. These changes improve the operation of an already fine piece of radio equipment. ■

✓See List of Advertisers on page 114

Dave Schmarder N2DS
11 Beaver Avenue
Beaver Dams NY 14812

Add a Touch of Class to CB Conversions

Converting a Hy-Gain board to 10 meters is only half the story. Try adding a digital readout and scanning capability . . .

Have you been bitten by the ten-meter FM bug? Do those Hy-Gain CB boards look interesting? Here is your chance to do a little bit of building and have a lot of fun. Since the actual rf conversion of the Hy-Gain boards has been well described in past *73 Magazines*,[1] I will only deal with this digital-scanning frequency selector.

This circuit will give you direct frequency readout. Example: 60 = 29.60 MHz, and so on. There are 40 channels available at 10-kHz increments with a repeater offset for 20 of these channels. A squelch-operated scanner allows you to search the band without lifting a finger.

The crystal in the radio which is 11.8066 MHz has to be changed to 12.69166 MHz. This crystal can be obtained from Jan Crystals in Ft. Myers, Florida. Pins 8 and 9 of the PLL-02 have to be tied to plus 5 volts (preload to binary 192). Pin 10 must be separated from pin 9. This is the conversion that differs from the original in the reference. It is important to get a CB board with a 16-pin PLL chip. The ones with 18 pins require changing the chip to a PLL-02 and rewiring.

The best way I found to build this is shown in Fig. 2. I use perfboard with the holes spaced at .1 inches. The parts are not critical, but an LS series IC can be used to reduce current drain. Five volts must be provided and a 7805 IC can be mounted on the TA7205P heat sink on the radio.

Refer to Fig. 1 for the fol-

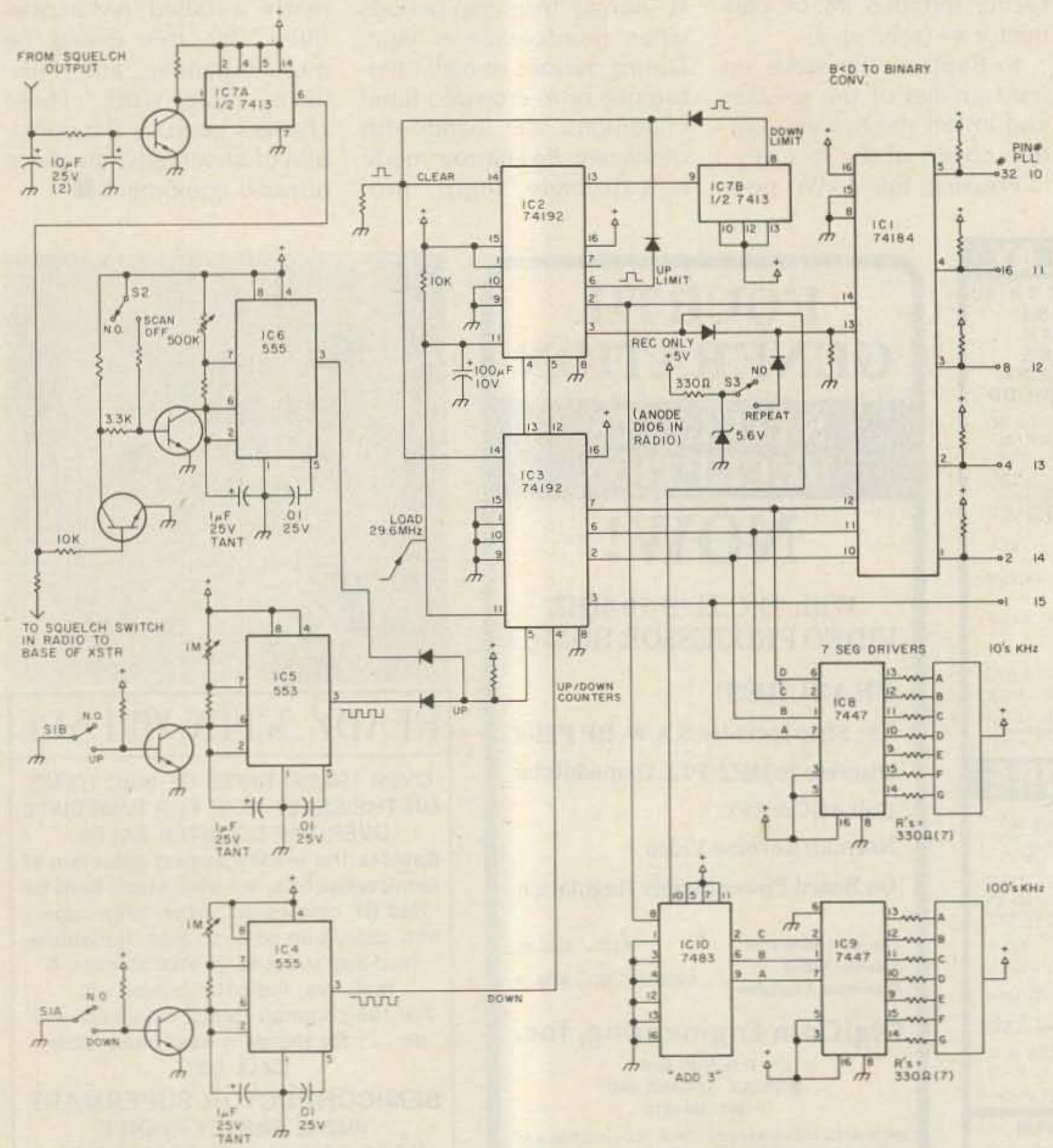


Fig. 1. All transistors—2N3904. All unmarked resistors are 1k Ohms. All + are 5 volts. All diodes—1N4148.

lowing circuit details. IC1 is a BCD-to-binary converter. The PLL-02 IC in the radio requires a binary code to select the frequency we want. But to make it easier for us to select the frequency, it is converted from BCD. IC2 and IC3 are up/down counters that provide the sequence counting and the memory for the selected frequency. The counters are driven from IC4, IC5, and IC6, which are gated astable multivibrators. IC7a is used as a Schmitt trigger which is driven from the squelch output. A dc signal must be fed to this so that a high level (greater than one volt) will raise up the base of Q120 in the radio, thus squelching the radio. IC8 and IC9 are BCD decoder/drivers for the LED readouts. The pinout of the readouts depends on what type of common anode displays they are. IC10 is a binary adder. This circuit "adds" 3 to any number found at the output of IC2 (0 to 4). This will let the LED display read the operating frequency, not just a channel number. For example, when the outputs of IC2 and IC3 are all zero, the frequency of the radio is 29.30 MHz. But without IC10, the readout would read "00". But with the "3" added, the readout reads "30".

S1a and S1b is a momentary SPDT center-off toggle switch. When the switch is closed in either direction, it turns off the transistor associated with it and this allows the up or down multivibrators to operate. S2, the scan switch, when closed prevents the squelch circuits from starting the IC6 multivibrator, which is used to run the scanning section. The repeat switch, S3, when open does nothing to the radio. But when closed, it will add 100 kHz to the operating frequency on receive only. When the PTT is pushed, the radio will transmit on the displayed frequency. The anode of D106 in the radio provides about 7 volts in receive only, which makes this offset possible. A special note: This offset circuit works only between 29.30-29.39 and 29.50-29.59 MHz. But the repeater inputs are between 29.51 and 29.59 MHz.

Another feature of this circuit is that when the radio is turned on, the frequency will be 29.60 MHz, which is the international simplex calling frequency. This is done by slowly bringing up pin 11 on IC2 and IC3 during power-up.

In closing, I would say that the use of this circuit really adds polish to these converted CB boards. I would like to thank Charlie DeVoe WA2IUJ for building one of these, to show it could be repeated, and for his opinion of its operation.

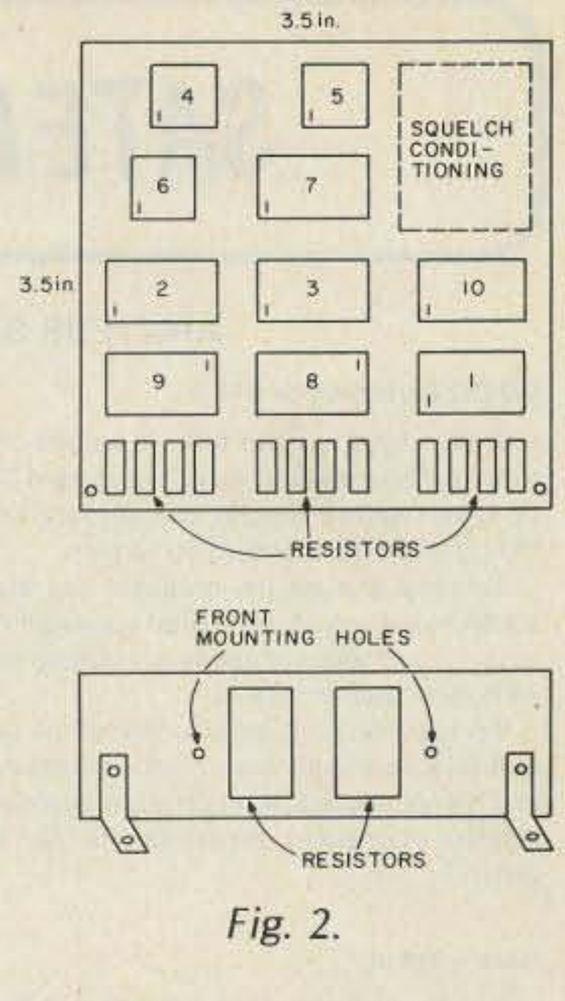


Fig. 2.

I welcome any comments, and I will reply to any questions when an SASE is enclosed. ■

Reference

1. Howard Knickerbocker K1DCS, Andrew Weise N1XN, and Robert Stielau W1WRO, "CB to 10 FM—best conversion yet?", *73 Magazine*, January, 1980, p. 117.

✓See List of Advertisers on page 114

SATELLITES

AMATEUR SATELLITE NEWS

CQ CQ Earthside de STS-9

Well, maybe not, but there is a good chance that amateur radio will be among the astronauts' leisure-time activities aboard STS-9, the ninth flight of NASA's Space Shuttle. Dr. Owen Garriot W5LFL, one of four STS-9 crew members, will operate a small 2-meter FM rig, if all goes according to plan.

Actually, though the proposal has plenty of support from the amateur community, NASA has yet to grant its final approval. W5LFL himself is said to be pushing for the ham activity, and there is plenty of backing from the ARRL, AMSAT, and a number of prominent individual amateurs.

Yet to be decided is the format of the space-borne amateur festivities. A free-for-all operation would likely result in the greatest pileup of all time, complete with frayed nerves and rising tempers. A much more organized method will no doubt evolve—perhaps even a series of one-way transmissions from W5LFL to the thousands of us listening on the ground.

Iskra—Again!

Cosmonauts aboard Russia's Salyut 7 space station have once again launched an amateur satellite. Iskra 3, like its predecessor Iskra 2, was literally tossed out the back door by the cosmonauts, who pushed it through an air lock normally used to jettison refuse. The satellite was launched last November 18 and features a telemetry beacon on 29.583 MHz.

If the example of Iskra 2 is the norm, Iskra 3 may be short-lived. Iskra 2 survived only eight weeks in orbit following its May 17, 1982, launch before plunging back into the atmosphere. And what of the never-mentioned Iskra 1? If the Soviets know, they aren't telling.

Orbital Calendars

Once again this year, Project OSCAR, Inc., has produced an orbital calendar for amateur satellite users. The 1983 version contains the time and longitude of every northbound equatorial crossing for each of the amateur satellites carrying a communications transponder: OSCAR 8, RS5, RS6, RS7, and RS8. It's a real time-saver.

The calendar is available in the USA, Canada, and Mexico for a $10 donation ($12 elsewhere). Send a mailing label, along with your check or money order, to: Project OSCAR, Inc., PO Box 1136, Los Altos CA 94022.

Thanks to *Amateur Satellite Report* and the *W5YI Report* for portions of this month's news.—Jeff DeTray WB8BTH, *73* Staff.

Amateur Satellite Reference Orbits

	Date	OSCAR 8 UTC	OSCAR 8 EQX	RS-5 UTC	RS-5 EQX	RS-6 UTC	RS-6 EQX	RS-7 UTC	RS-7 EQX	RS-8 UTC	RS-8 EQX	Date
Feb	1	0002	80	0154	103	0006	80	0008	78	0113	92	1
	2	0007	81	0149	104	0149	107	0157	107	0110	93	2
	3	0011	82	0144	104	0134	105	0147	106	0107	93	3
	4	0016	83	0138	104	0118	103	0138	105	0104	94	4
	5	0020	84	0133	104	0103	100	0128	104	0101	95	5
	6	0024	85	0128	104	0048	98	0119	104	0059	96	6
	7	0029	86	0122	105	0032	96	0109	103	0056	97	7
	8	0033	88	0117	105	0017	93	0059	102	0053	97	8
	9	0038	89	0112	105	0001	91	0050	101	0050	98	9
	10	0042	90	0106	105	0145	119	0040	100	0047	99	10
	11	0046	91	0101	105	0129	116	0030	99	0044	100	11
	12	0051	92	0056	105	0114	114	0021	98	0042	101	12
	13	0055	93	0050	106	0059	112	0011	97	0039	102	13
	14	0059	94	0045	106	0043	109	0001	96	0036	102	14
	15	0104	96	0039	106	0028	107	0151	125	0033	103	15
	16	0108	97	0034	106	0012	105	0141	125	0030	104	16
	17	0113	98	0029	106	0156	132	0132	124	0028	105	17
	18	0117	99	0023	107	0140	130	0122	123	0025	106	18
	19	0121	100	0018	107	0125	127	0112	122	0022	106	19
	20	0126	101	0013	107	0110	125	0103	121	0019	107	20
	21	0130	102	0007	107	0054	123	0053	120	0016	108	21
	22	0135	103	0002	107	0039	120	0043	119	0013	109	22
	23	0139	105	0156	137	0023	118	0034	118	0011	110	23
	24	0000	80	0151	138	0008	116	0024	117	0008	111	24
	25	0005	81	0145	138	0151	143	0014	117	0005	111	25
	26	0009	82	0140	138	0136	141	0005	116	0002	112	26
	27	0013	83	0135	138	0120	139	0154	145	0159	143	27
	28	0018	84	0129	138	0105	136	0145	144	0156	144	28
Mar	1	0022	86	0124	139	0050	134	0135	143	0153	145	1
	2	0027	87	0119	139	0034	132	0125	142	0151	146	2
	3	0031	88	0113	139	0019	129	0116	141	0148	146	3
	4	0035	89	0108	139	0004	127	0106	140	0145	147	4
	5	0040	90	0103	139	0147	155	0056	139	0142	148	5
	6	0044	91	0057	140	0131	152	0047	138	0139	149	6
	7	0048	92	0052	140	0116	150	0037	138	0136	150	7
	8	0053	93	0047	140	0101	148	0027	137	0134	150	8
	9	0057	95	0041	140	0045	145	0018	136	0131	151	9
	10	0102	96	0036	140	0030	143	0008	135	0128	152	10
	11	0106	97	0031	140	0014	141	0158	164	0125	153	11
	12	0110	98	0025	141	0158	168	0148	163	0122	154	12
	13	0115	99	0020	141	0142	166	0138	162	0119	154	13
	14	0119	100	0015	141	0127	163	0129	161	0117	155	14
	15	0124	101	0009	141	0112	161	0119	160	0114	156	15
	16	0128	103	0004	141	0056	159	0109	159	0111	157	16
	17	0132	104	0158	172	0041	156	0100	159	0108	158	17

SOCIAL EVENTS

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

ARLINGTON HEIGHTS IL
FEB 6

The Wheaton Community Radio Amateurs will hold their hamfest on February 6, 1983, at Arlington Park Race Track Expo Center, Arlington Heights IL. Tickets are $3.00 at the entrance and $2.50 in advance. Doors will open at 8:00 am. Flea market tables are free and plenty of floor space will be available. There will be a large commercial area (including a computer section), awards, and clear, paved parking. Talk-in on 146.01/.61 and 146.94. For general information, call W9JTO at (312)-231-9524. For advance tickets, send an SASE to WCRA, PO Box QSL, Wheaton IL 60187.

MANSFIELD OH
FEB 13

The ARRL-approved Midwinter Hamfest/Auction will be held on Sunday, February 13, 1983, beginning at 8:00 am, at the Richland County Fairgrounds, Mansfield OH. Tickets are $2.00 in advance and $3.00 at the door. Tables are $5.00 in advance and $6.00 at the door. Half tables are available. Talk-in on 146.34/.94. For additional information or advance tickets, contact Harry Frietchen K8HF, 120 Homewood Road, Mansfield OH 44906, or phone (419)-529-2801 or (419)-524-1441.

MARLBOROUGH MA
FEB 20

The Algonquin Amateur Radio Club will hold its annual flea market on Sunday, February 20, 1983, at the Marlborough Jr. High School, Marlborough MA. Admission is $1.00 and children under 12 will be admitted free. The doors will open at 9:00 am for dealers and 10:00 am for buyers. Refreshments will be available. Tables reserved before February 12, 1983, are $7.00; any remaining tables will be $10.00 at the door. Talk-in on 146.01/.61 and 146.52. For table reservations or more information, contact Algonquin ARC, PO Box 258, Marlborough MA 01752.

MELVILLE LI NY
FEB 20

The Long Island Mobile Amateur Radio Club Indoor Hamfest will be held on February 20, 1983, from 9:00 am to 5:00 pm, at the Electricians Hall, 41 Pinelawn Road, Melville LI NY, located just north of Exit 49 of the Long Island Expressway (495). General admission is $3.00 and sellers' tables (4' × 6' with oval corners) are $10.00 in advance. Food and refreshments, lots of parking, and coat and equipment checking will be available. For reserved tables, contact Hank Wener WB2ALM, 53 Sherrard Street, East Hills NY 11577, or phone (516)-484-4322 between 10:00 pm and midnight. For additional information, phone Sid Wolin K2LJH in the evening at (516)-379-2861.

ELKIN NC
FEB 20

The sixth annual Elkin Winter Hamfest will be held on Sunday, February 20, 1983, at the Elkin National Guard Armory, located two miles off Interstate 77 at Exit #85 in Elkin NC. Doors will open at 0800 to the public, and breakfast and lunch will be served at the hamfest by the Foothills ARC of Wilkesboro NC and the Briarpatch ARC of Galax VA. Talk-in on 144.77/145.37, 146.22/.82, and 147.69/.09. For ticket inquiries, table reservations, or other information, contact either George Reeves WD4BMG, Route 6, Box 412, North Wilkesboro NC 28659, (919)-670-2803, or Tommy Lineberry WD4BTF, 308 Poplar Street, Galax VA 24333, (703)-236-8424.

LANCASTER PA
FEB 20

The 1983 Lancaster Hamfest will be held on Sunday, February 20, 1983, from 0800 to 1600, at the Guernsey Sales Pavilion, US Route 30 East, Lancaster PA. General admission is $3.00 for all hams and dealer personnel. Table fees are $10.00 in the main display area and $6.00 in the annex area. There will be tailgating if weather permits. Dealer setup is at 0600 by reservation. Talk-in on 146.01/.61, 147.615/.015, and 146.52. For reservations, send checks made payable to SERCOM, Inc., to Hamfest Committee, RD #1, Box 56V, Blue Ball PA 17519.

ROBBINSDALE MN
FEB 26

The Robbinsdale Amateur Radio Club (K0LTC) will hold its Midwinter Madness Amateur and Computer Fest on February 26, 1983, beginning at 8:30 am, at Sacred Heart Church School Auditorium, 4087 West Broadway, Robbinsdale MN. General admission is $2.00 in advance and $3.00 at the door. Contact Bob Reid N0BHC, 19725 Jackie Lane, Rogers MN 55374, for commercial exhibit space (tables are $15.00 each). Flea-market space is available from Barry Blazevic WB0FBN, 5437 Virginia Avenue N., New Hope MN 55428. Doors will open for setups at 7:00 am. Activities will include seminars on antennas, towers, and computer interfacing, as well as a slide presentation on the voyage of the Viking ship *Hjemkomst*. Lunch will be available in the building.

GLASGOW KY
FEB 26

The Glasgow Swapfest will be held on Saturday, February 26, 1983, beginning at 8:00 am Central time, at the Glasgow Flea Market Building, 2 miles south of Glasgow just off highway 31E, Glasgow KY. Admission is $2.00 per person. There is no additional charge for exhibitors. The first table per exhibitor will be free, and extra tables will be available for $3.00 each. There will be a large heated building, free parking, free coffee, and a large flea market. Talk-in on 146.34/.94 or 147.63/.03. For further information, write Bernie Schwitzgebel WA4JZO, 121 Adairland Court, Glasgow KY 42141.

JENSEN BEACH FL
FEB 26

The Martin County Amateur Radio Association will hold its annual free hamfest on Saturday, February 26, 1983, from 8:00 am to 4:00 pm, at Langford Park, Route 707, Jensen Beach FL. There will be free table or tailgate space and free admission. Food will be available or bring your own picnic. There is an area for cooking and playing, so bring the family. Talk-in on 146.46/147.06 (Stuart repeater). For more information, write MCARA, PO Box 1901, Stuart FL 33495.

LAPORTE IN
FEB 27

The LaPorte Amateur Radio Club Winter Hamfest will be held on Sunday, February 27, 1983, at the LaPorte Civic Auditorium, LaPorte IN. The donation is $2.50 at the door and tables are $1.00 each. Dealers will receive help unloading starting at about 6:00 am. For more information or reservations, send an SASE to PO Box 30, LaPorte IN 46350.

LIVONIA MI
FEB 27

The Livonia Amateur Radio Club will hold its 13th annual LARC Swap 'n Shop on Sunday, February 27, 1983, from 8:00 am to 4:00 pm, at Churchill High School in Livonia MI. Reserved table space (12-foot minimum) is available. Talk-in on 144.75/145.35 and .52. For further information, send an SASE (4″ × 9″) to Neil Coffin WA8GWL, c/o The Livonia Amateur Radio Club, PO Box 2111, Livonia MI 48151.

VIENNA VA
FEB 27

The 10th annual ARRL-approved winter season hamfest, WINTERFEST™ '83, celebrating the 20th anniversary of the Vienna Wireless Society, will be held on Sunday, February 27, 1983, beginning at 8:00 am, at the Community Center, 120 Cherry Street, Vienna VA. Tickets are $4.00 and sales tables are $5.00 and $10.00. Parking is free. Features will include a CW contest, commercial displays, an indoor flea market, and outdoor Frostbite tailgating. Excellent food service will be available. Talk-in on 146.31/.91 and 146.52. For additional information, send an SASE to WINTERFEST '83, PO Box 418, Vienna VA 22180, or call Jeff Wilkes W4NFA at (703)-281-4249 or on the Virginia Sideband Net.

MORRIS PLAINS NJ
MAR 4

The Split Rock Amateur Radio Association will hold its sixth annual electronics auction on Friday, March 4, 1983, at VFW Post #3401, State Route 53, Morris Plains NJ. The Morris Plains VFW hall is located a short distance from US 202 and NJ 10 and is easily reached via I-80, I-287, and US 46. Admission is $1.00. Doors will open at 7:00 pm for unloading and inspecting equipment and the auction will commence at 8:00 pm sharp. Items to be sold must be working equipment and loose parts must be bagged in the largest quantity possible. A commission of 10% will be taken on the first $50.00 of each sale. Commissions are payable in cash only. Refreshments will be available. Talk-in on 146.385/146.985 (WR2ADB) and 146.52. For more information, please write to SARA, PO Box 3, Whippany NJ 07981.

OLD BRIDGE NJ
MAR 6

The Old Bridge Radio Assocation will hold its third annual auction on March 6, 1983, at the K of C Hall, Pine Street (just off Route 18), Old Bridge NJ. Doors will open for registration and inspection at 9:00 am and the sale will begin at 10:00 am. Admission is $2.50. On successful sales, there will be a club commission of 10% on the first $100 and 5% on the remainder. Food and drink will be available. Talk-in on .72/.12, .34/.94, and .52. For more information, contact Fred Goldberg WA2BJZ, 29 Clearview Road, East Brunswick NJ 08816, or phone (201)-257-8753.

See List of Advertisers on page 114

SOUTH ST. LOUIS MO
MAR 11

The Jefferson Barracks Amateur Radio Club will hold its annual auction and hamfest on March 11, 1983, at the Carondelet Sunday Morning Athletic Club in South St. Louis MO.

FORT WALTON BEACH FL
MAR 12-13

The Playground Amateur Radio Club will hold its 13th annual North Florida Swapfest on Saturday, March 12, 1983, from 8:00 am to 4:00 pm, and on Sunday, March 13, 1983, from 8:00 am to 3:00 pm, at the Okaloosa County Fairgrounds, Fort Walton Beach FL.

MARTINSVILLE IN
MAR 13

The Morgan County Amateur Radio Club will sponsor the Martinsville Hamfest on March 13, 1983, beginning at 8:00 am, at the Morgan County 4-H Building and Fairgrounds. Admission is $3.00 in advance and $4.00 at the door; children 11 and under will be admitted free. Flea-market space with a table is $5.00 and flea-market space without a table is $3.00. Premium tables are $20.00. Tables will be available on a first-come basis and the best spaces will be assigned first. Vendor setups will start at 5:00 am and parking will be free. Talk-in on 147.66/.06. For tickets, table reservations, and information, send an SASE to Aileen Scales KA9MBK, 3142 Market Place, Bloomington IN 47401.

ERIE PA
MAR 19

The Radio Association of Erie PA will hold The RAE Eyeball QSO Party on Saturday, March 19, 1983, at the Perry Highway Hall, 8/10 of a mile south of I-90 on the west side of Route 19. Admission is $2.00 per person. Tables (8-foot) are $3.00 each and are by reservation only. Food will be available. There will be FCC testing for applicants that mail Form 610 to the Buffalo office by February 22nd. Talk-in on .01/.61 and .22/.82.

MARSHALL MI
MAR 19

The Southern Michigan ARS and the Calhoun County Repeater Association will hold the 21st annual Michigan Crossroads Hamfest on March 19, 1983, beginning at 8:00 am, at the Marshall High School, Marshall MI. Tickets are $2.00 at the door and $1.50 in advance. Table space is $.50 a foot. Doors will be open at 7:00 am for exhibitors and there will be plenty of carry-in help and free parking. Food service will be available in the cafeteria. For tables or tickets, contact SMARS, PO Box 934, Battle Creek MI 49016, or phone Chuck Williams at (616)-964-3197.

MIDLAND TX
MAR 19-20

The Midland Amateur Radio Club will hold its annual St. Patrick's Swapfest on March 19-20, 1983, from 8:00 am to 6:00 pm on Saturday and from 8:00 am to 3:00 pm on Sunday, at the Midland County Exhibit Building, east of Midland on Highway 80 on the north side. Pre-registration is $5.00 (at the door, $6.00). Tables are $4.00 each. Refreshments will be available. Talk-in on .16/.76 and .01/.61. For further information and reservations, please contact Midland Amateur Radio Club, PO Box 4401, Midland TX 79704.

JEFFERSON WI
MAR 20

The Tri-County Amateur Radio Club will hold its annual hamfest on March 20, 1983, from 8:00 am to 3:00 pm at the Jefferson County Fairgrounds, Jefferson WI. Tickets are $2.50 in advance and $3.00 at the door. Tables are $2.50 in advance and $3.50 at the door. Parking is free and there will be plenty of food available. Talk-in on 146.52, 146.22/.82, and 144.89/145.49. For more information, advance tickets, and tables, send an SASE to Horace Hilker K9LJM, PO Box 204, 261 E. High Street, Milton WI 53563.

TRENTON NJ
MAR 20

The Delaware Valley Radio Association will hold its 11th annual flea market on Sunday, March 20, 1983, from 8:00 am to 4:00 pm, at the New Jersey National Guard 112th Field Artillery Armory, Eggerts Crossing Road, Lawrence Township. Registration is $2.50 in advance and $3.00 at the door. There will be an indoor and outdoor flea-market area and refreshments, including breakfast at 7:00 am. Sellers must bring their own tables. Talk-in on 146.52 and 146.07/.67. For further information, send an SASE to DVRA, PO Box 7024, West Trenton NJ 08628.

CIRCLEVILLE OH
MAR 20

The Teays Amateur Radio Club will hold its sixth annual King of the Pumpkin Hamfest on Sunday, March 20, 1983, from 8:00 am to 4:00 pm, at the Pickaway County Fairgrounds Coliseum. Tickets are $2.00 in advance and $3.00 at the door. Tables (8-foot) are $4.00 in advance and $5.00 at the door. Doors will be open for setups on Saturday at 4:00 pm and overnight security will be provided. A large parking area and food will be available. Talk-in on 147.78/.18 and .52/.52. For additional information, please send an SASE to Dan Grant W8UCF, 22150 Hulse Road, Circleville OH 43113, or phone (614)-474-6305.

STERLING IL
MAR 20

The Sterling/Rock Falls Amateur Radio Society will hold its 23rd annual hamfest on March 20, 1983, beginning at 7:30 am, at the Sterling High School Field House, 1608 4th Avenue, Sterling IL. Tickets are $2.00 in advance and $2.50 at the door. Commercial tables and flea-market tables requiring electricity are $5.00; all others are $3.00. A concession stand, free parking, and overnight space for self-contained campers will be available. There will be commercial distributors, dealers, and a large flea market. Talk-in on 146.25/.85 (W9MEP). For advanced tickets, tables, and information, contact Sue Peters, 511 8th Avenue, Sterling IL 61081, or call (815)-625-9262.

BLACKSBURG VA
MAR 21-24

The Virginia Polytechnic Institute and State University will hold a Personal Microcomputer Interfacing and Scientific Instrumentation Automation Workshop on March 21-24, 1983, on the Virginia Tech campus in Blacksburg VA. The workshop, directed by Drs. Paul Field, Chris Titus, Jon Titus, and Mr. David Larsen, is hands-on, with the participant designing and testing concepts with actual hardware. The charge is $595.00. For more information, write Dr. Linda Leffel, C.E.C., Virginia Tech, Blacksburg VA 24061, or call (703)-961-4848.

JOHNSTOWN PA
MAR 27

The Conemaugh Valley Amateur Radio Club will hold its sixth annual hamfest on Sunday, March 27, 1983, from 8:00 am to 4:00 pm, at the East Taylor Fire Hall, which is located on Route 271, 5 miles south of Route 22 (4 miles north of Johnstown). There will be plenty of food and refreshments available. Talk-in on 146.34/.94.

GRAYSLAKE IL
MAR 27

The Libertyville and Mundelein Amateur Radio Society will hold LAMARSFEST 1983 on Sunday, March 27, 1983, beginning at 8:00 am, at the Lake County Fairgrounds, Routes 45 and 120, Grayslake IL. Tickets are $2.00 in advance or $3.00 at the door. Tables (9-foot) are $5.00 each. Reservations are encouraged because choice locations will be assigned first. Commercial setups will begin at 6:30 am and other setups will begin at 7:00 am. There will be free parking, and breakfast and lunch will be available. Talk-in on 147.63/.03 and 146.94. For tickets, table reservations, or exhibitor information, send an SASE to LAMARS, PO Box 751, Libertyville IL 60048.

BALTIMORE MD
MAR 27

The Baltimore Amateur Radio Club, Inc. (BARC), will hold the 1983 Greater Baltimore Hamboree and Computerfest on

March 27, 1983, beginning at 8:00 am, at the Maryland State Fairgrounds Exhibition Complex (located east of I-83 exit 17, three miles north of I-695, north of Baltimore), Timonium MD. Admission is $3.00; children under 12 will be admitted free. Overnight accommodations are available in the immediate area. Amateur-radio, personal-computer, and small-business-computer dealers will be present. There will be an indoor flea market, a large hard-surfaced outdoor tailgate area, food service, free parking, and guest speakers throughout the day. For additional information and table reservations, contact GBH&C, PO Box 95, Timonium MD 21093-0095, or phone (301)-561-1282. For a recorded announcement, dial (301)-HAM-TALK.

MADISON WI
APR 10

The Madison Area Repeater Association, Inc. (MARA), will hold its eleventh annual Madison Swapfest on Sunday, April 10, 1983, at the Dane County Exposition Center Forum Building, Madison WI. Doors will open at 8:00 am for commercial exhibitors and flea-market sellers, and at 9:00 am for the general public. Admission is $2.50 per person in advance and $3.00 at the door. Children twelve and under will be admitted free. Flea-market tables are $4.00 each in advance and $5.00 at the door. Features will include commercial exhibitors, a flea market, an all-you-can-eat pancake breakfast, and a barbecue lunch. Plenty of parking space and nearby hotel accommodations are available. Talk-in on 146.16/.76 (WR9ABT). For reservations (early ones are advised) or more information, write to MARA, PO Box 3403, Madison WI 53704.

SOUTH SIOUX CITY NE
APR 15-17

The 39 Hundred Club will hold the 1983 Midwest ARRL Convention on Friday, Saturday, and Sunday, April 15–17, 1983, at the Marina Inn, South Sioux City NE, directly across the river from Sioux City. On Saturday, features will include a QCWA breakfast, a 3900 Club luncheon, an all-day ladies' program, and an evening banquet with entertainment. There will be seminars, displays, commercial exhibits, and a 66-table flea market, all indoors in the same building. Tables (8 ft. × 30 in.) are $5.00 for the 3 days, $4.00 for Friday night and Saturday. For table reservations, contact Al Smith WØPEX, 3529 Douglas Street, Sioux City IA 51104. Exhibitors should contact Jim Boise KAØGZY, 22 LaSalle Street, Sioux City IA 51104. Setup time is Friday afternoon, April 15th. Convention fees are $6.00 for the 3 days; advance banquet reservations are $10.00 (at the door, $12.00). For advance banquet tickets and motel reservations, write to Jerry Smith WØDUN, Akron IA 51001. For general information, contact Dick Pitner WØFZO, General Chairman, 2931 Pierce Street, Sioux City IA 51104.

DAYTON OH
APR 23

The Washington University Amateur Radio Club will hold a reunion dinner on Saturday, April 23, 1983, at the Dayton Hamfest. All past members of the club are invited. For more information, contact Washington University ARC WØQEV, Box 1128, St. Louis MO 63130.

PARAMUS NJ
MAY 1

The Bergen ARA will hold a Ham Swap 'n' Sell on May 1, 1983, from 8:00 am to 4:00 pm, at Bergen Community College, 400 Paramus Road, Paramus NJ. Admission for sellers is $3.00; buyers will be admitted free. There will be thousands of spaces but tailgating only. Sellers must bring their own tables. Talk-in on .79/.19 and .52. For more information, contact Jim Greer KK2U, 444 Berkshire Road, Ridgewood NJ 07450, or phone (201)-445-2855.

HAM HELP

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

I am looking for manuals and schematics for the Gonset G50 6-meter transceiver and the Conco 611 VHF transceiver, model 861-0611-001. I will pay a reasonable price for the original manuals or photocopies.

Gary Kohtala DA2XF
USAFS-A, Box 1415
APO NY 09458

I would like to find the schematics or technical manual for the VHF Engineering TVX-10 transmitter. I also need the address of VHF Engineering's new parent company. I will pay all copying costs and postage costs.

Lee Robinson WA3HJC
317 Peninsula Dr. #53
Erie PA 16505

I would like a copy of the schematic for the Wang 629 double cassette deck, which is part of the Wang 500/600 programmable calculator.

Dave Overton
1709 W. 30
Austin TX 78703

I need help in identifying some of the components in the Sabtronics #8610B-A 600-MHz, 9-digit counter. I would like to identify 2 chips: one is in the preamp of the prescaler, marked SAB 1009 (also marked J7940) and the other is in the frequency divider and is marked SP 8680B (also marked PS 5 A2). Any information on these ICs would be greatly appreciated.

Patrick Chivington
1478 Grace Ave.
Lakewood OH 44107

I would like to locate a copy of the instruction manuals for the Beckman models 607 and 609 heterodyne converters. These plug-ins extended the frequency range of the Beckman 6100 series counter.

Lyle Pellock W9MWP
2423 Holt St.
Vienna VA 22180

I am forming a nationwide network of motorcycling amateur radio operators. Anyone interested should please check in on 3967 kHz at 0300Z on Thursdays. Send an SASE for more details.

Gary McDuffie AGØN
Route 1 Box 90-A
Bayard NE 69334

I am having difficulties running phone patches with Radio Shack model ET-100T and ET-100 telephones. Rf is causing interference in the telephones. Can anyone give me ideas on how I can clear up the problem?

Everett C. Bollin WA3DVO
8000 Ray Leonard Ct.
Palmer Park MD 20785

I need a wrench that can remove the spanner nut from the microphone jack of the Kenwood TR-9000. I would also like to increase the scan delay to 10 seconds. Any help would be appreciated.

Curtis R. Olsen WAØNZQ
Box 115
Regent ND 58650

I have a synthesized 2-10-MHz AM-CW transceiver made by Delco. Their designation is Delco 1600. Does anyone know the military designation, or have a manual schematic for the unit?

Gary Cain
1428 Marigold Way
South Bend IN 46617

Wanted: two 60-kHz coil assemblies, part number M42005-1, for the Hammarlund HQ-170. They are marked as T10, T11, and T28 on the schematic.

John Seely WB3EPG
7080 Moore Avenue
Pensacola FL 32511
(904)-456-8096

Has anybody worked out a computer program for converting helical scan transmissions such as weatherfax to information that could be printed on a dot-matrix printer?

Larry J. Clark
c/o USCG Marine Safety Office
Galveston TX 77550

I need information on X- and K-band traffic-control radar units. I would like to build X- and K-band oscillators with an output of about 10 W and any schematics or other information would be greatly appreciated.

A1C Mark LaSalle
Box 2241
APO NY 09130

I am looking for the schematic and manual for the Eico model 249 VTVM. I will pay for any copying costs.

Len TenEycke VE3INK
132 Silverhill Dr.
Islington, Ontario
M9B 3W7 Canada

I am looking for proven modifications or ideas for improving the Ten-Tec Omni D- or C-series units. In exchange, I will provide modification data from my files.

Mickey McDaniel W6FGE
940 Temple St.
San Diego CA 92106

Wanted: bandswitch or individual wafers for the Hallicrafters SX-110 receiver. Suggestions welcome; whole radios considered.

Nick Adams WA4YKV
3009 NE 14th St.
Gainesville FL 32601

I need the manual and voltage specifications for the Heath HG-10 vfo for 2-80 meters, as well as the manuals for the HP500B frequency meter, the Ameco R5 receiver, the Heath FM adapter and the Heath SSB adapter. Finally, does anyone need an "as is" TEK oscilloscope?

Kevin Neal
Route A Box 221A
Flippin AR 72634

I am looking for the schematic to an RME pre-war receiver.

David R. Nadeau
S. 1200 Kelly Ave.
Coeur D'Alene ID 83814

I need assistance in locating the manuals and schematics for the SBE model 34 SSB transceiver and the EMC model 213 tube tester. I will reimburse any expenses.

Jim Seeber
708 Avenue I
Matamoras PA 18336

I am looking for information on software for using the VIC-20 on RTTY and CW. In addition, I would like to know if there is a VIC-20 net or if anyone would be interested in starting one. Just send your suggested time and frequency to me.

Dave Land KD5FX
2512 Bonnie
Ponca City OK 74601

I am interested in receiving the Space-Shuttle communications on 296.8 MHz with a JIL SX-200 AM-FM programmable scanner. Anyone knowing where I can purchase a converter system, please contact me.

Larry Powell
111 Trailview Dr.
Terrell TX 75106

I want to locate the schematic for a Western Electric #2565 HK 3-73 telephone with five incoming lines. I am reassembling the phone with a Western Electric 35AF3A 3-73 pad and a Western Electric 425 terminal block. The telephone will dial out, but it does not ring properly and the feedback monitoring system is dead.

H. Lee Hancock, Jr. W4NXC
301 Forest Hills Blvd.
Naples FL 33942

I need the manuals, either originals or copies, for the Hallicrafters model SX-146 receiver and the companion model HT-46 transmitter. I will gladly pay the costs.

James Hogarth
421 Gruber Rd.
Harleysville PA 19438

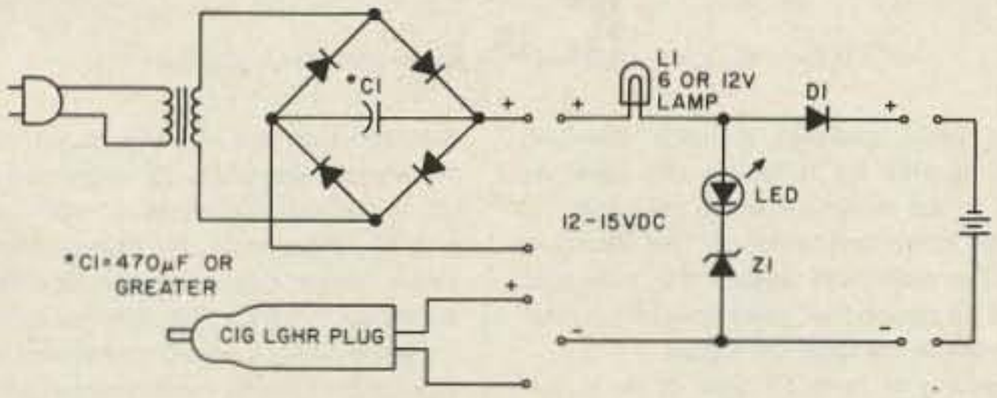
I am looking for the operation and maintenance manual for a Tektronics type L high-gain, fast-rise-time plug-in for a model 545 oscilloscope. I will copy the manual and return it.

Bruce Rahn WB9ANQ
410 Coronado Trail
Enon OH 45323

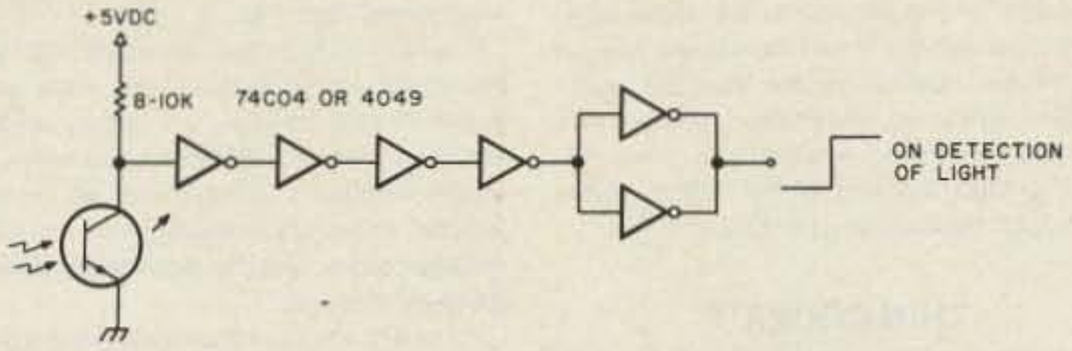
CIRCUITS

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

In exchange for these technical gems, 73 offers you the choice of a book from the Radio Bookshop, *to be sent upon publication. Submit your idea (and book choice) to: Circuits, Editorial Offices, 73* Magazine, *Peterborough NH 03458. Submissions not selected for publication will be returned if an SASE is enclosed.*

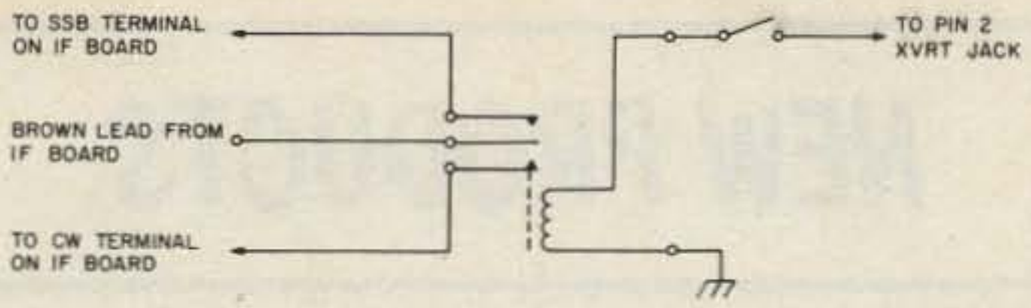


NICAD CHARGER WITH CURRENT AND VOLTAGE LIMITING: Lamp L1 will glow brightly and the LED will be out when the battery is low and being charged, but the LED will be bright and the light bulb dim when the battery is almost ready. L1 should be a light bulb rated for the current you want (usually the battery capacity divided by 10). Diode D1 should be at least 1 A, and Z1 is a 1-W zener diode with a voltage determined by the full-charge battery voltage minus 1.5 V. After the battery is fully charged, the circuit will float it at about battery capacity divided by 100 mA.—Dave Land KD5FX, Ponca City OK.

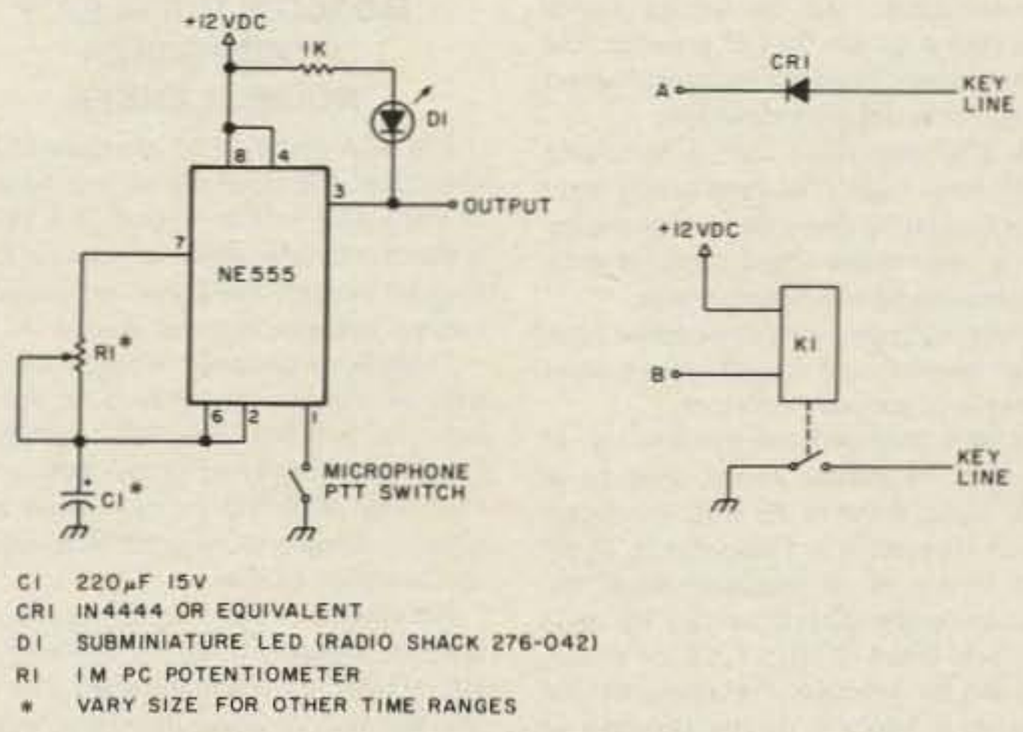


FAST AND RELIABLE PHOTODETECTOR: Using only 3 components, this circuit yields very reliable operation. Gates have been chained together for rapid action and wired in parallel for increased output current. Analog output can be obtained from either the collector of the phototransistor or the output of the first gate. A pot can be substituted for the resistor to adjust the circuit's sensitivity.—Terry Fletcher WA0ITP, Ottumwa IA.

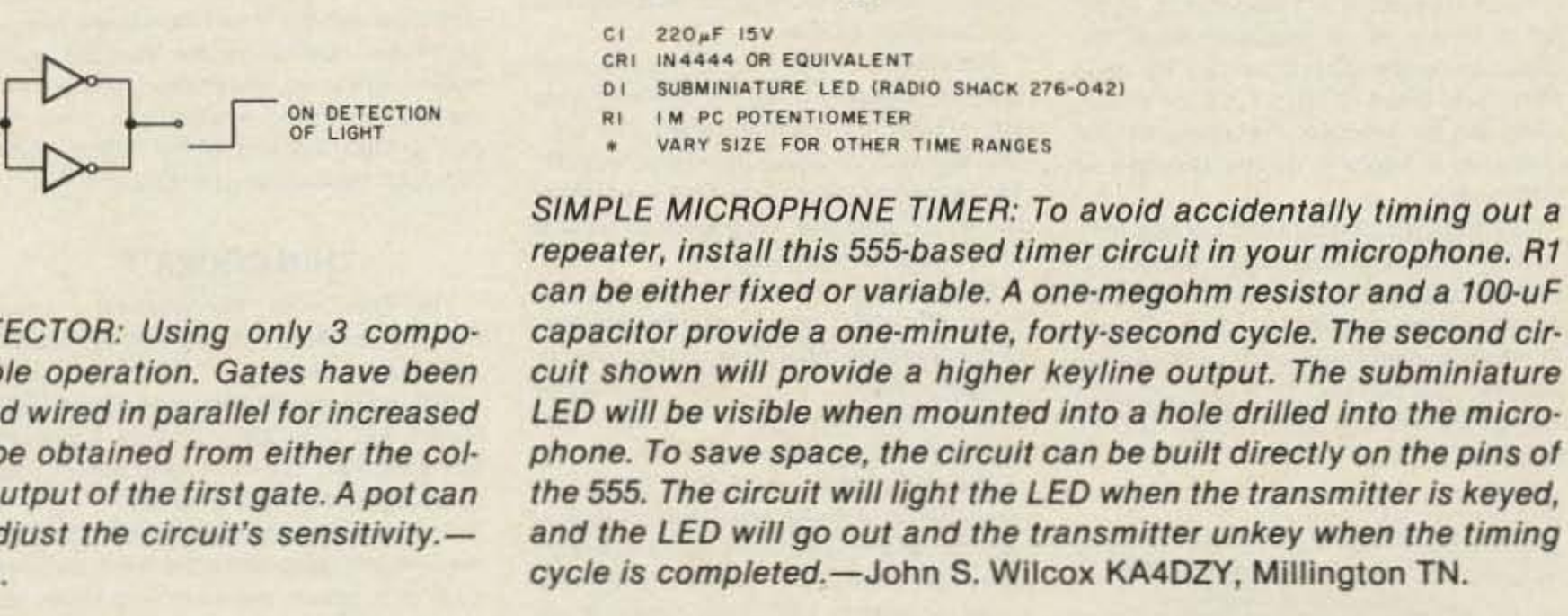
CRYSTAL OSCILLATOR REPLACEMENT FOR THE COLLINS R390A: This circuit, when used in conjunction with a divider and phase detector which are not shown, will replace the first and second crystal oscillators in the R390A. The varicap diode is a nonlinear device, so oscillation amplitude should be kept as low as possible. The oscillator is a common-base circuit providing maximum output impedance, and the 300-pF coupling capacitor feeds a clean waveshape to the emitter. A 1k trimpot is used to set the desired amplitude.—Eiichi Takarada, Rockford IL.



SIMPLE SWITCHABLE CW SELECTIVITY FOR THE KENWOOD TS-520S: Open the case of the transciever and remove all the knobs and dial face plate. Unsolder the five wires from the RIT control. Remove the RIT control. Mount a 0-5000-Ohm potentiometer with a push-pull switch in the hole where you removed the RIT control. Solder a six-inch length of hookup wire to each of the switch terminals on the new control. Connect the five wires to the new control (these are yellow, blue, orange, orange, and orange). Ground one of the switch wires to chassis. Connect the other switch wire to the relay's coil terminal. Connect the other relay terminal to the transverter output jack to obtain the 14 V dc for the relay. Disconnect the brown SSB i-f lead and attach it to the switching contact on the relay. Connect the normally-open relay to the CW terminal on the i-f board. Connect the normally-closed relay contact to the SSB terminal on the i-f board. Reassemble the rig. Calibrate the CW selectivity to a zero-beat obtained on WWV.—Harry A. Ober WB6CGZ, Canyon Country CA.



SIMPLE MICROPHONE TIMER: To avoid accidentally timing out a repeater, install this 555-based timer circuit in your microphone. R1 can be either fixed or variable. A one-megohm resistor and a 100-uF capacitor provide a one-minute, forty-second cycle. The second circuit shown will provide a higher keyline output. The subminiature LED will be visible when mounted into a hole drilled into the microphone. To save space, the circuit can be built directly on the pins of the 555. The circuit will light the LED when the transmitter is keyed, and the LED will go out and the transmitter unkey when the timing cycle is completed.—John S. Wilcox KA4DZY, Millington TN.



NEW PRODUCTS

HAND-HELD COUNTER-TIMER

Global Specialties Corporation announces the new Model 5000 Counter-Timer. It is the first portable, hand-held instrument of its kind. The 5000 combines all of the important features and performance capabilities of a bench-top unit with the convenience of a fully portable, battery-operated instrument. The 5000 measures 7.6" × 3.75" × 1.7" and weighs in at 14 oz. (without batteries).

As for performance, the 5000 is designed to measure frequency, period, and pulse width with extreme accuracy and exceptional reliability. It features full signal conditioning including: attenuator (×1, ×10, ×100), slope selection (+ or − edge for pulse-width measurement), ac or dc coupling, and variable trigger level.

A high-contrast .43-inch LCD display offers 8-digit precision for fast and accurate readings. LCD annunciators indicate overflow, gate-open, and low-battery conditions. With a simple flick of a switch, the display-storage mode will maintain the last reading in the display indefinitely.

The 5000 features a unique automatic master reset logic. This time-saving reset function instantly clears the display and initiates a new measurement cycle eliminating erroneous partial measurement.

A self-diagnostic function performs analysis of internal logic and provides instant assurance of accurate operation.

The 5000 Counter-Timer has 3 modes of operation: frequency, period, and pulse width. Signal input is via BNC connector —input impedance is 1 megohm @ 25 pF for all modes. In the frequency mode, the 5000 can handle inputs from 0.1 Hz to 50 MHz. Gate times of .01, 0.1, 1.0, or 10 seconds can be selected. Frequency will be displayed in kilohertz on the easy-to-read LCD screen.

The 5000 will measure any periods from 25 ns to 10 seconds and deliver a single cycle measurement or an average of 10, 100, or 1000 cycles. Time will be displayed in μs. Pulse-width measurement from 25 ns to 10 seconds can be made. Either the high or low portion of the input signal can be selected.

All of the controls on the 5000 Counter-Timer are convenient slide switches and are front panel mounted. These include: Trigger Level, Gate Time/Cycles Averaged, Mode, Power (On/Test/Off), Display (Normal/Hold), Polarity (+ to − or − to + edge selection in pulse-width mode), Coupling, and Attenuation.

The 5000 is powered by 6 AA nicad or alkaline batteries or an optional ac adapter/charger. Optional accessories for the 5000 include a 120-V-ac adapter/charger (MMAC-2), a 220-V-ac charger/adapter (MMAC-3), an automobile cigarette lighter adapter, a 24" BNC input cable terminated with color-coded quick hooks, an antenna, and a rugged carrying case.

For additional information, contact *Global Specialties Corporation, 70 Fulton Terrace, New Haven CT 06509-1942; (800)-243-6077.*

The 5000 Counter-Timer from Global Specialties.

MOSCOW MUFFLER™ WOODPECKER NOISE BLANKER

The AEA model WB-1 Moscow Muffler Woodpecker Blanker represents the latest of many AEA breakthroughs. This blanker is the first to offer effective blanking of the Russian Woodpecker signal with no modifications to the receiver required.

The WB-1 is designed to be connected in the antenna feedline between the antenna and the receiver. The WB-1 effectively blanks the interfering pulses before they have been stretched out by receiver tuned circuits, thereby causing the least amount of distortion possible.

Because the WB-1 is a synchronous blanker, it simply does not overload from strong adjacent channel signals. The overload condition is a significant problem with all i-f blankers, making the Moscow Muffler the most effective Woodpecker blanker under most band conditions.

In addition to the superior blanking features, the WB-1 offers an effective low-noise broadbanded 6-dB rf preamp with + 13-dBm intercept point. The preamplifier may be switched in or out whether or not the WB-1 is in the blanking mode.

The WB-1 Moscow Muffler Blanker is available in a transceiver version (model WB-1C) which features a carrier-operated relay (COR) for automatic transfer from receive to transmit. A COR ADJ control is provided for adjusting the relay dropout delay in switching from transmit to receive.

The Model 340 Thin-Coder™ from CES.

AEA's Moscow Muffler™ Woodpecker noise blanker.

The WB-1 features a pulse blanking width control for reducing the blanking width to the minimum width necessary to achieve maximum blanking. The minimum blanking width will assure the minimum signal distortion that must result from placing holes in the received signal.

Blanking of both 10- and 16-Hz Woodpecker modes is achieved with the WB-1. At the time this brochure is being written, most Woodpecker transmissions are made with a 10-Hz pulse repetition rate.

The WB-1 is simple to operate and the most effective blanker of Russian Woodpecker signals that we have been able to test, including the most popular blankers built into modern transceivers. The WB-1 will typically display 45 to 50 dB of Woodpecker signal attenuation with no overload from strong adjacent channel signals.

The WB-1 comes with a 90-day limited warranty and is backed by the same AEA customer service that has earned AEA a prominent position in the amateur radio market. For more information, contact *Advanced Electronic Applications, Inc., PO Box C-2160, Lynnwood WA 98036; (206)-775-7373.* Reader Service number 476.

THIN-CODER™

The Thin-Coder, the smallest manual tone dialer made, is now being introduced by CES.

CES president Ron Hankins states, "The Model 340 Thin-Coder is truly a pocket-sized encoder. You don't need bulky cases or pouches to carry it with you."

The Model 340 measures 2-1/2" by 3-1/8" by only 3/4" deep and effectively dials the user into private networks, computer access, or dimension systems. Its rugged white case features a brown faceplate and white digit blocks. A convenient normal/high switch allows flexible volume control. Up to 10,000 long-distance calls are possible with the Thin-Coder's long-life 9-volt battery. CES encoders utilize single-contact tactile keyboards for extra reliability.

Communications Electronics Specialties is a leader in the design and manufacture of quality encoder, microphone, interconnect, and other specialized equipment for communications markets worldwide. For complete information on the Thin-Coder Model 340 Encoder and other CES products, contact *Ron Hankins, CES Inc., PO Box 507, Winter Park FL 32790; (305)-645-0474.* Reader Service number 484.

SIMPSON 470 CALCULATOR-STYLE DMM

Simpson Electric Company has introduced a brand-new calculator-style DMM, the 470. . . a high performance DMM with features that are usually found only on more expensive units. 25 ranges are provided, including 1000 volts dc, 750 volts ac, and 10 Amps ac/dc. All voltage and resistance ranges are protected against transients up to 6 kV at 100 microseconds.

Convenient recessed human-engineered thumbwheel knobs control ranges and functions. An audible tone on the 2000-Ohm range provides fast checks for shorts and continuity. A diode test provides quick, good-bad checks of semiconductor junctions.

The easy-to-read, high-contrast, 3½-digit, 7-segment LCD display also features a low-battery indicator—battery life is about a year's average use.

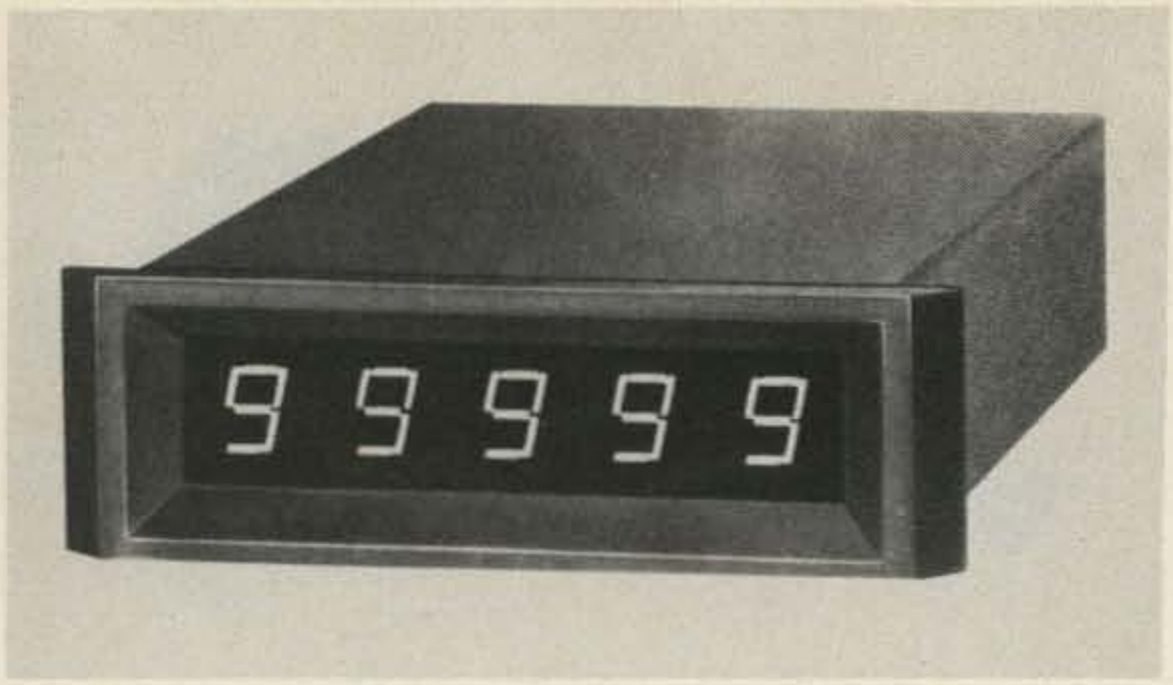
The instrument is manufactured by Simpson in the USA and carries Simpson's 1-year warranty. The high-impact, sealed case is 1.8" × 3.4" × 7.1". A two-way fold-out stand provides for convenient bench-top use or for hanging in an upright position. The 470 weighs less than 1 lb.

The 470 is supplied complete with UL-recognized, color-coded test leads with screw-on alligator clips, 9-V battery, and instruction manual. Optional accessories include Simpson's Amp-Clamp ac current adapter, as well as temperature, rf, and high-voltage probes, and the recently announced test-lead systems.

"The 470 and other calculator-style instruments will join the growing family of Simpson UL-listed DMMs," announced Simpson's sales director, Mel Buehring. "They will be available from leading electrical/electronics distributors worldwide."

For further information, contact *Simpson, Katy Industries, Inc., Electrical Equipment and Products Group, 853 Dundee Avenue, Elgin IL 60120; (312)-697-2260.* Reader Service number 483.

The Simpson 470 calculator-style DMM.



Non-Linear Systems' PF-5 frequency counter.

Microcraft's Videoscan-1000 high-resolution SSTV converter.

NEW FREQUENCY COUNTERS

Non-Linear Systems, Inc., recently announced two new digital-panel frequency counters capable of counting up to 10 MHz. Designated the PF-4 and PF-5 respectively, the new counters are packaged in miniature cases measuring only 15/16 × 2½ × 3½ inches and provide four selectable timebases: 0.01, 0.1, 1, and 10 seconds. The decimal point may be externally selected and the display may be blanked, dimmed, or tested externally.

The PF-4 is a four-digit display, while the PF-5 is a five-digit display. Internal signal-conditioning circuitry permits input signals having slow rise and fall times to be accommodated without difficulty, and both ac-coupled or dc-coupled inputs are accepted.

Input impedance is 75 kilohms and input signal amplitude may be +3 to +30 volts peak-to-peak. The instruments may be field-modified to accept up to 700 volts peak-to-peak. The units operate from an external 5-volt-dc supply.

For additional information, contact *Non-Linear Systems, Inc., PO Box N, Del Mar CA 92014.* Reader Service number 485.

SOLAR PHOTOVOLTAIC BATTERY CHARGER

The Phaeton II photovoltaic battery charger manufactured by International Solar Products Corporation of Durham, North Carolina, is being called "the most revolutionary development in rechargeable technology since the rechargeable battery." The unit produces 4.8 volts of direct-current power at 240 milliamps in peak sunlight. Four AA cells, two C cells, and two D cells can be charged with the unit. Batteries are fully recharged in 14 to 16 hours of sunshine.

Phaeton II measures 6" × 7" and weighs less than two pounds. It is constructed with spage-age materials—annodized gold or silver frame, heavy-duty aluminum battery cradles, and the same silicone covering used to protect the solar cells on orbiting communication satellites. The unit contains no plastic parts.

According to the manufacturer, the average consumer could spend as much as $100 per year on throwaway batteries to power the portable radios, tape recorders, toys, games, flashlights, cameras, and other electronic appliances found in many homes today.

For additional information, contact *International Solar Products Corporation, 1105 W. Chapel Hill St., Durham NC 27701; (919)-489-6224.* Reader Service number 478.

HIGH-RESOLUTION SSTV CONVERTER

Microcraft Corporation has announced the new Videoscan-1000, a high-resolution SSTV converter. Although the converter is compatible with amateur standard and first-generation SSTV equipment, the Videoscan-1000 also has two high-resolution modes producing 256-line pictures with 256 pixels per line.

The converter's pixels are quantized to 64 levels of gray, and it features a built-in gray-scale pattern to use in setting controls as well as three scan rates for optimum versatility.

With the Videoscan-1000's split-screen mode, four SSTV pictures may be viewed at one time, and the built-in memory can hold one frame of video from the camera or other sources. Your callsign may also be programmed into memory.

The converter takes care of all switching between the transmitter, microphone, and tape recorder. The only additional equipment necessary for operation is a camera and a monitor.

For additional information, contact *Microcraft Corporation, PO Box 513, Thiensville WI 53092; (414)-241-8144.* Reader Service number 481.

SELF-RESET POWER-LINE INTERRUPTER

Electronic Specialists expands its Ac Power-Line Interrupter series to include automatic reset models. Should ac line voltage be disrupted or exceed preset safety limits, the Power Interrupter disconnects ac power from controlled apparatus. A 4-minute time delay, followed by automatic self-reset, helps avoid wide voltage fluctuations associated with power-line malfunctions. An optional line voltage monitor is available.

Intended for installations operating unattended for long periods, the Self-reset Power Interrupter provides safety and protection for equipment and personnel.

Connecting to the ac line with a standard 3-prong plug, the Self-reset Power Interrupter can accommodate a 15-Amp resistive load or a 10-Amp inductive load.

For further information, contact *Electronic Specialists, Inc., 171 South Main Street, PO Box 389, Natick MA 01760; (617)-655-1532.* Reader Service number 477.

RTTY SOFTWARE

John Yurek K3PGP has introduced a line of TRS-80 programs for use in the ham shack.

CW runs on 4K Level I or Level II and turns the stock machine into a CW keyboard and receive terminal. The hardware interface for the program consists of a transformer and a transistor, both available from local Radio Shack stores. The program features a FIFO buffer and 8 regular buffers.

CW creates a split-screen display, allowing you to fill the buffer with a return message before you transmit. Speeds are adjustable from the keyboard, and text editing is provided for error correction.

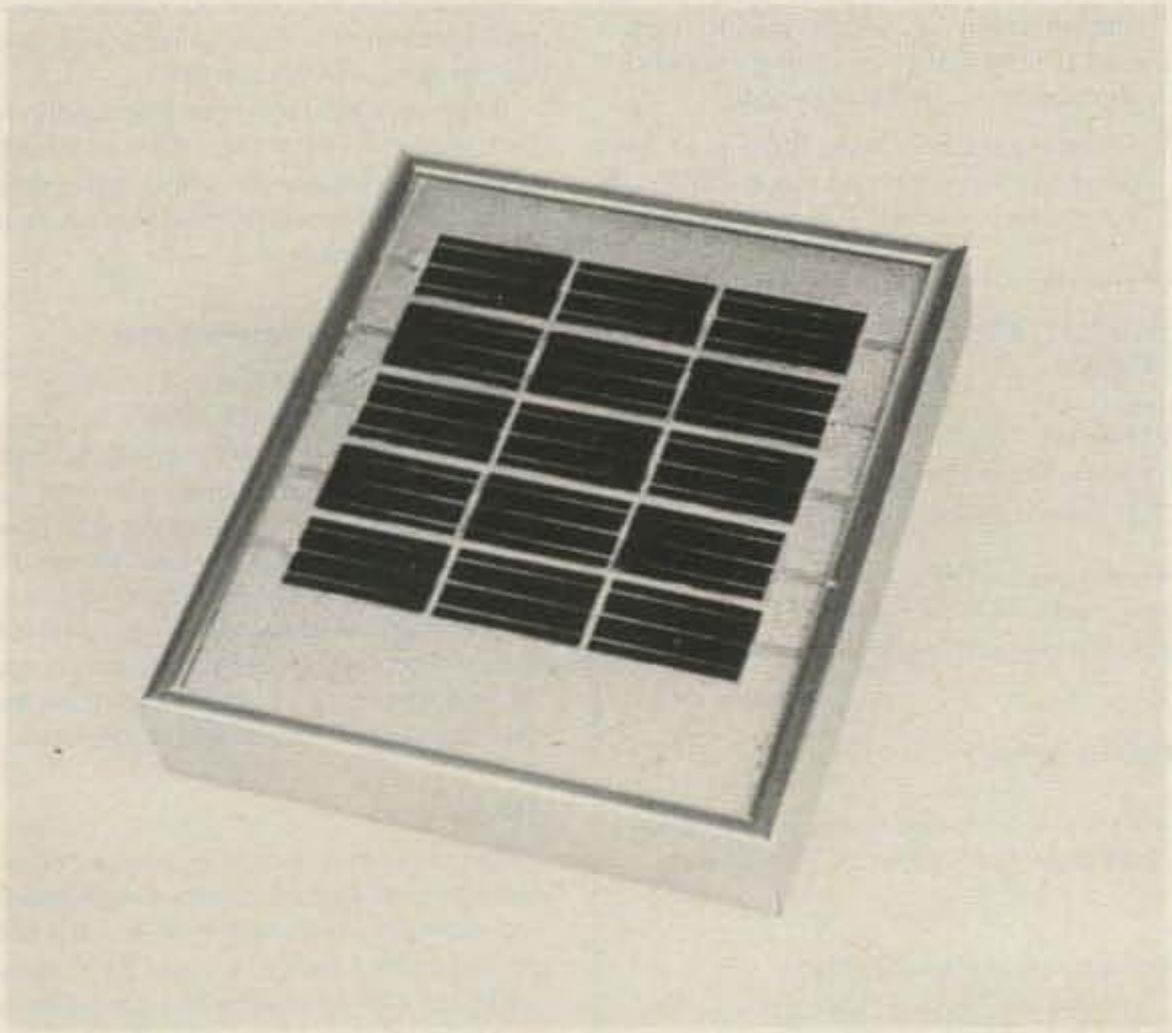
RY turns a TRS-80 stock machine into a 5-level (Baudot) teletype machine. This program also includes a FIFO buffer and a split-screen display. It will operate at all legal amateur speeds, and T/R switching is controlled automatically.

Both programs use the audio output of the cassette port to key the transmitter, without using the cassette relay.

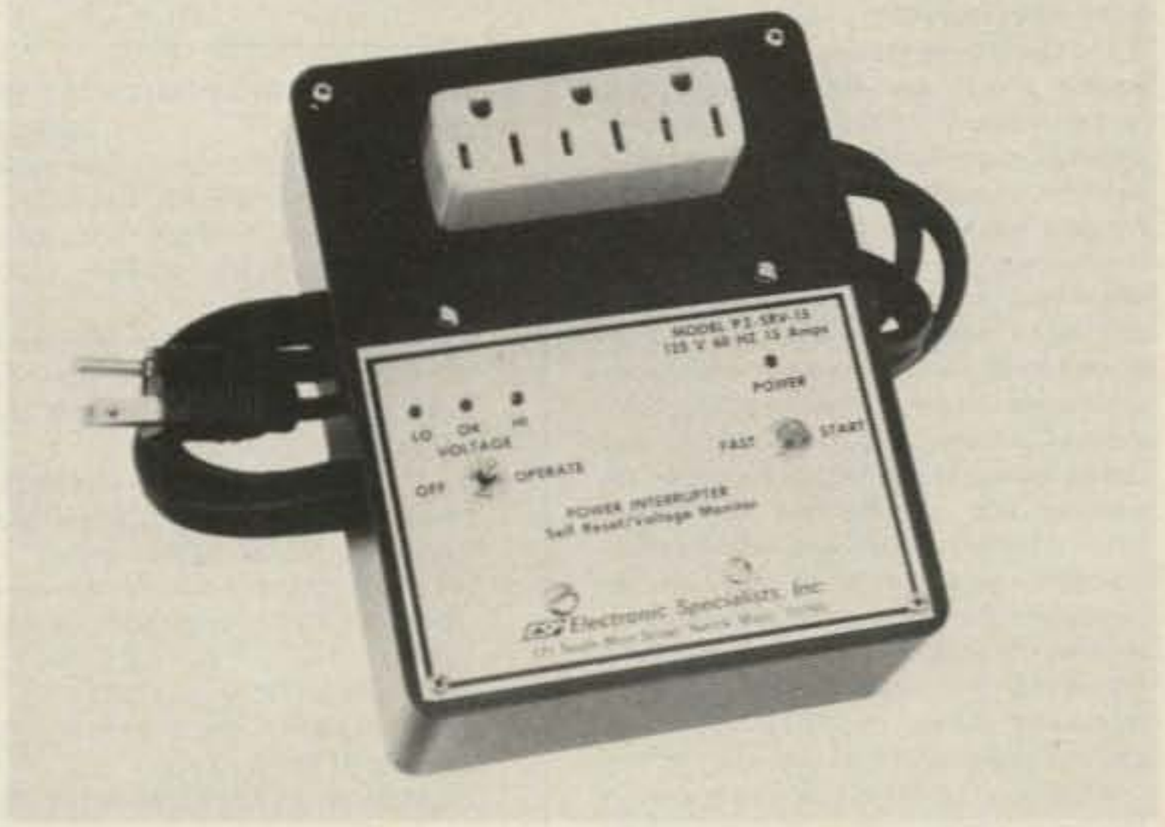
For $1, which is refundable with your first order, a catalog may be ordered from *John Yurek K3PGP, RD #6, Box 413, Irwin PA 15642.* Reader Service number 482.

WIDEBAND ANTENNA PREAMPLIFIER

Grove Enterprises, prominent manufacturer of accessories for scanner and short-



The Phaeton II photovoltaic battery charger manufactured by International Solar Products Corporation.



Self-reset Power Line Interrupter from Electronic Specialists, Inc.

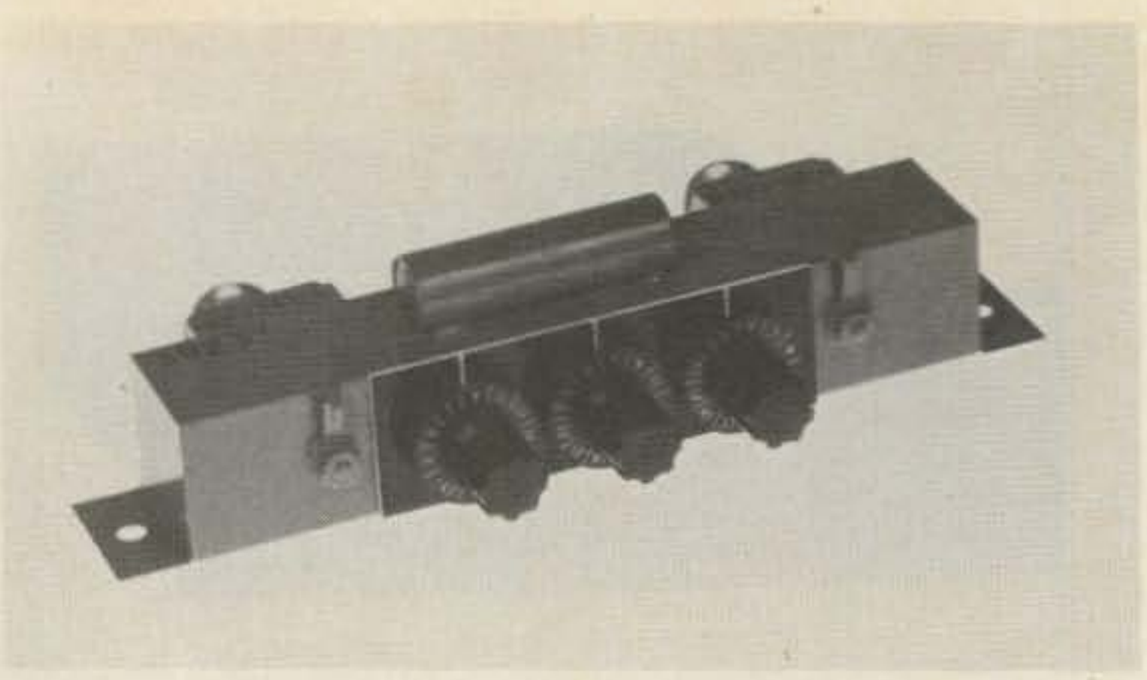
The PRE-1 Signal Amp preamplifier from Grove Enterprises.

wave reception, has just announced its PRE-1 Signal Amp masthead preamplifier.

Designed to provide high-gain, low-noise amplification for received VHF and UHF signals, the PRE-1 boasts a mid-band gain of at least 15 dB with a noise figure of only 1.8 dB.

The Signal Amp consists of a lightweight antenna-mounted preamplifier module and an indoor control unit. Switch-selectable high and low gain allows the user to customize his signal-enhancing needs.

Guaranteed to outperform competitive indoor preamplifiers, the PRE-1 Signal Amp comes with all necessary hardware, connectors, and instructions. For additional information, contact *Grove Enterprises, 140 Dog Branch Road, Brasstown NC 28902; (704)-837-2216.*



Microwave Filter Company's 3923-T TVRO filter.

TUNABLE TVRO FILTER

Microwave Filter Company's new 3923-T bandpass filter tunes to any of the 24 TVRO transponders by means of three calibrated dials.

When tuned to a particular transponder, the 3-dB bandwidth is 40 MHz with less than 1.5 dB loss. Selectivity is 30 dB at ± 76 MHz. The new filter features type-N connectors and passes dc power. Delivery can be made in ten days from date of order, and the 3923-T filter comes with specification sheet and tuning instructions.

For more information contact *Emily Bostick, Microwave Filter Company, Inc., 6743 Kinne Street, East Syracuse NY 13057.* Reader Service number 479.

REVIEW

FACSIMILE WEATHER-CHART RECORDER BY ALDEN ELECTRONICS

Remember the old adage, "Everyone talks about the weather, but nobody does anything about it"? Well, that's not quite true—if it ever was—and Alden Electronics of Westborough, Massachusetts, is surely proof that somebody really does do something about the weather. They have introduced a facsimile weather-chart-recorder kit for the home hobbyist and ham.

Specifically, Alden Electronics is one of the world's largest manufacturers of radiofacsimile receiving and recording equipment...equipment that prints charts of significant weather information from around the globe, gathered by weather stations and rebroadcast in coded form for use by ships, aircraft, scientific expeditions, military and oceanographic groups, and many other stations.

The world depends upon radiofacsimile weather charts and satellite photographs for up-to-date information about storms, icebergs, significant changes in weather patterns, and other vital data needed by virtually everyone who lives, works, and travels in an interdependent world. Merchant mariners, naval officers, fishermen, and small boatmen make critical decisions based on local weather and ocean conditions. Air force officers, pilots, commercial airlines, airport operators, and others make critical decisions based on weather and atmospheric conditions. Modern radiofacsimile and satellite technology is now able to bring timely and accurate weather information to these users on a worldwide basis. Correct interpretation of the information inevitably leads to increased safety, improved efficiency, and even competitive advantage.

It has been said that a picture is worth a thousand words, and so it seems to be with weather information whose presentation in chart or picture form is so much more meaningful to the end user than information represented merely by strings of coded symbols, numbers, and letters. The location of major weather systems, storm fronts, areas of violent oceanic or atmospheric activity, and similar information can be seen and understood quickly on a weather map or from a satellite photograph. Therefore, if your own personal situation or livelihood depends on or is associated in any way with weather-related phenomena, you are certainly a candidate for Alden's goods and services.

The Alden weather-chart recorder prints weather charts and satellite pictures from radiofacsimile signals transmitted by a network of government-owned and -operated stations located around the globe.

The recorder requires an external receiver. It features solid-state circuitry and a simple electromechanical design to ensure long, trouble-free operation.

The Alden weather-chart recorder uses electrically-sensitive paper packaged in handy, disposable cassettes, the 11"-wide paper requires no threading...and replacement involves the mere insertion of another cassette. The printing process is quiet and free from smoke, odors, and fumes. No venting is required, and the compact size and light weight permit a variety of desktop or wall-mounting arrangements.

Background and Amateur Applications

Many hams have their own home weather stations which record or display temperature, pressure, and wind velocity... and weather is usually a part of the conversation between two hams. It's good fun to tell the other station just how bad (or how good) your weather is, compared with that in his own area. Historically, however, facsimile has been used for the transmission of other information—maps, schematic diagrams, drawings, photographs, and other images.

Radio amateurs have often built their own fax transmitting and receiving equipment, and many have converted surplus military or commercial units to this purpose.

There are several systems of encoding and decoding fax information for its broadcast and reception, all of which work satisfactorily. None need be discussed here, because the information is available in a variety of references on the subject.

Some hams have received the radiofacsimile weather information direct from the satellites that broadcast it, while others prefer to use the information rebroadcast on the HF bands by weatherfax stations.

In one sense, fax is like RTTY, amateur television, or similar modes of communication...it is enjoyed by small, select groups of hams who prefer the challenge and fun of doing something slightly differ ent. For a long period of time, hams built their own TUs for RTTY reception and converted old Model 15s or Model 19s to amateur use. Then, with the revolution in solid-state electronics and computers, homemade apparatus gave way to commercially-available units of advanced design and infinitely increased capability.

It appears that radiofacsimile is now on that threshold of development at which commercially-available units have made home-built or converted surplus units a thing of the past.

WEATHER-CHART-RECORDER KIT MODEL 9321
SPECIFICATIONS

Recording rate: 120 spm (scans per minute).
Index of cooperation: IOC 576 CCIR, 169 lines per inch.
Control signals: Automatic start, stop, frame; manual start and frame.
Start: Signal shifting between 1500 Hz and 2300 Hz at a 300-Hz rate for 5 seconds.
Frame: A 1500-Hz signal interrupted by a short burst of 2300 Hz each scan line. Duration—20 to 30 seconds immediately following start signal.
Stop: Signal shifting between 1500 Hz and 2300 Hz at a 450-Hz rate for 5 seconds.
Circuitry: Solid state.
Input impedance: 600 Ohms balanced.
Input frequencies: FSK-1500 Hz black, 2300 Hz white.
Scanning electrode: Stylus belt.
Recording paper: Alfax electrosensitive paper in throw-away cassettes with built-in printing electrode. Each cassette contains 35 feet of 11-inch-wide paper.
Input voltage: 115 V ac ± 10%, 50/60 Hz.
Maximum power: Standby mode: 10 Watts; operating mode: 30 Watts.
Net weight: 10.1 pounds.
Dimensions: 3-5/8" H, 17-1/16" W, 10-1/2" D.

Alden's Weather-Chart Recorder

Our staff received two units for test... one ready-to-go, and the other a kit. Each was accompanied by an amply illustrated and detailed manual which told how to connect the unit to the receiver, and how to tune and adjust it for best reception and printing. The kit unit had, in addition, a construction manual which included pictorial as well as schematic diagrams, plus detailed step-by-step instructions for the mechanical and electrical assembly.

The Kit

The kit arrived packed in a large box divided into twelve or so internal compartments, each partitioned from its neighbor by corrugated paper barriers. Each compartment was numbered and contained a correspondingly-numbered plastic envelope of parts wrapped in protective packing material. The manual calls out the contents

of each compartment and invites the kit builder to identify, check off, and repack each component ready for use.

Everything you will need, including solder, is included. Most of the more difficult assemblies have been prefabricated and subassembled so that you won't have any trouble with difficult or critical components. You assemble the mechanical parts first, according to a logical step-by-step procedure. Then, you solder the precut wires to length and solder them to the subassemblies. Finally, you interconnect the wires, harnessing them as you go.

All critical construction, board-stuffing, testing, and adjusting has been done for you, meaning that your task will be pleasant, simple, and straightforward.

Two of us started construction on Friday evening, each helping the other with the work of selecting and positioning parts, fastening them in place, connecting them, and checking them off in the manual. The work goes fast, and there is nothing to be done that could not be handled by even a beginner.

Saturday evening saw all but final assembly and checkout. . . which took place on Sunday morning. We logged 24 man-hours (12 hours total time) on assembly and test.

Preliminary checkout and test before hookup to radio receiver is done with a multimeter and consists of measuring some resistances, voltages, and continuity. Again, each step of the way is detailed in such a way that the procedure is fail-safe. There is no such thing as a smoke test.

Operation

Alden thoughtfully included a worldwide marine radiofacsimile schedule in which you will find a list of stations around the world which broadcast the radiofacsimile signals. We tuned our all-band, general-coverage Icom R70 receiver to the Halifax, Nova Scotia, and Norfolk, Virginia, stations whose signals came roaring in on their assigned frequencies.

Also included is a *Facsimile Products Guide*, which is an aid for interpreting HF radiofacsimile charts transmitted from the US Naval Eastern Oceanography Center in Norfolk VA. The guide is reproduced with permission of the US Naval Eastern Oceanography Center, whose personnel originally prepared it. You will find information covering broadcast frequencies and schedules. Each chart is illustrated and described in detail, covering atmosphere analysis, atmosphere prognoses, oceanographic analysis, and oceanographic prognoses. The charts are typical of what is transmitted worldwide. Using this information, you can tune in to the exact information you want or need, and immediately start receiving pictures and charts.

There are only two connections for you to make with the finished weather-chart recorder. One is to plug it into the house mains—115 V ac. The next is to connect the terminals on the back of the recorder to the audio output of your receiver and to ground, respectively. Although the instructions called for 600-Ohm output, we were able to receive perfectly satisfactory charts using the 3.2-Ohm receiver output. Later, we built a little impedance step-up device that transformed the R70's output to approximately 500 Ohms for a better match to the unit, although this was not considered necessary.

After connection, and before turning the unit on, you make sure that the paper cassette is properly installed and the cover of the unit (which has a safety interlock) is snapped into place over the paper cassette.

As you tune in the USB audio-frequency-shift signals on your receiver, you will notice two little LEDs on the top of the recorder blinking red and green. The green LED represents the white image, and the red LED represents the black image on the paper. We found that the receiver's RIT (incremental tuning) control helped adjust to the exact frequencies needed after the main tuning dial was locked on to the frequency. Proper adjustment is thoroughly covered in the manual.

The next step is to depress the start switch, which begins the drum rotation and the stylus scanning. If the broadcast is already in progress, you will need to press the frame button to center the map on the paper. The weather-chart recorder is set to receive broadcasts at 120 lines (scans) per minute, which is the standard for most stations you will tune.

After a few minutes, you'll see the paper coming out of the recorder with a map or picture on it. Then, it's just a matter of waiting until the map or chart is complete before you tear the paper (or cut it) to separate the completed picture.

A very nice feature of the recorder is its auto-start and auto-stop function, which allows you to leave the unit in operational condition, but silent, until a broadcast of live material begins. The broadcast itself will issue start and framing pulses which will activate your recorder and properly frame the picture.

After a transmission, a stop pulse will be transmitted, stopping the machine and placing it in the standby mode, ready for another chart.

It was fun to see the satellite picture taken over the North Atlantic just a few hours before, showing the cloud cover (what else?) over the New England area. Much of the United States is covered, as well as most of the North Atlantic ocean. You can see the Caribbean islands, some of Central America, and parts of Greenland and Iceland.

The weather charts containing pressure isobars, temperature and wind-velocity data, and much more require some study to understand. You'll be fascinated at all the things you can discover with your recorder. For example, if you have a directional antenna, you can tune in the weather facsimile broadcast stations in England, France, Russia, Germany, the Pacific, Australia, Japan, etc., etc. These will give you charts and maps, as well as possible satellite pictures from their own parts of the world. You could even tell that DX station what his own weather is like, if you wanted to!

One of the better books available from Alden is *A Mariner's Guide to Radiofacsimile Weather Charts* which, in its 127 pages of text, charts, and photographs authored by Dr. Joseph Bishop, presents the best understanding of the earth's atmospheric and oceanic processes I have ever read. It is simple, lucid, and interesting. Even for someone who has no formal education in weather interpretation or analysis, the book is easily read and understood. By all means, be sure to order this book.

I must say that Alden has opened my eyes to an unexpected and pleasant facet of radio that I had never before experienced, in spite of my 32 years of hamming. Radiofacsimile reception is fun, it's fascinating, and—believe it or not—it kept me off the ham bands for two weeks while I explored the intricacies of the world's weather. . .through the weather-chart recorder.

You should avail yourself of the small (approximately 17″ × 10″ × 4″) and lightweight (about 10 pounds) Alden weather-chart recorder ($995) and experience a new thrill in radio. It's guaranteed to be fun and educational.

For further information, contact *Alden Electronics, Washington Street, Westborough MA 01581*. Reader Service number 488.

Alden's weather-chart recorder.

Jim Gray W1XU
***73* Staff**

Gene Smarte WB6TOV
Hancock NH

THE ICOM R70

The Icom R70 is a general-coverage communications receiver covering a frequency range of 100 kHz to 30 MHz. Newly introduced to the market, it made me anxious to review it and share my impressions.

As with most hams, I could not resist the urge to unpack the radio and begin using it immediately without, of course, reading the instruction manual. It is because of this ease of use that I have such good things to say about it.

The IC-R70 has a front panel that is both uncluttered and functional. All controls are clearly marked, and after studying it for a few minutes I became aware of the radio's versatility. Bringing it to life was extremely easy, with just two connections, power cable and antenna. The 117/235-V-ac input is standard, with optional 13.8 V dc available. It is also internally modifiable to 100/200/220 V ac. The built-in speaker eliminated hunting around the shack for the phones or that bullet-riddled speaker that usually turns up.

The receiver is a quad conversion unit with its first i-f at 70.4515 MHz. The second i-f is at 9.0115 MHz. Without an antenna, I tuned across about all of its range, observing the birdies. The few I found at expected places were, however, far below the level of signals present with the antenna connected.

All of the initial testing took place on the ham bands using my triband beam. Twenty meters provided the kind of signals I was looking for, especially at the lower portion of the phone band. The R70 features a Pass-Band-Tuning (PBT) system allowing you to narrow the width of frequencies passing through the crystal filter. The passband can be moved up to 500 Hz from the upper or lower side in SSB mode (2.7 kHz in the AM mode). With the control in the OFF position, the passband is 2.3 kHz wide in SSB mode and 6 kHz in the AM mode. Using this control, I was able to hear stations that could not be received by using the notch control alone. No information was published as to the shift and depth of the notch filter, but it seems as effective as any other I've used.

While the PBT system took some getting used to, the frequency and mode selection did not. The radio has three selectable-tuning rates, 1 kHz, 100 Hz, and 10 Hz. These controls are located to the right of the tuning knob and, with a little practice, I could quickly zero in on the desired frequency. The one thing that did get a little confusing was the fact that the frequency does not roll over. Increasing from, say, 7.999.9 kHz returned you to 7.000.0 and not on to 8.000.0 kHz. This, however, turned out to be a time-saver when tuning from high to low ends of a band or vice versa. A LOCK push-button also is provided to disable the tuning knob, preventing accidental changes in frequency.

To the left of the tuning knob are three controls marked BAND UP, DOWN, and

Icom's R70 receiver.

HAM/GENERAL. These are used to increment or decrement the most significant digit of the frequency display when in the general-coverage mode. When in the ham coverage mode, these controls step you through 160m, 80m, 40m, etc., skipping all of the frequencies in between. It does stop at the new 10-, 18-, and 15-MHz bands, also.

Other front-panel controls include CW (wide and narrow—500 Hz), SSB, RTTY, AM, and FM (with the optional module). There is a separate FUNCTION push-button designed to select the sideband opposite the one you are in and select the narrow CW filter. The receiver automatically chooses upper or lower sideband depending on whether the frequency is above or below 9 MHz. A SQUELCH control also is provided, obviously getting used more for the FM mode than any other. It did work very well in SSB mode, however, but only on strong stations. Its action was dependent on the agc timing, and in the slow setting took quite a while to open (or close). I cannot see any real need for it except in the FM mode.

The frequency-display panel includes a 7-digit readout with 100-Hz resolution; it displays which mode and vfo is in use. There are two vfo's that can be loaded with the current frequency information and called independently of each other. An RIT control is provided to shift the received frequency ±800 Hz from the displayed frequency. No indication is given on the display except for a status LED showing that the control is in use. A useful feature is the fact that the RIT control is automatically disabled once the main tuning knob is moved. It can be re-enabled anytime by depressing the push-button. This assures you that you are receiving the displayed frequency.

A built-in preamplifier and attenuator is switch-selectable from the front panel. Claimed attenuation is 20 dB, with no mention of the amount of preamplification. Judging from the S-meter indication, it seems to be in the order of 6 dB. An agc selector permits a timing of fast or slow, or OFF. This I found more than adequate for all types of communications using the fixed rates. A switchable noise blanker proved very effective in both the available narrow or wide settings. It also seemed very effective with woodpecker-type noise. No decrease in signal levels was perceived with the noise blanker switched in.

The built-in speaker provided good-quality reproduction of all types of signals. In the AM mode, SW broadcast stations were very enjoyable to listen to without the high-pitched sound that one might expect from such a small speaker. In any event, an external speaker jack is provided should you wish to use it, as well as a recorder output jack. The latter outputs an audio level independent of the volume-control setting.

Although advertised as a general-coverage communications receiver, rear-panel connectors are provided to allow easy use of the unit with a transmitter or transceiver. The IC-R70 has a mute input allowing it to be quieted during transmit. Transmitted signals can be heard in the receiver, however, by using its monitor function. The volume of the monitored signal can be adjusted with the front-panel control.

The rear-panel accessory socket can also be used to control VHF and UHF converters. The switching arrangement is covered in sufficient detail in the manual. Also available on the accessory socket is an output from the receiver's detector stage. This output is at a fixed level regardless of the volume or gain settings. It is intended to be used to drive a RTTY terminal unit. Other rear-panel connectors include a scope output from the first i-f (70.4515 MHz). This would be useful for using a panoramic-type display.

Rear-panel antenna connectors are of both the PL-259 type and spring-clip type. The former is intended for approximately 160 meters and up, while the single-wire input is intended for the AM broadcast band below. The coaxial connector is designed for a 50-Ohm-impedance antenna system, and no specifications are given for the long-wire connector. No provisions are made for antenna matching, leaving it entirely up to the user to determine optimum performance.

My final comments deal with the instruction manual and schematics. As one who likes to maintain his own equipment, I found the documentation included totally lacking in content. The manual is an excellent operating instruction manual, but very little information is given on circuit description, troubleshooting, and general maintenance. The schematics are of the type showing detail of individual circuits, but interconnections are vague.

In summary, I would consider this receiver an excellent value. Its performance would make it suitable for the beginning ham, as a standby receiver for the shack, or to fill the void between hamming and casual listening. Its usefulness for Field Day or emergency communications cannot be overlooked. Also, I don't think the new or seasoned SWL could find fault with its performance—again making it a worthwhile addition to the shack. My wife, on the other hand, did not like the radio; that was after I told her that I would like to have one.

For further information, contact *Icom America, Inc., 2112 116th Ave. NE, Bellevue WA 98004; (206)-454-8155.*

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CK-2 MEMORY KEYER

Keys and keyers, like tools, are interfaces between a worker and his work. The right tools make the job easier—even pleasant. Sometimes, when the work is pleasant and the craftsman is in a proper frame of mind and the tools are of superb quality, the tools become an extension of the craftsman—seeming to have no independent existence—and the finished product becomes a work of art.

In case you wonder what all this has to do with a product review, let's go back to the beginning and talk about keys and keyers.

Each CW operator prefers a certain type of key, and within that type exists an almost infinite variety of examples. Dozens of varieties of hand keys are in daily use, and the same holds true for semiautomatic mechanical keyers, electronic keyers, iambic keyers, and memory keyers. Each has its own group of devoted adherents—operators who swear by a particular kind or make and wouldn't have any other.

Memory keyers recently have come into greater use and acceptance than ever before, particularly by contest operators, for very good reasons. Electronic memory keyers not only have the capability of forming nearly perfect Morse characters into ideally spaced and "weighted" letters, words, and sentences, but they also have the ability to store words and sentences for later transmission, merely by pushing a button or touching a keypad. In typical contest work, the same message or exchange is sent over and over again, meaning that repeated retransmission of such a message from memory is both practical and necessary if high contest scores are to be obtained. Non-contesters also have found that a CQ message is practical, and even the simplest memory keyers now in use permit limited storage of simple messages.

In the field of electronic keyers, Morse trainers, CW-generating devices, and character-encoding and -decoding devices, Advanced Electronic Applications of Lynnwood, Washington, has carved a niche for itself and has gained a reputation for quality and reliability. AEA electronic memory keyers set the pace for others to follow with their Morsematic—a do-everything memory keyer and top-of-the-line product which, in the hands of experienced operators, is equally capable of sending exquisite CW or teaching new operators to do the same. Following on the heels of the Morsematic came the CK-1, a contest keyer with all of the features of the more expensive keyer (except for the "beacon" feature and training capability) at a significantly lower price.

The Morsematic and CK-1 offered selectable characteristics of "weight" (i.e., dot-dash length ratio) and spacing, speed control, and message storage, all available by means of a keypad located on the top of the unit within easy reach and sight of the operator. Beyond that, there were pitch and volume controls which allowed the operator to adjust the keyer sidetone to exactly suit his or her preference. Finally, AEA packaged all of these features into a neat, lightweight, and versatile box that conveniently fits on the disk or table at the operating position and unobtrusively gives the operator station command from tune-up to rapid-fire exchanges.

Now, the CK-2

Mike Lamb N7ML and the folks at AEA have just released their newest electronic memory keyer, the CK-2, which incorporates the CK-1 features and adds a few more to make CW even more pleasant and simple. CK-2 stands for Contest Keyer, second model, but it also has a name: Contester.

Recently, I was fortunate to be asked to review the Contester for *73*. Fortunate, because I am a CW afficionado and because I had heard so much about the CK-1 and Morsematic but had used the Morsematic only a few times and the CK-1 not at all.

Let's take a look, together, at the CK-2, pretending that we are seeing it for the first time.

The sturdy 10" × 10" × 4" cardboard carton is your first clue to the careful and rugged packaging. Inside, you find the CK-2 neatly sealed in a plastic bag and nestled down into its shock-protective wadding. Alongside, you'll see another plastic bag containing the following items: a battery-eliminator-type power supply (optional) that plugs into the wall and furnishes 12 volts dc at .35 Amps, a three-circuit, PL-68-type plug attached to a length of two-conductor shielded wire, a separate dc power plug and cable for attaching the CK-2 to a separate dc source, and a 2-circuit PL-68 plug connected by a shielded cable to an RCA-type phono plug.

AEA has thought of nearly everything, because the 3-circuit plug connects your keyer paddle to the CK-2 and the 2-circuit PL-68/RCA phono combination connects the CK-2 to your rig. Not much else to do.

Now for the *piece de resistance*, the CK-2 itself. The housing is a matte-black-finished metal box with rounded corners, measuring approximately 2" high by 5" deep by 7" wide. A twelve-button keypad occupies the right-hand top surface of the CK-2, and two knobs—a switch and an LED—occupy the left-hand top surface.

The first knob is the on-off/sidetone-volume control, and the second is the delay max/min control. The switch activates the memory-repeat function, and the LED is a full memory indicator. The rear panel contains the power jack, the paddle jack, and the key + and key – jacks which allow your CK-2 to key a high-current tube-type rig that uses cathode keying, or a low-current, solid-state keying circuit.

My particular keyer has serial number 364, and was inspected by "Robin"—a nice touch in this day of faceless manufacturers and nameless inspectors. You have the feeling that AEA cares about you and wants you to know who they are in case you need their help. Bravo! A confidence-builder that costs very little but means a lot.

We can't forget the instruction manual that accompanies the keyer. It's there, all right, and tells you how to operate the CK-2 in each of its various modes and parameters. Now let's plug the CK-2 in and turn it on to see how it plays.

Memory Functions

The CK-2 memory storage accommodates up to 500 characters in either a single group or in up to ten different groups, selectable by the keypad.

Two basic types of memory storage are available: real time or auto memory. Real-time memory means that everything you send, including pauses between characters and words, is loaded and counted in the 500-character group. Auto memory means that whenever you pause between characters or words, the CK-2 begins counting to itself, and when you have accumulated the equivalent of a word's worth of spaces, it shuts down—thereby saving you lots of space. For the speed demons this may not be necessary, but for us slow thinkers it's a real boon. Counting begins again when you send the next character.

By switching on the "memory load" function and then keying **9, you select the auto-load function. If real-time loading is your preference, a mere *9 will get you there.

Memory location is keypad-selectable, too. By selecting any digit between 0 and 9, you can put each message into that particular storage space ready for later recall.

The # symbol terminates memory loading. Already-loaded messages can be deleted from memory when desired merely by pressing #N, where N is the number of the memory location in storage. If you forget where you put it (as I have done), that's your problem. . . you'll just have to keep trying until you find it.

In the playback mode, your message keeps going out over the air (at the selectable delay-between-messages of your choice) until you hear an answer. Just a single tap on your paddle will halt the message and allow you to pick up the break. If, or when, you wish to resume the message, all you have to do is request it from your friendly Contester.

Oh, yes, before I forget. You can edit messages as you load them without having to start all over again—a real time-saver!

The Contester's memory includes a long-term "keep-alive" circuit, battery-powered from an alternate power source. . . a 9-volt transistor battery, for example (not supplied). This feature allows you to keep intact those previously-stored messages while you travel to the contest site or to your Field Day location.

Take some time to get acquainted with your CK-2 before you try out the message-storage functions. There's a lot to learn, and it's best to relax with the regular functions before beginning any new ones. I might add that the automatic message-repeat function will be available to you when you need it, and the delay between repeats can be adjusted from about 2 sec-

onds to 3 minutes . . . affording you almost infinite variations between casual rag chewing and high-speed contesting.

Operating Your CK-2

When you turn on the CK-2, it beeps once at about 500 Hz, the sidetone baritone note. If you prefer tenor, you can get that, too. Here—let's try it: press *1 and hold the 1. Notice the tone climbing the scale, the pitch getting higher and higher? Okay, when you reach the note you like, just lift your finger off 1 and there you are. Simple, huh? (Lower the tone with **1.)

Now, how about speed? Well, there are two speeds already preset into the CK-2. Here—try keying something—at about 20 wpm, right? That's memory A for speed. Now, touch *9 and try keying. About 30 wpm. That's memory B. Let's say you want to change both memory A and memory B for speed—no problem. **8NN lets you put the desired speed in memory A; the NN is the speed in wpm that you want. Example: **815 will give you 15 wpm. Okay, let's set that in memory A. In memory B, let's put in 25 wpm. Hit **925 and there you are! Now, by hitting *8 you get 15, and *9 gives you 25. (If you turn off the keyer, and then come back on, memories A and B will have reverted to their original 20 and 30 wpm respectively.)

Here's another neat trick. Suppose you don't know the speed you want (in terms of a particular number of words per minute) but wish to listen until it sounds about right. Okay, simple: press *6 and hold the six while keying your paddle on the dot or dash side. When the length is what you want, remove the pressure from the 6. Let's say you want to decrease speed smoothly: press *7 and hold the 7 until the speed is down where you like it. Release the 7, and presto, right on! Speeds from 1 to 99 wpm are available, in 1-wpm increments.

Here's another f'rinstance: Suppose you want to keep a serial-number record of the messages sent out by your CK-2. No problem; just press *0 and set the message number into memory. Incrementing from that number forward will then take place automatically each time the message plays back from memory. If you want to reset to 01, press **0. To set the serial number to any desired value between 0 and 9,999, you just press *0NNNN (where the Ns represent the number).

Other Features

The CK-2 allows you to tailor its parameters to your own liking. For example, if you prefer fully-automatic dot-and-dash completion for iambic keying, you can have it. If you prefer a bug version, you can have just automatically-completing dots and manual-dash formation. If you don't like iambic keying but just want to have an ordinary electronic keyer, that's possible, too.

For tuning the rig, you can select a tune mode which will key the carrier until you have completed your adjustments; a tap on your paddle will instantly shut it off.

The CK-2 has rf protection against false keying, too. This might have been somewhat of a problem with solid-state devices operated in strong rf environments, but AEA has solved the problem for you.

Your friends at AEA provide full-service backup for your purchase and are always willing to help with questions or problems should they arise; since they are your friends, they want satisfied, enthusiastic customers.

You'll find the instruction manual complete, not only for using the CK-2 but also for troubleshooting and repairing it should that need ever arise. Schematic and pictorial diagrams plus a parts list are provided in the manual.

The Advanced Electronic Applications CK-2 memory keyer.

Summary

These are by no means all of the tricks that the CK-2 can teach you, but you'll learn them all if you get one for yourself. I'm still learning some of them myself!

What *didn't* I like about the CK-2? Well, very little, to be honest. It did tend to show me where my shortcomings lie, and it forced me to get out of my comfortable rut and learn something new and different. As Churchill was supposed to have said: "I love to learn, but I hate to be taught." In my case, the CK-2 was a good teacher—and I didn't hate it at all. In fact, learning was pleasant, fast, and fun.

If you need a lifetime keyer that allows you to grow in proficiency while matching your requirements exactly—the CK-2 will stick with you all the way. On the other hand, if you're just a Sunday afternoon rag chewer, the Contester can be a trusted and patient friend. The choice is yours . . . and the CK-2 can do it all.

The CK-2 is priced at $139.95 and a dc adapter is available for $14.95. For further information, contact *Advanced Electronic Applications, PO Box C-2160, Lynnwood WA 98036; (206)-775-7373.* Reader Service number 486.

Jim Gray W1XU
***73* Staff**

THE PALOMAR ENGINEERS PT-407 ANTENNA TUNER

The true test of a race car is on the long track in Indianapolis, and the strength of a dune buggy is discovered in the heat of the Baja desert.

So, to test the Palomar Engineers PT-407 antenna tuner, I put it on the first floor of a brick apartment building, with a random-wire antenna and no earth ground.

And it performed flawlessly.

In an apartment, all of the possible problems of operating a station become a reality. Antenna space is extremely limited, TVI problems are multiplied by the closeness of neighbors, and the lack of an earth ground exacerbates the other problems. With these difficulties in mind, the PT-407 was hooked up between a Kenwood TS-520 and about 75 feet of wire.

My first surprise came during the tune-up. After having had visions of going through two sets of finals before I finally found an acceptable swr, I was pleased to settle in at 1.4 to 1 on 15 meters with two or three bursts of knob-fiddling. Tune-up on the other bands was just as easy, and I found that I could always get a match of 1.5 to 1 at the highest. However, on most of the frequencies tried, a lower swr could be found in just a few seconds.

Tune-up procedure for the T-network of the PT-407 is standard. Two controls—Antenna and Transmitter—adjust variable capacitors, and the 12-position Inductance switch selects connections on an air-wound coil. In addition, the tuner has a balun for open-wire feeds and a coaxial switch to use in conjunction with a dummy load or an antenna that needs no matching device. Its total capacity is for four antennas.

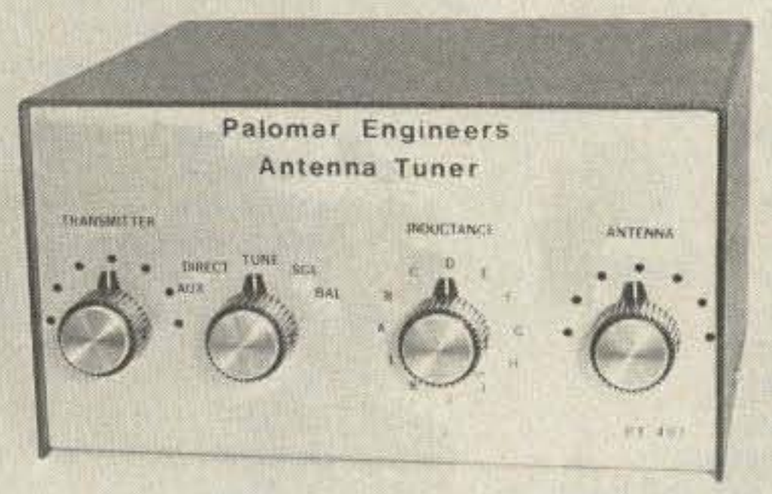
Tune-up is done at low power to avoid damaging the finals while they are loading onto a mismatch. The first control to be adjusted is the inductance; you set that at the lowest swr. The antenna and transmitter capacitances are interactive, making the second part of the tune-up the most trying.

The tuner will handle up to 300 Watts, which is enough to use with almost any rig running barefoot, and it takes up only 8" by 8" by 4½". Construction inside the unit is solid; knowing from sad experience that a single poor connection is anathema to good output, I checked the unit over carefully during the first trial and could find no flaws.

With the case on, the tuner is unobtrusive yet handsome. The three-sided top is finished in a black crinkle, with a brushed aluminum front and back. The connections in back are made via three SO-239s and three porcelain insulators for a balanced feedline and the single-wire antenna.

To my surprise, the tuner proved to be quite broadbanded. Going from phone to CW on 40 meters required little peaking, and readjustment within band segments was not needed.

Assured that my finals were safe from the dangers of high swr, my attention turned next to the tuner's TVI-reduction capabilities. For this admittedly unscientific test, I used an old-model television with absolutely no shielding; my fellow apartment dwellers also (unwittingly) participated in this test. In my situation, TVI suppression is not good enough; the num-



The Palomar Engineers PT-407.

ber and density of television sets in my area necessitates a completely clean signal.

With the television on and next to the transceiver, there was minimum TVI. At voice peaks, the familiar lines we all know and fear broke the picture, but otherwise no interference was present. In the living room, a bare 15 feet away, there was no interference. And so far, I have not received any complaints from irate neighbors.

As with any component in a system, one unit's performance is limited by the other parts of the system—so other configurations could produce better or worse results. But the final question when using a matching device is if the tuner is absorbing most of the output to create an acceptable load. A few short minutes later, my question was answered in a QSO with KA7BEX in Louisiana and a second with KE0S in Colorado, both of whom gave me a good signal report.

Admittedly, most hams would not consider this great DX. But from the depths of an apartment building in Boston, Colorado is just short of a miracle.

For further information, contact *Palomar Engineers, Box 455, Escondido CA 92025; (714)-747-3343.*

Avery L. Jenkins WB8JLG
73 Staff

AMATEUR RADIO CALL DIRECTORY

Since 1920, there has been only one directory of amateur radio operators. The *Radio Amateur Callbook* has been the sole source of names and addresses of hams worldwide—until recently.

Now, in addition to the *Callbook*, there is the *Amateur Radio Call Directory*, published by Buckmaster Publishing in Ridgefield, Connecticut. Though similar to the *Callbook*, the *ARCD* has a slightly different format and comes in three books, each indexed differently—by call, by name, and by area.

Like the *Callbook*, the *ARCD*'s callsign index ($12.95) is divided into three columns per page. However, where the *Callbook* has separate sub-columns for the state and the zip code, the *ARCD* only separates the state and zip by commas. This makes the *ARCD* more difficult to read or copy from.

In addition, the *ARCD* does not have some of the operating aids which are included with the *Callbook*, such as a prefix list, QSL bureaus, Q signals, and time charts. And although the *ARCD* is the same width and height as the *Callbook*, it is somewhat thicker. When using the *ARCD*, I found that I missed having that additional information at my fingertips.

The *ARCD*'s geographical and name indexes are about half the length of the callsign index, but they are priced substantially higher than the callsign index. However, both of these indexes are good ideas, and I am surprised that nobody published these books earlier.

The geographical index ($25) is divided first by state, and then by city in alphabetical order. The city is followed by the street address and the callsign, enabling the reader to cross-reference to the call directory and get the full name and address. Although this process is rather cumbersome, it does save space and reduce the amount of redundant information.

Each page is topped by the state abbreviation and the listing is divided into six columns per page. Fortunately, divisions between columns have been clearly marked.

This index will not find much daily use in the average shack, but it would be quite useful if a club were putting together a prospective member mailing list or estimating the density of hams in a given area.

The *ARCD* name index ($25) is an alphabetical listing, by last name, of all hams in the US. The index includes the full name, middle initial, callsign, and state, again enabling the user to cross-reference to the callsign directory for more information.

Nor will this index quickly become dog-eared, although I am sure enterprising hams will find uses for it. My first response was that hams more frequently know each other by first name than they do by last. However, this is a useful source of information for clubs or nets.

Together, these three volumes comprise an extensive source of information, and although their comparison with the *Callbook* is necessary and inevitable, the *Callbook* and the *ARCD* are useful for different purposes.

Because of the operating aids in the *Callbook*, as well as its format, I find it handier in the shack than the *ARCD*. However, when you need an index for uses other than filling out a QSL card, the various indexes of the *ARCD* prove to be a valuable adjunct to the *Callbook*. Together, the *Callbook* and the *ARCD* would provide a highly versatile source of information.

For further information, contact *Buckmaster Publishing, 70 Florida Hill Rd., Ridgefield CT 06877.* Reader Service number 487.

Avery L. Jenkins WB8JLG
73 Staff

FUN!

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

HOW HAMS VIEW THEMSELVES

Well, it's that time of year again. What time of year? Why it's time for the annual FUN! Poll, amateur radio's only free-form opinion survey where every ham gets his or her chance to speak out on the issues of the day. A ham tradition for three years.

If the past is any indication, this year's poll should manage to stir up a substantial amount of heat. And considering February's reputation for bitter cold breezes, a little heat just may be what we could all use right now. I can hardly wait until I see my mailman struggle up the icy walk to my house with a bag loaded with reader response forms. As you may have already guessed, there's a definite sadistic streak in KI2U.

This year, as in previous FUN! Polls, we're keeping some old questions in order to keep track on developing trends in our hobby, and adding some new ones to keep up with the times. Sharpen those pencils.

ELEMENT 1—BACKGROUND

1) Sex:
A) Male
B) Female

2) Age:
A) 15 or below
B) 16-21
C) 22-39
D) 40-59
E) 60 or above

3) License class:
A) Novice
B) Technician
C) General
D) Advanced
E) Extra

4) Number of years licensed:
A) 1 year or less
B) 1-5 years
C) 6-10 years
D) 11-20 years
E) 21 years and up

5) Do you have a new (post-March '78) call?
A) Yes
B) No

6) How many hours a week do you devote to amateur radio?
A) 0-1 hour
B) 2-5 hours
C) 6-10 hours
D) 11-20 hours
E) 21 hours or more

7) Which HF band do you use most?
A) 80-75 meters
B) 40 meters
C) 20 meters
D) 15 and/or 10 meters
E) Don't operate HF

8) Which VHF-UHF band do you use most?
A) 6 meters
B) 2 meters
C) 220 MHz
D) 420 MHz and/or up
E) Don't operate VHF-UHF

9) Which mode do you use most?
A) SSB
B) CW
C) FM
D) RTTY
E) Other

10) How much money have you spent on amateur radio within the past year? (Include QSL expenses, magazine subscriptions, club dues, and other incidental expenses.)
A) 0-$250
B) $251-$500
C) $501-$1,000
D) $1,001-$2,500
E) $2,501 and up

ELEMENT 2—SOCIAL CHARACTERISTICS

11) Has amateur radio influenced your career choice?
A) Greatly
B) Somewhat
C) Not at all

12) Do you answer QSLs that include a self-addressed, stamped envelope?
A) Yes
B) No

13) Politically, how would you define yourself?
A) Conservative
B) Middle-of-the-road
C) Liberal

14) Do you think amateur radio will exist 20 years from now?
A) Yes
B) No

15) How old were you when you first became a ham?
A) 15 or below
B) 16-21
C) 22-39
D) 40-59
E) 60 or above

16) Were you a CBer before you became a ham?
A) Yes
B) No

17) Do you own a home computer?
A) Yes
B) No

18) Do you think hams, compared with computer hobbyists, are:
A) More technically inclined in their hobby
B) Less technically inclined in their hobby
C) Both are about equally skilled in their hobby

19) Do you think that home computing is siphoning people (including youngsters) away from amateur radio?
A) Yes
B) No

20) Did you ever use a "cheat book" (not counting the *ARRL License Manual*) to upgrade your license?
A) Yes
B) No

21) If someone offered you ten million dollars, tax free, on the condition you give up amateur radio forever, would you?
A) Yes
B) No

22) Do you belong to a local ham radio club?
A) Yes
B) No

23) Have you ever attended a ham flea market?
A) Yes
B) No

24) Do you think the new ARRL leadership is better than the previous administration?
A) Yes
B) No

ELEMENT 3—OPERATING HABITS

25) Should Novices have phone privileges?
A) Yes
B) No

26) Do you think US phone bands should be expanded at the expense of foreign-station-only bands?
A) Yes
B) No

27) Have you ever used a personal computer in connection with your amateur radio activities?
A) Yes
B) No

28) Is it time to completely deregulate amateur radio by having the FCC turn over all responsibility for ham operation to the amateur community?
A) Yes
B) No

29) Where do you think the future of ham radio lies?
A) On the HF bands
B) On the VHF-UHF bands

30) Should we get rid of, or reduce in size, the CW subbands?
A) Yes
B) No

31) Do you think religiously-oriented nets have a place in ham radio?
A) Yes
B) No

32) Do you think politically-oriented nets have a place in ham radio?

RESPONSE FORM

Instructions: Read each question and mark your response by circling the appropriate letter next to the number of the question.

Element 1:
1) A B
2) A B C D E
3) A B C D E
4) A B C D E
5) A B
6) A B C D E
7) A B C D E
8) A B C D E
9) A B C D E
10) A B C D E

Element 2:
11) A B C
12) A B
13) A B C
14) A B
15) A B C D E
16) A B
17) A B
18) A B C
19) A B
20) A B
21) A B
22) A B
23) A B
24) A B

Element 3:
25) A B
26) A B
27) A B
28) A B
29) A B
30) A B
31) A B
32) A B
33) A B C D E
34) A B C D E
35) A B
36) A B
37) A B
38) A B
39) A B C D E
40) A B
41) A B
42) A B
43) A B
44) A B
45) A B C D E
46) A B C D E
47) A B C D E
48) A B C D E
49) A B
50) A B

Comments: _____

Please mail Response Form to: John Edwards KI2U, 78-56 86th Street, Glendale NY 11385.

A) Yes
B) No

33) If, while tuning across a band, you heard a net of gay hams in progress, would you:
A) Jam it
B) Ignore it
C) Complain to the FCC or some other organization
D) Listen
E) Join it

34) If, while tuning across a band, you heard a net called "The American Communist Radio Society" in progress, would you:
A) Jam it
B) Ignore it
C) Complain to the FCC or some other organization
D) Listen
E) Join it

35) If required, could you solidly copy CW at the speed at which you were licensed?
A) Yes
B) No

36) If required, could you pass the FCC theory test for your license class without consulting a "cheat book"?
A) Yes
B) No

37) Have you ever purposely operated in an amateur subband you weren't licensed to use?
A) Yes
B) No

38) Do you think the FCC affects amateur radio in a positive manner?
A) Yes
B) No

39) Do you ever speak to foreign, non-English-speaking hams in their own language?
A) Always
B) Sometimes
C) I attempt it
D) Rarely
E) Never

40) Do you feel yourself competent to replace the finals in a tube-type rig?
A) Yes
B) No

41) Do you feel yourself competent to replace the finals in a transistor-type rig?
A) Yes
B) No

42) Have you ever built an electronic project from a kit?
A) Yes
B) No

43) Have you ever home-brewed an electronic project from a book or magazine?
A) Yes
B) No

44) Have you ever designed your own electronic project?
A) Yes
B) No

45) What do you think of contesting?
A) Great
B) Good
C) Okay
D) Don't like it
E) Despise it

46) What do you think of DXing?
A) Great
B) Good
C) Okay
D) Don't like it
E) Despise it

47) What do you think of repeaters?
A) Great
B) Good
C) Okay
D) Don't like them
E) Despise them

48) What do you think of traffic handling?
A) Great
B) Good
C) Okay
D) Don't like it
E) Despise it

49) Do you plan to use Phase III OSCAR within a year of its launch?
A) Yes
B) No

50) Do you plan to use the new 10.1-MHz band within one year of its opening?
A) Yes
B) No

HAM HELP

I have a Swan 350 and would like to know if anyone has added an RIT to this transceiver. I'll be happy to pay for any copying or postage fees.

James Herriges WB9RSK
542 E. Van Beck Ave.
Milwaukee WI 53207

I would like to find the manual (or copy) for the Alda 105. I am willing to pay a reasonable price.

Larry K. Pittman WD9EME
18919 E Rd., 410N
Hope IN 47246

I need the manual, schematic, or any information on a rack-mounted modem marked as both Periphonics DSU-400 and as I/Onex Type Autotone model 302. I am also looking for work in electronics in upstate New York. I have a BSEE, FCC General-class license, and I am very good with computers, especially assembly language.

Michael Moroney WA2VXY
18 Sevilla Drive
Clifton Park NY 12065

See List of Advertisers on page 114

Wanted: AA, AB, AC, and AD coils for a National HRO-60 receiver.

Fred P. Robbins Jr. W5LNE
Star Route Box 166
Bay City TX 77414

I am looking for the Hallicrafters Super Skyrider model SX-28A, the UHF model S-37, and the Panoramic Receiver, model S-35. I will pay all costs.

Peter Dal Corobbo
18650 S. Marshfield
Homewood IL 60430

I need the manuals (or copies of them) for the Yaesu FT-7B and the Azden PCS 2000.

Larry Fields, Engine Dept.
USNS Silas Bent T-AGS26
FPO San Francisco CA 96661

I need a manual for a Model 75 Aerovox resistance-capacitance bridge. Can you help?

A. D. Buckley WB1AQV
14 Knapp Drive
Prospect CT 06712

Wanted: manual for the Tektronix 564 mainframe. I would prefer to buy it, but I am willing to copy a manual and return it.

Hugh Watson
59 Orchard St.
Elmwood Park NJ 07407

W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 8

at that time, so this might be a good opportunity to mount a major DXpedition. The hams in Brunei are enthusiastic about this—anything to get DXers off their backs. I've talked with hams in Sabah about this, too, and perhaps the independence of Brunei might be a good excuse to mount an all-Borneo DXpedition. I'll bet we could get coverage on television for something like that. We might send a team to 9M8, 9M6, and YB7 as well as Brunei and put these countries on the air for a week solid. Anyone game for this? I think we could arrange for a very reasonable charter air flight, group accommodations at a reduced rate, and so on. I have been assured that licenses can be arranged if we start far enough ahead. I'd suggest this as a project for DX clubs, with each choosing one country for their group to activate. Then we could all get together in Singapore at the end for one hell of an Asian hamfest.

By the way, I've found that there is considerable enthusiasm from all of the DX amateurs in our starting a foreign operating news section for *73*. All of them are interested in keeping up with rule changes in other countries, reciprocal licensing news, DXpeditions, and anything else unusual happening around the world. This is a world hobby today, but none of the ham magazines has really treated it as such. We are all interested in knowing about countries which will be becoming independent, in the formation of new countries such as Qua Qua, in new certificates and contests, and so on. We want to know about major hamfests and conventions around the world. We'd like to know about any outstanding cases where amateur radio provided emergency communications.

With a couple new magazines in the works for 1983, I may have to skip the next Asian tour myself, but this is no reason for you to pass up this fantastic trip. Hit the major cities and their electronics shows, then ad lib some unusual spots on your way back home. You'll find the local hams outstanding in their hospitality. And, if you start well ahead of time, you may be able to get your own license and do some DXing from the rare end. By 1984, I think we'll be putting together the Borneo Super DXpedition if enough of you like the idea. As I told the chaps when we were going to Navassa, no matter what else you ever do in life, this is one experience you will never, never forget. The experience is priceless.

One little hint for those with the guts to make the decision to come to Sabah: You will enjoy it. I guarantee you will enjoy it. But be sure, if you stop at the Hyatt, not to take an inside room. The entertainment in the central atrium is loud and continues until midnight, filling the room with 90-dB sound. Take an outside room.

HAM HELP

I need schematics or service manuals for the Heath DX-150 transmitter and the Heath IO-10 oscilloscope. I will copy and return them.

William Bohnenberger
18 E. 199 St.
Bronx NY 10468

Wanted: a lower sideband crystal, 251.650 kHz, for the Collins KWS-1 transmitter. Please advise me of the condition and the delivered price.

Edward Dobblelaere
4164 Long Lake Road SE
Port Orchard WA 98366

Can anyone send me a copy of the schematics and manual for the Realistic DX-120 communications receiver? I will pay for copying.

John P. Centers
514 Pine St.
Wapakoneta OH 45895

Anyone who can provide historical information on the defunct American Legion net, which operated in California from 1924 to 1952, please contact me.

J. Phil Scherck WA7AGY
8987 Curbaril Ave.
Atascadero CA 93422

I am looking for the manual, schematic, or parts list for the Measurements Corporation model 62 VTVM. I will gladly pay copying and mailing costs.

Vernon Jones WB1BVH
32 Cat Mousam Rd.
Kennebunk ME 04043

I would like to get in touch with other users of the R390A/URR. I need a source for manuals, schematics, and modifications.

Bob Lombardi WB4EHS
2046B Renee Place
Melbourne FL 32935

I am looking for a manual for a Knight KG-685 color pattern generator and a tube chart for a B & K model 650 tube tester. I will pay for shipping both ways so I can photocopy.

Larry Schuldt
545 Willow Rd.
Marengo IL 60152

I am trying to find schematics for the Heath HO-10 monitor scope and the Ameco model CN 6-meter nuvistor converter. I will reimburse all expenses.

Howard Robb
340 S. 5th St.
Bird Island MN 55310

I would like to add 10-meter capability to my DenTron GLA-1000B linear amplifier. Please write me; I will defray costs.

George Gauggel
3660 Puuku Mauka Dr.
Honolulu HI 96818

I need a schematic and a manual for the Eico model 320 signal generator. I am willing to buy it or pay copying costs.

Edwin Adams KB3DH
RD4 Box 241A
Bloomsburg PA 17815

We need the manuals or schematics for a Fermont Engine Generator Plant 10-kW diesel generator, model J-141-1, bearing serial number J-141-0018. The generator is marked as a General Electric #LC7470B16 type 6J, model number 5SJ4254P22Y12. The battery recharging circuitry, marked Fermont #6064-0001, has been damaged. We will gladly make arrangements to obtain information on this generator.

Wayne Richardson
Lebanon Junction Area Coordinator
Bullitt County Division of Disaster and Emergency Services
Main St.
Lebanon Junction KY 40150

I am looking for information on the Western Electric Indicator BC 1152-A, particularly the schematic and data on the 3HP7 CRT. I will pay costs for copying and postage.

Torgny Karlsson SM7CFQ
Sandormsvagen 7
S-260 41 Nyhamnslage
Sweden

I am looking for pen pals in the US. I am 18 years old and an engineering student.

Isaac Maxwell Kyereboah
PO Box 078
Takoradi, Ghana
West Africa

I am looking for modifications for the Heath SB-101 transceiver. I am particularly interested in improving 10-meter reception, adding an RIT and improving the selectivity. I will answer all replies and refund expenses.

Paul Newman G4INP
3 Red House Lane
Leiston, Suffolk IP16 4JZ
United Kingdom

I need 3 tubes, type 12JB6, for my Drake TR-3. I cannot find these tubes in Brazil.

Walter Pereira Da Costa PY4ZO
PO Box 207
Araguari, Minas Geraid
38440 Brazil

I desperately need parts to repair my Hallicrafters FPM-300 transceiver. I will pay for a complete non-working unit or the audio amplifier module, a U401 balanced mixer assembly MX-1, part number 150-018555-001.

Robert Sondack VE2ASL
260 Rue Bellerive
St-Luc, Quebec
Canada J0J 2A0

I need the manual for the Hammarlund HQ-180A receiver. I will pay for copying costs and send a note of thanks.

Bob Napoli K2LGO
Box 158
Riverhead NY 11901

CORRECTIONS

In Fig. 1 of "The Automatic Beam Aimer," on page 23 of November's issue, the power-supply diode was drawn backwards. The cathode should be connected to the transformer secondary.

Avery Jenkins WB8JLG
73 Staff

The parts values were omitted from the "Headlight Reminder" which appeared in the November "Circuits" feature on page 109. Q can be any common PNP transistor, but a 2N3638 or a 2N2907 works well; D1 and D2 are 1N4002 diodes; R1 is a 5.6k, ¼- or ½-W resistor; R2 is a 4.7k, ¼- or ½-W resistor.

Avery L. Jenkins WB8JLG
73 Staff

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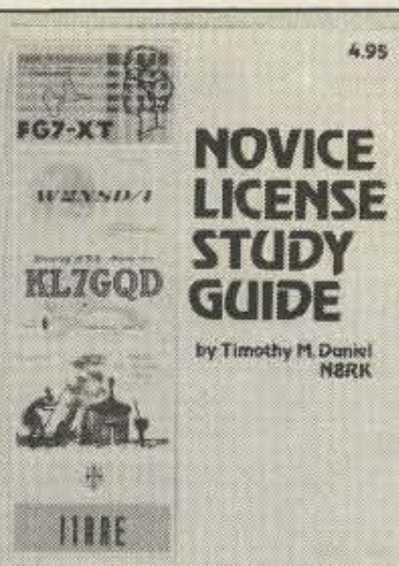

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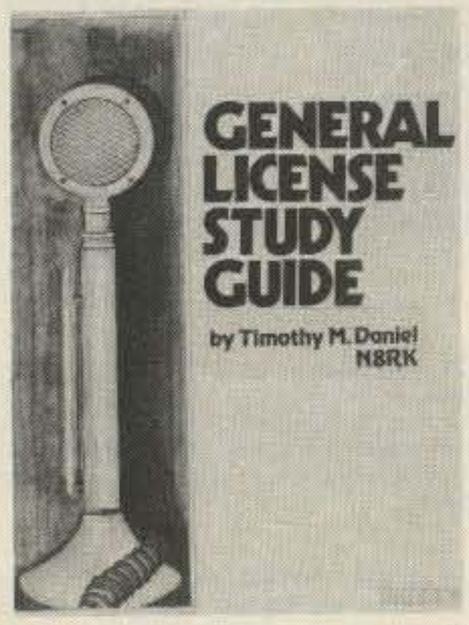

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"GENESIS"

5 WPM—CT7305—This is the beginning tape for people who do not know the code at all. It takes them through the 26 letters, 10 numbers and necessary punctuation, complete with practice every step of the way using the newest blitz teaching techniques. It is almost miraculous! In one hour many people—including kids of ten—are able to master the code. The ease of learning gives confidence to beginners who might otherwise drop out.

"THE STICKLER"

6+ WPM—CT7306—This is the practice tape for the Novice and Technician licenses. It is made up of one solid hour of code, sent at the official FCC standard (no other tape we've heard uses these standards, so many people flunk the code when they are suddenly—under pressure—faced with characters sent at 13 wpm and spaced for 5 wpm). This tape is not memorizable, unlike the zany 5 wpm tape, since the code groups are entirely random characters sent in groups of five.

"BACK BREAKER"

13+ WPM—CT7313—Code groups again, at a brisk 14 per so you will be at ease when you sit down in front of the steely-eyed government inspector and he starts sending you plain language at only 13 per. You need this extra margin to overcome the panic which is universal in the test situations. When you've spent your money and time to take the test, you'll thank heaven you had this back-breaking tape.

"COURAGEOUS"

20+ WPM—CT7320—Code is what gets you when you go for the Extra class license. It is so embarrassing to panic out just because you didn't prepare yourself with this tape. Though this is only one word faster, the code groups are so difficult that you'll almost fall asleep copying the FCC stuff by comparison. Users report that they can't believe how easy 20 per really is with this fantastic one hour tape.

"OUTRAGEOUS"

25+ WPM—CT7325—This is the tape for that small group of overachieving hams who wouldn't be content to simply satisfy the code requirements of the Extra Class license. It's the toughest tape we've got and we keep a permanent file of hams who have mastered it. Let us know when you're up to speed and we'll inscribe your name in 73's CW "Hall of Fame."

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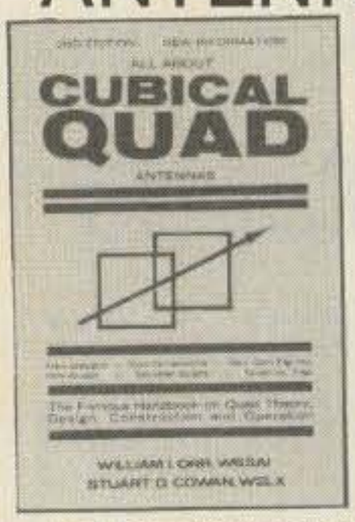

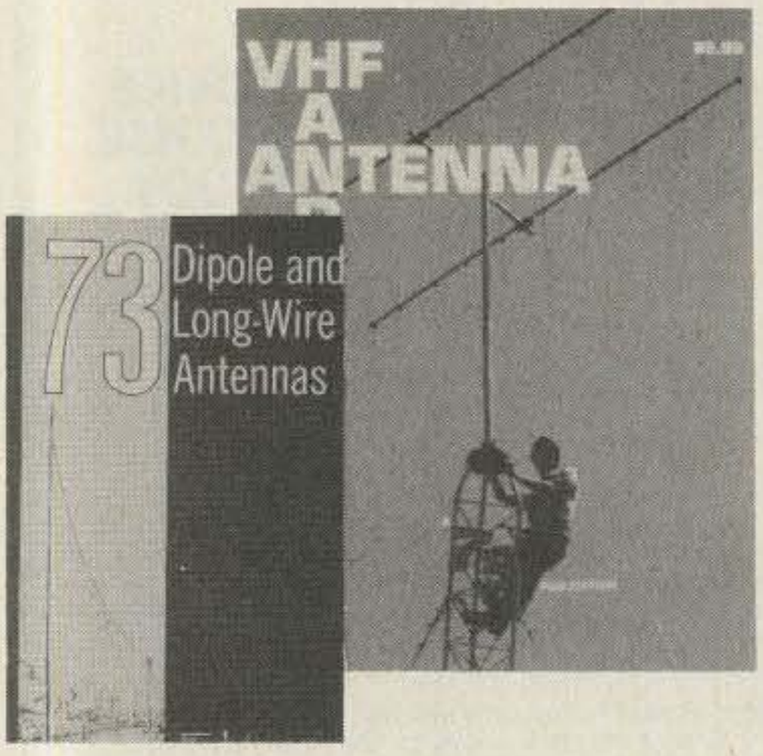

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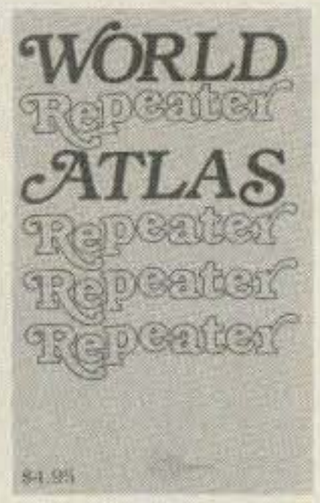

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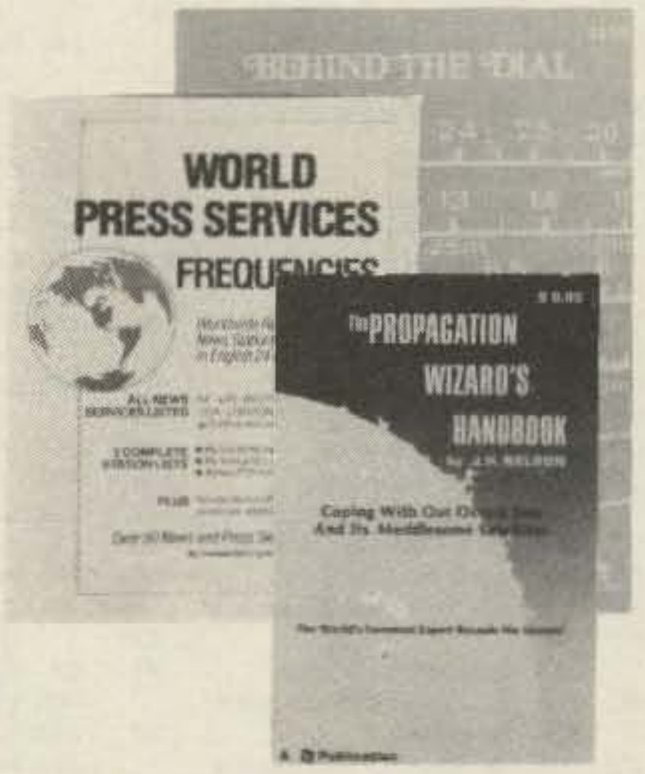

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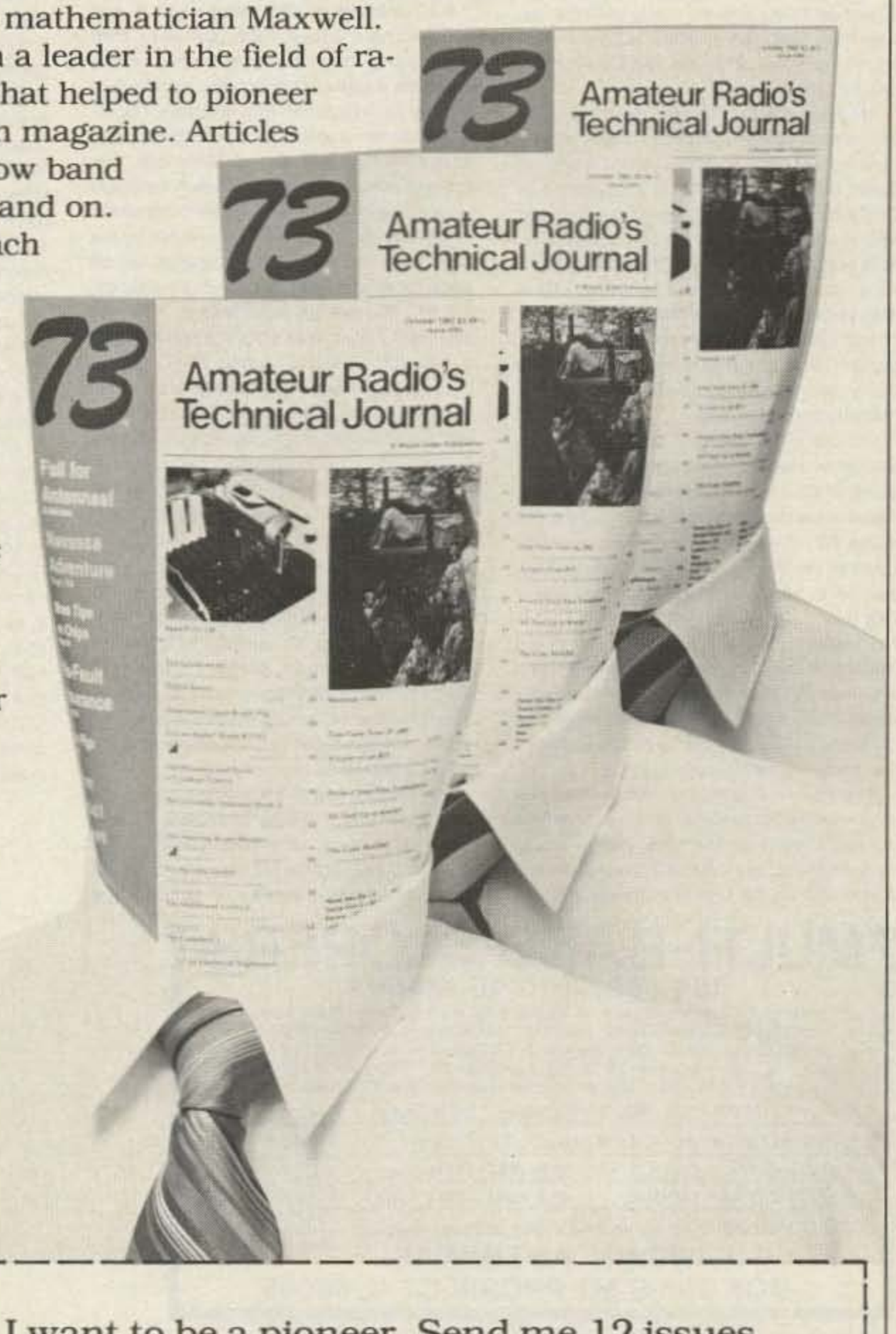

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There's a great old song written by James V. Monaco and Joe McCarthy called "You Made Me Love You." It's that kind of feeling that I get in February, what with Valentine's Day and all, along with the letters from you, the readers, whom I truly adore. Let's see what you all have to relate this month.

Starting with the "foreign desk" (sounds like "World News Tonight"), I have a note here from a colleague in Central America. David Reuben Harris, M.D., a physician in Costa Rica, is a TRS-80 user who is trying to obtain software for his Model I that will enable him to both copy RTTY and fully interface his computer on the air. Now, I have always been a fan of software solutions to "hard" problems, but not this time. A perusal through the published literature really fails to demonstrate much in the "strictly software" vein.

On the other hand, I have received a packet of material that just might answer some of Dr. Harris's needs. Kantronics, located in Lawrence, Kansas, produces a versatile RTTY interface, which we touched upon in December. With some more information in hand, let's see what they say it can do.

Their box, called "The Interface," is the hardware link that turns a computer and amateur transceiver into a highly sophisticated RTTY system. It allows transmission on Murray, ACSII, or Morse with essentially the same operating convenience.

The unit itself is contained in a small box that attaches to external devices through a series of jacks on the back panel. Inputs and outputs are provided which accept audio and digital inputs between speaker audio, computer, and accessory keyboard or key. Front-panel indicators include a tuning LED and bar-graph LED, used to center incoming signals within the demodulator's passband. There is even a loop driver available to switch an external 60-mA loop so that an antique Model 15 can be used as a printer for such a modern system.

No hardware of this complexity is any good without equally able software and, recognizing this, Kantronics has made available a group of programs known generically as "Hamsoft" that interface The Interface to the Apple II, Vic-20, TRS-80C, and Atari 400/800 computers. Additionally, it is entirely possible to write custom software to use The Interface with other computers.

An interesting possibility is raised by the note that the Hamsoft programs, which allow for Morse code in the 5-99-wpm range, 60-, 67-, 75-, and 100-wpm Murray, 110- and 300-baud ASCII, split-screen display, transmit buffer, Morse ID during RTTY, printer output, and more, will operate with other terminal units. That means that you might, and I emphasize *might*, be able to use the Hamsoft program between your computer and terminal unit if all else is compatible. Kantronics makes no promises that you can, but it might be interesting to try.

A further indication of the care that went into this product is a full section in the manual of The Interface which details modifications needed to operate with certain transceivers which present problems. Whether the modifications need be made to The Interface or the transceiver, it is spelled out in enough detail that accomplishing the change should be no real problem.

Kantronics has put together a nice package here, and I will be interested to hear from those of you who have used The Interface and Hamsoft in its various configurations. I am sure that Phil Anderson W0XI, president of Kantronics, and the other folks out there will be happy to answer your questions. Write them at 1202 E 23rd Street, Lawrence KS 66044, and be sure to mention 73's RTTY Loop.

Speaking of Phil Anderson, he passes along a question which several others have also posed. Kirk Baxter WB0AXX, in Mission, Kansas, and John Ryan, in Alcove, Quebec, both also are interested in several of the encoded RTTY signals heard on commercial frequencies. Kirk relates a series of such codes, including bit inversion, bit transposition, TOR codes, SITOR codes, ARQ, FEC, and SEL-FEC codes. These signals are uncopyable on a standard system and can represent a real challenge to the hard-core RTTYer.

The first few codes asked about are simple techniques, designed merely to ensure some degree of privacy. It is fairly easy to envision manipulating a standard Murray character to, say, invert one or more bits from mark to space, or vice versa. Thus, the letter "R" would change from 01010 to 00110, if bits two and three were inverted, and would print as an "I" on an unmodified machine. Similarly, one can consistently transpose two or more bits in each character, again rendering it unprintable without the key for deciphering.

These codes are not difficult to decode with a computer program which recognizes the cipher and undoes what the sender did. Of course, if the encoding station is really nasty, the characters can have bits both inverted and transposed, but that is another convolution.

The Murray code, as we all know, is a five-level code. While ASCII is the most common code using more than five bits, it is apparently quite rare on radio circuits. A complex series of codes is used on many commercial circuits which has error-detection abilities. Known as the Moore code, or CCITT No. 3, it is a seven-bit code sent synchronously, as opposed to the asynchronous Murray code.

Thirty-five characters are each composed of three marks and four spaces, in various combinations. If a character is received which does not have the correct number of marks and spaces, the receiving station can send a code to repeat the last transmission. This is called the "Automatic Repetition on Request" and yields the mnemonic "ARQ" when referring to this code.

Another code system which allows for error correction is the "Telex Over Radio," or TOR system. Some trademarks for systems using TOR include SITOR and SPECTOR. The TOR codes resemble the Moore system in their formulation, but are each four marks and three spaces; thus, the characters themselves are completely different. The FEC noted above is a Forward Error Correction in which each character is sent multiple times to receivers unable to request a correction. The receiver is set up to select any of the repetitions which meet the correct mark/space ratio and discard the rest.

Although this is an overview, I hope this explains the more unusual codes heard on the air. If there is sufficient interest, we may be able to devote more time in the future to schemes to decode some of these code types. Let me know with your cards and letters; I look forward to them.

I will close this month with a request from another reader out west. Bob Sanett W6TWR, in Van Nuys, California, is trying to hook up a Siemens T-1000 RTTY unit. He describes this as a daisy-wheel printer for TTY! Sounds interesting, but he needs any information he can get. Anyone with anything of note should drop me a line and send Bob a copy at PO Box 7323, Van Nuys CA 91409. I'm sure he will appreciate it.

Will try to outline some more on the terminal next month, and of course something from you, the readers. This is our column, yours and mine, and between old Model 15s and new computers, that's quite a range, here, in RTTY Loop.

↙See List of Advertisers on page 114

CONTESTS

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

ARIZONA QSO PARTY

Starts: 1800 GMT February 5
Ends: 0600 GMT February 6

Sponsored by the Southern Arizona DX Association. Single-operator and club entries, all bands and modes but no repeater contacts allowed. Each station may be worked only once per band.

EXCHANGE:

RS(T) and state, province, DXCC country, or Arizona county. Novices and Technicians also sign /N or /T, respectively.

FREQUENCIES:

Phone—3895, 7230, 14280, 21365, and 28560.

CW—60 kHz up from lower band edge.

Novice—25 kHz up from lower band edge.

SCORING:

Count 1 point per phone QSO, 2 points for each CW or other mode QSO, and 4 points per QSO with Novice or Technician in the Novice bands. Arizona stations multiply QSO points by number of states, provinces, and DXCC countries. Others multiply QSO points by number of Arizona counties (13 maximum). The club station, W7NQ, also counts as 1 multiplier for non-Arizona stations. Anyone working all Arizona counties and W7NQ may double the multiplier.

AWARDS:

Certificates for the highest-scoring station in Arizona, non-Arizona, and Novice/Technician. In addition, certificates for highest score in any Arizona county, state, province, or DXCC country in which there are at least five entries.

Other certificates for Arizona and non-Arizona clubs whose members' scores combine for the highest score. Club entry must consist of at least five individual entries to be eligible. Club residency determined by mailing address.

ENTRIES:

Individual entries should show each station worked, exchange, and time and frequency of each QSO. Include a summary sheet of your scoring and dupe sheets for bands with more than 50 QSOs. Entry may designate one club with which you are participating. Deadline for individual entries is March 5th.

Club entries should be submitted by a club officer with a summary of callsigns and claimed scores. To be counted toward the club total, the individual entries must also designate the club. Deadline for club summaries is April 5th.

Include a large SASE for results. Entries should be addressed to: Southern Arizona DX Association, c/o Philip M. Stickney N7BUP, 1890 West Paseo Cuenca, Tucson AZ 85704.

SOUTH CAROLINA QSO PARTY

Starts: 1800 GMT February 5
Ends: 2359 GMT February 6

The QSO party is again sponsored by the Colleton County Contestors. The same station may be worked on each band and mode, simplex only. South Carolina mobile stations that change counties are considered new stations. Novice and Technician stations please sign /N or /T.

EXCHANGE:

RS(T) and state, province, country, or South Carolina county.

SCORING:

Phone contacts are worth 2 QSO points, CW contacts are worth 3 points. The multiplier for South Carolina stations is the number of states, provinces, and DX countries worked. Others multiply QSO points by the number of South Carolina counties worked (46 maximum).

FREQUENCIES:

Phone—3895, 7230, 14280, 21365, and 28560.

CW—3560, 7060, 14060, 21060, and 28060.

Novice—3725, 7125, 21125, and 28125.

AWARDS:

Certificate to top-scoring station in each South Carolina county, state, province, and DX country. Novices and Technicians compete only with other Novices and Technicians.

ENTRIES:

Include a summary sheet with your entry showing scoring and other information. Indicate each new multiplier in your log as it is worked. Novices and Technicians indicate class on your entry. Include a large SASE for results. Mailing deadline is March 5th. Send to: Colleton County Contestors, c/o Elliott Farrell, Jr. KE4VP, Rt. 3 Box 658, Walterboro SC 29488.

NEW HAMPSHIRE QSO PARTY

1900 GMT February 5 to 0700 GMT February 6
1400 GMT February 6 to 0200 GMT February 7

Sponsored by the Concord Brasspounders, Inc. (W1OC), to promote the Worked New Hampshire Award. Stations may be worked once per band, per mode. New Hampshire stations may work each other.

EXCHANGE:

Send RS(T) and country, ARRL section, or New Hampshire county as appropriate.

FREQUENCIES:

Phone—1820, 3935, 3975, 7235, 14280, 21380, and 38575.

CW—1810, 3555, 7055, 14055, 21055, and 28130.

Novice—3730, 7130, 21130, and 28130.

VHF—50.155 and 145.015 FM simplex, no repeaters.

SCORING:

New Hampshire stations score 1 point per QSO multiplied by the number of ARRL sections plus countries plus New Hampshire counties. Others score 5 points per New Hampshire QSO times the number of New Hampshire counties worked.

ENTRIES:

Send your entry no later than March 12th to the Concord Brasspounders, Inc., c/o Norman W. Littlefield, RFD 1 Buck St., Box 323, Suncook NH 03275. Include a large SASE for results and/or award.

VERMONT QSO PARTY

2100 GMT February 5 to 0700 GMT February 6
1100 GMT to 2400 GMT February 6

Sponsored by the Vermont Amateur Radio Club (W1BD). Each station may be contacted once on each band and mode. Repeater contacts and multiple contacts with the same station on the same band and mode are invalid.

EXCHANGE:

QSO number and state, province, country, or Vermont county.

FREQUENCIES:

Phone—3930, 3960, 7230, 7260, 14280, 14320, 21360, 28570, 50.110, and 144.2.

CW—3530, 3730, 7030, 7130, 14080, 21060, 21160, 28070, and 144.1.

SCORING:

Vermont stations score one point per contact with any station. Multiply QSO points by number of states plus Canadian provinces plus countries (exclude US/Canada). Others score one point per Vermont contact and multiply by the number of Vermont counties (14 maximum).

AWARDS:

For non-Vermont stations, certificate to highest-scoring station in each state, province, and country and to highest-scoring Novice/Technician. Certificates will be given each Vermont station submitting a log. W/VT Award given to stations working 13 of Vermont's 14 counties.

ENTRIES:

Send SASE for official log and score sheets. Send logs/facsimiles, name, class of license, and address not later than March 1st to: D. Nevin KK1U, W. Hill, Northfield VT 05663. Include an SASE for a copy of the results.

QCWA QSO PARTY—CW

Starts: 0001 GMT February 12
Ends: 2000 GMT February 13

This is the 26th annual QCWA QSO Party, with separate weekends for CW and phone. You can work the same station more than once providing it is on another band. Only the bands listed under frequencies will count in this QSO party.

EXCHANGE:

QSO number, operator's first name, QCWA chapter identification (official number or name), and state or country. Members not affiliated with a chapter should use "AL."

FREQUENCIES:

Any authorized amateur frequency in the bands that are listed below is permissable. The following suggested frequencies have been selected to minimize interference to others, but please feel free to wander up or down from these if you so desire. Bands: 3530-3560, 7030-7060, 14030-14060, 21040-21070, and 28040-29070. The above are selected as a starting place. When pileups occur, don't be afraid to go to either side of these frequencies.

SCORING:

Each contact made with another QCWA

CALENDAR

Feb 5-6	South Carolina QSO Party
Feb 5-6	Arizona QSO Party
Feb 5-6	Vermont QSO Party
Feb 5-7	New Hampshire QSO Party
Feb 12-13	QCWA QSO Party—CW
Feb 15-16	America Radio Club International DX Contest
Feb 18-20	*A5 Magazine* UHF-ATV (FSTV) QSO Party
Feb 19-20	YL ISSB QSO Party—Phone
Feb 19-20	ARRL International DX Contest—CW
Feb 26	RTTY World Championship Contest
Mar 5-6	ARRL International DX Contest—Phone
Mar 12-13	YL ISSB QSO Party—CW
Mar 12-13	QCWA QSO Party—SSB
Mar 12-14	Idaho QSO Party
Mar 12-14	Virginia QSO Party
Apr 9-10	CARF Commonwealth Phone Contest
Apr 9-10	ARRL QSO Party—CW
Apr 16-17	ARRL QSO Party—Phone
Jun 11-12	ARRL VHF QSO Party
Jun 25-26	ARRL Field Day
Jul 9-10	IARU Radiosport Championship
Jul 15-17	*A5 Magazine* SSTV DX Contest
Aug 6-7	ARRL UHF Contest
Aug 19-21	*A5 Magazine* UHF FSTV DX Contest
Sep 10-11	ARRL VHF QSO Party

RESULTS

1982 *A5 MAGAZINE* NORTH AMERICAN FSTV-UHF CONTEST

1	W6VCF	9989
2	WA8RUT	5685
3	WD8MRV	3560
4	WB6ROP	3403
5	KB0XL	3015
6	WB9MCF	1955
7	W2RPO	1907
8	WB0ZJP	1905
9	WA9NJR	1895
10	VE3FYY	1621
11	W6RVP	1620
12	W2WHK	1496
13	WA8SAR	1494
14	K8HVA	1445
15	KA0BVT	1225

PARKING AE5C/R 147.78 / .18 TICKET
PLANO AMATEUR RADIO KLUB

NEWSLETTER OF THE MONTH

Although most people do not like to get parking tickets, the hams in Plano, Texas, get one every month—and they enjoy it.

The Parking Ticket is the newsletter of the Plano Amateur Radio Klub, and it encompasses a rare combination of humor, information, and good looks.

The good looks came from recent experimentation with the newsletter, varying the type and layout in response to reader feedback. The result is a very clean newsletter; the columns are well laid out and rarely can a typographical error be found.

Inside features include a two-month calendar of events—not just a list, but a full-fledged calendar with enough room to write notes. Regular features include "Traffic Talk," an educational column on traffic handling, and "The Novice Corner," a tongue-in-cheek tribute to beginning hams. December's issue featured a review of some books titled *The EMP That Ate Worldwide Communications*, and *Practical Tree Pruning With Mobile Antennae*.

However, editor Rick Goodin N5CBI admits that he does have his limitations. "I had grand delusions," he said in a recent editorial, "of writing a coherent, cogent, and otherwise brilliant column, but that was quite a few hours ago when my body still felt awake and my cerebrum had not yet lapsed into autopilot."

Take a nap, Rick; you deserve it for a job well done.

73 encourages clubs to send in their club newsletters. Just address them to *73*, Pine Street, Peterborough NH 03458. Let us know what is going on in your area.

member will count as a single point. This year's contest has three multipliers: chapters, states, and countries. For each band, every new chapter is a multiplier of one, every new state (USA) is a multiplier of one, and every new country (ARRL DXCC list) is a multiplier of two. At the end of the party add up your total contacts for all bands and multiply it by the sum of all your multipliers for all bands. This will give you your total and final score.

ENTRIES:

Please keep separate logs for each band. Logs should include the following information: time (GMT), call, QSO numbers, name, chapter number or name, state or country. It is the responsibility of each contestant to provide a legible log (no carbon copies) and to list all claimed contacts. The total contacts and multipliers for each page should be recorded at the bottom of each page. The total contacts for the party should be recorded on the first page of the log. Log sheets will not be returned. Make sure you have correct postage when you mail your logs. Send logs no later than March 31st to: Spaceport Center #66, Donald McClenon N4IN, 3075 Florida Avenue, Melbourne FL 32901. Separate logs and scores must be submitted for the CW and phone parties.

AMERICA RADIO CLUB INTERNATIONAL DX CONTEST

Starts: 0400 GMT February 15
Ends: 2400 GMT February 16

Any amateur station making two contacts with America Radio Club DX member operators during the two-day contest will be eligible to apply for the Special Silver QSL Award. Stations making three contacts will be eligible for the Special Gold Silver QSL Award. Contacts must be during the two-day period listed above. Suggested frequencies include all authorized frequencies in the 10-, 15-, 20-, and 40-meter phone and CW bands. Exchange RS(T) and QTH. SWL stations also may apply for this award on a heard basis. For special award, send QSL and $2.00 in US funds or 3 IRCs to: America Radio Club QSO Contest, PO Box 3576, Hialeah FL 33013.

YL ISSB QSO PARTY—PHONE

Starts: 0001 GMT February 19
Ends: 2359 GMT February 20

Two six-hour rest periods are required. Operating categories include: single operator, DX/WK partners, and YL/OM teams. All bands will be used and the same station may be contacted on different bands for contact points but not as country multipliers. VHF and UHF may be used but all contacts must be direct and not through repeaters. Nets are not allowed!

EXCHANGE:

Name, RS, SSBer number, country, W/K state or VE province, and DX/WK partner's call. If no partner, leave blank. If nonmember, send "NO NUMBER."

FREQUENCIES:

On HF, use the USA General-class band portions. On 20 meters, be aware of the nets on 14313 and 14336. Stay away from 14332; leave it open for DX members trying to make contacts. Check 80 and 40 meters on the hour.

SCORING:

Score 3 points for each member contacted on your own continent, 6 points if different continent. Nonmembers' contacts count one point. Only member station contacts count for multipliers. Multipliers are each state, country, and VE province. Also, each team contacted but only once for each team. When DX/WK partners contact each other it counts as a double multiplier. If your total dc input power is 250 Watts or less during the entire QSO party, then count an additional power multiplier of two. Final score is the sum of QSO points times the total multiplier.

AWARDS:

Special certificates will be awarded to the winners of each category. Regular certificates for country, US state, and Canadian province winners.

ENTRIES:

Logs must show date/time (GMT), station QSOed, RS, mode, band, SSBer number, US state, VE province, or country, and period of rest time. Summary sheets show states, Canadian provinces, countries, YL/OM teams, DX/WK teams, and partner contacts. Send logs and summary sheets to Rick and Minnie Connolly (K0RDJ and KA0ALX), Star Rt. 1, Crocker MO 65452 prior to June 1st. Be sure to indicate who your DX/WK partner is!

RESULTS

1982 NEW JERSEY QSO PARTY

New Jersey Stations

Station	QSO Points	Sections	Score
WA2QNW	1018	72	73,296
W2ZQ*	534	62	33,108
N2AEW	260	48	12,482

Out-of-State Stations

Station	Contacts	Counties	Score
N3RJ	77	21	1,617
W5WG	47	19	893
KC4HN	47	18	846

New Jersey Counties

Station	Score
Atlantic	
WD4SIG/M	234
Bergen	
WB3HUP/M	8
Burlington	
W2XQ	3,475
WD4SIG/M	209
WB3HUP/M	10
Camden	
WD4SIG/M	88
WB3HUP/M	8
Cape May	
W2YC/2	4,060
WD4SIG/M	143
Cumberland	
W2ZY	3,536
WD4SIG/M	192
Essex	
WD4SIG/M	54
WB3HUP/M	30
Gloucester	
WD4SIG/M	72
WB3HUP/M	25
Hudson	
WB3HUP/M	72
Hunterdon	
WA2HCC	3,000
WD4SIG/M	70
WB3HUP/M	4
Mercer	
W2ZQ*	33,108
WB2PKG	4,350
WB3HUP/M	4
Middlesex	
WA2QNW	73,296
WD4SIG/M	49
WB3HUP/M	2
Monmouth	
W2GSA* (Operators: KN2B, KA2F, WA2SSH)	11,562
KF2T	2,508
WD4SIG/M	132
Morris	
WD4SIG/M	324
WB3HUP/M	54
Ocean	
N2AEW	12,480
WD4SIG/M	192
Passaic	
KC2PL	3,000
WA2ASQ	561
WB3HUP/M	30
Salem	
WB2KMR	918
WD4SIG/M	56
Somerset	
WD4SIG/M	70
WB3HUP/M	9
Sussex	
W2RQ	112
WD4SIG/M	112
WB3HUP/M	9
Union	
WB2DND	1,045
WD4SIG/M	72
WB3HUP/M	2
Warren	
WD4SIG/M	72
WB3HUP/M	16

Out of State

Location	Station	Score	Location	Station	Score
CT	KF1B	143	KY	WA4EBN	231
	W2CC/1	1	VA	KC4HN	846
ME	N1PL/1	364		K0RI/4	782
	WB1GLH	25		WA4PGM	247
E. MASS	KA1CLV	228	LA	W5WG	893
E. NY	K2POF	592	N. TX	KX5U	9
	W2WSS	187	S. TX	W5PWG	646
W. NY	WB2IPX	442	AZ	AK7J	30
DEL	N3ARV	180	OH	WD8OYF	264
E. PA	N3RJ	1617	WI	K9GDF	30
(Worked 21 Counties)			CO	N0CKC	225
	KB3ZF	688	ONT.	VE3KK	595
	W3SK	420		VE3DIF	120
(Operators: AA3B)			DX	JA2YKA	1
	WA3JXW	216	(Operators: JR2GMC, JJ1BTC, JH2QXG)		
W. PA	N3COR	216			
N. FLA	WD4ITK	144			

* = Multi-operator

2ND ANNUAL RTTY WORLD CHAMPIONSHIP CONTEST

Starts: 0000Z February 26
Ends: 2400Z February 26

SPONSORS:

73 and *The RTTY Journal*.

MISCELLANEOUS RULES:

The same station may be worked once on each band. Crossmode contacts do not count. Single-operator stations may work 18 hours maximum, while the multi-operator stations may operate the entire 24-hour period. Off periods are no less than 30 minutes each and must be noted in your log(s).

OPERATOR CLASSES:

(A) Single operator, single transmitter, phone only. (B) Multi-operator, single transmitter, phone only.

ENTRY CATEGORIES:

(A) Single band. (B) Allband, 10-80 meters.

EXCHANGE:

Stations within the continental 48 US states and Canada must transmit an RST report and state, province, or territory. All other stations, including Alaska and Hawaii, transmit RST report and consecutive contact number.

QSO POINTS:

1 QSO point is earned for each valid contact.

MULTIPLIER POINTS:

1 multiplier point is awarded for each of the 48 continental US states, Canadian provinces or territories, and DX countries worked on each band.

FINAL SCORE:

Total QSO points times total multiplier points equals claimed score.

CONTEST ENTRIES:

Entries must include a separate log for each band, a dupesheet, a summary sheet, a multiplier checklist, and a list of equipment used. Contestants are asked to send an SASE to the contest address for official forms.

ENTRY DEADLINE:

All entries must be postmarked no later than March 26, 1983.

DISQUALIFICATIONS:

Omission of any required entry form, operating in excess of legal power, manipulating of contest scores or times to achieve a score advantage, or failure to omit duplicate contacts which would reduce the overall score more than 2% are all grounds for immediate disqualification.

AWARDS:

Contest awards will be issued in each entry category and operator class in each of the US call districts and Canadian provinces and territories, as well as in each DX country represented. Other awards may be issued at the discretion of the awards committee. A minimum of 5 hours and 25 QSOs must be worked to be eligible for awards.

CONTEST ADDRESS:

Send an SASE to RTTY World Championship Contest, c/o *The RTTY Journal*, PO Box RY, Cardiff CA 92007.

DX

Chod Harris VP2ML
Box 4881
Santa Rosa CA 95402

FROM EASTER ISLAND TO CHRISTMAS ISLAND

The Pacific adventures of DXpeditioner Eric Sjolund SM0AGD were mentioned in the August, 1982, edition of this column. The saga of how a copy of that column caught up with Eric reflects the hectic nature of his recent six-month journey.

Fellow Swede (SM5HIH—and how's *that* for a CW callsign!) picked up a copy of the August *73* while his ship was in Houston. SM5HIH sent the article to Eric Edberg W6DU, who maintained daily schedules with SM0AGD as the latter prowled the Pacific. W6DU fired the column off to Eric on Tarawa, in the Kiribati Islands. One month later, the letter arrived in Tarawa postmarked Taiwan and marked, "Not in Taiwan" Well, *some* of the letters are the same. . .

Meanwhile, Eric had completed his two-week operation from T30CB and was in Pago Pago in American Samoa. The letter containing the copy of the column was forwarded to Pago Pago, but once again Eric was on the high seas before the letter caught up with him, this time heading for Christmas Island. The letter missed Eric again at Christmas, but the next forwarding to Hawaii did the trick and Eric finally got to see the column mentioning his "forthcoming DXpedition" at the very end of that trip.

Your DX reporter caught up with world-traveler Eric on his way home to provide this update on one of the most successful amateur radio journeys in many years. Eric reviewed his odyssey for the benefit of *73* readers.

"After the International DX Convention in Visalia, California, I headed for Rarotango in New Zealand's Cook Islands to meet my yacht. We sent the generators and beam antennas ahead by air freight to make sure they would arrive on time, but they didn't show up. The skipper was anxious to leave, so we sailed to deserted Suwarrow Atoll, where I operated as ZK1AF.

"Before he died, a hermit had been the sole occupant of the atoll for years. I used the desk from his hut as my operating table, but I had to move it to the shore of the lagoon to get away from the trees around the hut. It was the most beautiful operating position on the trip: looking out over the long wire and Windom antennas stretched across the blue water. We made two more stops in the North Cook Islands, at the inhabited atolls of Manihiki and Pukapuka.

"I left my transportation in Fiji since the skipper was heading for New Zealand and would miss the other Pacific islands. I spent a month in Fiji looking for a yacht going in the right direction, while operating as 3D2DX. And although the island has no television, I received TVI complaints. It seems the neighbor's video players were sensitive to my low-band operations in the evening. Fortunately, the telecommunications official handling the problem was the person who issued my amateur license, and he took my side.

"It was just as well that I spent the time in Fiji. The poor propagation and solar flares would have made for frustrating DXing. I finally found a yacht heading north. I put T30CB on the air from Tarawa, where I stayed with a local ham, T30BY. I didn't feel guilty about spending a lot of time fishing and seeing the island, as T30 is not too rare.

"In Tuvalu I received my T2AGD callsign in a couple of hours and spent about a week operating. I was the only passenger on a seaplane to Wallis Island, but I had no trouble getting on the air as FW0AG.

"I finally caught up with my generators, TH2 beam, and transportation, and we sailed for Atafu Atol in the Tokelau Islands. This was my favorite stop on the entire trip; I only wish I had been there without radios. The island is unspoiled due to its lack of a good anchorage. The natives were extremely friendly, throwing feasts and dances in my honor. I had to explain that the pileups were waiting and I had to return to the radio. They all thought I was a bit crazy to sit and operate the radio all day and night. I never got to see much of the islands, and I think I would like to go back to really explore them, without a radio—or at least with only a very small one.

"After four wonderful days we sailed on to Kanton Island, the rarest spot on the trip. Kanton was once a military base, so old buildings and antennas abound. Unfortunately, I could not use the huge log-periodic antennas because we had no power to turn them.

"Kanton's two-dozen residents enjoy joint administration by the United States and Kiribati. Thus, I could use two callsigns: T31AD and SM0AGD/KH1. To reduce the confusion and to give out as many contacts as possible, I alternated callsigns, changing them daily at 2400 UTC. It was very confusing for me, so I hung up a sign with my call. At 2400Z, I would turn over the sign and change the call."

Eric Sjolund SM0AGD (right) recently completed a six-month DXpedition in the Pacific, making 47,600 contacts. Friend Eric Edberg W6DU (left) helped Eric stay in touch with Europe during the poor propagation last summer.

Eric's dedication to his DXing is evident in the impressive statistics he rolled up on Kanton: 19,000 contacts in six days of operation under each callsign. He worked 80 meters between 1100 and 1300 UTC, sunrise across the US, to give all operators their best chance to work him, even though this was the middle of the night in Kanton. In fact, Eric got by on only a couple of hours of sleep each night during his two-week stay. "There were no social distractions on Kanton," Eric relates, "but I did get a little tired the second week." Eric operated the radio nearly all the time he was on Kanton, except for a single afternoon that he spent bird watching.

Eric's last DXpedition stop was Christmas Island where he operated for six days as T32AJ. When he finally flew into Honolulu at the end of the voyage, he deposited his rig in a locker at the airport so that he wouldn't be tempted to turn it on.

After a week on the beach at Waikiki, Eric headed home for Sweden. Behind him he left thousands of pleased DXers. Among the 47,600 contacts were thousands of new ones and many more thousands from new-band countries. DXers from the 300-country level to the newcomer worked Eric, many at every stop. Even long-time DXers commented on the excellent handling of the pileups, saying that it was always a pleasure to work Eric.

"He gives everyone a fair shake; you know you will get through eventually, and he almost never misses a callsign, no matter how bad the pileup."

QSL CARDS

Those who made one of the 47,600 contacts with Eric will undoubtedly be looking for their QSL cards. So far, in my series on QSLs and QSLing, I have covered the design of the card, filling out the card, and mailing it to the proper person. Now let's look at the most fun part of QSLing: How do we get the card *back*?

If you are in a hurry (and who isn't?), the fastest way to get your return QSL is by sending a self-addressed, stamped envelope (SASE) with your card. Let's look at the finer points of using SASEs.

Your first step in preparing an SASE is to choose an appropriate envelope. The envelope should be large enough to accept standard-sized cards without folding; try a few of your larger cards first. If you are expecting a return card from outside the US, use an airmail envelope with the little colored slashes around the edges. In the place for the return address, put the call of the DX station.

Neatly address the envelope to yourself, including your callsign, and be careful to include "USA" at the end of your address. Use a separate envelope for each contact —or at least for each different callsign.

Hot Tip: Write the QSO information from your QSL card on the inside of the return envelope flap. For example: T30CB 13X82 0435Z 14003 kHz 2xCW 599. Then if the envelope gets separated from your card, the DX station or QSL manager can fill out and mail you a card based solely on the envelope.

If you are mailing your card and SASE to a stateside station or QSL manager, you can include a US stamp for return postage. (Watch out for postage-rate increases, and include enough postage to pay for the return.) But what if you're mailing your card to Eric's QSL manager, SM3CXS, in Sweden? You can't get Swedish airmail stamps at your local US post office, so how do you supply sufficient return postage? Most amateurs turn to the International Reply Coupon (IRC).

The tiny IRC has many mysteries of its own which we'll explore in a future column, but we'll keep it simple for now. In theory,

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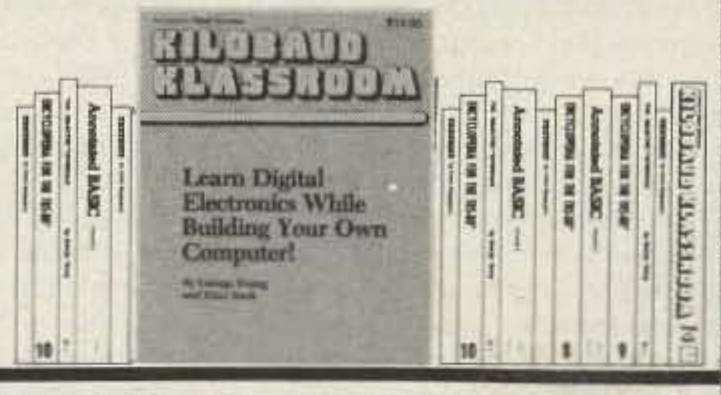

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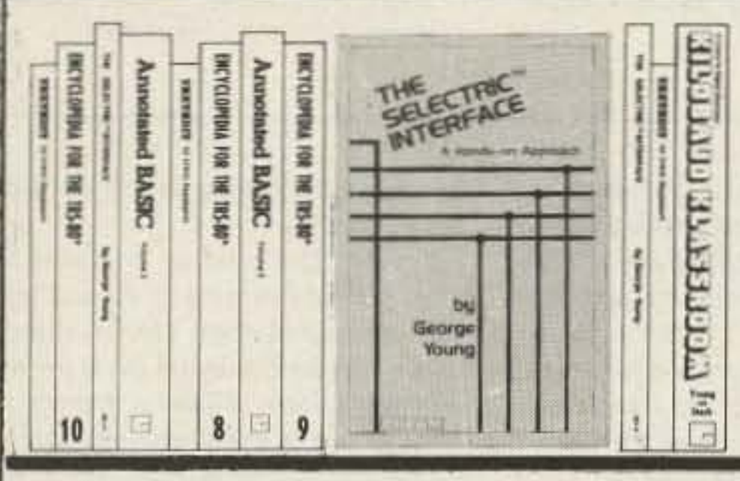

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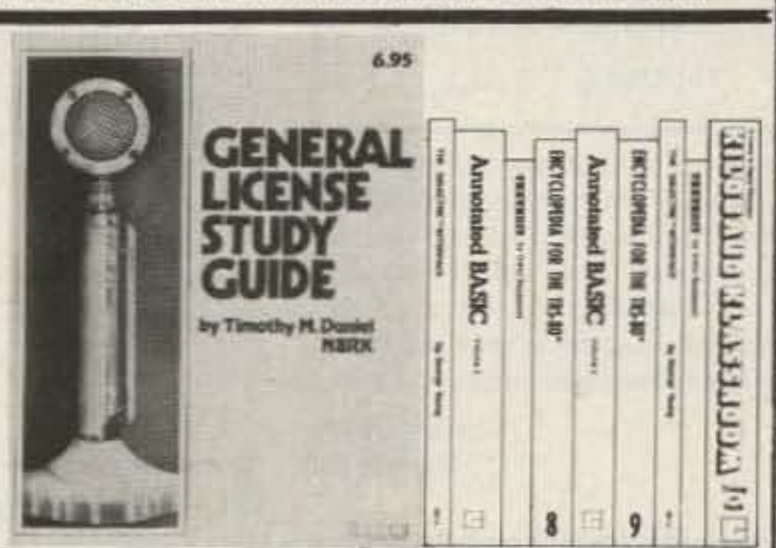

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By Timothy M. Daniel N8RK

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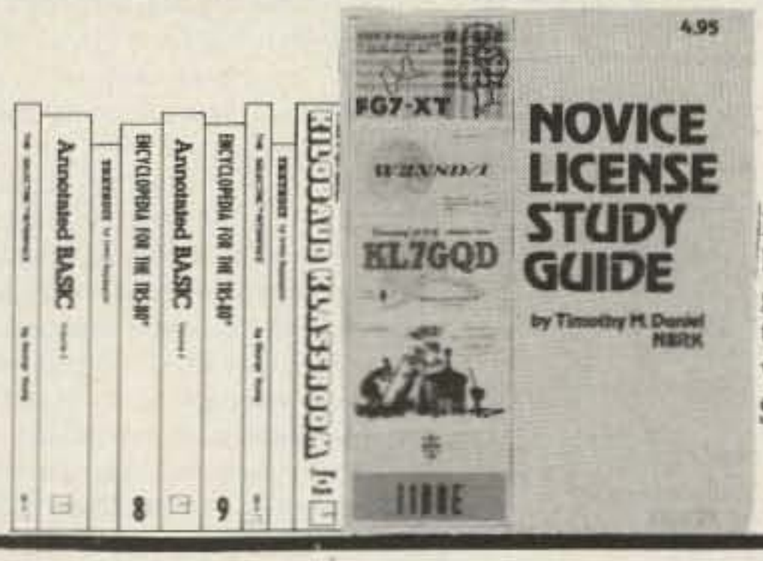

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you can buy International Reply Coupons at any US post office. However, I have gotten a blank stare at some of the smaller branches when I asked for some IRCs. The cost of the IRC goes up frequently, but they were selling for $0.65 each at last count.

You might be able to purchase IRCs for less through your local radio club or from QSL managers and DX stations which receive a lot of IRCs. Ask around. A typical asking price might be $0.40 each, in lots of 100.

The International Reply Coupon forms a sort of internationally-recognized currency for hams. IRCs are seldom cashed in at a post office. Since each is worth one unit of international *surface* postage in exchange, you would get one $0.30 stamp for each IRC turned in. At $.65 each, this is quite a loss.

The IRC has several advantages in DX QSLing. It is universally recognized, even in countries where they are not directly useful, such as communist countries. Eastern Europeans, for example, cannot buy or exchange IRCs within their countries, but they can send out any they receive.

The chief drawback to the use of IRCs is their expense. Many operating aids for the **DXer specify the number of IRCs necessary to return your envelope and QSL via airmail. This number ranges from 2 to 5, so it might** cost as much as $3.25 in IRCs to get your card back from Sri Lanka, not counting the cost to get your card and return envelope *to* Sri Lanka.

Because of the high cost of IRCs and the poor exchange rate at the local post office, some DX stations suggest a "Green Stamp" instead of IRCs. No, not a real Green Stamp, but a US $1.00 bill. It costs less than 2 IRCs, is almost as universally recognized as the IRC, and usually is worth more in exchange. The money is certainly useful to the DX station and often is used to finance future DXpeditions.

However, "Green Stamps" have their own problems. First, they are easily lost or stolen before the money ever gets to the DX station. Also, some DXers question the ethics of asking for money, especially over the air. The ARRL will not accept QSLs from stations which *insist* on a cash "donation" for a QSL. But many stations "suggest" rather than insist on cash. Finally, a hoard of US dollars could get hams in some countries in trouble with the local authorities. If you are in doubt, stick with IRCs.

There is a third method of arranging for return postage for your QSL: Supply **stamps which the DX station can use directly to return your card. In other words, if you send your card to SM3CXS, you put** Swedish airmail postage on your envelope. All you need is a source of small quantities of mint airmail stamps from countries all over the world. You might try the local stamp and coin dealer, but he is unlikely to have much of a selection, and he'll want a stiff premium on what he does have. Wouldn't it be nice if some ham bought such stamps in quantity and packaged them for individual DXers?

Fortunately, someone has! Send an SASE (you know how to do it right, now) to DX Stamp Service, 7661 Roder Parkway, Ontario NY 14519, for their current price list.

The use of these stamps has several advantages. The cost is comparable to IRCs (and can be cheaper when 4 or 5 IRCs are required). The DX station returning your card does not have to dispose of the IRCs at a loss nor arrange to sell them. He doesn't even have to go to his local post office to buy stamps to return your card. He merely fills out your card, sticks it in the envelope, and throws it into the mailbox.

By making the QSL return so easy for the DX station, the QSL-return rate increases. And isn't that the point of this whole operation, to get your card back as quickly as possible? So try using the DX Stamp Service and see what it does for your QSL returns.

Next month we'll talk about QSL bureaus. Until then, good DX!

LETTERS

THANKS TO ALL

In response to the notice you put in the *73 Magazine* "Ham Help" column for me, requesting a schematic for a Philco 89 radio, I have so far had no fewer than 16 offers of help. I've written to each one thanking them and would like to say thank you to you, too. Hams are certainly helpful people!

Charles Owens
Durham NH

BOOTLEG COMMENTS

When the early morning hours of Monday, September 6th, produced some of the finest auroral curtain reflections I've ever heard on VHF (and a dazzling visual light show as well—one of the hottest ever seen in New England), I began to wonder how inexperienced or uninformed operators would react to this bizarre propagation phenomenon and its ghostly northern echos. Naturally, I tuned my receiver down to the illegal "bootleg band" (27.6-28.0 MHz) that lies between CB and ten meters for a first-hand look.

The band was hot with auroral reflection and my hunch was confirmed in spades! A hop across the band produced these howlers, which deserve to be logged for posterity:

From an unidentified source: "How come everybody in skipland sounds like they're gargling with Listerine? This has got to be the worst outbreak of bad breath I ever heard, 10-4?"

From a station in New Jersey: "O.K., Massachusetts, but there's lots of QRM from a station in North Carolina—he really be booming in *OFF THE BACK SIDE* (sic) of this here beam!!!"

From two stations in Maine: "10-4 on Old Orchard Beach...we're about 50 miles **apart but you're peakin' off the *BACK* of the beam...I had to turn north to pull you in, and you're right dead off the back of the** antenna. I don't know what to make of it."

The next time someone talks to you about the advantages of lowering or eliminating licensing standards for the amateur service, just reflect for a moment about the consequences of turning emergency communications services over to a gang of operators who don't even know which way to turn an antenna to work an auroral curtain—let alone (God help us!) the reasons why.

I've never had a heartier laugh, nor met a better argument for keeping licensing standards exactly as they are.

Dave Beauvais KB1F
Amherst MA

THANK BASH, WAYNE

I have subscribed to your magazine since 1977. In that time you have consistently vilified incentive licensing (something we WDs and KAs would not have thought to question). For the last year or two, you have been attacking the Morse code requirement. In your October, 1982, editorial, you demean Bash.

With at least the passive connivance of the non-hams running the FCC, Bash has given you exactly what you asked for. Incentive licensing is now a joke. (Wanna upgrade? Send a check.) I received a catalog in the mail last week which offered Bash tapes of the code tests. Now knowledge of Morse is irrelevant.

Wayne, where is your gratitude? Your sermonizing and lobbying just filled editorial space. Bash has accomplished your stated purposes. How can you attack him for that?

I don't believe incentive licensing has ever bothered newcomers to amateur radio. Incentive licensing irritated a bunch of geriatric AM operators by crowding them up the band among the sidebanders.

If the Feds ever caused a slump in new hams, it was probably by terminating Conditional licenses. The Bash hams of today are the sons of the Ws, Ks, and WAs who got their licenses by buying a new rig from the right guy.

I don't see how turning licensing over to radio clubs can be much of an improvement over the old Conditional system. I saw the Bash booth at the Cedar Rapids convention; there were enough people standing around, presumably licensed amateurs, to form a club.

Possibly hams could learn from the relationship the National Rifle Association enjoys with the Army. The military should be well funded for at least the duration of the Reagan administration, and it has a vested interest in rule 97.1(d). Today's armed forces, particularly the Navy and Air Force, have a far greater need for electronics and communications experts than for skilled riflemen. Reserve, National Guard, and ROTC units are conveniently located close to population centers and should be eager for a chance to show their best side to young electronics enthusiasts.

The FCC should be glad to give up the expense of the testing program, and the military should want a program that actually determines proficiency in electronics and communications skills.

Robert A. Wiley WD9FQD
Solon IA

INCENSED AND LICENSED

As a new amateur, I enjoy *73*—even bought a subscription. But after 2 issues I became incensed after reading comments from your other readers. Hams apparently are a big bunch of hypocrites when it comes to code and licensing.

The consensus—at least judging from your magazine—is that CW is:

1. A sacred cow: "I got mine, so everyone else must also suffer."
2. CW keeps yo-yos off the ham bands.
3. Every ham constantly uses CW.
4. Bash is destroying the tradition of hams for understanding radio.

Well, I say bull! First, if code is so sacred, then current hams would not mind taking a retest at renewal time to prove proficiency. Betcha a lot of Extra class would become Novice, maybe! At a recent ARS auction, the auctioneer, in selling a bug without success, asked if *anyone* uses CW. The laughter spoke for itself.

Second, it appears to me that the only ham bands that are crowded are the phone bands. The CW portion of all but the Novice bands are unused by comparison. And please tell me what General, Advanced, and Extra are doing on the Novice bands sending at 18-20 wpm with umpteen Watts?

Now to the test. The written FCC test is a joke. I studied a complete Heath course and the ARRL manuals, memorized all sorts of formulas, and flunked the test. The questions are ridiculous. My advice is to forget Bash, or whatever, peruse a manual or two, take and flunk the test, then study. The questions don't change.

Now that everybody is mad at me, I will make my recommendations for improving amateur radio.

1. Keep the code as a license requirement but set the General speed at 10 wpm. Nothing sacred about 13 that I know about. The single item keeping more people from becoming hams is $$$ for equipment. And require a code retest with every renewal. If that's too hard to swallow, set 10 wpm for Technician and grant phone on 40 and 80.
2. Expand the phone bands. An awful lot of our frequencies are wasted.
3. Restructure the written test to be a true evaluation of knowledge of radio telecommunications.

Pete Thacher N4HQZ
Raleigh NC

HABLA MORSE?

You're right on the mark regarding elimination of Morse code as a part of the amateur licensing process. What the FCC really ought to require is that all hams learn Spanish. You never know when someone knowing only Spanish could get into an emergency situation with only a phone-capable rig and couldn't remember any code (only time he used it was for the test).

Just the other evening I listened to two locals talking on two meters saying that we have to keep the screen tight and keep the code. Then they went on to talk about how they were working to upgrade and how nice the Bash books were. Who is kidding whom?

Drop the code and keep the written, but maybe print up 10 or 20 different versions to make it memory-proof. Contrary to the November editorial in *QST*, the time IS now.

Charles L. Kelsey WB2EDV
Mayville NY

LEARN TO EARN

Without going totally into the debate pro or con on the code requirement and justification for each question on the written exam, it appears to me that both have strong and weak points. I submit that anyone who has reasonable intelligence and desire can learn the code at 5 wpm. Whether 13 or 20 wpm should be required for phone privileges, I question. Also, the theory exam certainly has a problem. I think Bash is wrong to provide direct answers to the FCC questions! However, I think he is right in that some questions are ridiculous. The wording and content of some questions are outdated and would not lend themselves to the scrutiny of a first-year education major. Maybe H.R. 3239 will provide some change

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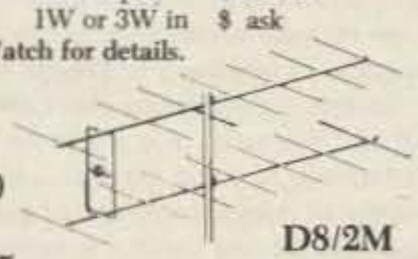

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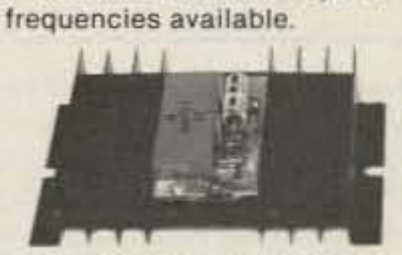

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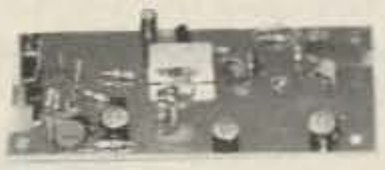

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for the better in these problem areas. Nevertheless, my main purpose in writing is to discuss learning the code.

I would like to share my experience at learning the code. This technique was used for both the 13-wpm General exam and the 20-wpm Extra exam. Now, I do not consider that I have much time available as I am a full-time employee (Texas Instruments), full-time father, full-time husband, and part-time student. Oh, yes, I do have a little time left over for a hobby. Also, I do not consider myself exceptionally bright (not a member of Mensa).

I purchased a battery-operated cassette tape recorder/player with earphone and a copy of the *73* 13+ wpm tape. Then I placed the tape player with pad and pencil on a table near my favorite chair. Each evening as I sat down to read or rest I would copy code for 10-15 minutes (at most). Very few evenings would I miss an opportunity to copy, however.

Using this technique, I passed the 13-wpm test on the first try after one month. On the 20-wpm test, I studied for six weeks and passed on the first try. I used only the *73* random character tapes and trained myself to copy only one letter at a time, responding to the composite sound. Also, I concentrated only on the code and did not prepare for the written (theory) exam. I prepared for that at a separate time after passing the code.

The very first hurdle is to decide that *you* are going to learn the code at the wpm required and dedicate some time to the project. Thus, the first problem is a psychological one. Also, you understand, no one is going to "give" you a passing grade—you earn it.

I consider the code as part of earning a privilege and it makes my license worth even more to me. Maybe code is outmoded and not modern, but like some of the theory, it gives me a taste for what is involved and the ability to use it when and if needed. Whether one needs to learn code at 20 wpm to get full privileges is questionable, but a good stiff theory exam seems appropriate. Let's keep the code, make it appropriate, and improve the theory exam.

Mike Grimes K5MLG
Sherman TX

INSULTING

Reference my letter to you, published in the September, 1982, *73* ("Emergency Systems"). Your reply is, to say the least, oversimplified and insulting to my intelligence. I wonder how many IC boards you worked on and whose kids work on your equipment. If you can't give an intelligent answer to the problem, why waste space and time?

From all the comments on the CW issue versus comments on "Emergency Systems," it appears that there is no interest in the latter issue, and with your funny/useless/stupid comment, the problem will never be considered seriously. Of course, Wayne, there won't be any problems because the enemy will give us plenty of advance warning so we all can disconnect our antennas, and when your equipment gets blown away, you can find the kids to repair it.

I know you won't print this rebuttal to your stupid answer, but at least I got it off my chest. I most probably did a hell of a lot more equipment repair than you ever did. I can't find kids to do my repair work.

Good luck, Wayne. In your old age you are getting very sarcastic.

Arnold D. Samuels KH6COY
Ocean Shores WA

Old age may have made me sarcastic (no, I've always been sarcastic—it's just that you are getting old enough to recognize it at last), Arnold, and I don't doubt for a moment that I have insulted your intelligence. I also don't doubt that you've done a lot more repair work than I. I did train in the Navy and did the electronic repair on the USS Drum *during the war, keeping the radar, radio, and sonar running despite every effort of the submarine tenders to screw it up. And I spent ten years or so building ham gear for RTTY, sideband, and so on. . . managing to twist my hip permanently from standing on one leg at the workbench. But you're right—I've gotten away from servicing and even building, much is the pity, doing it only when there is no alternative. However, before I wrote my "funny/useless/stupid" response to the letter, I did my homework. If you do yours, in return, you will find out what I know. . . and that is that it is the youngsters who are the real hot shots at repairing today's circuits. The best service person we've ever had here was a teenager. . . and the worst were some older hams. The* Drum *is still around, so I did okay.—Wayne.*

SOFTWARE NEEDED

I don't have to tell you about the growing invasion of microcomputers into the ham shack. Many of your editorials show your awareness of this. I would, however, like to bring your attention to the expanding popularity of one computer in particular: the Commodore VIC 20. Many people don't realize how fast this machine's popularity is growing. For example, I know about nineteen hams who own computers. Out of these nineteen, two own the Heathkit H-89. One owns an Apple, two own a Radio Shack Color, five own Model 1s (Radio Shack), and nine own the Commodore VIC 20. And why not? The VIC 20 is an easily expandable computer with a fairly powerful Basic (CBM V2.0). Also, it is rf-tight. It's perfect for beginners in computing who are trying to learn and, right now, that is a lot of hams.

Unfortunately, there is one problem which, if let go too long, may cause the computer to be self-defeating. Because so many beginners are buying the machine, there is a shortage of good software. In fact, that is the one big reason many hobbyists may have for not buying the VIC.

Naturally, I don't want to see the death of such a fine computer. The solution to this problem, as I see it, is not so much to make available packaged software as it is for magazines, such as *73*, to publish software along with articles which explain how and why this software works. This would not only make software available but also would supply other VIC 20 owners with a better understanding of their computer so that they, in turn, could write programs to be published.

I have written a number of programs which would be of interest to hams, such as RTTY and Morse programs, programs which track OSCAR, etc. Also, many VIC owners don't realize how simple it is to interface a Model 33 ASCII teleprinter to their computer to serve as a line printer.

I'm sure that if you investigate this a bit further, you will find that printing this information could be profitable not only to amateur radio, but to *73* as well.

Jim Archer KF1T
Warwick RI

ANTI-SEMITIC?

In your November, 1982, editorial regarding how hard work pays off, you wrote, "given equal opportunity, the US would be as proportionately populated with wealthy Chinese as it is wealthy Jews."

I was shocked and surprised to read such an obvious anti-Semitic statement. Did you take a survey asking bank balances and religious persuasion? How about wealthy Catholics? Or wealthy Protestants? Why did you single out Jews? How in good conscience can you perpetrate this ugly myth and stereotype and in doing so inflame the fires of anti-Semitism?

As a former New Yorker, you must be aware of the many needy unfortunate Jewish families in the lower East Side of Manhattan. Did you take them into account in your survey?

Your point would have had the same effect if you had deleted "Jews" and substituted the word "people." By noting your comparison to "wealthy Jews," it showed you as a narrow, unthinking person who may profess to be free of bias but in reality is not.

Mike Herbstman KM2F
New York NY

While I've never been anti-Semitic before, I think in your case I might be able to make an exception. You, sir, appear to have a very serious inferiority problem. At any rate, I gather that you are trying to make a case that there is something wrong with being successful. Well, that's a good rationalization for your personal failure to be as successful as you feel you should. No, I'm not anti-Jew, anti-Chinese, anti-Catholic, anti-WASP, and so on, and I have thirty years of editorials to back me up. . . plus a wide range of personal friends of every known persuasion and color. I'm known, I think, not to be anti-Arab—which may taint me in your estimation. Now, I must admit that I do have my prejudices, being anti-drugs (which includes tobacco), anti-establishment (and most of you know what government agencies I am referring to), anti-laziness, anti-illiteracy. . . and so on. I have a strong record as being pro-success and I think I can point with pride to the intelligence and success of Jews, the Chinese (where they have not been screwed by the communist political system), and the Japanese.—Goy Green.

KEEP THE GOOD STUFF

QST and *Ham Radio* were my steady diet of amateur radio magazines for as many years as I care to admit—at least since the inception of *Ham Radio*. But in one way or another, these magazines changed (as magazines tend to do) and I became disenchanted. Being the inquisitive experimenter type, new excitement was needed. What seemed to have been lost, I found in *73*!

I like your editorial philosophy of including the type of articles in *73* which, according to some publishers, do not belong in amateur radio magazines. Hogwash! For example, one of these days (and sooner than most of us believe), the ham fraternity will have access to its own geosynchronous satellite, complete with microwave-band transponder! (See *Westlink Report*, September 10,1982.)

Over the years, I have authored about 22 ham magazine articles, not the least of which was the popular coffee-can feedhorn (*Ham Radio*, May, 1976). In fact, in *73* for October, 1982, John Franke WA4WDL, says, "The first antenna I tried was the popular coffee-can horn. Since then it has become my standard to which all other antennas are compared."

Seeing testimonials like this from fellow amateurs gets my adrenalin pumping! Makes life seem worthwhile! But, alas, one can't have everything. I fear few persons know about the 1976 article or who authored it.

TVRO will never be the same since that article was published. You probably know that rectangular horns were the "in" thing originally, but not anymore. I like to think I should take a teeny bit of credit for that, too. It seems to me both the amateur and non-amateur stand to gain from articles of this kind; it works both ways.

Keep the good stuff coming. Maybe I'll even renew my *73* subscription! And I might even find time to write an article or two for *73*.

Norman J. Foot WA9HUV
Elmhurst IL

P.S. My consulting business is to a large degree an outcome of my amateur radio activities over the years. Your editorial covered such a possibility very well.

BEST ISSUE EVER

The November issue of *73* is the best amateur magazine I have ever seen—simply outstanding in its variety of construction projects. The power-supply project by WA6TTY is so good I can't believe it—even to an offer of help for an SASE! The step-by-step instructions are what are so sorely needed. I have, 2 years ago, written to *QST* and said that this is what we need, but I'm afraid the letter was given a stock reply and there it ended. But there are many of us who are not technical wizards who want to learn and construct. Well, Ken Wyatt has done a great service for us, and I do hope that you can encourage him to contribute again. How about a 66-foot 4- or 5-band cheap dipole—simple, yes, but isn't that what will get the new ham into making rather than buying? A cursory glance through the ham ads will show you how many hams buy their dipoles.

Well, anyway, if you never produce another issue for a year, the November issue is worth the annual price. Keep that up and let *QST* keep on with the dreary contest rules/winners/DX clubs, etc.

I could write pages of congratulations, I'm so pleased with that issue.

Eric Stabler VE3ISD
Ontario, Canada

HAM HELP

I need an original or photocopy of *TVI*, written by Dick Wildman W6MOG and published by *73*. I also need a DO-T35 or DO-T6 audio transformer, and I would like to buy MBD 201 or MBD 301 hot-carrier diodes in lots of 10. Please write and state your price before sending material.

Gordon La Grange W5AKQ
318 East Circle Dr.
Baytown TX 77521

I am a GI stationed in Europe and a soon-to-be Novice. I need a schematic for a Yaesu FT-401D (same as the FT-DX401). Also, can anyone tell me how to hook up my frequency counter to the FT-401 to measure the receive frequency? I will, of course, pay postage and copying costs for this information.

David Granholm
HHD, 69th Sig. Bn.
APO New York 09178

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✓See List of Advertisers on page 114

AWARDS

Bill Gosney KE7C
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40-METER HOOT OWLS

There is another Hoot Owl network, which has been in existence since 1967. This net was started by W3CDH and others, meeting on 40 meters at 0600Z on Saturday mornings. Various frequencies have been used over the years but now they meet on 7.274 MHz, plus or minus QRM, and have check-ins from all across the country. To call in, merely say "hoot hoot," and after five regular check-ins, an award will be mailed to show participation.

The type of rig, power output, antenna system, or genus of operator has no bearing on the degree of Hoot Owl classification. Hoot Owl capability is based solely on the licensed operator's ability to stick with it on the 40-meter band at least two hours beyond his sensible bedtime.

An associate membership may be issued to operators who qualify in some respects but operate in the wrong frequency band or, for some other reason, fold up and are unable to hack it.

There's even an women's auxiliary! Any female stayer-upper attempting to qualify who is thereby hollered at by her father or husband shall be designated a "Mini-Hoot"!

Dues for the organization are $10.00, which keeps a Hoot Owl in good standing for a period of ten years. If not paid within the ten-year period, the former Hoot Owl becomes a "Chirp," which means he no longer gives a hoot.

Oh yes, the password, we must not forget that! Any Hoot Owl can easily be identified by another member when the password "hoot hoot" is injected at the point of contact. Do you give a hoot, or not?

CANADAWARD

The Canadian Amateur Radio Federation is pleased to announce the following awards available to all radio amateurs worldwide.

A colorful certificate will be issued to any amateur who confirms two-way contact with all Canadian provinces and territories. All QSOs must be on one band only. Separate awards are issued for each band on which the applicant qualifies.

Canadian provinces and territories include: VO1/VO2 Newfoundland/Labrador; VE1 Prince Edward Island; VE1 Nova Scotia; VE1 New Brunswick; VE2 Quebec; VE3 Ontario; VE4 Manitoba; VE5 Saskatchewan; VE6 Alberta; VE7 British Columbia; VE8 Northwest Territories; VY1 Yukon Territories. Note: VO2, Labrador, is part of the province of Newfoundland and therefore counts for a Newfoundland contact.

A mode endorsement is available if all QSOs are made on the same mode (CW, SSB, RTTY, SSTV). Contacts made after July 1, 1977, only will count for this award. All amateur bands may be used. Each distinct satellite mode (432/144, 144/29, or 144/432 MHz respectively) will count as a separate band.

To apply, submit the twelve QSL cards with $2.00 (Canadian or US funds) or ten IRCs plus sufficient funds ($.60) for return postage for your cards. CARF members need only send funds for return postage as the award is free to all CARF members.

A special plaque is available to any amateur who confirms two-way contact with all Canadian provinces and territories on each of five separate bands. Submit your 60 confirming QSL cards with $25.00 (Canadian or US funds) plus sufficient funds for return postage to: Canadawards, PO Box 2172, Station D, Ottawa, Ontario, Canada K1P 5W4.

WBCC AWARD

The Worked Broward County Cities award is sponsored by the Broward Amateur Radio Club. All amateurs are invited to apply for this very attractive and desirable certificate, printed in three colors on heavy parchment stock.

Applicants must obtain two-way contact with five of the Broward County cities. A gold seal will be awarded for fifteen cities worked.

All contacts must be made from the home QTH of the applicant; QSOs with mobile or portable stations in Broward are valid. All legal bands and modes may be used, but contacts via repeater will not be accepted.

Applicants should list the date, time, band, mode, and call and QTH of the Broward stations worked. Have this list verified by two fellow amateurs. Send your list, together with a fee of $1.00 and two first-class mail stamps (DX applicants send US $1.00 plus 3 IRCs), to: WD4RAF Awards Manager, 1921 NW 41st Street, Oakland Park FL 33309. Gold seals will be issued for a self-addressed envelope or one IRC.

The following Broward County cities apply: Coconut Creek, Cooper City, Coral Springs, Dania, Davie, Deerfield Beach, Fort Lauderdale, Hacienda Village, Hallandale, Hillsboro Beach, Hollywood, Lauderdale-by-the-Sea, Lauderdale Lakes, Lauderhill, Lazy Lake, Lighthouse Point, Margate, Miramar, North Lauderdale, Oakland Park, Parkland, Pembroke Park, Pembroke Pines, Plantation, Pompano Beach, Sea Ranch Lakes, Sunrise, Tamarac, and Wilton Manors.

THE VK5 WHISKEY CHARLIE AWARD

This award was originally created to commemorate 25 years of the club's existence and is still an award hunter's challenge.

For the first 23½ years of VK5WC's existence, it was the only callsign authorized from Woomera, a now small Australian community and former home to the European Launch Development Organization (ELDO). The club presently has four active HF members with several other members awaiting their reciprocal calls. VK5OL, VK5MQ, VK5AH, and VK5LA can be heard operating from the village as well as the club's station itself.

The award is available to all licensed amateurs throughout the world who can show proof of two-way contacts with club station VK5WC and two club members, or four different Woomera stations who are club members.

Any authorized frequency or band, including crossband and VHF, UHF, or satellite repeater, and any mode or combination of modes for which the stations concerned are licensed are permissible. Contacts may be claimed retroactive to May 3, 1978, which is the date the use of individual callsigns was authorized within the Woomera village community.

To apply for the award, submit a copy of all eligible log entries signed by the claimant and certified by either the cosigning of two other licensed amateur radio operators or, in the case of an isolated claimant, certified by a justice of the peace or a notary public. In case of dispute, local log entries at Woomera shall be accepted as proof conclusive of whether or not a contact took place.

Claims for the award are to be submitted in writing to the Award Manager, Woomera Amateur Radio Club, PO Box 538, Woomera, South Australia 5720, Australia, accompanied by $2.50 in Australian currency (or equivalent), preferably by bank check payable to Woomera Amateur Radio Club, Award Account.

The award is an enlarged version of the club's QSL, with black, red, and blue printing.

WORKED VK8 AWARD

Work or hear eight stations in the VK8 area, irrespective of applicant's QTH. Any band, any mode, GCR applies. Award fee is $3.00 Australian or ten IRCs. Send log data with fee to: Awards Manager, PO Box 40318, Casuarina 5793, Northern Territory, Australia.

TASMANIAN DEVIL AWARD

Applicants must establish contact with a number of VK7 stations depending on their QTH: Australia, 50 contacts; Oceania and Antarctica, 30 contacts; Asia and North America, 20 contacts; Europe and South America, 10 contacts; Africa, 7 contacts. Band and mode endorsements are available as well as special endorsements for making all contacts with Novice stations.

Claim logs with applicant's call and full name are to show station contacted, date, time, band, and mode. The claim is to be signed by the applicant and countersigned by two other amateurs. Spot checks will be made with contact stations in VK7 for confirmation. QSLs are not required. Contacts made on or after January 1, 1978, are valid. The award fee is five IRCs or equivalent for Australian applicants, ten IRCs for overseas applicants. Apply to: Tasmanian Devil Award, VK7 QSL Bureau, PO Box 3710, Hobart 7001, Tasmania, Australia.

ZONE 29 AWARD

To qualify for this award, it is necessary to contact 25 amateur stations located in zone 29. Zone 29 includes the VK6 and VK8 call areas. Only contacts after 0800 GMT on January 1, 1952, are valid. No crossband contacts are permitted. Minimum acceptable exchange of reports is RS33 or RST338.

QSL cards are not required as proof of valid contacts but the applicant must show that the log extracts have been examined and verified by two other amateurs. A simple declaration that the applicant's station has conformed to all licensing regulations related to his operation is mandatory.

The fee for the award is $1.00 Australian or five IRCs. Apply to: Awards Manager, Zone 29, WIA (VK6 Division), PO Box N1002, Perth 6001, Western Australia, Australia.

THE VK1 AWARD

This award is available to any amateur or SWL who submits details of valid contacts with the required number of VK1 stations. On HF, VK stations require 20 VK1 contacts, others require 10 VK1 contacts. On VHF, 10 VK1 contacts are required.

A log extract is required, showing for each contact claimed the GMT date and time, band, mode, callsign of the station worked, and reports or cyphers exchanged. SWLs must show callsigns of both stations in the QSO and the reports or cyphers given by each station. The award cost is $2.00 Australian or five IRCs. Applications should be forwarded to: Awards Manager, WIA (VK1 Division), PO Box 46, Canberra 2600, Australian Capital Territory, Australia.

THE SOUTHERN CROSS AWARD

This award is granted to amateurs and SWLs who obtain the required number of points from working or hearing members of the Eastern and Mountain Districts Radio Club of Melbourne, Victoria. To qualify, Australian amateurs and SWLs require fifteen points, New Zealand amateurs and SWLs require ten points, and all other amateurs and SWLs require five points.

A point is awarded for each club member worked or heard. The club callsigns VK3ER and VK3BNW each count two points, but only three points can be claimed if both callsigns are included in any one application for the award.

The award will be issued for multiband and multimode or specific band or mode as requested at the time of application.

To obtain the award, a General Certificate Log and the award fee of $.50 Australian or three IRCs should be sent to: Awards Manager EMDRC, PO Box 87, Mitcham 3132, Victoria, Australia.

The General Certificate Log Rule means that any officer of a recognized amateur radio club or society, any two licensed amateurs, or any CHCer may certify a copy of the applicant's log. In this way, you do not have to submit your original log.

THE NAVAL POSTGRADUATE SCHOOL AMATEUR RADIO CLUB

The Naval Postgraduate School Amateur Radio Club in Monterey, California, will operate a special-event station K6LY during the 42nd Bing Crosby National Pro-Am Golf Championship. The station will be located near the eighteenth green at Pebble Beach. Operating hours will be 1800Z-2400Z daily, February 3-6, 1983. K6LY will operate on the lower part of the General class phone band on 15 & 40 meters. Stations contacting K6LY and wishing to receive a commemorative Crosby Pro-Am QSL card should send their QSL card to WB6ZSB, 831 Avalon Place, Monterey CA 93940. An SASE is not required.

NORTH OKANAGAN RADIO AMATEUR CLUB

We of the North Okanagan Radio Amateur Club are going to be having a special station set up during our winter carnival again this year. Our station will be operating during the week of February 4-13, 1983, from 2100Z to 2400Z, daily. The frequencies that we will be on are 28.575, 21.375, and 14.295, plus or minus QRM. The cost of our award is either $1.00 or an SASE sent to North Okanagan Radio Amateur Club, Box 1706, Vernon, British Columbia V1T 7T9, Canada. This award, called the Vernon Winter Carnival Award, is available year round by working our club station (VE7NOR) or 3 Vernon area stations. The Vernon area is defined as Vernon, Armstrong, Winfield, Oyama, Lumby, and Enderby.

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- Fast CASSETTE I/O and many other features...

Additional Disk Features:
- Two-way message SELCALL. A "PERSONAL MSO"...
- AUTO-MONitor frequency activity to disk...
- SAVE, LOAD, KILL & DIR plus other I/O...

INTRODUCTORY SPECIAL

DISK VERSION.....$199.00
CASSETTE VERSION.....$179.00
CASSETTE, later upgrade to DISK.....$20.00
Guaranteed-Include Amateur CALLSIGN-POST PAID

ROYAL
407 Conkle Road
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✓150

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45 DAY WARRANTY! MARS MODS

A HAM RADIO STORE THAT SPECIALIZES IN SERVICE!!!

We are in the business of providing top quality repairs on all types of amateur radio equipment. A complete line of parts is kept on hand to provide you with an extremely fast turnaround.

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GUY
N2CJW

NEMAL ELECTRONICS

COAXIAL CABLE SALE

This Month's Specials — Same Day Shipping

RG8U-20 ft., PL-259 ea. end.....$4.95
RG214U dbl silver shield, 50 ohm.....$1.35/ft.
100 ft. RG8U with PL-259 on each end $19.95
BELDEN Coax in 100 ft. rolls
RG58U #9201.....$11.95
Grounding strap, heavy duty tubular braid
3/16 in. tinned copper.....10¢/ft.
3/8 in. tinned copper.....30¢/ft.

POLYETHYLENE DIELECTRIC

RG213 noncontaminating 95% sheild mil spec. 36¢/ft.
RG174/U mil spec. 96% shield.....10¢/ft.
RG11U 96% shield, 75-ohm mil spec.....25¢/ft.
RG8U 96% shield, mil spec.....$27.95/100 ft. or 31¢/ft.
RG6A/U double shield, 75-ohm.....25¢/ft.
RG58AU stranded mil spec.....12¢/ft.
RG58 mil spec. 96% shield.....11¢/ft

LOW LOSS FOAM DIELECTRIC

RG8X 95% shield (black, white or gray).....$14.95/100 ft. 17¢/ft.
RG8U 80% shield.....18¢/ft.
RG58U 80% shield.....07¢/ft.
RG58U 95% shield.....10¢/ft.
RG59U 100% foil shield, TV type.....$7/100 ft. 10¢/ft.
RG8U 97% shield 11 ga. (equiv. Belden 8214).....31¢/ft.

Rotor Cable 8-con. 2-18 ga, 6-22 ga.....19¢/ft.

CONNECTORS MADE IN USA

Amphenol PI-259.....79¢
PL-259 push-on adapter shell.....10/$3.89
PL-259 & SO-239.....10/$5.89
Double Male Connector.....$1.79
PL-258 Double Female Connector.....98¢
1 ft. patch cord w/RCA type plugs each end.....3/$1.00
Reducer UG-175 or 176.....10/$1.99
UG-255 (PL-259 to BNC).....$3.50
Elbow (M359).....$1.79
F59A (TV type).....10/$2.15
UG 21D/U Amphenol Type N Male for RG8.....$3.00
BNC UG88C/U, male.....$1.25
3/16 inch Mike Plug for Collins etc.....$1.25
UG273 BNC to PL-259.....$3.00

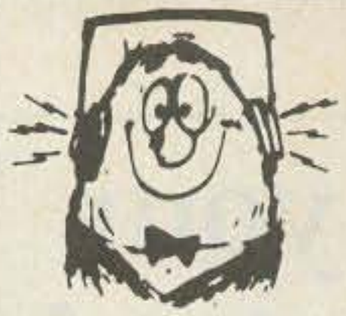
FREE CATALOG
COD add $1.50—FLA. Res. add 5% Sales Tax

Connectors—shipping 10% add'l, 2.50 minimum

Cable—shipping $3.00 1st 100 ft., $2.00 each add'l 100 ft

✓412

1327 NE 119th Street, Dept. RLO, No. Miami, FL 33161 Call (305) 893-3924



The HAM SHACK

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Evansville, IN 47711

AEA
MBA-RO Reader.....$259.00
MBA-RC Rcv/Code Conv. Xmt.....395.00
MM-2 MorseMatic Ultimate Keyer.....150.00
CK-2 Contest Memory Keyer.....125.00
ALLIANCE HD 73 Rotator.....$99.00
ARRL 83 Handbook.....$12.00
ASTRON
RS7A 5-7 Amp Power Supply.....$49.00
RS12A 9-12 Amp Power Supply.....69.00
RS20A 16-20 Amp Power Supply.....89.00
RS20M 16-20 Amp w/meter.....109.00
RS35A 25-35 Amp.....135.00
RS35M 25-35 Amp w/meter.....149.00
RS50A 37-50 Amp.....199.00
RS50M 37-50 Amp w/meter.....225.00
AZDEN
PCS 4000 2M Xcvr.....call
PCS 300 Handheld.....$285.00
BASH Code Tapes/Study Guides.....$9.95
B&W Folded Dipole very broadbanded.....$135.00
BENCHER BY-1 Paddle.....$36.00
BUTTERNUT HF6V Vertical.....$119.00
CALLBOOK U.S./DX.....$18.95/19.95
CUSHCRAFT
A3 Tribander 3EL.....$179.00
A4 Tribander 4EL.....229.00
32-19 Superboomer 19EL 2M.....79.00
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CN 520 1.8-60 MHz SWR/Pwr Mtr.....$63.00
CN-620B 1.8-150 MHz SWR/Pwr Mtr.....110.00
DENTRON.....call for prices
DRAKE
TR7A Xcvr.....$1,439.00
TR5 Xcvr.....695.00
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ST-144/μP.....$289.00
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CT 2100 Terminal/KB 2100 Keyboard.....$850.00
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TH7 DXS 7EL Tribander.....$375.00
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Pro-Comm 200 Dual Headphones/Mic.....90.00
Free Shipping on all Crankup Towers
ICOM
R70 General Coverage Receiver.....$669.00
720A General Coverage Xcvr.....1,140.00
740 Xcvr.....965.00
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505 6 Meter Xcvr.....395.00
25A 2 Meter.....299.00
290H 2 Meter All Mode.....475.00
2AT/3AT/4AT Handhelds.....235.00
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KLM
KT34XA Tribander.....$459.00
144-148-13LBA 2M Long Boomer.....79.00
LARSEN 5/8 Wave 2M Mag Mt.....$39.00
MFJ
941C Tuner.....$81.00
496 Super Keyboard.....279.00
422 Keyer/BENCHER Paddle Combo.....89.00
1040 Deluxe Preselector.....89.00
104 New 24 hr. Dual Clock.....36.00
MIRAGE B1016 Amp.....$239.00
MICROLOG.....call
ROBOT 400/800.....call
SHURE 444D Desk Mic.....$50.00

TEN-TEC
Call about the new Corsair.
The performance is incredible!!
List $1,169.00

TOKYO HY-POWER
HL82V 80W Amp.....$155.00
HL160V 160W Amp.....285.00
HC2000 Tuner.....285.00
VOCOM Amplifiers/Ants.....call

Prices and availability subject to change.

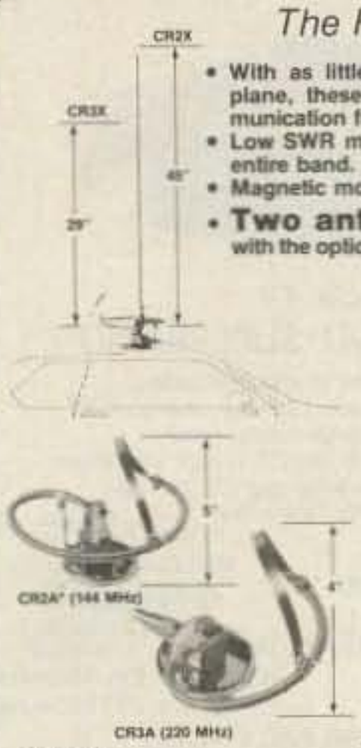
812-422-0231 ✓449
MON-FRI 9AM-6PM • SAT 9AM-3PM
Send SASE for our new & used equipment list.

↙See List of Advertisers on page 114

NEW!

DDRR Space Beaters!

The Repeater Beaters



- With as little as one square foot of ground plane, these unique antennas provide communication from virtually anywhere.
- Low SWR match to a 50 ohm line across the entire band.
- Magnetic mount included.
- **Two antennas in one** when used with the optional CR2X or CR3X range extender.

CR2A* or CR3A — **$39** plus **$2** shipping

CR2X or CR3X — **$12** plus **$2** shipping

(continental USA)

AS REVIEWED IN 73 MAGAZINE OCTOBER 1980

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GRAND ISLAND, NEW YORK 14072
(716) 773-1445

Visa and MasterCard accepted

✓163

sample issue only $2.50 PPD

OUR 16TH YEAR!

AMATEUR TELEVISION MAGAZINE

✓115

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½ year	$ 10.00	$ 13.00	$ 20.00	$ 23.00
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3 year	$ 56.00	$ 74.00	$116.00	$134.00

ATV-SSTV-FAX-RTTY-Satellites-EME Microwave and Computers.

Published 12 times per year by Mike Stone WB0QCD
P.O. Box H, Lowden, Iowa 52255 0408

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Complete Systems From $69.95

1.9 to 2.5 GHz Antennas

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85301
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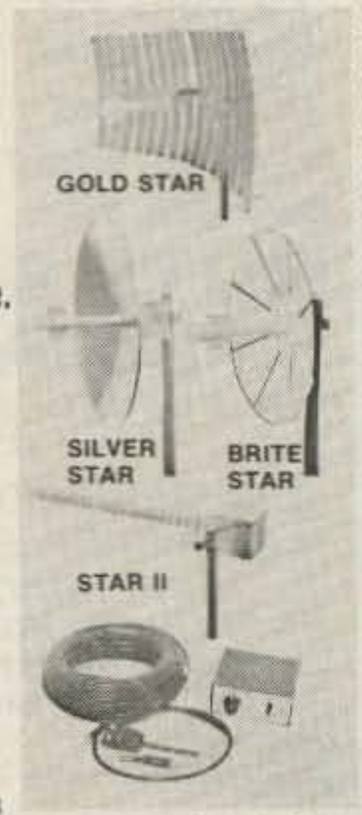

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ALL ELECTRONICS CORP
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2000 WORLDWIDE radioteletype stations by frequency... press, military, air, government, diplomatic, all utilities with calls, times, plus other information 3 to 30 MHZ. $12 POSTPAID

WORLD PRESS Services Frequencies 3 LISTS & MANUAL
All press services, frequencies and transmission times. $8 POSTPAID

UNIVERSAL ELECTRONICS
1280 AIDA DR. • REYNOLDSBURG, OH 43068

YAESU FT-207R OWNERS

AUTO SCAN MODULE AND BATTERY SAVER KIT

WRITE FOR CLUB DISCOUNTS

15 minutes to install; scan restarts when carrier drops off; busy switch controls automatic scan on-off; includes module and instructions.

Model AS-1. $25.00

new

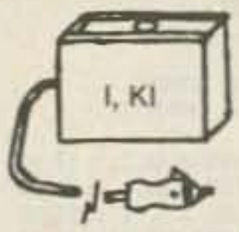
FT-207R BATTERY SAVER KIT MODEL BS-1 $14.95

- *No more dead batteries due to memory back-up
- *30% less power drain when squelched
- *Simple to install; step-by-step instructions and parts included
- *4 mA memory backup reduced to 500 λA.
- *45 mA receiver drain reduced to 30 mA.
- *Improved audio fidelity and loudness

ENGINEERING CONSULTING
P.O. Box 216
BREA, CALIFORNIA 92621

✓400

GO MOBILE WITH YOUR H.T.!



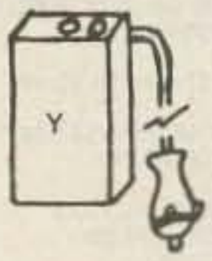
Model I—Icom IC-2A/T, Etc.
Model K-1 for TR-2500
—slides on bottom of radio

Guaranteed!

Model K—TR-2400;
—powered thru battery plug
Model N—FT-208R
Model T—Simple mod for Tempo

NOW FOR FT-208R & TR-2500

Model Y—FT-207R,
—fits into battery compartment



***A unique battery eliminator* HANDI-TEK Regulator allows constant hand-held operation from auto DC or base supply with no nicad drain and WITHOUT RADIO MODIFICATION! $24.95 PPD in USA. CA add $1.50 Sales Tax.**

✓460

HANDI-TEK
P.O. BOX 2205, LA PUENTE, CA 91746

TIME-DUAL TONE DECODER $15

The LJM2RK decoder kit converts your receiver into a special receiver or control. When a user-selected time-tone combination is received, the output provides a relay control for activating speakers or other devices.

INPUT: Audio from transceiver, scanner, etc.
OUTPUT: SPST (N.O.) relay.

FEATURES: Single or dual tones adjustable over the T/T range● Adjustable time delay● Relay output● Manual or auto reset● Single tone ON latching with different single tone reset OFF● Operates on 12VDC● Interfacing of multiple boards for multi-digit sequential activation and reset.

APPLICATIONS: Call-up system● Repeater or commercial controls● Etc. limited only to your imagination● Write for information on the LJM2RK for your application.

LJM2RK decoder kit includes all component, relay, and P.C. Board...$15 plus $1.50 ship

LJM2RC enclosure kit includes molded case, speaker, input cable.....$5 plus $1.50 ship.

THE METHENY CORPORATION
204 Sunrise Drive, Madison, IN 47250 ✓205

See Product Review Jan. 1983 issue of 73

CB TO TEN METER CONVERSION KITS

10 METER FM—Limiter discriminator board with specific instructions to fit over 80 different AM & SSB chassis

SSB-AM KITS—Now in stock kits for most CB models—23 or 40 channels

NEW & USED—FM—SSB—AM converted C.B.'s in stock

ANEXTER MARK ANTENNAS—You saw them at Dayton. Now in stock the HW-3 three band helewhip that covers 10—15—20 meters with no traps

FREE CATALOG—Write or call today

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CRYSTAL SUPPLY COMPANY

141 Rt. 6A, Box 183
Sandwich, Ma. 02563-0183
(617) 888-4302

✓78

See List of Advertisers on page 114

FACIT 4555 SERIAL PAGE PRINTER

The Facit 4555 alphanumerical serial printer is complete. Equipped with RS232C Interface, printing mechanism, control electronics, drive electronics, power supply and character generator. The adaptation electronics can be modified in four versions:Bit-parallel data transfer, CCITT (EIA, RS232C) for bit-serial data transfer and the current loop (TTY) interface also for bit serial data transfer. The Facit 4555 prints on ordinary paper and is adjustable for different paper widths and formats, 9.5" paper width with 66 lines per page or DIN A4 with 70 lines per page.

SPECIFICATIONS

Print speed	up to 60ch.s.	Char. spacing	2.54mm/1/10" 80ch/line 1.55mm/0.06" 132ch/line
Printing mode	Incremental.		
Max. # of ch/line	80 alt. 132.	Char. Code	ECMA-6 7-bit coded char. set
Matrix	7 X 5 dot matrix.	Char. Set	63 Char. various national versions.
Char. Size Height	2.7mm/1/8"		
Char. Size Width	1.3mm/0.05" 132ch/line 2.1mm/0.083" 80ch/line	Feed mechanism	Sprocket feed.

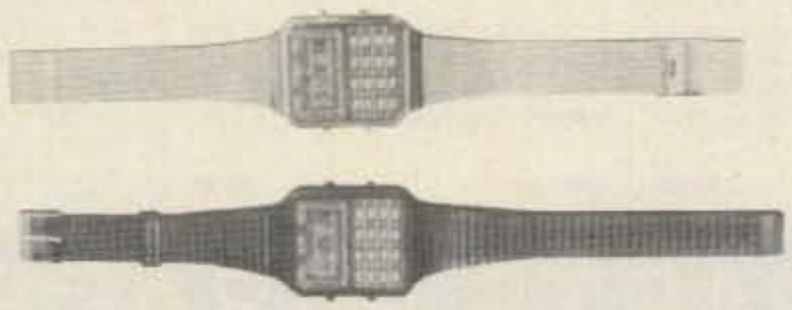
THESE UNITS WERE PULLED OUT OF SERVICE IN GOOD WORKING CONDITION. WE CHECK EACH UNIT ON A RADIO SHACK TRS-80 COLOR COMPUTER.

PRINTER ONLY $129.99

Printer with linecord, box of paper, inter-connect cable for TRS-80 COLOR COMPUTER. $149.99

GENEVA CALCULATOR WATCH

This attractive watch has the following modes:
Normal Time Setting,
Calendar Setting,
Daily Alarm Time Setting,
Weekly Alarm Time Setting,
Chronograph,
Calculator.



Featured in Black Plastic $24.99 or Featured in Stainless Steel $29.99

SILICON DIODES

MR751	100vdc	6Amps	10/$5.00	100/$38.00
MR510	1000vdc	3Amps	10/$3.75	100/$24.00
HEP170	1000vdc	2Amps	20/$2.00	100/$15.00
1N3209	100vdc	15Amps	$2.00	10/ $15.00
BYX21/200	200vdc	25Amps	$2.00	10/ $15.00
1N2138A	600vdc	60Amps	$5.00	10/ $40.00
DS85-04C	400vdc	80Amps	$10.00	10/ $80.00
1N3269	600vdc	160Amps	$15.00	10/$120.00
275Z41	300vdc	250Amps	$20.00	10/$175.00
7-5754	300vdc	400Amps	$30.00	10/$250.00
RCD-15	15KVDC	20ma.	$3.00	10/ $20.00
SMFR20K	20KVDC	20ma.	$4.00	10/ $30.00
1N4148	signal		30/$1.00	100/ $3.00

FAIRCHILD 4116 16K DYNAMIC RAMS 200ns. Part # 16K75

25 For $25.00 or 100 For $90.00 or 1000 For $750.00

HEWLETT PACKARD MICROWAVE DIODES

1N5711	(5082-2800)	Schottky Barrier Diodes	$1.00 or 10 for $ 8.50
1N5712	(5082-2810)	" " "	$1.50 or 10 for $10.00
1N6263	(HSCH-1001)	" " "	$ .75 or 10 for $ 5.00
5082-2835		" " "	$1.50 or 10 for $10.00
5082-2805	Quad Matched	" " " per set	$5.00 or 10 for $40.00

FEED THRU SOLDER RF CAPACTORS

470pf +-20%

5/$1.00 or 100/$15.00 or 1000/$100.00

1000pf/.001uf +-10%

4/$1.00 or 100/$20.00 or 1000/$150.00

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27L32/25L32	$10.00 each

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MHz electronics

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WATKINS JOHNSON WJ-M6 Double Balanced Mixer

LO and RF 0.2 to 300MHz	IF DC to 300MHz	$21.00
Conversion Loss (SSB)	6.5dB Max. 1 to 50MHz 8.5dB Max. .2 to 300MHz	WITH DATA SHEET
Noise Figure (SSB)	same as above 8.5dB Max. 50 to 300MHz	
Conversion Compression	.3dB Typ.	

NEC (NIPPON ELECTRIC CO. LTD. NE57835/2SC2150 Microwave Transistor

NF Min	F=2GHz	dB 2.4 Typ.	MAG	F=2GHz	dB 12 Typ.	$5.30
	F=3GHz	dB 3.4 Typ.		F=3GHz	dB 9 Typ.	
	F=4GHz	dB 4.3 Typ.		F=4GHz	dB 6.5 Typ.	

Ft Gain Bandwidth Product at Vce=8v, Ic=10ma. GHz 4 Min. 6 Typ.
Vcbo 25v Vceo 11v Vebo 3v Ic 50ma. Pt. 250mw

UNELCO RF Power and Linear Amplifier Capacitors

These are the famous capacitors used by all the RF Power and Linear Amplifier manufacturers, and described in the RF Data Book.

5pf	10pf	18pf	30pf	43pf	100pf	200pf	1 to 10pcs. $1.00 ea
5.1pf	12pf	22pf	32pf	51pf	110pf	220pf	11 to 50pcs. $ .90 ea
6.8pf	13pf	25pf	33pf	60pf	120pf	470pf	51 up pcs. $ .80 ea
7pf	14pf	27pf	34pf	80pf	130pf	500pf	
8.2pf	15pf	27.5pf	40pf	82pf	140pf	1000pf	

NIPPON ELECTRIC COMPANY TUNNEL DIODES

		MODEL 1S2199	1S2200 $7.50
Peak Pt. Current ma.	Ip	9min. 10Typ. 11max.	9min. 10Typ. 11max.
Valley Pt. Current ma.	Iv	1.2Typ. 1.5max.	1.2Typ. 1.5max.
Peak Pt. Voltage mv.	Vp	95Typ. 120max.	75Typ. 90max.
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Valley Pt. Voltage mv.	VV	370Typ.	350Typ.

FAIRCHILD / DUMONT Oscilloscope Probes Model 4290B

Input Impedance 10 meg., Input Capacity 6.5 to 12pf., Division Ration (Volts/Div Factor) 10:1, Cable Length 4Ft. , Frequency Range Over 100MHz.
These Probes will work on all Tektronix, Hewlett Packard, and other Oscilloscopes.

PRICE $45.00

MOTOROLA RF DATA BOOK

Listsall Motorola RF Transistors / RF Power Amplifiers, Varactor Diodes and much much more.

PRICE $7.50

Toll Free Number
800-528-0180
(For orders only)

MHz electronics

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RF TRANSISTORS, MICROWAVE DIODES

PART	PRICE
1S2199	$ 7.50
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2N1561	25.00
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2N5589	8.65
2N5590	10.35
2N5591	13.80
2N5635	10.95
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2N5642	10.95
2N5643	15.50
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2N5646	20.70
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2N5836	5.45
2N5842	8.00
2N5849	20.00
2N5913	3.25
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2N6096 /M9624	15.50
2N6097	17.25
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BLY89	15.00
BLY90	20.00
BLY351	10.00
C4005	20.00
CA402 (TRW)	25.00
CA405 (TRW)	25.00
CA612B (TRW)	25.00
CA2100 (TRW)	25.00
CA2113 (TRW)	25.00
CA2200 (TRW)	25.00
CA2213 (TRW)	25.00
CA2418 (TRW)	25.00
CA2612 (TRW)	$ 25.00
CA2674 (TRW)	25.00
CA2881-1 (TRW)	25.00
CA4101 (TRW)	25.00
CA4201 (TRW)	25.00
CA4600 (TRW)	25.00
CD1889	20.00
CD2545	20.00
CMD514AB	20.00
D4959	10.00
D4987M	20.00
D5147D	10.00
D5506	10.00
D5827AM	20.00
DMD6022	30.00
DMS-2A-250	40.00
HEP76	4.95
HEPS3002	11.30
HEPS3003	30.00
HEPS3005	10.00
HEPS3006	19.90
HEPS3007	25.00
HEPS3010	11.34
HTEF2204 H.P.	112.00
5082-0112 H.P.	14.20
5082-0253 H.P.	105.00
5082-0320 H.P.	58.00
5082-0386 H.P.	POR
5082-0401 H.P.	POR
5082-0438 H.P.	POR
5082-1028 H.P.	POR
5082-2711 H.P.	23.15
5082-3080 H.P.	2.00
5082-3188 H.P.	1.00
5082-6459 H.P.	POR
5082-8323 H.P.	POR
35826E H.P.	POR
35831E H.P.	29.99
35853E H.P.	71.50
35854E H.P.	75.00
HPA0241 H.P.	75.60
HXTR3101 H.P.	7.00
HXTR3102 H.P.	8.75
HXTR6101/2N6617 H.P.	55.00
HXTR6104 H.P.	68.00
HXTR6105 H.P.	31.00
HXTR6106 H.P.	33.00
QSCH1995 H.P.	POR
JO2000 TRW	10.00
JO2001 TRW	25.00
JO4045 TRW	25.00
K3A	10.00
MA450A	10.00
MA41487	POR
MA41765	POR
MA43589	POR
MA43636	POR
MA47044	POR
MA47651	25.50

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GaAs, TUNNEL DIODES, ETC.

PART	PRICE
MA47100	$ 3.05
MA47202	30.80
MA47771	POR
MA47852	POR
MA49558	POR
MB4021	POR
MBD101	1.00
MDO513	POR
MHW1171	42.50
MHW1182	48.60
MHW4171	49.35
MHW4172	51.90
MHW4342	68.75
MLP102	25.00
MM1500	32.32
MM1550	POR
MM1552	50.00
MM1553	50.00
MM1614	10.00
MM2608	5.00
MM3375A	11.50
MM4429	10.00
MM8000	1.15
MM8006	2.30
MO277L	POR
MO283L	POR
MO3757	POR
MP102	POR
MPN3202	10.00
MPN3401	.52
MPN3412	1.00
MPSU31	1.01
MRA2023-1.5 TRW	42.50
MRF212/208	16.10
MRF223	13.25
MRF224	15.50
MRF237	3.15
MRF238	12.65
MRF243	25.00
MRF245	34.50
MRF247	34.50
MRF304	43.45
MRF315	23.00
MRF420	20.00
MRF421	36.80
MRF422	41.40
MRF427	16.10
MRF428	46.00
MRF450/A	13.80
MRF453/A	17.25
MRF454/A	19.90
MRF455/A	16.00
MRF458	19.90
MRF463	25.00
MRF472	1.00
MRF475	2.90
MRF477	11.50
MRF502	1.04
MRF503	$ 6.00
MRF504	7.00
MRF509	5.00
MRF511	8.65
MRF605	20.00
MRF629	3.47
MRF644	23.00
MRF816	15.00
MRF823	20.00
MRF901	3.00
MRF8004	2.10
MS261F	POR
MT4150 Fair.	POR
MT5126 Fair.	POR
MT5481 Fair.	POR
MT5482 Fair.	POR
MT5483 Fair.	POR
MT5596 Fair.	POR
MT5764 Fair.	POR
MT8762 Fair.	POR
MV109	.77
MV1401	8.75
MV1624	1.42
MV1805	15.00
MV1808	10.00
MV1817B	10.00
MV1863B	10.00
MV1864A	10.00
MV1864B	10.00
MV1864D	10.00
MV1868D	10.00
MV2101	.90
MV2111	.90
MV2115	1.55
MV2201	.53
MV2203	.53
MV2209	2.00
MV2215	2.00
MWA110	7.45
MWA120	7.80
MWA130	8.25
MWA210	7.80
MWA220	8.25
MWA230	8.65
MWA310	8.25
MWA320	8.65
MWA330	9.50
NEC57835	5.30
ON382	5.00
PPT515-20-3	POR
PRT8637	POR
PSCQ2-160	POR
PT3190	POR
PT3194	POR
PT3195	POR
PT3537	POR
PT4166E	POR
PT4176D	POR
PT4186B	$ POR
PT4209	POR
PT4209C	POR
PT4566	POR
PT4570	POR
PT4571	POR
PT4571A	POR
PT4577	POR
PT4590	POR
PT4612	POR
PT4628	POR
PT4640	POR
PT4642	POR
PT5632	POR
PT5749	POR
PT6612	POR
PT6626	POR
PT6709	POR
PT6720	POR
PT8510	POR
PT8524	POR
PT8609	POR
PT8633	POR
PT8639	POR
PT8659	POR
PT8679	POR
PT8708	POR
PT8709	POR
PT8727	POR
PT8731	POR
PT8742	POR
PT8787	POR
PT9790	41.70
PT31962	POR
PT31963	POR
PT31983	POR
PTX6680	POR
RAY-3	24.99
40081	POR
40281	POR
40282	POR
40290	POR
RF110	25.00
SCA3522	POR
SCA3523	POR
SD1065	POR
SS43	POR
TP1014	POR
TP1028	POR
TRW-3	POR
UTO504 Avantek	70.00
UTO511 Avantek	75.00
V15	4.00
V33B	4.00
V100B	4.00
VAB801EC	25.00
VAB804EC	25.00
VAS21AN20	25.00

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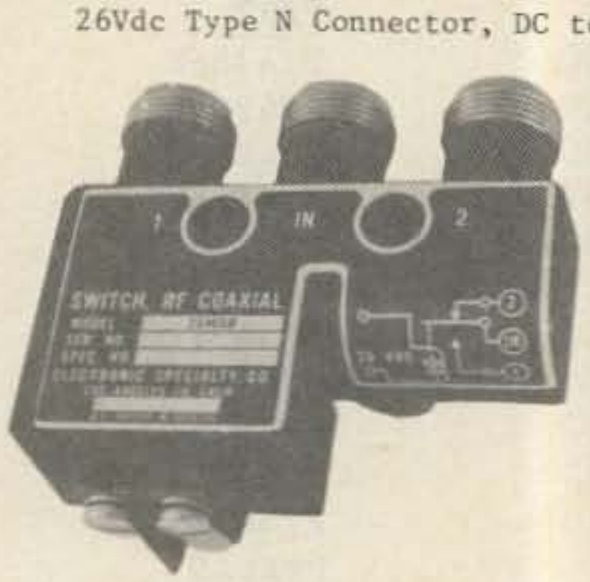
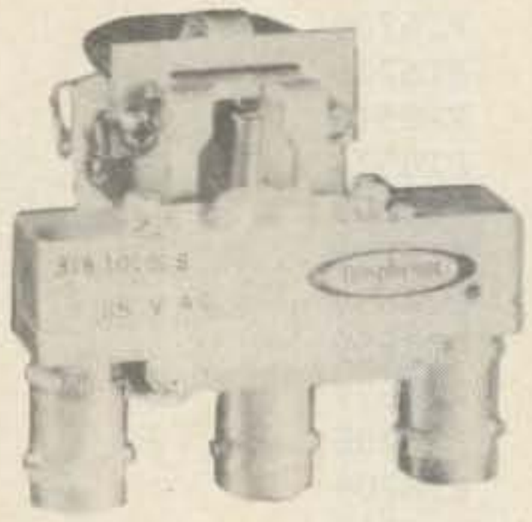
COAXIAL RELAY SWITCHES SPDT

Electronic Specialty Co./Raven Electronics FSN 5985-556-9683 $49.00
Part # 25N28 Part # SU-01
26Vdc Type N Connector, DC to 1 GHz.



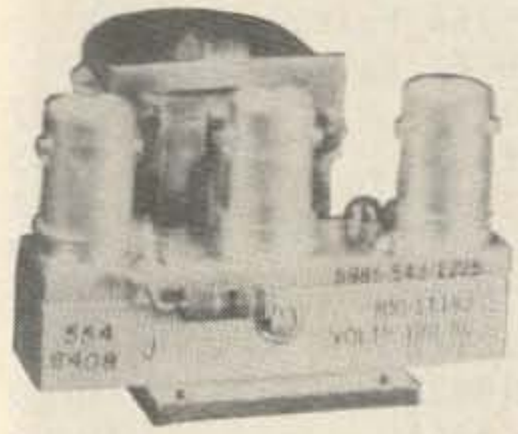
Amphenol
Part # 316-10102-8
115Vac Type BNC DC to 3 GHz.

$29.99



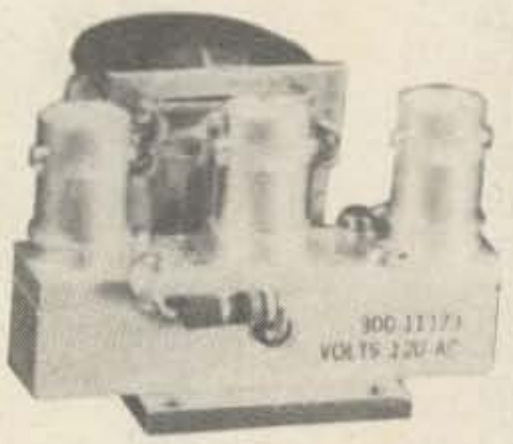
FXR
Part # 300-11182
120Vac Type BNC DC to 4 GHz.
FSN 5985-543-1225

$39.99



FXR
Part # 300-11173
120Vac Type BNC Same
FSN 5985-543-1850

$39.99



BNC To Banana Plug Coax Cable RG-58 36 inch or BNC to N Coax Cable RG-58 36 inch.

$7.99 or 2 For $13.99 or 10 For $50.00

$8.99 or 2 For $15.99 or 10 For $60.00

SOLID STATE RELAYS

P&B Model ECT1DB72 PRICE EACH $5.00	5vdc turn on	120vac contact at 7amps or 20amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.
Digisig, Inc. Model ECS-215 PRICE EACH $7.50	5vdc turn on	240vac contact 14amps or 40amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.
Grigsby/Barton Model GB7400 PRICE EACH $7.50	5vdc turn on	240vac contact at 15amps or 40amps on a 10"x 10"x .124 aluminum. Heatsink with silicon grease.

NOTE: *** Items may be substituted with other brands or equivalent model numbers. ***

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RECALL PHONE MEMORY TELEPHONE WITH 24 NUMBER AUTO DIALER

The Recall Phone Telephone employs the latest state of art communications technology.It is a combination telephone and automatic dialer that uses premium-quality,solid-state circuitry to assure high-reliability performance in personal or business applications. $49.99

ARON ALPHA RAPID BONDING GLUE

Super Glue #CE-486 high strength rapid bonding adhesive.Alpha Cyanoacrylate.Set-Time 20 to 40 sec.,0.7fl.oz.(20gm.)
$2.00

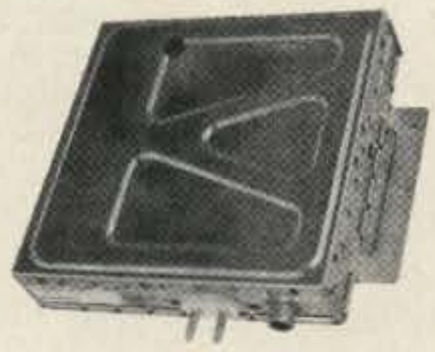
TOUCH TONE PAD

This pad contains all the electronics to produce standard touch-tone tones. New with data.

$9.99 or 10/$89.99

MITSUMI UHF/VHF VARACTOR TUNER MODEL UVE1A

Perfect for those unscrambler projects. New with data.



$19.99 or 10/$149.99

INTEGRATED CIRCUIT.

		1 to 10	11up
MC1372P	Color TV Video Modulator Circuit.	$ 4.42	$2.95
MC1358P	IF Amp.,Limiter,FM Detector,Audio Driver,Electronic Attenuator.	5.00	4.00
MC1350P	IF Amplifier	1.50	1.25
MC1330A1P	Low Level Video Detector	1.50	1.15
MC1310P	FM Stereo Demodulator	4.29	3.30
MC1496P	Balanced Modulator/Demodulator	1.50	1.25
LM565N	Phase Locked Loop	2.50	2.00
LM380N14	2Watt Audio Power Amplifier	1.56	1.25
LM1889N	TV Video Modulator	5.00	4.00
NE564N	Phase Locked Loop	10.00	8.00
NE561N	Phase Locked Loop	10.00	8.00

FERRANTI ELECTRONICS AM RADIO RECEIVER MODEL ZN414 INTEGRATED CIRCUIT.

Features:
1.2 to 1.6 volt operating range.,Less than 0.5ma current consumption. 150KHz to 3MHz Frequency range.,Easy to assemble,no alignment necessary. Effective and variable AGC action., Will drive an earphone direct. Excellent audio quality.,Typical power gain of 72dB.,TO-18 package. With data. $2.99 or 10 For $24.99

NI CAD RECHARGEABLE BATTERIES

AA Battery Pack of 6 These are Factory New. $5.00

SUB C Pack of 10 2.5Amp/Hr. $10.00

Gates Rechargeable Battery Packs

12vdc at 2.5Amp/Hr. $11.99
12vdc at 5Amp/Hr. $15.99

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"SOCKETS AND CHIMNEYS"

EIMAC TUBE SOCKETS AND CHIMNEYS

SK110	Socket	$POR
SK300A	Socket For 4CX5000A,R,J, 4CX10,000D, 4CX15,000A,J	$520.00
SK400	Socket For 4-125A,250A,400A,400C,4PR125A,400A,4-500A,5-500A	260.00
SK406	Chimney For 4-250A,400A,400C,4PR400A	74.00
SK416	Chimney For 3-400Z	36.00
SK500	Socket For 4-1000A/4PR1000A/B	390.00
SK600	Socket For 4CX250B,BC,FG,R,4CX350A,F,FJ	51.00
SK602	Socket For 4CX250B,BC,FG,R,4CX350A,F,FJ	73.00
SK606	Chimney For 4CX250B,BC,FG,R,4CX350A,F,FJ	11.00
SK607	Socket For 4CX600J,JA	60.00
SK610	Socket For 4CX600J,JA	60.00
SK620	Socket For 4CX600J,JA	66.00
SK626	Chimney For 4CX600J,JA	10.00
SK630	Socket For 4CX600J,JA	66.00
SK636B	Chimney For 4CX600J,JA	34.00
SK640	Socket For 4CX600J,JA	36.00
SK646	Chimney For 4CX600J,JA	71.00
SK700	Socket For 4CX300A,Y,4CX125C,F	225.00
SK711A	Socket For 4CX300A,Y,4CX125C,F	225.00
SK740	Socket For 4CX300A,Y,4CX125C,F	86.00
SK770	Socket For 4CX300A,Y,4CX125C,F	86.00
SK800A	Socket For 4CX1000A,4CX1500B	225.00
SK806	Chimney For 4CX1000A,4CX1500B	40.00
SK810	Socket For 4CX1000A,4CX1500B	225.00
SK900	Socket For 4X500A	300.00
SK906	Chimney For 4X500A	57.00
SK1420	Socket For 5CX3000A	650.00
SK1490	Socket For 4CV8000A	585.00

JOHNSON TUBE SOCKETS AND CHIMNEYS

124-111/SK606	Chimney For 4CX250B,BC,FG,R, 4CX350A,F,FJ	$ 10.00
122-0275-001	Socket For 3-500Z, 4-125A, 250A, 400A, 4-500A, 5-500A	(pair)15.00
124-0113-00	Capacitor Ring	15.00
124-116/SK630A	Socket For 4CX250B,BC,FG,R, /4CX350A,F,FJ	55.00
124-115-2/SK620A	Socket For 4CX250B,BC,FG,R, /4CX350A,F,FJ	55.00
	813 Tube Socket	20.00

TUBE CAPS (Plate)

HR1, 4	$11.00
HR2,3, 6 & 7	13.00
HR5, 8	14.00
HR9	17.00
HR10	20.00

CHIP CAPACITORS

.8pf	10pf	100pf*	430pf
1pf	12pf	110pf	470pf
1.1pf	15pf	120pf	510pf
1.4pf	18pf	130pf	560pf
1.5pf	20pf	150pf	620pf
1.8pf	22pf	160pf	680pf
2.2pf	24pf	180pf	820pf
2.7pf	27pf	200pf	1000pf/.001uf*
3.3pf	33pf	220pf*	1800pf/.0018uf
3.6pf	39pf	240pf	2700pf/.0027uf
3.9pf	47pf	270pf	10,000pf/.01uf
4.7pf	51pf	300pf	12,000pf/.012uf
5.6pf	56pf	330pf	15,000pf/.015uf
6.8pf	68pf	360pf	18,000pf/.018uf
8.2pf	82pf	390pf	

PRICES: 1 to 10 - .99¢ 101 to 1000 .60¢ * IS A SPECIAL PRICE: 10 for $7.50
11 to 50 - .90¢ 1001 & UP .35¢ 100 for $65.00
51 to 100 - .80¢ 1000 for $350.00

WATKINS JOHNSON WJ-V907: Voltage Controlled Microwave Oscillator $110.00

Frequency range 3.6 to 4.2GHz, Power ouput, Min. 10dBm typical, 8dBm Guaranteed. Spurious output suppression Harmonic (nf_o), min. 20dB typical, In-Band Non-Harmonic, min. 60dB typical, Residual FM, pk to pk, Max. 5KHz, pushing factor, Max. 8KHz/V, Pulling figure (1.5:1 VSWR), Max. 60MHz, Tuning voltage range +1 to +15volts, Tuning current, Max. -0.1mA, modulation sensitivity range, Max. 120 to 30MHz/V, Input capacitance, Max. 100pf, Oscillator Bias +15 +-0.05 volts @ 55mA, Max.

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TYPE	PRICE	TYPE	PRICE	TYPE	PRICE
2E26	$ 5.69	KT88	$ 20.00	6562/6974A	$ 50.00
2K28	100.00	DX362	50.00	6832	22.00
2X1000A	300.00	DX415	50.00	6883/8032A/8552	7.00
3B22	19.75	572B/T160L	49.00	6897	110.00
3B28/866A	7.50	592/3-200A3	144.00	6907A	75.00
3-500Z	102.00	807	7.50	6939	15.00
3-1000Z	400.00	811	10.00	7094	125.00
3CX1000A/8283	428.00	811A	15.00	7117	17.00
3CX1500A7/887	533.00	812A	35.00	7211	60.00
3X2500A3	200.00	813	50.00	7289/3CX100A5	34.00
3CX3000A7	490.00	829B	38.00	7360	11.00
4-65A/8165	45.00	832A	28.00	7377	67.00
4-125A/4D21	58.00	4624	310.00	7408	4.00
4-250A/5D22	75.00	4662	80.00	7650	250.00
4-400A/8432	90.00	4665	585.00	7695	8.00
4-400C/6775	95.00	5675/A	25.00	7843	58.00
4-1000A/8166	300.00	5721	200.00	7854	83.00
4B32	22.00	5768	85.00	7868	5.00
4E27A/5-125B	155.00	5836	100.00	7894	12.00
4CS250R	146.00	5837	100.00	8072	65.00
4X150A/7034	30.00	5861/EC55	110.00	8117A	130.00
4X150D/7035	40.00	5876A	25.00	8121	60.00
4X150G/8172	100.00	5881/6L6W	6.00	8122	100.00
4X250B	30.00	5893	45.00	8236	30.00
4CX250B/7203	45.00	5894/A	50.00	8295/PL172	506.00
4CX250F/G/8621	55.00	5894/B	60.00	8462	100.00
4CX250K/8245	100.00	5946	258.00	8505A	73.50
4CX250R/7580W	69.00	6080	10.00	8533W	92.00
4CX300A/8167	140.00	6083/AX9909	89.00	8560/A	65.00
4CX350A/8321	83.00	6098/6AK6	14.00	8560AS	90.00
4CX350F/J/8904	95.00	6115/A	110.00	8608	34.00
4X500A	282.00	6146	7.00	8637	38.00
4CX600J/8809	607.00	6146A	7.50	8643	100.00
4CW800F	625.00	6146B/8298A	8.50	8647	123.00
4CX1000A/8168	340.00	6146W	14.00	8737/5894B	60.00
4CX1500B/8660	397.00	6156	66.00	8873	260.00
4CX5000A/8170	932.00	6159	15.00	8874	260.00
4CX10000D/8171	990.00	6161	233.00	8875	260.00
4CX15000A/8281	1260.00	6291	125.00	8877	533.00
4PR60A	100.00	6293	12.00	8908	12.00
4PR60B/8252	175.00	6360	5.00	8930/651Z	71.00
4PR400A/8188	192.00	6524	53.00	8950	12.00
5CX1500A	569.00	6550	10.00		
6BK4C	6.00	6JM6	6.00	6LQ6 (Sylvania)	7.50
6DQ5	5.00	6JN6	6.00	6LU8	6.00
6FW5	6.00	6JS6B	6.00	6LX6	6.00
6GE5	6.00	6KG6/EL505	6.00	6ME6	6.00
6GJ5	6.00	6KM6	6.00	12BY7A	4.00
6HS5	6.00	6KN6	6.00	12JB6A	6.00
6JB5/6HE5	6.00	6LF6	6.00	6KD6	6.00
6JB6A	6.00	6LQ6 (GE)	6.00	6JT6A	6.00
				6KD6	6.00

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"TVRO BOARD LIST"

70 MHZ IF BOARD: This circuit provides about 43dB gain with 50 ohm input and output impedance. It is designed to drive the Demodulator. The on-board bypass filter can be tuned to bandwidths between 20 and 35 MHz with a passband ripple of less than ½ dB. Hybrid IC's are used for the gain stages.

SINGLE AUDIO BOARD: This circuit recovers the audio signals from the 6.8 MHz frequency. The Miller 9051 coils are tuned to pass the 6.8MHz subcarrier and the 9052 coil tunes for recovery of the audio.

DUAL AUDIO BOARD: Duplicate of the single audio but also covers the 6.2 range.

DC CONTROL BOARD: No description.

DUAL AUDIO BOARD	PRICE EACH
Printed Circuit Board	$ 25.00
2 3pf sm	1.00
2 12pf sm	1.00
2 50pf sm	1.00
2 68pf sm	1.00
4 91pf sm	1.00
5 .001mfd	.35
6 .01mfd	.35
2 .047mfd	.35
1 .47mfd 25vdc	.35
2 1mfd 10vdc	.59
4 4.7mfd 35vdc	.59
1 470mfd 25vdc	1.29
2 220K 1/4w	.15
2 150K 1/4w	.15
2 6.8K 1/4w	.15
2 3.3K 1/4w	.15
2 2.2K 1/4w	.15
4 1K 1/4w	.15
2 10 ohm 1/4w	.15
2 50K pots	1.00
1 5K pot	1.00
2 CA3065	2.16
1 LM380	1.56
1 7812 Voltage Reg.	1.17
5 2N2222	.50
4 Miller 9051	5.99
2 Miller 9052	5.99
TOTAL KIT PRICE	97.62

DC CONTROL BOARD	
Printed Circuit Board	15.00
2 470mfd 25vdc	1.29
2 4.7mfd 25vdc	.59
1 1meg 1/4w	.15
3 10K 1/4w	.15
1 3.3K 1/4w	.15
3 2.2K 1/4w	.15
1 1K 1/4w	.15
2 5K 10 turn trimpot	1.00
4 10K 10 turn trimpot	1.00
1 10K 10 turn with dial	10.00
1 7815 Voltage Reg.	1.17
1 LM324	2.50
1 5 pole rotary switch	2.50
1 SPDT switch	1.00
1 DPDT swich	1.00
1 0-1ma meter	5.00
1 18 to 24vdc at 1 amp power supply	24.99
TOTAL KIT PRICE	74.27

DEMODULATOR BOARD	PRICE EACH
Printed Circuit Board	$ 40.00
1 1mfd 35vdc	.59
13 .01mfd 50vdc disc	.35
1 470mfd 25vdc	1.29
2 100mfd 16vdc	.69
2 22mfd 35vdc	.59
3 4.7mfd 35vdc	.59
1 4300pf sm	2.00
1 330pf sm	1.00
1 100pf sm	1.00
1 91pf sm	1.00
2 3pf sm	1.00
1 2 to 8pf ceramic trimmer	1.00
1 100uh choke	1.50
1 4.7uh choke	1.50
1 2.7uh choke	1.50
4 100K 1/4w	.15
1 51 ohm 1/4w	.15
1 27K 1/4w	.15
5 10K 1/4w	.15
1 8.2K 1/4w	.15
2 4.7K 1/4w	.15
1 2.2K 1/4w	.15
1 1.2K 1/4w	.15
3 1K 1/4w	.15
3 560 ohm 1/4w	.15
1 470 ohm 1/4w	.15
1 390 ohm 1/4w	.15
1 300 ohm 1/4w	.15
1 270 ohm 1/4w	.15
1 150 ohm 1/4w	.15
1 41 ohm 1/4w	.15
1 10K pot	1.00
1 NE592/LM733N	2.50
1 NE564	5.00
1 MWA120 (Motorola)	7.80
1 7812 Voltage Reg.	1.17
1 7815 Voltage Reg.	1.17
3 2N2222	.50
2 1N34/38	.50
1 HP5082-2800	2.20
1 5 to 7 volt Zenner	1.00
TOTAL KIT PRICE	92.25

COMPLETE KIT WITH DUAL AUDIO $923.23
COMPLETE KIT WITH SINGLE AUDIO 880.77

LESS 10% ON ALL COMPLETE KIT ORDERS

BOARDS AND PARTS MAY BE PURCHASED SEPERATELY AT THE PRICES LISTED ABOVE.

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TVRO BOARD DESCRIPTION AND PARTS LIST

DUAL CONVERSION BOARD: This board provides conversion from the 3.7-4.2 band first to 900 MHz where gain and bandpass filtering are provided and, second, to 70 MHz. The board contains both local oscillators, one fixed and the other variable, and the second mixer. Construction is greatly simplified by the use of Hybrid IC amplifiers for the gain stages.

DEMODULATOR BOARD: This circuit takes the 70 MHz center frequency satellite TV signal in the 10 to 200 millivolt range, detects them using a phase lock loop, de-emphasizes and filters the result to produce standard NTSC video. Other outputs include the audio subcarrier, a DC voltage proportional to the strength of the 70 MHz signal, and AFC voltage centered at about 2 volts DC.

DUAL CONVERSION BOARD	PRICE EACH
Printed Circuit Board	$ 25.00
6 47pf chip caps	1.00
2 4.7mfd 35vdc	.59
2 .01mfd 50vdc disc cap	.35
4 1.5 to 8pf piston trimmer cap	5.99
2 470 ohm 1/4w	.15
2 MWA320 (Motorola)	8.65
1 7815 Voltage Reg.	1.17
1 VTO8090	150.00
1 VTO8240	156.25
2 1N4005	.39
1 DBM500/1100 (Varil)	125.00
1 MLP102 (Engleman)	25.00
8 SMA Male Connector	5.00
TOTAL KIT PRICE	572.64

70 MHZ IF BOARD	
Printed Circuit Board	25.00
3 MWA120	7.80
7 .01mfd 50vdc	.35
2 4.7mfd 35vdc	.59
1 10pf sm	1.00
5 22pf sm	1.00
1 18pf sm	1.00
1 33pf sm	1.00
2 330 ohm 1/4w	.15
5 J.W. Miller 4500-4	4.99
1 7815 Voltage Reg.	1.17
TOTAL KIT PRICE	86.45

SINGLE AUDIO BOARD	PRICE EACH
Printed Circuit Board	$ 15.00
1 3pf sm	1.00
1 12pf sm	1.00
1 50pf sm	1.00
1 68pf sm	1.00
2 91pf sm	1.00
3 .001mfd	.35
3 .01mfd	.35
1 .047mfd	.35
1 .47mfd	.35
1 1mfd 10vdc	.59
3 4.7mfd 35vdc	.59
1 470mfd 25vdc	1.29
1 220K 1/4w	.15
1 150K 1/4w	.15
1 6.8K 1/4w	.15
1 3.3K 1/4w	.15
1 2.2K 1/4w	.15
3 1K 1/4w	.15
1 10 ohm 1/4w	.15
1 50K pot	1.00
1 5K pot	1.00
1 CA3065/MC1358P	2.16
1 LM380	1.56
1 7812 Voltage Reg.	1.17
3 2N2222	.50
2 Miller 9051	5.99
1 Miller 9052	5.99
TOTAL KIT PRICE	55.16

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"CHIPS"

FAIRCHILD VHF AND UHF PRESCALER CHIPS		PRICE
95H90DC	350MC Prescaler divide by 10/11	$ 8.50
95H91DC	350MC Prescaler divide by 5/6	8.50
11C90DC	650MC Prescaler divide by 10/11	15.50
11C91DC	650MC Prescaler divide by 5/6	15.50
11C06DC	UHF Prescaler 750MC D Type Flip Flop	12.30
11C05DC	1GHz Counter Divide by 4 (Regular price $75.00)	50.00
11C01FC	High Speed Dual 5/4 Input NO/NOR Gate	15.40
82S90	Presettable High Speed Decade/Binary Counter used with the 11C90/91 or the 95H90/91 Prescaler can divide by 100. (Signetics)	5.00
11C24DC	This chip is the same as a Motorola MC4024/4324 Dual TTL Voltage Control Multivibrator.	3.37
11C44DC	This chip is the same as a Motorola MC4044/4344 Phase Frequency Detector.	3.37

GENERAL ELECTRIC CO. GUNN DIODE MODEL Y-2167
Freq. Gap (GHZ) 12 to 18, Output (Min.) 100mW, Duty (%) CW, Typ. Bias (Vdc) 8.0, Type. Oper. (MAdc) 550, Max. Thres. (mAdc) 1000, Max. Bias (Vdc) 10.0. **$39.99**

VARIAN GALLIUM ARSENIDE GUNN DIODES MODEL VSX-9201S5
Freq. Coverage 8 to 12.4GHz, Output (Min.) 100mW, Bias Voltage (Max.) 14vdc, Bias current (mAdc) Operating 550 Typ. 750 Max., Threshold 850 Tup. 1000 Max. **$39.99**

VARI-L Co. Inc. MODEL SS-43 AM MODULATOR
Freq. Range 60 10 150MC, Insertion Loss 13dB Nominal, Signal Port Imp. 50ohms Nominal, Signal Port RF Power + 10dBm Max., Modulation Port BW DC to 1KHZ, Modulation Port Bias 1ma. Nominal. **$24.99**

AVANTEK CASCADABLE MODULAR AMPLIFIERS	Model UTO-504	UTO-511
Frequency Range	5 to 500 MHz	5 to 500 MHz
Gain	6dB	15dB
Noise Figure	11dB	2.3dB to 3dB
Power Output	+ 17dB	– 2dB to – 3dB
Gain Flatness	1dB	1dB
Input Power Vdc	+ 24	+ 15
mA	100	10
PRICE	$70.00	$75.00

HEWLETT PACKARD MIXERS MODELS		10514A		10514B
Frequency Range		2MHz to 500MC		2MHz to 500MC
Input/Output Frequency	L & R	200KHz to 500MC		200KHz to 500MC
	X	DC to 500MC		DC to 500MC
Mixer Conversion Loss	(A)	7dB		7dB
	(B)	9dB		9dB
Noise Performance (SSB)	(A)	7dB		7dB
	(B)	9dB		9dB
	PRICE	$49.99	PRICE	$39.99

FREQUENCY SOURCES, INC MODEL MS-74X MICROWAVE SIGNAL SOURCE
MS-74X: Mechanically Tunable Frequency Range (MHz) 10630 to 11230 (10.63 to 11.23GHz) Minimum Output Power (mW) 10, Overall Multiplier Ratio 108, Internal Crystal Oscillator Frequency Range (MHz) 98.4 to 104.0, Maximum Input Current (mA) 400.

The signal source are designed for applications where high stability and low noise are of prime concern. these sources utilize fundamental transistor oscillators with high Q coaxial cavities, followed by broadband stable step recovery diode multipliers. This design allows single screw mechanical adjustment of frequency over standard communications bands. Broadband sampling circuits are used to phase lock the oscillator to a high stability reference which may be either an internal self-contained crystal oscillator, external primary standard or VHF synthesizer. This unique technique allows for optimization of both FM noise and long term stability. List Price is $1158.00 (THESE ARE NEW) **Our Price—$289.**

HEWLETT PACKARD 1N5712 MICROWAVE DIODE
This diode will replace the MBD101, 1N5711, 5082-2800, 5082-2835 ect. This will work like a champ in all those Down Converter projects. **$1.50 or 10/$10.00**

MOTOROLA MHW1172R LOW DISTORTION WIDEBAND AMPLIFIER MODULE.
Frequency Range: 40 to 300 MHz., Power Gain at 50MHz 16.6min. to 17.4max., Gain Flatness ±0.1 Typ. ±0.2 Max. dB., DC Supply Voltage – 28vdc, RF Voltage Input + 70dBmV **PRICE $29.99**

GENERAL ELECTRIC AA NICADS
Model #41B905HD11-G1
Pack of 6 for $5.00 or 60 Cells, 10 Packs for $45.00
These may be broken down to individual cells.

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DEFECTIVE MATERIAL: All claims for defective material must be made within sixty (60) days after receipt of parcel. All claims must include the defective material (for testing purposes), our invoice number, and the date of purchase. All returns must be packed properly or it will void all warranties.

DELIVERY: Orders are normally shipped within 48 hours after receipt of customer's order. If a part has to be backordered the customer is notified. Our normal shipping method is via First Class Mail or UPS depending on size and weight of the package. On test equipment it is by Air only, FOB shipping point.

FOREIGN ORDERS: All foreign orders must be prepaid with cashier's check or money order made out in U.S. Funds. We are sorry but C.O.D. is not available to foreign countries and Letters of Credit are not an acceptable form of payment either. Further information is available on request.

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INSURANCE: Please include 25¢ for each additional $100.00 over $100.00, United Parcel only.

ORDER FORMS: New order forms are included with each order for your convenience. Additional forms are available on request.

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PREPAID ORDERS: Order must be accompanied by a check.

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NEW LOW-NOISE PREAMPS

New low-noise microwave transistors make preamps in the 0.9 to 1.0 dB noise figure range possible without the fragility and power supply problems of gas-fet's. Units furnished wired and tuned to ham band. Can be easily retuned to nearby freq.

Models LNA( ), P30, and P432 shown

Model	Tunable Freq Range	Noise Figure	Gain	Price
LNA 28	20-40	0.9 dB	20 dB	$39.95
LNA 50	40-70	0.9 dB	20 dB	$39.95
LNA 144	120-180	1.0 dB	18 dB	$39.95
LNA 220	180-250	1.0 dB	17 dB	$39.95
LNA 432	380-470	1.0 dB	18 dB	$44.95

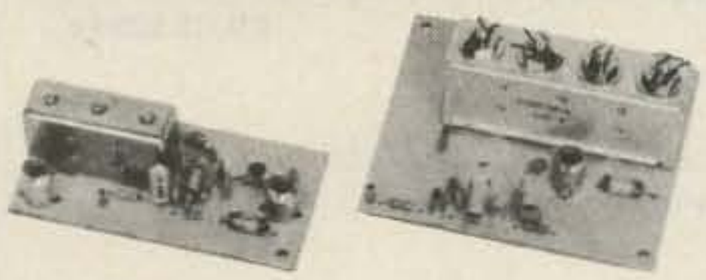
ECONOMY PREAMPS

Our traditional preamps, proven in years of service. Over 20,000 in use throughout the world. Tuneable over narrow range. Specify exact freq. band needed. Gain 16-20 dB. NF = 2 dB or less. VHF units available 27 to 300 MHz. UHF units available 300 to 650 MHz.

- P30K, VHF Kit less case $14.95
- P30C, VHF Kit with case $20.95
- P30W, VHF Wired/Tested $29.95
- P432K, UHF Kit less case $18.95
- P432C, UHF Kit with case $24.95
- P432W, UHF Wired/Tested $33.95

P432 also available in broadband version to cover 20-650 MHz without tuning. Same price as P432; add "B" to model #.

HELICAL RESONATOR PREAMPS



Our lab has developed a new line of low-noise receiver preamps with helical resonator filters built in. The combination of a low noise amplifier similar to the LNA series and the sharp selectivity of a 3 or 4 section helical resonator provides increased sensitivity while reducing intermod and cross-band interference in critical applications. See selectivity curves at right. Noise figure = 1 to 1.2 dB. Gain = 12 to 15 dB.

Model	Tuning Range	Price
HRA-144	143-150 MHz	$49.95
HRA-220	213-233 MHz	$49.95
HRA-432	420-450 MHz	$59.95

RECEIVING CONVERTERS

Models to cover every practical rf & if range to listen to SSB, FM, ATV, etc. NF = 2 dB or less.

	Antenna Input Range	Receiver Output
VHF MODELS	28-32	144-148
	50-52	28-30
Kit $44.95	50-54	144-148
Less Case $39.95	144-146	28-30
Wired $59.95	145-147	28-30
	144-144.4	27-27.4
	146-148	28-30
	144-148	50-54
	220-222	28-30
	220-224	144-148
	222-226	144-148
	220-224	50-54
	222-224	28-30
UHF MODELS	432-434	28-30
	435-437	28-30
Kit $54.95	432-436	144-148
Less Case $49.95	432-436	50-54
Wired $74.95	439.25	61.25

SCANNER CONVERTERS Copy 72-76, 135-144, 240-270, 400-420, or 806-894 MHz bands on any scanner. Wired/tested Only $79.95.

SPECIAL FREQUENCY CONVERTERS made to custom order $119.95. Call for details.

SAVE A BUNDLE ON VHF FM TRANSCEIVERS!

FM-5 PC Board Kit – **ONLY $159.95**
complete with controls, heatsink, etc.
10 Watts, 5 Channels, for 6M, 2M, or 220

Cabinet Kit, complete with speaker, knobs, connectors, hardware. Only $59.95

REPEAT OF A SELLOUT!

While supply lasts, get $59.95 cabinet kit free when you buy an FM-5 Transceiver kit. Where else can you get a complete transceiver for only $159.95?

TRANSMIT CONVERTERS

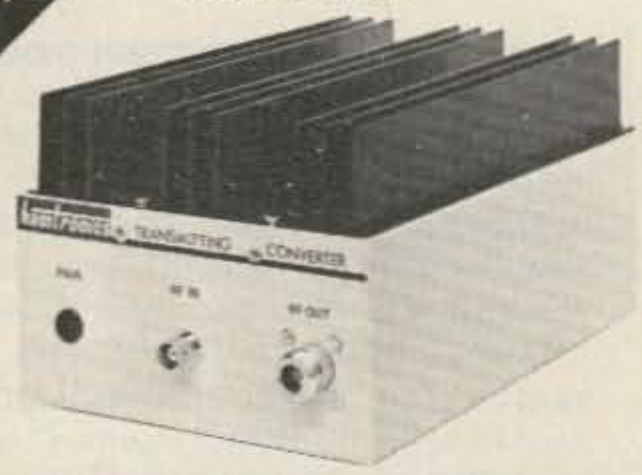
For SSB, CW, ATV, FM, etc. Why pay big bucks for a multi mode rig for each band? Can be linked with receive converters for transceive. 2 watts output.

	Exciter Input Range	Antenna Output
For VHF,	28-30	144-146
Model XV2	28-29	145-146
Kit $79.95	28-30	50-52
Wired $119.95	27-27.4	144-144.4
(Specify band)	28-30	220-222
	50-54	220-224
	144-146	50-52
	50-54	144-148
	144-146	28-30
For UHF,	28-30	432-434
Model XV4	28-30	435-437
Kit $99.95	50-54	432-436
Wired $149.95	61.25	439.25
	144-148	432-436*

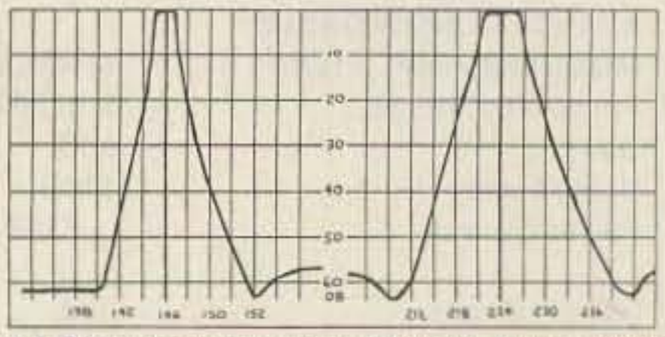
*Add $35 for 2M input

FREE OFFER

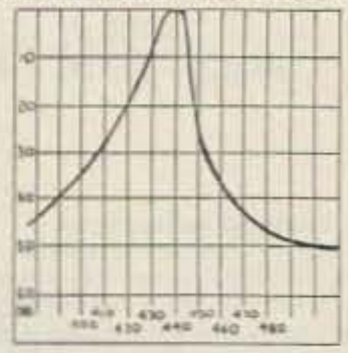
For limited time, buy a transmit converter above with 40-45W PA ($129.95) and get $39.95 cabinet FREE.



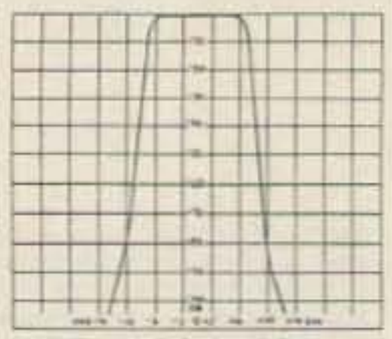
LOOK AT THESE ATTRACTIVE CURVES!



R144 & R220 Front Ends. HRA 144/220, & HRF-144/220

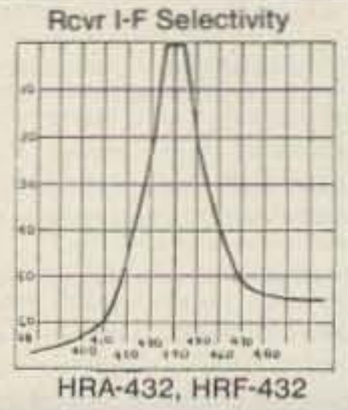


R451 Receiver Front End



Rcvr I-F Selectivity

Typical Selectivity Curves of Receivers and Helical Resonators.



HRA-432, HRF-432

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JUST LOOK AT THESE PRICES!

Band	Kit	Wired/Tested
6M,2M,220	$595	$745
440	$645	$795

Both kit and wired units are complete with all parts, modules, hardware, and crystals.

CALL OR WRITE FOR COMPLETE DETAILS.

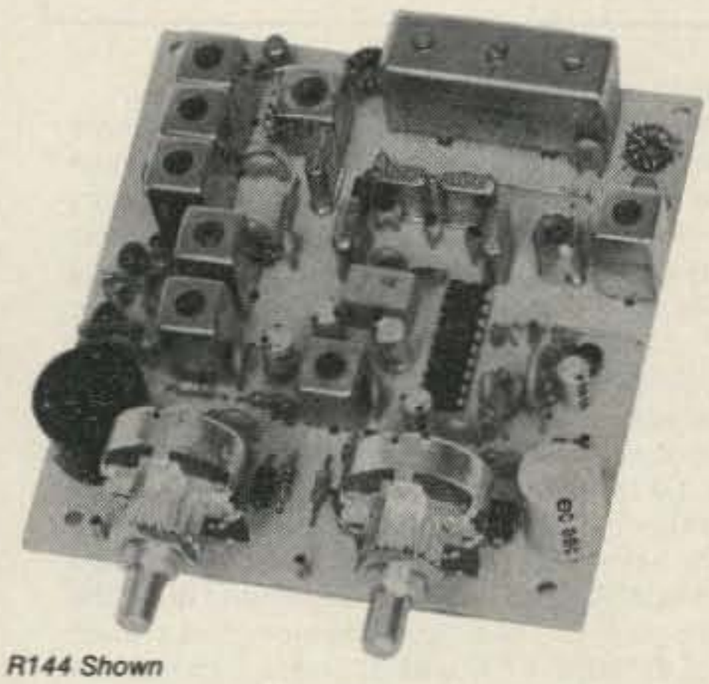
Also available for remote site linking/crossband & 10M.

FEATURES:

- SENSITIVITY SECOND TO NONE; TYPICALLY 0.15 uV ON VHF, 0.2 uV ON UHF.
- SELECTIVITY THAT CAN'T BE BEAT! BOTH 8 POLE CRYSTAL FILTER & CERAMIC FILTER FOR GREATER THAN 100 dB AT ± 12KHZ. HELICAL RESONATOR FRONT ENDS. SEE R144, R220, AND R451 SPECS IN RECEIVER AD BELOW.
- OTHER GREAT RECEIVER FEATURES: FLUTTER-PROOF SQUELCH, AFC TO COMPENSATE FOR OFF-FREQ TRANSMITTERS, SEPARATE LOCAL SPEAKER AMPLIFIER & CONTROL.
- CLEAN, EASY-TUNE TRANSMITTER; UP TO 20 WATTS OUT.

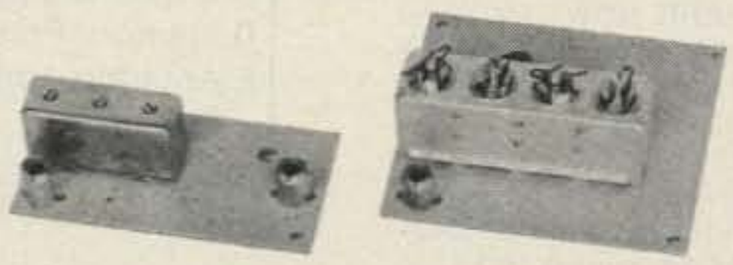
HIGH QUALITY MODULES FOR REPEATERS, LINKS, TELEMETRY, ETC.

INTRODUCING — NEW 1983 RECEIVERS



R144 Shown

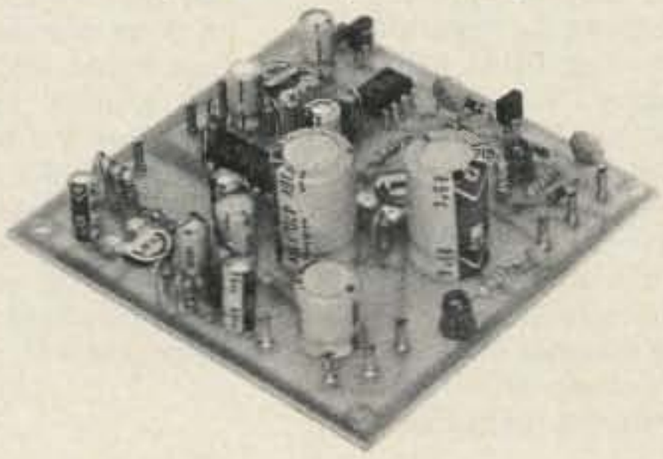
- **R144/R220 FM RCVRS** for 2M or 220 MHz. 0.15uV sens.; 8 pole xtal filter & ceramic filter in i-f, helical resonator front end for exceptional selectivity (curves at left). AFC incl., xtal oven avail. Kit only $119.95
- **R451 FM RCVR** Same but for uhf. Tuned line front end, 0.2 uV sens. Kit only $119.95.
- **R76 FM RCVR** for 10M, 6M, 2M, 220, or commercial bands. As above, but w/o AFC or hel. res. Kits only $109.95.
  Also avail w/4 pole filter, only $94.95/ kit.
- **R110 VHF AM RECEIVER** kit for VHF aircraft band or ham bands. Only $84.95.
- **R110 UHF AM RECEIVER** for UHF uses, including special 296 MHz model to hear SPACE SHUTTLE. Kit $94.95.



- **HELICAL RESONATOR FILTERS** available separately on pcb w/connectors.

  HRF-144 for 143-150 MHz $34.95
  HRF-220 for 213-233 MHz $34.95
  HRF-432 for 420-450 MHz $44.95

  (See selectivity curves at left.)



- **COR KITS** With audio mixer and speaker amplifier. Only $29.95.
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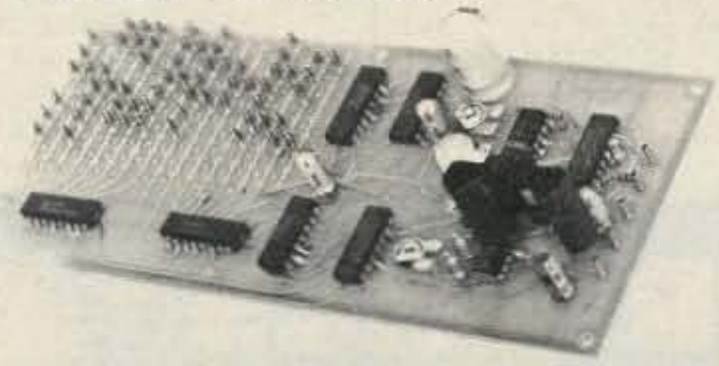
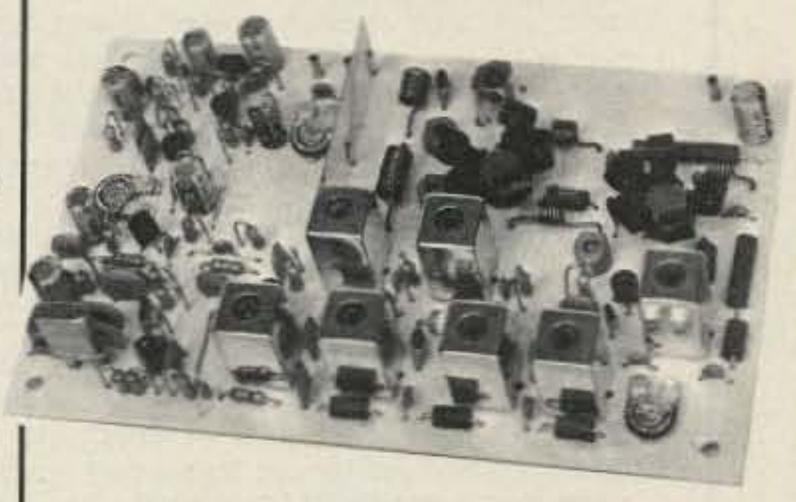
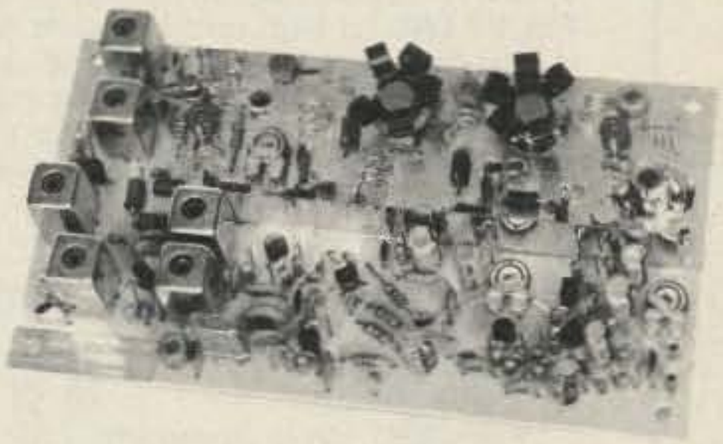


- **A16 RF TIGHT BOX** Deep drawn alum. case with tight cover and no seams. 7 x 8 x 2 inches. Only $18.00.

TRANSMITTERS AND ACCESSORIES



- **T51 VHF FM EXCITER** for 10M, 6M, 2M, 220 MHz or adjacent bands. 2 Watts continuous. Kits only $59.95



- **T451 UHF FM EXCITER** 2 to 3 Watts on 450 ham band or adjacent. Kits only $69.95.
- **VHF & UHF LINEAR AMPLIFIERS.** Use on either FM or SSB. Power levels from 10 to 45 Watts to go with exciters & xmtg converters. Kits from $69.95.

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Revolutionary Instant Access Digital Shortwave Scanner

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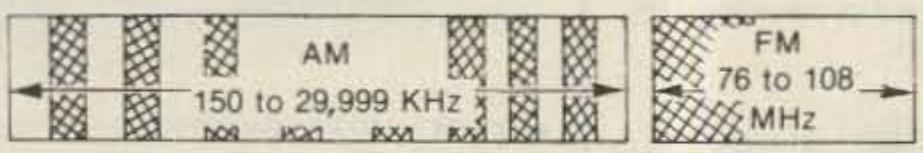
- **6 Memories for Any Mode (AM,SSB/CW, & FM)**
- **Dual PLL Frequency Synthesized—No Drift!**

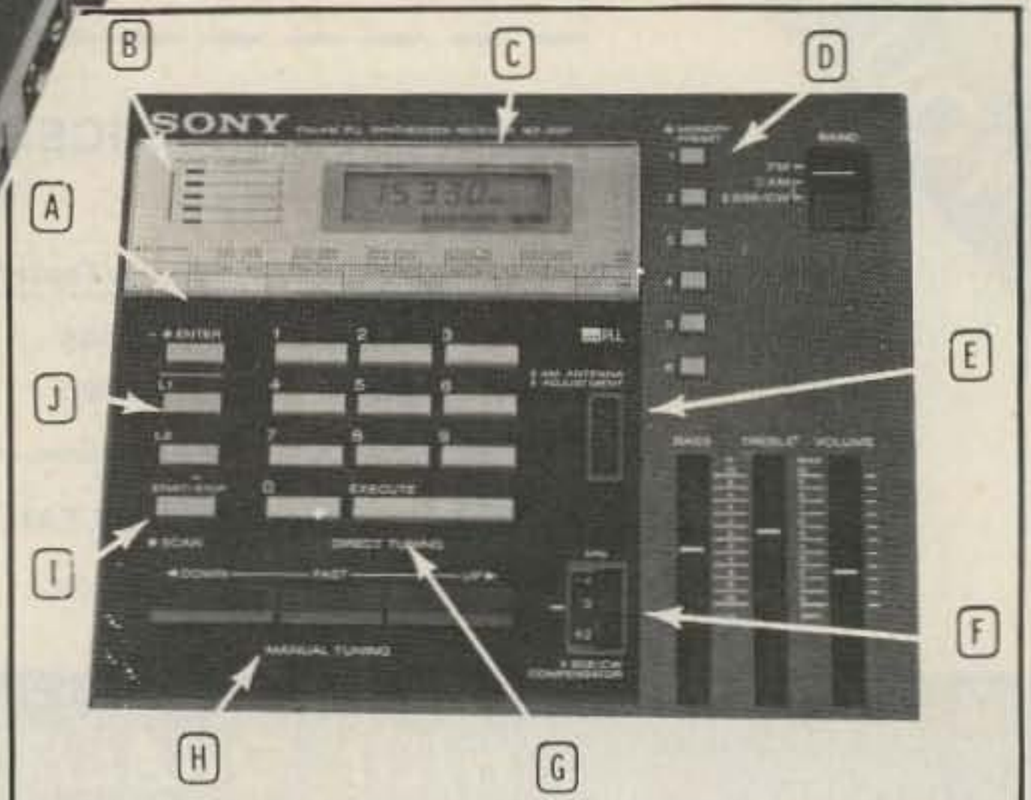
A WHOLE NEW BREED OF RADIO IS HERE NOW! No other short wave receiver combines so many advanced features for both operating convenience and high performance as does the new Sony ICF-2001. Once you have operated this exciting new radio, you'll be spoiled forever! Direct access tuning eliminates conventional tuning knobs and dials with a convenient digital keyboard and Liquid Crystal Display (LCD) for accurate frequency readout to within 1 KHz. Instant fingertip tuning, up to 8 memory presets, and continuous scanning features make the ICF-2001 the ultimate in convenience.

Compare the following features against any receiver currently available and you will have to agree that the Sony ICF 2001 is the best value in shortwave receivers today:

DUAL PLL SYNTHESIZER CIRCUITRY covers entire 150 KHz to 29.999 MHz band. PLL_1 circuit has 100 KHz step while PLL_2 handles 1 KHz step, both of which are controlled by separate quartz crystal oscillators for precise, no-drift tuning. **DUAL CONVERSION SUPERHETERODYNE** circuitry assures superior AM reception and high image rejection characteristics. The 10.7 MHz IF of the FM band is utilized as the 2nd IF of the AM band. A new type of crystal filter made especially for this purpose realizes clearer reception than commonly used ceramic filters. **ALL FET FRONT END** for high sensitivity and interference rejection. Intermodulation, cross modulation, and spurious interference are effectively rejected. **FET RF AMP** contributes to superior image rejection, high sensitivity, and good signal to noise ratio. Both strong and weak stations are received with minimal distortion.

EXTENDED SPECTRUM CONTINUOUS TUNING





A Enter Button
B Signal Strength Indicator
C Liquid Crystal Display
D Memory Preset Buttons
E Antenna Adjustment Dial
F SSB/CW Compensator
G Execute Bar
H Manual Tuning Buttons
I Scan Button
J High/Low Limit Buttons

OPERATIONAL FEATURES

INSTANT FINGERTIP TUNING with the calculator-type key board enables the operator to have instant access to any frequency in the LW, MW, SW, and FM bands. And the LCD digital frequency display confirms the exact, drift-free signal being received. **AUTOMATIC SCANNING** of the above bands. Continuous scanning of any desired portion of the band is achieved by setting the "L_1" and "L_2" keys to define the range to be scanned. The scanner can stop automatically on strong signals, or it can be done manually. **MANUAL SEARCH** is similar to the manual scan mode and is useful for quick signal searching. The "UP" and "DOWN" keys let the tuner search for you. The "FAST" key increases the search rate for faster signal detection. **MEMORY PRESETS.** Six memory keys hold desired stations for instant one-key tuning in any mode (AM, SSB/CW, and FM), and also, the "L_1" and "L_2" keys can give you two more memory slots when not used for scanning. **OTHER FEATURES:** Local, normal, DX sensitivity selector for AM; SSB/CW compensator; 90 min. sleep timer; AM Ant. Adjust.

SPECIFICATIONS

CIRCUIT SYSTEM: Fm Superheterodyne; AM Dual conversion superheterodyne. **SIGNAL CIRCUITRY:** 4 IC's, 11 FET's, 23 Transistors, 16 Diodes. **AUXILIARY CIRCUITRY:** 5 IC's, 1 LSI, 5 LED's, 25 Transistors, 9 Diodes. **FREQUENCY RANGE:** FM 76-108 MHz; AM 150-29,999 KHz. **INTERMEDIATE FREQUENCY:** FM 10.7 MHz.; AM 1st 66.35 MHz., 2nd 10.7 MHz. **ANTENNAS:** FM telescopic, ext. ant. terminal; AM telescopic, built-in ferrite bar, ext. ant. terminal. **POWER:** 4.5 VDC/120 VAC **DIMENSIONS:** 12¼ (W) X 2¼ (H) X 6¾ (D). **WEIGHT:** 3 lb. 15 oz. (1.8 kg)

ramsey the first name in Counters !

9 DIGITS 600 MHz $129.95 WIRED

PRICES	
CT-90 wired, 1 year warranty	$129.95
CT-90 Kit, 90 day parts warranty	109.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC Adapter/Charger	12.95
OV-1, Micro-power Oven time base	49.95
External time base input	14.95

The CT-90 is the most versatile, feature packed counter available for less than $300.00! Advanced design features include; three selectable gate times, nine digits, gate indicator and a unique display hold function which holds the displayed count after the input signal is removed! Also, a 10mHz TCXO time base is used which enables easy zero beat calibration checks against WWV. Optionally; an internal nicad battery pack, external time base input and Micro-power high stability crystal oven time base are available. The CT-90, performance you can count on!

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 10 MV to 150 MHz Less than 50 MV to 500 MHz
Resolution:	0.1 Hz (10 MHz range) 1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	9 digits 0.4" LED
Time base:	Standard-10.000 mHz, 1.0 ppm 20-40°C. Optional Micro-power oven-0.1 ppm 20-40°C
Power:	8-15 VAC @ 250 ma

7 DIGITS 525 MHz $99.95 WIRED

SPECIFICATIONS:

Range:	20 Hz to 525 MHz
Sensitivity:	Less than 50 MV to 150 MHz Less than 150 MV to 500 MHz
Resolution:	1.0 Hz (5 MHz range) 10.0 Hz (50 MHz range) 100.0 Hz (500 MHz range)
Display:	7 digits 0.4" LED
Time base:	1.0 ppm TCXO 20-40°C
Power:	12 VAC @ 250 ma

The CT-70 breaks the price barrier on lab quality frequency counters. Deluxe features such as; three frequency ranges - each with pre-amplification, dual selectable gate times, and gate activity indication make measurements a snap. The wide frequency range enables you to accurately measure signals from audio thru UHF with 1.0 ppm accuracy - that's .0001%! The CT-70 is the answer to all your measurement needs, in the field, lab or ham shack.

PRICES:

CT-70 wired, 1 year warranty	$99.95
CT-70 Kit, 90 day parts warranty	84.95
AC-1 AC adapter	3.95
BP-1 Nicad pack + AC adapter/charger	12.95

7 DIGITS 500 MHz $79.95 WIRED

PRICES:

MINI-100 wired, 1 year warranty	$79.95
AC-Z Ac adapter for MINI-100	3.95
BP-Z Nicad pack and AC adapter/charger	12.95

Here's a handy, general purpose counter that provides most counter functions at an unbelievable price. The MINI-100 doesn't have the full frequency range or input impedance qualities found in higher price units, but for basic RF signal measurements, it can't be beat! Accurate measurements can be made from 1 MHz all the way up to 500 MHz with excellent sensitivity throughout the range, and the two gate times let you select the resolution desired. Add the nicad pack option and the MINI-100 makes an ideal addition to your tool box for "in-the-field" frequency checks and repairs.

SPECIFICATIONS:

Range:	1 MHz to 500 MHz
Sensitivity:	Less than 25 MV
Resolution:	100 Hz (slow gate) 1.0 KHz (fast gate)
Display:	7 digits, 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	5 VDC @ 200 ma

8 DIGITS 600 MHz $159.95 WIRED

NEW READ RECEIVER FREQUENCY

SPECIFICATIONS:

Range:	20 Hz to 600 MHz
Sensitivity:	Less than 25 mv to 150 MHz Less than 150 mv to 600 MHz
Resolution:	1.0 Hz (60 MHz range) 10.0 Hz (600 MHz range)
Display:	8 digits 0.4" LED
Time base:	2.0 ppm 20-40°C
Power:	110 VAC or 12 VDC

The CT-50 is a versatile lab bench counter that will measure up to 600 MHz with 8 digit precision. And, one of its best features is the Receive Frequency Adapter, which turns the CT-50 into a digital readout for any receiver. The adapter is easily programmed for any receiver and a simple connection to the receiver's VFO is all that is required for use. Adding the receiver adapter in no way limits the operation of the CT-50, the adapter can be conveniently switched on or off. The CT-50, a counter that can work double-duty!

PRICES:

CT-50 wired, 1 year warranty	$159.95
CT-50 Kit, 90 day parts warranty	119.95
RA-1, receiver adapter kit	14.95
RA-1 wired and pre-programmed (send copy of receiver schematic)	29.95

DIGITAL MULTIMETER $99.95 WIRED

PRICES:

DM-700 wired, 1 year warranty	$99.95
DM-700 Kit, 90 day parts warranty	79.95
AC-1, AC adaptor	3.95
BP-3, Nicad pack +AC adapter/charger	19.95
MP-1, Probe kit	2.95

The DM-700 offers professional quality performance at a hobbyist price. Features include; 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3½ digit, ½ inch LED readout with automatic decimal placement, automatic polarity, overrange indication and overload protection up to 1250 volts on all ranges, making it virtually goof-proof! The DM-700 looks great, a handsome, jet black, rugged ABS case with convenient retractable tilt bail makes it an ideal addition to any shop.

SPECIFICATIONS:

DC/AC volts:	100uV to 1 KV, 5 ranges
DC/AC current:	0.1uA to 2.0 Amps, 5 ranges
Resistance:	0.1 ohms to 20 Megohms, 6 ranges
Input impedance:	10 Megohms, DC/AC volts
Accuracy:	0.1% basic DC volts
Power:	4 'C' cells

AUDIO SCALER

For high resolution audio measurements, multiplies UP in frequency.

- Great for PL tones
- Multiplies by 10 or 100
- 0.01 Hz resolution!

$29.95 Kit $39.95 Wired

ACCESSORIES

Telescopic whip antenna - BNC plug	$ 7.95
High impedance probe, light loading	15.95
Low pass probe, for audio measurements	15.95
Direct probe, general purpose usage	12.95
Tilt bail, for CT 70, 90, MINI-100	3.95
Color burst calibration unit, calibrates counter against color TV signal	14.95

COUNTER PREAMP

For measuring extremely weak signals from 10 to 1,000 MHz. Small size, powered by plug transformer-included.

- Flat 25 db gain
- BNC Connectors
- Great for sniffing RF with pick-up loop

$34.95 Kit $44.95 Wired

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The biggest and best Ham Store in the midwest featuring quality Kenwood products with working displays. We sell only the best. Authorized Kenwood Service. **Universal Amateur Radio Inc., 1280 Aida Dr., Reynoldsburg (Columbus) OH 43068, 866-4267.**

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Your company name and message can contain up to 25 words for as little as $150 yearly (prepaid), or $15 per month (prepaid quarterly). No mention of mail-order business or area code permitted. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the April. '83 issue must be in our hands by Feb. 1st. Mail to 73 Magazine, Peterborough NH 03458. ATTN: Nancy Ciampa.

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GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14A	7A	7	7	3A	3A	3A	7B	14	14	21A	21A
ARGENTINA	21	14	7B	7B	7B	7	14A	21A	21A	21A	21A	21A
AUSTRALIA	21A	14	7B	7B	7B	7B	7B	14B	14	14	21	21A
CANAL ZONE	14A	7A	7	7	7	7	14	21A	21A	21A	21A	21A
ENGLAND	7	7	7	3A	7	7	14	21A	21A	21	14	7
HAWAII	21A	14	7B	7	7	7	7	14B	14	21A	21A	21A
INDIA	7B	7B	7B	7B	7B	7B	14	21	14	7B	7B	7B
JAPAN	21A	14	7B	7B	7B	7	7	7B	7B	7B	14	14A
MEXICO	21	7A	7	7	7	7	7	14A	21A	21A	21A	21A
PHILIPPINES	14A	14B	7B	7B	7B	7B	7B	7B	7B	7B	7B	14
PUERTO RICO	14A	7	7	7	7	7	14	21	21A	21A	21A	21
SOUTH AFRICA	14	7	7	7	7B	14	21	21A	21A	21A	21	21
U.S.S.R.	7	7	3A	3A	7	7B	14	21A	21	14B	7B	7
WEST COAST	21A	14	7	7	7	7	3A	14	21A	21A	21A	21A

CENTRAL UNITED STATES TO:

ALASKA	21	14	7	7	3A	3A	3A	7	7	14	21A	21A
ARGENTINA	21A	14	7B	7B	7B	7	14	21A	21A	21A	21A	21A
AUSTRALIA	21A	21	14B	7B	7B	7B	7B	7B	14	14	21	21A
CANAL ZONE	21	14	7	7	7	7	7A	21	21A	21A	21A	21A
ENGLAND	7	7	7	3A	7	7	7	14A	21A	21	14	7
HAWAII	21A	21	14B	7	7	7	7	7	14	21A	21A	21A
INDIA	7B	14	7B	7B	7B	7B	7B	14B	14	7B	7B	7B
JAPAN	21A	14	7B	7B	7B	7	7	7	7B	7B	14	21
MEXICO	21	14	7	7	7	7	7	14	21	21A	21A	21A
PHILIPPINES	21A	14	7B	7B	7B	7B	7B	7B	7B	7B	7B	14
PUERTO RICO	14A	7A	7	7	7	7	14	21	21A	21A	21A	21
SOUTH AFRICA	14	7	7	7	7B	7B	14	21A	21A	21A	21	21
U.S.S.R.	7B	7	3A	3A	7	7B	7B	14A	21	14B	7B	7B

WESTERN UNITED STATES TO:

ALASKA	21	14A	7A	7	3A	3A	3A	7	7	14	21A	21A
ARGENTINA	21A	14A	7B	7B	7B	7	7B	14A	21A	21A	21A	21A
AUSTRALIA	21A	21A	14	14B	7B	7B	7B	7B	14	14	21	21A
CANAL ZONE	21	14	7	7	7	7	7	14A	21A	21A	21A	21A
ENGLAND	7B	7B	7	3A	7	7B	7B	14B	21A	21	14	7B
HAWAII	21A	21A	14	7A	7	7	7	7	14	21A	21A	21A
INDIA	7B	14A	14	7B	7B	7B	7B	7B	14B	7B	7B	7B
JAPAN	21A	21	14	7B	7B	7	7	7	7	7B	14	21A
MEXICO	21	14A	7	7	7	7	7	7	14A	21A	21A	21A
PHILIPPINES	21A	21A	14	7B	7B	7B	7B	7	7	7B	7B	14A
PUERTO RICO	14A	14	7	7	7	7	7	14	21A	21A	21A	21A
SOUTH AFRICA	14	7B	7	7B	7B	7B	7B	14	21A	21A	21	21
U.S.S.R.	7B	7B	3A	3A	3A	7B	7B	14B	14	14B	7B	7B
EAST COAST	21A	14	7	7	7	7	3A	14	21A	21A	21A	21A

A = Next higher frequency may also be useful.
B = Difficult circuit this period.

First letter = night waves. Second = day waves.
G = Good, F = Fair, P = Poor. * = Chance of solar flares.
 # = Chance of aurora.

NOTE THAT NIGHT WAVE LETTER NOW COMES FIRST.

FEBRUARY

SUN	MON	TUE	WED	THU	FRI	SAT
		1 F/F	2 F/G	3 F/G	4 G/G	5 G/G
6 F/G	7 F/F	8 G/G	9 G/G	10 G/G	11 G/G	12 G/G
13 G/G	14 G/G	15 F/F*	16 P/F*	17 P/F	18 F/F	19 F/G
20 F/G	21 F/G	22 G/G	23 G/G	24 G/G	25 F/G	26 F/G
27 F/F	28 G/G					

MEET THE NEW YAESU FT-102

The FT-102 is factory equipped for operation on all present and proposed Amateur HF bands. An extra AUX band position is available for special applications. Equipped for SSB, CW, and AM (RX), the FT-102 may be activated on FM and AM (TX) via the optional AM/FM-102 Module.

The all-new receiver front end utilizes a low-distortion RF preamplifier that may be bypassed via a front panel switch when not needed. Maximum receiver performance is yours with this impressive lineup of standard features: IF Notch Filter, Audio Peak Filter, Variable IF Bandwidth Control, IF Shift, Variable Pulse Width Noise Blanker, Independent SSB and CW Audio Channels with Optimized Audio Bandwidth, and Front Panel Audio Tone Control. Wide/Narrow filter selection is independent of the Mode switch.

The celebrated transmitter section is powered by three 6146B final tubes, for more consistent power output and very low distortion. An RF Speech Processor, Mic Amp Audio Tone Control, VOX, and an IF Monitor round out the transmitter lineup.

Futuristic panel design and careful human engineering are the hallmarks of the FT-102. Convenient pop-out controls below the meters may be retracted when not in use, thus avoiding inadvertant mistuning. Abundant relay contacts, rear panel phono jacks for PTT, microphone/patch input, and other essential interface connections make the FT-102 extremely simple to incorporate into your station.

SPECIFICATIONS

TRANSMITTER

Power Input: (1.8-25 MHz) (28-29.9 MHz)

SSB, CW	240W DC	160W DC
AM	80W DC	80W DC
FM		160W DC

RECEIVER

Image Rejection:
- Better than 70dB from 1.8-21.5 MHz
- Better than 50dB from 24.5-29.9 MHz

IF rejection:
- Better than 70 dB

Selectivity (−6 dB/ −60 dB):
- SSB, CW, AM; 2.7/4.8 kHz (with no optional filters)
- Width adjusts continuously from 2.7 kHz to 500 Hz (−6 dB)

Spurious Radiation: Better than −40 dB

SP-102 FT-102 FV-102DM FC-102

P-102

The SP-102 External Speaker/Audio Filter features a large, high-fidelity speaker with selectable low- and high-cut audio filters. The front panel A-B switch allows selection of two receiver inputs for maximum versatility. Also available is the SP-102P Speaker/Patch.

FV-102DM

The FV-102DM Synthesized External VFO tunes in 10 Hz steps. Keyboard entry of frequencies, UP/DOWN scanning, and 12 memories make the FV-102DM a "must" for serious DX or contest work.

FC-102

The FC-102 Antenna Coupler is capable of handling 1.2KW of transmitter power, with an in-line wattmeter, separate SWR meter, and A-B input/output selection expanding your station's capability. The optional FAS-1-4R allows remote selection of up to four antennas via one coaxial cable connected to the FC-102.

See your Authorized Yaesu Dealer today for a hands-on demonstration of the rig that everybody's talking about. It's the FT-102, The Transceiver of Champions!

Price And Specifications Subject To Change Without Notice or Obligation

1082

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Eastern Service Ctr., 9812 Princeton-Glendale Rd., Cincinnati, OH 45246 • (513) 874-3100

Scan the World.

NEW

SSB, CW, AM, FM, digital VFO's, 10 memories, memory and band scan, dual 24-hour clocks...

R-2000

The R-2000 is an all mode SSB, CW, AM, FM receiver that covers 150 kHz–30 MHz in 30 bands. New microprocessor controlled operating features and an UP conversion PLL circuit provide maximum flexibility and ease of operation to enhance the excitement of listening to stations around the world. Key features include digital VFO's, ten memories that store frequency, band, and mode information, memory scan, programmable band scan, fluorescent tube digital display, and dual 24-hour clock with timer.

R-2000 FEATURES:

- **Covers 150 kHz–30 MHz in 30 bands.** Uses innovative UP-conversion digitally controlled PLL circuit. UP/DOWN band switches (1-MHz step). VFO's continuously tuneable across 150 kHz–30 MHz.
- **All mode: USB, LSB, CW, AM, FM.** Provides expanded flexibility in receiving various signal types. Front panel mode selector keys, with LED indicators.
- **Digital VFO's for best stability.** 50-Hz step, switchable to 500-Hz or 5-kHz, using front panel pushbutton switches. F. LOCK switch provided.
- **Ten memories store frequency, band, and mode data.** Complete information on frequency, band, and mode is stored in memory, assuring maximum ease of operation. Each memory may be tuned as a VFO. Original memory frequency may be recalled. AUTO. M switch for automatic storage of current operating data, or, when off, selective storage of data using M. IN switch.
- **Lithium battery memory back-up. (Est. 5 yr. life.)**
- **Memory scan.** Scans all memories, or may be programmed to scan specific memories. HOLD switch interrupts scanning. Frequency, band, and mode are automatically selected in accordance with the memory channel being scanned. The scanning time is approximately 2 seconds per channel.
- **Programmable band scan.** Scans automatically within the programmed bandwidth. Memory channels 9 and 0 establish upper and lower scan limits. HOLD switch interrupts scanning. Frequency may be adjusted, using the tuning control, during scan HOLD.
- **Fluorescent tube digital display (100-Hz resolution).** Built-in 7 digit fluorescent tube digital display indicates frequency or time, plus memory channel number. DIM switch provided. The display may be switched to indicate CLOCK-2, FREQUENCY, CLOCK-1, and timer ON or OFF by the front panel FUNCTION switch.
- **Dual 24-hour quartz clocks, with timer.** Permits programming two different time zones. Timer for ON and OFF programming. Timer REMOTE output on rear panel (not for AC power).
- **Three built-in IF filters with NARROW/WIDE selector switch. (CW filter optional.)** 6 kHz wide or 2.7 kHz narrow on AM. 2.7 kHz automatic on SSB. 2.7 kHz wide on CW, or, with optional YG-455C filter installed, 500 Hz narrow. 15 kHz automatic on FM.
- **Squelch circuit, all mode, built-in, with BUSY indicator.**
- **Noise blanker built-in.** Eliminates pulse-type noise on SSB, CW, and AM.
- **Large front mounted speaker.**
- **Tone control.**
- **RF step attenuator. (0-10-20-30 dB.)** Four step attenuator, plus antenna fuse.
- **AGC switch. (Slow-Fast.)**
- **"S" meter, with SINPO "S" scale.**
- **High and low impedance antenna terminals.** A high impedance (500 ohm) terminal, and a low impedance (50 ohm) co-axial connector are provided.
- **100/120/220/240 VAC, or 13.8 VDC operation.** (Optional DCK-1 cable kit required for 13.8 VDC.)

Other features.
- RECORD output jack.
- Audible "beeper" (through speaker).
- Carrying handle.
- Headphone jack.
- External speaker jack.

Optional accessories:
- HS-4, HS-5, HS-6 headphones.
- DCK-1 DC cable kit.
- YG-455C 500-Hz CW filter.
- HC-10 World digital quartz clock.

More information on the R-2000 is available from all authorized dealers of Trio-Kenwood Communications
1111 West Walnut Street
Compton, California 90220.

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Specifications and prices are subject to change without notice or obligatio