October 1979 $2.50

73 Magazine for Radio Amateurs

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The TEMPO S-2

ONCE AGAIN... TEMPO IS FIRST

This time with a superior quality synthesized 220 MHz hand held transceiver. With an S-2 in your car or pocket you can use any 220 MHz repeater in the United States. It offers all of the advanced engineering, premium quality components and exciting features of the S-1. It is completely synthesized, offering 1000 channels in an extremely lightweight but rugged case.

If you're not on 220 it's about time you try it and this is the perfect way to get started. With the addition of a matching Tempo solid state amplifier you can use your S-2 as a powerful mobile or base station as well. It's all you really need. And if you already have a 220 MHz rig, the S-2 will add versatility you never dreamed possible.

Also...the price is right. The ni-cad battery pack, charger, and telescoping whip antenna are included. Although not a necessary option, the touch tone pad shown in the illustration adds greatly to its convenience at a low price.

The time has never been better to expand your horizons...there has never been a better little rig for 220 than the S-2.

The Tempo line also features a fine line of extremely compact UHF and VHF pocket receivers. They're low priced, dependable, and available with CTCSS and 2-tone decoders. The Tempo FMT-2 & FMT-42 (UHF) provides excellent mobile communications and features a remote control head for hide-away mounting.
The Tempo FMH-42 (UHF) and the *NEW* FMH-12 and FMH-15 (VHF) micro hand held transceivers provide 6 channel capability, dependability plus many worthwhile features at a low price. FCC type accepted models also available.
Please call or write for complete information. Also available from Tempo dealers throughout the U.S. and abroad.

SPECIFICATIONS

Frequency Coverage:	220 to 225 MHz
Channel Spacing:	Receive every 5 kHz, transmit Simplex or -1.6 MHz
Power Requirements:	9.6 VDC
Current Drain:	17 ma-standby 500 ma-transmit
Batteries:	8 pieces ni-cad battery included
Antenna Impedance:	50 ohms
Dimensions:	40 mm x 62 mm x 165 mm (1.6" x 2.5" x 6.5")
RF Output:	Better than 1.5 watts
Sensitivity:	Better than .5 microvolts

Price... $349.00

With touch tone pad . . .$399.00

SUPPLIED ACCESSORIES
Telescoping whip antenna, ni-cad battery pack, charger.

OPTIONAL ACCESSORIES
Touch tone pad (not installed):$39 • Tone burst generator: $29.95 • CTCSS sub-audible tone control: $29.95 • Rubber flex antenna: $8 • Leather holster: $16 • Cigarette lighter plug mobile charging unit: $6 • Matching 25 watt output 13.8 VDC power amplifier (S-25): $89 • Matching 75 watt output power amplifier (S-75): $169

The TEMPO S-1. The world's first synthesized 2 meter hand held transceiver. Its superb engineering and top quality components give it an uncommon degree of reliability...a fact now proven by the thousands of units in use worldwide.

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10W	80W	80A10	$149
30W	80W	80A30	$159
2W	50W	50A02	$129
2W	30W	30A02	$ 89

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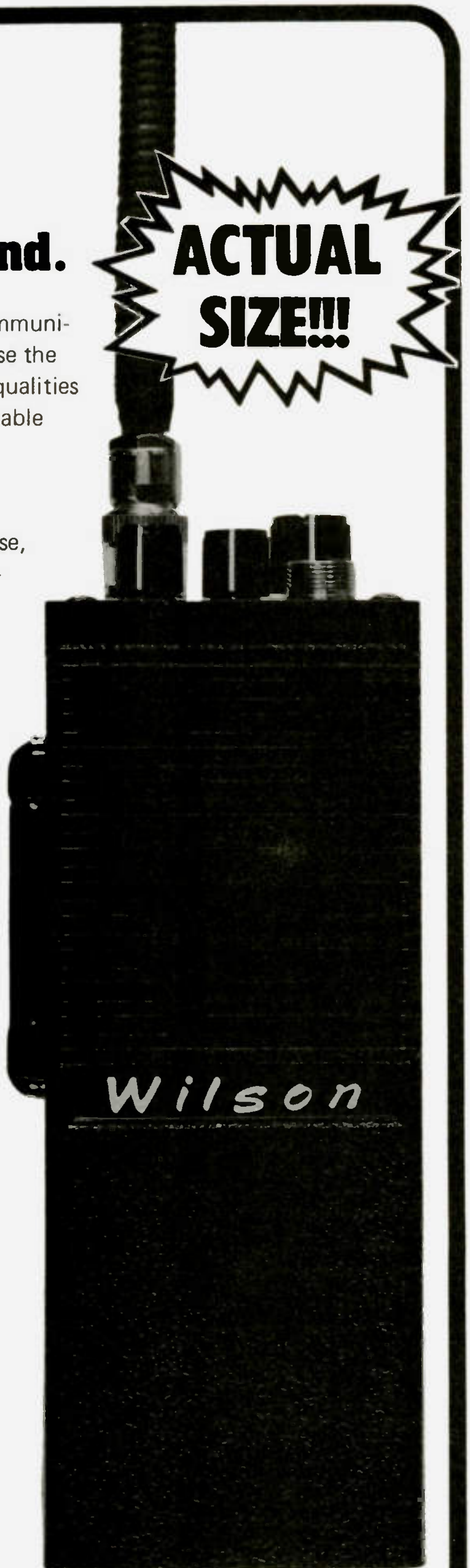

Today's Amateur demands rugged, rapid and accurate communications between Hams in the know. That's why they choose the Wilson Mark Series of hand-held radios. With exceptional qualities like these . . . why not choose the most popular radio available for yourself?

FEATURES

Advantages such as solid state circuitry, rugged Lexan® case, removable rear panel (enabling easy access to battery compartment) and compact mini-size enhance the Mark Series portable radio's versatility. In addition, Wilson carries a full line of accessories to satisfy almost any of your requirements.

SPECIFICATIONS

The Mark radios offer: • 144-148 MHz range • 6 Channel operation • Individual trimmers on TX and RX xtals • Rugged Lexan® outer case • Current drain: RX; 15 mA, TX; Mark II: 500 mA, Mark IV: 900 mA • A power saving Hi/Lo Switch • 12 KHz ceramic filter and 10.7 monolithic filter included • 10.7 MHz and 455 KHz IF • Spurious and harmonics, more than 50 dB below quieting • Uses special rechargeable Ni-Cad battery pack • LED battery condition indicator • Rubber duck and one pair Xtals 52/52 included • Weight: 19 oz. including batteries • Size: 6" x 1.770" x 2.440".

OPTIONS

Options available, include Touch Tone Pad, CTCSS, Leather Case, Chargers for Desk Top, Travel or Automobile, Speaker Mike and large capacity, small size batteries.

For more details and/or the name of your nearest dealer, contact: Consumer Products Division, Wilson Electronics Incorporated, 4288 So. Polaris Ave., P. O. Box 19000, Las Vegas, Nevada 89119. Phone 702/739-1931.

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Prices and specifications subject to change without notice.

✓ Reader Service—see page 211

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W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

GLORY-SEEKING

Having failed to make contact between Pack Monadnock mountain in New Hampshire and the WA1KPS DXpedition to New York State on 10 GHz, it appeared that sterner measures would be necessary. The Pack is a 2,500-foot mountain and has the benefit of a road going right to the summit. The only problems with that are the surprising cold and wind which can strike even on relatively warm days . . . and the pesky little black flies which can make a hot, windless day wretched. These tiny but persistent devils get into your hair, crawl up your sleeves and into your shirt, and BITE!

Not far from the Pack is Grand Monadnock mountain, reaching up 3,500 feet. Since this one has to be climbed on foot, it is nowhere near as popular as the Pack. But, with six states already contacted on 10 GHz and with all contacts being over a path of at least 50 miles, I reluctantly agreed to take an expedition up in the interests of science and a world record . . . Guinness, please note.

Tim N8RK/1, Sherry, and I struggled up Grand Monadnock the previous Sunday in order to make the Connecticut to New Hampshire contact. It took us about two hours to scramble up the 2½-mile path of rock, but at least we were rewarded by getting a nice signal report over that path. Chuck Martin of Tufts Electronics was on the other end with Steve Murray K1KEC and Eric Williams WA1HON. On the second trip, I was able to talk Tim into going again, but Sherry had more sense and she passed up the great event. Jim Grubb WB1AFC, who works for Chuck, drove up from Boston and helped us cart the equipment up the mountain.

We'd just taken along a barefoot Gunnplexer for the Connecticut contact. That was small enough to fit in a knapsack, so it was easy to carry. The signals from that unit had not been overpowering, so we decided this time to take along some insurance in the form of a two-foot dish and a tripod. That was a bit more formidable to haul up the rocky path. Some of the rocks are *big*.

Sunday arrived and the three of us headed for the mountain, talking with Chuck and his DXpedition to New York via the Mt. Greylock repeater. To say that I was not enthusiastic about the climb would be quite an understatement. My normal exercise is to walk from my desk to the kitchen and back for a meal . . . maybe 100 feet total . . . three times a day. Then, exhausted from this, I stagger 20 feet more and up a flight of stairs to my apartment to rest. Typing my editorials strengthens little more than the outrage level in Newington.

Nothing short of the prospect of achieving an almost unbeatable world record of seven states worked on 10 GHz could have gotten me a second time onto that accursed trail up Monadnock. My knees had finally stopped making me limp a day or two earlier, and here I was about to insult them again with another struggle up the endless rocks, although I suppose that two and a half miles of stairs would pretty much do a person in, too. And on the way down, while you don't have your knees pulling your weight up, they do have to take shock after shock as you jump down one to two feet at a time.

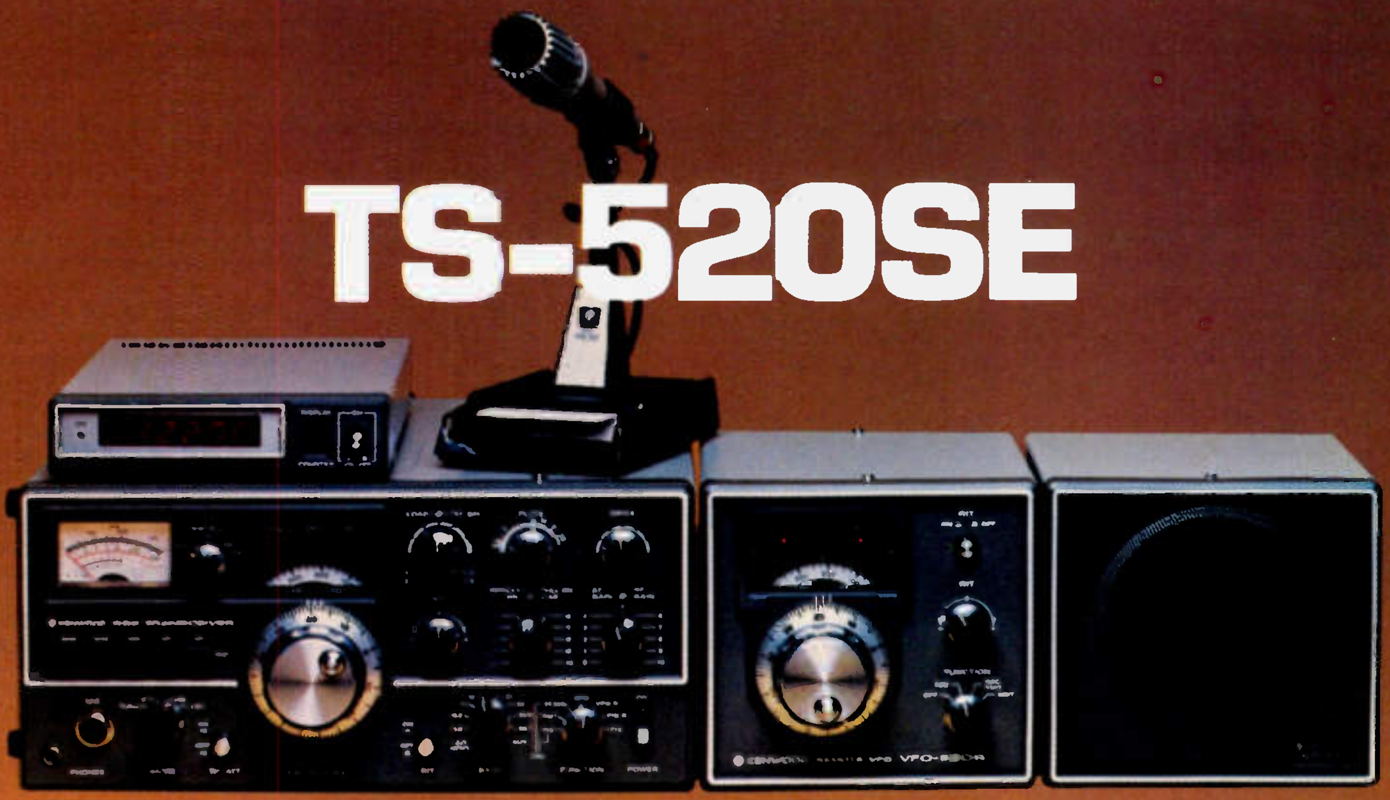
The day was warm and very damp. A dense cloud sat over the entire mountain, dripping now and then and threatening to dump rain on us at any moment. We had HTs along for both 146 and 220 MHz and we kept track of downpours which were just a few miles away as we huffed and puffed our way up . . . the sweat pouring off. I'd lost three pounds the Sunday before, and only by virtue of really diligent eating had I managed to regain my fighting weight in time for this ordeal.

The top part of the mountain is all rock. Fires a hundred years or so ago had cleared the trees and shrubbery and allowed the dirt to be washed away, making the mountain one of the most accessible with ecological characteristics that normally are found only above the tree line of other mountains. Naturalists apparently travel hundreds of miles to scramble up these rocks and dote on amazing ecology. I just sweated on it as I climbed. The top part was cooler as we got out of the trees, and there was no protection from the wind. It felt wonderful . . . even in the dense fog.

Just to convince you that when I say rocks, I mean rocks . . . here is what they call a "trail." It's foggy, and you can't see more than about 50 feet.

Perhaps you can make out Tim with the disk on his back, disappearing into the fog. Just to the left is Jim, bringing the tripod on his back. I brought a camera plus my most prized possession . . . me.

TS-520SE



"Cents-ability" in a quality HF Rig!

The TS-520SE is an economical new version of the TS-520S...the world's most popular 160-10 meter Amateur transceiver. Now anyone can easily afford a high quality HF transceiver, providing 200 watts PEP input on SSB and 160 watts DC on CW!

The TS-520SE is a high-quality 160-10 meter SSB/CW transceiver intended for ham-shack use. The following changes were made to produce the new "SE" model:

- Replaced the heater switch with a CW WIDE/NARROW bandwidth switch, for use with the optional CW-520 500-Hz CW filter. A big improvement for the CW operator!
- Removed DC converter terminals. Now it operates strictly on 120 VAC and is not intended for mobile use.
- Removed transverter terminals. Now it is strictly a 160-10 meter SSB/CW transceiver.

All other proven features and high quality of the TS-520S have been retained in the TS-520SE, including:

- Effective noise blanker.
- Three-position (OFF, FAST, SLOW) amplified-type AGC circuit.
- RIT control.
- Eight-pole crystal filter.
- Built-in 25 kHz calibrator.
- Front-panel carrier level control.
- Semi-break-in CW with sidetone.
- VOX/PTT/MANUAL operation.
- TUNE position for low-power tune up.
- Built-in speaker.
- Built-in cooling fan.
- 20-dB RF attenuator.
- Provisions for four fixed channels.
- Speech processor consisting of a very effective audio compression amplifier.

The TS-520SE functions with many popular accessories, including:

- DG-5 digital frequency display/counter.
- VFO-520S remote VFO.
- SP-520 external speaker.
- CW-520 500-Hz CW filter.
- AT-200 antenna tuner/SWR and RF power meter/antenna switch.
- TL-922A linear amplifier.
- MC-50 dynamic microphone.
- SM-220 Station Monitor with BS-5 pan display module.

SPECIFICATIONS FOR THE TS-520SE

GENERAL: Frequency Range:	1.8- 2.0 MHz (160 m) 3.5- 4.0 MHz (80/75 m) 7.0- 7.3 MHz (40 m) 14.0-14.35 MHz (20 m) 21.0-21.45 MHz (15 m) 28.0-28.5 MHz } (10 m) 28.5-29.1 MHz } (10 m) 29.1-29.7 MHz } (10 m) 15.0 MHz, receive only (WWV)
Modes:	SSB (USB, LSB), CW
Antenna Impedance:	50-75 ohms
Frequency Stability:	Within ± kHz during one hour after one minute of warm-up and within 100 Hz during any 30-minute period thereafter.
Power Requirements:	120 VAC, 50/60 Hz; 280 W (transmit)
Dimensions:	13-1/8 inches wide, 6 inches high 13-3/16 inches deep
Weight:	35.2 pounds
TRANSMITTER: Input Power:	200 W PEP (SSB), 160 W DC (CW)
Carrier Suppression:	Better than 40 dB
Unwanted Sideband Suppression:	Better than 50 dB
Spurious Radiation:	Better than -40 dB
Microphone Impedance:	50 k ohms
AF Response:	400-2,600 Hz
RECEIVER: Sensitivity:	0.25 μV for 10 dB (S + N)/N
Selectivity:	SSB: 2.4 kHz/-6 dB; 4.4 kHz/-60 dB CW: 0.5 kHz/-6 dB; 1.5 kHz/-60 dB (with optional CW filter)
Image Ratio:	Better than 50 dB
IF Rejection:	Better than 50 dB
Audio Output:	1.0 W (8-ohm load with less than 10% distortion)
AF Output Impedance:	4-16 ohms

Ask your Authorized Kenwood Dealer about the amazing TS-520SE...and its surprisingly affordable price!

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Eventually we made it to the top, and here are Tim and Jim setting up the 10-GHz system. The two HTs at the bottom left provided us with communications with the New York contingent . . . Chuck, Eric, and Steve, in the Taconic Range of the Berkshire Hills, some 30 miles east of Albany.

Tim is looking around for a flat spot to set up the tripod and dish, a place with a view to the west and New York, hopefully. This brought up the question of which way was west. There is a compass rose painted on the top of the mountain, but it was almost 100 feet from where we were setting up, so we had to sort-of relay the correct bearing through the fog to aim the dish from Jim, standing at the rose, to Tim, halfway between, and me at the site. A passing climber lent us a compass just to check out the dish heading, and we'd come very close.

We got set up a little bit before Chuck and the others reached their hill in New York, so we sat and cooled off a bit, resting. When Chuck was finally set up, we put on the headset and crossed our fingers. Would the whole trip be for nothing? There was no way in the world they would get me to go through that ordeal a third time; whether we made it or not, this was the one and only try . . . so it had better work. Our topographical maps indicated that it was very chancy. Maps of the horizon from the top of Monadnock didn't give us much hope. The signals on 220 MHz, usually a very good indicator of a line-of-sight path, were marginal. I had to hold the HT just in the right spot to make contact. Two meters was a bit better, working on a direct simplex channel.

The moment arrived . . . Chuck finally had his unit, with a four-foot dish, set up and ready to go. We both turned on the switches at the same time and the signal-strength needle swung right off scale . . . whoopee, we'd made it! Now what do you talk about on a solid and very private path like that? After a round of "Come here, Watson, I need you" and some swinging of the dishes to peak the signals, we called it a day and packed up for the trip back home.

The only incident of note was about halfway back down when Jim slid on a rock and went head over heels, landing on his pack on another rock. The only damage was a ruined canteen, which was better than a busted back. My knees hurt only a day or two after the ordeal this time, so I suppose that I might be able to make the climb with no strain if I kept at it for a few more weeks. Don't worry, I won't. And I wasn't nearly as tired this time as the week before . . . hmm. It's too bad exercise takes so much time and is so little fun.

If any of you happen to see Chuck, you might congratulate him on having the world record for working one state from the most other states. I remain the only human being who has worked seven different states from New Hampshire, and I'll bet I will hold that record for a while.

DONATE

The question of ARRL finances seems to get murkier all the time. We see letters crying for donations and we read about the horrible losses they are sustaining with their staff, with few old-timers left and empty offices everywhere . . . offices which were just recently built at enormous expense.

The donations for their WARC efforts are particularly difficult to justify. Noel Eaton testified before the manufacturers that they have over $600,000 available, if they wish to spend it. In addition to that rather tidy sum, I see by the latest Annual Report that they still have kept up their $100,000 fund for the defense of amateur frequencies . . . and WARC would seem to qualify in this department.

Now, it is entirely possible that the League is intending to spend more than $750,000 at Geneva this year. If their perfor-

Continued on page 20

WORLD'S BEST JOB

How would you like to spend your time setting up and operating all of the latest ham gear . . . and getting paid for it? We at *73 Magazine* are searching for a good technician to come to Peterborough, New Hampshire, and work in the *73* ham shack. We want someone capable of installing, repairing, and evaluating equipment, and generally keeping things in good working order. Some writing ability is also desirable, since we'll want equipment reviews for *73*.

All in all, this is probably the world's best job for an active and curious ham. When you're not erecting a new tower or troubleshooting a balky linear, you'll find that Peterborough is one of the best DX and contest locations anywhere. If we can hear 'em, we can work 'em . . . and we hear 'em all. New Hampshire also offers other advantages, such as no state sales or income taxes.

If you can handle the job and don't smoke, drop us a line—tell us about yourself. Write to: *73 Magazine*, Opportunity of a Lifetime Dept., Peterborough NH 03458. Attention: Jeff DeTray WB8BTH.

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Specifications : FT-101Z

GENERAL

Frequency coverage: Amateur bands from 1.8—29.9 MHz + WWV/JJY (receive)
Emission types: LSB, USB, CW
Power requirements: AC 100/110/117/200/220/234 volts, 50/60 Hz, DC 13.5 volts, negative ground (with optional DC—DC converter installed)
Power consumption: AC 85 VA receive (73 VA HEATER OFF) 330 VA transmit, DC 5.5 amps receive (1.1 amps HEATER OFF) 21 amps transmit
Case size: 345(W) x 157(H) x 326(D) mm
Weight: Approx. 15 kg.

RECEIVER

Sensitivity: 0.25 μV for S/N 10 dB
Selectivity: SSB 2.4 kHz at −6 dB, 4.0 kHz at −60 dB. CW (with optional CW filter: 600 Hz at −6 dB, 1.2 kHz at −60 dB)
Image rejection: Better than 60 dB (160—15 m), better than 50 dB (40 m)
IF Bandwidth: Continuously variable from 2.4 kHz to 300 Hz, using two 8-pole IF filters
Audio output: 3 watts at 10% THD into 4 ohms.

TRANSMITTER

Power input: 180 watts DC
Carrier suppression: Better than 40 dB
Unwanted sideband suppression: Better than 40 dB (14 MHz, 1 kHz modulation)
Other spurious radiation: Better than 40 dB down
Third order distortion products: Better than 31 dB down
Transmitter frequency response: 300 — 2700 Hz (−6 dB)
Antenna output impedance: 50—75 ohms, unbalanced.
Microphone input impedance: 500—600 ohms (low impedance)
Note: FT-101Z (analog) cannot be used with the FV-901DM, as there is no frequency display.

Price And Specifications Subject To Change Without Notice Or Obligation

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Two 8-pole crystal filters in cascade provides a 1.4:1 shape factor at -100dB! The ultimate in selectivity.

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All Band Coverage using PLL and Synthesizer for Band Selection
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The ASTRO 102BX with it's companion PSU-6 Power Supply, 1500Z Linear Amplifier and ST-2A Antenna Tuner provides a matched and highly efficient 1500 watt PEP or 1000 watt CW complete station to be complemented by a great Swan antenna.

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Looking West

Bill Pasternak WA6ITF
24854-C Newhall Ave.
Newhall CA 91321

I have yet to hear from the FCC in answer to the questionnaire I mailed to them in May (reprinted here in the August column). I didn't expect a quick response, but two and a half months ago isn't exactly yesterday. Wheels in Washington move rather slowly as we all know, and in the meantime, the malicious interference problem out here grows worse. I suspect that it may be the same elsewhere; my mail seems to indicate this from time to time. Anyhow, when and if the FCC ever gets around to answering, I will quickly share the information with you.

The ARRL has formed the ECRBA! What's that, you say? The ARRL did *what*? I suspect that some clarification is necessary. The "ARRL" I am speaking about is *not* the Newington, Connecticut, variety, but an organization known as the *Atlantic Region Repeater Legion*. (Isn't that a great play on a set of logo letters!) This "ARRL" has now sprouted the east coast's first organized remote-base owners' organization, entitled aptly, the East Coast Remote Base Association (ECRBA). Founded on May 26, 1979, the ECRBA currently has about a half-dozen member systems, with more joining each month.

Unlike its west coast counterpart, SCRRBA, the ECRBA does not act as a frequency coordination council and does not assign systems to specific channels. In the areas in which their member systems operate, such activities are the domain of established frequency coordination councils such as TSARC. Its main purpose is to act as an affiliation of, and thereby a voice for, individual amateurs and amateur clubs along the eastern seaboard who either now operate or are interested in the construction of amateur remote-base stations.

It was to that end that the ECRBA established the following goals for itself:

1) The promotion and support of current remote-base technology and activity.

2) The designation of simplex frequencies on VHF and UHF amateur bands upon which remote-base systems can meet.

3) The coordination and filing of existing remote-base systems in geographically diverse areas along the eastern seaboard so that communications over long distances can be achieved through the creation of remote-base networks.

4) Such other purposes as may later be defined by the ECRBA membership.

The ECRBA appears to be the first such organization to be formed outside the far western and southwestern United States whose avowed purpose is fostering interest and expansion of remote-base operation. If you want more information, send an SASE to the East Coast Remote Base Association, c/o Atlantic Region Repeater Legion, 333 West 57 St., #306, New York NY 10019. For your efforts, you will receive an information sheet and an application for membership.

THE INTERTIE DEPARTMENT, OR "IT'S TIME FOR A REAL GAME PLAN"

How many repeaters are there? 1,000? 3,000, possibly? Experts peg the number of repeaters operational in the continental USA at close to 5,000, with over 3,000 of them on two meters alone! Let's face it. That's a heck of a lot of rf hardware sitting atop tall buildings, broadcast towers, and mountaintops. What do we do with most of it? By and large we use it simply to gab a bit further than we could without such relay devices. In doing so, we miss one of the greatest communication challenges ever placed at our fingertips. The challenge? The creation of a coast-to-coast, border-to-border VHF intertie. An intertie that would permit amateurs from all over the nation to converse and communicate with but handheld transceivers.

With all this hardware operational already, why has such an intertie not yet been developed? Was not one of our greatest objectives in overturning the results of Docket 18803 to permit restoration of intercommunity relay communication and again permit repeaters to interlink for greater range? What have we done with this freedom we gained a few short years ago? Little! True, there have been a number of regional and interregional experimental interlinks, most, if not all, privately owned and operated with highly restricted access and usership. The few local open interties are a minority within a minority. The potential exists, the equipment is there already, and with the addition of a bit more human communication, a national system could come into being within a year or two.

The key to the establishment of an open national intertie is to set our goal and then utilize what we already have. At the outset, a national organization to oversee the implementation of such an intertie is not necessary, although it could make the job a whole lot easier. Once off the ground, such an organization, filled with many layers of bureaucracy that are the byword of such organizations, will develop. Who knows, if we do a good enough job, the American Radio Relay League may even take all the credit for it. Right now, though, we must begin in as simple a way as we can, building outward from the local level.

You might start by locating another repeater in your area some distance away and arrange some form of permanent interlink between the two. Then add a third system in the same or another direction. Exactly where you wind up, geographically speaking, is not that important. Communicating with one another outside the normal coverage area of your favorite repeater is. If enough systems jump on this bandwagon, and if normal growth patterns prevail here as they have in repeater operation development itself, then a national open intertie can and will develop of its own accord.

What's nice about doing it in this way is that we need not add any new systems to the already overcrowded two-meter spectrum. The radio links can be on 420 MHz or, in areas where 420 to 450 is already totally utilized, the 220-MHz band would be an ideal choice. Even in areas where UHF is overflowing with activity, in most cases the 220 MHz band lies dormant. Can you think of a better use for 220 MHz?

There is another important prerequisite. For this idea to work, each area has to know what the next area is doing. To that end, "Looking West" could provide the space necessary to disseminate information. I can act as an informational clearinghouse and thereby give you monthly updates of who is accomplishing what, where. How about it? Does the idea of such a national intertie intrigue you? Do you find interesting the idea of driving in downtown Chicago while conversing on VHF with two friends many thousands of miles away?

At the very close of Dave Bell's new film, "The World Of Amateur Radio," the film's narrator, Roy Neal K6DUE, states: "We look forward to the day that members of our fraternity will be going into space, to the moon and beyond." Maybe for the moment this is but a dream of the future, but when Art Gentry W6MEP placed K6MYK (now WR6ABN) on the air back in the 1950s, I'll bet that he had no idea where it would all lead. Art had made one of his dreams come true, and out of early experiments such as K6MYK grew the VHF and UHF relay activity we have today. In reality, we have far more repeaters in more places than we know what to do with. Many lie dormant day after day awaiting some form of utilization. We have at our fingertips the ability to make the future part of the present. Any dreamers out there? Any takers?

THE VIDEOTAPE DEPARTMENT

A few months ago, I purchased a truly great toy of the 70s. It's called a Sony Betamax videocassette recorder-player and it has brought me many hours of joy. It sits comfortably in a special cabinet in our living room just below our Sony 19" Trinitron color TV, and it gets quite a bit of use, especially with my busy schedule. Originally, it was the "time-shift" feature that caused me to purchase it: the ability to be elsewhere and yet not miss something I wanted to see. Of late, though, I have come to see other uses for my toy, uses that transform it from the toy category into a useful tool—one that can be applied to amateur radio. First, however, let's take a look at what is available in home video recording equipment today.

The Sony Corporation really started what would lead to the home video revolution back in 1968 when it introduced in the US marketplace a video machine that used ¾" tape packaged in a convenient-to-use, fully-enclosed tape cassette. The unit was called the U-Matic, and it was not long before it became a standard in the broadcast industry. While it was not as good as 2" high-band quad, it gave excellent results and soon began to nudge film from the limelight in news gathering and dissemination. By the early 70s, with the advent of the portable videocassette recorder-player along with light-weight (by comparison) cameras, what is now called the "electronic news gathering" or "electronic journalism" era had begun. Today, the majority of news we see on TV is on videotape rather than film.

For consumers like us, things lagged behind. Only the truly affluent could afford a U-Matic type machine. Tape cassettes were rather expensive and offered but one-hour record-play time. However, Sony foresaw the coming video revolution, and around 1975 it introduced its first ½" format home videocassette system to which it

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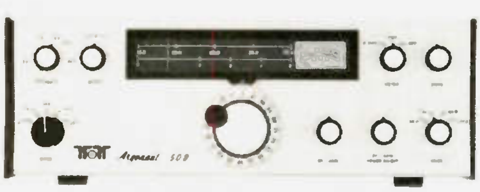

Model 509 Argonaut $389

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2. Model 206A Crystal Calibrator ($29), or:
3. Model 208 CW Filter ($29).

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DX

Chuck Stuart N5KC
5115 Menefee Drive
Dallas TX 75227

These are the heydays of DXing. If it seems like we keep repeating ourselves on this subject, bear in mind that we only want to make you aware that this is not the normal state of things. We are now at the peak of cycle 21, and, although there are many good days ahead for the deserving DXer, we are now on the downhill slide. Work everything in sight; those QSL cards will help you make it through the doldrums ahead. Hopefully some of the following information will help you in your quest.

HEARD ON THE BAND

VR3AH left Christmas Island July 22 and returned to the states. VR3AR plans to remain active until February or March and there is a new operator there waiting only for the necessary license to begin operating. There is a possibility that Greg WB4PRU will handle the QSLs for this new station. During the period May 28, 1979, to July 8, 1979, while Doug VR3AH was in the states for a little R & R, Slim paid a visit to his station and managed a number of QSOs. If you logged VR3AH during this period, know that you have met the Slim one himself.

Jerry WA1ZXF sent in the following in response to our request for more CW activity reports. It covers a typical night on 20 meters and while nothing super rare is covered, it shows there is plenty of "bread and butter" DX there for the taking.

FC9UC—On regularly from 1700 to 1900 UTC between 1410 kHz and 14160 kHz. Jean is always happy to answer a CW call.

UK2GAT—A club station operated by the various members. On nightly from 2300 UTC between 14050 kHz and 14070 kHz with a strong signal.

YU2CAL—Mladen is a nightly regular around 14030 kHz.

SP8RJ—Another almost nightly regular. Jurek puts a strong signal into the states around 14035 kHz.

LZ1GC—Stan is on nightly from 0400 UTC around 14070 kHz.

Jerry says there are many more such stations available nightly for the deserving DXer.

EA6DD, formerly EA3EG, shown with his nice station in Palma in the Balearic Islands. Eighty years young and still going strong, he prefers CW and can usually be found on the low end of fifteen or twenty when the band is open.

The second annual International Island DX Contest sponsored by the Whidbey Island DX Association begins at 0000Z on January 12, 1980, and runs through 2400Z January 13, 1980. This is a good chance to pick up some of the rarer islands for your DXCC. Contest entry forms are available from Gary Pierson WA7GVM, Box C, LaConner WA 98257.

Roy W5VJT reports receiving QSL cards from UC2AF, UC2AFA, and UC2AFB. UC2AF is father to UC2AFA and UC2AFB.

CK2CRS was the official station of the Canoe/Kayak World Championship. QSL to Serge Freve VE2FIT, 1505 des Martinets, Chicoutimi, Quebec G7H 5X9, Canada.

Jean Ghys, formerly ON4KU, reports that Slim seems to have taken a liking to his old call because he has been receiving a number of QSLs for stateside contacts he never made. Jean says he is no longer active and that any contacts with anyone signing ON4KU are bogus.

We received numerous responses to our comments concerning the trend towards DXpeditions spreading the calling stations out over a 40 to 50 kHz portion of the band, thereby making it useless for any normal use. Those defending such operations pointed to the fact that this method resulted in the highest QSO-per-hour rate. That argument misses the point entirely. The QSO-per-hour rate is not the problem. The problem is that while such an operation is in process, all normal day-to-day communications come to an abrupt halt. This hardly endears us to our fellow hams. While a few wrote to say that all split-frequency operations should be banned (transceiver owners, no doubt), the majority favored spreading the calling stations out over no more than 15 to 20 kHz. If this proves inadequate, the DX station can go by call areas or even by prefixes within call areas. There are many ways to ensure a successful DXpedition, but widespread calling is not one of them.

Johanna OY5J has been showing on 14240 kHz Mondays after 2330Z. This is the group led by WA2JUQ and a number of rare-type DX stations can usually be found checking in looking for the deserving ones.

5H3KS has been drawing massive CW pileups almost daily on 21022 kHz from 2330Z.

Seems like 7J1 is still high on most-needed lists in the W2 area. The JARL is reportedly aiming for another all-out effort after the monsoon season.

OE6EEG is said to be planning another 8Z4 effort for right about now.

Scotty K5CO and Dave N2KK plan to remove the entire Indian Ocean area from your needed list and are right on schedule. They plan to start on FR7 Reunion Island around the first of December and then sweep through the area, taking no captives. Dave is gearing up for some extensive 40 through 160 action, while Scotty handles the 10/15/20 demand.

Seven or eight S79 stations did manage to get their licenses renewed on June 1st, but the fee was a bit stiff—$82.00 each.

FH8OM and FH8YL ask that cards be sent via their managers only. Seems that someone in the local post office is an avid green-stamp and IRC collector.

Those new J7 prefixes replace the old VP2D prefixes. Al VP2DD now signs J7DD.

VQ9TC now signs KG6JIQ.

There is a new DX-DX SSB net on 7082 kHz at 0500Z. N5RQ takes stateside check-ins at 0630Z on 7165 kHz.

CQ Magazine has raised the price on all DX Certificate applications to $5.00.

Any ZA activity you might hear is probably Slim, but, of course, work them anyway. It will keep you in practice for that day when the real thing appears. The present situation is as follows: The license application by SM4CMN and SM3VE is being ignored, DL7FT (who was

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LETTERS

BEFUDDLED

I must admit that I like your magazine; technically, it strikes a middle ground between the continuous brilliance of *Ham Radio* and the occasional gems in *QST*. Nevertheless, the political ramblings leave me a bit befuddled.

For instance, I notice regular references to the "debacle" of incentive licensing. So what's the hassle? If you want the greater privileges, you get off your ass, stop complaining, and study for the next higher license.

If any body should *not* be complaining, it's you, Wayne. The way I figure it, you do a pretty penny's worth of business in code tapes and study guides for aspiring applicants. Seems to me if incentive was dumped, you'd have a major "walletectomy" there.

But, ignoring that, I *still* don't see what's so bad. Incentive licensing is the same system that made America great: Those with higher rank get higher privileges. I'm convinced any one of us could get the Extra if he was motivated to study enough. At least, unlike business or military worlds, hard work guarantees results.

Seems to me incentive licensing is like the American socioeconomic system in a microcosm. I don't see how you could like one and not the other.

By the way, I don't hold the Extra class, so this isn't the voice of the "haves" telling the "have-nots" to be happy and shut up. It's just in recognition of a damn good system that apparently still needs defense.

I also doubt that this will ever get into your rag since I've tacitly called all of you anti-incentive types un-American.

At any rate, your mag is basically good, if all you read is the technical stuff. I *may* even renew.

Bob Lombardi WB4EHS
Ft. Lauderdale FL

Bob, you need to talk with someone who has been around amateur radio for a few years and then you would understand the irony of the term "incentive licensing." Sure, the system is working pretty well now, but do you honestly think that what you see now is all we ever had?

In 1963, the League proposed what they called "incentive licensing." The idea was to go back thirty years to the licensing system of the 1930s. They proposed taking most of the phone bands away from the General class, the way it was pre-WWII. I put up such a fuss that eventually the FCC only took half the phone bands away. The whole idea was to get amateurs to upgrade. I said they would do better if they gave rewards for upgrading; the ARRL said it would be better to take frequencies away and then give them back if you upgraded. The basic difference was one of punishment vs. rewards.

This brought on ten years of zero growth, little upgrading (I have published the facts and figures showing the extent of this disaster), and the death of all of the major manufacturers. Then the FCC put through my suggestion of giving the callsign of your choice to Extra class licensees...and clubs responded to my plan for getting them to offer Novice study courses, for which I published instruction manuals and provided code tapes. Amateur radio finally started to grow again and at last we had an increase in Extra class licensees.

The League saw what was happening and put out their own code course and did their best to cover over the incentive licensing fiasco. By the way, the FCC admitted that this was a complete debacle . . . that's why they changed the system to the present one . . . which is working reasonably well.—Wayne.

STRIKING DISTANCE

It was over a year ago that you very kindly sent me the *73* code system tapes, i.e., 5, 6, 13, and 20+ wpm, which were available at that time.

Now that I'm copying the 20+ at about 95% and working out at that speed, I thought you might like a breakdown of progress since starting and until now.

First, let me say that I think your system is excellent and without it would never have passed my CW test nor obtained my ZS (unrestricted) license here in South Africa.

Being a Master Mariner and a Nautical Examiner of Masters and Navigating Officers and also an ex-lecturer/training officer of cadets preparing for the Mercantile Marine, I feel I'm qualified to give an opinion on your training method, which I feel is without equal.

Second, although I'm 54 years of age, I have always, since going to sea at 14, known the Morse code, so I didn't have to learn the characters from start. But, in the Mercantile Marine, candidates for the various Certificates of Competency are required to "satisfy the examiner of their ability to send and receive signals in Morse code by *flash lamp* up to 6 wpm."

I think you will agree that there is a world of difference between copying a flashing light at 6 wpm and sound. So I virtually had to start from scratch insofar as sound was concerned.

I started on the 5 wpm tape in May, 1978. In July (just over 2 months later), I passed the CW test (12 wpm) and received my ZS license. Since then, I have had nearly 500 QSOs on CW and I can thank you for giving me that pleasure.

From the 13 wpm tape, I moved to the 20+ wpm tape in August, and by December, some 5 months later, I was copying about 80%. As I have said already, I'm copying about 95% now.

Now I'm practicing on local weather reports in order to learn to copy at 25-30 wpm. It has been your excellent system which has placed me within striking distance of my goal.

Norman Caseley ZS5NC
Pinetown, South Africa

CUSHCRAFT

It seems that we are always hearing stories of problems with service, quality, and delivery from the many manufacturers and dealers of amateur radio equipment and supplies. I feel equal recognition should go to the manufacturer or distributor who gives service above and beyond the call of duty.

A couple of weeks ago, I purchased from a local dealer a Cushcraft ATB-34 triband beam. At the same time, I contracted a man with a crane to help me put it on my tower. Upon assembling the antenna 3 days before it was to be installed, I unfortunately encountered a defective part. I thought my deposit to the installer was lost because I contracted for a particular time and day and I knew for sure that the part would never make it from the wilds of New Hampshire to New Jersey in the 2 days I had left. After a phone call to Cushcraft and a conversation with a gentleman named Hugh, I found out my worries were unfounded. At their expense, they navigated through the woods and mountains of New Hampshire to the nearest post office immediately after my phone call. They had the part shipped Express Mail with a promise from the US government that the part would be at my door within 24 hours. Sure enough (for a change), the government was right. I had the part the next morning and the antenna went up the following day as scheduled.

This personal service was, in my opinion, far beyond what can be generally expected from most of the companies with whom I have dealt in the past. Granted, if something you purchase is under warranty, it will be repaired or a defective part replaced, but usually with a long delay even under emergency conditions as was my case.

This experience with Cushcraft service shows the concern the company has for the consumer *after* the sale is made. Unfortunately, this cannot be said for many other companies I have dealt with.

Ed Feins WA2ZDN
Linden NJ

WOODPECKING

I heard something on twenty last night that bothered the heck out of me. Please recall the correspondence concerning the "Russian woodpecker" and its cure from about two months ago. If you have not heard already, this cure (CW tones in pace with the radar pulses) no longer works.

Apparently the defense taken by amateurs was too effective for the Russians, for they have modified their system. The tones are no longer the broadband clicks of yore, but seem now to be a type of broadband FM. It sounds like the only way to cope with this would be to sync slow-scan signals on top of the radar, or use recordings out of sync to throw off their video display. Either cure is worse than the disease, with slow-scan and radar recordings chasing the intruder up and down the band!

Wayne, please tell your readers that *any time* they hear the "woodpecker," they should immediately call the nearest FCC monitoring station. It's been said before, but if they get bothered with enough calls, we may get something done.

I haven't listened to the bands in the last week or so, so

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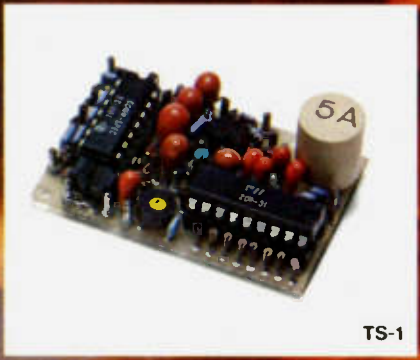
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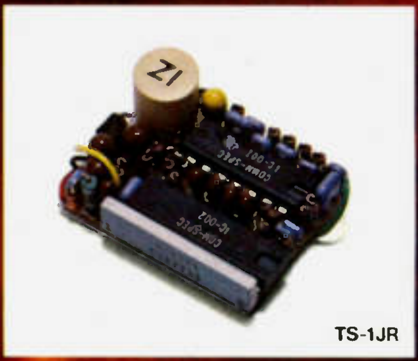
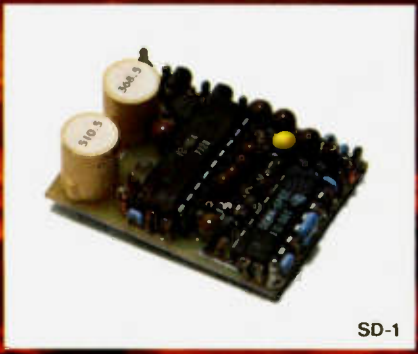

TS-1JR

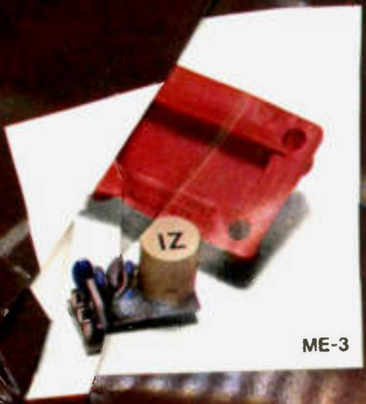

PE-2

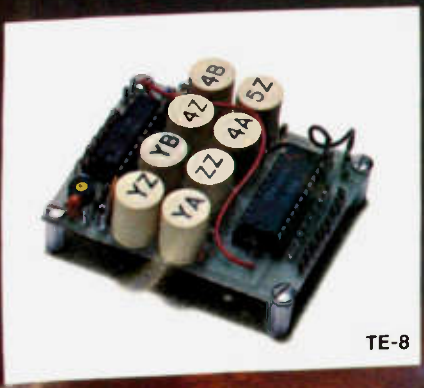

SD-1

THE DAWNING

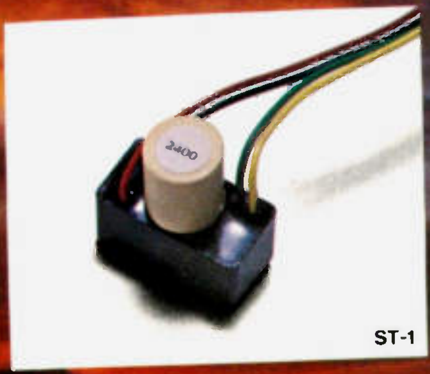
The age of tone control has come to Amateur Radio. What better way to utilize our ever diminishing resource of frequency spectrum? Sub-audible tone control allows several repeaters to share the same channel with minimal geographic separation. It allows protection from intermod and interference for repeaters, remote base stations, and autopatches. It even allows silent monitoring of our crowded simplex channels.

We make the most reliable and complete line of tone products available. All are totally immune to RF, use plug-in, field replaceable, frequency determining elements for low cost and the most accurate and stable frequency control possible. Our impeccable 1 day delivery is unmatched in the industry and you are protected by a full 1 year warranty when our products are returned to the factory for repair. Isn't it time for you to get into the New Age of tone control?


IZ
ME-3


4B
5Z
4Z
4A
YB
ZZ
YZ
YA
TE-8


TE-12


2400
ST-1

✓ Reader Service—see page 211

RTTY Loop

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

As much as I hate to do this, I am starting this month's column with a word of caution. In my February, 1979, "RTTY Loop," I relayed a blurb sent to me by a firm called "Teleprinter Art, Ltd." in Urbana, Illinois. The company presented itself as a source for all kinds of RTTY artwork, at reasonable prices. Its catalog is decorated with samples and stocked with many delightful bargains. If only it were true! Over the past few months, I have received letters from several individuals who have ordered material from Teleprinter Art, Ltd., and never received anything but their cashed checks. Communication with the management of the company has been fruitless, and as of this writing almost one month has elapsed since I sent a letter of inquiry to them. No reply has yet been received. While I acknowledge that to date there is no conclusive evidence of wrongdoing by Teleprinter Art, Ltd., I would urge anyone anticipating doing business with that firm to approach the transaction with reasonable caution. If anyone has further experiences regarding this company, either positive or negative, I would be interested to hear from you. I shall try to forward any such information to you all as received, and to keep you posted on the situation in general.

Moving from the questionably secret to the openly clandestine, many of you have been writing in asking about press and weather frequencies. Fig. 1 is an attempt to answer some of those questions. Now, before you get all bent out of shape and totally snowed by the chart, let me do some explaining. As suggested a few months ago, most of the commercial RTTY stations do not transmit "ham standard" 60-wpm, 850-Hz or 170-Hz shift, low-space RTTY. They *do* send anything they darn well want to, including strange shifts, shift direction, or speed. Thus the table.

Whether or not you can copy the transmitted shift is more a function of the converter than anything else. By straddle-tuning, almost any shift should be copyable. The ST-6, for example, can copy 425-Hz shift with the autostart turned off. You will just have to try yours and find out.

The speed may present more of a problem if you are using a machine which is not geared for the frequently-found 67 wpm speed. Most Model 15s and 19s will do fairly well if the range selector is set to the high end. Again, experimentation may be the best bet.

As more of these frequencies are received, I will try to compile them and include a list, periodically, in the column. Let me know what you hear, and I'll pass it along.

A letter received from Richard Black W2DBU asks about the use of the ASR-33 on a Baudot/Murray circuit following code conversion. Richard writes, ". . . you mentioned that the ASR-33 is just too slow to receive 60-wpm RTTY. I do not understand this as I believe that the old Baudot printers could copy this speed. Is not 60 wpm about 45 baud?"

The answer to the question is, "Yes and no!" While 60 wpm is 45.45 baud and the ASR-33 copies at 110 baud (or 100 wpm), that is not the problem. The statement was made with respect to a code conversion program which used a software UART for receiving the RTTY. Thus, decoding could not begin until the last data pulse had been received. Following decoding, the data must be sent to the printer before the next start pulse is expected. In a worst-case situation, i.e., receiving at "machine speed," this leaves the length of the stop pulse, about 31 ms, to send the character to the printer. In order to send one ASCII character in 31 ms, you need to send at a rate of at least 300 baud. That is where the problem lies. If you are content to pause 100 ms or so after each character is sent, the ASR-33 will be able to follow. But you can't do that practically, so you really can't use a 110-baud printer.

Remember, however, that the constraint on the system is that the processor must be available for the full time that a character is being received. What if, you might suppose, you presented the entire character at one time; could you then use a 110-baud output? Of course, you can! The way to implement this is to use a hardware UART such as a 1013 to receive the RTTY, allow the processor a few microseconds or so to do a code conversion, and dump the ASCII into another UART or ACIA. This would work just fine, but it was not the scheme of the program. Hope this clears things up for you, Richard.

NEAT TRICKS DEPARTMENT

From time to time, I will try to pass along some neat tricks which can save you time and money while playing with your RTTY. I am sure that most of you are aware that replacement ribbons for your Teletype™ machines are available at any stationery and many variety stores. No, they may not be labeled as such, but any ribbon which fits an Underwood standard typewriter will fit your Teletype machine just fine. There comes a time, however, when you need a dark image and no new ribbon is available. What then? Well, it turns out that most light ribbons are not out of ink, they are just dried out. A little solvent will frequently bring new life to an old ribbon, with almost no effort. What I do is spray some contact cleaner (I use one called LPS-1) along the length of the ribbon while the machine is spacing. Don't spray too much or you will have an inky mess of a machine. You want to just dampen the ribbon. Wait overnight for the excess to evaporate, and you have a rejuvenated ribbon. Like I said, *neat trick*!

FREQUENCY (kHz)	SHIFT	NORM/REV	SPEED	COMMENTS
14484	425	REV	67	Reuter News
14573	?	?	67	French News
14600	425	REV	67	New York News
14700	425	REV	67	Polish News
14845	425	NORM	67	UPI News
14900	425	NORM	67	Spanish News
14974	425	REV	67	English News

Fig. 1. Some RTTY press frequencies.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 6

mance at the last WARC in 1959 is any criterion, where League officials were flown over at League expense, even with their salaries being paid by the League, and for no more important function than to attend some lavish parties, then they might indeed run through the three-quarters of a million.

Will the League again have a lavish suite of rooms in one of the most expensive hotels in Geneva, all paid for by some 80,000 generous League members? The concept of Yankee thrift seems not to extend down to Connecticut. If you are sucker enough to eagerly send in your hard-earned money for these turkeys to enjoy themselves at your expense, so be it.

While on the one hand I keep hearing the moans of poverty from Newington, on the other I look at their recent balance sheet and find that their net worth increased last year by almost 10%. Most firms would count that as a profit, but the League, being "non-profit," shuffles the bookkeeping around and puts the funds into stocks and bonds (they have over $1.5 million sitting in securities).

The election of directors is coming up this fall and half of the directors are up for reelection. If you blindly return these chaps to office, then *you* must share in the responsibility for what is happening. With the exception of Don Miller, you have nothing to lose by turning the lot of them out. Darned few are active hams anyway . . . they are politicians and they're using your money for gratifying their egos. With some new directors, you might have a chance of getting the entrenched clique kicked out of HQ and getting someone with business experience into the job.

I think every amateur really wants to be able to be proud of the ARRL and see it regain its leadership position. But we can't respect it when we see the double-talk and cover-ups . . . and when we see everyone we've known at HQ for years getting the hell out . . . except for Baldwin and Dannals.

It is the responsibility of the directors to see that they have an HQ staff which will run the organization in the black. It is the responsibility of the members to see that they vote in directors who will run the organization and not be buffaloed by a couple of people at HQ. In the meanwhile, sending more money to the League will

Continued on page 170

This NEW MFJ Versa Tuner II . . .

has SWR and dual range wattmeter, antenna switch, efficient airwound inductor, built in balun. Up to 300 watts RF output. Matches everything from 1.8 thru 30 MHz: dipoles, inverted vees, random wires, verticals, mobile whips, beams, balanced lines, coax lines.

MFJ LOWER PRICES!

NEW, IMPROVED MFJ-941B HAS . . .

- More inductance for wider matching range
- More flexible antenna switch
- More sensitive meter for SWR measurements down to 5 watts output

NEW LOWER PRICE

$79.95

Transmitter matching capacitor. 208 pf. 1000 volt spacing.

Sets power range, 300 and 30 watts. Pull for SWR.

Meter reads SWR and RF watts in 2 ranges.

Efficient airwound inductor gives more watts out and less losses.

Antenna matching capacitor. 208 pf. 1000 volt spacing.

Only MFJ gives you this MFJ-941B Versa Tuner II with all these features at this price:

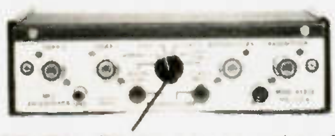
A SWR and dual range wattmeter (300 and 30 watts full scale) lets you measure RF power output for simplified tuning.

An antenna switch lets you select 2 coax lines direct or thru tuner, random wire/balanced line, and tuner bypass for dummy load.

A new efficient airwound inductor (12 positions) gives you less losses than a tapped toroid for more watts out.

A 1:4 balun for balanced lines. 1000 volt capacitor spacing. Mounting brackets for mobile installations (not shown).

With the NEW MFJ Versa Tuner II you can run your full transceiver power output — up to 300 watts RF power output — and match your transmitter to **any** feedline from 160 thru 10 Meters whether you have coax cable, balanced line, or random wire.



ANTENNA SWITCH lets you select 2 coax lines direct or thru tuner, wire/balanced line, dummy load.

You can tune out the SWR on your dipole, inverted vee, random wire, vertical, mobile whip, beam, quad, or whatever you have.

You can even operate all bands with just one existing antenna. No need to put up separate antennas for each band.

Increase the usable bandwidth of your mobile whip by tuning out the SWR **from inside your car.** Works great with all solid state rigs (like the Atlas) and with all tube type rigs.

It **travels well, too.** Its ultra compact size 8x2x6 inches fits easily in a small corner of your suitcase.

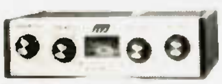
This beautiful little tuner is housed in a deluxe eggshell white Ten-Tec enclosure with walnut grain sides.

SO-239 coax connectors are provided for transmitter input and coax fed antennas. Quality five way binding posts are used for the balanced line inputs (2), random wire input (1), and ground (1).

NEW 300 WATT MFJ VERSA TUNER II'S: SELECT FEATURES YOU NEED.

NEW MFJ-945 HAS SWR AND DUAL RANGE WATTMETER. NEW LOWER PRICE

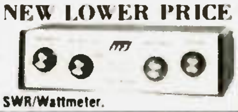
$69.95 BRAND NEW



Same as MFJ-941B but less 6 position antenna switch.

NEW MFJ-944 HAS 6 POSITION ANTENNA SWITCH ON FRONT PANEL. NEW LOWER PRICE

$69.95 BRAND NEW



Same as MFJ-941B but less SWR/Wattmeter.

NEW MFJ-943 MATCHES ALMOST ANYTHING FROM 1.8 THRU 30 MHz. NEW LOWER PRICE

$59.95 BRAND NEW

Same as MFJ-941B, less SWR/Wattmeter, antenna switch, mounting bracket. 7x2x6 in.

ULTRA COMPACT 200 WATT VERSA TUNERS FOR ALL YOUR NEEDS.

MFJ-901 VERSA TUNER MATCHES ANYTHING, 1.8 THRU 30 MHz. NEW LOWER PRICE

$49.95 BRAND NEW

Efficient 12 position air inductor for more watts out. Matches dipoles, vees, random wires, verticals, mobile whips, beams, balanced lines, coax. 200 watts RF, 1:4 balun, 5x2x6 in.

MFJ-900 ECONO TUNER MATCHES COAX LINES/RANDOM WIRES. NEW LOWER PRICE

$39.95 BRAND NEW

Same as MFJ-901 but less balun for balanced lines. Tunes coax lines and random lines.

MFJ-16010 RANDOM WIRE TUNER FOR LONG WIRES. NEW LOWER PRICE

$29.95

1.8 thru 30 MHz. Up to 200 watts RF output. Matches high and low impedances. 12 position inductor. SO-239 connectors. 2x3x4 inches. Matches 25 to 200 ohms at 1.8 MHz. Does not tune coax lines.

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Microcomputer Interfacing

Jonathan A. Titus
Christopher A. Titus
David G. Larsen
Peter R. Rony

The purpose of this month's column is to introduce the reader to some of the characteristics of the Intel 8253 programmable interval timer, an extremely versatile I/O chip that can be used in a wide variety of potential applications, such as a real-time clock, event counting, and period counting, in addition to the replacement of software-implemented timing loops.

The 8253 is a 24-pin integrated circuit that requires a single 5-volt supply and contains three independent 16-bit *interval timers*, each of which can be operated in six different modes. An *interval timer* has been defined by Graf's *Modern Dictionary of Electronics* as a device for measuring the time interval between two actions or a timer that switches electrical circuits on or off for the duration of the preset time interval. Fig. 1 serves the dual purpose of giving the pin diagram of the 8253 chip and showing how the chip can be interfaced with an 8080A/8085-based microcomputer system using memory-mapped I/O.

The 8253 chip contains four internal registers (three interval timers and a control register) that are decoded as memory locations 200 000 through 200 003 with the aid of the address bus signals A0, A1, and A15 (see Fig. 1 and Table 1). Observe in Table 1 that the $\overline{RD}$ and $\overline{WR}$ control inputs determine whether you are loading or reading a specific register. It is not possible to read the contents of the control register.

Table 2 summarizes the coding for the 8-bit control register within the 8253 chip. Observe that bits D7 and D6 determine the selection of the interval timer, bits D5 and D4 determine the nature of the read/write operation associated with the chosen timer, bits D3, D2, and D1 determine the mode of operation of the chosen timer, and bit D0 determines whether the timer counts down in binary or binary-coded decimal (BCD).

Fig. 2 provides a block diagram for a typical counter in the 8253 chip. The microcomputer loads the 16-bit down counter as two successive bytes, a HI byte and a LO byte, via the bidirectional data bus, D0 through D7. If the gate line GATE is active, negative edge transitions at the CLK input decrement the counter. When the counter reaches zero, OUT becomes active, its actual behavior depending upon the mode programmed into the control register for the counter (see Table 2). The 8253 chip contains three independent 16-bit counters, and each can be programmed independently in any one of the six modes of operation. The counter inputs and outputs, CLK, GATE, and OUT, for the chosen counter are independent of the CLK, GATE, and OUT input/output of the remaining two counters on the chip.

In addition to the address bus, data bus, and control bus connections shown in Fig. 1, the CLK0 and GATE0 inputs to counter #0 are respectively connected to the $\phi 2$ (TTL) microcomputer clock output (typically 2 MHz) and to bit 0 of accumulator output port 000. Any TTL level clock with a frequency of less than 2 MHz can be used as input to CLK0, and any suitably debounced switch or source of strobe pulses can be used to control the timer at GATE0. The output of the counter OUT0 can be connected to an oscilloscope to permit observation of each of the six timer modes of operation.

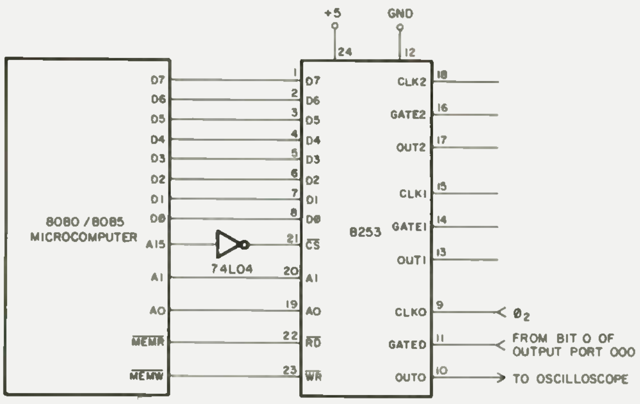

Fig. 1. Interface circuit between a 8253 programmable interval timer and an 8080/8085 microcomputer. The 8253 chip uses four locations of memory in this memory-mapped interface circuit.

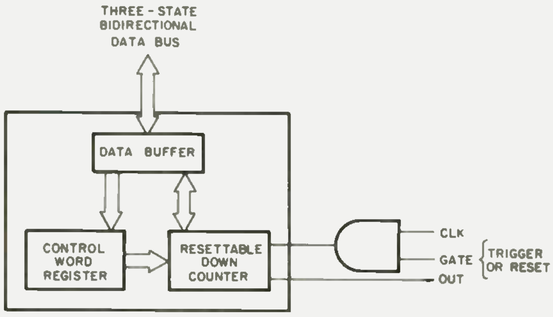

Fig. 2. Functional diagram of each of the three 16-bit interval timers in the 8253 chip. The gate input acts alternatively as a gate, trigger, or reset input, depending upon the mode chosen.

$\overline{CS}$	$\overline{RD}$	$\overline{WR}$	A1	A0		Memory address in demonstration program and interface circuit
0	1	0	0	0	Load counter #0	200 000
0	1	0	0	1	Load counter #1	200 001
0	1	0	1	0	Load counter #2	200 002
0	1	0	1	1	Load control register	200 003
0	0	1	0	0	Read counter #0	200 000
0	0	1	0	1	Read counter #1	200 001
0	0	1	1	0	Read counter #2	200 002
0	0	1	1	1	No operation (three state)	–
1	X[a]	X	X	X	Disable chip (three state)	–
0	1	1	X	X	No operation (three state)	–

X[a] = don't care (logic 0 or logic 1).

Table 1. Addressing the 8253 programmable interval timer.

Bits			Control function
	D7	D6	
	0	0	Control word is for counter #0
	0	1	Control word is for counter #1
	1	0	Control word is for counter #2
	1	1	–
	D5	D4	
	0	0	Latch both bytes of chosen counter for read operation
	0	1	Load or read only most significant byte of chosen counter
	1	0	Load or read only least significant byte of chosen counter
	1	1	Load or read LS byte first, then MS byte of chosen counter
D3	D2	D1	
0	0	0	Mode 0: Output = 1 on zero counter
0	0	1	Mode 1: Retriggerable variable-width one shot
X[a]	1	0	Mode 2: Programmable rate generator
X	1	1	Mode 3: Programmable square wave generator
1	0	0	Mode 4: Delayed strobe (software triggered strobe)
1	0	1	Mode 5: Triggered strobe (hardware triggered strobe)
		D0	
		0	Count down in binary
		1	Count down in binary-coded decimal (BCD)

X[a] = don't care (logic 0 or logic 1).

Table 2. Coding for the 8-bit control register in the 8253 chip.

Ham Help

I need some help. I have recently inherited a Hammarlund HQ-120X receiver and I am badly in need of a diagram. If anyone out there can help, I would gladly pay for copying costs. Thank you.

Louis A. Johnson
32 Crosscreek Drive, Apt. I 3
Charlestown SC 29412

I am in need of maintenance manuals for the following:

1. Standard signal generator, model 82, manufactured by the Measurements Corporation of Boonton NJ.
2. Frequency meter, FR-114 A/U, made by Sentinel Electronics, Inc.
3. Signal generator, TS-323 U/R.

I will be happy to purchase these manuals or copies of the pertinent maintenance data, schematics, etc., and pay cost of mailing.

Robert L. Marcon W5CBW
Rt. 7, Box 96A
Lucedale MS 39452

The Scanning Memorizers

FT-127RA
(220 MHz)

FT-227RB
(144 MHz)

FT-627RA
(50 MHz)

The FT-127RA, FT-227RB and FT-627RA, FM transceivers, allow scanning and expanded memory coverage for the demanding VHF FM operator. All feature up/down scanning capability with control from the microphone; the scanner will also search for a busy or clear channel. Four memory channels are available — two for simplex, three for repeater channels,one for a split of up to 4 MHz. Other performance features are similar to those of the renowned FT-227R.

OPTIONAL EQUIPMENT

Keyboard Microphone: YM-22 for FT-127RA and FT-627RA
(YM-22 standard feature with FT-227RB)
Squelch Unit • FP-4 AC Power Supply

CPU-2500R/K 2M FM Transceiver
with Central Processing Unit

The age of computers has entered the amateur scene with the announcement of the CPU-2500R/K 2-meter FM transceiver. Controlled by a 4-bit central processing unit (CPU), the CPU-2500R/K contains a scanner, 4 memory channels, manual or automatic tone burst, an optional sub-audible tone squelch, and 25 watts output.

The keyboard microphone allows two-tone input for autopatch or control purposes, as well as remote programming of dial or memory frequencies.
Automatic ±600 kHz repeater split, or program a split up to 4 MHz using the memory. Keyboard microphone allows remote programming of odd splits.

CPU scanner will search for a busy or clear channel, upon your command.
Four memory channels for simplex or repeater use, plus another memory channel for a split of up to 4 MHz.

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The radio.

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✓ *Reader Service—see page 211*

Awards

Bill Gosney WB7BFK
2665 North 1250 East
Whidbey Island
Oak Harbor WA 98277

Note: The address shown for Bill Gosney in the August issue of 73 was incorrect. The correct address is that shown above.

As editor of *73*'s newest column, I'm quite impressed with the warm reception received from so many of our readers situated throughout the world. Obviously, my recent announcement of an exclusive *73* Awards Program has turned quite a few heads and stimulated the interest of a great many. I thank you all for your written support arriving from all continents on the globe.

Without further to-do, let's turn to part II of our two-part series and learn for the first time about the four stateside award programs being sponsored by *73*. Keep in mind that these awards were not meant to be an overnight venture nor were they designed to duplicate any in existence today. Each offers its own degree of difficulty and creates a sense of accomplishment amongst those who are happy recipients.

WORK ALL USA AWARD

Sponsored by the editors of *73 Magazine*, this award is available to licensed amateurs throughout the world. To be valid, all contacts must be made January 1, 1979, or after. There are no band or mode restrictions; however, single-band accomplishments will be recognized.

To qualify, applicants must work each of the 50 US states within the same calendar year (January 1 through December 31). Annual endorsements will be afforded those applicants who can substantiate their claim.

To apply for the Work All USA Award, make a self-prepared list of claimed contacts in alphabetical order by US state, beginning with the state of Alabama. Indicate the state, the callsign of the station worked, the date and time in GMT, and the band and the mode of operation.

Do not sent QSL cards! Have your list of contacts verified by two amateurs, a local secretary, or a notary public. Forward your application along with the award fee of $3.00 or 8 IRCs to: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North 1250 East, Oak Harbor, Whidbey Island, Washington 98277 USA.

As you quickly surmised, the Work All USA Award with its 12-month limitation, more or less in a manner of speaking, separates the men from the boys when it comes to working all states.

Regardless of how difficult it may first appear, applicants who choose to work a few of the contesting events held each month or check into a few of the WAS nets will find the USA Award a relatively easy accomplishment.

Now, on the other hand, should you care to undertake an even greater challenge, take a hard look at this next award. This one was designed to appear fairly simple at first glance, but will drive you right up the wall with frustration as it is pursued. Known as the District Endurance Award, you'll need to find yourself an accurate timepiece, as you'll have exactly sixty minutes to work all US call districts. Simple, huh? Read on; there is a catch:

DISTRICT ENDURANCE AWARD

This award, sponsored by the editors of *73 Magazine*, is offered to licensed amateurs throughout the world. To be valid, all contacts must be made January 1, 1979, or after. There will be no band or mode restrictions. Contacts while a contest station or while working a contest station will not be allowed. Likewise, contacts made on any type of net operations will be invalid.

To qualify for this award, applicants must work all ten US call districts in one hour or less. The time will commence the moment the first contact is made and will end with the time logged for the last district required.

To apply, applicants must prepare a signed declaration that all contacts were independent of contest or net operations. Applications should include a self-prepared list of claimed contacts in order of their prefix. Include the date and time worked in GMT, the band and mode of operation, and the state.

Do not send QSL cards! Have your list of contacts verified by at least two amateurs, a local radio club secretary, or a notary public. Forward your application along with the award fee of $3.00 or 8 IRCs to the attention of: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North 1250 East, Oak Harbor, Whidbey Island, Washington 98277 USA.

What would an awards program be like without some sort of QRP incentive? With this in mind, the editors of *73* feature a special ten-meter achievement award. Being an avid user of converted Citizens Band equipment, I found personal interest in this award and hope our readers will share the challenge.

TEN-METER 10-40 AWARD

Available to licensed amateurs worldwide, this award sponsored by the editors of *73 Magazine* offers a challenge second to none. To be valid, all contacts must be made on the 10-meter band using only "channelized" converted Citizens Band equipment or similar type "commercial units." Power is limited to 15 Watts pep output. External amplifiers may not be used.

To be eligible, all contacts must be made October 1, 1978, or after on either AM, SSB, CW, or FM. Mixed mode contacts are not valid.

To qualify for this Ten-Meter Award, applicant must work and confirm at least forty (40) of the 50 US states. An endorsement for all fifty states will be issued to those who verify their claim.

To apply, make a list of contacts in alphabetical order by US state beginning with Alabama. Include the full callsign, date and time worked in GMT, band and mode of operation, and a brief description of the equipment used for each contact claimed.

Do not send QSL cards! Have your list verified by two amateurs, a local radio club secretary, or a notary public. Send your application along with your award fee of $3.00 and 8 IRCs to: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North 1250 East, Oak Harbor, Whidbey Island, Washington 98277 USA.

As noted in the Ten-Meter Award rules, recognition is given for single-mode contacts only. To the best of my knowledge, this award is the only one in existence that offers FM endorsement. Should you or a friend be involved in the latest craze of 10-meter FM operation, be sure to pass the word along that we have an award designed especially for you. While you are at it, why not lend your September as well as this October issue of *73* to fellow amateurs who are not aware of our new awards program? All eight domestic and DX achievements are outlined.

Though the title may be deceiving, this next award is probably the ultimate in our domestic program. Consider it the toughest to attain. A look at the requirements clearly identifies the degree of difficulty in obtaining this award. Luckily we were sympathetic enough to eliminate any time limitations.

CENTURY CITIES AWARD

This award, sponsored by the editors of *73 Magazine*, is available to licensed amateurs throughout the world. Designed as a dual Work-All-USA effort, the applicant who qualifies for this accomplishment will realize he has achieved what is probably the greatest feat in domestic award programs available today.

As with all the *73*-sponsored awards, with the exception of the 10-meter incentives, all contacts must be made January 1, 1979, or after to be valid.

To qualify, the applicant must work and confirm a minimum of two cities or towns in each of the fifty (50) US states for a total of 100 US cities.

To apply, prepare a list of claimed contacts, listing each one in alphabetical order by state. As shown below, include the full callsign of the station worked, the date, the band, and the city. Beginning with Alabama, your list will look something like the following example:

Alabama—W4ZZZ, March 31, 1979, 14 MHz, Decatur; N4XXY, February 1, 1979, 21 MHz, Mobile. Alaska—KL7AB, January 22, 1979, 7 MHz, Anchorage; WL7WW, May 19, 1979, 28 MHz, Fairbanks.

Do not send QSL cards with your application! Have your list of contacts verified by two amateurs, a local radio club secretary, or a notary public. Enclose your verified list along with the award fee of $3.00 or 8 IRCs and send to: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North 1250 East, Oak Harbor, Whidbey Island, Washington 98277 USA.

ARROWHEAD RADIO AMATEUR FIFTY-YEAR CERTIFICATE

A free certificate is being offered by the Arrowhead Radio Amateur Club of Duluth, Minnesota/Superior, Wisconsin, to celebrate fifty years of organized amateur radio in the Twin Ports area.

For this award, any amateur within fifty air miles of Duluth/Superior is considered an Arrowhead amateur. To receive this award, US and Canadian amateurs must work five Arrowhead amateurs; all foreign amateurs must work two Arrowhead amateurs during the month of October, 1979.

Contacts made during the Arrowhead Radio Amateurs Fiftieth Anniversary QSO Party on October 20 and 21, 1979, may be used for this certificate.

Logs must show band, mode, date, time in UTC, and stations worked to receive this award. Send logs, with SASE or IRC, to Arrowhead Radio Certificate,

Continued on page 176

HELLO WORLD

NBVM CALLING

W6OJV W7JWR W5QCS W1EA WA7UXT W8BTN KH6BB W6MBA K6MYC K5SBU W8EPI W8OMY W9HOC W5PLK KA7AZI W8NBQ DL6GH W5GEL WA1SCF W6TN W7JHQ ON4MX VP9BK K9JS WB4ETT/HC-1 WA2BZW WA6SFP W6ZN W7LDC W7OHZ VK8AC WB3EFC WB6CZX W6ZH WB3HLJ VE7BCJ NO9SZ FBZF WB9OBN W3AC W5DUU WB6ILN WB3DJS K3BI K6VG VE6BG VE7BC HB9JW KV4KV 9Y4NP WA2LQQ W9TC KA4AFT W3VP W3PE 5B4HF N1AF W3OEJ W3XO WA4DPF W4RL W4OJK W7GYR WB3EJP WB6UCS K1HTV W8NMK/JA W2GRD 9Y4OK WA2KDL W3HFY W3KRQ W7BPS N2WA VE2AGF/6

Microphone not included

The VBC Model 3000, the world's first and only narrow band voice modulation system is now a proven success. Leading communications engineers were enthusiastic about the NBVM system from the beginning. Now the idea of more QSO's per kilocycle has fired the imagination of Amateurs everywhere. The benefits of this advanced communications system are being demonstrated all over the world.

For present VBC users we can provide a list of other happy owners. For those Amateurs, who have not experienced NBVM yet, "why not add your name to the list?"

The VBC Model 3000 provides full audio level compression and expansion... complete intelligibility in only 1300 Hz bandwidth. It permits you to take full advantage of other stations' RF speech clippers and processors... similar to the amplitude compression and expansion used for many years in telephone and satellite communications.

The Model 3000 is for mobile and fixed station use and requires no modifications to your existing equipment. It is completely self contained, including its own audio amplifier. The unit automatically switches into transmit mode when microphone is keyed or voice operation is used. It connects just after the microphone on transmit and just prior to the speaker on receive. In addition to its basic function of operating in a narrow bandwidth, the Model 3000 also increases the performance of your station in the following ways:

- Reduces adjacent channel interference
- Increases signal to noise ratio
- Increases communications range

Some of its outstanding features include:

- High quality narrow band speech
- Self contained transmit/receive adapter
- Built in audio amplifier
- 5 active filters with a total of 52 poles
- Rugged dependable hybrid IC technology
- Low power consumption

Receive only features, such as sharp voice and CW filtering and amplitude expansion, provide improved reception without requiring a unit at the transmitting station.

For the more advanced experimenter the Model 3000 is available in a circuit board configuration for building into your present transceiver.

Henry Radio is ready to offer technical assistance and advice on the use and servicing of the Model 3000 and will help introduce new owners to others operating NBVM units. Get in on the ground floor... order yours now.

Price: VBC Model 3000 $349.00
Circuit board configuration $275.00

For more detailed information please call or write. The Model 3000 will be available from most Tempo dealers throughout the U.S. and abroad.

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For all states except California.
Calif. residents please call collect on our regular numbers.

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Covers 160 thru 10 meters. Variable IF bandwidth, rejection tuning, CW audio peak filter, built-in Curtis keyer, RF speech processor, 10 second tune mode timer, 6146B finals, auto mic gain control, 25 kHz crystal calibrator and ±5 kHz clarifier, built-in VOX, 180W DC input for SSB/CW, 80W AM FSK FM, DC-DC converter. *Call for Quote!* $1459.00 list

DRAKE TR7/DR7 Solid State synthesized HF transceiver

Covers 160 thru 10 meters, reception from 1.5-30 continuous, 0-30 MHz with optional AUX 7 modes, USB, LSB, CW, RTTY, AM. True passband tuning, RIT, built in RF wattmeter, SWR bridge. SSB 250 watts PEP, CW 250 watts, AM 80 watts. Power supply required for AC operation. PS-7 120/240V power supply available. **$1395.00** *List Call for quote*

TEN•TEC Omni D HF Transceiver

Totally solid state, 200W all bands. Covers 160 thru 10 meters, digital readout, built in VOX and PTT, adjustable squelch, 4 position CW/SSB filter, 8 pole crystal SSB filter, 2 range offset tuning, crystal calibrator, zero beat switch, SWR bridge and more. 12 VDC for mobile use, external power supply needed for fixed use. **$1069.00** List. Call for quote

***ICOM* IC-701 All Mode HF Transceiver**

All solid state. 100W continuous duty on all bands, all modes, 160 thru 10 meters, dual built in digital VFO's for split freq. operation. VOX, semi break in CW, RIT, AGC, noise blanker and built speech processor. IC-701PS needed for AC operation. Power supply requirements: DC 13.6V negative ground. **$1,332 LIST**—*Call for quote!*

***ICOM* IC 211 2 meter Transceiver**

144-148 MHz coverage, modes SSB, CW, FM, LSI synthesizer, PLL, 7 digit LED readout, pulse type noise blanker, VOX with adjustable gain, SWR bridge, CW monitor, Adj. power level, AC/DC power supply, antenna impedance 50 ohms unbalanced, TX output 13.8 VDC at 3 amps continuous. **$899.00 List** Call for quote

YAESU FT-7B

Frequency coverage, 10-80 meters. Emissions USB, LSB, CW & AM. 100 Watts DC, 25 Watts AM. Single knob tune-up. 100 KHz Calibrator, built-in semi breakin with sidetone - receiver offset tuning

A Great Portable Solid State Rig! $675 List CALL FOR QUOTE!

YAESU FT-625RD All Mode 6 Meter Solid State Transceiver $895 List *Call for quote*

SSB/CW/FM 25 watts, AM 8 watts, digital plus analog display. Noise blanker, built in AC/DC supplies, 50-54 MHz coverage. Variable power output, 3 way metering, much more!

ATLAS 210X

160-10 meter fully solid state transceiver. Final protected, 100 watts, USB/LSB/CW. No tuning required (RX or TX) with noise blanker. Deluxe mobile mount. Mars operation available. ***SUPER RECEIVER! Very Compact. Great for Mobile.***

List $899 **Special Price - $679.00**

SWAN 100 MX

80-10 meters fully solid state portable transceiver. CW/LSB/USB. 235 watts all modes. Rit, one knob tune-up, calibrator, noise blanker, Vox. 13.8 VDC @ 18A Xmit. List $699.95 *CALL FOR QUOTE!*

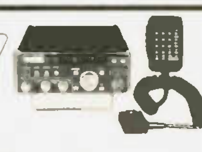
KDK

THE NEW KDK FM2016A TWO METER TRANSCEIVER (AT $299) IS FOR YOU!

1000 channels, Built-in Mars, cap frequency coverage, big bright 3/8" LED digital readout display, 4 channel Ram memory, any offset, any split, 16 Watts output and much more

YAESU FT-127RA 220 MHz FM TRANSCEIVER

Up/Down scanning capability, scanner will search for a clear or busy channel, four memory channels, available. Freq. coverage 200-225 MHz, 600 channels, 2 simplex memories, 3 repeater memories and 1 odd split memory, RF output 10W, 1800 Hz toneburst, repeater split ± 1.6 MHz, 13.8 VDC at 2.5A transmit. **$479.00 List.** *Call for Quote*



YAESU CPU 2500RK 2 Meter FM Transceiver

With 800 PLL channels, automatic scan over entire 2m band, 4 memories, toneburst, 25W Hi/3W Lo, 13.6 VDC at 8A continuous. Freq. coverage 144-148 MHz. Comes with a key board mic that allows remote input of memory or dial freqs., up/down scanning, aux. repeater selection to 4 MHz, 2 tone input for autopatch. 585.00 list. Call for quote

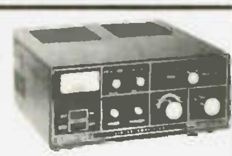
YAESU FT-101ZD High performance HF Transceiver

Covers 160 thru 10 meters plus WWV, modes LSB, USB and CW, built in power supply, input power 180 WDC, digital and analog frequency readout, 6146 final tubes, RF speech processor, variable IF bandwidth (300 Hz to 2.4 KHz), noise blanker, VOX, attenuator 10 dB or 20 dB, 100-234V operation, TX/RX freq. offset. $886 list

Call for Quote

Dentron GLA-1000 LINEAR AMPLIFIER

Freq. 80 to 15 meters, covers most Mars frequencies. RF drive max. 125, power consumption 117 VAC 50/60 Hz 12.5 Amps, factory fused at 15 Amps, 234 VAC 50/60 Hz 7 Amps. DC input 1 KW CW and 1200W PEP SSB. Final tubes 4 D-50A tubes (6LQ6). **$379.50** ***Call for Quote***



DENTRON Clipperton L

160 thru 15 meters. 200 watts PEP on SSB. 1000 watts DC on CW, RTTY or SSTV, covers most MARS frequencies just outside Ham bands, and easily changed 117V or 234V AC 50-60 Hz. **$599.00** ***Call for Quote***

ALPHA 76A

Alpha 76A by ETO offers full power with desk top convenience, is rated up to 2.5KW PEP SSB, 1KW average, CCS. Tunable 1.8-2MHz, 3-24MHz. Nominal drive is 100W PEP, 60 W carrier. Used 2-Eimac 8874 ceramic/metal triodes in G/G/. Full cabinet-ducted air cooling. 7.5"W, 14.75"D, 65 lbs. List $1,395—*Call for Quote*

YAESU FT-207R

144–148 MHz FM Synthesized Hand-Held. Four memories plus offset, Auto Scan, Keyboard entry, 3 watts output, automatic battery saver, LED Display, BNC Antenna Connector, condensor mike, and MUCH MORE! Get your order in to insure delivery by late fall! List $399 Call for Quote!

MFJ

For compact antenna tuners, CW keyers and audio filters— It's MFJ! Give us a call to quote your needs!

KLM

Call for Quote!

KLM 2 Meter Mobile Amplifiers

		List
PA-2-25 B	25 Watts	72.95
PA-4-80 BL	80 Watts	219.95
PA-4-160 BL	160 Watts	281.95
PA-15-40 BL	40 Watts	129.95
PA-15-80 BL	80 Watts	189.95
PA-15-160 BL	160 Watts	289.95
PA-45-160 BL	160 Watts	229.95

Call for Quote!

CUSHCRAFT ANTENNAS

H.F. - VHF - UHF - Cushcraft Builds 'em strong!

	List		List
ATB 34	269.95	A147-11	36.95
ATV-4	89.95	A147-22	109.95
ATV-5	109.95	A144-10T	42.95
ARX-2	39.95	A144-20T	62.95
AR-6	36.95	A147-20T	34.95
ARX-220	39.95	A430-11	34.95
ARX-450	39.95	A432-20T	59.95
A144-11	36.95	*And Much More!*	

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hy-gain.

Hy-Gain Antennas In-Depth Hy-Gain Stock!

	List
TH3JR	169.95
TH5DX	269.95
TH3MK3	229.95
TH6DXX	329.95
TH2MK3	149.95
18AVT/WB	88.30
14AUO	67.85
12AUO	42.09

Call for our special prices!

ROHN

ROHN TOWER

Rohn 25G Products in stock . . . Also, full line of Rohn accessories to put up a great tower / antenna system! Call for further Info!

BIRD MODEL 43 Thruline Watt Meter

50 Ohms nominal impedance. VSWR with UHF connectors 1.05 max.—Expanded scales of 25, 50 & 100 permits direct reading from 100 Mw to 10,000 watts

$125.00

Call for yours today

ROBOT All Units and Accessories

	List
Model 400 Scan Converter	795.00
10M915 Monitor	259.00
TC-1000 Camera	279.00

Call for your quotes and slow scan needs!

ARRL PUBLICATIONS

All ARRL Books, Maps, etc. In stock!!

Tune In the World	7.00	ARRL Logbook	1.75
Hints and Kinks	4.00	Understanding Amateur Radio	5.00
License Manual	4.00	ARRL Codekit	8.00
Antenna Handbook	5.00	*And . . . Much More!*	
Radio Amateur Handbook	9.75		

AMECO, 73 AND CALLBOOK PUBLICATIONS

Map Library	3.75
U.S. Callbook	15.95
DX Callbook	14.95
Ameco Novice Guide	5.95
Ameco Code Course	4.95
Radio Amateur Theory Course	4.95
73 VHF Antenna Book	4.95
73 Novice Study Guide	4.95
73 General Study Guide	4.95

Plus Much More! Call Us!

SAXTON WIRE / DABURN INSULATORS

Antenna Wire

18 gauge solid copperweld 50'	1.09
14 gauge solid copperweld 50'	3.29
12 gauge solid copperweld 50'	3.99
14 gauge stranded	3.98
16 gauge stranded	2.69

Dipole Insualtors

4" porcelain end	.96
4" porcelain center	1.41

Contests

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

CALIFORNIA QSO PARTY
Starts: 1800 GMT October 6
Ends: 2359 GMT October 7

Single-operator stations are limited to 24 hours operating time with on and off periods clearly marked in the log. Multi-operator stations may operate the full 30 hours. Stations may be worked once per band per mode, simplex only. CA stations that change counties may be considered new stations.

EXCHANGE:

CA stations send QSO number and county. All others send QSO number and state, province, or ARRL country.

FREQUENCIES:

CW—1805, 3560, 7060, 14060, 21060, 28060.

SSB—1815, 3895, 7230, 14280.

Novice CW—3725, 7125, 21125, 28125.

SCORING:

Each complete contact is worth 2 points; CA stations count the 50 states plus VO/VE 1-7 and VY1 for a maximum of 58 multipliers; non-CA stations will use the number of different CA counties worked, a maximum of 58. Final score equals QSO points times the multiplier.

ENTRIES:

Summary sheet and logs must be postmarked not later than November 1 and sent to: NCCC, c/o Alan Brubaker K6XO, 34456 Colville Place, Fremont CA 94536. Please include a business-size SASE with your entry. Awards for individuals and clubs will be awarded.

QRP ANNUAL OCTOBER QSO PARTY
Starts: 2000 GMT Saturday, October 6
Ends: 0200 GMT Sunday, October 7

Sponsored by the QRP Amateur Radio Club International, Inc., the contest is open to all amateurs and all are eligible for the awards. Stations can be worked once per band for QSO and multiplier credits. General call is "CQ QRP."

EXCHANGE:

Members send RS(T), state/province/country, QRP number. Non-members send RS(T), state/province/country, power input in Watts.

SCORING:

Each member QSO counts 3 points. Non-members count 2 points per QSO. Stations other than W/VE count as 4 points. Multipliers are as follows: more than 100 Watts input = x1, 25 to 100 Watts = x1.5, 5 to 25 Watts input = x2, 1 to 5 Watts input = x3, and less than 1 Watt input = x5. Final score is QSO points times total number of states/provinces/countries per band times the power multiplier.

FREQUENCIES:

CW—1810, 3560, 7060, 14060, 21060, 28060, 50360.

SSB—1810, 3985, 7285, 14285, 28885, 50385.

Novice—3710, 7110, 21110, 28110.

All frequencies plus or minus 5 kHz to clear QRM.

AWARDS:

Certificates to the highest-scoring station in each state, province, or country. Other places will be given depending on activity. One certificate for the station showing three "skip" contacts using lowest power.

ENTRIES:

Send full log data, including full name, address, and bands used, plus equipment, antennas, and power used. Entrants desiring result sheet and scores please enclose a business-size SASE. Logs must be received by October 31 to qualify. Send all logs and data to: QRP ARC Contest Chairman, E. V. Sandy Blaize W5TVW, 417 Ridgewood Drive, Metairie LA 70001.

9-LAND QSO PARTY
Starts: 1800 GMT Saturday, October 13
Ends: 2359 GMT Sunday, October 14

A maximum of 24 of the 30-hour period may be worked.

EXCHANGE:

9-land stations send RST, county, and state. All others send RST, state, province, or ARRL country. The same station may be worked once per band and mode. If any station change counties, it may be worked again.

SUGGESTED FREQUENCIES:

CW—1805, 3560, 7060, 14060, 21060, 28060, +VHF.

SSB—1815, 3895, 7230, 14280, 21355, 28600, +VHF.

Novice—3725, 7125, 21125, 28125.

AWARDS:

Certificate to top score in each state, province, and ARRL country, 2nd and 3rd if justified. Also top mobile, portable, multi-single, multi-multi, club, and Novice.

SCORING:

Each QSO is worth 2 points. Scores shall be computed as follows: 9-land—(#QSOs) (states + provinces + ARRL countries + 9-land counties) (2 points/QSO) = total; others—(#QSOs) (9-land counties) (2 points/QSO) = total.

REPORTING:

Submit summary sheet and log. Each new multiplier shall be clearly indicated. Send logs and a large SASE to III Wind Contesters, c/o John W. Sikora WB9IWN, 8155 Woodlawn Street, Munster IN 46321, for results.

ARROWHEAD FIFTIETH ANNIVERSARY QSO PARTY
Operating periods:
1500 GMT October 20 to 0300 GMT October 21
1500 GMT to 2359 GMT October 21

This QSO party is sponsored by the Arrowhead Radio Amateurs Club and is to help celebrate fifty years of organized amateur radio in the Duluth MN-Superior WI area. The club was first affiliated with the ARRL in 1929. The contest is open to all radio amateurs. All amateurs within 50 air miles of Duluth/Superior are considered Arrowhead amateurs in this contest. Arrowhead amateurs may work anyone; amateurs outside the area may work only Arrowhead amateurs. The same station

Continued on page 174

Calendar

Oct 6-7	QRP Annual October QSO Party
	California QSO Party
	VK/ZL/Oceania DX Contest—Phone
Oct 13-14	ARRL CD Party—CW
	9-Land QSO Party
	VK/ZL/Oceania DX Contest—CW
	RSGB 21/28 MHz—Phone
Oct 20-21	ARRL CD Party—Phone
	Arrowhead Fiftieth Anniversary QSO Party
	WADM Contest
	Jamboree on the Air
	RSGB 7 MHz—Phone
Oct 27-28	CQ Worldwide DX Contest—Phone
Oct 28	Crazy Eight Net QSO Party
Nov 3-4	ARRL Sweepstakes—CW
	RSGB 7 MHz—CW
Nov 10-11	CQ-WE Contest
	IPA Contest
Nov 11	OK DX Contest
Nov 17-18	ARRL Sweepstakes—Phone
	Austrian 160 CW Contest
Nov 24	DAFG Short Contest—SW
Nov 24-25	CQ Worldwide DX Contest—CW
Nov 25	DAFG Short Contest—VHF
Dec 1-2	ARRL 160 Meter Contest
Dec 1-3	North Carolina QSO Party
	Connecticut QSO Party
Dec 8-9	ARRL 10 Meter Contest

Results

RESULTS OF THE 1979 COUNTY HUNTERS SSB CONTEST

Fixed

N7TT/2	2,034,760**
WD4FGW	835,835*
WA9MSW	809,710*
WB4UPW	786,828*
W8WT	346,104*
K9GTQ	341,964*
W7JYW	173,019*
WB9DCZ	165,200*
WA2GPT	83,185*
W1DIT	64,288*
WD4PZN	60,288*
N7SU	54,802
WD8MDG	50,400
VE3RN	39,344
K2EL	8,250
K8BBH	5,610
N5QQ	3,320
WA9WGJ	3,124
WB1ANT	1,088
VE3IR	460

Mobile

N4UF	555,385**
AI5P	477,688**
K3KX	253,242*
WAØYJL	94,188*
WØBK	62,964*
W5AWT	51,531*
WØEWH	48,160*
VE3IR	17,861*
K9DZG	15,067*
WØQWS	343,555 (check log)

DX

CT1BY	61,236**
I2PHN	48,440*
VK4VU	45,288*
CT1TZ	1,804
LA5YF	1,612*

SWL

SWL-NL-4276**
Netherlands 24,336

**Plaque Winner
*Certificate Recipient

OSCAR Orbits

Courtesy of AMSAT

The listed data tells you the time and place that OSCAR 7 and OSCAR 8 cross the equator in an ascending orbit for the first time each day. To calculate successive OSCAR 7 orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the day's first ascending (northbound) equatorial crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world from you, it will descend over you. To find the equatorial descending longitude, subtract 166° from the ascending longitude. To find the time OSCAR 7 passes the North Pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR 7 when it is within 45 degrees of you. The easiest way to determine if OSCAR is above the horizon (and thus within range) at your location is to take a globe and draw a circle with a radius of 2450 miles (4000 kilometers) from your QTH. If OSCAR passes above that circle, you should be able to hear it. If it passes right overhead, you should hear it for about 24 minutes total. OSCAR 7 will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15° east or west of you, add another minute; at 30°, three minutes; at 45°, ten minutes. Mode A: 145.85-.95 MHz uplink, 29.4-29.5 MHz downlink, beacon at 29.502 MHz. Mode B: 432.125-.175 MHz uplink, 145.975-.925 MHz downlink, beacon at 145.972 MHz.

OSCAR 8 calculations are similar to those for OSCAR 7, with some important exceptions. Instead of making 13 orbits each day, OSCAR 8 makes 14 orbits during each 24-hour period. The orbital period of OSCAR 8 is therefore somewhat shorter: 103 minutes.

To calculate successive OSCAR 8 orbits, make a list of the first orbit number (from the OSCAR 8 chart) and the next thirteen orbits for that day. List the time of the first orbit. Each successive orbit is then 103 minutes later. The chart gives the longitude of the day's first ascending equatorial crossing. Add 26° for each succeeding orbit. To find the time OSCAR 8 passes the North Pole, add 26 minutes to the time it crosses the equator. OSCAR 8 will cross the imaginary San Francisco-to-Norfolk line about 11 minutes after crossing the equator. Mode A: 145.85-.95 MHz uplink, 29.4-29.50 MHz downlink, beacon at 29.40 MHz. Mode J: 145.90-146.00 MHz uplink, 435.20-435.10 MHz downlink, beacon on 435.090 MHz.

OSCAR 7 Orbital Information

Orbit	Date (Oct)	Time (GMT)	Longitude of Eq. Crossing °W
22304qrp	1	0113 01	83 9
22316	2	0012.21	68.7
22329X	3	0106:38	82 3
22341	4	0005:58	67 2
22354	5	0100:15	80.8
22367	6	0154:32	94 3
22379	7	0053:52	79 2
22392qrp	8	0148:09	92 8
22404	9	0047:29	77 6
22417X	10	0141:46	91 2
22429	11	0041.06	76 1
22442	12	0135.23	89 7
22454	13	0034:44	74 5
22467	14	0129.01	88 1
22479qrp	15	0028.21	73 0
22492	16	0122:38	86 6
22504X	17	0021:58	71 4
22517	18	0116 15	85.0
22529	19	0015.35	69.9
22542	20	0109.52	83 5
22554	21	0009 12	68.3
22567qrp	22	0103 29	81.9
22579	23	0002 50	66 7
22592X	24	0057 06	80.3
22605	25	0151 23	93 9
22617	26	0050:44	78 8
22630	27	0145.01	92 4
22642	28	0044 21	77 2
22655qrp	29	0138:38	90 8
22667	30	0037 58	75 7
22680X	31	0132.15	89.3

OSCAR 8 Orbital Information

Orbit	Date (Oct)	Time (GMT)	Longitude of Eq. Crossing °W
8011Abn	1	0004 26	47 5
8025Abn	2	0009 35	48 8
8039X	3	0014 44	50 2
8053Abn	4	0019 53	51 5
8067Abn	5	0025 02	52 8
8081Jbn	6	0030 12	54 1
8095Jbn	7	0035 21	55 4
8109Abn	8	0040 30	56 7
8123Abn	9	0045 39	58 0
8137X	10	0050 48	59 3
8151Abn	11	0055 57	60 6
8165Abn	12	0101 06	61 9
8179Jbn	13	0106 15	63 2
8193Jbn	14	0111 24	64 5
8207Abn	15	0116 33	65 8
8221Abn	16	0121.42	67 1
8235X	17	0126 51	68 4
8249Abn	18	0132 00	69 7
8263Abn	19	0137 09	71 0
8277Jbn	20	0142 18	72 3
8290Jbn	21	0004 13	47 8
8304Abn	22	0009 22	49 1
8318Abn	23	0014 31	50 4
8332X	24	0019 40	51 8
8346Abn	25	0024 49	53 1
8360Abn	26	0029 58	54 4
8374Jbn	27	0035 06	55 7
8388Jbn	28	0040 15	57 0
8402Abn	29	0045 24	58 3
8416Abn	30	0050 33	59 6
8430X	31	0055 42	60 9

FCC

Some 73 readers have inquired about the legality of building and using the MDS receiving system featured in the August, 1979, issue ("You Can Watch Those Secret TV Channels"). In response to these inquiries, an FCC Public Notice (dated January 24, 1979) on MDS is reproduced here.

The key issue seems to be whether the reception of MDS transmissions by an amateur experimenter constitutes an illegal "benefit" under Section 605 of the Communications Act. Before you construct your own MDS receiving system, we urge you to read the material below.

UNAUTHORIZED INTERCEPTION AND USE OF MULTIPOINT DISTRIBUTION SERVICE (MDS) TRANSMISSIONS

In response to a few informal inquiries and complaints, this Notice is a reminder that the unauthorized reception and beneficial use of addressed communications in the Multipoint Distribution Service (MDS) is a violation of Section 605 of the Communications Act of 1934 (47 U.S.C. §605).

MDS is a common carrier service which utilizes an omnidirectional radio transmission to distribute addressed broadband communications (usually forms of television information) for simultaneous reception at multiple fixed receive points by the members of commercial, or other institutional, subscribers in accordance with their specific transmission, reception, and informational requirements.

MDS stations are not television broadcasting stations. They operate on microwave radio frequencies (2150-2162 MHz) which are allocated for common carrier service between fixed points, and which, because of their high frequency, are not receivable by conventional television or other receivers. Additional equipment is required to down-convert or to demodulate the microwave signal before it can be utilized by those television receivers, facsimile terminals, or computer data display terminals authorized to receive the communication by its sender.

Nor are MDS stations disseminating radio communications intended to be received by the general public. MDS station transmissions generally consist of various forms of private television, high-speed computer data, facsimile, control information, or other forms of addressed broadband communications. This programming is provided to the station by its institutional subscriber and is intended to be received only by members of the subscriber organization located at the multiple receive points. The MDS station transmits this programming pursuant to a federally-regulated tariff and is responsible for both its transmission and reception under Section 21.903 of the Commission's Rules and Regulations (47 C.F.R. §21.903). Although this rule permits the station's institutional subscriber the option of owning the microwave receiving equipment, such equipment must be installed, maintained, and operated pursuant to the carrier's instruction and control.

Section 605 of the Communications Act makes it unlawful:

—for a person not authorized by the sender to intercept radio communications and divulge or publish the existence, contents, substance, purport, effect, or meaning thereof to any persons; or,

—for a person not entitled thereto to receive radio communications and *use such communication or any part thereof for his own benefit* or for the benefit of another who is not entitled thereto (emphasis added).

Because material transmitted over stations is not intended to be "broadcast" material within the meaning of Section 605, authority for its reception and use must be given by the sender. Therefore, persons will be in violation of the law if they divulge, publish, or use for their own benefit any MDS communications which they were not authorized to receive.

Violations of Section 605 can result in either criminal prosecution or civil lawsuit, or both. *See KMLH Broadcasting Corp. v. Twentieth Century Cigarette Vending Corp.*, 264 F. Supp. 35 (C.D. Calif. 1967).

Ham Help

I have a Heathkit® SB-110A 6m SSB/CW transceiver. I was thinking about getting a new rig that was more up to date, but after I saw the price tags on them, I decided to keep the 110A. Can anyone recommend a noise blanker for this rig?

I'd like also to find out about all mods that can be done to the SB-110A to modernize it. I would appreciate any information that anyone can give me. Thanks.

SSG Gary Kohtala HL9TG
USAFS-K, Box 194
APO San Francisco 96271

New Products

ICOM'S IC-701 ALLBAND ALL-SOLID-STATE TRANSCEIVER

When an Icom IC-701 transceiver arrived at the *73* shack, I was pleasantly surprised by the size of the three boxes that the rig, its companion power supply, and several other accessories were packed in. Times had certainly changed from when I stumbled through the door with a brand new tube-type rig just a few years ago. The 701's size (111 mm x 221 mm x 311 mm) and 7.3-kg weight make it an ideal competitor in the growing mobile radio market.

There is no tune-up to worry about, since the radio is broadbanded. You just set the band and frequency and start talking. It's almost as easy as operating a 2-meter rig. The 701 has full coverage of the HF spectrum in the USB, LSB, CW, and RTTY modes. Receive capability for the 15-MHz WWV signal is also included.

After the rig was unpacked, there was concern as to how such a small box could possibly do so much. The controls seemed to be crowded and it looked easy to make a mistake. A month of operating has proven this to be an ill-founded fear. The front panel is well laid out—Icom certainly engineered it well.

The solid-state finals don't need any coaxing to reach their rated 200-Watt input level. A thermostatically controlled fan is included, but in normal SSB use it has never had to kick in. This rig runs cool. It is important to use a well matched antenna with your 701, a small price to pay in an age when many ham shacks have antenna tuners already. If the transmitter does overheat, the flashing frequency display lets you know that it's time to pull the switch and find out what's wrong.

Versatile Vfos

Anyone who operates *73*'s IC-701 mentions the synthesized tuning as an outstanding feature. The computer-compatible tuning system allows 110-Hz increments in frequency selection. Even the most discriminating amateur should be pleased with being no more then 50 Hz from the desired frequency. The musical effect that occurs when a heterodyne is tuned in always brings a smile to the face of a first-time user.

The tuning knob has a 5-kHz per revolution change, but a "fast tune" position allows the band to be covered in seconds. The only analog readout available is from the 100-Hz and 1-kHz dial markings. The idea of being totally dependent on a digital display doesn't seem so bad when you remember that dial backlash and the like are things of the past with the IC-701. No external vfo is needed, since the rig contains two independent ones. It is handy to set vfo "A" on a particular receive channel and use vfo "B" for transmitting when working DX. Total flexibility is the best way to describe it.

This rig stands apart from the rest when an Icom IC-RM2 is hooked to the accessory socket. It is a whole new world of operating when you can change bands and enter frequencies from a keypad. Push a button and you are on a completely different band and predetermined frequency; push another button and the 701 scans to the band edge, all in less time then it takes to say your callsign. The RM2 provides a second digital readout that is smaller than the 701's display, but it is still very useful. Four frequencies may be stored in memory and three different scanning rates are available. Any number of schemes involving remote operation, crossband repeaters, etc., are possible, thanks to the computer-compatible tuning system.

Icom's IC-701 transceiver.

Helpful Extras

No matter how versatile the Icom IC-701 synthesizer is, the rest of the rig must also be considered. Despite the lack of any pre-select control, the receiver seems to offer a sensitivity that is comparable to tuned rigs. SSB reception lacks any tinny or echoing quality, and the external speaker does a more than adequate job. The passband and RIT features are very smooth and go a long way in eliminating troublesome QRM. The instruction manual honestly states that the noise blanker works best with pulse-type noise, but may not be effective in all cases. Mobile operators may not be interested in features like a 10-dB attenuator and selectable agc, but Icom includes them for amateurs who take their operating seriously.

Speech processors have become more than just an option with most new transceivers, and the 701 is no exception. Icom advertisements suggest that the rf processor may be left on all the time without worrying about the final transistors. However, we found that the added punch given by the processor means slightly less fidelity for the operator on the other end. Processing is definitely used when I am in a pileup or similarly tough situation. The proper adjustment of the speech processor and microphone gain can be a bit confusing at first, especially when you switch to CW and the process control knob sets the output level. Hams who split their time between SSB and CW will be pleased with the 701's separate VOX delay values for each mode. No compromise here—there is even a separate volume control for the sidetone.

The four VOX adjustments, plus seven other controls, are found under the access cover which is conveniently located on top of the radio. Icom has included an swr metering circuit. Unfortunately, it is easy to leave the "set" switch on, canceling the power-out (PO) metering. The swr meter is nice for making occasional antenna checks, but it can't compete with the external variety. Another frill is the dimmer switch. This allows the frequency display and meter illumination to automatically change when the room lighting shifts.

A Few Bugs

The IC-701's most noticeable deficiency was revealed when it came time to interface the rig to the real world. Use with many linear amplifiers will require the addition of a small 12-volt relay for switching and a 10k pot to control the ALC level. A more frustrating problem occurred when I tried to use an electronic keyer. The instruction manual dictates that the terminal voltage of any external keying device must be less then .4 volts dc. Since many keyers use electronic switching, they will not work here. When I contacted an Icom representative about this problem, he suggested that the keyer output circuit be modified. It was also mentioned that Icom does not consider this to be a fault of the 701, and no changes are planned.

To save space, a miniature phone jack is used for the key rather then the universally accepted ¼-inch type. If you want to use the IC-RM2 remote controller in addition to other accessories, it will be necessary for you to modify the 24-pin accessory plug or obtain the IC-EX1 extension terminal. The EX1 overcomes the switching relay problem and offers a ¼-inch-jack-to-miniature-phone-plug combination for CW keying. Although the interfacing problems are not insurmountable, they can mean an unneeded delay for the amateur who expects easy hookup.

Since the IC-701 relies heavily on digitally-based circuitry, rf shielding is very important. Correspondence with other hams—and on-air testing—have shown that feedback problems may occur, especially when the IC-RM2 remote controller and high-power amplifier are used. Good grounding practices and careful attention to the audio lines help to cure these bugs. The instruction manual gives adequate information on problems that may result from misadjustment of the normal user controls, but little information is available about other difficulties that may crop up.

Icom has incorporated more then 470 solid-state devices in the 701. The theory documentation provides a general outline of the design, but with a few exceptions, it does not give a detailed description of individual circuits. Because of the complexity and small size of the IC-701, it is doubtful that most hams would want to service it. Some instructions for internal adjustments are given. These often require a frequency counter, rf voltmeter, signal generator, or oscilloscope. A highly competent dealer or

Icom distributor is the best source of help for the less adventuresome owner.

Being limited to admiring the rig's outward appearance is not an unpleasant pastime. The IC-701 is a sharp looking, highly functional unit. Except for peeling lamination on the faceplate of the RM2, our 701, with accessories, has performed well during daily use for the past month. Although Icom's compact "black box" seems dwarfed by the nearby antenna tuner, it is a real performer. *Icom, 3331 Towerwood Drive, Suite 304, Dallas TX 75234; (214)-620-2780.*

Tim Daniel N8RK
Peterborough NH

30-MEGAHERTZ, DUAL-TRACE, PORTABLE MINISCOPE

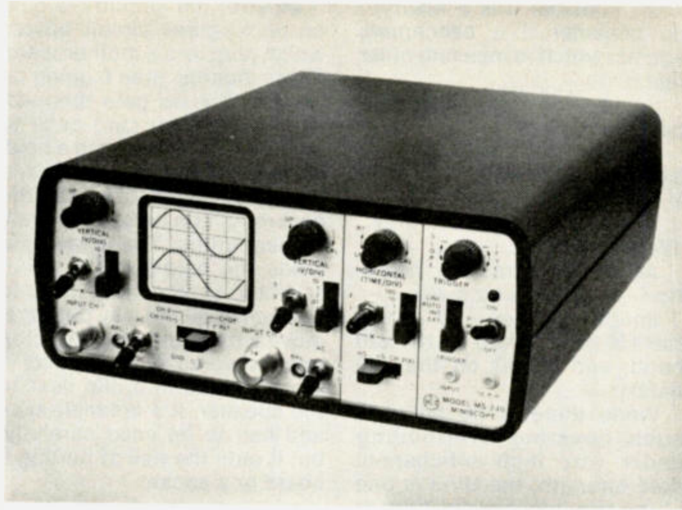
Non-Linear Systems has increased the number of their Miniscope oscilloscopes to three with the introduction of their Model MS-230 30-megahertz, battery-operated, dual-trace miniscope. Its size is 2.9 inches high by 6.4 inches wide by 8.5 inches deep. The weight is 3.5 pounds, including batteries.

The MS-230 features alternate, chopped, and separate sweep modes. Internal and external trigger modes are included. There are 12 vertical gain settings for each channel's range, from 0.01 to 50 volts per division. Timebase settings range from 0.05 microseconds to 0.2 seconds per division. Verniers are provided for timebase and vertical amplifier adjustment.

The MS-230 Miniscope includes a horizontal input channel and an internal calibrator. The graticule consists of .25-inch divisions arranged 5 across and 4 high.

The MS-230 comes complete and ready to use. Included are input cables and a battery charger permitting battery or line operation. Accessories include a 10:1, 10-megohm probe and a leather carrying case with shoulder strap and belt loop.

For further information, contact *Non-Linear Systems, PO Box N, Del Mar CA 92014; (714)-755-1134.* Reader Service number N22.



The Model MS-230 Miniscope.

A CRITICAL REVIEW OF THE DRAKE UV-3

Drake's three-band VHF/UHF FM transceiver has gotten a good deal of attention and discussion. I've had one since Christmas, and I'd like to pass on comments about my experiences with it.

Vital Statistics

The UV-3 is a synthesized unit with 5-kHz steps. Coverage is all of 2 meters, all of 220, and 440 to 450 MHz. The unit can be ordered with any one band, any two, or all three. Built-in offsets are zero, plus or minus 600 kHz on 2 meters, plus or minus 1.6 MHz on 220, and plus or minus 5 MHz on 440. Up to three additional offsets may be programmed on a plug-in diode board, and the same three are shared between all bands. The frequency may be set up on front-panel switches, or up to four frequencies in each band can be diode-programmed. A master switch selects either the front panel or any of the programmed frequencies. The bandswitch is unconditional. There are no tune-up controls.

Each band uses a separate rf section, each adding 2½" to the depth of the case. Each band has a separate antenna jack. Maximum power is 25 W on 2 meters and 10 W on the other bands. The "low" setting of the power switch is about 10% of full power, and this can be changed by resistor substitution. There is a scan function which allows either programmed frequency #4 or the front-panel frequency to be checked every few seconds—momentarily interrupting the selected frequency—and locks in if carrier is present. A non-encoding mike is supplied, but the jack is wired to accept a Drake encoding mike. A mobile mounting bracket is included. There is an accessory jack.

Viewpoint

To make use of a theater review, it's necessary to be aware of the critic's prejudices and biases in order to put his comments in proper context. The same is true of a product review.

I take the attitude that any piece of equipment built for a serious purpose, of which repeater communication is sometimes a prime example, should have a set of features and specifications that follow with logical precision from that purpose. That is, it should do exactly what it's supposed to do.

There should be sufficient reserve performance to allow for expected component deterioration. It should be free of quirks that get in the way of its intended use or which require attention from the user beyond that which is inherently required by the function being fulfilled. It should be rugged, in the sense that conditions to be expected during use will not cause failure or degradation. It should be maintainable; assembly and disassembly needed to reach components should be easy, straightforward, and quick; parts should be readily available; and the design should be comprehensible, at least to the extent of avoiding peculiar tricks.

This is the standard by which a commercial workhorse is judged. There's an awful lot of ham gear around that wouldn't begin to measure up to that level. The first thing to say about the UV-3, though, is that it's a serious piece of engineering. The things that I will be criticizing probably would not even be mentioned in a review of a lesser piece of gear.

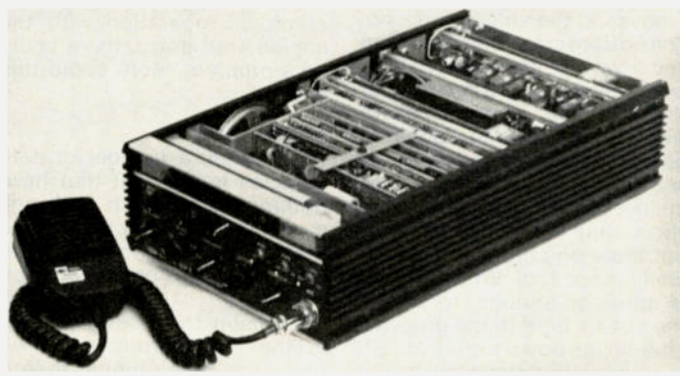
Performance

The UV-3's strong suit seems to be raw performance. There is no heterodyne synthesis; instead, a single vco for each band is retuned in going from receive to transmit. While I have not had the opportunity to check the spurious output specs with the spectrum analyzer, this approach tends to eliminate most spurs right at the source. The spec is −60 dB on 2 meters and 220, and −40 dB on 440. The lock range of the vco's easily exceeds spec; on the 2-meter band it held almost from 142 to 150 MHz.

Although the rf section is broadbanded and needs no tuning adjustments (except for dialing up the synthesizer), the output power was about 5% above specs across the rated bandwidth and didn't drop off too badly until the vco lost lock.

An apparent instability in power output turned out to be an effect of running off a storage battery with the charger turned off. Power is somewhat sensitive to supply voltage, but this is not a criticism. It just likes to be run off rated voltage, which is 11.5 to 15 volts. Incidentally, the negative side is grounded to the chassis, as are the antenna jacks. It requires a positive supply.

The audio is very good, to the point of attracting attention. I've repeatedly been asked, "That rig sounds pretty good; what is it?" To the ear, the response sounds smooth and distortion is not noticeable. There are no special audio shaping circuits; this makes it possible to wire the touchtone™ encoder directly across the mike and have the correct twist relationship. On receive, the sound reminds the listener of the music receiver, allowing, of course, for the 12-kHz i-f bandwidth. The unusually large magnet in the speaker has to be one reason for this. If anything keeps you from communicating, it won't be the rig's audio. I



Drake's UV-3 VHF/UHF FM transceiver.

don't consider this a luxury; I do consider it a benchmark against which to measure other rigs.

Some highlights from the published specs:

Frequency accuracy—0.0005%, 0°to 60°C, 11.5 to 15 V dc.

Sensitivity—0.5 uV max., 12-dB SINAD.

Adjacent channel rejection—60 dB, 15 kHz away.

Image rejection—80 dB on the 140 band, 60 dB on the 220 band, and 55 dB on the 440 band.

While there is no spec as such covering overloading under very high off-channel field strength, the UV-3 is one of the few transceivers, ham or commercial, that doesn't misbehave going through the infamous "Intermod Alley" along Boston's Route 128. Intermod attenuation is given as −80 dB on 2 meters, −75 dB on 220, and −55 dB on 440. Figures like this don't tell the whole story because any receiver has an overload point at which the front end goes nonlinear and mixing begins. This one has a very high overload point; I have operated other transmitters near it without breaking squelch.

Construction

It's in the mechanical structure and assembly that the attitude of Drake's people shows most clearly. There is a great deal of attention to detail—detail that most other manufacturers might have skipped to save a few cents. I give Drake a lot of credit for resisting the temptation.

You won't find sheet metal screws in the UV-3. Pemnuts are pressed into the aluminum, giving a deep steel thread. Repeated disassembly won't damage any sheet metal parts. Lock washers are used freely inside, so screws are unlikely to shake loose in mobile operation.

Access to almost all of the insides is obtained by removing two screws at the back of the top cover and sliding the cover straight back along a pair of grooves in the side extrusions. The bottom cover comes off the same way, if necessary. There are ripples along the edges of the top and bottom covers which, at first glance, appear to be warpage in thin metal. When you look at the covers from the inside, though, it becomes obvious that those ripples were put there on purpose by a specially made tool. What they do is serve as springs, to wedge the covers tight in the grooves. That keeps down rattles at fairly high receive audio levels and most likely helps with rf shielding.

Most of the circuitry is built on epoxy-glass circuit boards which plug into a motherboard. These boards aren't going to crack if the rig gets dropped; there's a partial card cage to take care of flexing, and a hold-down is secured by a screw and the top cover. There was a little cost reduction here, but no real corner-cutting. The screw that holds the hold-down is about 1/16" too short so that it has to be backed all the way out to remove a card and tends to drop into the works. A board puller is stored inside in a clip next to the speaker. It's a simple type and has to be used carefully, but it cuts the risk of hurting a board or a socket.

The front panel carries no rf. It is removed by taking out four screws and pulling it straight out of the chassis. This is done when the remote control kit is used.

The rf modules are full of shielding and tight construction and don't look particularly easy to take apart in the field. A nice touch, though, is the accurate mechanical alignment of the side extrusions where the modules meet the main chassis and each other. There is no tendency for the top and bottom covers to catch at the joints.

The aluminum parts have anti-corrosion surface treatment, apparently Iridite. Outside surfaces are black anodize, black vinyl, or black paint.

Uses

The UV-3 fits in as a main desktop or mobile workhorse for dependable local communication. The design clearly doesn't contemplate operation while in motion on foot. While this is not wholly out of the question, it would require a lot of external accessories, and the rig is a pretty hefty hunk of hardware as well as a power-eater. The power requirements are targeted at car electrical systems and can be supplied easily from an ac-operated power supply. In emergency operation from a storage battery, or during very long periods of mobile operation with the engine shut down, there could be a problem. More about this later.

Drawbacks

There are a number of deficiencies in the unit that have nothing to do with its communication capabilities. These are failures of concept rather than of design or manufacturing.

Probably the most important is that the current drain on receive is much higher than it should be. This one spec is anything but state-of-the-art. It is 0.9 A. Almost half of this is used up by the dial lights that make the frequency switch settings visible. Thus, in emergency operation in a disaster involving general power failure, a battery small enough to carry easily to an operating position would be hard put to keep going for a day or two. A full-size car battery would be called for.

No method is provided for turning off the lights, and if the lights are simply disconnected to save power, the dark plastic window makes the dials almost impossible to read. As a stopgap measure, I cut a piece of 1/16" acrylic sheet the same size as the window (which drops easily out of its groove when the meter is pushed back against the mounting spring) to make a clear window and disconnected the lights. Unfortunately, this makes the 5 visible whether the last digit is zero or 5.

A better fix would be to glue a reed switch to the top edge of the lamp board just under the top cover, wired in series with the lights. Laying a magnet on top of the cover would then kill the lights and allow the use of the original window without using the lights—except to get on frequency. Drake really should do something about this. There should be a light switch at the very least, and putting in knobs that have markings out in the open would be better. As part of the latter, replacing the 0/5 toggle switch with a rotary like the rest would make operation a little easier.

This leads us to the way you change frequency on a UV-3—the same way you preflight an airplane. That is, you do a complete checklist, examining and verifying the position of *every* switch and knob on the panel. If you're only moving within the same megahertz, you can get away with just twisting knobs in the display row. Any more than that and you're likely to end up with the wrong offset, out of band, or not changing frequencies at all.

A few hours of thought about human engineering would have helped here. If the panel were as good as what's behind it, the frequency could be read unambiguously from one row of digits—band, offset, and all. And if the diode board and selector switch were retained at all, it would be obvious to the eye when the dial was disabled.

Another thing that didn't receive quite enough thought at the brainstorming stage is the remote control feature. Remoting, by itself, allows theft protection of the expensive parts by mounting the rig in the trunk or wherever else the owner's imagination and determination allow. However, security is only one of the purposes of remoting—the other is space conservation in the crowded front seat areas of today's cars.

The panel of the UV-3 is plenty big! Remoting cuts down on depth, but doesn't do a thing for the frontal area. I wouldn't particularly care to have a collision while a UV-3 panel was next to my legs, either. Using standard components, I figure a control panel could be made about twice the area of the end of a walkie-talkie and maybe 3 inches deep. Then if a blank panel were put on the main chassis with a recessed socket to take the miniature control panel, removal from the vehicle would be accomplished by unplugging the cable from the main chassis panel and popping the control panel into the chassis. This, incidentally, is not an unreasonable homebrew project.

Two of the features could just as well have been left out, to make space available for more useful things.

The first is the scan feature. When a carrier comes up on the priority scan channel, the voice you were listening to goes away in mid-word. I can hardly conceive of anyone wanting to hear everything said on some other channel in preference to the QSO in progress. Reversing the priority might make some sense, but monitoring another machine really requires a separate receiver. Also, whenever the frequency jumps to check the priority frequency and carrier is present on the selected channel, there is a short but loud burst of noise as the vco settles on the other frequency. This gets very annoying when it happens every couple of seconds and soon forces the user to shut the scan feature off.

This should not influence anyone's decision on whether or not to buy the UV-3. When a feature is useless in principle, it doesn't matter whether or not it works.

The other thing that could be eliminated is the diode programming. It was necessary on such early rigs as the IC-22S, but when any frequency can be dialed up directly from the front panel, internal diode programming is redundant. Elimination would also get rid of the confusion with the channel switch. If you do program the diodes, do it on a day when you have plenty of time, and use a good light and decent tools. Check your work thoroughly, or, better still, get somebody else to do the checking. The layout of the diode boards is such as to invite mistakes. One thing they did right was to supply diodes

Continued on page 164

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Extremely Low Frequency Radiation: Cause for Worry?

—studies on ELF are inconclusive, but the battle is joined

Invisible health hazards may hang over America—radiation from high-voltage power lines.

Scientists and researchers worldwide are beginning to understand more about the effects of Extremely Low Frequency, ELF, as they call it. And some of these scientists are becoming concerned.

Most people believed, at the time when high-tension wires first appeared, crisscrossing and looping over our major cities and the countryside, that the electricity in the wires stayed there—that it did not leave the metal and pass through the insulation.

Now, of course, we know better. The flux set up by wires carrying high voltages is composed of two distinct forces: electric and magnetic fields.

We also know that these fields, at the right intensities, can reach us. But, unlike microwaves, which have been proven to be dangerous, little is known of the possible dangers of low-frequency radiation.

Presently, there are more than 100,000 miles of overhead high-tension lines in the United States which carry up to 765,000 volts at 60 Hz (50 Hz in Canada, 25 Hz in most of Europe). For the future, power companies are looking to lines carrying 1 million and 1.5 million volts—and that's what has many people concerned. The fluxes formed by such high voltages are enough to make your hair stand on end if you walk near them. And, if you hold a 40-Watt fluorescent bulb underneath a 345,000-volt line within about 100 feet of the line's right of way, it will light up.

Why do we need such high voltage? The answer is simple. The higher the voltage, the cheaper it is to transmit. Line losses are reduced as the voltage is increased.

Around 1967, realizing that the way to go was higher and higher voltages, studies funded by the American Electric Power Company and carried out by Johns Hopkins University looked at linemen who worked near high-voltage lines to see if they were being affected by the fields.

The linemen's health was studied, and so were some mice in the laboratory who also received exposure to similar ELF fields. Several of the linemen showed nominally low sperm count, but nothing conclusive. The mice seemed unaffected except that their progeny had slightly stunted growth. Again, however, the departure from normal fell within statistically acceptable limits. Even so, for most scientists and for the electric power companies, this showed a need for further experimenting and tests.

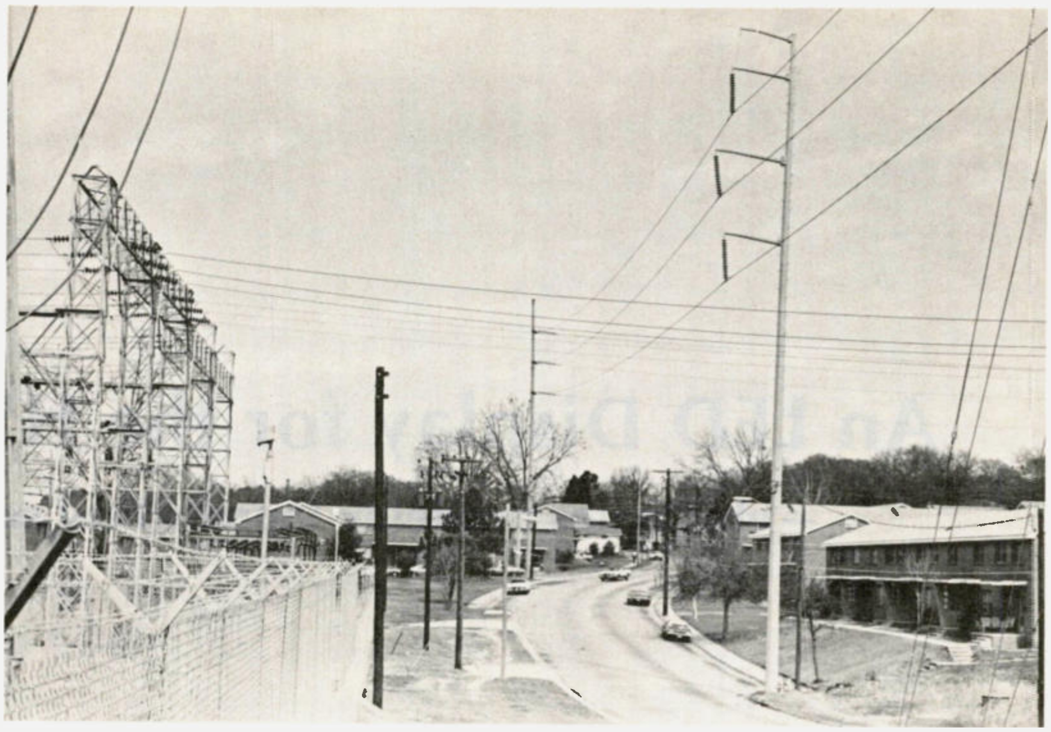
Then came Project Sanguine, a Navy project to build a huge antenna network covering hundreds of acres in Wisconsin. It was designed to transmit radio messages to submerged submarines throughout the world's oceans. The transmitting frequencies would be near those of an overhead power line—actually a bit lower, in the 15-20-Hz range.

The project was, to say the least, controversial. Environmentalists objected to it because it would literally rip up large tracts of land needed to bury the antenna. Others pointed to a study done by the University of Wisconsin which showed that ELF affected the physiology of a slime mold. Other studies done during Sanguine's planning stages also showed that ELF affected some lower organisms. The studies did not necessarily show ill effects, but they indeed showed a cause-and-effect relationship. Those studies, and citizen protests, were enough to table Project Sanguine.

Around this time, the late 1960s and early 1970s, a lot of other people started to get into the ELF act. For more than three years, New York State's Public Service Commission held hearings on the ELF situation. As a result of those hearings, packed by folks who didn't want a proposed 765,000-volt line running across their farmland, the PSC admitted that ELF presents some health threat to those who live and work near the lines.

The PSC did two things in response to its ELF hearings. It created an Administrative Research Council which would fund research on ELF's effects, and it widened the right of way of new lines from 350 feet to 1,200 feet. Right now, however, the Power Authority of New York is fighting the ARC on the grounds that setting up a research group is not within the PSC's jurisdiction. The courts have not yet ruled on that point of law.

One of the more vocal speakers at the hearings was Dr. Andrew Marino, a researcher at the Veterans Administration Hospital in Syracuse, New York. "There is little doubt from the literature that biological changes do occur in humans exposed to high-tension wires," he said. Marino has been studying the effects of ELF on mice for about 3 years under a $75,000 National Institute of Health grant. In previous studies, he found that mice exposed to ELF had stunted growth. Results of his present studies have not yet been released.



The US Department of Energy has allocated about $3 million for high-voltage studies, and Bob Flugum, assistant director of DOE's Power Delivery Program, said that about $7 million is being spent on research throughout the world.

A famous study done in the Soviet Union showed that switchyard workers who worked near high-voltage equipment showed pulse rate changes and blood pressure fluctuations. It also showed that the men and women had tremors during or shortly after exposure. The studies were not conclusive, however, because only about 300 workers were studied — certainly not a large enough test sample. Even so, the Soviets have set maximum exposure standards for their citizens. The US has not. The Soviets, you may remember, also set standards for microwave exposure before the US government even acknowledged that the super-high frequencies were harmful.

"The most important proof that ELF alters biology is that some researchers are using it to heal bones," said Marino. "There is no doubt it effects living organisms, but exactly what those changes are, we are not yet certain."

Dr. Harry Kornberg, a researcher for the Electric Power Research Institute in Palo Alto, California, is not as convinced as Marino that ELF affects humans. He said that work so far showing effects on humans and animals has been shoddy and not within good scientific procedure. EPRI is a research funding group sponsored by American utility companies, each of which gives the Institute money for its work. Kornberg said, however, that we are just beginning to see the start of what he calls "highly controlled, high quality, clinical testing."

Farmers will tell you that grass turns brown under high-tension wires, and just recently Penn State reported that leaf tips turn brown in the lab under similar conditions. Another recent study which Kornberg believes was done with good control was one at the University of Illinois. It showed that honeybees exposed to ELF build unusually small hives.

But Kornberg still disagrees that high-tension wires affect humans. "There have been no definitive studies which show it," he said. And he is correct.

No one has yet studied large groups of people exposed to ELF for long periods of time. Only then could we be certain that statistical and other laboratory anomalies did not creep into the results.

But even as scientists are beginning now to pull together all the information on ELF, and excellent studies are being done both in and out of the lab, a new wrinkle has been added — direct current. In an attempt to make power transmittal even more economical, power companies have begun experimenting with dc in voltages reaching over 1 million volts.

In case you haven't seen the papers in the past year, a battle over such a line has been brewing in Minnesota. The fight is between environmentalists and farmers on one side and the power companies on the other. A 400,000-volt dc power line was planned from North Dakota to the Minneapolis-St. Paul area. While the line's towers were being built, there was harassment allegedly from the farmers' side. They supposedly tore down towers and generally made life miserable for those building them.

Right now, the farmers seem to have lost the war. The line has been built and is now under test awaiting a power plant's completion in North Dakota.

Mike Casper, chairman of the Physics Department of Carleton College in Northfield, Minnesota, is writing a book about the struggle. "Very little is known about dc's effects at such high voltage," he said, "and the line, once in operation, will be the largest dc carrier in the nation." There is now one in California.

Casper, who has followed the fight from its inception several years ago, said that he expects to see continued guerrilla tactics from now until the 400-mile line carries its first electron . . . if it ever does. ■

An LED Display for the HW-2036

—eliminates unwieldy thumbwheel switches

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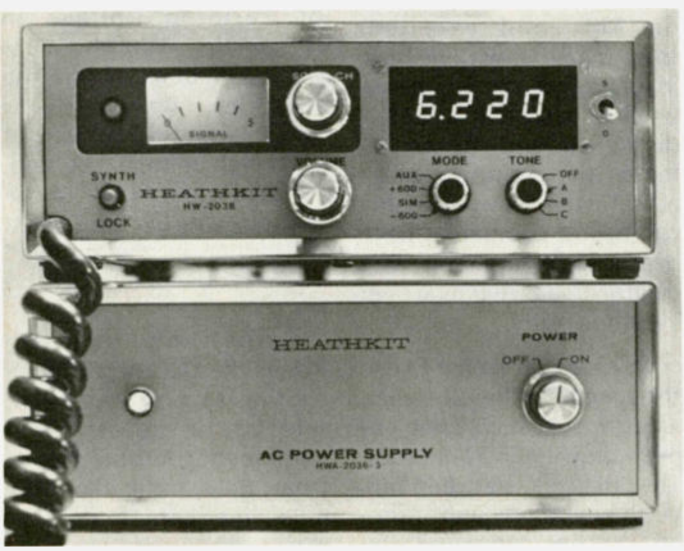
El Toro CA 92639

Since I purchased and built the HW-2036, I have had only praise for the unit. However, after operating the HW-2036 for some time, I found the thumbwheel switches quite worrisome. It is almost impossible to see how to change frequency in the car at night and very difficult to get to the switches while driving. For these reasons, I decided to modify my 2036. When the idea for this modification was in its earliest stages, I knew I wanted to put the digital display in place of those awkward thumbwheels, but I did not know what to use to set the operating frequency. I knew an external box to enclose such a unit would look messy, and that went against my main objective which was to enhance the looks and capabilities of my HW-2036. Then the idea came to me to enclose a circuit board inside the Micoder™ that would do just that. It was neat, compact, and would make the Micoder able to switch frequency and also keep it a touchtone™ pad, just as before. The finished product has a very professional appearance and I think it will appeal to those who want to update their units to digital readout.



HW-2036 with digital modification installed.

Circuit Description

I decided to put common-cathode seven-segment LEDs behind a red plastic lens to display the frequency being used. I implemented the Fairchild decoder/driver because it drives the LEDs directly (Fig. 1). This means that dropping resistors are not needed from the driver to the display. In order to hold the BCD frequency and to feed it to the synthesizer board, I used SN74LS298s. These are quad two-input multiplexers with storage. The zero—or five-kHz digit is developed by a BCD-to-decimal decoder. This, in turn, is fed to an inverter for conditioning and then to a five-input NOR gate for the final 0/5-kHz output signal. This signal is connected to pin X on the synthesizer circuit board.

The microphone cable can be replaced with a new one that has at least twelve conductors. I revamped the Micoder so that it is a touchtone pad in the transmit mode, and so that the operating frequency can be selected in the receive mode (Fig. 2). Three chips were installed into the 2036-MB (MicBoard). The NE555 was used as a clock generator for the MC14419 keypad-to-BCD decoder. The MC14410 keypad tone integrator is also installed on this board. The original microphone element is retained but I added a 2.2k resistor from the original Micoder board. Two 7805 voltage regulators were added to supply the necessary voltage for the additional circuitry (Fig. 3).

Chassis

To accomplish the modifications, proceed as follows: Remove all the covers and knobs from your 2036. Care should be taken not to ruin the synthesizer lock LED as you separate the front panel subplate and bezel. Next, remove the thumbwheel switches and save the four supporting screws and nuts. Fit the red plastic window over the thumbwheel switch window and mark the locations for the four holes that you will drill to accommodate the previously-removed supporting screws. On the side of the window where the 0/5 switch is located, a small notch should be filed in order for the nut (that holds the 0/5-kHz switch to the subchassis) to clear when assembled. Two #6 screw holes have to be drilled to hold the 7805 regulators against the subchassis. The first hole should be drilled beside the speaker and below the synthesizer board. See Fig. 4. To get to the second hole, you will need to pull the power amplifier board a few inches away from the back panel (Fig. 5). Drill these holes with care and do not let shavings fall near the boards. Install both 7805 voltage regulators as illustrated in Figs. 4 and 5 using silicone grease. Then reinstall the power amplifier board.

Now remove the microphone cable from your rig. It will be replaced by a 12- to 24-conductor cable. Place some type of insulation over the speaker connections and side magnet, preferably electrical tape. This will keep the snug-fitting 2036-DB (display board) from shorting on the speaker. The display board should be on a horizontal plane with the bottom of the display window. Use a plastic washer on the rear and front mounting hole of the 2036-DB. This will keep the mounting screws and nuts from shorting the bottom of the circuit board. Use 6-32 × 1¼″ countersunk mounting screws for the 2036-DB (Fig. 4).

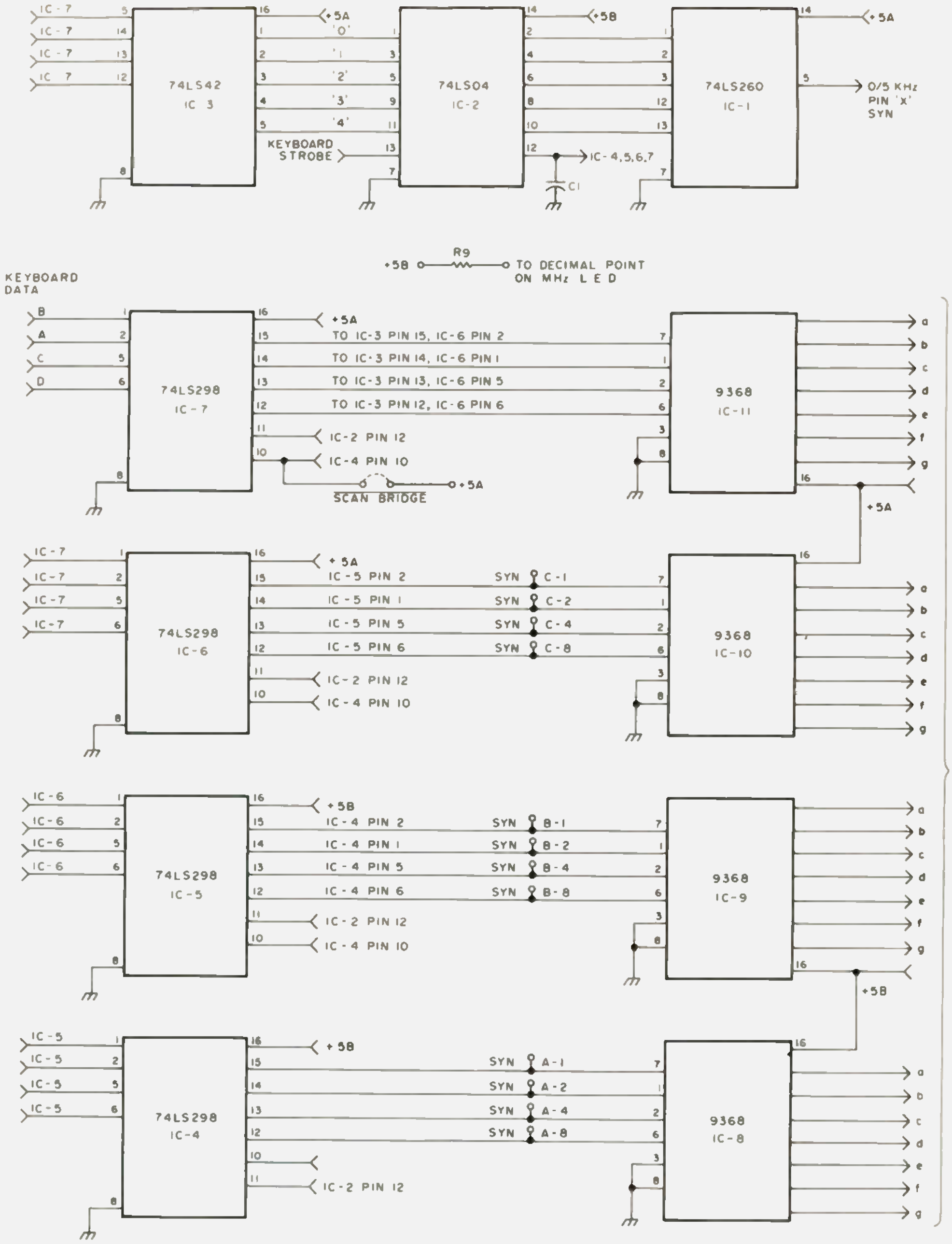


Fig. 1. 2036-DB Display Board schematic.

MicBoard 2036-MB

Disassemble the Micoder completely by unsoldering all the wires and by removing the board. Clean the terminal strip of all solder and wire. Retain the 2.2k resistor and join it to one of the microphone element leads. Connect a ground wire to the microphone element ground. The remaining lead is connected for audio output. See Fig. 6. Remove the pin sockets from your old Micoder board and reinstall in the new 2036-MB. These are the pin sockets that will hold the keypad. Put the chips in on the component side. Do observe correct pin locations. Connect pin 8 on the MC14410, pin 8 on the MC14419, and pin 1 on the NE555 to the ground plane. Notice that the .01-uF and .047-uF capacitors are electrolytic, so observe the correct polarity. The only parts that go on the underside of the board are the 1 MHz crystal and the .01-uF clock capacitor, if the disc type is being used.

After all parts are set up on the 2036-MB, follow the correct cable color code for interconnection to the 2036 (Fig. 7). On the 24-conductor microphone cable that I used, the end with pin connectors should go in the microphone housing.

Connect one wire to +5 V dc on receive, one to +5 V dc on transmit, one to +5 V dc, one to ground, and the last to audio output—all on the 2036-MB. The +5 V dc on transmit is labeled pin 3, +5 V dc on receive is pin 1, and audio output is pin 2. The +5-V dc power for the 2036-MB is acquired from the 7805 IC-1 originally in the rig.

Display Board 2036-DB

Molex pins may be used as well as low profile

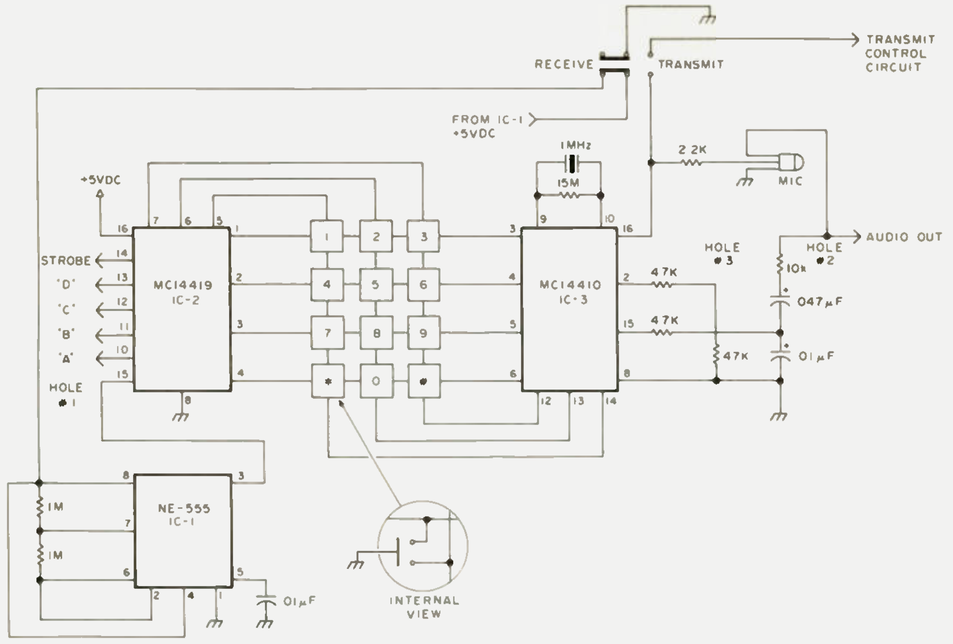


Fig. 2. 2036-MB MicBoard schematic.

sockets on this board. Install the sockets or directly install the chips. Install 220-Ohm, ¼-Watt resistor R9 to make the decimal point connection. Capacitor C1 is only installed if triple or double digiting is encountered when you key in a number. The value of this capacitor is dependent on whether or not the SN74LS298 chips match. The capacitor should be somewhere in the range of 100 uF to 470 pF. If desired, SN74LS48 BCD-to-seven-segment decoder/drivers may be employed instead of the 9368s, by running 2k pull-up resistors to the LEDs. When using the SN74LS48 chips, pin 3 of the decoder/driver should be clipped off, as the lamp test function is not used. (To test all lamps, just key in four eights in a row.) Using the pull-up resistors in this fashion makes for a rough time when you take the decoder/driver chips out and does not accommodate my scanner option board. (See Fig. 8 for pinouts on both chip styles.) From the synthesizer circuit board, remove all of the pull-up resistors associated with the thumbwheel switches: R401-409 and R411-413. Make a small solder bridge with a piece of wire at the scan bridge to pin 10 of IC7 if you are *not* using the scan option on the 2036-DB.

Resolder the wires from the thumbwheel switches to their corresponding display drivers. For the MHz, use IC8 pin 7. This is BCD "A", which goes to synthesizer circuit board pin A1. IC8 pin 1 is BCD "B", which goes to synthesizer pin A2, and so forth. IC9 is used for the hundreds of kilohertz and IC10 is used for the tens of kilohertz. IC11 remains to display the one-kilohertz digit. Remove the wiring from the 0/5-kHz switch completely. Put in the 0/5-kHz wire to the corresponding location on the 2036-DB. You will have to make a small five-wire bundle, eight inches long, out of the wires in the microphone cable to make the strobe and the BCD connections from the microphone cable to the 2036-DB. This wire bundle does not have to be shielded, but should be run under the volume and mode switches.

Install the 25-uF, 25-V dc and .01-uF capacitors on both outputs of the 7805 regulators. Connect the rear 7805 to the +5B power hole and the front 7805 to the +5A power hole. Install the ground wire connection to the 2036-DB at this time. The common-cathode LEDs that you choose can be socketed. Align all four sockets on a flat surface and "super glue" them together. Install the 2036-DB and, with a pencil, mark on the board the width of the display window opening. Remove the board and "super glue" the four sockets in the center of the marked display opening and to the rear of the board as far as possible. Keeping the sockets to the rear of the board will prevent the LEDs from scratching the red plastic lens. Remove the pins not used by the LEDs. Wiring from the sockets to the board should be accomplished by using wire-wrap.

Checkout

After I completed all connections and reassembly, I tested my modifica-

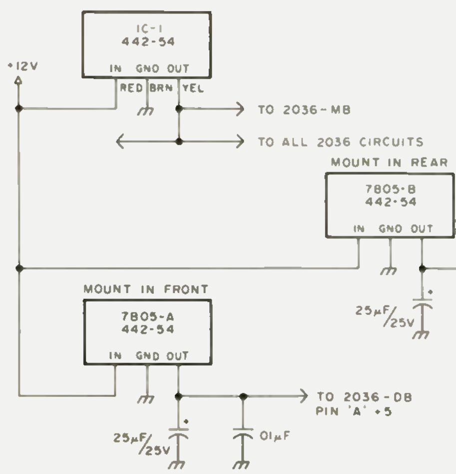


Fig. 3. 7805 voltage regulator schematic.

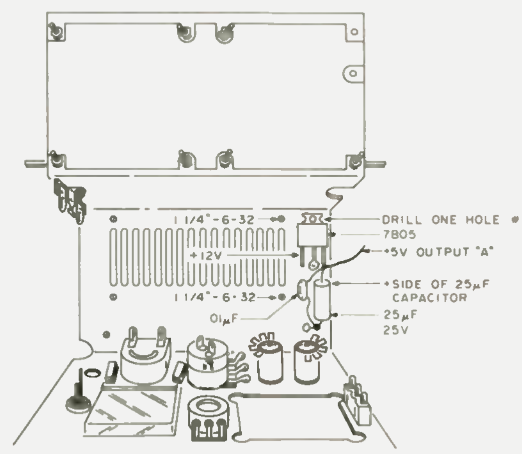


Fig. 4. +5-volt "A" supply regulator location inside speaker area.

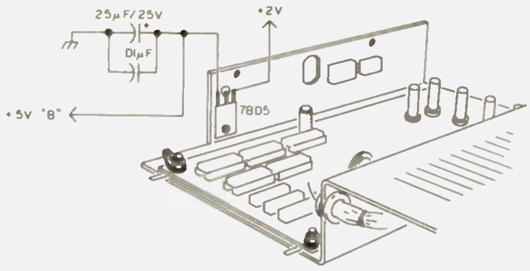


Fig. 5. +5-volt "B" supply regulator location inside transmitter area.

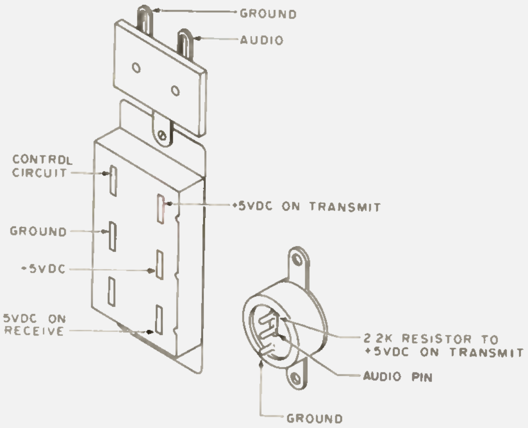
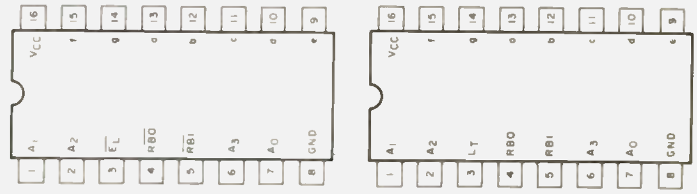


Fig. 6. Inside view of mic element and switch, showing the correct points for signal placement.

Fig. 7. Corresponding signal-to-cable colors used in the Radio Shack 24-conductor microphone cable. The end with the connectors should be placed in the Micoder.



A_0, A_1, A_2, A_3	Address (data) inputs
$\overline{E_L}$	Latch enable (active low) input
$\overline{RBI}$	Ripple blanking (active low) input
$\overline{RBO}$	Ripple blanking (active low) output
a,b,c,d,e,f,g	(active high) outputs

A_0, A_1, A_2, A_3	Address (data) inputs
LT	Lamp test
RBI	Ripple blanking input
RBO	Ripple blanking output
a,b,c,d,e,f,g	Outputs

Fig. 8. Seven-segment decoder/drivers. Either device may be used, although 2k pull-up resistors will be needed with the SN74LS48s.

tion. I started with the 2036-MB. With power on, the display should show random numbers and sometimes letters. I checked pin 8 of the NE555 for +5 V dc, and also pin 16 of MC14419 for +5 V dc. If this checks out, you may assume pin 3 of the 555 is generating a clock pulse. This pulse is used to generate the keypad strobe upon depression of a keypad number. The # and * are considered invalid digits, and, therefore, they will not generate a bit pattern when the operator selects a frequency. After depressing a valid digit, I looked for a short strobe pulse, one that goes from low to high and back to low. The BCD digit will be on the output lines as long as you hold your finger on the pad. Keypad data is fed to IC7 upon receipt of a keypad strobe pulse. It is then shifted in or out to the next stages, IC6, and so on. For IC7, which is the kHz digit, the BCD signals are sent to a BCD-to-decimal converter (IC3). This will send a logic one out if the BCD input is between zero and four, and a logic zero will be sent if it is between five and nine. IC2 inverts the signals which are then sent to a five-input NOR gate for the final 0/5-kHz output. A logic zero equals zero kHz and a logic one equals a 5-kHz signal.

Audio generated by the keypad-to-tone integrator MC14410 is coupled directly to the audio input line. In most units with this completed modification, the transmitter deviation needed to be lowered. It is advisable to check your deviation and set it to not more than 5 kHz.

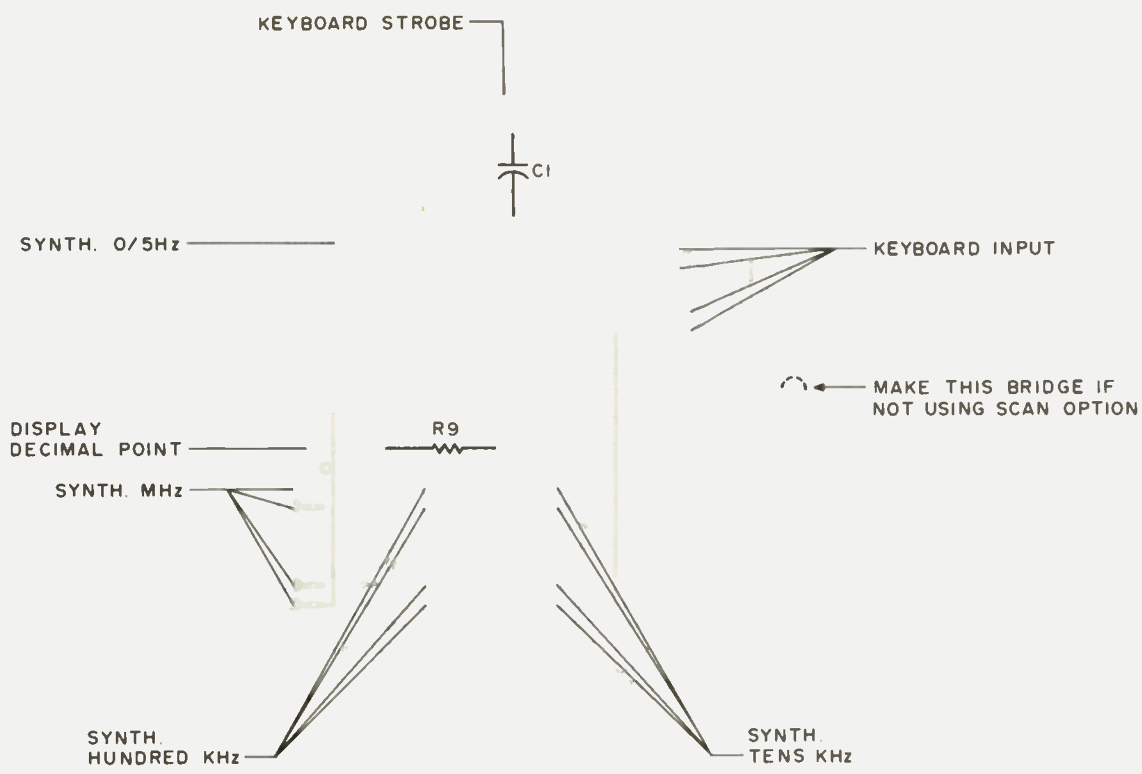
To display the operating frequency of 146.820 MHz, simply touch in the digit sequence 6, 8, 2, 0 on the keypad. The same is true for 147.855 MHz; the digit sequence would be 7, 8, 5, 5. When the push-to-talk

Required Parts

Quantity	Type	Description	Source	Price
2	7805	+ 5-volt regulator	Radio Shack	$1.29
1	W-1878	24-conductor Mic cable used on One-Hander™**	Radio Shack	$6.95
1	EK-2036	Touchtone kit	Data-Signal*	$13.50 + postage
4	443-694	Fairchild 9368 LED driver	Heathkit	$2.50 ea.
4	SN74LS298	Quad 2-input multiplexer	Hamilton-Avnet	$2.00 ea.
1	MC14419	2 of 8 BCD encoder	Hamilton-Avnet	$3.00
1	SN74LS260	5-input NOR	Hamilton-Avnet	$ .50
1	NE555	Timer	Hamilton-Avnet	$ .40
1	443-807	SN74LS42 BCD-to-decimal	Heathkit	$1.00
1	SN74LS04	Hex inverter	Hamilton-Avnet	$ .40
2		25-uF, 25-V dc capacitors		
4	FND-357	Common-cathode 7-segment LEDs	Fairchild	
1		Red plastic lens	Radio Shack	
2		1-megohm ¼-Watt resistors		
1		.01-uF disc capacitor		
1		220-Ohm ¼-Watt resistor		
1		1k ¼-Watt resistor		
1		Super Glue		

*Data-Signal, Inc., 2403 Commerce Lane, Albany GA 31707.

**Order at local Radio Shack with instructions for manager to order from: Radio Shack National Parts, 1801 South Beach, Ft. Worth TX 76105.



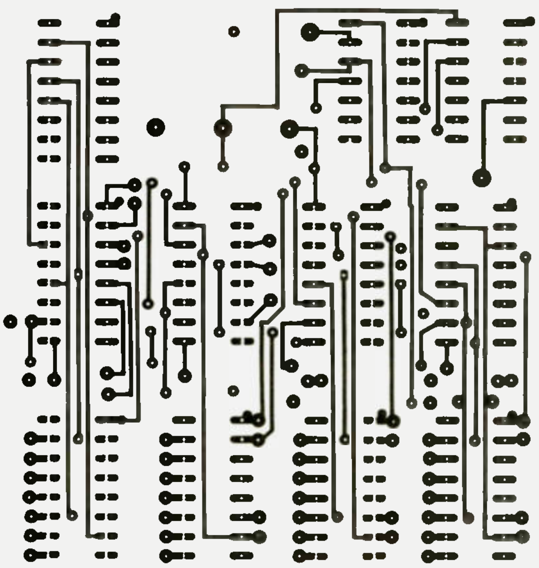
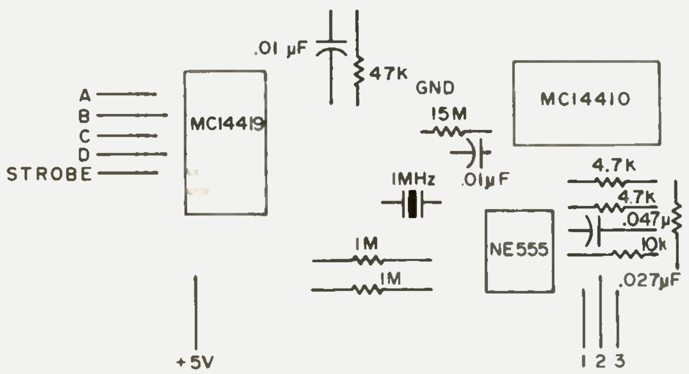
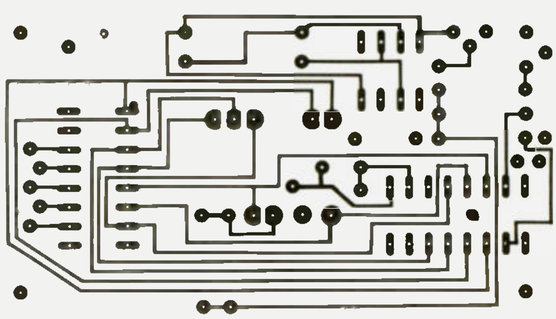


Fig. 9. PC board layout for the 2036-DB board. Top view shows components side; bottom view shows other side.

Fig. 10. PC board layout for the 2036-MB board. Left view shows component side; right view shows other side.





switch is depressed, the keypad is now a touchtone pad. Be careful not to hold your finger on a digit and then let go of the push-to-talk switch—you will find yourself on some other frequency.

Conclusion

This modification has been on my HW-2036 since April, 1978, and I appreciate the rig more each day. It works beautifully, and really is pleasing to the eye. The maximum overall cost for project parts should not exceed $65. The EK-2036 kit, which can be purchased from Data-Signal, Inc., includes a 1-MHz crystal, a MC14410 touchtone encoder, and assorted discrete components. There is another option board which allows the HW-2036 to scan any 1-MHz segment of the band and stop on any carrier. A small push-on only switch is added at one side of the microphone to cause scanning to continue. This works fine for those units that are not plagued by birdies at various divisions of one MHz.

The MicBoard (2036-MB) and Display Board (2036-DB) can be acquired by writing directly to me. These boards are double-sided and plated through. The price for two boards and an instruction booklet is $16.95. For the intrepid constructor, PC board layouts for the two boards are shown in Figs. 9 and 10.

My thanks to Jim Bell K4FUP for the accompanying photograph. ■

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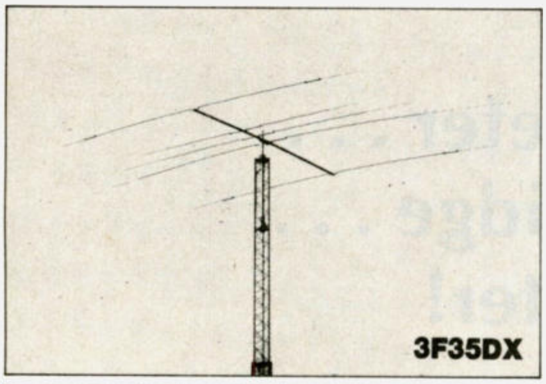
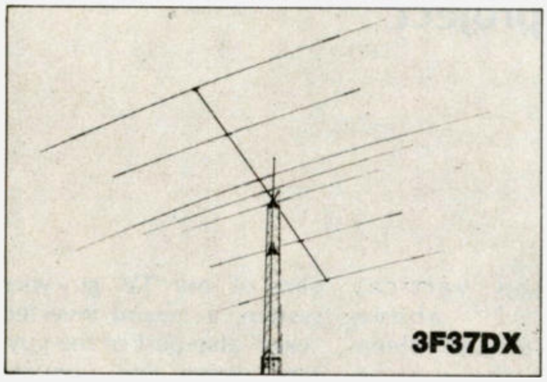
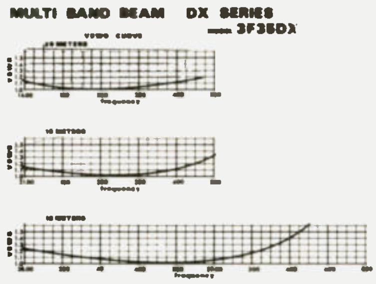


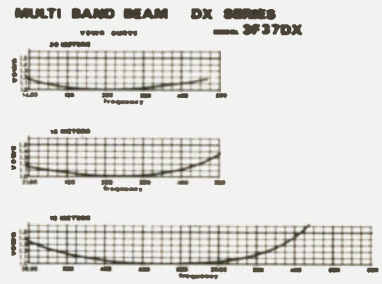
3F35DX

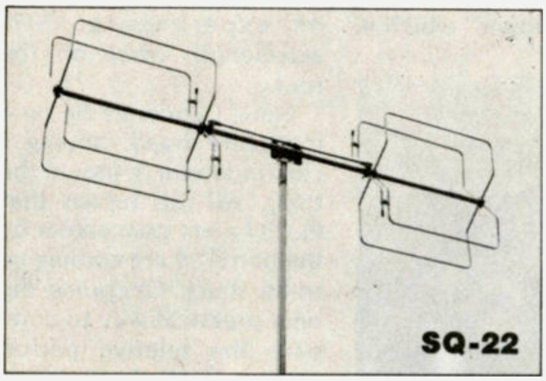


3F37DX

MODEL		3F37DX	3F35DX
BAND		14 21 28	14 21 28
ELEMENTS		7	5
ELEMENTS PER BAND	20m	3	3
	15m	5	3
	10m	5	3
ANTENNA GAIN	20m	8. 5dB	8. 0dB
	15m	10dB	8. 5dB
	10m	10dB	8. 0dB
FRONT BACK RATIO		25dB	20-25dB
MAX. POWER INPUT		3kw	3kw
VSWR		1. 5 OR BETTER	1. 5 OR BETTER
IMPEDANCE		50 Ω	50 Ω
MAX. ELEMENT L		10. 5m	10. 5m
BOOM LENGTH		7. 5m	5. 0m
BOOM DIAMETER		50mm	50mm
TURNING RADIUS		5. 3m	5. 25m
WIND RATING		40m/sec.	40m/sec.
SUITABLE MAST		50mm	50mm
WEIGHT		23kg	17kg







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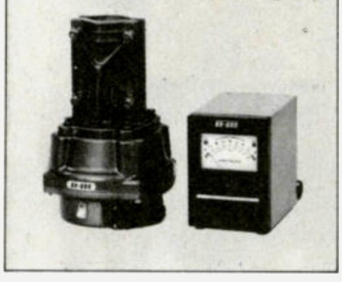

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It's a Wattmeter . . .
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It's Swattmeter!

—a super home-brew project

A. R. Pedrick K4LBY
1446 Hagen Lane
Rockledge FL 32955

One of my favorite pastimes in amateur radio is designing and building antennas for the HF spectrum. I have a 5-band trap vertical mounted 12'' above ground, a ground plane vertical on the roof, a 10-meter "sloper" which is part of my TV guy-wire system, a 3-band inverted "vee," also part of the guy-wire system, and a couple of experimental 3/2-wavelength wires on the roof.

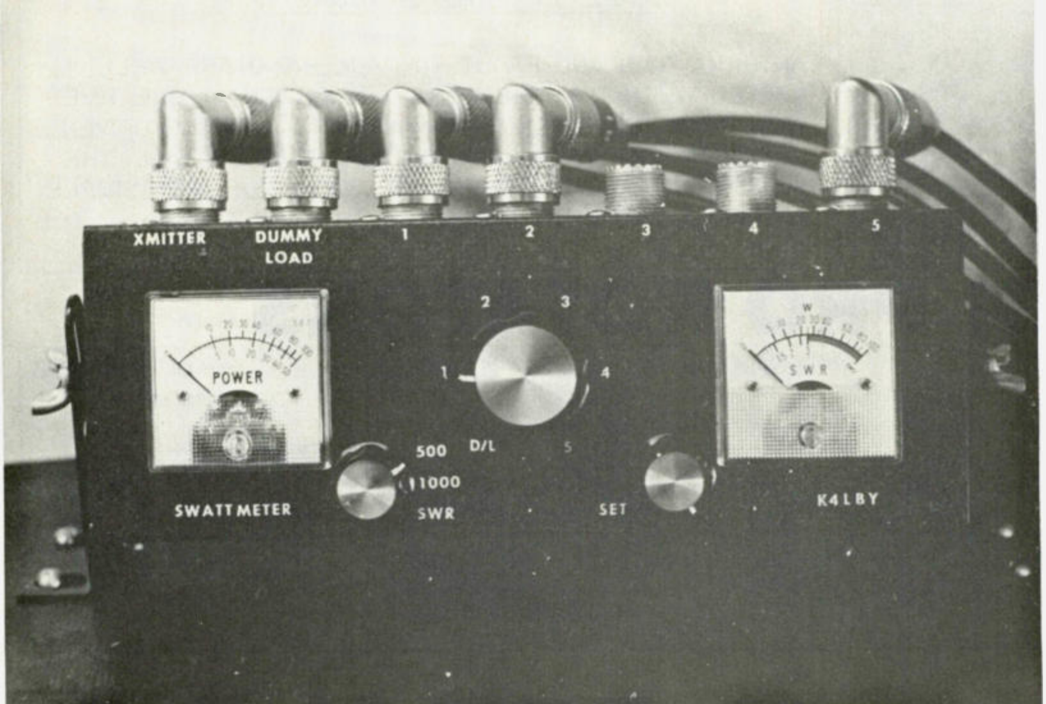

Photo A. The Swattmeter is mounted in station operating position. The meter on the left reads forward power. Reverse power and swr are shown on the right.

Now, I am working on a miniature quad, hoping I can find room to mount the thing. All this means that PL-259 coax connectors by the barrelful are coming into the shack. Of course, the only practical way to compare the relative performance of all these antennas is to use a husky coax switch so that I can readily go from one antenna to another during a QSO, and hopefully get some meaningful reports from the guy on the other end without making him wait until I disconnect and reconnect coax cables.

With this thought in mind, I recently acquired a B&W Model 595 coaxial switch which is a 6-position in-line model designed for wall or desk-top mounting. I preferred the in-line arrangement to the axial configuration, in order to keep the thing from looking like an octopus squatting on the shelf.

Once I had the switch in hand, I started to think about all the other outboard stuff I had connected between my transceiver and the antennas. There was, of course, the low-pass filter, then an swr meter, and finally a borrowed power meter. Now, with the switch in place, the shack was beginning to resemble something out of Rube Goldberg. Besides the fact that it looked like a mess, did you ever have the need to determine just how long your transmission line is for matching purposes? Some of my antennas load best when the transmission line length is in multiples of 45'6" for RG-58/U. Outboard devices are handy, but just how much length does a switch like the B&W add, anyway? (I'll admit that the length added by any one outboard device is negligible, but I'm a nitpicker. And when you add two or three other gadgets, you start talking feet, not inches.)

Needless to say, the B&W came apart, and I discovered that the effective transmission line length was variable, depending on the position of the switch. Fig. 1 shows how the switch is wired as it comes from the factory.

When the switch is in positions 1 or 6, the effective length is the shortest, and in positions 3 and 4, the longest. As I said before, it probably does not mean much as a matter of practical fact, but what did matter was something else I noticed: There was a lot of wasted space in the guts of that switch! The space, in fact, looked tailor-made to contain a couple of meters and the necessary components for an swr/power bridge.

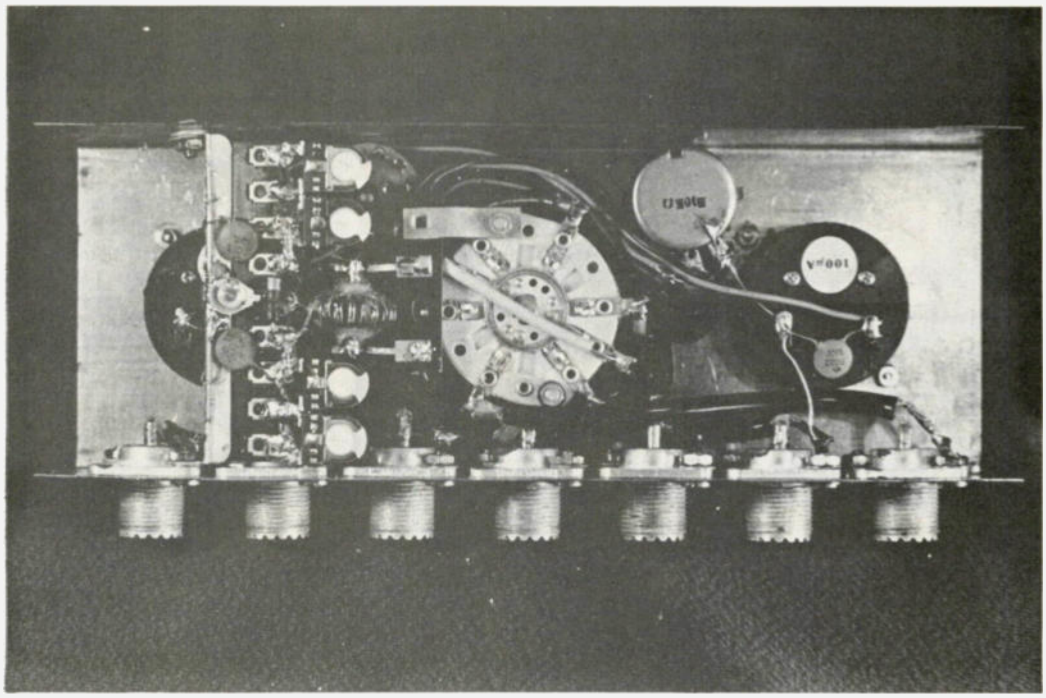

Photo B. An inside view of the Swattmeter. The SO-239 connector on the left is the input.

And so the Swattmeter was hatched, which is really what this article is about (I do ramble, don't I?). Line length forgotten for the moment, I took off after this new idea like a hound sniffin' grass, much to the exasperation of the XYL.

You might ask, why bother? Well, it's neater and results in less junk outboard from the transceiver. Besides, it looked like a challenge, and then there's that line-length factor . . .

Description and Criteria

The accompanying photographs pretty much show how the Swattmeter is constructed and what went into it. There is really nothing new in its design, but, rather, a circuit modification or two. The wattmeter portion of the Swattmeter uses the 100-uA dual meters cannibalized from the Swan model SWR-1. Also cannibalized from the Swan is the dual 10k potentiometer used for swr "set." What is different from the Swan meter is the toroid current transformer used as the directional coupler, rather than the transmission line-type coupler used in the Swan and similar inexpensive swr meters. I used the meters from the Swan because I had them, and they were already calibrated in terms of power and swr. Of course, any 100-uA meters may be used. The only criterion is that they fit into the space on either side of the switch.

Fig. 2 is the schematic of the Swattmeter. You will see that, with some exceptions, the circuit is similar to one described by Bruene in *QST* (April, 1959). The bridge circuit by Bruene uses a capacitive voltage divider and a current detector to provide two voltages proportional to the forward and reflected voltages or currents of the transmission line. See Fig. 3.

The circuit in Fig. 2 uses the stray capacitance between the current transformer and the line as part of the voltage divider. Most bridge designs try to eliminate stray capacitance so that a controlled amount can be used in the design. I figured, why fight it? I coudn't figure out how to shield everything in the confines of the B&W switch, and "if you can't lick 'em, join 'em!" The variable 6- to 20-pF ceramic trimmer of Fig. 2 is the other half of the voltage divider.

The design here uses a bifilar-wound current transformer in which the low impedance at the secondary is split into two equal parts. The center tap on the transformer is also part of the voltage sampling network (stray capacitance plus the 6- to 20-pF trimmer) so that the sum and difference voltages are available at the ends of the transformer secondary winding. With the values shown, the meter maintains its calibration to within 10 percent over the frequency range of 3 to 30 MHz—and probably from

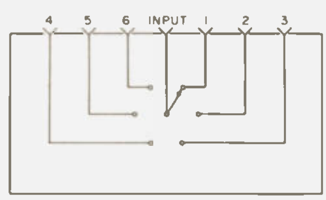

Fig. 1. Simplified wiring diagram, B&W Model 595 coaxial switch. Note: Automatic grounding (not shown) of all unused positions is incorporated.

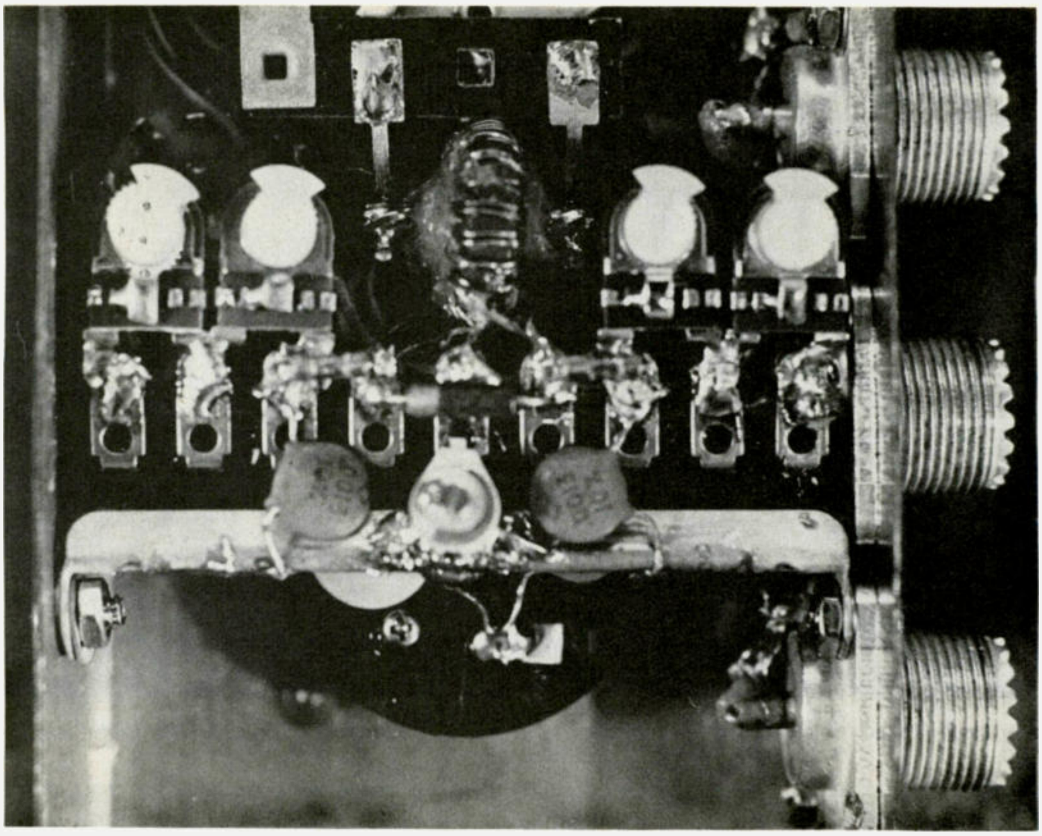

Photo C. A closeup view of nine-lug terminal strip and current transformer. The input SO-239 connector is on the lower right.

1 to 50 MHz, although I have used only the former. The degree of isolation between forward and reverse readings into a matched dummy load is excellent (estimated to be between 20 and 30 dB). I can pump nearly 500 Watts of rf into a 50-Ohm dummy load through the Swattmeter with nary an indication of reverse power.

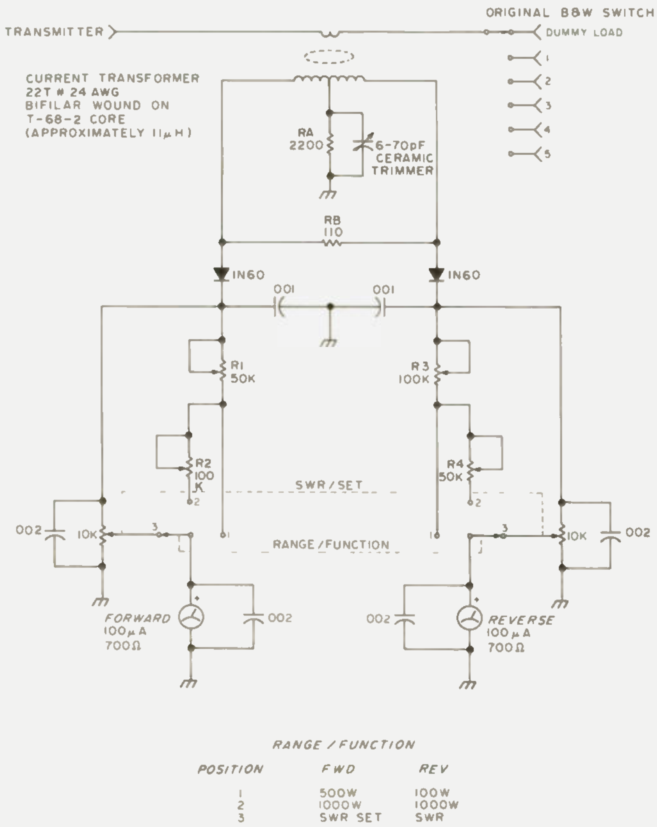

Fig. 2. Swattmeter schematic.

A three-position switch is used as a function/range selector allowing for two power ranges and an SWR position. Position 1 of the switch allows forward power measurement of 500 Watts and reverse power of 100 Watts. Position 2 reads 1000 Watts forward and 1000 Watts reverse, and position 3 is for standard swr measurements using the "set" control variable potentiometer to calibrate the left-hand meter in the conventional manner. Swr is then read directly from the right-hand meter. Alternatively, the "swr set" potentiometer dial also can be calibrated in Watts if desired. When the function switch is set at swr and the pot is wide open, maximum sensitivity (both forward and reverse) is less than 5 Watts full scale.

The wattmeter can be made more sensitive by increasing the number of turns on the toroid. This causes the inter-turn capacitance to increase, however, and causes the response to fall at high frequencies. Consequently, the directivity also falls. The values of R_A and R_B were determined experimentally and can vary by 10%. R_B should have a value of 150 Ohms if the Swattmeter is to be used predominately with 72-Ohm cable. The values shown are good for 50- to 53-Ohm coax.

The 1N60 diodes need to be matched for both forward and reverse resistance. They should be within 5% if possible, with the forward resistance more important than the reverse.

A word here about bypass capacitors is in order. Use good quality ceramic capacitors rated at 1000 volts. Some ceramic capacitors act as fine inductors, especially at the higher frequencies, and can cause all sorts of spurious readings. This is particularly important in the confined space available in the B&W switch body, with all that rf bounding around inside. With good capacitors, noninductive resistors, and the layout shown, you should have no problems.

Construction

Assuming you have all the parts handy, the first step is to *completely* disassemble the B&W switch. I removed even the SO-239 coax connectors by drilling out the rivets in order to allow ground lugs to be mounted, one at each connector. The reason for this will be evident later on (remember the original line-length problem). Besides, the paint job on the 595 didn't please me, and I wanted to refinish the thing once I got the meter and control holes drilled.

The layout is tight but

workable, and depends pretty much on the size of your meters and other components. The meters I used mount in a 1½-inch diameter hole (which was convenient, since I happened to have a Greenlee punch just the right size). Needless to say, but I'll say it anyway, *check all dimensions carefully*. You get only one chance for proper clearances.

Once all the holes are drilled, the original finish can be removed (your option) with lacquer thinner, and the unit primed and refinished. I used Walsco Collins Instrument charcoal gray wrinkle varnish which comes in a convenient spray can.

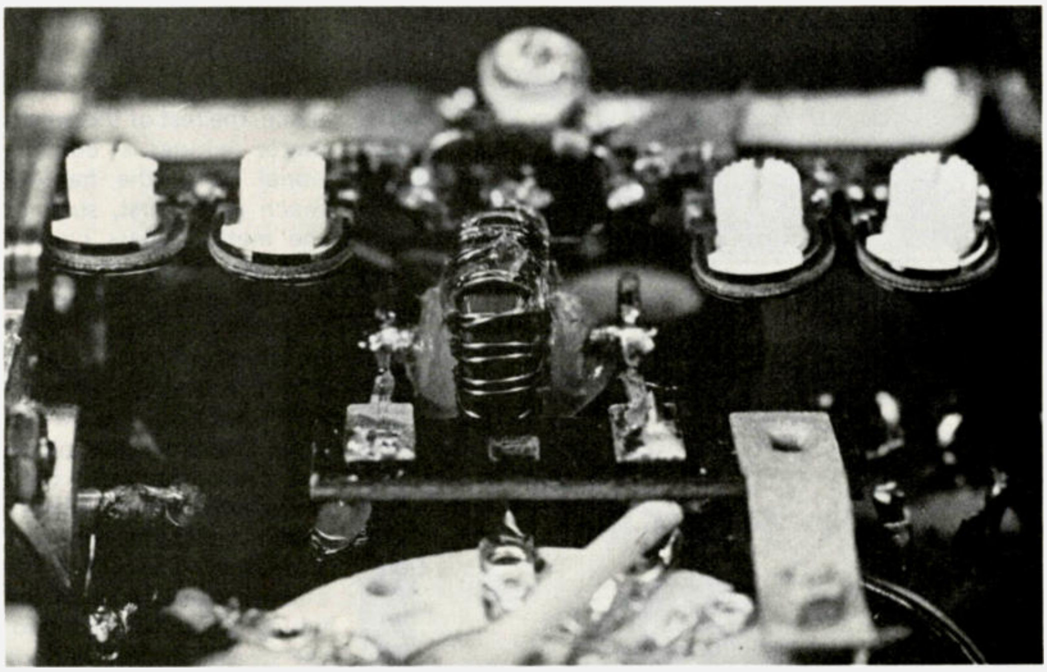

Photo D. Detailed view of the two-lug terminal strip and current transformer.

Once the paint is dry, you may wish to apply the panel markings before the components are mounted. It is easier if you know what you want and where you want it. Dry-mount lettering is easy to apply even to wrinkle finish, but should be sprayed afterwards with a clear finish to protect the lettering. I usually do it the hard way, and put the markings on last just in case I want to change something at the last minute.

The SO-239 coaxial chassis connectors should be mounted using 6-32 hardware with lock washers and a ground lug for each connector. Make sure there is no paint on the inside of the case, which may cause a poor metal-to-metal contact. Mount all the other components as shown in the photos, except for the nine-lug terminal strip. (It will be mounted after the switch has been wired.)

First, after all the hardware is secure, wire the coax switch. The input to the switch is now the first SO-239 connector on the left. This was done to allow room for the current transformer. All output connectors were wired to the switch in a clockwise direction using 5" lengths of RG-58C/U, which is more flexible than the others. The outer conductor of each length of coax is grounded to its respective SO-239 ground lug, but stripped back out of the way on the end which connects to the switch. This provides for shielded leads *all the same length* within the Swattmeter (I told you we would get back to that) and enables the switch-wiring to be routed easily out of the way of the other components. The effective transmission line length of the switch when wired in this manner is approximately 1 foot in all positions, give or take an inch.

Don't forget that the B&W switch actually has two decks, one of which grounds all unused positions. In the original switch, this second deck was grounded at the switch at a lug on the switch spacer. I preferred to eliminate that lug and ground the second deck to the nearest SO-239 ground lug.

The input side of the switch uses a 3" length of RG-58C/U, prepared as above and fastened to the input SO-239 in the same manner as the other cables. The exception is the other end, which goes to one lug of a two-lug terminal strip as shown in the photo. The second lug of the terminal strip is wired with bare wire to the input terminal of the switch.

You may have to improvise a little with this two-lug terminal strip, which is used to hold the toroid transformer. I found mine in my junk box and it was a perfect fit.

As you can see in the photos, the current transformer is slipped over a short piece of RG-8/U center conductor and the stripped ends of the RG-8/U are then soldered to the two-lug terminal strip. Fig. 4 illustrates a little more clearly how this is done. The physical configuration of the terminal strip lugs and the RG-8/U inner conductor acts as a half-turn loop, or primary, for the toroid. Actual dimensions are not critical, but the wiring to and from the terminal strip lugs should be soldered at the base rivet of each lug and *not* where the RG-8/U center conductor is soldered. The toroid is held in place by a few dabs of silicone cement.

The current transformer is wound on a T-68-2 (red) core which is rated for use between 1 and 30 MHz. Cut two pieces of no. 24 enameled wire about 60 cm (24") long. Put two ends together in a vise and twist until you have about 1 twist per cm (2½ twists per inch). Wind 22 turns on the toroid, leaving about 2½ cm (1") out of the toroid on both ends of the

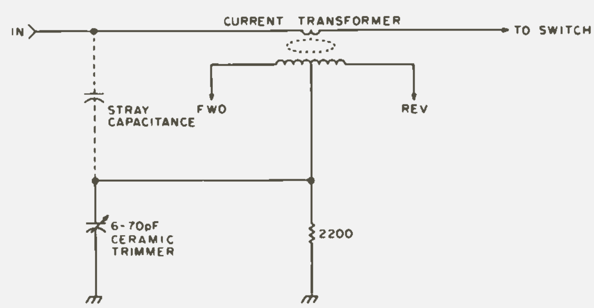

Fig. 3. Capacitive voltage divider with current transformer.

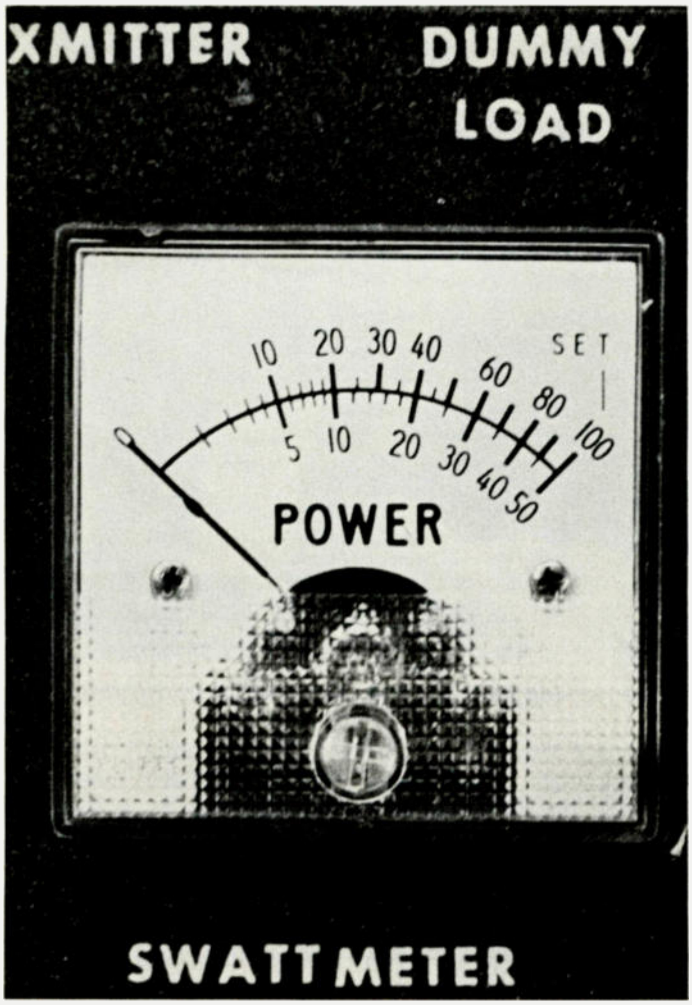

Photo E. Calibration of forward power meter.

winding. The turns should be close-wound around the inner circumference of the core, and evenly spaced along the outer circumference.

Carefully remove all the enamel back towards the toroid, select a wire from each end of the winding, and test with an ohmmeter to find two wires that do not show continuity. Connect these two wires together and hold with a drop of solder. This is the center tap. Check for continuity on the two remaining wires. The result is two bifilar windings in series, with a center tap, or 44 total turns. Total inductance is approximately 11 uH.

The toroid coil should then be slipped over a short length of RG-8/U coax with the outer insulation and braid removed, and mounted and soldered to

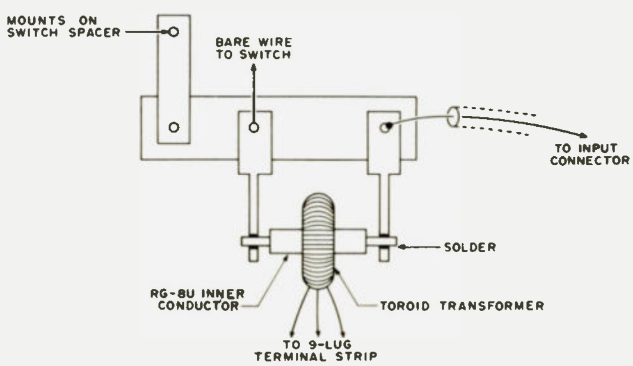

Fig. 4. Mounting the current transformer.

the two-lug terminal strip as described above.

After the toroid is in place, the rest of the Swattmeter wiring is conventional. Wire the hard-to-reach items first, such as the meter bypass capacitors and leads, which are located under the seven-lug terminal strip once it is installed. I used a series 3000, nine-lug terminal strip with a cadmium-plated steel mounting base for point-to-point wiring (available from Allied/Radio Shack). I did consider a PC board, but decided against it since the wiring is so simple. Also, the steel mounting base of the terminal strip makes a fine balanced ground point, as you can see in the photos.

The mounting holes on the terminal strip are bent at right angles away from the lugs. One side is mounted under the bottom nut holding the first (input) SO-239 connector. The other side is secured with 6-32 hardware through a hole drilled in the front of the enclosure. *Use lock washers between the terminal strip mounting holes and the steel enclosure/SO-239 connector,* as well as under each nut.

The center lug of the nine-lug terminal strip is the junction or tie point for the toroid center tap. The 2.2k resistor should be mounted on the underside of the terminal strip, using short leads. Use the metal base of the terminal strip as the ground point. Similarly, the 6- to 70-pF ceramic trimmer capacitor is mounted on the top side of the terminal strip. Again, use the metal base of the terminal strip just opposite of the center lug as a ground point for the capacitor.

Do not connect the two outer wires of the toroid until all other wiring is completed. You will have to determine by trial which lead is forward and which is reverse.

Use short leads for all bypass capacitors, and ground at the closest point possible. *Do not add additional capacitors.* They aren't needed and could make problems. Route all wires from and to the nine-lug terminal strip *under* the terminal strip away from the toroid. Make the layout as uniform and symmetrical as possible. The last components to be soldered in place should be the trimpots used to calibrate the two power positions of the function switch. Fig. 5 and the photos show the location of these trimpots.

I used the miniature pots available at Lafayette because they were the smallest I could get my hands on inexpensively. I cut off the center connector of each pot, and made a solder bridge from the remaining part of the center lug to one side of the pot to conserve space. All four pots are held in place with solder. Forget the old adage of a "good mechanical connection." "Solder is enough," is my motto.

Setup and Calibration

Assuming that all other wiring is complete, tack-solder the two remaining toroid wires to the terminals as shown in Fig. 5. You have a 50/50 chance of getting it right the first time, but Murphy's Law is still in effect, so don't count on it.

Now comes the "smoke" test. Hook up the input connector to an rf source of at least 5 Watts and a 50-Ohm dummy load to one of the output connectors. *Make sure the Swattmeter switch is in the appropriate position* or else there will be smoke, and it won't be coming from the power meter! (Don't ask me how I know!)

Set your rf source, transmitter, or transceiver on 10 meters and the Swattmeter function switch to SWR. Run the swr meter "set" pot up full clockwise, and key the transmitter. *A lot of power is neither needed nor desired at this point.* Use a rf output level that you can comfortably maintain for a period of time without worrying about your finals sagging.

If all has gone well, the forward power meter (on the left) should register, and the reflected power meter may or may not register. Carefully and slowly, adjust the 6- to 70-pF trimmer capacitor and watch the meters for results. If the toroid is connected correctly, the reading on the reflected power meter should null out. If the null is experienced on the forward side, reverse the toroid connections and try again. Use minimum power and try to hit the null square in the middle. You will find that the null is fairly sharp on 10 meters, but gets broader as the frequency is reduced. Not to worry. Once balanced at 28 MHz, the bridge is okay at all other frequencies.

At this point the bridge is balanced, and all we have to do is calibrate the two power positions. If you have used meters which are calibrated at 0-100 uA, calibration for power will be nonlinear because the meter samples voltage, whereas power is proportional to voltage squared. Table 1 shows the relationship between a 0-100 linear meter scale and power. Two power ranges are shown: 0-50 Watts and 0-100 Watts. The meters I used were already calibrated in terms of power and swr (from the Swan SWR-1), and the power ranges were calculated to match the existing scales.

If you have to use meters calibrated at 0-100 uA, you can use Table 1 to determine actual power and swr, or you can remake the linear scales using dry-transfer press-on lettering. It isn't really all that difficult. Calibration is a heck of a lot less difficult if the meter scales read power instead of microamperes.

There are at least three ways to calibrate the Swattmeter. In each case, the wattmeter is calibrated by feeding power through the meter into a dummy load. It also is possible to infer calibration by measuring the dc output of the forward detector, which can be measured with a high-impedance dc voltmeter (more on this later). In all cases except the last, the reflected power meter is calibrated by reversing the external connections to the coaxial line.

The first method is to beg or borrow another wattmeter to use as a calibrated reference. Simply connect the borrowed meter in series with the power meter between your transmitter and dummy load. Set the range switch to 0-500 Watts and crank up your transmitter for a 10-Watt output as indicated by the borrowed meter. Adjust R1 for a 10-Watt indication on the 0-50 scale of the power meter. Move the range switch to 0-1000 Watts and adjust R2 for a 10-Watt reading on the 0-100 scale. Reverse the coaxial connections to the Swattmeter and calibrate for reflected power in the same manner, using R3 first for the 0-100-Watt position, and R4 for the 0-1000-Watt position.

The second method requires an rf voltmeter and measuring the power dissipated in the dummy load by measuring the rf voltage across the load. However, most rf probes designed for use with com-

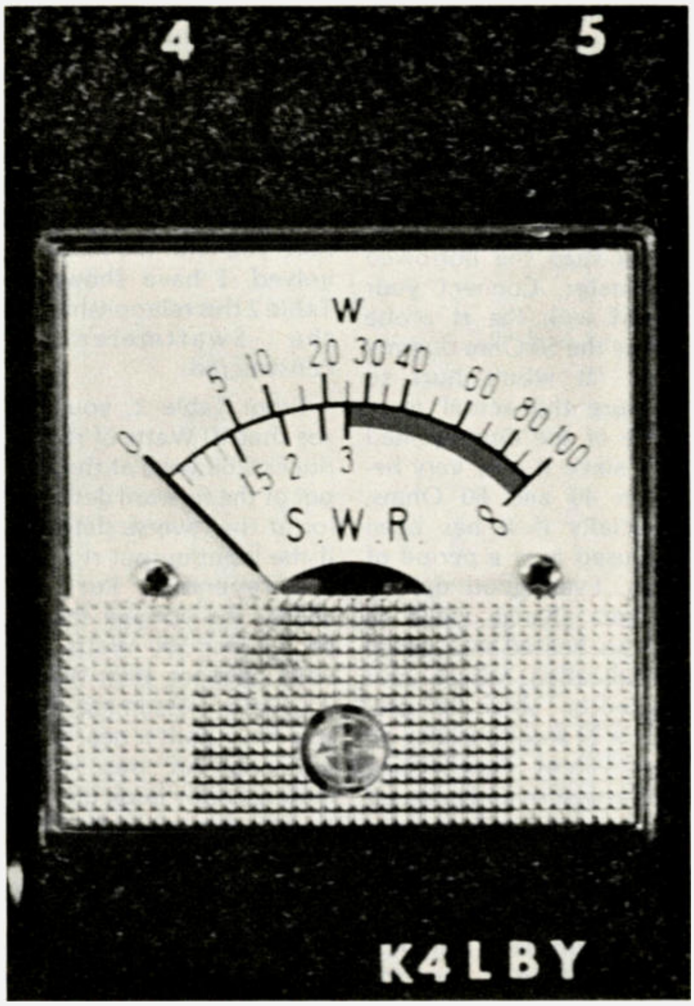

Photo F. Calibration of reverse power and swr meter.

mercial VTVMs are strictly limited. The reason is that the peak reverse voltage appearing across the probe diode will exceed the diode breakdown rating for a peak rf power of much over 10 Watts. (Ten Watts rf across a 50-Ohm dummy load will produce about 22.4 volts dc.) Fortunately, all we need is one bench mark if we assume the wattmeter to be reasonably linear; and a 10-Watt bench mark is as good as any.

An alternative is to use a voltage divider, say 10:1, in front of the diode detector, but that messes up the total load since the voltage divider then appears in parallel with the 50-Ohm dummy load. You can do it if you want to recalculate the load, for example, but it really isn't necessary. The Swattmeter isn't meant to replace a really

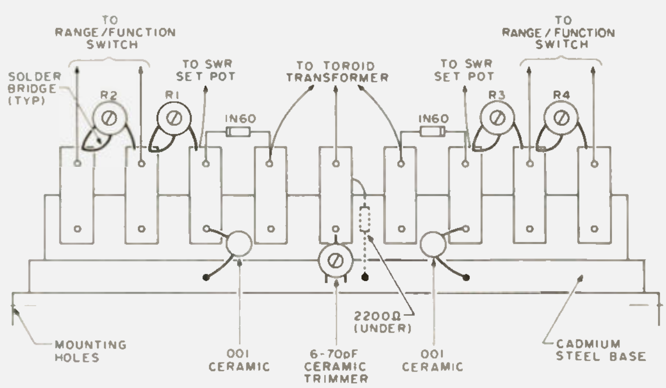

Fig. 5. Wiring diagram, nine-lug terminal strip.

good high-accuracy wattmeter in the first place.

The procedure using the second method of calibration is the same as outlined above, using a second wattmeter. The reference, however, is your VTVM rather than the borrowed wattmeter. Connect your VTVM with the rf probe across the 50-Ohm dummy load. (It won't hurt to measure the actual resistance of the dummy load first, since it may vary between 40 and 60 Ohms, especially if it has been well-used over a period of years. Even good quality resistors change value as they are heated and cooled periodically.) Adjust your transmitter drive to produce a 22.4-volt reading on your VTVM representing 10 Watts of rf, and proceed as above to adjust trim pots R1 through R4. Use a very short coax jumper between the Swattmeter and the dummy load for best results. If your dummy load resistance is off by more than 10% (45-55 Ohms), use Ohm's Law to recalculate the proper voltage for 10 Watts of rf.

The third method that can be used reasonably to calibrate the Swattmeter is to infer the peak line voltage from the dc output of the forward detector, which can be measured with a high impedance dc voltmeter. If you have examined the Swattmeter schematic closely, you will have noticed that the 10k Ohm "Swr Set" controls act as load resistors for the two diodes for all positions of the range selector switch. This loads the diodes on the most linear portion of their response curve, and the calibrating resistors, R1 through R4, plus their respective 100 uA meters, act as simple dc voltmeters measuring the voltages across each 10k control.

No, Virginia, you can't use the Swattmeter meters for self-calibration, but you can calculate the voltage to be expected across the 10k "Swr Set" controls for a given rf power level through the wattmeter. Not wishing to bore you with the math involved, I have shown in Table 2 this relationship for the Swattmeter as constructed.

From Table 2, you will see that 10 Watts of rf produces 0.66 volts at the output of the forward detector (or at the reverse detector if the input/output rf leads are reversed). For 100 Watts, the voltage should be 2.3, for 500 Watts, 5.2 volts, and for 1000 Watts, 7.5 volts. Assuming that you have built a nearly exact copy of the Swattmeter, simply hook up a dc source across both "Swr Set" potentiometers, along with an accurate VTVM or DVM (no rf needed). Set the range selector switch to 500/100 and the dc source to 2.3 V. Adjust R1 and R3 for a 100 Watt reading on both meters. Next, set the range selector to 1000/100 and adjust R2 and R4 for a 100-Watt indication. Run your dc source up to 7.5 volts and check both meters for 1000-Watt indications.

You may have to jockey R1 through R4 a little for compromise readings using the voltages given in Fig. 6. The readings will vary a little because of the load produced by the 100-uA meter movement, but don't worry too much about it. Remember, the Swattmeter is not intended to be a precision instrument—just a handy combination gadget convenient for tuning up and practical as a performance monitor for your station.

Once the calibration is complete, put the back on and install it in a handy location. I installed mine (as you can see from the photos) on a swivel mount, using M-359 angle adapters to keep the coax neat.

Potential Problems

When first constructed, the Swattmeter was erratic on some frequencies—the cause being poor ceramic bypass capacitors. If you experience power peaks, and know it's not caused by your transmitter, replace the capacitors. Another problem experienced was a negative swr indication at very low power levels! This was caused by slightly unmatched diodes which "turned on" at different voltages. If this happens to you, either increase the power level to get each diode turned on or rematch your diodes.

Speaking of diodes, it is possible (although I've never experienced it) that the diodes in any directional wattmeter are likely to produce harmonics of the applied frequency. Change the diodes if you suspect this is happening.

As I said before, Murphy's Law is still in effect, and you could run into some different problems. I have covered all those that I experienced.

Conclusion

My Swattmeter is a comfort when I'm on the air. I can tune up the rig into a dummy load using very little power, switch to whatever antenna I want to use, and load the finals in just a few seconds. It is reassuring to know your finals are putting out just about what they should, and that there is minimum reflected power on the line.

Variations are possible, if you don't like the design or if it doesn't fill your need. You can leave out the range switch and simply calibrate the "Swr Set" control for various power levels. You can eliminate, on the other hand, the swr function and simply have a forward and reflected wattmeter. You even can eliminate both controls, and replace them with fixed-value components for a "one range" Swattmeter. Different power ranges are easy also—just adjust R1 through R4 for wattever (pun intended) full scale power level you desire. And there are still more. . . let me see, now. If I put a 20-dB coupler in there, maybe I can come up with a spare receiver tap. Then there is the possibility of adding another diode and a capacitor and an op amp to read peak power. . . no, on the other hand, I guess the XYL wouldn't stand for it! ■

Power, Watts	0-100 Meter Reading
1000/500	100
900/450	95
800/400	89
700/350	84
600/300	78
500/250	71
400/200	63
300/150	55
250/125	50
200/100	45
100/50	32
50/25	22
25/12.5	16
20/10	14

Swr	0-100 Meter Reading
1:3	50
1:2	34
1:1.5	20

Table 1. Meter scale calibration.

Power, Watts	Forward Detector Dc Output
1000	7.5 V
900	7.0 V
800	6.6 V
700	6.2 V
600	5.7 V
500	5.2 V
400	4.7 V
300	4.0 V
200	3.3 V
100	2.3 V
50	1.6 V
10	0.66 V

Table 2. Forward detector dc-output vs. power.

James S. Beeson III WA5QAP
165 Shady Lane
Dayton TX 77535

The Double-Sawbuck QRM Annihilator

—3-IC circuit yields perfect CW

Having been a ham for almost 13 years, I guess you could say that I am set in my ways in some areas. One of these just happens to be CW. I do not work much CW, but when I do, I like to have a strong clear signal to do it with. This little circuit can give you just that.

I like projects that use components that are easily obtainable and not too expensive. All parts here can be obtained from your nearby Radio Shack for less than $10, as well as a copy of their book, *Integrated Circuits, Volume 3, Projects* ($1.50), which helped me to understand the 567 better.

Overall Description

Basically, what this circuit does is take a CW signal from your receiver via the phones jack, and output to you via speaker or headphones a clear, uncluttered CW signal. It will work with very weak signals that are almost impossible to copy. It has an extremely narrow bandwidth so that it can easily separate two very close signals, especially when you are trying to copy the weaker of the two. If someone has a poor-sounding signal (chirp), you will never know it. It will receive RTTY, and you can tape a good signal off the air for practice later. It requires very little power, less than a Watt, so you can use an ac supply—or a small battery will do.

Circuit Description

See Fig. 1 as you read the following description. Audio enters pin 3 of the 567 via coupling capacitor C1. The 567 is a tone decoder which outputs a negative-going signal from 5 volts to 0 volts. The particular frequency that is able to activate the output depends upon a combination of R1 and C3. The center frequency can be determined by the equation: center frequency = 1.1/R1 x C3.

I used a center frequency of 2300 Hz. C2 is called the low-pass filter, and it determines the bandwidth that the 567 will pass at the center frequency. C4 is called the output filter, and it attenuates frequencies that lie outside the desired band of frequencies.

Normally, pin 8 of the 567 is high. When you tune across a CW signal so that

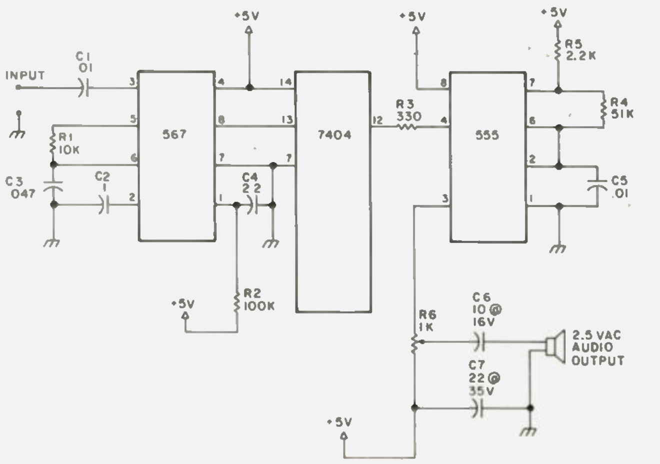

Fig. 1. Schematic diagram of CW circuit. R6 is a Bourns 3339P-1-102 PC board pot. Capacitor values are in microfarads; resistor values are in Ohms. The 555 and 567 are mini-DIP chips.

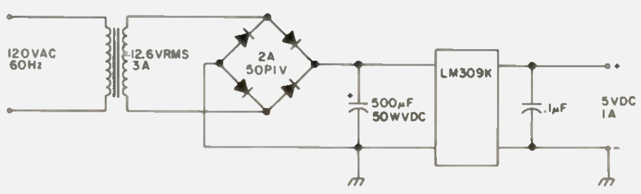

Fig. 2. 5 volts at 1 Amp dc power supply.

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CT-50

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Accuracy adjustable to 0.5 ppm
Stability 2.0 ppm over 10° to 40° C, temperature compensated
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Overload 50VAC maximum, all modes
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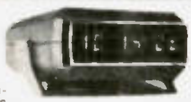

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An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Completely self-contained, includes mike, runs on 110VAC, controls up to 300 watts.
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SUPER SLEUTH

A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2 W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker.
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POWER SUPPLY KIT

Complete triple regulated power supply provides variable 6 to 18 volts at 200 ma and +5V at 1 Amp. Excellent load regulation, good filtering and small size. Less transformers, requires 6.3V @ 1 A and 24 VCT.
Complete kit, PS-3LT $6.95

SIREN KIT

Produces upward and downward wail characteristic of a police siren. 5W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker.
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ramsey electronics
BOX 4072, ROCHESTER, N.Y. 14610

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TERMS: Satisfaction guaranteed or money refunded. COD, add $1.50. Minimum order $6.00. Orders under $10.00, add $.75. Add 5% for postage, insurance, handling. Overseas, add 15%. NY residents, add 7% tax.

it generates the proper tone, pin 8 will go to zero with each dot or dash. So you end up with negative-going CW!

The signal enters the 7404, a hex inverter, at pin 13, and leaves at pin 12 as a positive-going CW signal.

From here, the signal enters the 555 at pin 4.

Data for the 555 can be obtained from *The Linear Control Circuits Data Book*, published by Texas Instruments. The 555 can be set up to run in many different modes. Here it is used to produce a tone every time it sees an input at pin 4. The frequency of this tone is determined by the equation: frequency = 1.44/C5(R5 + 2R4).

So, by changing the values of the components such as R4, you can vary the tone of the output in case you do not like my tone! You could even make R4 a pot, but I did not, to keep the cost low.

The 555 outputs the tone at pin 3, and its volume to your speaker is controlled by R6. Capacitor C7 was used as a filter because I used a 5-volt power supply. If you use a battery, it will not be necessary. And that is it; from the speaker comes uncrowded, clear CW!

Fig. 2 shows a simple 5-volt power supply if you do not already have one.

Summary

You will find that the circuit has a very narrow bandwidth so you have to be exactly at the correct "spot" to get an output. I have enjoyed using this circuit for a couple of months now, and, who knows, it might relight the CW flame in you, now that you do not have to listen to everyone on the band at once! ■

Mike Maloney AC5P
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Center Insulator for your Next Antenna

—do it yourself with PVC

Here is a scheme for a center insulator for your dipole or center-fed antenna that does the job beautifully and is inexpensive and easy to make.

The parts are of the ½-inch, heavy-duty, schedule 40 PVC plastic variety, and should be available at your local plumbing supply or large hardware store. Try to obtain parts that are grey in color, as the ultraviolet radiation from the sun is harder on the white. Painting the white PVC with a dark enamel will help here. The strain relief fitting may require a trip to your local electrical supply store. My fitting is a Ralco brand made of cast aluminum which cost 89 cents. This fitting cost less than a pair of coax fittings and is waterproof to boot. Taking the fitting apart will show you how it works much more easily than I can describe, so I won't go into that. Fittings are available that will accept the larger RG-8 size coax also, but I use 58C/U, with which the ¼-inch hole in the rubber grommet works nicely.

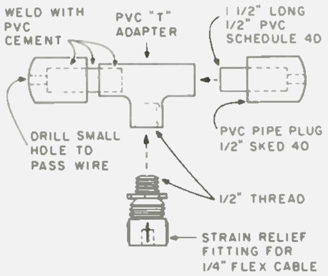

Fig. 1. Details of center insulator.

Run the element wires though their respective end cap holes and tie an overhand knot about 1 inch from the end of each wire. (Hope you use stranded flexible insulated wire, hi.) Pass the coax through the strain relief fitting and out the unglued end of the "T". Strip 2 inches of the jacket off the coax and separate the shield and center conductor. Strip ½ inch of insulation off the dipole ends and make the connection to the coax. Tape up the connections, and then carefully pull the works back into the center of the "T" and complete assembly.

Tighten the compression ring on the strain relief, and you're all set. If desired, before final assembly, the inside of the T-plug caps can be filled with wax, caulking compound, duct seal, etc., for additional protection against moisture through the end holes. You will find the completed project very strong, professional looking, and easily capable of doing its job. It can be tied to a supporting structure with nylon or poly rope, and you can be assured of good insulation and lasting performance. ■

Bill Hosking W7JSW
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Scottsdale AZ 85251

Another Approach to Repeater Control

—uses 7516 chip for low parts count

Over the last couple of years, I have written several articles using the 567 type of IC tone decoder. If you have used these decoders, you probably have discovered that, while they do the job, they have many limitations. They are very sensitive to input level, the decoding bandwidth changes with the input level, and there is bounce or ringing on the output. In order to function well in a complete 16-tone DTMF (touch-tone™) decoding system, the 567s require a lot of special effort, not the least of which is the addition of an agc amplifier.

Our local repeater organization is in the process of upgrading our control system and some of the first things on the list to be replaced were several 567-based DTMF decoders. We reviewed the specifications on several new monolithic tone decoders that have come on the market in the last couple of years. After reviewing the specifications, we decided on the Telenetics decoder which, although expensive (over $100), has several very attractive features, not the least of which is single-supply operation. Telenetics markets a system which consists of two ICs, a tone decoder, and an address selector, either of which is a stand-alone device which can be used without the other. Before proceeding with this article, I would like to acknowledge the help of Jay Hein WB7DQN, who did most of the initial logic layout.

Decoder

A very simplified block diagram of the 7516 decoder is shown in Fig. 1.

To briefly go through the decoder, it has an input audio amplifier which will accept either balanced or unbalanced inputs. The amplifier output feeds low- and high-pass bandsplitting filters which separate the high- and low-group DTMF tone-group ranges. The output of the filters then goes into a limiter. That output then drives an envelope detector and the digit decoder. The envelope detectors provide an input to the decoder portion which tells the decoder if valid dual tones are present. The decoder, through a digital counting scheme, decodes the tones and then provides either a one-of-sixteen logic output or a BCD-coded output, depending upon what the user selects. One thing I didn't mention earlier is a speech detector circuit which prevents false decoding with speech-type waveforms. The device also has several test points brought out which allow checking of device operation. In addition to the test points, a 10-kHz clock signal is brought out. This signal is required by the address selector. The specified operating range of the device is 8 to 28 volts, which adds to the versatility.

Address Selector

The 7511 address selector does just what its name suggests, i.e., recognizes an address. The length of the address to be recognized is user-selectable to lengths of 2, 3, 4, 7, or 10 digits. The chip requires a 10-kHz clock which can be provided directly from the 7516 tone decoder. This signal is used for internal timing. The selector provides either a positive- or a negative-going logic signal when the correct address is decoded, and the length of this output can be user-selected for 3, 5, or 9 seconds. The ingenious people who designed this circuit also provided for recognizing invalid digits through use of an "ANY DIGIT" output from the decoder or by resetting if too much time is taken in the digit selection. One minor drawback is the input voltage range; the maximum on the address selector is about 17 volts. This

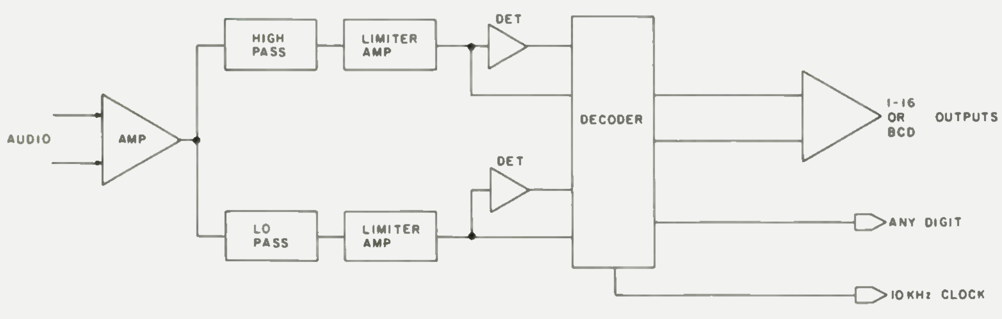


Fig. 1. Simplified block diagram of the Telenetics 7516 tone decoder. We obtained these and the address selectors direct from Telenetics, Inc, 4120 Birch St., Newport Beach CA 92660.

normally won't present a problem.

Control Decoder

Now that I have introduced you to the device we are using, let's take a look at the complete repeater control system we designed around these devices. I divided the system up into blocks which are a little easier to describe. The first of these blocks is the control decoder, the heart of the system. The decoder is shown in Fig. 2.

The connections to the decoder and address selector are very straightforward and come straight from the Telenetics applications notes. The 12 (I didn't use all 16) digit outputs go to pads where they can be jumpered to the digit inputs of the address selector. In addition to these pads, I also ran the digit outputs out to the outside world so that the system can easily be expanded.

There is a 10-kHz clock output from the decoder (mentioned earlier) that is needed by the address selector. I also ran this line to the outside so that additional address selectors could be added at a future date. In order to ignore wrong addresses, the "ANY" line must also be connected. This line provides a pulse for each digit decoded by the decoder.

Pads also have to be provided for the selection of the address length and the address-selector output duration. The selection of 1-of-16 instead of BCD outputs I have shown hardwired, since that was the way our application went.

We used the low-going output of the selector ($\overline{Q}$) to trigger a 555 timer, which in turn puts out an enable signal to the rest of the function decode logic and will hold it for more

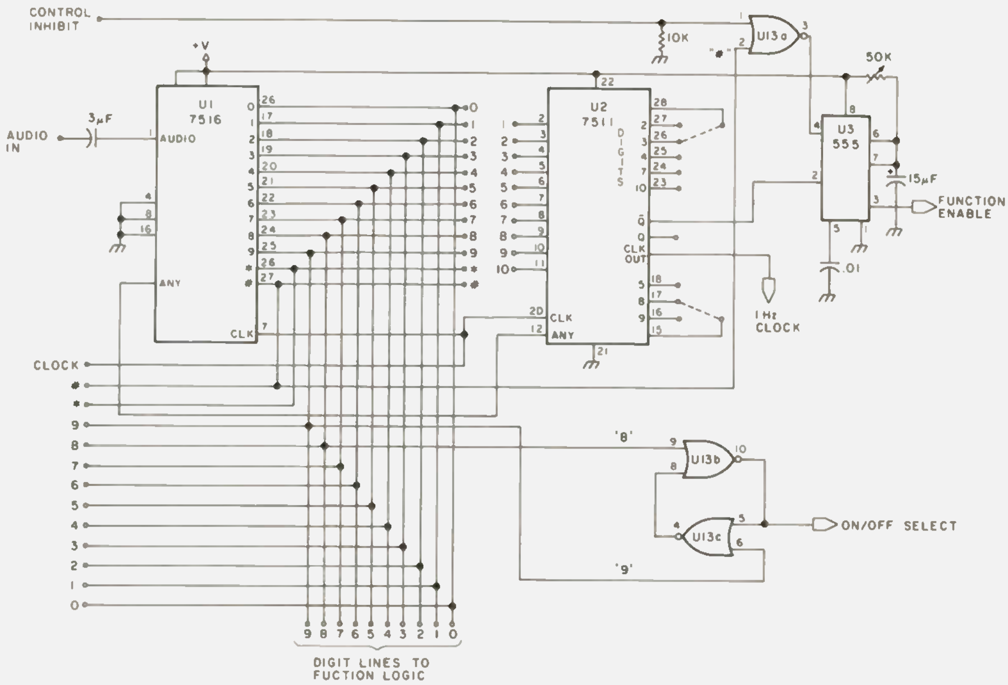


*Fig. 2. Schematic diagram of the decoder section of the complete control system. In this and the following schematics, the arrowheads indicate connections contained on the printed circuit board, while circles indicate those lines which go off the circuit board. The * is available but not used.*

than the time available from the selector. The # digit is fed through U13A and is used to reset the enable timer if desired. The other input to U13A serves as an inhibit to the control process. If this line is high, it will prevent enabling of the function-selection gates.

Two sections of U13 are cross-connected as a flip-flop and run off the decoded 8 and 9 digits to provide on/off toggling of the selected function.

Control Logic

The next section, illustrated in Fig. 3, recognizes that a valid address and control command have been sent and then provides an appropriate latched logic output to the outside world. In the case of the 6 and 7 functions, the logic in our system is hard-wired for timer disable and repeater disable, respectively.

The first digit normally sent would be an 8 or 9 to set the on/off flip-flop condition. The on/off flip-flop output line controls the D inputs to the flip-flops in U6, 7, 8, and 9. Now, if any of the flip-flops are clocked by the action of U4 or U5, their outputs will follow the state of the D input and set or reset the desired function.

In order to illustrate the operation this far, let's

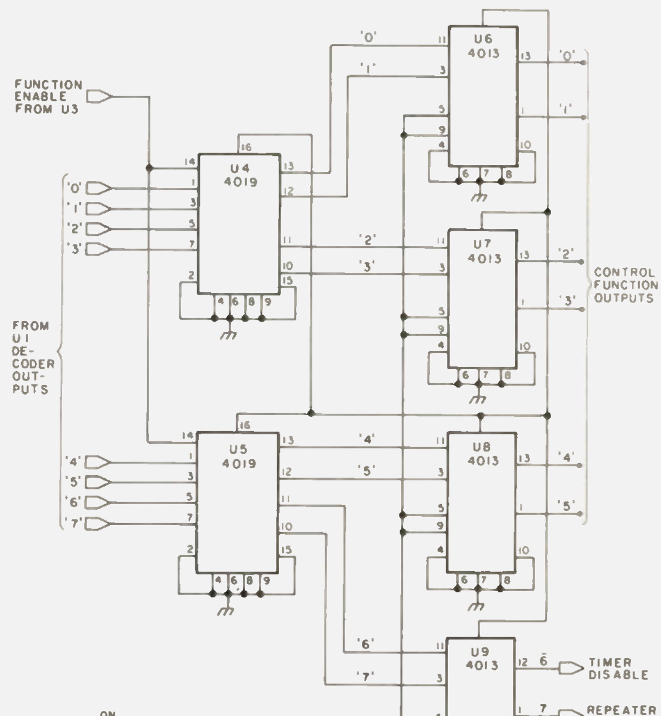


Fig. 3. Schematic diagram of the function decoder section of the control decoder. The control functions 0 through 5 go off the board for whatever auxiliary use may be needed.

assume that the correct address has been selected. U3 will then provide a high on the function enable line for about 5-10 seconds. This high will let the appropriate control-digit pulses through to the rest of the logic. If the next digit to follow the address was, for example, a 0, U4 would pass the high through to U6, where, if pins 5 and 9 were high, it would cause a latched high on the 0 function output. If the 0 had already been high and pins 5 and 9 were low, the output would have been reset to low.

As mentioned earlier, the 6 function is hard-wired for repeater disable and the 7 function is wired for timer disable. I made no attempt to buffer the CMOS outputs because of printed wiring board space limitations and because I thought it would put some restraints on the versatility of the board.

COR/Timer

The last section contains the COR, drop-out delay timer, time-out timer, and beep generator. The schematic for this section is shown in Fig. 4.

The PTT transistor is driven by U14A. One input of U14A is fed with a diode OR gate which allows either the time-out timer or the repeater disable signal from the control circuitry to inhibit the transmitter PTT. The other side of U14A is fed from U14B, which allows PTT operation from an external IDer, a second receiver, or from the internal COR switch.

The primary receiver COR circuit requires a signal keyed to ground when the COR is active. This signal activates timers U15A and U15B. U15A then activates the PTT; the setting of the 50k pot on this IC will determine the amount of time the PTT will stay on after the COR has shut off (drop-out delay). Timer U15B acts in the same manner except that it controls the time out timer. U15B also triggers a beep generator comprised of U16A and B on its falling edge. This provides a short beep when the timer is reset. In order for this function to work properly, the drop-out delay must be longer than the time-out timer time.

A typical setup for this would be to set U15A for about 2 seconds and U15B for about 1 to 1½ seconds. Thus the beep would be heard (and the timer reset) about 1 second before the carrier drops. There is a 50k pot on the beep timer which sets the duration of the beep tone.

One last connection to describe: The line marked COR inhibit, if taken to ground, will prevent the timers of U15 from operating. This effectively precludes PTT operation from the COR. This line was added as an afterthought to add to the possible methods of control. The last but not least section of this functional block is the time-out timer. I neglected to mention that the 7511 address selector also provides an output which is the clock input divided by 10,000, which, for the normal 10-kHz clock input, provides a one Hz output. By simply counting this output, time functions such as time-out can easily be accomplished.

The time-out circuit then simply consists of a chain of presettable counters which count down the 1-Hz clock. The first counter, U10, is hard-wired as a divide-by-10 to give a 10-second output. The second two counters, U11 and U12, are provided with strapping pads to allow programming of the desired time out in increments of 10 seconds. The output of U13D is also fed back to U10, where it stops the counting function, thereby holding the counter in its present state and holding the PTT off. U14 resets the whole timer chain when the COR signal is removed.

Operation

In the last section, I tried to tell you how this thing worked; however, its use is somewhat complicated, so I will try to explain it in some detail. Using the system requires two basic

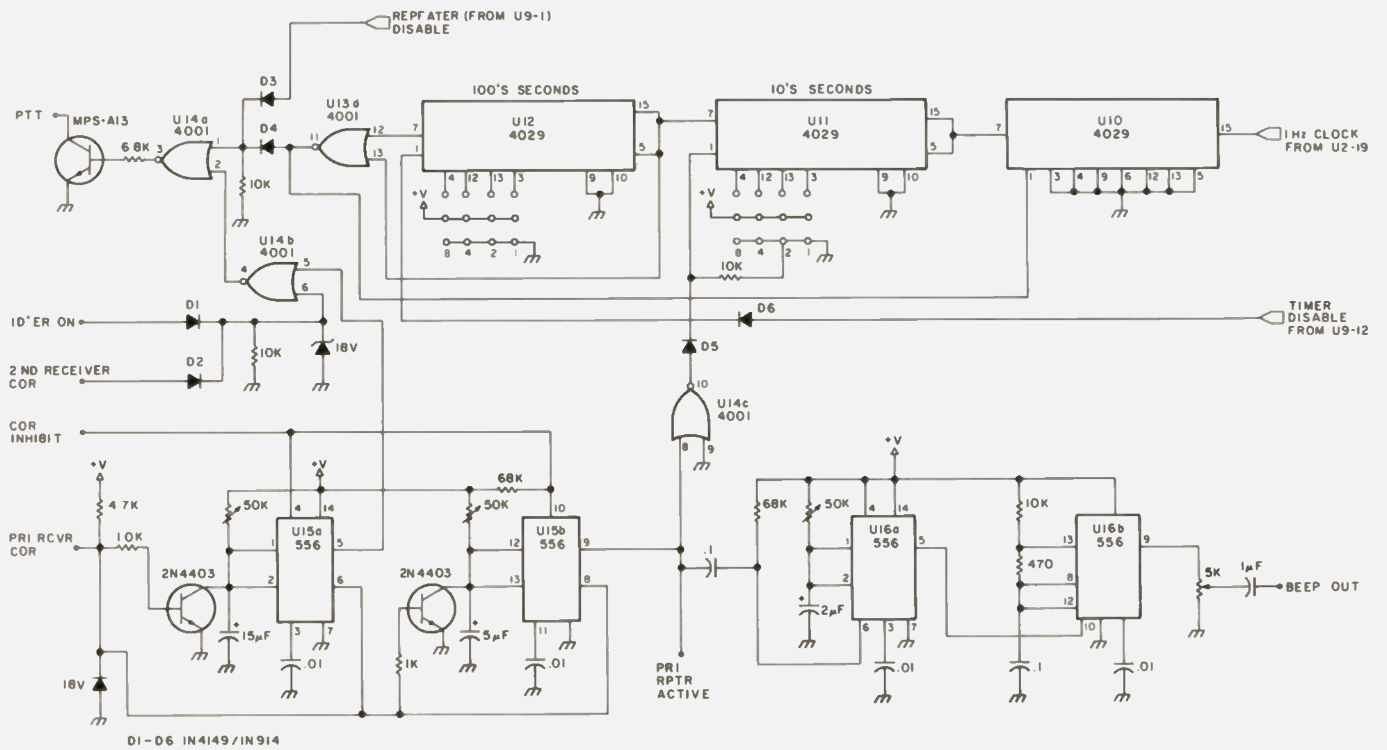


Fig. 4. Schematic diagram of the COR and timer sections of the control system. Note that the repeater disable and timer disable signals come directly from the function decoding logic (Fig. 3).

stages: initial setup and interconnection/adjustment.

Initial setup involves making some decisions and then strapping the options according to your decisions. The first decision is the length of the control address. This can be 2, 3, 4, 7, or 10 digits long. This option is set by installing a jumper between pin 28 of U2 and one of the following pins of U2: 27, 26, 25, 24, or 23.

The second decision, once the length of the address is decided, is what the actual address will be. I think this can best be explained by example. Let's say you selected an address length of three digits (U2, pin 28 to U2, pin 26) and an address of 9-4-2. Pin 2 of U2 is the first digit input, pin 3 the second digit input, and so forth to 10 (max.). Now, you would strap the first digit (pin 2, U2) to the nine digit output of U1, which appears at pin 25. Next, connect U2, pin 3 to the four-digit output (U1-20), and finally U2-4 to U1-18 (the two output). Your decoder system will now respond to an address of 9-4-2. Taking longer than about five seconds between digits or sending a digit out of sequence will cause the selector to reset and reject the address.

The last jumper you have to install on the address selector is the one which determines how long the output will stay active after a valid address is decoded. By jumpering U2, pin 15 to U2, pin 16, 17, or 18, you can select 9, 3, or 5 seconds. The printed circuit board being offered by the ARA* is hard-wired for a three-second time.

One last comment regarding the decoder: It can be jumpered for BCD outputs instead of one-of-sixteen as was done here. To do this, you have to reverse the states of pins 15 and 16. I don't want to go into any more detail since it is a whole different mode of operation.

The selection of time-out requires installation of jumpers also. The jumpers on U11 set increments of 10 seconds and the jumpers of U12 set multiples of 100 seconds. Both are programmed by jumpering the appropriate bit high or low in a BCD code for the digit desired. For example, if you want a three-minute timer, which is 180 seconds, you would program U11 to an 8 and U12 to a 1. To do this, we connect pin 4 of U11 and pin 3 of U12 to +V and then ground pins 12, 13, and 3 of U11 and pins 4, 12, and 13 of U12. This is now all of the jumpers required. The remaining adjustments should be made once the board is installed.

The primary connections to the controller are shown in Table 1.

Each of the function outputs is a latched CMOS-compatible signal which can be used, with the proper buffering, to control a number of various functions.

Conclusion

There we have a complete repeater control system which provides control decode functions, primary repeater control, auxiliary control functions, COR/PTT functions, adjustable squelch tail length, adjustable time-out timer length, and time-out beeper. With some professional assistance, we got the entire circuit on one 4½ x 6 inch plug-in circuit card. The Arizona Repeater Association is going to be marketing the printed circuit boards for the control system along with a compatible CMOS identifier printed circuit board. As of this writing, only prototype boards were completed, so pricing was not available. For pricing and availability, either contact the ARA or me.

One last comment; I almost forgot. Not shown on the schematic but present on our PC boards and highly recommended are .01 uF capacitors on the supply pins of each IC and 18-volt zener diodes on input lines for spike protection.■

*Arizona Repeater Association, Suite 4000, Valley Center, Phoenix AZ 85073.

Signal	Description
PRI RCVR COR	An input line that is keyed to ground when the primary receiver is active.
COR INHIBIT	A normally open input line. A ground on this line will inhibit operation of the COR/PTT.
PTT	A transistor switch output keyed to ground and capable of about 200 mA. If anything other than a transistor circuit is to be keyed, it should be through a relay.
IDer ON	A high (+V) on this input line from the IDer will keep the PTT keyed while the ID is being sent.
2ND RCVR COR	Provides input capability for a second (link) receiver to operate the PTT. Note that this and ID both bypass the time-out timer.
BEEP OUT	Adjustable audio output signal which can be fed into the transmitter mic input.
AUDIO INPUT	This is the control audio input which may come from a control line or from another receiver. Not normally fed from repeater receiver.
CONTROL INHIB	This input, normally open, will inhibit the control decoding process if a high is placed on it.

Table 1. Primary connections to the controller.

Reader Service—see page 211

Michael J. Di Julio WB2BWJ
97 Woodside Rd.
Maplewood NJ 07040

Yes, You <u>Can</u> Build this Synthesizer!

—keep your crystal rig

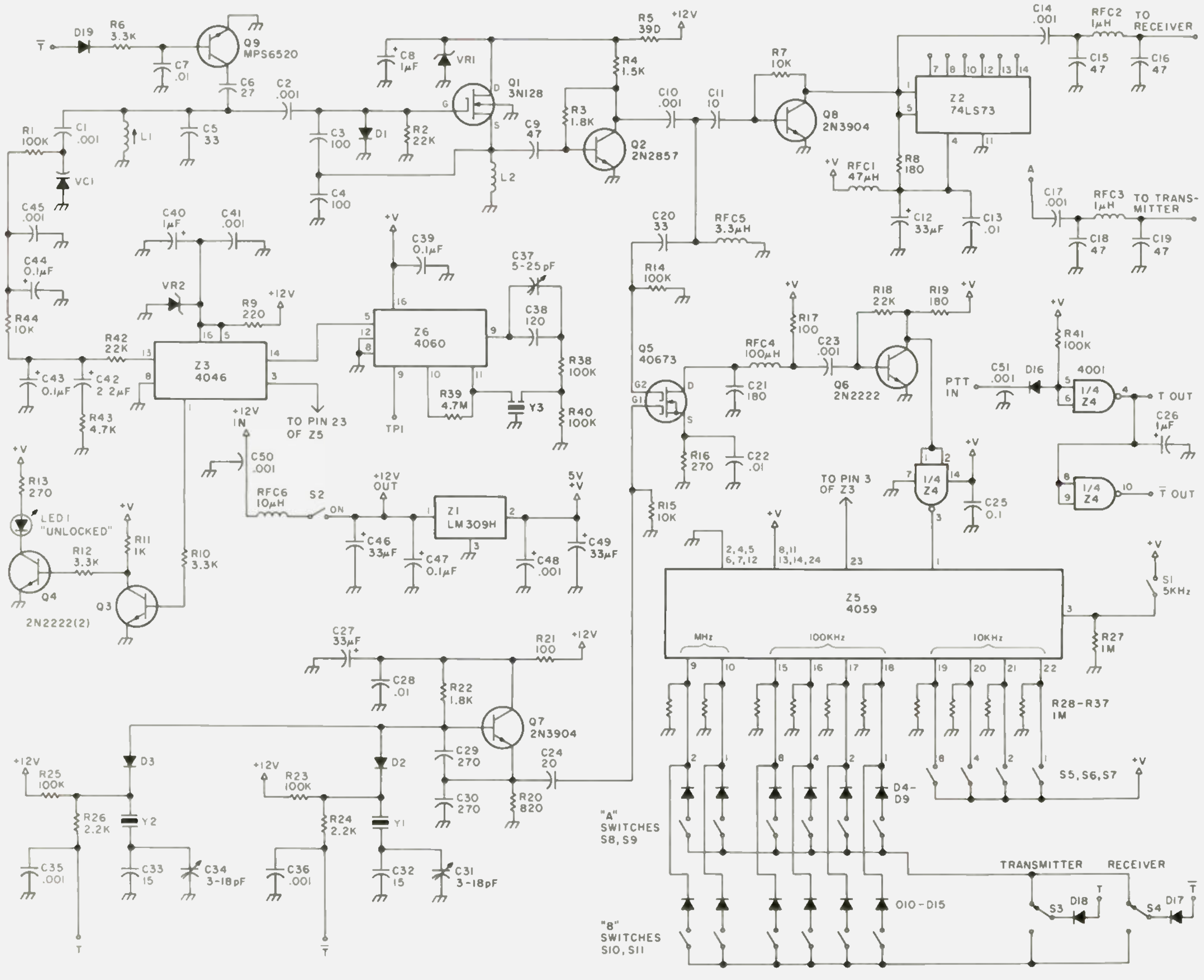
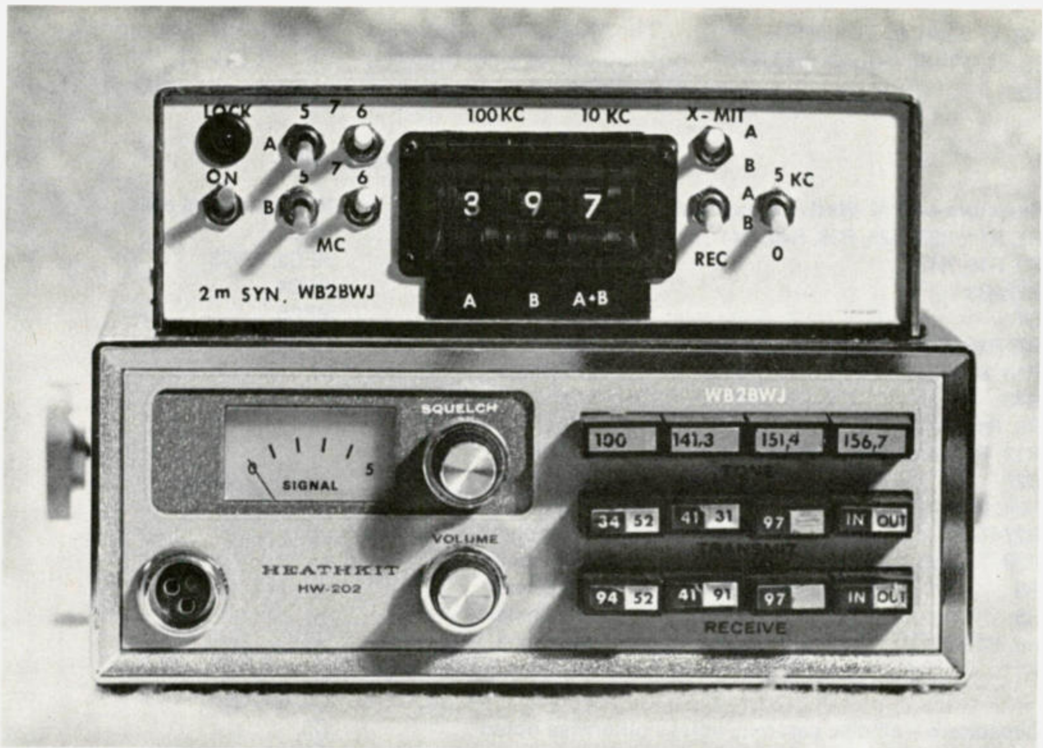


Fig. 1. 2m synthesizer schematic diagram.

A low-cost, low-power, compact two meter synthesizer can now be built due to recent developments in COSMOS technology. The synthesizer covers 144-148 MHz and can be adapted to almost any rig simply by programming the output divider and using the proper crystals in the beat oscillator. Any repeater offset can be generated, as the receive and transmit frequencies are independently set in 5-kHz steps. The unit uses a total of six integrated circuits and draws about 60 mA at 12 volts. My unit is interfaced with a Heathkit® HW-202.



See Fig. 1. Q1, along with its associated components, forms a vco which has an output in the 22-25-MHz region depending upon what the voltage on VC1 is and if Q9 is turned on or off. Q2 is a buffer amplifier which is connected to one gate of mixer Q5. The other gate of Q5 is connected to Q7, which is the beat oscillator that also oscillates in the 22-25-MHz range depending on which crystal is switched into its base. The output of Q5 contains the sum and difference frequencies of the two signals present at its gates. RFC4 and C21 form a filter which allows the difference frequency to pass on to Q6 which shapes and level-shifts the signal so that it is CMOS compatible.

The first gate of Z4 acts as a buffer to drive Z5, which is a divide-by-N divider. The divider is connected to divide by 800 plus twice the switch settings, and then plus one if the 5-kHz switch is on. These switches are labeled as to what decade of the frequency they determine. The output of the divider goes to the input of Z3, which is a phase comparator. The other input of Z3 goes to Z6, an oscillator /binary divider, whose output is 833.333 Hz. This is the reference frequency. The output of Z3 is connected to a low-pass filter whose output goes to varactor VC1.

Let us now trace a complete cycle of the loop (see Fig. 2). Suppose we want to transmit on 146.940 MHz, and we set the switches as such. Our divider divides by 800 + 2(294) = 1388. Suppose that the vco is free-running at 24.00 MHz. This mixes with the 23.3333-MHz transmit crystal to give an output of .6667 MHz. This is divided by 1388 to give 480.3 Hz. This is compared to the 833.333-Hz reference, and the 4046 raises the voltage to VC1 to increase the frequency of the vco. When the vco has an output of 146.940 MHz/6 which is 24.490 MHz, the loop will

For 24-MHz crystals, connect point A (C17) to pins 1 and 5.
For 12-MHz crystals, connect pin 13 to A.
For 8-MHz crystals, connect pin 8 to pin 14, pin 7 to 12, pin 10 to 13, and pin 14 to A.
For 6-MHz crystals, connect pins 7, 10, and 12, all tied together, and pin 8 to A.

Table 1. Programming chart for Z2. All of these connections are made directly to the socket pads of Z2.

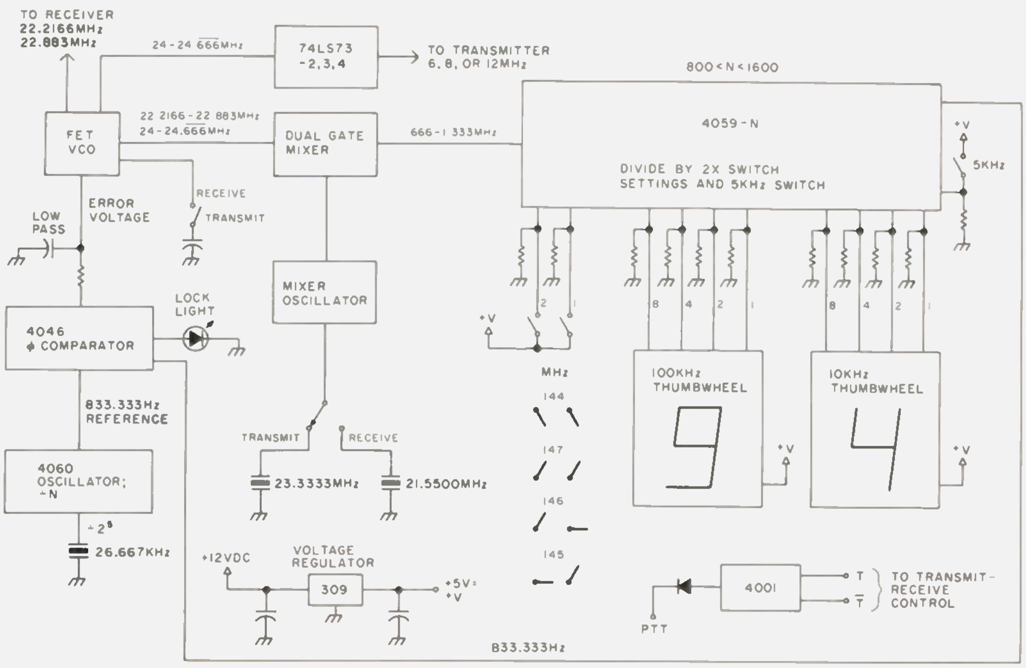


Fig. 2. 2m synthesizer block diagram.

lock since (24.490 − 23.333)/1388 equals 833.333 Hz.

The 4046 will adjust its output voltage so that the two inputs are identical in phase and frequency. Q3, Q4, LED 1, and associated components form an indicator that lights when the synthesizer is unlocked. This indication

Parts List

Resistors—all ¼-Watt, five percent

R1, R14, R23, R25, R38, R40, R41	100k
R2, R18, R42	22k
R22, R3	1.8k
R4	1.5k
R7, R15, R44	10k
R13, R16,	270 Ohms
R43	4.7k
R6, R10, R12	3.3k
R17, R21, and one in radio	100 Ohms
R20	820 Ohms
R24, R26	2.2k
R27-R37	1 megohm
R39	4.7 megohms
R9	220 Ohms
R5	390 Ohms
R8, R19	180 Ohms
R11	1k

Capacitors—all disc ceramic, unless otherwise noted

C1, C2, C10, C14, C17, C23, C35, C36, C41, C45, C48 and two in radio	0.001 uF
C50, C51	0.001-uF feedthroughs
C3, C4	100-pF silver mica
C9, C15, C16, C18, C19	47 pF
C12, C27, C46, C49	33-uF tantalum
C7, C22, C28	0.01 uF
C42	2.2-uF tantalum
C43, C44	0.1-uF tantalum
C13, C25, C39, C47	0.1 uF
C24	20 pF
C29, C30	270-pF silver mica
C32, C33	15-pF silver mica
C8, C26, C40	1-uF tantalum
C38	120-pF silver mica
C5	33-pF silver mica
C20	33 pF
C21	180 pF
C6	27-pF silver mica
C11	10 pF
C31, C34, C37	5-30-pF subminiature trimmers

RF chokes and coils

RFC1	47 μH
RFC2, RFC3	1 μH
RFC4	100 μH
RFC5	3.3 μH
RFC6	10 μH
L1	¼-inch slug-tuned form wound with 8 turns of #22 wire
L2	20 turns #30 wire on Amidon #73-801 ferrite bead

Semiconductors

Z1	LM309H
Z2	74LS73
Z3	4046
Z4	4001
Z5	4059
Z6	4060
Q1	3N128
Q3, Q4, Q6	2N2222
Q5	40673 or HEP F2004
Q7, Q8	2N3904
Q9	MPS6520 or HEP S0009
Q2	2N2857
VC1	HEP R2503 varactor
D1-D19	1N914 diodes
LED1	any type red LED
VR1, VR2	5.1-volt ½-Watt zener diode

Crystals

Y1	23.3333-MHz, Heath #404-586*
Y2	21.5500-MHz, Heath #404-584*
Y3	26.667-kHz, Statek type SX-1H

Switches

S5, S6, S7	10-position BCD switches with endplates
S3, S4	SPDT toggle switches
S1, S2, S8, S9, S10, S11	SPST toggle switches

*International crystal cat #435274

Miscellaneous

2 RCA phone plugs and jacks
RG-174/U miniature 50-Ohm coax
Amidon #64-101 ferrite beads

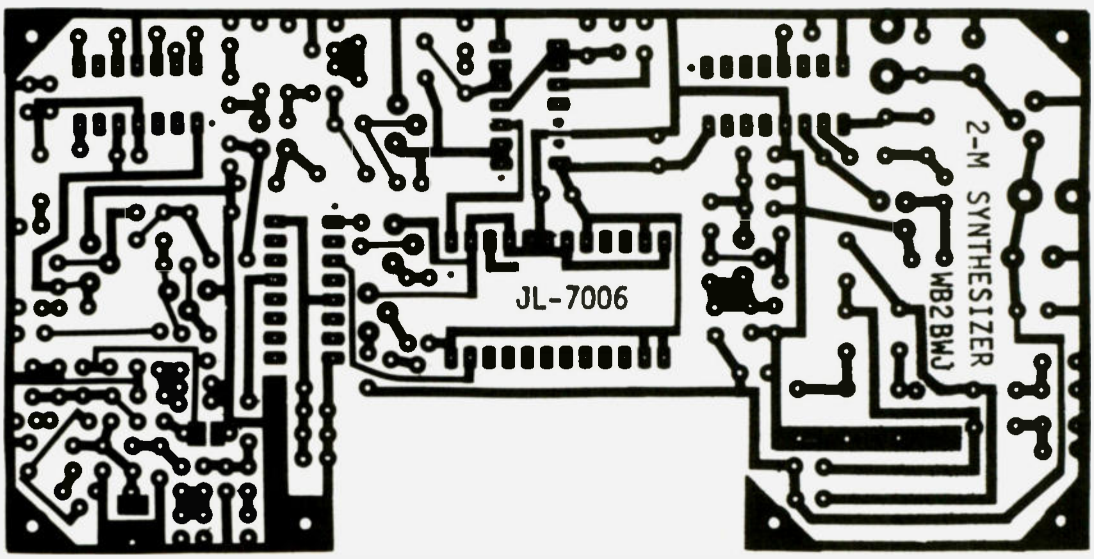


Fig. 3. PC board layout.

is useful when initially tuning the synthesizer, and warns the operator not to transmit if the loop becomes unlocked due to component failure, etc.

The second and third gates of Z4 generate two signals: T and T̄ (pronounced not T). T is high in transmit and low in receive, and T̄ is its complement. These signals switch between Y1 and Y2, select which set of frequency switches is connected to the 4059, and turn Q9 on and off, which places C6 in parallel with the vco tank to lower its frequency range in the receive mode. Q8 is a buffer stage which isolates the vco from the output circuitry.

Before the signal from Q8 goes to the receiver, it is passed through the low-pass filter composed of C14, C15, C16, and RFC2. This passes the 24-MHz rf, but keeps the VHF rf from the transceiver from getting into the synthesizer. Q8 is also connected to Z2, which is a quad flip-flop. By connecting the pins of Z2, as shown in the programming chart, Table 1, the chip can divide the 24-MHz signal by 2, 3, or 4, giving a 12-, 8-, or 6-MHz output. The transmitter's signal also goes through a low-pass filter.

Z1 is a five-volt regulator which supplies power to most of the circuit. Some parts of the circuit require 12 volts, and this is obtained at C46. In the HW-202, I take the supply voltage off the 11-volt regulated line within the radio.

Parts layout is fairly critical, and it is recommended that the PC board layout shown in Figs. 3 and 4 be used. Keep all leads as short as possible and mount Y3 and Z1 flush to the board. The use of IC sockets is encouraged. Resistors R28-37 and diodes D4-15, D17, and D18 are not mounted on the board but directly on the switches concerned. C50 and C51 are .001-uF feedthroughs mounted directly to the metal cabinet enclosing the synthesizer. RFC6 is not mounted on the board but is connected directly to feedthrough capacitor C50. RCA-type jacks are used for the receiver and transmitter output connectors. RG-174/U, 50-Ohm miniature coax is used to connect the receiver and transmitter output from the boards to their respective low-pass filters and jacks. The low-pass filters are assembled around the jacks. There are several jumpers that are connected to the bottom of the board (Table 2). They are noted on the parts placement diagram as J1, J2, etc. For example, a jumper must be connected from one point labeled J1 to another point labeled J1. Some jumpers go to more than one place. For example, there is a J4a, b, and c. This means that J4a goes to J4b and J4b goes to J4c. All jumpers are RG-174/U coax, and provision is made at each point for the shield to be soldered to

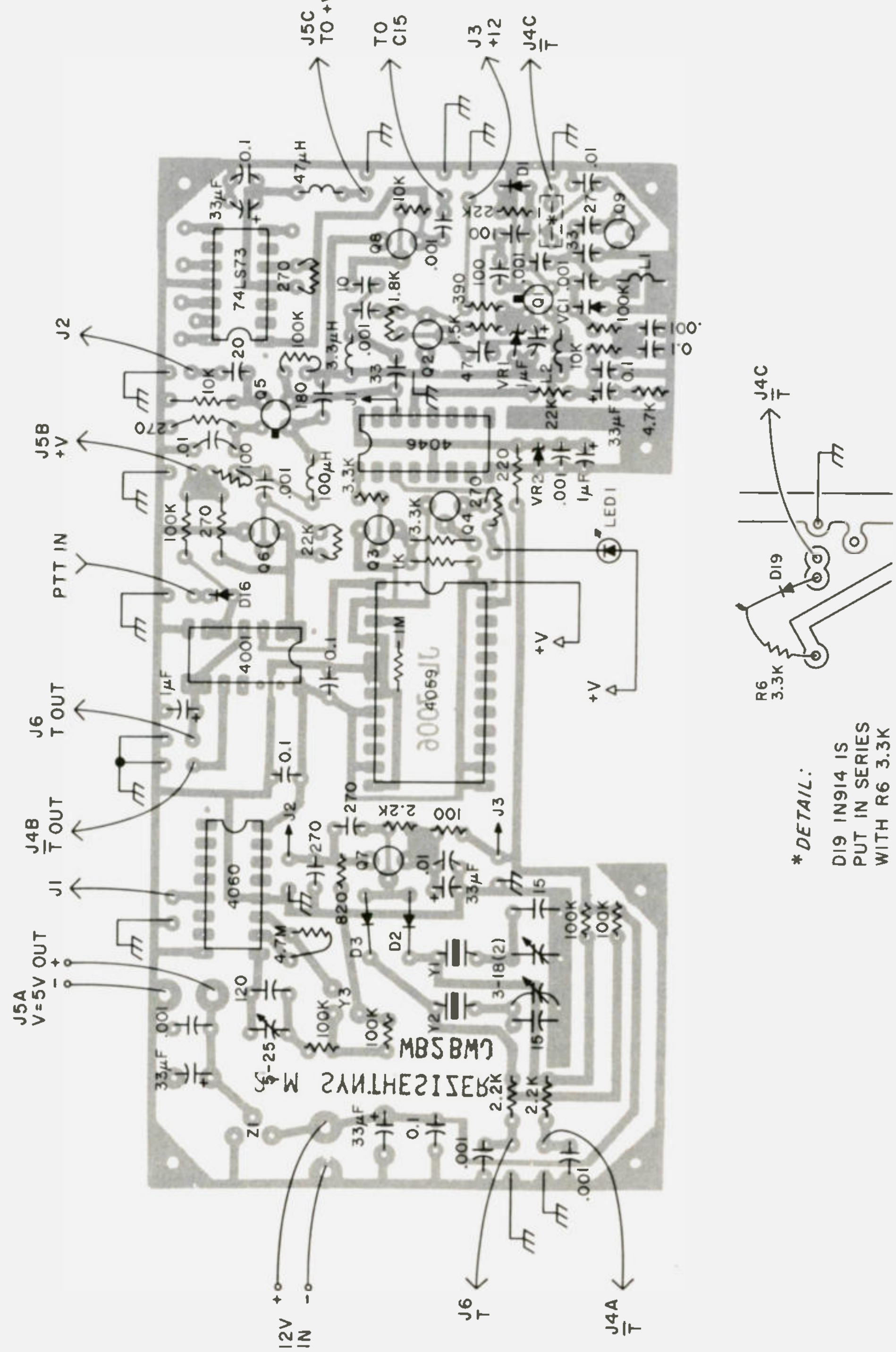
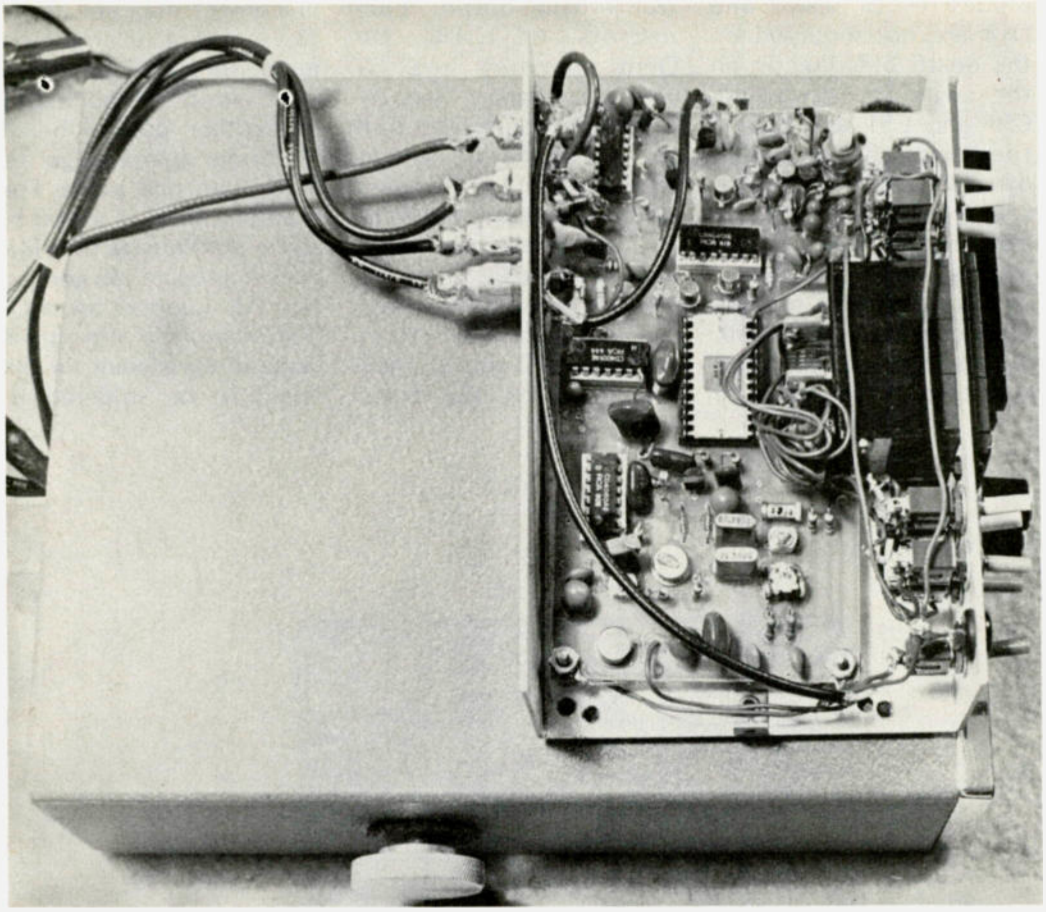


Fig. 4. Component placement.



ground. Table 3 shows the cable lengths.

The switching arrangement I used (Fig. 5) was designed to keep the number of thumbwheel switches to a minimum. The arrangement consists of two sets of switches, one labeled A and the other B. S8 and S9 are SPST switches that comprise the MHz selection for the A set. Placing both switches down (turning them off) sets the MHz to 144, S9 up (S8 down) is 145, S8 up (S9 down) is 146, and both up is 147. S10 and S11 work in a similar fashion for the B set. S5 is a thumbwheel switch that selects the 100-kHz step for A; S6 does this for B. S7 is another thumbwheel that sets the 10-kHz step for both A and B. S1 selects whether or not 5-kHz step is used. S3 and S4 select whether or not the A or B setting will be used for transmit or receive.

As an example, if we want to go on 146.34/146.94 with A selecting the transmit frequency and B selecting the receive frequency, we set S8 and S10 to on, S5 to 3, S6 to 9, S7 to 4, S3 to A, and S4 to B. To go on simplex on 146.34, say, to monitor the input, we set S4 to A. To go simplex on 146.94, we set S3 and S4 to B. To go on reverse 146.94/146.34, we set S3 to B and S4 to A. With this method of switching, most common repeater pairings can be obtained. If a more sophisticated system is desired, an automatic offset[1] could be built in, or a keyboard-type entry system[2] could be used. The important thing to note is that the synthesizer only requires the BCD code of the desired frequency—no look-up table is needed.

Mount all of the parts on the board in the following order: sockets, resistors, capacitors, chokes, transistors and diodes, crystals, and jumpers. Before inserting the IC chips, apply 12 volts to the unit and check for the proper supply voltages at the IC sockets. After turning the supply off, insert all of the IC chips. Turn the unit on again and the unlocked light should come on. The first signal to check on the unit is pin 14 of Z3. There should be a 5-volt peak-to-peak square wave at a frequency of 833.333 Hz. With an accurate frequency counter, preferably set to measure the period, adjust C37 until the frequency, or period, is as stated. This adjustment could also be made by looking at pin 9 of Z6 and setting C37 for a frequency here of 26.6666 kHz. Connect the positive lead of a VTVM or FET VOM to the lead of R1 farthest from VC1. The voltage here probably will be either near zero volts or near 10 volts, either of which represents an unlocked condition. With the synthesizer in the receive mode, set the frequency select switches to 147.995 MHz and adjust the tuning slug on L1 until the voltage reads approximately four volts. The unlocked light should now be extinguished. Change the frequency select switches to 144.000 MHz and check to see if the light is still extinguished. Simulate the transmit mode by grounding the PTT line on the synthesizer and check to see that the synthesizer locks over the same frequency range in transmit. The voltages at R1 should be within 0.5 volts of one another for the same frequency on transmit and receive.

Trim L1 until the tuning range is correct. Any con-

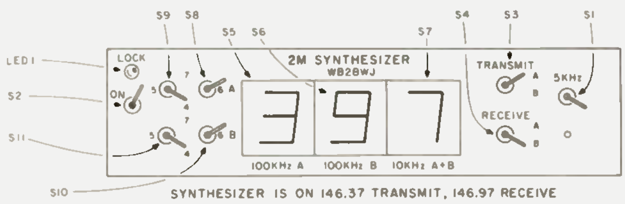


Fig. 5. Switch arrangement.

1. Cable J1 from pin 5 of Z6 to pin 14 of Z3; this is the divide-by-N out.
2. Cable J2 from C24 to R20; this is the beat oscillator-to-mixer line.
3. A Cable from J4a to J4b and one from J4b to J4c; this is the $\overline{T}$ line.
4. Cable J3 from R5 to +12 volts at R21; this is the +12-volt line.
5. A cable from J5a to J5b and J5b to J5c; these are +5-volt connections.
6. Cable J6; this is the T line.

Table 2. List of required jumpered connections. Use RG-174/U coax.

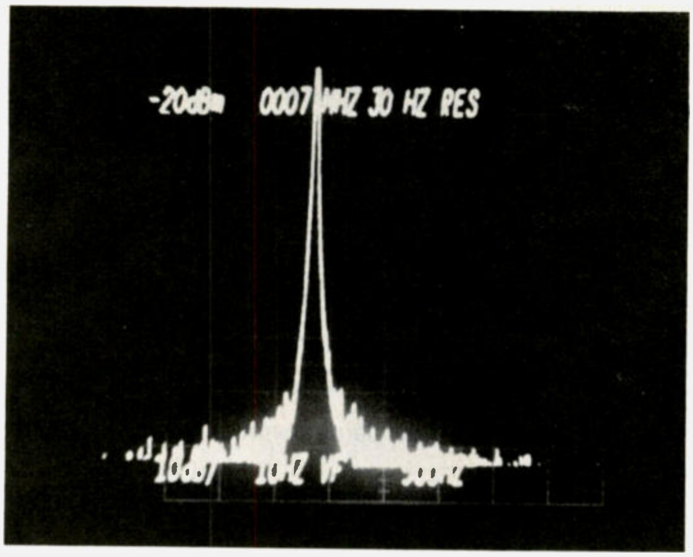


Photo A.

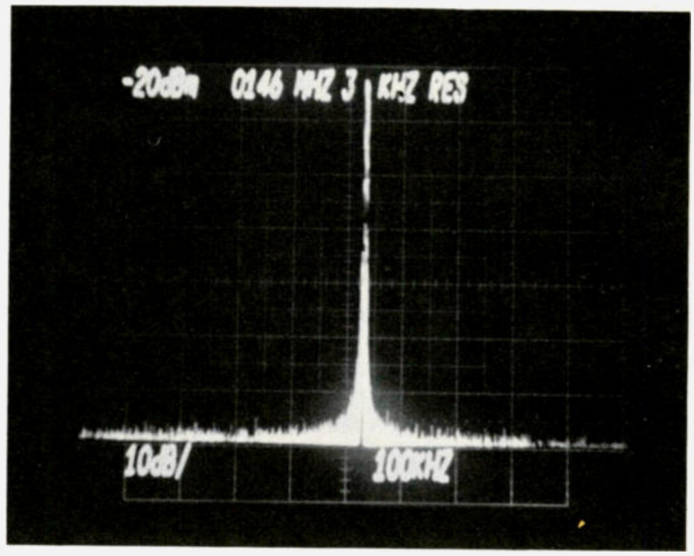


Photo B.

stant flickering of the unlocked light indicates an unstable condition, and the transceiver should be keyed only if the light is fully extinguished. A brief flash of the light when setting the frequency select switches, or when keying the transceiver, is just an indication that the synthesizer has become unlocked momentarily while changing frequency.

With the PTT line open (receive mode), connect a frequency counter to the receiver output jack and set the frequency select switches to 146.000 MHz. Adjust C34 until the counter reads 22.5500 MHz. Ground the PTT line (transmit mode) and adjust C31 until the counter reads 24.3333 MHz. It should be noted that the reading of 22.5500 MHz in the receive mode assumes that Y2 is 21.5500 MHz, which is the proper crystal for a 10.7-MHz i-f. For any other i-f, the counter should read (24.3333 − i-f/6). This completes the calibration of the synthesizer.

The unit should be built in a metal box with a cover that makes good electrical contact all around its perimeter. This prevents rf from getting into the synthesizer from the transceiver. Connecting leads to the transceiver should be made with RG-174/U. The first step in interfacing the synthesizer to the transceiver is to select Y2. Its value depends on the i-f frequency of your transceiver. For a radio with a 10.7-MHz i-f and receive crystals in the 45-MHz region, Y2 will be (23.3333 − 10.7/6) = 21.5500 MHz. For other i-fs, (23.3333 − i-f/6) will give the value for Y2. Even though the transceiver takes 45-MHz crystals and 22-23 MHz comes from the synthesizer, the receiver's oscillator and multiplication circuits do the proper multiplication. Receivers using 15- or 22-MHz crystals will also work with this scheme.

Connect the receiver output coax to the transceiver at an unused receiver crystal socket. Use a .001-uF capacitor to couple into the socket (Fig. 6).

The transmitter output coax from the synthesizer also goes to an unused crystal socket, but a 100-Ohm resistor and a .001-uF capacitor are connected as shown in Fig. 7. The resistor assures smooth operation of Z2. A ferrite bead is placed as shown to act as a choke which keeps the VHF rf from entering the synthesizer.

The PTT input line should go to a line in the transceiver that is open or has at least +5 volts on it during receive and is grounded during transmit. This line will most probably be the PTT line from the microphone to the relay. The +12-volt input line can go to the same place from which the transceiver gets power, but if it is at all possible, connect it to some source of regulated and hash-filtered power within the rig. A ferrite bead should be placed at the ends of the coax on both the PTT and +12-volt connections. See Fig. 8.

The most difficult part of interfacing the synthesizer to a particular transceiver is keeping stray rf from the transceiver from getting into the synthesizer. This problem will be noticed when your audio is reported as sounding bassy or distorted. A very severe case of rf leakage will cause the unlocked light to glow on transmit. A less severe case will cause the aforementioned bassy audio.

Cable	Length (inches)
J1	3½
J2	3¼
J3	4¼
J4ab	3½
J4bc	4½
J5ab	3½
J5bc	2½
J6	3½

Table 3. Cable lengths (RG-174/U).

If you have this problem, listen to yourself on a nearby receiver. Disconnect the receiver's coax at the synthesizer while transmitting, to see if the audio clears up. If it does, then this is the path of leakage. Try more ferrite beads or an additional low-pass filter in series with the other one. To check if the rf is leaking through the power supply line, temporarily run the synthesizer off a 12-volt battery and see if the audio clears up. If it does, try more ferrite beads or a larger value for RFC6. To check if the rf is leaking through the PTT line, disconnect it from the synthesizer and simply short the PTT input to ground. If the audio clears up, try more ferrite beads or another bypass capacitor. If none of these remedies seems to cure the problem, then the transmit

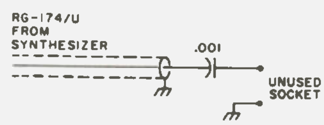


Fig. 6.

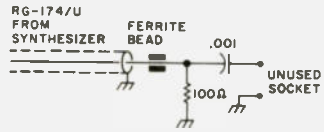


Fig. 7.

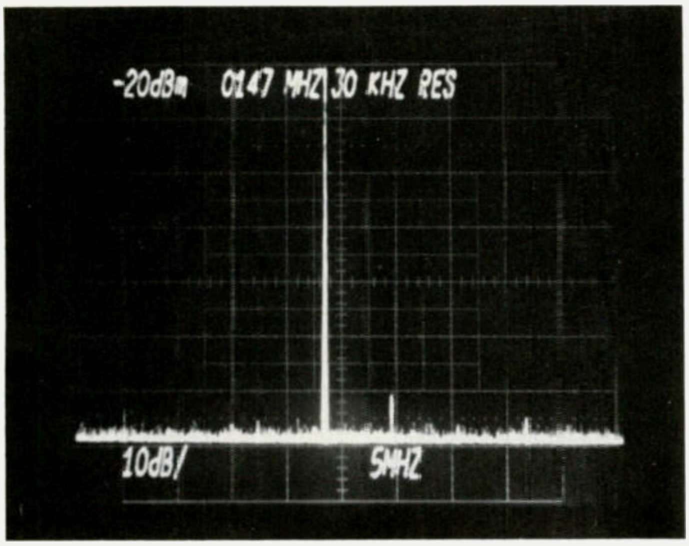


Photo C.

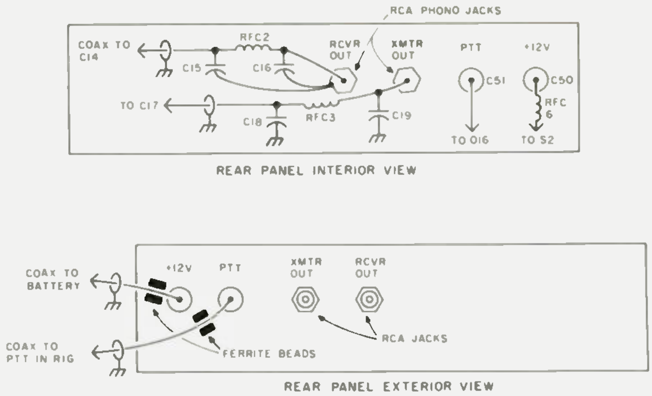


Fig. 8. Rear panel connections.

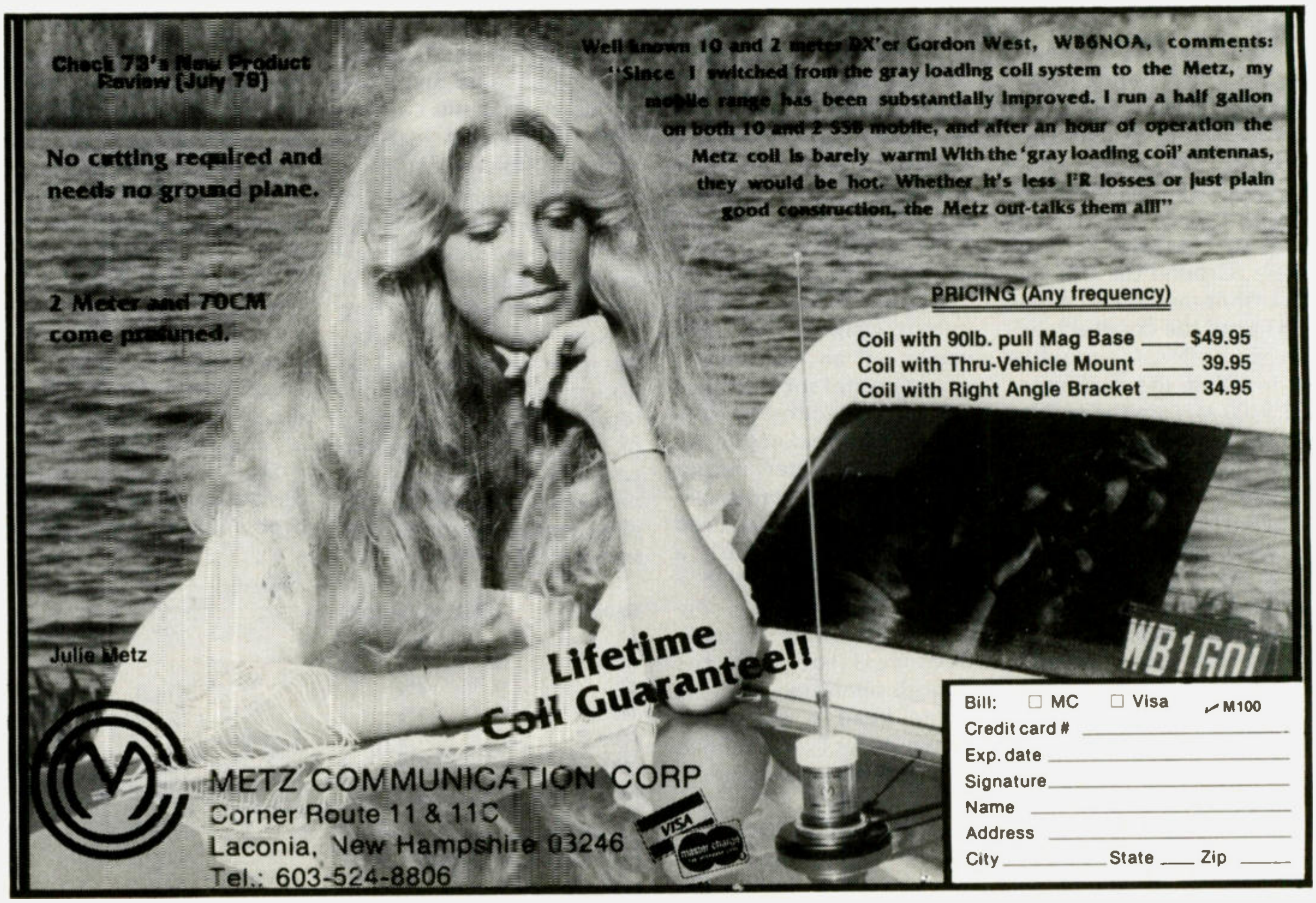
coax is probably the path of coupling, and additional ferrite beads or another low-pass filter probably will fix it.

Photo A is a spectrum analyzer photograph of the 6-MHz output of the synthesizer being sent to my transmitter. The analyzer is set for a 30-Hz resolution, 500 Hz per division, and a 10-Hz video filter in place. The vertical is calibrated at 10 dB per division. The signal is very clean; there is no sign of the 833.333-Hz reference sidebands, and the noise is 60 dB down. Photo B is the output of my transceiver with the synthesizer set at 146.000 MHz. The analyzer is set for 3-kHz resolution, 100 kHz per division, and 10 dB per division vertically. There are no close-in spurs within 60 dB. Photo C is also the output of my transceiver, but the resolution is 30 kHz, and every division now represents 5 MHz. The strongest spur is at about 154 MHz, but it is 60 dB down, complying fully with the latest FCC regulations for spurious output.

In conclusion, this synthesizer is performing very well on my HW-202. It is a versatile design and it leaves room for many additions that people may want to incorporate.■

References

1. "Automatic Repeater Offsets," Bruce McNair N2YK, *73*, November, 1978, p. 82.
2. "A Practical 2m Synthesizer," Michael I. Cohen WA3SYI, *73*, September, 1977, p. 146.



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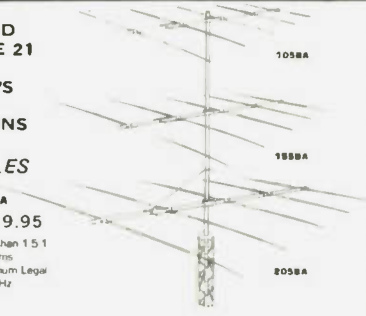

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2:1 VSWR Bandwidth	400 KHz	500 KHz	1.5 MHz
Longest Element	36½'	24½'	18½'
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Boom Diameter	2"	2"	2"
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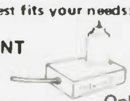

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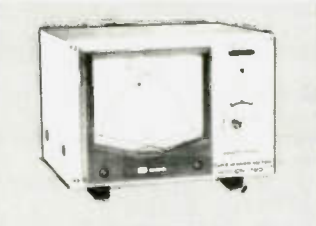

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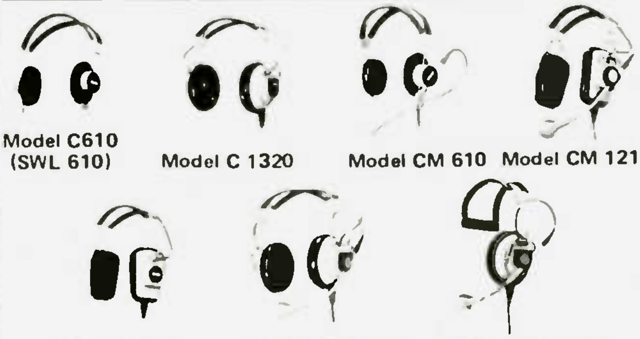
Headphone Impedance	3.2 20 ohms	2000 ohms	3.2 20 ohms	3.2 20 ohms	3.2 20 ohms	3.2 20 ohms	3.2 20 ohms	3.2 20 ohms
Microphone Frequency Response					50 8000 Hz	50 8000 Hz	50 8000 Hz	50 8000 Hz
Microphone Impedance					High	High	High	High
Microphone Sensitivity Below 1 volt/microbar at 1kHz					51dB ±5dB	51dB ±5dB	51dB ±5dB	51dB ±5dB
Price	$10.45	$12.25	$29.70	$41.80	$47.20	$62.75	$75.25	$59.95



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—while designed for biomedical signals, these circuits work with any analog data

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Joseph J. Carr K4IPV
5440 South 8th Road
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The use of OSCAR to transmit human electrocardiograms (ECG—or EKG, after the German spelling), and the article in the February, 1978, issue of *73 Magazine* ("Inexpensive EKG Encoder" by WA3AJR), indicate interest in the transmission of analog data. The techniques needed to transmit the human ECG are also useful for transmitting almost any form of analog data signal in which the repetition rate is low and all frequency components fall into the "under 500 Hz" range. In this article, we will examine such circuits from the viewpoint of the human ECG and certain other physiological signals, but the information can be applied to other problems as well.

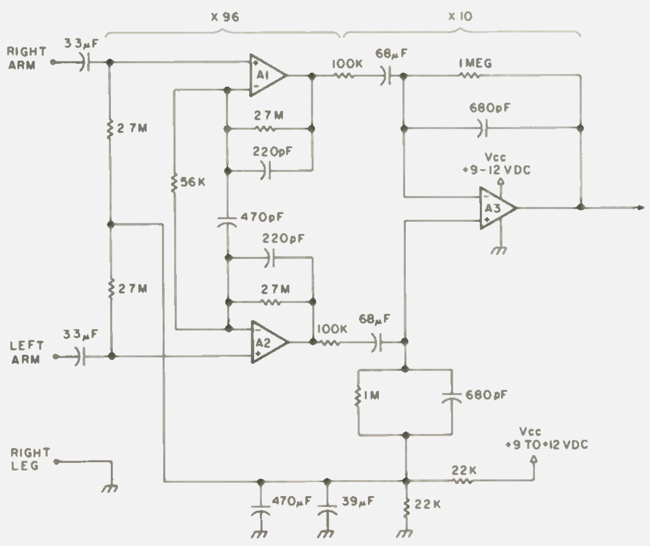

Fig. 1. Typical ECG preamplifier.

The ECG Preamplifier

The peak amplitudes in the ECG waveform are on the order of 1 or 2 millivolts, and significant frequency components exist in the 0.05- to 100-Hertz range. Electronic amplifiers used in professional diagnostic ECG equipment will have this AHA-recommended frequency response, while equipment used exclusively for monitoring usually has a frequency response of 0.05 to 40 or 50 Hertz (depending upon manufacturer).

ECG preamplifiers usually are differential types so that their inherent rejection of common mode signals can be used to eliminate 60-Hertz interference.

Additionally, ECG preamps must be capacitor-coupled to prevent drift due to changes in the *electrode-offset potential* that exists between the electrode and the patient's skin. The electrolytic skin surface reacts with the metallic electrode to form a battery that produces upwards of a volt or more.

Fig. 1 shows the circuit for an ECG preamplifier used in a battery-operated radio telemetry transmitter. This circuit operates from a single 9- to 12-volt dc power source, although, in most non-portable applications, it could easily be redesigned to take advantage of the operational amplifier's bipolar power supply terminals.

The circuit in Fig. 1 is basically an ac-coupled version of the classic instrumentation amplifer, and has a voltage gain of approximately 1000 (see "Op-Amp Encyclopedia" by K4IPV, *73 Magazine*, February, 1978).

Under specific sets of circumstances, ac mains-powered equipment can be hazardous to connect to some patients, so modern ECG preamplifiers use isolated designs. In most cases, the output of a preamplifier such as in Fig. 1 will be used to amplitude-modulate an oscillator operating in the 30- to 100-kHz range (see Fig. 2). The preamplifier will be on an isolated portion of the printed circuit board, along with the amplitude-modulator and a floating rectifier-filter that creates a dc power suply from the 50-kHz signal. Alternatively, some use separate dc-to-dc converters that do essentially the same thing from a separate oscillator.

The situations that create a hazardous environment for patients do not ordinarily exist outside of the hospital/medical environment, but experimenters and science-fairists who might want to use these techniques are advised *not* to connect people to *any* mains-powered equipment. The use of battery power provides the same isolation as used in professional equipment, but only if the entire apparatus is battery operated.

Transmission Encoders

Some portable units do not encode the ECG waveform at all before transmission, and are called direct-FM telemetry systems. In this type of transmitter, the output of a preamplifier such as in Fig. 1 is applied directly to a varactor-modulated crystal oscillator. In one popular brand, the oscillator operates at 12 to 14 MHz and is multiplied into the 174- to 215-MHz region with the final deviation being 75 kHz or so.

Other models first encode the ECG waveform in the form of a frequency-modulated audio carrier that can be transmitted over a wire or radio communications channel. This method is called FM/FM telemetry. The encoder consists of a voltage-to-frequency converter, or voltage-controlled oscillator (vco), that uses the ECG signal as its control or input voltage. The output of the vco is then applied to an ordinary FM transmitter.

Fig. 3(a) shows a circuit for an ECG encoder that was originally designed at the National Institutes of Health (NIH)[1] in Bethesda MD, for use in telephone call-in cardiac pacemaker-surveillance systems.[2] The circuit was built into the case of a modem (modulator/demodulator used in computer systems), and was issued to patients. The box had a pair of telephone earpiece cups so that the tone could be transmitted down the line. The patient would phone in to the pacemaker clinic once a week, where an analog recording of the waveform was made, and certain computer measurements were taken. These were reviewed later by a cardiologist (an M.D.), who would decide whether or not to ask the patient to come in for a closer examination.

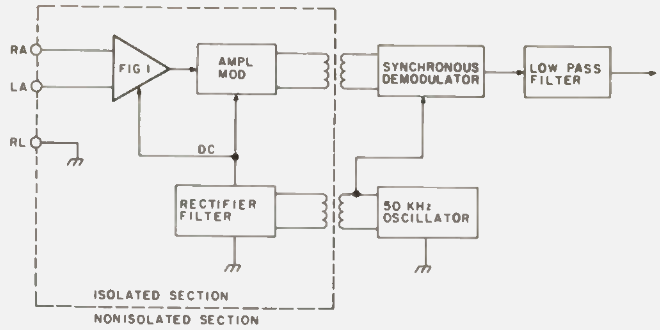

Fig. 2. Block diagram of an isolated ECG preamplifier.

The encoder in Fig. 3(a) uses four 741-family-operational amplifiers and a Motorola MC4024P vco chip that drives a loudspeaker in the modem box. Note that this device is filtered too heavily to provide diagnostic quality ECG recordings, but is sufficient for the limited purpose intended. For those who wish to use the circuit for a wider frequency-response system, some modification of the low- and high-pass filter sections is in order.

Gain is provided by amplifier A1, while A2 serves as the high- and low-pass filter section. The frequency response was limited intentionally so that interfering signals from the patient's skeletal muscles did not obscure the ECG waveform—a necessity because of the less-than-optimum situations in which recordings were attempted. The amplifier input lines were connected to a pair of 1.5-inch metal disk electrodes on the top surface of the modem box. This is not the best possible configuration, but is convenient for the home patient.

The 60-Hertz power mains will cause a tremendous interference signal to be present in nondifferential amplifiers and in those differential amplifiers in which the input balance cannot be maintained. To overcome this, a 60-Hz notch filter, A3 plus the cir-

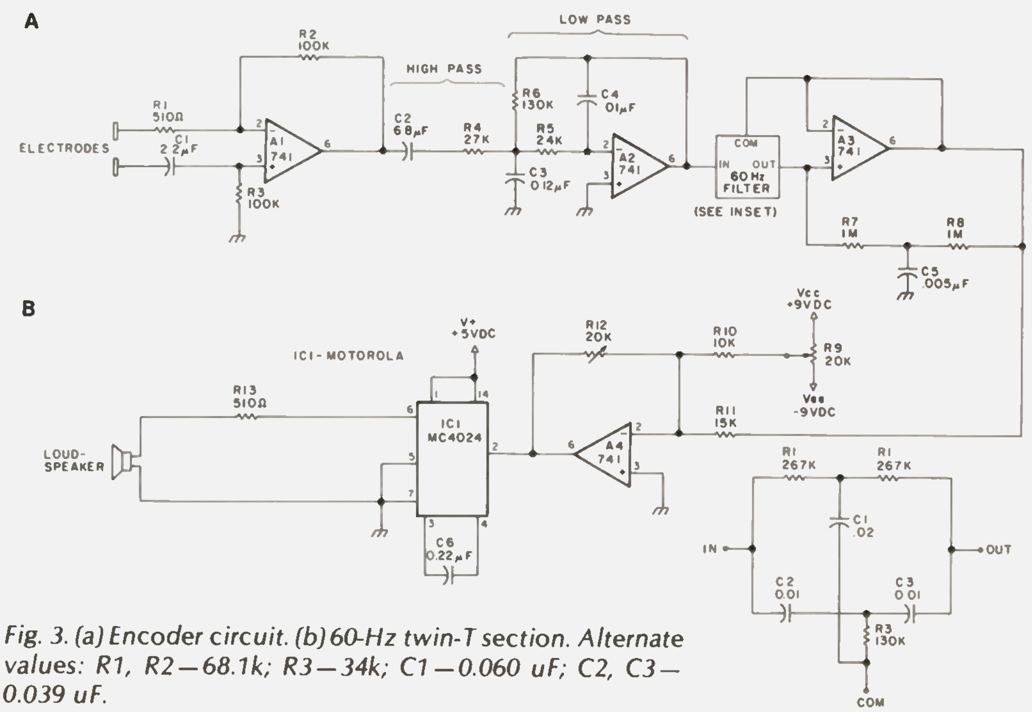

Fig. 3. (a) Encoder circuit. (b) 60-Hz twin-T section. Alternate values: R1, R2—68.1k; R3—34k; C1—0.060 uF; C2, C3—0.039 uF.

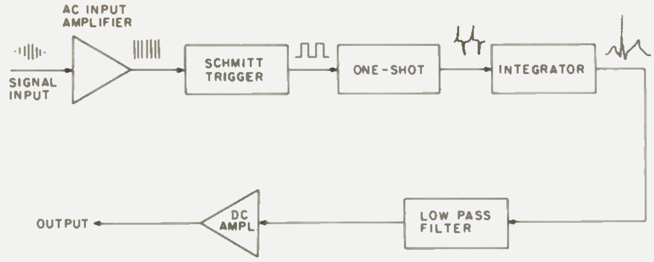

Fig. 4. Block diagram of a pulse-counting FM detector.

cuit in Fig. 3(b) is provided. A claim of 50-dB suppression is made, but we could verify only 18-23 dB.

Amplifier A4 serves as a level shifter between the ECG preamplifier and the MC4024P vco input. The output of the vco is fed to a loudspeaker for acoustical coupling to a telephone. Note that a series resistor is used between the speaker and the vco. This component is needed because the TTL output of the vco will be loaded too much by the low impedance typical of speakers.

The output of the vco in Fig. 3(a) is too high for most radio transmitter audio input stages, and the waveform consists of a chain of square waves. To overcome this problem, an attenuator/low-pass filter is needed between the vco output and the radio transmitter input connector.

Decoders

Neither the circuit of Fig. 3(a) nor the circuit presented in the February, 1978, issue of *73* is useful by itself, except to show that your heart can control the whistle of the modulation in the loudspeaker! Unless a decoder (i.e., FM demodulator) is provided, all these circuits can do is whistle at you in step with the ECG waveform!

The encoded signal is an audio-range (1 to 5 kHz) carrier that is frequency-modulated by the ECG waveform. Any phase-sensitive detection scheme could conceivably work, but two types are most commonly employed: phase-locked loops, and pulse-counting (also called digital) FM demodulators.

A number of technical papers have been written that show the use of low-cost PLL chips for ECG telemetry decoding, but, in my experience, these circuits have not been altogether satisfactory. It seems that many of the low-cost PLL chips do not recover rapidly enough following the ECG R-wave (the spike-like feature). This results in distortion of the waveform in an area that is of particular interest to the physician. Such circuits should, however, prove interesting to the hobbyist who can tolerate some distortion.

It is a little easier to use the pulse-counting detector of Fig. 4. The signal received from the radio loudspeaker or telephone line will probably be weak and noisy, so the first stage will be an amplifier and bandpass filter stage. It should have a bandwidth that is not much greater than the signal's frequency swing, i.e., 2x deviation. In most encoders, the deviation is 25 to 75 percent of the unmodulated carrier frequency.

The amplified audio-FM carrier is then squared in a Schmitt trigger circuit or other form of circuit that will produce output square waves from irregular input signals. The output of the Schmitt trigger is then differentiated to form spike pulses that are suitable for triggering a monostable multivibrator (one-shot).

The actual detector consists of the one-shot and an integrator stage. This arrangement is common not only in telemetry applications, but also in many industrial and scientific instruments, including FM-carrier tape recorders that record low frequency analog data on ordinary audio tape. This circuit produces a dc level that is proportional to the frequency or pulse-repetition rate of the input signal.

The one-shot produces an output pulse for each trigger pulse received at its input. The one-shot output pulses differ from the input pulses, however, in that they have a constant amplitude and duration (period). Only their repetition rate varies with the input frequency. As a result, the output of the integrator, which is a time-averaging circuit, is a dc level proportional only to frequency. Note that at least one high-quality hi-fi FM tuner uses this technique at 10.7 MHz to demodulate the FM i-f signal. The integrator is a form of low-pass filter, so the circuit is inherently low-noise.

A practical example of this type of detector is shown in Fig. 5(a). Note that this is not a clinically acceptable circuit, but it is able to produce results that are good enough for educational or experimental applications. Most serious experimenters wishing to transmit low-frequency human or animal physiological signals by radio or wire, or to store them on an audio tape, will be successful with this circuit.

An LM311 voltage comparator is the input signal conditioner. This circuit is connected as a zero-crossing detector and requires at least 200 mV of signal to operate reliably. Lower signals can be accommodated if IC1 is preceded with an operational amplifier gain stage.

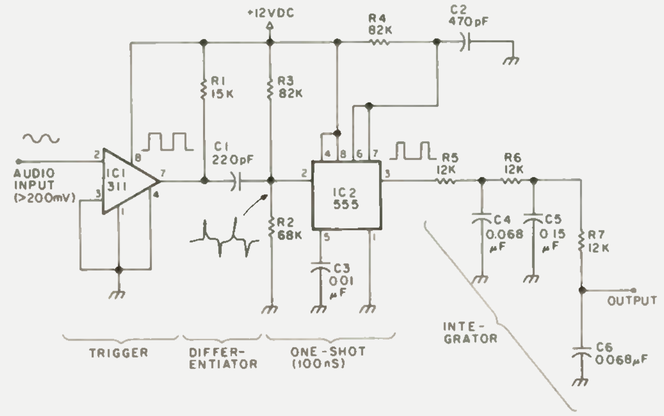

Fig. 5(a). Practical hobbyist decoder circuit.

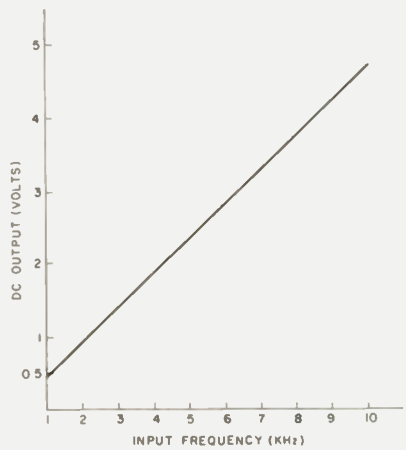

Fig. 5(b). Output voltage versus input frequency.

The square waves at the output of the LM311 are differentiated by C1-R2 to form spike pulses that will trigger the 555 one-shot stage (IC2). The 555 output pulses have a constant amplitude and duration, but their repetition rate varies with the input frequency.

The 555 pulses are integrated in a three-stage RC integrator. The output is taken across capacitor C6, and is a frequency-dependent dc potential. The graph showing input frequency versus dc voltage is shown in Fig. 5(b).

Does it work? I built a modulator using the A4/IC1 portion of Fig. 3(a) and used a function generator to drive its input. A triangle waveform of 2 Hz was selected because it approximates the frequency components of the ECG waveform. The output of the modulator was attenuated and then applied to the input of the circuit in Fig. 5(a). Fig. 5(c) shows the original input waveform from the function generator (upper trace) and the dc output of the decoder (lower trace). Note that the demodulated version shows some, but not much, loss of high frequencies in the waveform.

The vertical gain of the oscilloscope used was adjusted to show more clearly the two waveforms. The amplitude of the upper trace was several volts p-p, while that of the lower was approximately 80 mV p-p. An operational amplifier following the integrator would build this level up to whatever level is required.

Accessories

A qrs-beeper can be used by using the R-wave to trigger an audio oscillator. this is the "beep-beep" used to good effect in doctor TV shows. A popular method is to use the R-wave to fire a one-shot that drives one input of a NAND gate. The other input of the NAND gate is driven by a 1-kHz (or so) audio oscillator.

Alternatively, the output of the one-shot that is triggered by the R-wave can be connected to an LED to form a qrs-flasher. These circuits are shown in Fig. 6. In both cases, the noninverting input of the comparator might either be grounded, as in Fig. 5(a), or connected to a dc level that prevents the comparator from firing on noise impulses or, in most cases, the ECG T-wave.

The circuit of Fig. 5(a) is also useful to make a cardiotachometer (jargon for heart-rate meter) if the time constants are changed. The ECG waveform has a fundamental frequency of approximately 0.5 to 2 Hz, so it will not work properly with the 2-kHz values used when the decoder in Fig. 5(a) is used, but the same principle is used in the tachometer. (The same principle has been published many times as an auto tachometer, incidentally, again with suitable component value changes).

In the case of a cardiotach, the one-shot duration should be 25 to 50 ms, and the values of the integrator capacitors and resistors will probably have to be raised. The dc output meter can be calibrated in beats-per-minute. If you do not have a 1-Hz range function generator to calibrate this circuit, then use TTL or CMOS counter/dividers *a la* crystal calibrator circuits to divide the 60-Hz line from a 5-V ac filament transformer (*not* direct from the 115 V ac line!) down to 0.5, 1, and 2 Hz for calibration purposes. ■

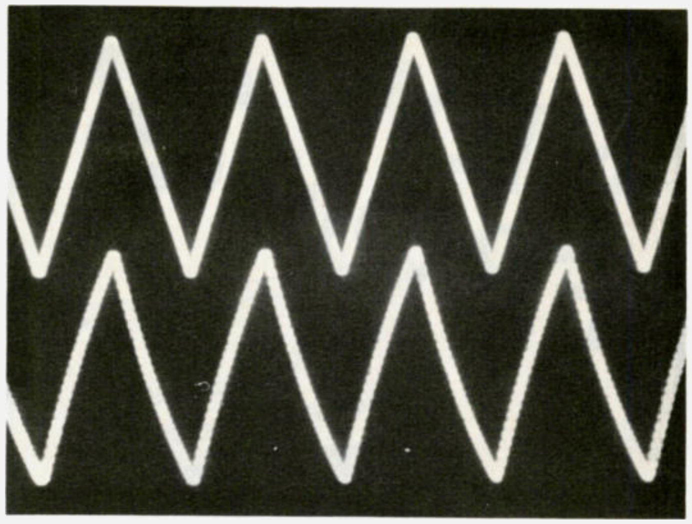

Fig. 5(c). Input (upper) and output (lower) waveforms.

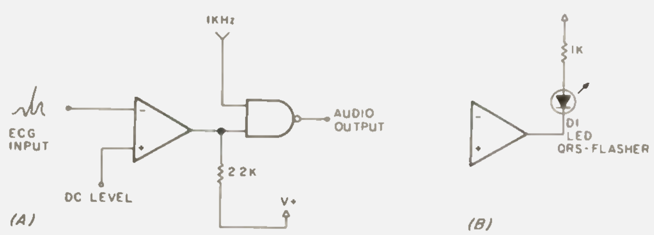

Fig. 6. (a) Qrs-beeper. (b) Qrs-flasher.

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2. Klingenmaier, C.H. *et al*, "A Method of Computer-Assisted Pacemaker Surveillance From a Patient's Home via Telephone," *Computers and Biomedical Research*, 6, pp. 327-335, 1973.

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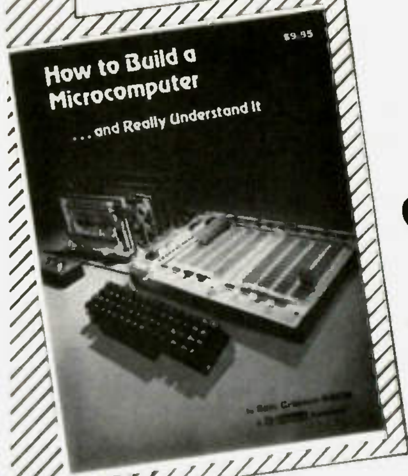

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The MICROSIZER: Computerized Frequency Control

—a synthesized vfo replacement for most HF rigs

The use of microcomputers in the operation of amateur radio stations has increased rapidly in the past year. Applications have ranged from simple Morse keyboards to complex antenna-tracking systems. One use that has been neglected is that of controlling the frequency of a transceiver with a microcomputer. Microcomputer frequency control is extremely useful and flexible, but has not been explored because of the incompatibility of analog vfos in transceivers with the digital output of the microcomputer. Now, however, it is possible to combine a handful of inexpensive digital ICs with a few discrete components on a single printed circuit board to form a 5.0-5.5-MHz frequency synthesizer. This unit can serve as a solid-state replacement for the mechanically-tuned vfos used in nearly every popular amateur HF transceiver. Because thumbwheel switches do not meet the amateur's requirements for casually scanning the bands, a convenient method of "tuning" the synthesizer is needed. The marriage between the computer and the radio was inevitable. This article presents a practical approach to building an HF synthesizer for your transceiver, plus some simple software to enable a 6800-based microcomputer to control it.

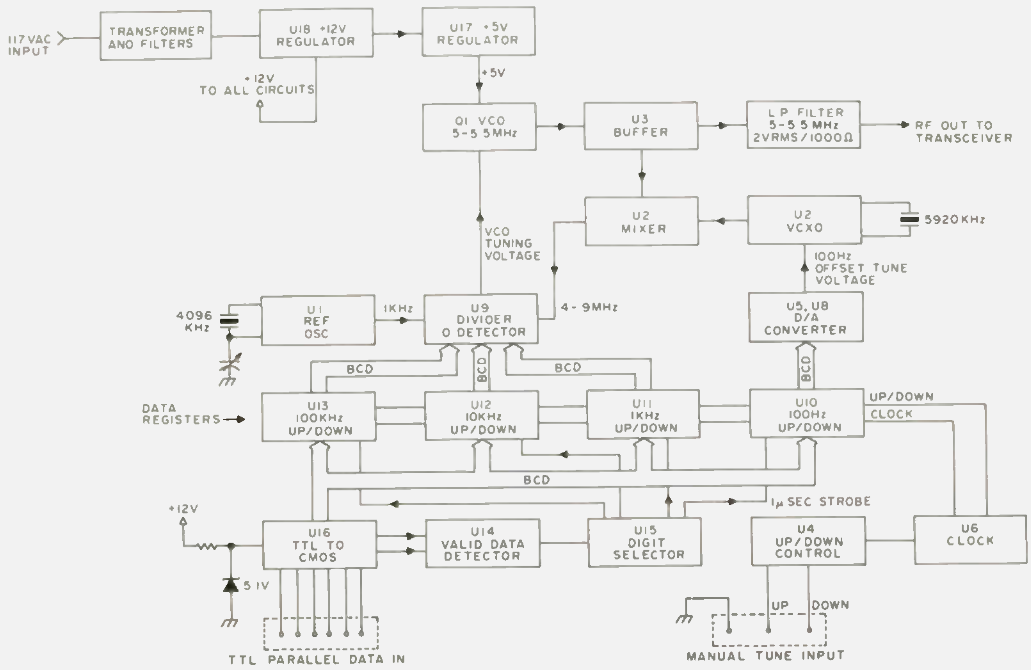
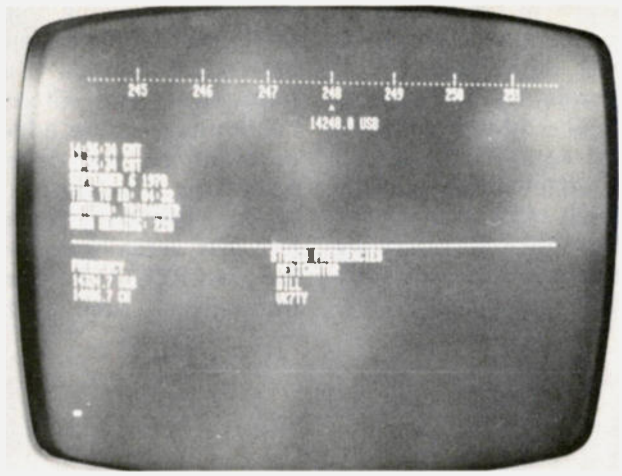


Fig. 1. Block diagram of the MICROSIZER. All parallel data bits are normally high between data words for at least 1 μs. Valid data should be held for a minimum of 4 μs. All digit values are BCD. Digit selector: 100 Hz = 00; 1 kHz = 10; 10 kHz = 01; 100 kHz = 11.

The Hardware

The MICROSIZER, as it is affectionately called, is a solid-state, digitally-synthesized remote vfo that will operate with virtually any HF transceiver. It tunes the popular 5.0-5.5 MHz vfo range in precise 100-Hz increments and can

MICROSIZER in operation at WAØQJI.



Simulated "dial" display.

be controlled by an 8-bit parallel interface port from any microcomputer. The frequency stability and signal purity are excellent, exceeding that of most analog vfos. When controlled by a computer, a CRT terminal is used for entering and displaying the operating frequency. Alternately, the MICROSIZER can be used by non-computer-equipped amateurs as a stand-alone remote vfo with fast or slow up/down tuning controlled by the station's keyer paddle. When operating without a computer, a digital readout in the transceiver is used to indicate the operating frequency. A dual paddle is preferred, offering a slow tuning rate of 500 Hz per second if either the up or down paddle is activated. If both paddles are closed simultaneously, the tuning rate increases to 20 kHz per second, with the tuning direction determined by which paddle was first closed.

Circuit Description

The MICROSIZER's circuitry consists mostly of CMOS ICs and is contained on a single-sided 4.8" × 5.3" PCB. The board has been designed for mounting in a Radio Shack Model 270-253 utility cabinet. Most of the parts are available directly from regular advertisers in *73 Magazine*. A PCB and some other selected parts can be supplied by sources listed in the parts list on page 82. Please note that the PCB layout printed here is copyrighted and reproduction by individuals for other than their private use is prohibited. Microcomputer interface or local control connections are through a 10-terminal connector on the rear panel. Other than an on/off switch, no controls are required on the front panel, making out-of-the-way placement convenient.

Circuit Operation

Refer to the block diagram in Fig. 1 and the schematic in Fig. 2 for the discussion to follow. The vco (voltage-controlled oscillator) operates directly at 5.0-5.5 MHz, using a high-Q varactor-tuned Colpitts circuit. The output of the vco drives the vco buffer, U3, and is then low-pass-filtered and applied to the transceiver. The output level is approximately 2.0 V rms across 1000 Ohms, a level compatible with the remote vfo input requirements of most transceivers. The output of the vco also drives a section of U3 used as a buffer, which is applied to mixer U2. Another input to the mixer is from the vcxo offset oscillator, U2, operating at approximately 5.9 MHz. The difference frequency from the mixer is in the 400 to 900 kHz range and is applied to U9, a Hughes HCTR-0320, containing a 3-stage programmable divider and a phase detector. The 100-, 10-, and 1-kHz BCD inputs to the programmable divider section of U9 determine the division ratio. The phase detector section of U9 compares the output of the divider with a 1.00000-kHz reference signal, converting any frequency or phase error to an error voltage to correct the frequency of the vco. The 1.00000-kHz reference signal is derived from a 4096-kHz oscillator and 12-stage binary divider, U1.

Thus, five hundred 1-kHz channels are produced over the 5.0-5.5 MHz range by varying the data to the programmable divider from 400 to 900. This data comes from 3 sections of a 4-section data register composed of U10 through U13. This register is a 4-decade up/down presettable counter with outputs from 0000 to 5000, corresponding to the five thousand 100-Hz channels. The output of the 100 kHz counter, U13, is modified by a section of U7 so that 4 is added to its output. Thus, the data presented to the programmable divider, U9, varies from 400 to 900 as the vco output varies from 5.5 to 5.0 MHz. The 100-Hz steps are produced by varying the frequency of the 5.9-MHz offset vcxo (voltage-controlled crystal oscillator) over a 900 Hz range in nine 100-Hz steps. This is accomplished by a digital-to-analog (D/A) converter (U8 and U18) controlled by BCD inputs from the 100-Hz section of the data register, U10. This scheme allows a lockup 10-times-faster than at least one commercially-available HF transceiver—without sacrificing frequency resolution. The data register can be clocked up or down at a fast or slow rate by circuits from U6 and U4. This is the mode of operation when microcomputer control is not used. The data register is automatically reset to 0000 each time power is applied to the MICROSIZER, preventing invalid BCD codes from upsetting U9. Microcomputer control is accomplished by utilizing outputs of a TTL-to-CMOS converter, U16, to program the BCD preset inputs of the data register. The two digit-select bits are also converted from TTL to CMOS levels by U16 and then decoded to one of four outputs by U15. U15 is enabled by a one-microsecond strobe pulse to load the data register with the BCD data present on bits 0-3 of the 8-bit interface. As in the manually-tuned up/down mode, 0000 in the data register corresponds to an approximately 5.5-MHz vco output frequency. The 5.9 MHz offset vcxo is actually at 5.920 MHz so that 0000 will produce an operating frequency approximately 20 kHz below each amateur band, allowing plenty of margin for off-frequency heterodyne crystals in the transceiver. The software calibration routine adds a constant to the desired operating frequency to produce the "data frequency" that actually controls the MICROSIZER. Some transceivers, such as the Drake TR series, tune "backwards" on some bands, in which case 0000 would produce an operating frequency approximately 20 kHz above the high end of the normal tuning range of the vfo. This causes no major problems, because the operating frequency could be subtracted from a constant to produce the desired output data and tuning direction.

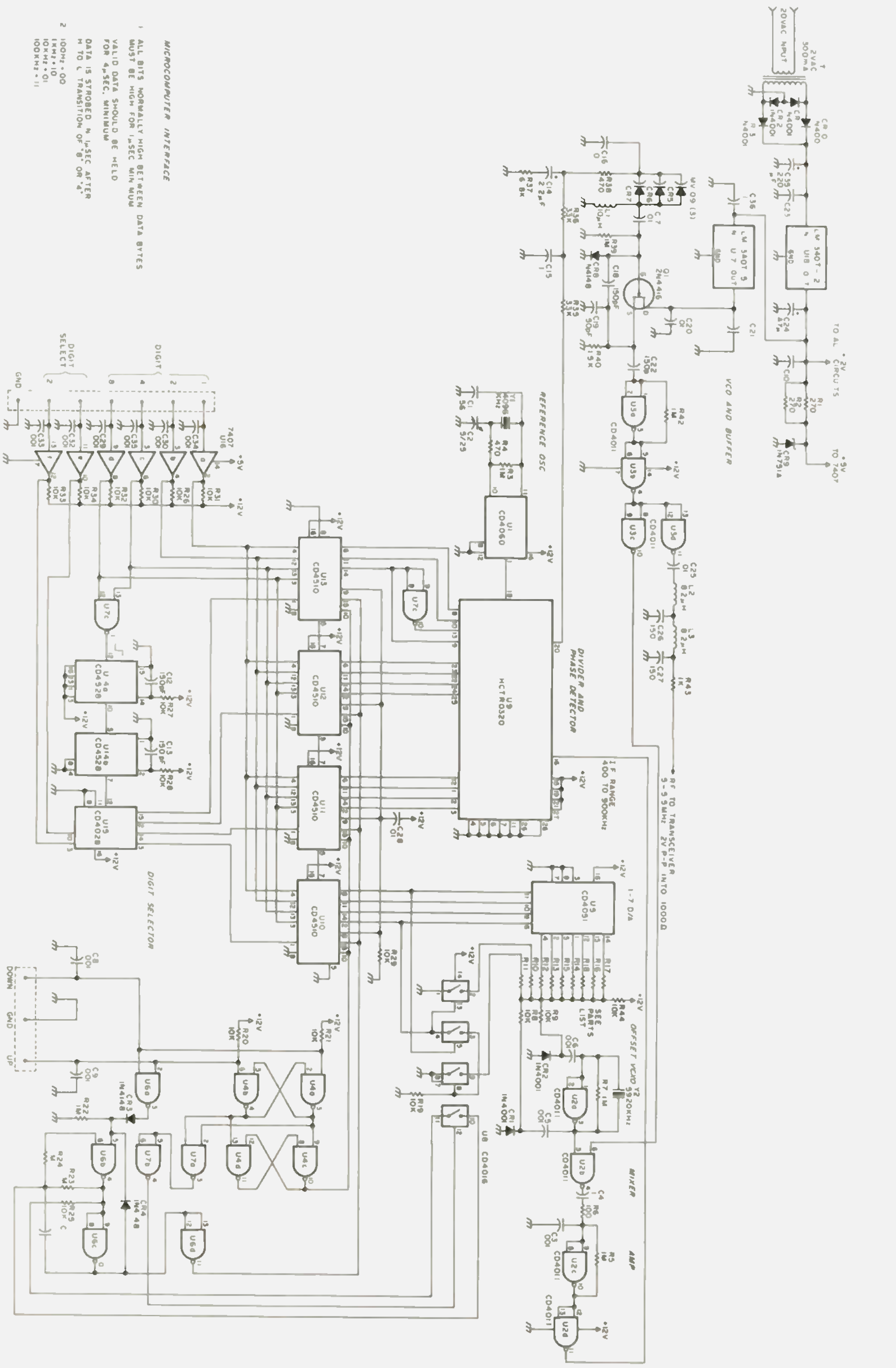


Fig. 2. Schematic of the MICROSIZER.

Power Supply

The vco operates from a regulated 5-volt source provided by a 3-terminal regulator, U17. The rest of the circuits operate from a separate 3-terminal 12-volt regulator. Five volts for the TTL-to-CMOS level converter is zener-regulated from the output of U18. Both 3-terminal regulators operate on 15 volts from the rectified and filtered output of a 12-volt transformer. A 10% variation in the ac line voltage causes no measurable shift in the output frequency. As is characteristic of all high-quality synthesizers, the frequency drift, even from a cold start, is very low, typically a few Hz. In the photograph of the spectrum of the MICROSIZER, note that the 1-kHz sampling sidebands are down more than 60 dB.

Possible Applications

The number of uses for a computer-controlled transceiver is limited only by the imagination. Here are a few seeds for thoughts. Many of you readers are programmers by profession and could develop these ideas more effectively than we.

Storage and Recall of Frequencies

Any of the 5000 channels in the basic 5.0-5.5 MHz range could be stored for instant recall by the computer. These frequencies could be catalogued as channel numbers, or with more meaningful designators (such as SSTV for 14.230 MHz or W1AW for 07.080 MHz). Some uses of this capability are:

1. Scanning selected frequencies for activity;
2. Split-frequency operation for DX;
3. Net operation and coordination.

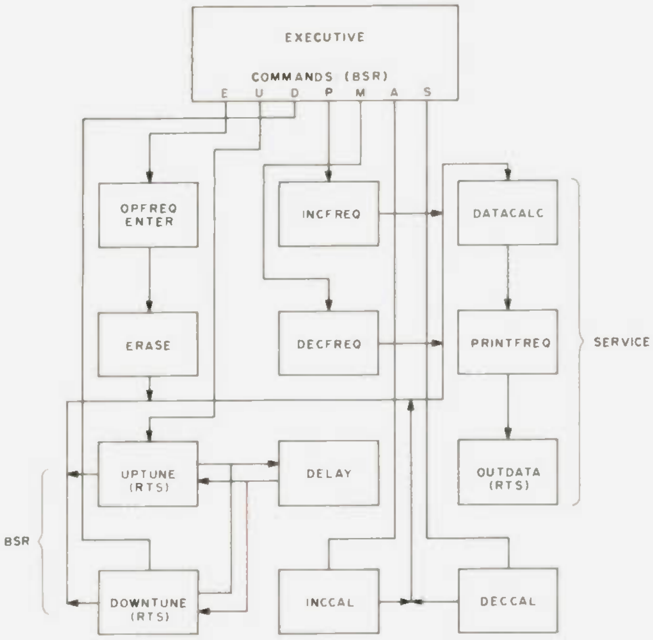
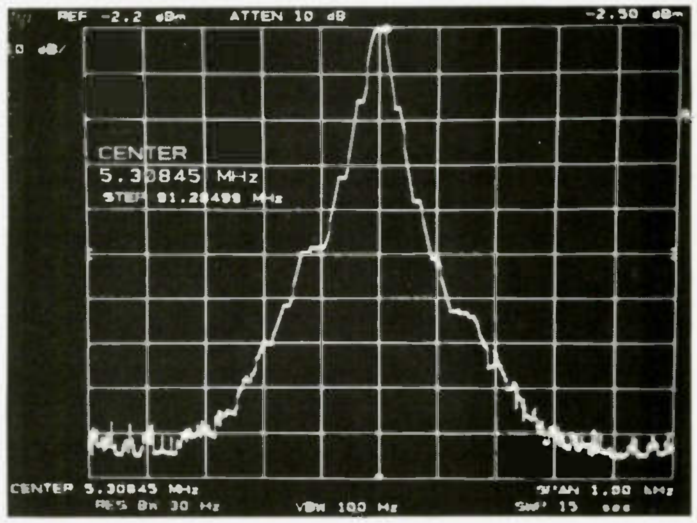


Fig. 3. Block diagram showing the functional arrangement of and linkage between the modules.



Spectrum analyzer photo of output.

Automatic Tuning

The transceiver could be swept automatically over any given band or band segment and at practically any tuning rate, ignoring undesired band segments. Out-of-band operation or operation on unauthorized frequencies can be detected by the tuning software, and an error message can be displayed to the operator. This would be especially useful during hectic contest or DX-chasing when the operator's attention sometimes strays. A similar frequency-recognization scheme could make the transceiver "hop over" foreign broadcast QRM on 40 meters or boring nets on 20 meters. With the computer's ability to decode CW, the times and frequencies of rare DX activity could be monitored and recorded continuously, especially during multiband single-operator DX contest operations.

Doppler Shift Correction For OSCAR-Relayed Signals

Using a variation of the automatic tuning mode, the transceiver could be tuned at the correct rate to track the Doppler shift of an OSCAR-relayed signal. Once a signal is initially tuned in, an OSCAR orbital prediction program and real-time clock in the microcomputer would determine the instantaneous Doppler shift and retune the receiver accordingly. The operator need only enter the geographic location of the transmitting station and the uplink and downlink bands.

Remote Control Operation

Virtually any microcomputer can be operated from a remote location by the addition of a simple modem and a remote terminal. This would permit

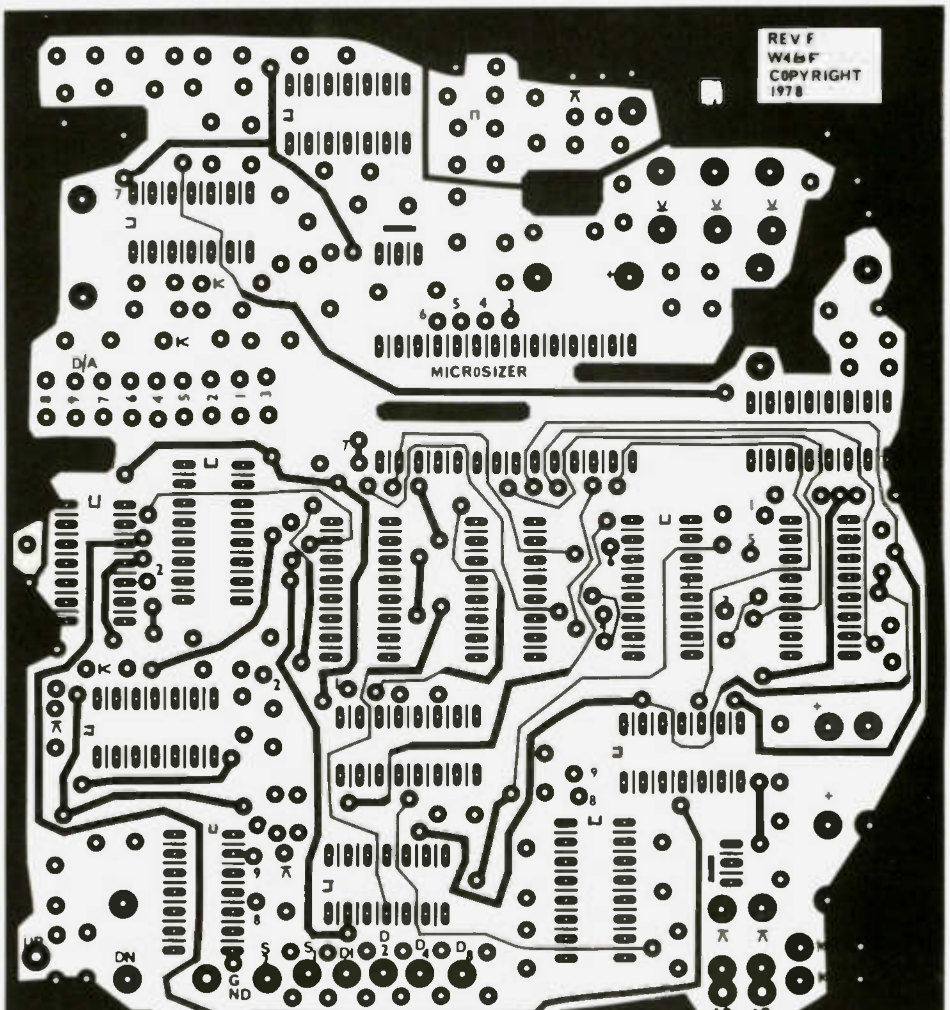


Fig. 4. Top view of PC board.

an operator to control the MICROSIZER and the other station functions from any location where an audio link could be established. The link could be either a telephone or radio system. Imagine operating your super DX station from your office telephone or through the local FM repeater! Unauthorized control of the system could be prevented by the use of classified "passwords" to limit computer access.

Improved Frequency Display

One common objection to digital readouts in conventional HF transceivers is the lack of visual "feel" when tuning. While tuning an analog dial, the operator can visually relate the operating frequency to other frequencies in the band. With a computer terminal serving as a display device, a simulated "dial" can be created with frequency calibrations and graticules moving left or right as the frequency changes. Some terminals even offer high-resolution color graphics, making possible some really "sexy" displays.

Some Software To Get You Started

OK, enough about our dreams. What have we really done? Well, desiring to develop some really useful software, but considering our lack of experience as programmers, we settled upon a few basic functions, which are:

1. Continuous CRT readout of the operating frequency;
2. Ability to tune continuously in 100-Hz steps;
3. Software correction for off-frequency heterodyne crystals;
4. Relocatable code;
5. Single 8-bit parallel interface.

This entire program was coded without the aid of an assembler, programming experience, or above average intelligence. Because each module of the program was developed and tested separately, this 500-byte program was only slightly more difficult to code than each of the short modules by itself. Our prime considerations obviously did not include fast program execution or ultra-efficient use of memory. An attempt was made to follow the basic guidelines of structured programming, but deviations were necessary because of the limitations of conditional branching in such a large program. Again, the program is modular in form, and branches between modules have been held to a minimum. The individual modules are simple enough for even the novice to understand. Each module may be modified to satisfy some special application requirement without disrupting the functions of the other modules. Because the program is relocatable, it should be easily integrated into any 6800 system having access to MIKBUG® or SWTBUG® routines and 520 bytes of RAM. Patches to other input-output routines will be very simple.

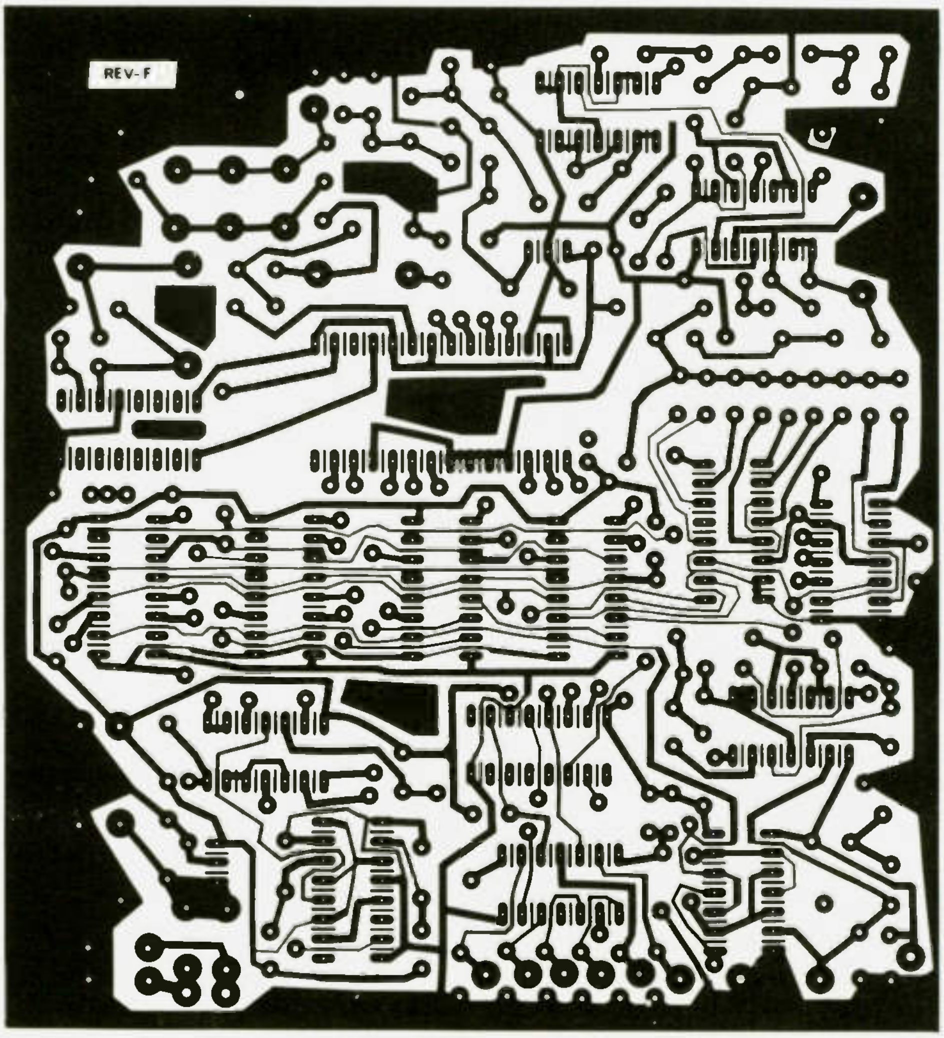


Fig. 5. Bottom view of PC board.

The Executive Routine (0030-007A)

The executive routine, as the name implies, is the master of this program. It monitors the system keyboard, decodes your commands, and calls upon the other modules of the program to perform various functions. Fig. 3 is a block diagram showing the functional arrangement of and linkage between the modules. Each module will be described in the text. The executive responds to the following commands: E—enter operating frequency; U—tune upward in frequency; D—tune downward in frequency; P—plus 100 Hz (single frequency step); M—minus 100 Hz (single frequency step); A—add 100 Hz to calibration offset; S—subtract 100 Hz from calibration offset.

Upon receiving an "E" command, the executive calls upon the "opfreq enter" module, which prompts with "FREQUENCY?" The operator enters six digits of frequency data. (Example: 142500.) Next, the "service" module adds this frequency data to the calibration offset (positive or negative), prints the operating frequency ("14250.0 kHz") on the CRT terminal, and outputs the frequency-controlling data to the frequency synthesizer sequentially through a single 8-bit parallel-output port.

A "U" command tells the executive to call upon the "uptune" module, a sort of "vice-executive" module, which in turn calls upon the "delay," "incfreq," and "service" modules repeatedly until any key is pressed, at which time program control is returned to the executive.

Similarly, on "D", the executive appoints "downtune," another vice-executive, to call the "delay," "decfreq," and "service" routines repeatedly until a key is pressed.

The "P" (plus 100 Hz) command tells the executive to call incfreq and service once only. The executive immediately resumes command of the program.

On "M" (minus 100 Hz), the executive calls decfreq and service, and resumes command.

On "A", the executive calls upon incal and service, and resumes command.

On "S", the executive calls upon decal and service, and resumes command.

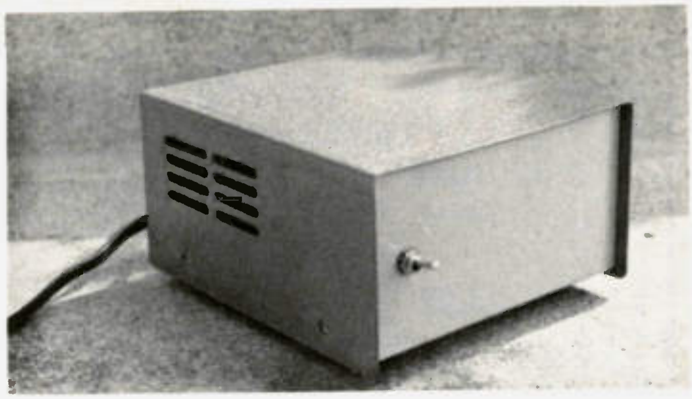
Future plans include a much more powerful executive to control synthesizer, Morse transmit and receive, and QSO logging routines.

Erase Module (007B-0098)

The erase module, when called, erases the screen of a CRT terminal by outputting the proper ASCII control characters. This module also initializes the 6820 PIA of the synthesizer interface port.

Delay Module (00EB-00F4)

The delay module, called by the uptune and downtune "vice-executives," determines the tuning rate of the uptune and downtune modes of operation. The number of cycles of the delay loop, and therefore the time delay, is determined by the values of the two bytes of data stored at hex locations A022 and A023 of the system's 6810 scratchpad RAM. The maximum delay occurs when A022/A023 contain FFFF, allowing 65,536 loop cycles, for a delay of approximately 1.75 seconds.



MICROSIZER in cabinet.

Incfreq Module (0099-00B1)

The incfreq module adds one (100 Hz) to the BCD frequency data stored at hex locations 0000-0005. A BRA command always routes the program flow to the service module.

Decfreq Module (00B2-00D2)

This module subtracts one (100 Hz) from the BCD frequency data stored at hex locations 0000-0005. A BRA command always routes the program flow to the service module.

Inccal Module (01D6-01EE)

Inccal adds one (100 Hz) to the BCD calibration offset data stored at hex locations 0007-000C. A BRA command always routes

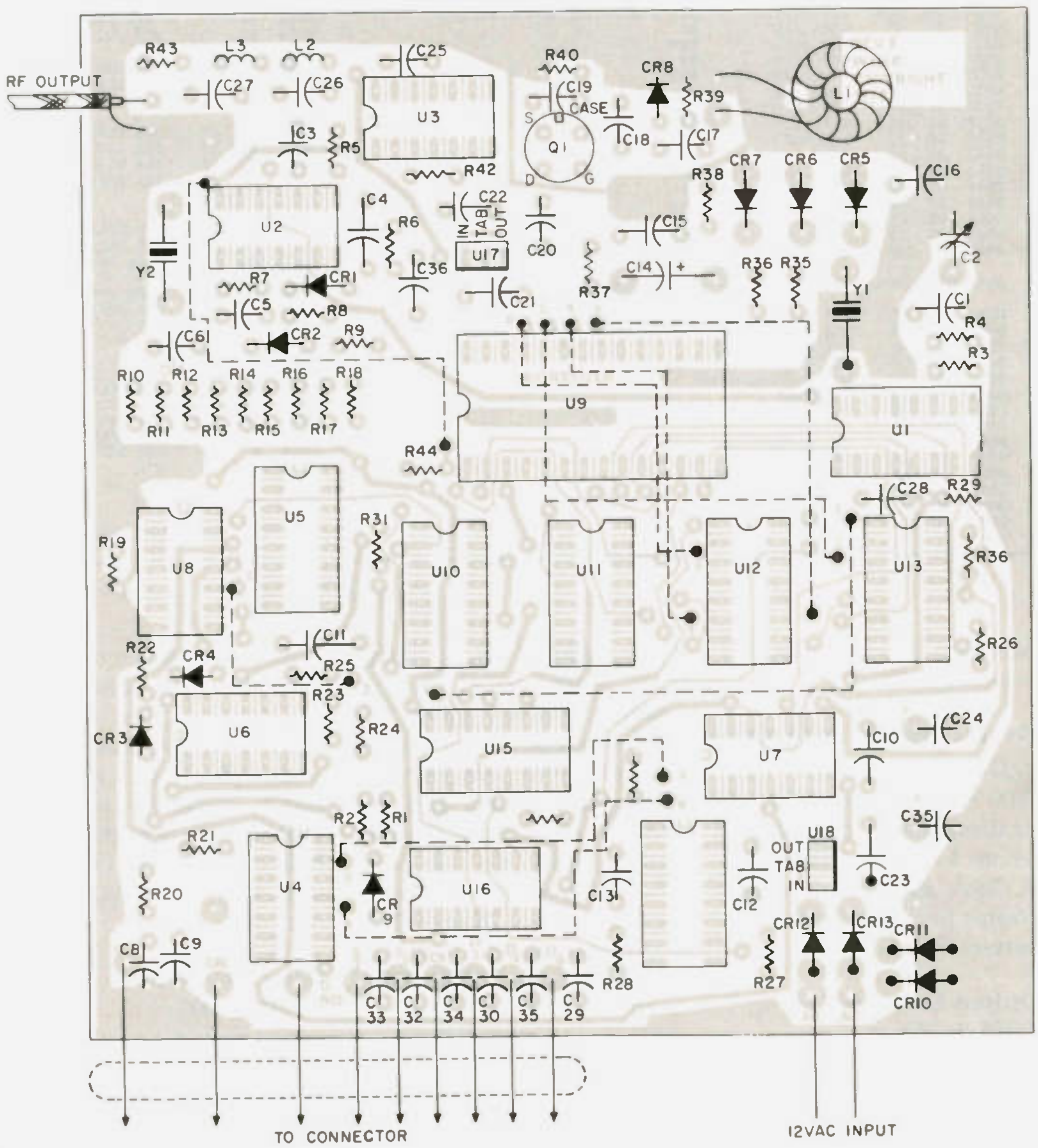


Fig. 6. Component layout of the MICROSIZER. Jumpers are shown with dotted lines.

```
DATA STORAGE MEMORY ALLOCATION

0000  30  "0"   (100 Hz)        Sample frequency of 14,205.0 KHz
0001  35  "5"                   and calibration offset of .7 KHz
0002  30  "0"
0003  32  "2"               OPERATING FREQUENCY DATA
0004  34  "4"
0005  31  "1"   (10 MHz)
0006  DD  STOP CHARACTER

0007  07  "7"   (100 Hz)
0008  00  "0"
0009  00  "0"               CALIBRATION OFFSET DATA
000A  00  "0"
000B  00  "0"
000C  00  "0"   (10 MHz)
000D  DD  STOP CHARACTER

000E  07  DIGIT 0 is "7" (100 Hz)
000F  15  DIGIT 1 is "5"
0010  20  DIGIT 2 is "0"              DATA FORMATTED FOR OUTPUT
0011  32  DIGIT 3 is "2" (100 KHz)
0012  DD  STOP CHARACTER

000E-001F UNUSED (RESERVED FOR FUTURE NEEDS)


0020  10  HOME
0021  20  SPACE
0022  20  SPACE
0023  46  "F"
0024  52  "R"
0025  45  "E"
0026  51  "Q"
0027  55  "U"
0028  45  "E"
0029  4E  "N"
002A  43  "C"
002B  59  "Y"
002C  3F  "?"
002D  20  SPACE
002E  20  SPACE
002F  DD  STOP CHARACTER

EXECUTIVE ROUTINE

0030  BD  E1AC  JSR INEEE       GET CHARACTER FROM KEYBOARD
0033  81  4D    CMPA #4D        M?
0035  27  2C    BEQ 0063        NO?
0037  81  50    CMPA #50        P?
0039  27  2C    BEQ 0067        NO?
003B  81  44    CMPA #44        D?
003D  27  38    BEQ 0077        NO?
003F  81  55    CMPA #55        U?
0041  27  30    BEQ 0073        NO?
0043  81  53    CMPA #53        S?
0045  27  24    BEQ 006B        NO?
0047  81  41    CMPA #41        A?
0049  27  24    BEQ 006F        NO?
004B  81  45    CMPA #45        E?
004D  27  10    BEQ 005F        NO?
004F  20  DF    BRA 0030        GET ANOTHER CHARACTER

0051-005E UNUSED (RESERVED FOR FUTURE COMMANDS)

005F  8D  70    BSR OPFREQ ENTER 00F5 (VIA BRANCH ISLAND 00D1)
0061  20  CD    BRA 0030        RETURN TO EXECUTIVE
0063  8D  4D    BSR DECFREQ 00B2
0065  20  C9    BRA 0030
0067  8D  30    BSR INCFREQ 0099
0069  20  C5    BRA 0030
006B  8D  62    BSR DECCAL 01EE (VIA 00CF)
006D  20  C1    BRA 0030
006F  8D  5C    BSR INCCAL 01D5 (VIA 00CD)
0071  20  BD    BRA 0030
0073  8D  5E    BSR UPTUNE 00D3
0075  20  B9    BRA 0030
0077  8D  66    BSR DOWNTUNE 00DF
0079  20  B5    BRA 0030

ERASE ROUTINE

007B  86  10    LDAA #10        HOME (CONTROL P)
007D  BD  E1D1  JSR OUTEEE
0080  86  16    LDAA #16        ERASE EOF (CONTROL V)
0082  BD  E1D1  JSR OUTEEE
0085  86  FF    LDAA #FF
0087  B7  8010  STAA 8010       INITIALIZE PIA-ESTABLISH ALL
008A  86  04    LDAA #04        8 LINES OF PORT A AS OUTPUTS.
008C  B7  8011  STAA 8011       (SWTPC I/O SLOT #4)
008F  01        NO OP
0090  01
0091  01
0092  01
0093  01
0094  01
0095  01
0096  01
0097  20  30    BRA SERVICE 0120 (VIA ISLAND 00C9)
INCFREQ ROUTINE

0099  FE  A020  LDX A020        FIND DATA
009C  A6  00    LDAA X 00       GET DATA
009E  81  DD    CMPA #DD        STOP CHARACTER?
00A0  27  CE    BEQ 00B0
00A2  84  0F    ANDA #0F
00A4  8B  01    ADDA #01        ADD ONE
00A6  19        DAA             DECIMAL ADJUST
00A7  A7  00    STAA X 00       REPLACE
00A9  81  09    CMPA #09
00AB  2F  03    BLE 00B0
00AD  08        INX             FIND NEXT DIGIT OF DATA
00AE  20  EC    BRA 009C
00B0  20  17    BRA SERVICE 012D (VIA ISLAND 00C9)

DECFREQ ROUTINE

00B2  FE  A020  LDX A020        (SEE INCFREQ)
00B5  A6  00    LDAA X 00
00B7  81  DD    CMPA #DD
00B9  27  0E    BEQ 00C9
00BB  84  0F    ANDA #0F
00BD  8B  09    ADDA #09        ADD NINE (SAME AS SUBTRACT ONE)
00BF  19        DAA
00C0  A7  00    STAA X 00
00C2  81  09    CMPA #09
00C4  2E  03    BGT 00C9
00C6  08        INX
00C7  20  EC    BRA 00B5
00C9  20  62    BRA SERVICE 012D (ALSO SERVES AS ISLAND)

ISLANDS
00CB  20  AE    BRA ERASE 007B
00CD  20  58    BRA 0127
00CF  20  58    BRA 0129
00D1  20  22    BRA 00F5
UPTUNE ROUTINE

00D3  8D  16    BSR DELAY 00EB
00D5  8D  C2    BSR INCFREQ 0099
00D7  B6  8004  LDAA 8004 (or address of input port used to
                     stop the tuning.)
00DA  81  FF    CMPA #FF          Compare fetched value to normal value.
00DC  27  F5    BEQ 00D3          Again.
00DE  39        RTS

DOWNTUNE ROUTINE

00DF  8D  0A    BSR DELAY 00EB
00E1  8D  CF    BSR DECFREQ 00B2
00E3  B6  8004  LDAA 8004  (see 00D7 of uptune.)
00E6  81  FF    CMPA #FF
00E8  27  F5    BEQ 00DF
00EA  39        RTS

DELAY ROUTINE

00EB  FE  A022  LDX A022  (Value at A022 sets delay.)
```

Program listing.

program flow to the service module.

Deccal Module (01EF-0207)

Deccal subtracts one (100 Hz) from the BCD calibration offset data stored at hex locations 0007-000C. A BRA command always routes program flow to the service module.

Opfreq Enter Module (00F5-012C)

The opfreq enter module utilizes the MIKBUG® / SWTBUG® OUTEEE routine to display "FREQUENCY?" on the top line of a CRT terminal. Next, using the monitor's INEEE routine, opfreq enter accepts six digits of frequency data, with the 10-MHz digit entered first, and the 100-Hz digit last. Opfreq enter does not accept decimal points or commas between the digits. The data entered is stored at hex locations 0000-0005, with the 100-Hz digit at 0000, and the 10-MHz digit at 0005.

Service Module (012D-01D5)

The service module is rather complex compared with the other modules of the program. For simplicity, this module was written and will be described as three separate modules that are unconditionally linked together. They are: datacalc, printfreq, and outdata.

Datacalc Module (012D-016D)

Datacalc takes the BCD operating frequency data at 0000-0005, adds to it the BCD calibration offset data at 0007-000C (positive or negative), formats this result for output to the frequency synthesizer, and stores it at 000E-0011.

Only four digits of data are required to drive the 05,000.0-05,500.0-kHz synthesizer, because the units (5) and tens (0) of MHz never change. Although the 5.0-5.5-MHz vfo of most HF transceivers tunes backwards, this reversal is handled by the hardware of the synthesizer. This software merely outputs the four least significant digits of the BCD operating frequency data, plus or minus any

```
00EE  09          DEX
00EF  01          NO OP
00F0  01          NO OP
00F1  01          NO OP
00F2  26   FA     BNE 00EE
00F4  39          RTS
```

OPFREQ ENTER ROUTINE

```
00F5  FE   A020   LDX A020        FIND DATA
00F8  A6   20     LDAA X 20       GET CHARACTER OF MSG
00FA  81   DD     CMPA #DD        STOP CHARACTER?
00FC  27   06     BEQ 0104        YES? BRANCH
00FE  BD   E1D1   JSR OUTEEE      NO? PRINT CHARACTER
0101  08          INX             NEXT CHARACTER
0102  20   F4     BRA 00F8

0104  FE   A020   LDX A020        FIND DATA STORAGE AREA
0107  BD   E1AC   JSR INEEE       GET 10 MHz DIGIT
010A  A7   05     STAA X 05       STORE IT
010C  BD   E1AC   JSR INEEE       1 MHz
010F  A7   04     STAA X 04       STORE
0111  BD   E1AC   JSR INEEE       100 KHz
0114  A7   03     STAA X 03       STORE
0116  BD   E1AC   JSR INEEE       10 KHz
0119  A7   02     STAA X 02       STORE
011B  BD   E1AC   JSR INEEE       1 KHz
011E  A7   01     STAA X 01       STORE
0120  BD   E1AC   JSR INEEE       100 Hz
0123  A7   00     STAA X 00       STORE LAST DIGIT
0125  20   A4     BRA 00CB        BRA SERVICE VIA ISLAND


0127  20   3D     BRA 0166        ISLAND
0129  20   3D     BRA 0168        ISLAND
012B  20   XX     BRA XXXX        SPARE ISLAND
```

DATACALC ROUTINE

```
012D  86   00     LDAA #00
012F  B7   A026   STAA A026       TEMPORARY STORAGE
0132  FE   A020   LDX A020        FIND DATA
0135  0C          CLC
0136  A6   00     LDAA X 00       GET OPFREQ DIGIT
0138  2B   23     BMI 0164        EXIT IF MINUS
013A  84   0F     ANDA #0F        AND MASK
013C  8A   40     ORAA #40
013E  E6   07     LDAB X 07       GET OFFSET DIGIT
0140  24   01     BCC 0143
0142  4C          INCA
0143  C4   0F     ANDB #0F
0145  CA   50     ORAB #50
0147  1B          ABA
0148  19          DAA
0149  84   0F     ANDA #0F
014B  BA   A026   ORAA A026
014E  A7   0E     STAA X 0E
0150  07          TPA
0151  F6   A026   LDAB A026
0154  CB   10     ADDB #10
0156  06          TAP
0157  F7   A026   STAB A026
015A  08          INX
015B  20   D9     BRA 0136
015D  86   DD     LDAA #DD        STOP CHARACTER
015F  FE   A020   LDX A020        FIND DATA STORAGE AREA
0162  A7   12     STAA X 12       PLACE STOP CHARACTER
0164  20   08     BRA SERVICE 016E
  •
0166  20   6E     BRA 01D6        ISLAND
0168  20   4E     BRA 01B8        ISLAND
016A  20   C1     BRA 012D        ISLAND
016C  20   XX     BRA XXXX        SPARE ISLAND
```

PRINTFREQ ROUTINE

```
016E  FE   A020   LDX A020        FIND DATA
0171  86   10     LDAA #10        HOME
0173  BD   E1D1   JSR OUTEEE
0176  BD   E0CC   JSR OUTS        SPACE
0179  BD   E0CC   JSR OUTS
017C  A6   05     LDAA X 05       GET 10 MHz DATA
017E  BD   E06B   JSR OUTHR       PRINT RIGHT NYBBLE
0181  A6   04     LDAA X 04       1 MHz
0183  BD   E06B   JSR OUTHR       PRINT
0186  A6   03     LDAA X 03       100 KHz
0188  BD   E06B   JSR OUTHR       PRINT
018B  A6   02     LDAA X 02       10 KHz
018D  BD   E06B   JSR OUTHR       PRINT
0190  A6   01     LDAA X 01       1 KHz
0192  BD   E06B   JSR OUTHR       PRINT
0195  86   2E     LDAA #2E        PERIOD
0197  BD   E1D1   JSR OUTEEE      PRINT PERIOD
019A  A6   00     LDAA X 00       100 Hz
019C  BD   E06B   JSR OUTHR       PRINT
019F  BD   E0CC   JSR OUTS        SPACE
01A2  86   4B     LDAA #4B        ASCII K
01A4  BD   E1D1   JSR OUTEEE      PRINT K
01A7  86   48     LDAA #48        H
01A9  BD   E1D1   JSR OUTEEE      PRINT H
01AC  86   5A     LDAA #5A        Z
01AE  BD   E1D1   JSR OUTEEE      PRINT
01B1  BD   E0CC   JSR OUTS        SPACE
01B4  20   06     BRA 01BC        BRA OUTDATA

01B6  20   B2     BRA 016A        ISLAND
01B8  20   35     BRA 01EF        ISLAND
01BA  20   XX     BRA XXXX        SPARE ISLAND
```

OUTDATA ROUTINE

```
01BC  FE   A020   LDX A020        FIND DATA
01BF  A6   0E     LDAA X 0E       GET DATA BYTE TO OUTPUT
01C1  81   DD     CMPA #DD        STOP CHARACTER?
01C3  27   0B     BEQ 01D0        IF YES, EXIT
01C5  B7   8010   STAA 8010       OUTPUT DATA BYTE
01C8  4F          CLRA
01C9  08          INX
01CA  43          COMA
01CB  B7   8010   STAA 8010       SET ALL OUTPUT BITS HIGH
01CE  20   EF     BRA 01BF        REPEAT
01D0  4F          CLRA            EXIT
01D1  43          COMA
01D2  B7   8010   STAA 8010       SET OUTPUT BITS HIGH
01D5  39          RTS
```

INCCAL ROUTINE

```
01D6  FE   A020   LDX A020        FIND DATA
01D9  A6   07     LDAA X 07       GET DATA
01DB  81   DD     CMPA #DD        STOP CHARACTER?
01DD  27   0E     BEQ 01EC        YES? EXIT
01DF  84   0F     ANDA #0F        INCREMENT DATA
01E1  8B   01     ADDA #01
01E3  19          DAA
01E4  A7   07     STAA X 07       REPLACE DATA
01E6  81   09     CMPA #09
01E8  2F   03     BLE 01EC        EXIT IF LESS OR EQUAL ZERO
01EA  08          INX             POINT NEXT BYTE
01EB  20   EC     BRA 01D9        REPEAT
01ED  20   C7     BRA 01B6        SERVICE
```

DECCAL ROUTINE

```
01EF  FE   A020   LDX A020        FIND DATA
01F2  A6   07     LDAA X 07       (SEE INCCAL)
01F4  81   DD     CMPA #DD        STOP CHARACTER?
01F6  27   0E     BEQ 0206        YES? EXIT
01F8  84   0F     ANDA #0F
01FA  8B   09     ADDA #09        DECREMENT DATA BYTE
01FC  19          DAA
01FD  A7   07     STAA X 07       REPLACE DATA BYTE
01FF  81   09     CMPA #09
0201  2E   03     BGT 0206        EXIT IF GREATER THAN ZERO
0203  08          INX             POINT NEXT BYTE
0204  20   EC     BRA 01F2        REPEAT
0206  20   AE     BRA 01B6        ISLAND
```

calibration offset.

Printfreq Module (016E-01BB)

Printfreq, utilizing OUTEEE, displays the operating frequency data stored at hex locations 0000-0005 on the top line of the CRT terminal. The five most significant digits are output, then a decimal point, the last digit, and the letters "KHZ".

Outdata Module (01BC-01D5)

Outdata outputs the previously formatted BCD frequency control data stored at hex locations 000E-0011 to the 8-bit parallel-output port driving the frequency synthesizer.

Modifications

The uptune and downtune modules repeatedly monitor the system's control interface for the signal to stop tuning. An interesting alternative would be to monitor the parallel port connected to a tone detector used for CW receive programs. The program would stop tuning when a signal is found, and with a more powerful executive, jump to a CW receive routine. The address of the port to be monitored is stored at 00D8-00D9 and 00E4-00E5. The value of the "normal" byte found there is stored at 00D8 and 00E7 (no stop command or no signal). Any different value stops the uptune or downtune function and returns program control to the executive.

Construction

A full-size layout of the printed circuit board is shown in Figs. 4 and 5. Even with the double-sided board, it is still necessary to install 9 wire jumpers (number 26 wire) on the top of the board. Fig. 6 shows the jumper and component layout. Notice that the resistors are mounted vertically to conserve space. Plated-through holes are not used in the design, although if you make your own boards and have the facilities, you could do so. Our boards use "Z" wires to connect certain pads on the top and bottom sides. Fig. 7 shows the location for the "Z" wires, along with the method of installation. The cost savings of plated-through holes

C1,	56 pF mica
C12, 13, 18, 19, 22, 26, 27	150 pF mica
C2	5/25 trimmer
C3, 5, 6, 8, 29, 30, 31, 9, 32, 33, 34	.001 ceramic, 50 V
C16, 17, 20, 25, 28	.01 ceramic, 50 V
C4, 10, 11, 15, 21, 23, 36	.1 ceramic, 50 V
C24	.47 uF, 25 V electrolytic
C35	220 uF, 35 V electrolytic
C14	2.2 uF, 15 V electrolytic
R1, 2	270 Ω, ¼ Watt, 10%
R4, 38	470 Ω, ¼ Watt, 10%
R37	6.8k, ¼ Watt, 10%
R8, 9, 19, 20, 21, 25, 27, 28, 29, 30, 31, 32, 33, 34	10k, ¼ Watt, 10%
R43	1k, ¼ Watt, 10%
R3, 5, 7, 22, 23, 24, 39, 42	1 meg, ¼ Watt, 10%
R35, 36	33k, ¼ Watt, 10%
R10	4.7k, ¼ Watt, 10%
R11	33k, ¼ Watt, 10%
R12	5.6k, ¼ Watt, 10%
R13	6.8k, ¼ Watt, 10%
R14	12k, ¼ Watt, 10%
R15	10k, ¼ Watt, 10%
U1	CD4060
U2, 3, 7, 4, 6	CD4011
U5	CD4051
U8	CD4016
U9	HCTRO320
U14	CD4528
U15	CD4028
U16	7407
U17	LM340T-12
U18	LM340T-5
R16	33k, ¼ Watt ± 10%
R17	47k, ¼ Watt
R18	18k, ¼ Watt
R40	4.7k, ¼ Watt, ± 10%
R6	100 Ω ¼ Watt, ± 10%
L1	10 uH, 37T #26 on .5" T-50, mix #2 core (Palomar Engineers)
L2, 3	8.2 uH molded chokes
CR1, CR2, CR10, CR10, CR11, CR12, CR13	1N4001
CR9	1N751A 5.1 V zener
CR3, CR4, CR8	1N4148
CR5, CR6, CR7	MV109 varactor diode
Q1	2N4416
Y1	4096 crystal, 20 pF, HC/6
Y2	5920 crystal, 20 pF, HC/6
T1	12 V ac at 300 mA (Radio Shack)
	SPST toggle switch, line cord, cabinet (Radio Shack), phono jack, printed circuit board, RG-174 miniature coax

Parts Availability

The following parts are available from MICROSIZER, PO Box 44, Cedar Rapids IA 52404: Double-sided, drilled G-10 PCB, tin-plated, $17.00; MV109 diodes, .75 ea. Hughes HCTR-0320 is available from Coombs Associates, 1001 E. Touhy Ave., Des Plaines IL 60018, for $14.70.

more than offset the inconvenience of the "Z"-wire installation. The rf output is routed from the pad on the PCB through miniature coax to an rf connector (RCA phono) on the rear. The PCB is mounted by removing the sheet metal screws that hold the rubber feet on the cabinet and replacing them with 5/8" 4-40 screws. The PCB is spaced off the bottom of the cabinet by appropriate spacers (or just #4 nuts on the top and bottom side of the board). The power transformer is mounted on the rear panel, using hookup wire to connect it to the PCB. Since the transformer was designed for PCB mounting, it is necessary to carefully bend the terminals so that they will not short to the chassis. An SPST toggle switch and ½-Amp fuse and fuse holder complete the mounting effort.

The vco inductor, L1, is mounted to the PCB with an insulated washer and a 5/8" 4-40 screw. Due to the tolerances in permeability of the toroid core, the actual turns required may vary by 1 or 2—so use the number called for in the parts list and remove a few if it is found necessary in the tune-up section. The two crystals are mounted directly on the PCB—just remember to solder quickly, in order to avoid too much heat on the pins.

Test and Alignment—Computer-Controlled

This step is easiest if you have the tuning program keyed in and ready to present data to the parallel data port connected to the MICROSIZER.

Apply the 120 V ac power and check for +12 and +5 at the outputs of the two regulators. Connect a frequency counter to the rf output jack and enter a frequency of XX0000. (Note that the first two digits don't really matter to the MICROSIZER—they are only for the CRT readout to indicate the tens and units megahertz.) The MICROSIZER should respond with a frequency somewhere in the range of 5.517 MHz. The exact frequency depends upon the frequency of the 5920 mixer crystal. However, this is not at all critical since the "A" or "S" calibration commands will correct the data frequency so that the MICROSIZER supplies the exact frequency to the transceiver to make XX0000 be at the bottom edge of any band. Monitor pin 9 of U1, the reference oscillator, and adjust the trimmer for 4096.000 kHz. Check the voltage at the junction of R35 and C15 (control voltage to the vco) for 11 to 11.5 volts. If necessary, adjust the number of turns on L1 or their spacing until this voltage is achieved. Next enter data XX5000 and check that the output frequency moved down exactly 500 kHz. The vco tuning voltage at this point should be between 5 and 6 volts. If everything

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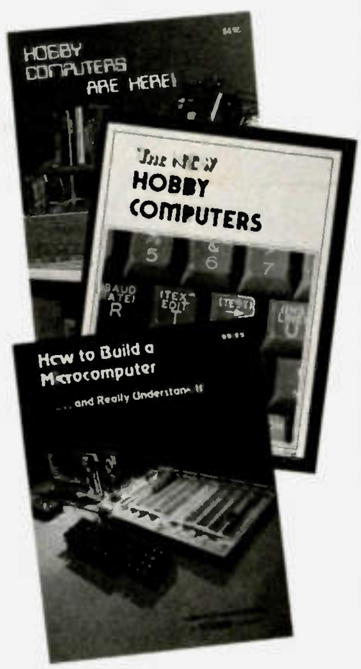

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has checked out so far, input various frequencies and check that the 100 kHz, 10 kz, 1 kHz, and 100 Hz data move the frequency as it should. At this point, you should be able to connect the MICROSIZER to your transceiver and successfully perform all of the software operations available. Notice that the lockup time between 100-Hz steps is very fast and smooth, and tuning up or down is just like using a vfo, except that it's all done by the computer. Now enter a frequency and watch the CRT display show a jump to the desired frequency, accurate to within 100 Hz, in less than 100 milliseconds. Try that with a regular vfo! ! !

100-Hz Adjustment

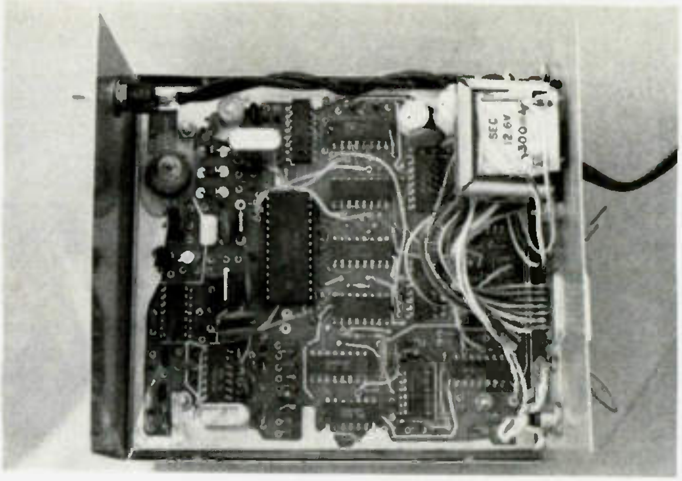
If your tests showed that the 100-Hz steps within a 1-kHz range were not accurate to within a few Hertz of the desired 100 Hz, some adjustment on the digital-to-analog converter may be necessary. The values for R10-R17 shown in the parts list may be juggled slightly to tailor the individual 5920 mixer crystal to the tuning diodes. Each 100-Hz step voltage is controlled by a single resistor, with the exception of the 900-Hz step, which is obtained by paralleling a resistor with the one used for the 800-Hz step. Table 1 shows the resistors and the 100-Hz steps that they control. If necessary, alter their values slightly—or, better yet, use a pot to determine the exact values, measure them, and replace each with a 1% unit.

Resistor	100-Hz Step Controlled
None	000
R17	100 Hz
R16	200 Hz
R18	300 Hz
R14	400 Hz
R15	500 Hz
R13	600 Hz
R12	700 Hz
R10	800 Hz
R11/R10	900 Hz

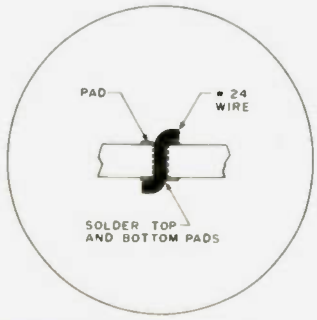
Table 1.

Test and Alignment—Manual Tuning Mode

If you don't have access to a computer to input data, you will probably need to measure the BCD output of the four data registers in order to determine their output to the divider chip and D/A converter. When the unit is first powered up, the registers should be all programmed with 0000, since C28 and R29 apply a 1-ms reset pulse when 5 volts first appears. Check that the output frequency is near 5.517 MHz, and zero the 1 kHz reference as described in the computer-controlled tune-up procedure. Now, ground the "up" tuning line, and the frequency should start changing in 100-Hz steps at a fairly slow rate. If the "down" line is simultaneously grounded, the tuning rate will increase. Momentarily remove power and reapply it to reset the counters to 0000; check



Interior view of MICROSIZER.



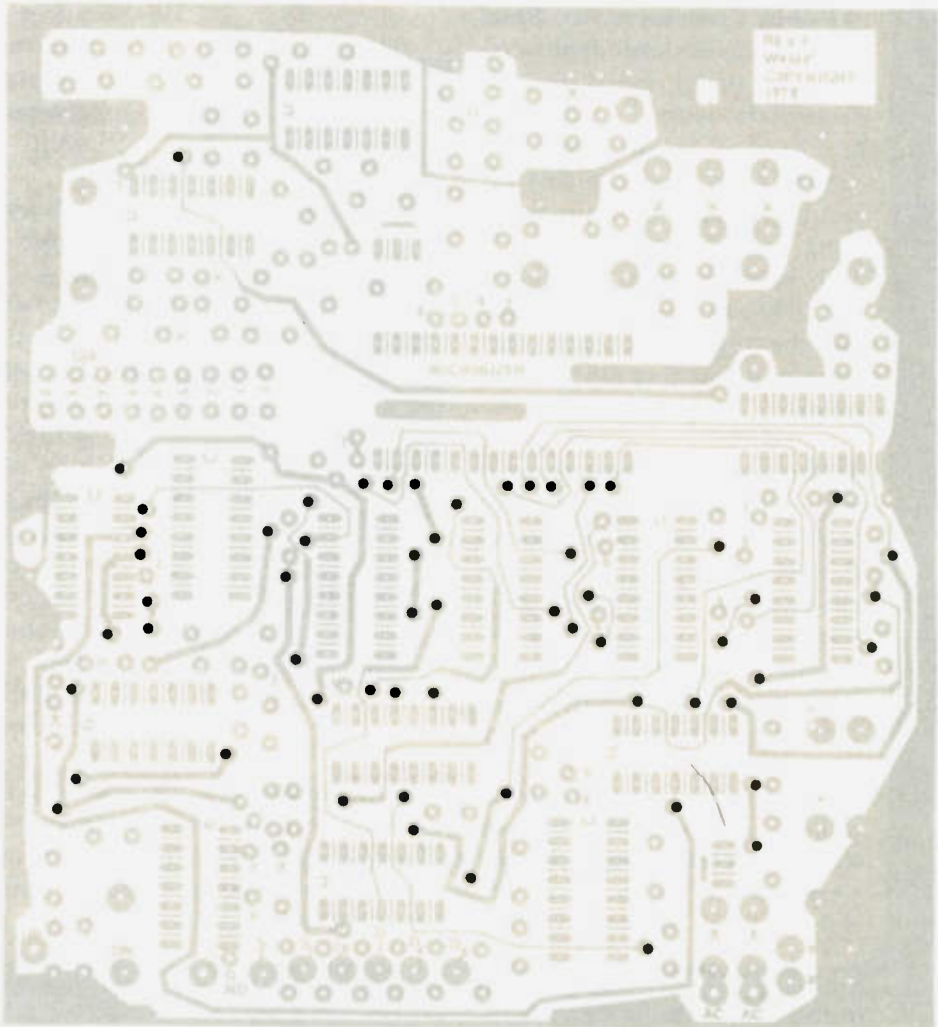


Fig. 7. "Z"-wire placement, along with method of installation.

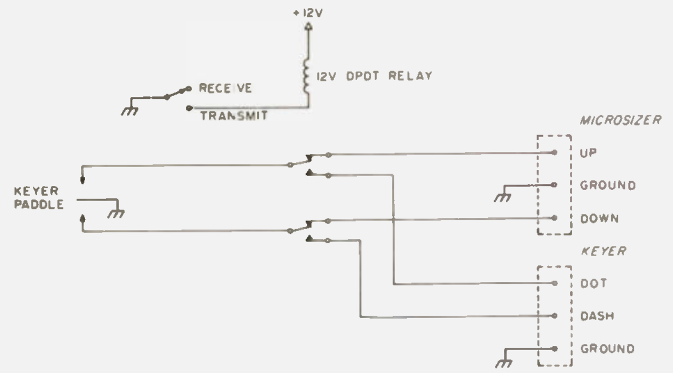
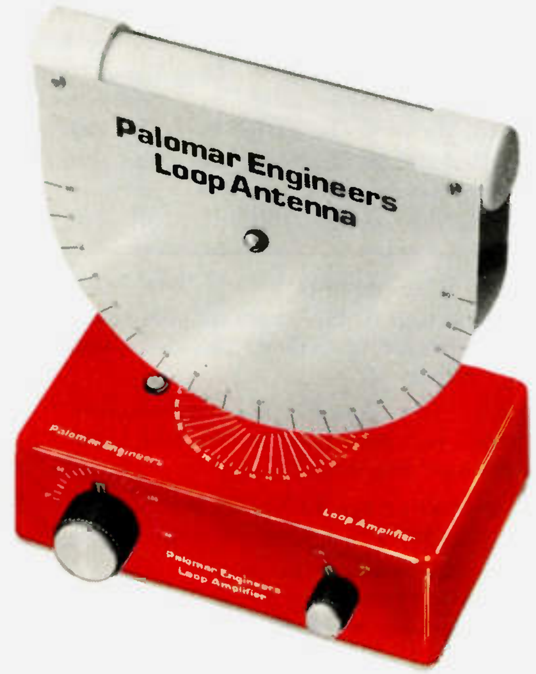


Fig. 8. Method for switching the keyer paddle between MICROSIZER tuning and keyer operation.

the vco tuning voltage as described in the computer-controlled tune-up procedure. Also, check the accuracy of the 100-Hz steps and vary the D/A converter resistors (R10-R17) if necessary. The tuning rate in the slow mode is controlled by C11; that in the fast mode is controlled by R25. They may be varied to adjust the tuning speed to suit your needs. If you are using your keyer paddle to tune, the simple circuit shown in Fig. 8 will permit it to tune the MICROSIZER in receive and operate the keyer in transmit.

Hopefully, this article will inspire radio amateurs to surrender the almighty tuning knob and discover the fascinating world of computerized "hamming." The possibilities are endless, and the cost of a computer is now less than that of a good transceiver. ■

Loop Antenna



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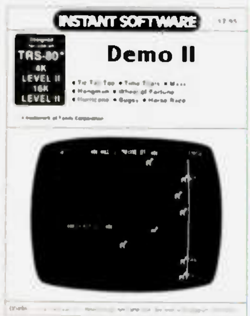

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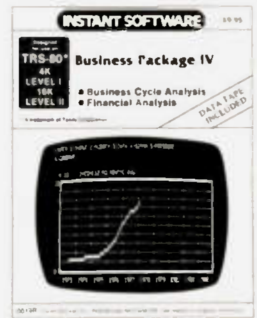

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Hex Pawn/Shuttle Craft Docking/Space Chase/ Sea Battle 16K; Order No. 0041R.

BUSINESS PACKAGE III

Sales are the lifeblood of virtually any business. With Business Package III, you'll be able to maintain inventories and work out discounts and commission percentages on your computer, giving your customers the fast answers they need and leaving you more time in the field.

Inventory

Why spring for a larger computer when you can maintain a full running inventory of up to 1153 items, showing stock number, quantity, and price, on your TRS-80? The program allows you to search for individual items or to review your entire inventory one block at a time. The program is so simple to run that your employees will be able to use it with only minimal training.

Discount and Commission Percentages

This automated business function program is just the tool you need to handle so many of your daily calculations. Any retail or wholesale company can benefit from fast, easy access to the following information:

- Selling Price
- Percent Markup
- Total Selling Price
- Discount Percentage
- Actual Price
- Percent Change
- Percent Profit

For the 4K Level I.

Order No. 0061R $7.95

Level I and II

Basic and Intermediate Lunar Lander 4K; L.I, 16K L.II; Order No. 0001R.

Space Trek II 4K L.I, 16K L. II; Order No. 0002R.

Beginner's Backgammon and Keno 4K L.I, 16K L. II; Order No. 0004R.

Golf/Crossout 4K L.I, 16K L.II; Order No. 0009R.

Air Flight Simulation 4K L.I, 16K L.II; Order No. 0017R.

Oil Tycoon 4K L.I, and L.II; Order No. 0023R.

HAM PACKAGE I

Ham Package I—We had to call it something, but this package is not only for hams. It's great for any experimenter or technician in need of a dynamic reference of popular electronics formulas:

Ohm's Law

Easily performs calculations involving voltage, current, resistance, and power.

Series and Parallel Calculations

Find the value of capacitors or resistors in parallel or series circuits.

Voltage Dropping and Voltage Dividing

This will give you the value of a dropping resistor and the effective resistance of the load.

R/C Time Constants

This section will calculate the resistance, capacitance, or the time delay of an R/C circuit.

Dipole Antennas and Yagi Antennas

These two programs will compute the dimensions of an antenna to your exact frequency and give you an on-screen display—complete with all measurements!

This program requires a 4K Level I or a 16K Level II.

Order No. 0007R $7.95

BEGINNER'S BACKGAMMON/KENO Why sit alone when you can play these fascinating games with your TRS-80?

- **Backgammon**—Play against the computer. Your TRS-80 will give you a steady, challenging game that's sure to sharpen your skills.
- **Keno**—Enjoy this popular Las Vegas gambling game. Guess the right numbers and win big.

You'll need a TRS-80 Level I or II. **Order No. 0004R $7.95.**

ELECTRONICS I

If you're still designing circuits the old-fashioned way, let the Electronics I package introduce the latest way to go:

Tuned Circuits & Coil Winding

Design tuned circuits for audio and radio frequencies. This two-part program will find the missing two values from any two of the following: frequency, capacitance, inductance, or reactance. The coil winding section will calculate the number of turns and wire gauge required for a close-wound air- or slug-tuned coil from the inductance, diameter, length, and permeability of the coil.

555 Timer Circuits

Timers, both monostable (one-shot) and astable (oscillator), can be easily designed with this two-part program. The program will also draw a complete schematic on the screen of your TRS-80.

LM 381 Pre-Amp Design

You too can quickly design an IC preamp. With this program all you need to do is enter the parameters of the performance you want, and the program does the rest—right down to drawing a detailed schematic of your circuit on the screen!

You will need a 4K Level I or a 16K Level II.

Order No. 0008R $7.95

Bowling 4K L.I, 16K L.II; Order No. 0033R.

Santa Paravia and Fiumaccio 4K L.I, 16K L.II; Order No. 0043R.

Level II

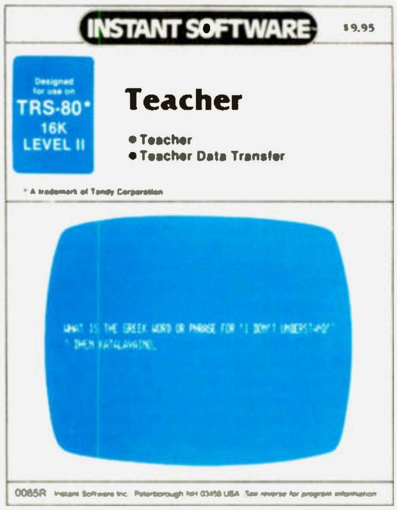
Model Rocket Analyzer and PreFlight Check 16K; Order No. 0024R.

Ramrom Patrol/Tie Fighter/Klingon Capture 16K; Order No. 0028R.

TRS-80 UTILITY 1 Ever wonder how some programmers give their programs that professional look? Instant Software has the answer with the TRS-80 Utility 1 package. Included are:

- **RENUM**—Now you can easily renumber any Level II program to make room for modification or to clean up the listing.
- **DUPLIK**—This program will let you duplicate any BASIC, assembler, or machine-language program, verify the data, and record the program on tape. You can even do Level I programs on a Level II machine.

For the TRS-80 Level II 16K. **Order No. 0081R $7.95.**



TEACHER

For decades, leading educators and computer scientists alike have been touting the future role of computers in education. Now you and your family can reap the benefits of computer-assisted instruction in the comfort of your own home. This practical program allows you to input any number of questions and answers from the fields of science, languages, history—you name it. Using this data, the computer will prepare several types of tests, quiz students—providing up to three hints per question—even offer graphic rewards for younger children, all at the user's discretion.

Teacher Data Transfer

This time-saving program allows the instructor to record several tests sequentially on a single cassette, thereby permitting the administration of whole lessons without the inconvenience of changing cassettes.

Teacher is effective, practical, easy to use—perfect for teachers, parents, businessmen or anyone faced with learning a lot of material in the shortest possible time. Furnished with blank data cassette.

Order No. 0065R $9.95

Space Trek IV 16K; Order No. 0034R.

Doodles and Displays II 16K; Order No. 0042R.

Household Accountant 16K; Order No. 0069R.

Financial Assistant 16K; Order No. 0072R.

Bowling League Statistics System 16K; Order No. 0056R. $24.95

Cards 16K; Order No. 0063R.

TRS-80 UTILITY 2 Let Instant Software change the drudgery of editing your programs into a quick, easy job. Included in this package are:

- **CFETCH**—Search through any Level II program tape and get the file names for all the programs. You can also merge BASIC programs, with consecutive line numbers, into one program.
- **CWRITE**—Combine subroutines that work in different memory locations into one program. This works with BASIC or machine-language programs and gives you a general checksum.

This package is just the thing for your TRS-80 Level II 16K. **Order No. 0076R $7.95**

PET**

Personal Weight Control/Biorhythms 8K; Order No. 0005P.

Casino I 8K; Order No. 0014P.

Casino II 8K; Order No. 0015P.

DUNGEON OF DEATH Battle evil demons, cast magic spells, and accumulate great wealth as you search for the Holy Grail. You'll have to descend into the Dungeon of Death and grope through the suffocating darkness. If you survive, glory and treasure are yours. For the PET 8K. **Order No. 0064P $7.95.**

Arcade I 8K; Order No. 0074P.

Digital Clock 8K; Order No. 0083P.

CW Fans: Give Superior Selectivity to your Atlas Rig

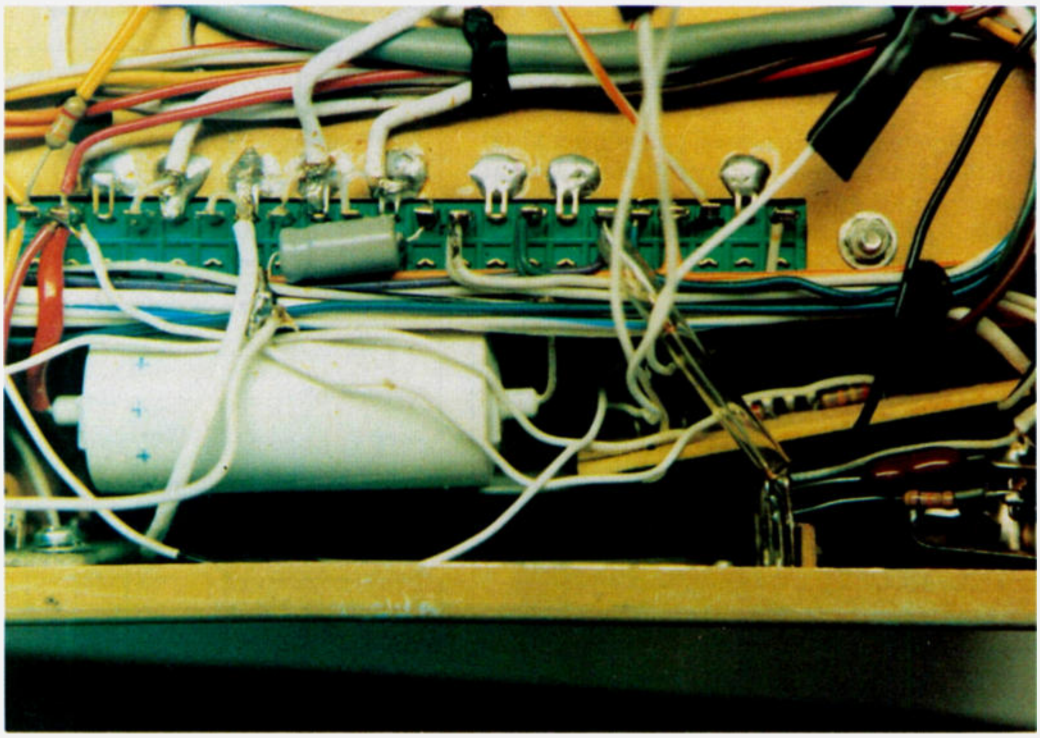
—this mod uses an inexpensive MFJ filter

Henry B. Ruh WB9WWM
Box 1347
Bloomington IN 47402

As have many other hams who enjoy the use of the great Atlas solid-state, no-tune-up rigs, I quickly discovered that while it was great for SSB, it lacked a little in CW reception ability. This simple modification will bring it around and make CW as enjoyable as sideband.

The Atlas rigs have a fine SSB i-f filter, but if you try to copy CW with this unit, you find that there is no original factory CW filter, nor any adjustments to narrow the i-f bandwidth. The problem of separating close CW signals by tone alone is difficult and frustrating, especially if you are a Tech trying to upgrade. (I finally got my Advanced using this rig on the Novice bands!)

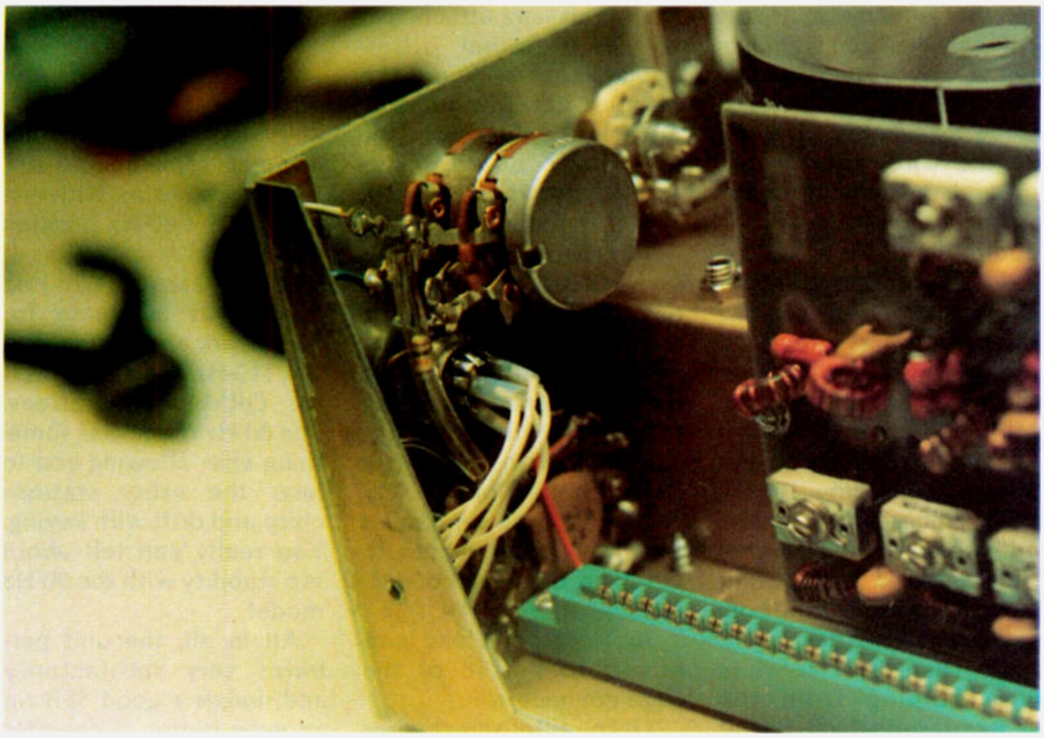
MFJ makes a dandy CW audio filter with a selectable bandpass which is centered at 750 Hz and which is also the CW offset of the Atlas, making it an ideal choice. While you could outboard the unit and keep buying 9-volt batteries for the filter, I found it could be placed easily inside the Atlas, deriving power and operational benefits from its location. While an audio filter is not as good as an i-f filter for CW, the performance of the hybrid unit when completed was more than adequate, and only the worst of QRM and zero-beating of signals could not be overcome. A more demanding CW operator would prefer the narrower i-f filter, but this works fine for most of us, and, since it can fit inside the rig, allows unimpeded mobile or portable operation.



Audio circuit connections, showing new wires and placement of the filter output capacitor (small electrolytic) in the center of the picture.

The MFJ filter, model CWF-2, like most MFJ products, comes in a small box and is powered by an internal 9-volt battery. Because of the small size and super compactness of the Atlas, there isn't much room inside for add-on goodies, but the MFJ fits.

The first step is to familiarize yourself with the operation of the MFJ filter. It employs a series of

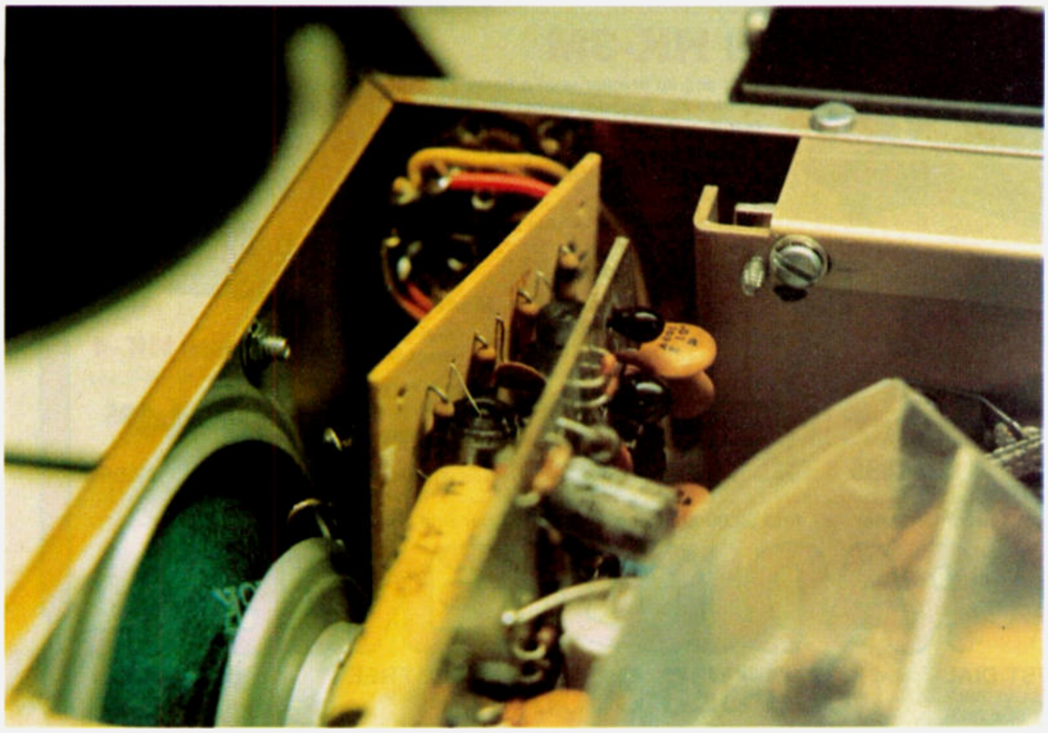


Mounted bandwidth selector switch.

active audio filters using IC chips and matched components for a 750-Hz center frequency and a variable bandwidth of 180, 110, or 80 Hz. This allows easy copy without resorting to very low audio notes—nice in a non-CW rig—so you don't walk down the band, retuning to hear the other guy. The selectivity is chosen from a multi-position slide switch. The MFJ unit is designed for use either between audio stages or between the rig output and a headphone jack, supplied on the front of the MFJ box.

Modification Steps

1. To complete the conversion as pictured in the photos, follow these easy steps. No mechanical work is necessary unless you have the noise blanker option in your unit, in which case a single 3/8" hole is required.



The filter boara is nestled between the speaker and the back wall of the chassis.

2. First, remove the screws holding the MFJ unit together. There are four, two on each side of the box.

3. Once the unit is open, you will see that the actual filter is contained on one PC board, held to the rear and bottom of the box with a rubber-like cement. Using an X-acto® or similar knife, carefully remove the PC board from the box. A wedging action between box and board is sufficient.

4. Remove the switches and headphone jack from the box by removing the four screws and a large nut holding the ¼" jack. The box should be set aside and all loose hardware stored in the bottom shell of the MFJ box.

5. Label or identify on the PC board each wire on the MFJ unit. There are two wires for power, + and −, audio in, and three audio out wires. The electrolytic capacitor attached to the multi-position switch is removed and saved for later use. After removal of the wires, the switches and connector can be remounted in the MFJ box. The box can be reassembled and set aside for other projects.

6. Remove both the top and bottom covers from the Atlas.

7. Remove the hole plug on the front panel below the NB (noise blanker) notation or, alternatively, drill a small (3/8") hole wherever you would like the bandwidth selector switch to go. A good spot is near the af/rf gain controls, positioned to allow as much room as possible for fingers to turn the knobs.

8. The switch selected for the rig shown in the photos was a Dale SP10T. A very small Alco or similar rotary with 4 positions is adequate. The Dale was in the ever-growing junk box. The type of switch used is the same as found on many HTs for frequency selec-

tion and is available from most parts houses, FM specialty houses, and ham stores. Spectronics (1009 Garfield, Oak Park IL 60304) has some for use on Motorola HTs for adding more frequencies. The cost is about $4.

9. Because the switch is really nestled in the rig, it is necessary to prewire the terminals. Five lengths of stranded no. 26 in your favorite colors, each about 14" long, will do nicely. Prepare the switch for insertion.

10. The PC board in the Atlas on the far right (facing front) is removed for insertion of the switch. This is the rf module, PC-100; or, if you have the noise blanker, find your hole and insert the switch as best you can.

11. The wires from the switch are routed to the front corner and down through the open space by the wafer selector switch to the underside of the Atlas. There is a channel in the rf cover over the vfo near the front lip which can serve as a cable raceway, or the wires can be run around the outside of the Atlas chassis over the audio board.

12. If you take the time and are neat, you can run the switch wires directly to the MFJ PC board. Or, use the wires attached to the MFJ unit and splice in midstream. Being naturally sloppy (according to the XYL), I chose to splice in midstream. The MFJ board slips between the speaker magnet and the rear connectors of the Atlas.

13. There is a red/white wire coming from the center terminal on the af level control which goes to the edge connector of the audio board in the Atlas. Remove the end attached to the edge connector. This is the input to the MFJ filter. This wire attaches to the #1 terminal (filter-bypass) position on the rotary switch. The audio input wire coming from the MFJ filter board is attached to the af level center terminal.

14. The output terminal on your selector switch is run to the vicinity of the edge connector and is connected to terminal 12 of the edge connector, using the electrolytic capacitor supplied with the filter (series connection).

15. The + power lead of the filter is connected to pin 21 of the edge connector.

16. The ground lead is attached to pin 18 of the edge connector.

17. The filter-select wires of the MFJ unit are connected to the terminals of the rotary switch in the order desired: 80, 110, 180, or 180, 110, 80 Hz.

18. The Atlas covers are replaced.

19. Turn on and enjoy!

Performance of the unit on the crowded 80- and 40-meter Novice bands was excellent. Needless to say, tuning the Atlas with the filter in the 80-Hz position makes for *fast* tuning. It was found that the 180-Hz mode was adequate for most work and tuning, and the 110-Hz mode was best for QRM-laden stations. The 80-Hz mode was something else, allowing you to hear the other stations chirp and drift with keying. You really can tell about vfo stability with the 80-Hz mode!

All in all, the unit performs very satisfactorily and makes a good SSB rig an even better all-rounder for those of us who only dabble in CW. The MFJ unit is currently priced at $29.95 and is available from a number of sources, including MFJ direct. ■

✓ Reader Service—see page 211

ATTENTION:

TO: All Amateurs
FROM: Wilson Systems, Inc.

Inflation . . . gas shortages . . . etc., all leading to higher prices each week, and cutting into the amount that we have to spend on our hobby. And face it, our hobby is what keeps us sane in this runaway inflation period, our escape from the hustle and hectic grind of working to make a living. We know — we see the same price increases at the grocery store, the same increases in the gas prices. Wilson Systems, Inc., is going to do something to help ease the purchase of your new tower and antenna.

As you may know, in January of 1979, Regency Electronics, Inc., purchased Wilson Electronics Corp. What you may not know is that in August, 1979, Jim Wilson purchased back the antennas and towers. There is now a new name to look for — WILSON SYSTEMS, INC. — With the new name and new company comes new ideas, methods, products and prices. Yes, prices. But not what you might expect. Wilson Systems is LOWERING the prices to where you will find it hard to believe. Check them out in the following pages of this issue. You will be surprised and pleased at what you will find.

What are we doing that will enable us to lower the prices? Well, we are Hams, too. We like to pay the lowest price possible and will spend much time assuring ourselves this is accomplished. We feel the same higher demands on our money for the house, food, and bills. And as this demand increases, the amount of money left for our hobby decreases. So when money is spent, we want the best quality for the best price.

There are a number of ways to bring the cost of a product down. By using a cheaper grade of material, buying raw materials in larger quantities to obtain a better discount, by cutting the profit ratio, and by eliminating the middle man. Wilson Systems will not lower the quality of the product. In fact, we have improved the strength and quality of almost every antenna in the line. The newly designed monobanders will stay up under heavy icing conditions when others are falling apart. Wilson Systems is currently purchasing at the lowest price possible from the aluminum companies, so these methods of cost reduction are eliminated. The third method mentioned is one that we have decided to consider as a part of the overall cost reduction plan, yet leaving room for research and development expense, so we may bring you the products you want and at a price you will like.

The last method mentioned is always a risky one. The dealers do not want their profits cut back just as you do not want your pay check cut. If you cut the dealers' profits back, some of them will just push the product that will tend to give them the most profit, rather than the one that will be the best performing for you. A rather drastic form of this method is the one that Wilson Systems will be choosing. You will not be able to find the Amateur products of Wilson Systems in stock at the dealers, nor will they probably recommend them. (After all, as long as they're not handling them and making a profit, why should they promote or even recommend them?) No, you will only be able to enjoy the most product for the least money by dealing with Wilson Systems factory direct. We will be offering you the amateur antennas and towers at prices that are below, in most cases, what the dealers pay for the products of other companies. And to make it even easier, we have a toll-free number for you to place your order. Now isn't this what you've been looking for? The best product for the least money!

Just remember these four points:

1. Highest Quality
2. Lowest Price
3. Toll-Free Order Number

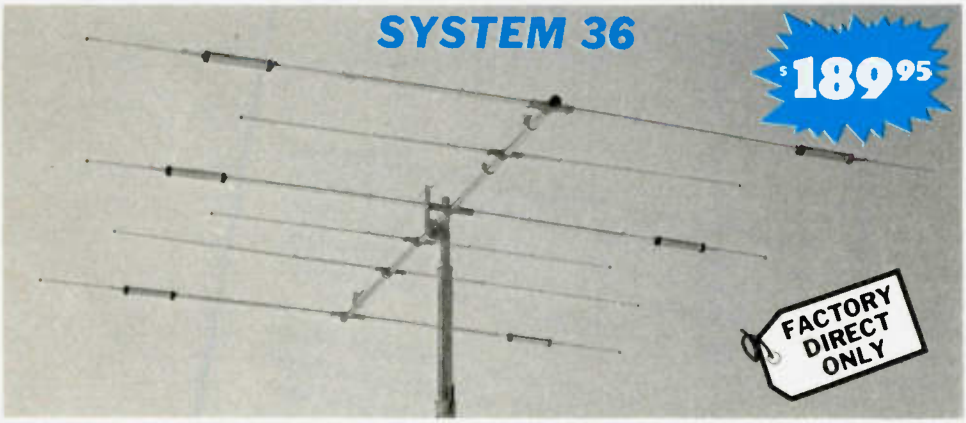
The fourth point? Remember the name . . . WILSON SYSTEMS, INC.

Yours Truly,
Jim Wilson
Wilson Systems, Inc.

WSI WILSON SYSTEMS, INC.
4286 S. Polaris Ave., Las Vegas, Nevada 89103
(702) 739-7401 — Toll-Free Order Number 800-634-6898

WILSON SYSTEMS INC. MULTI-BAND ANTENNAS

SYSTEM 36

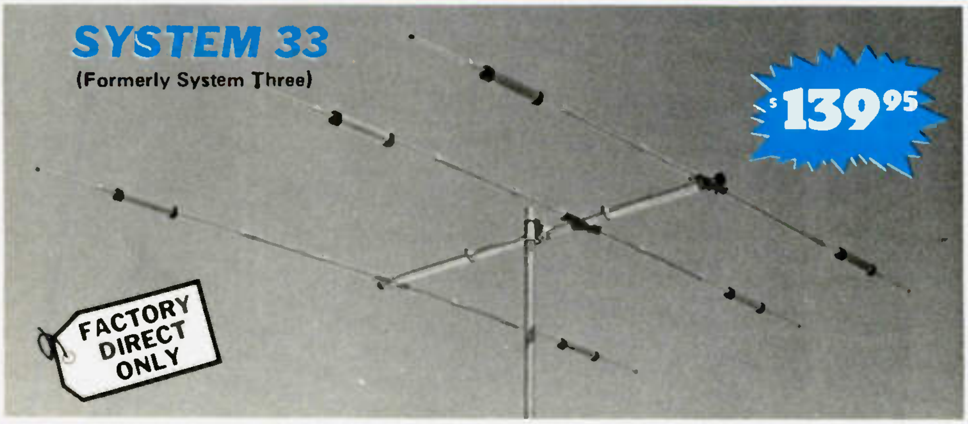


A trap loaded antenna that performs like a monobander! That's the characteristic of this six element three band beam. Through the use of wide spacing and interlacing of elements, the following is possible: three active elements on 20, three active elements on 15, and four active elements on 10 meters. No need to run separate coax feed lines for each band, as the bandswitching is automatically made via the High-Q Wilson traps. Designed to handle the maximum legal power, the traps are capped at each end to provide a weather-proof seal against rain and dust. The special High-Q traps are the strongest available in the industry today.

SPECIFICATIONS

Band MHz	14-21-28	Boom (O.D. x Length)	2" x 24'2½"	Wind loading @ 80 mph	215 lbs.
Maximum power input	Legal limit	No. of elements	6	Maximum wind survival	100 mph
Gain (dBd)	Up to 9 dB	Longest element	28'2½"	Feed method	Coaxial Balun (supplied)
VSWR @ resonance	1.3:1	Turning radius	18'6"		
Impedance	50 Ω	Maximum mast diameter	2"	Assembled weight (approx.	53 lbs.
F/B ratio	20 dB or better	Surface area	8.6 sq. ft.	Shipping weight (approx.)	62 lbs.

SYSTEM 33



Capable of handling the Legal Limit, the "SYSTEM 33" is the finest compact tri-bander available to the amateur.

Designed and produced by one of the world's largest antenna manufacturers, the traditional quality of workmanship and materials excells with the "SYSTEM 33".

New boom-to-element mount consists of two 1/8" thick formed aluminum plates that will provide more clamping and holding strength to prevent element misalignment.

Superior clamping power is obtained with the use of a rugged ¼" thick aluminum plate for boom to mast mounting.

The use of large diameter High-Q Traps in the "SYSTEM 33" makes it a high performing tri-bander and at a very economical price.

A complete step-by-step illustrated instruction manual guides you to easy assembly and the lightweight antenna makes installation of the "SYSTEM 33" quick and simple.

SPECIFICATIONS

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

WSI WILSON SYSTEMS, INC.

4286 S. Polaris Avenue
Las Vegas, Nevada 89103
(702) 739-7401
Factory Direct Toll Free 1-800-634-6898

$44.95

WV-1A

4 BAND TRAP VERTICAL (10 - 40 METERS)

No bandswitching necessary with this vertical. An excellent low cost DX antenna with an electrical quarter wavelength on each band and low angle radiation. Advanced design provides low SWR and exceptionally flat response across the full width of each band.

Featured is the Wilson large diameter High-Q traps which will maintain resonant points with varying temperatures and humidity.

Easily assembled, the WV-1A is supplied with a hot dipped galvanized base mount bracket to attach to vent pipe or to a mast driven in the ground.

Note:
Radials are required for peak operation. (See GR-1 below).

SPECIFICATIONS:

- Self supporting—no guys required.
- Input Impedance: 50 Ω
- Powerhandling capability: Legal Limit
- Two High-Q Traps with large diamater coils
- Low Angle Radiation
- Omnidirectional performance
- Taper Swaged Aluminum Tubing
- Automatic Bandswitching
- Mast Bracket furnished
- SWR: 1.1:1 or less on all Bands

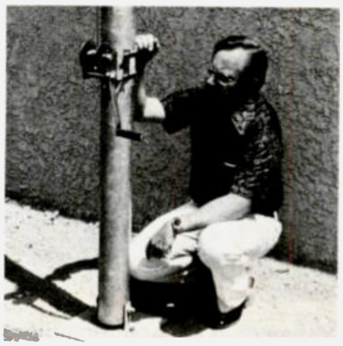
GR-1

$9.95

The GR-1 is the complete ground radial kit for the WV-1A. It consists of: 150' of 7/14 stranded copper wire and heavy duty egg insulators, instructions. The GR-1 will increase the efficiency of the GR-1 by providing the correct counterpoise.

Prices and specifications subject to change without notice.

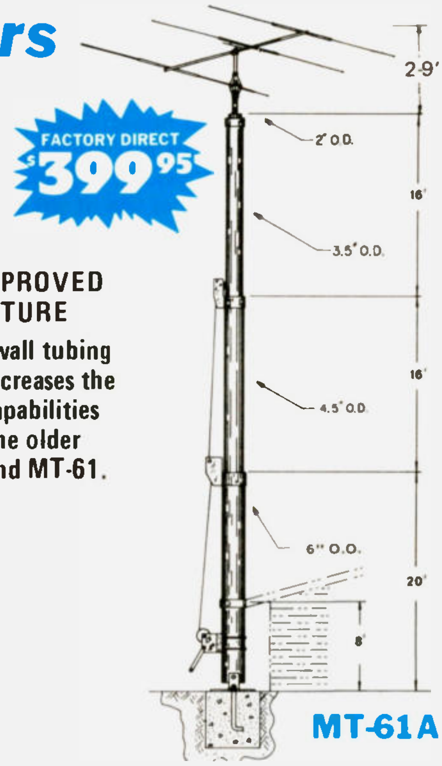
New, Improved Wilson Towers



Hinged Base Plate - Concrete Pad, Heavy Duty Winch

Mounting the House Bracket

The Hinged Base Plate allows tower to be tilted over for access to antenna and rotor from the ground.



NEW IMPROVED FEATURE

Heavier wall tubing greatly increases the stress capabilities over the older TT-45 and MT-61.

FEATURES:
- Maximum Height 45' (will handle 10 sq. ft. at 38') @ 50 mph
- 800 lb. winch
- Totally freestanding with proper base
- Total Weight, 189 lbs.

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

FEATURES:
- Is freestanding with use of proper base
- Maximum Height is 61' (will handle 10 sq. ft. at 53') @ 50 mph
- 1200 lb. brake winch
- 4200 lb. raising cable
- Total Weight, 350 lbs.

Recommended base accessory: RB-61A, FB-61A.

The MT-61A is our largest and tallest freestanding tower. By using the RB-61A rotating base fixture the MT-61A is ideally suited for the SY33 or SY-36. If you plan to mount the tower to your house, caution should be taken to make certain the eave is properly reinforced to handle the tower. If not, one of the base accessory fixtures should be used.

GENERAL FEATURES

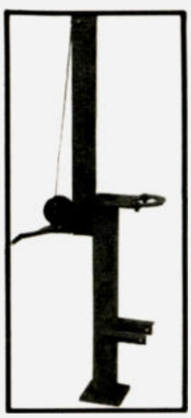
All towers use high strength heavy galvanized steel tubing that conforms to ASTM specifications for years of maintenance-free service. The large diameters provide unexcelled strength. All welding is performed with state-of-the-art equipment. Top sections are 2" O.D. for proper antenna/rotor mounting. A 10' push-up mast is included in the top section of each tower. Hinge-over base plates are standard with each tower. The high loads of today's antennas make Wilson crank-ups a logical choice.

TILT-OVER BASES FOR TOWERS

FIXED BASE

The FB Series was designed to provide an economical method of moving the tower away from the house. It will support the tower in a completely free-standing vertical position, while also having the capabilities of tilting the tower over to provide an easy access to the antenna. The rotor mounts at the top of the tower in the conventional manner, and will not rotate the complete tower.

FB-45A . . . $ 79.95
FB-61A . . . 109.95



ROTATING BASE

The RB Series was designed for the Amateur who wants the added convenience of being able to work on the rotor from the ground position. This series of bases will give that ease plus rotate the complete tower and antenna system by the use of a heavy duty thrust bearing at the base of the tower mounting position, while still being able to tilt the tower over when desiring to make changes on the antenna system.

RB-45A . . . $119.95
RB-61A . . . 179.95

Tilting the tower over is a one-man task with the Wilson bases.
(Shown above is the RB-61A.)

WSI WILSON SYSTEMS, INC.

4286 S. Polaris Avenue
Las Vegas, Nevada 89103
(702) 739-7401
Factory Direct Toll Free 1-800-634-6898

Prices and specifications subject to change without notice

New OMNI/SERIES B Filters The Crowd

The new OMNI/SERIES B makes today's bands seem less crowded. By offering a new i-f selection that provides up to 16 poles of filtering for superior selectivity. And a new Notch Filter to remove QRM. No other amateur transceiver we know of out-performs it.

NEW I-F RESPONSE SELECTION. OMNI comes equipped with an excellent 8-pole 2.4 kHz crystal ladder i-f filter which is highly satisfactory in normal conditions. But when the going gets rough, the new OMNI/SERIES B, with optional filters installed, provides two additional special purpose i-f responses.

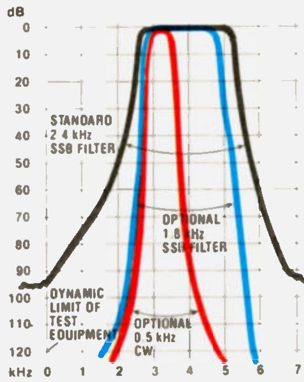
The 1.8 kHz crystal ladder filter transforms an unreadable SSB signal in heavy QRM into one that gets the message through. The 0.5 kHz 8-pole filter provides extremely steep and deep skirts to the CW passband window which effectively blocks out even the very strong adjacent signals.

Both of these filters can be front-panel switched in series with the standard filter to provide up to **16 poles** of filtering for near-ultimate selectivity. In addition, the standard CW active audio filters have three bandwidths (450, 300, and 150 Hz) to give even further attenuation to adjacent signals. In effect, OMNI/SERIES B has six selectivity curves—three for SSB and three for CW. That's true state-of-the-art selectivity.

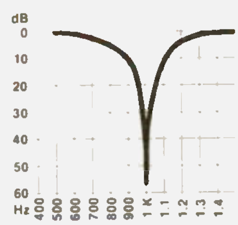
NEW NOTCH FILTER. A variable frequency notch filter in OMNI/SERIES B is placed inside the AGC loop to eliminate interfering carriers and CW signals without affecting received signals. Attenuation is more than 8 "S" units (over 50 db) for any frequency between 0.2 kHz and 3.5 kHz.

OMNI/SERIES B RETAINS ALL THE FEATURES THAT MADE IT FAMOUS.

All solid-state; 160-10 meters plus convertible 10 MHz and AUX band positions; **Broadband design** for band changing without tuneup, without danger;



OMNI/SERIES B I-F RESPONSES WITH STANDARD AND OPTIONAL FILTERS.



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A Sensible CMOS TT Decoder

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C. Warren Andreason N6WA
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Several years ago, *73 Magazine* published one of my articles titled "Autocall 76" (June, 1976). At that time, I offered printed circuit boards and the response was overwhelming. To make a long story shorter, over the time span, the circuit was redesigned using CMOS, and commercial printed circuit boards were developed.

While that circuit was intended for paging use, there were many letters asking how the circuit could be modified to work as a control circuit in a repeater with an on/off function. I designed a new circuit with a plug-in printed circuit board that meets this requirement.

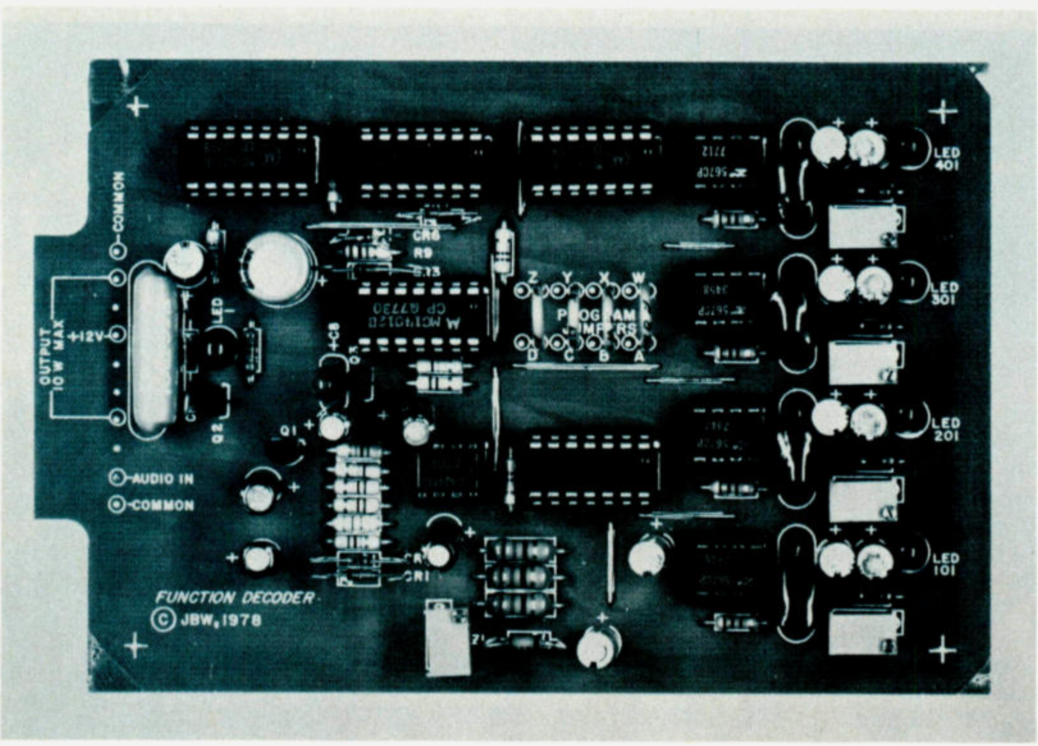


Photo of completed decoder.

This unit that is being presented is a totally self-contained single-function control board that requires only a 12- to 15-volt power source at about 100 mA and virtually any level of audio. The input is high impedance so it will not load or affect the audio line to which it is attached, and it adjusts its own input gain so that whatever audio input level is present is optimized for maximum performance. The output of this unit is in the form of a reed relay which can handle loads of up to 10 Watts. The relay contacts are isolated from all circuitry and may be used in any manner required. The circuit contains everything necessary for tuning and programming, without the need for test equipment. Once set up, the unit will respond to a four-digit touchtone™ code, latching the output relay, and releasing the relay upon reception of the proper and different four-digit off

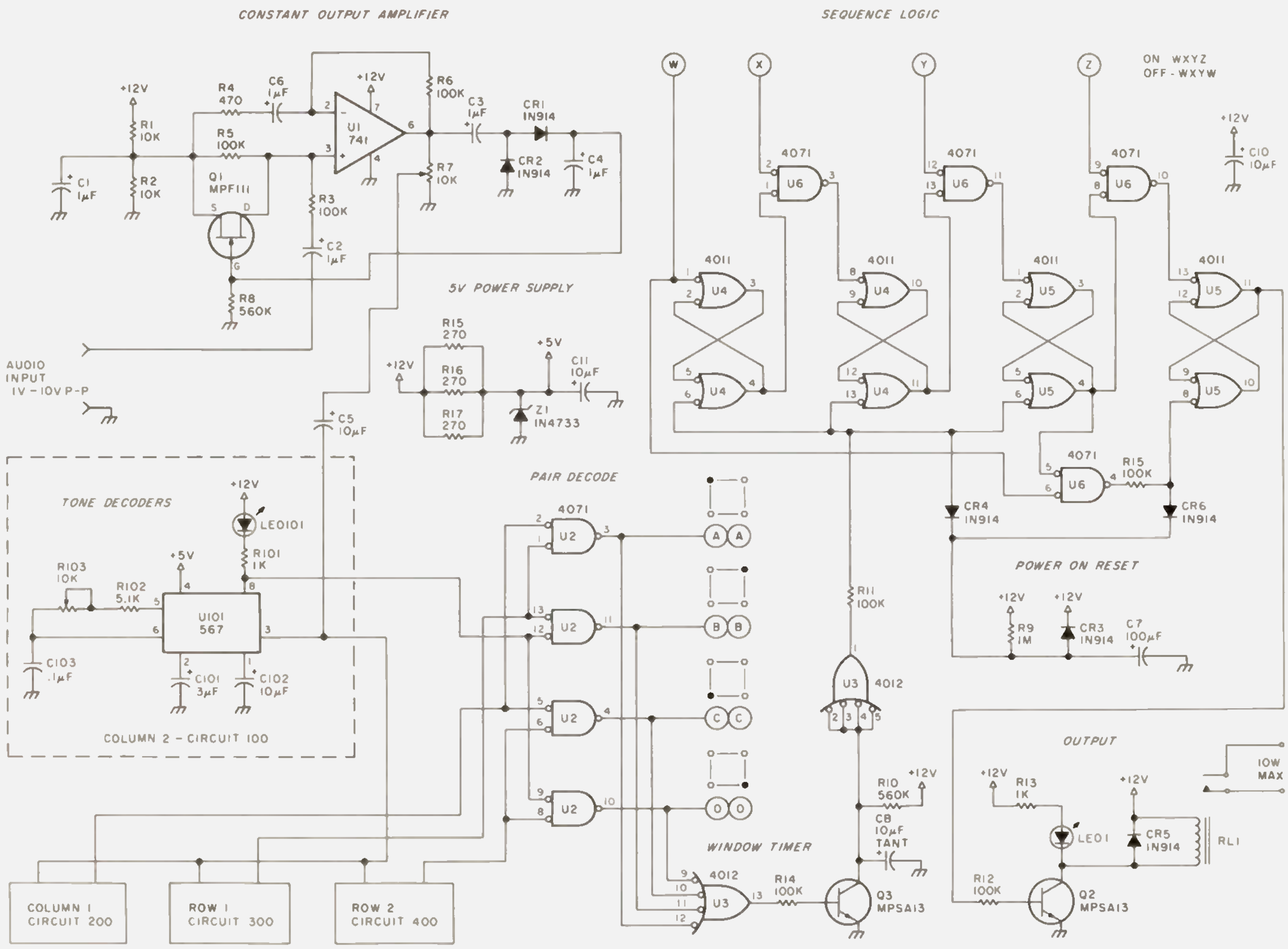


Fig. 1. Schematic of remote-control decoder. All resistors ¼ W, 5% unless otherwise stated. On all ICs, connect pin 14 to +12 volts and pin 7 to ground unless otherwise stated. Circuits 100, 200, 300, and 400 are identical except that part 101 becomes 201, etc.

code. This unit cannot be triggered by voices, yet will work even under the most trying conditions.

Circuit Description

See Fig. 1. The input stage of this function decoder is a self-adjusting automatic-leveling amplifier. It will take its input from any point which has audio available. The input impedance is on the order of 100k Ohms, so it will not load the audio line to which it is attached.

U1 forms a fixed-gain amplifier and the rectifier stage sampling the output produces a dc voltage level which is directly related to the output amplitude of the amplifier stage. This dc voltage is fed back to Q1, which turns on as the dc voltage goes in the positive direction. As the dc tries to go higher, the FET conducts more, shunting the input signal away from the amplifier input and not allowing the amplifier to produce any greater output.

In this way, the input stage regulates its gain to allow only small changes in the output, while the input may vary over a wide range.

The constant-level audio is fed to the inputs of circuits 100, 200, 300, and 400, which are tone decoders. Two of these circuits are tuned to column tones, and two to the rows. The desired decode tones are decided on and a touchtone dial (Fig. 2) is used to determine which columns and rows are needed. The leftmost column used will be referred to as column 1; column 2 is the rightmost. In a like manner, row 1 is the uppermost used row, and row 2 is the lowermost used row. Circuit 100 is tuned to the column 2 tone, circuit 200 to column 1 tone, circuit 300 to row 1 tone, and circuit 400 to row 2 tone.

These four decoded tones are fed into U2, (Fig. 1), which detects tone pairs and gives the digit-decode outputs. Output "A" would be row 1 and column 1; output "B" would be row 1 and column 2; output "C" would be row 2 and column 1; and output "D" would be row 2, column 2.

The decoded digits are fed to the W, X, Y, and Z inputs in the order in which the numbers are desired. An example would be the

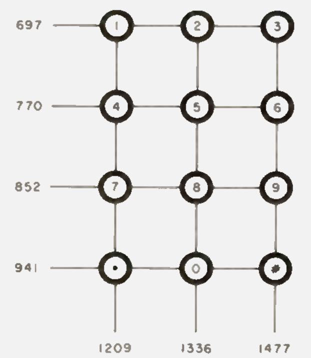


Fig. 2. Touchtone keypad showing row and column tones.

control number 1-3-7-9. 1 (column 1/row 1) output "A" goes to "W". 3 (column 2/row 1) output "B" would go to "X". 7 (column 1/row 2) output "C" would go to "Y". 9 (column 2/row 2) output "D" would to to "Z".

Anytime a digit is decoded, the output on pin

13 of U3 goes high, turning on Q3 and discharging C8. The low at C8 is inverted by the other half of U3, and is fed through R11 to the enable inputs of the sequence logic. As long as the enabling output from U3 is low, the sequence is held in a reset state, but the decoding of a digit and the subsequent discharge of C8 will enable the sequencing logic for a period determined by the charge time of C8.

If another proper digit is not received by the time C8 is charged by R10 (about 3 seconds), the logic is reset. As the proper sequence of digits is received, the flip-flops formed by U4 and U5 are set, in turn, until U5, pin 11, goes high with the proper decode of the fourth digit of the "on" code. When pin 11 is high, it drives the base of Q2, causing the transistor to conduct and relay RL1 to pull in. The relay will stay closed until the flip-flop driving Q2 is reset by the "off" code. The "off" code is the same as the "on" code except that the first digit of the code is also used as the fourth digit. If the code 1-3-7-9 were used as the "on" code, the "off" code would be 1-3-7-1.

LED1 in the collector of Q2 is a status light which allows the person looking at the board to know if the relay is energized. If the LED is lit, the relay is energized.

The network made up of C7, CR3, R9, CR4, CR6, R11, and R15 is used to provide power reset protection. In the event of a power failure, the unit will always come up in a mode where the relay is off (open contacts) when power is restored.

As mentioned earlier, this circuit is extremely effective and is in use in many repeaters, working as described. Some of the earlier units (based on the Autocall circuit with modifications for this task) have been on hilltops in repeaters and have been operating for several years without problems, so the circuit has been well proven.

In building this unit, it would be wise to select good temperature-stable components for operation in the area of the tone decoders. Resistors R102 and R103, and capacitor C103 must not change much if the tuning of the tone decoders is to remain stable. Show some care in handling and soldering of the CMOS logic, as I can attest to what a soldering iron with a leaky tip can do. If in doubt about your iron, ground the tip with a clip-lead near the handle. CMOS is great stuff but it cannot handle high voltage, even at extremely low current levels.

A final note of interest is that on the printed circuit card, the decoded digits, A, B, C, and D are brought out to a patch point and the sequencing logic inputs W, X, Y, and Z are also brought to the same point where convenient strapping is available for programming.

Professional PC boards and all components are available from CW Electronics (the author) as shown in the parts list.

Tuning—With Test Equipment

Provide an audio source and observe audio at pin 3 of any tone decoder on an oscilloscope. Adjust R7 until the audio peaks are about 200 mV. After deciding which tones to decode, connect a frequency counter which has a high-impedance input to pin 5 of each tone decoder (567), and, in turn, adjust each associated pot until the proper decode frequency is read as the vco idle frequency. This is done with no audio being fed into the unit.

Tuning—Without Test Equipment

Connect the audio input to a source of touchtones. Set R7 midrange and introduce the row 1 tone into the unit. This can be done by pushing two buttons of the touchtone pad simultaneously. Adjust pot R103 until the LED lights. Lower the adjustment of R7 until the LED goes out. Raise the adjustment of the R103 about 2 turns past the point where the LED lights again. Now, in a similar manner, provide the desired row or column tone, and adjust the other three tone decoders. R7 is set only once and just the tone decoders need adjusting. Make sure each tone pot is set in the center of the range, halfway between the drop-out points.

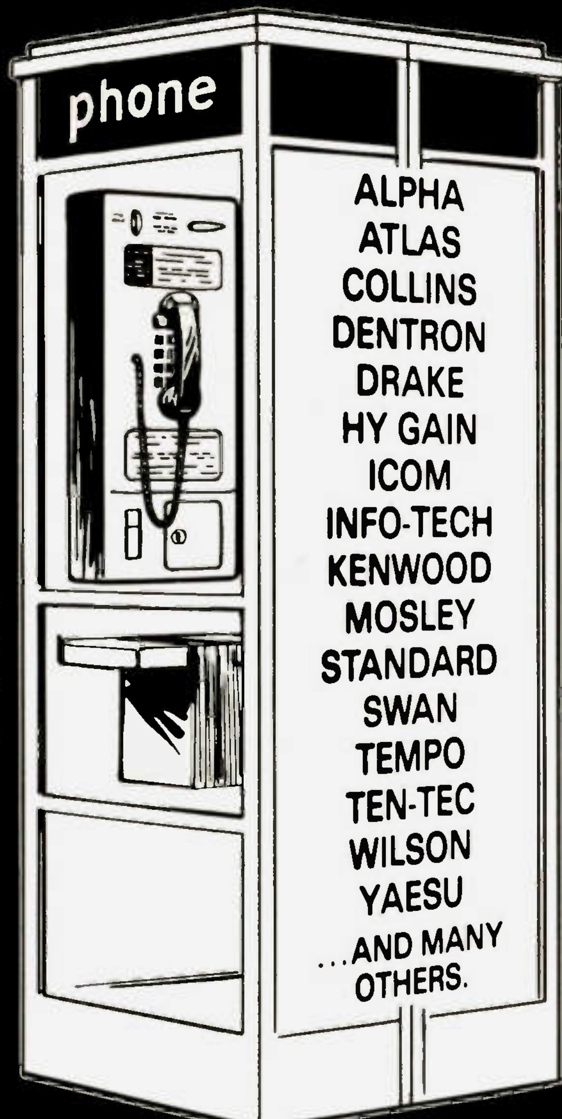
Jumpers

When all four decoders are set, decoded tone pairs will appear at outputs A, B, C, and D. Provide jumpers from A, B, C, and D to W, X, Y, and Z to obtain the desired order of decode, i.e., first digit to W, next to Y, and so on. ■

Parts List

Item	# Req.	Description	Designation
741	1	Op amp	U1
4071	2	Quad OR	U2, U6
4012	1	Dual NAND	U3
4011	2	Quad NAND	U4, U5
567	4	Tone decoder	U101, U102, U103, U104
MPF111	1	FET	Q1
MPSA13	2	NPN transistor	Q2, Q3
LED	5	Light-emitting diode	LED 101, 201, 301, 401, LED 1
1N914	6	Signal diode	CR1, CR2, CR3, CR4, CR5, CR6
1N4733	1	Zener diode	Z1
270 Ohm	3	½-W, 5% resistor	R15, R16, R17
470 Ohm	1	¼-W, 5% resistor	R4
1k	5	¼-W, 5% resistor	R101, R201, R301, R401, R13
5.1k	4	¼-W, 5% resistor	R102, R202, R302, R402
10k	2	¼-W, 5% resistor	R1, R2
100k	7	¼-W, 5% resistor	R3, R6, R5, R12, R11, R14, R15
560k	2	¼-W, 5% resistor	R8, R10
1 Meg	1	¼-W, 5% resistor	R9
10k	5	Trimpot	R7, R103, R203, R303, R403
.1uF	4	Mylar™ capacitor	C103, C203, C303, C403
1 uF	5	Electrolytic capacitor	C1, C2, C3, C4, C6
3 uF	4	Electrolytic capacitor	C101, C201, C301, C401
10 uF	7	Electrolytic capacitor	C5, C7, C1, C102, C202, C302, C402
10 uF	1	Tantalum capacitor	C8
100 uF	1	Electrolytic capacitor	C7
Relay	1	RA31441121, Elec-trol	RL1
PCB	1	Printed circuit board	Available from CW Electronics, PO Box 8306, Van Nuys CA 91409. Full kit is $42.00. Optional sockets for ICS 3.00. Optional edge connector 2.00.

Ham Radio Center has a Branch Store on the corner.



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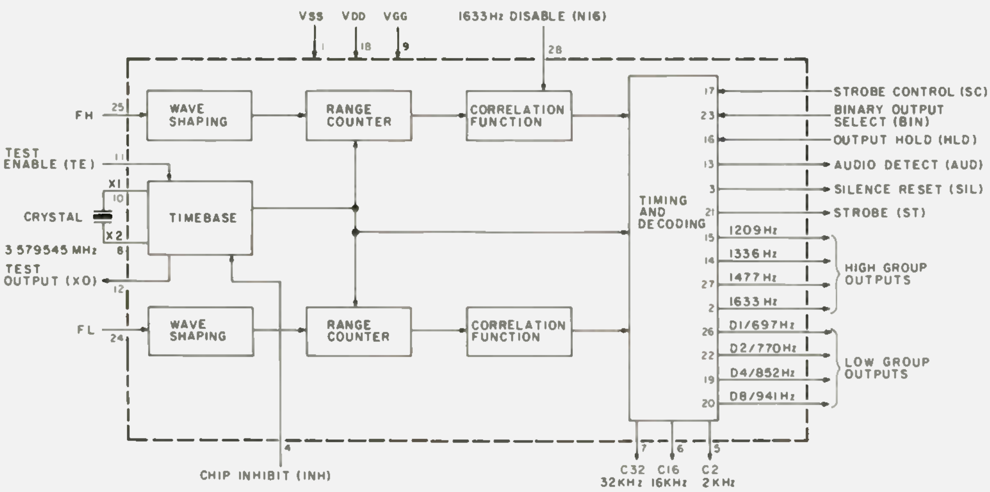


Fig. 1. CRC 8030 block diagram.

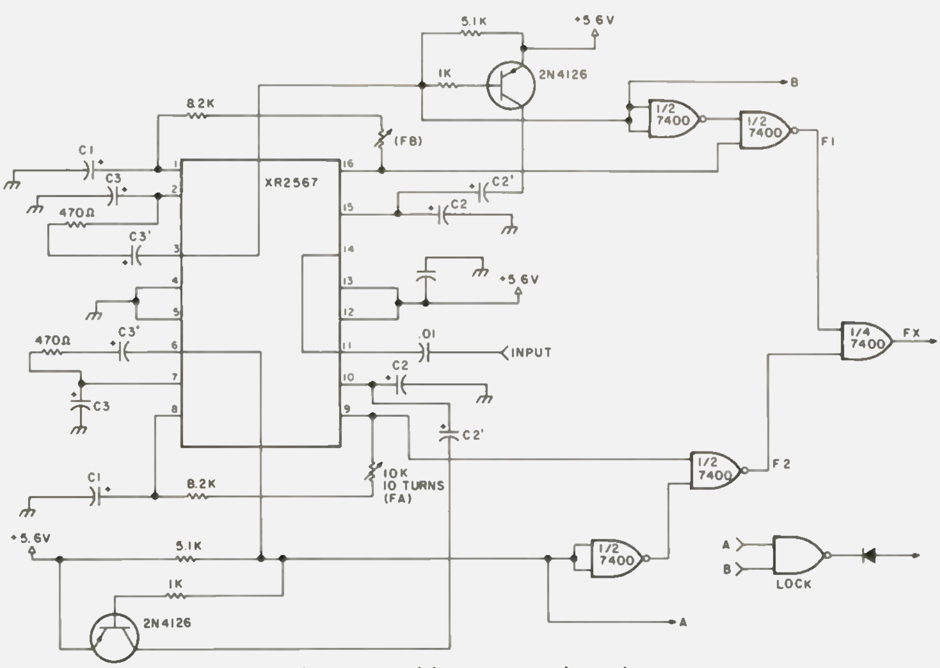


Fig. 2. Dual-loop tone decoder.

Decoding touchtone™ signals in a noisy environment can create real problems. Having the autopatch come up in the middle of a rag chew or turning on the air conditioner in the middle of winter can be embarrassing.

The development of the NE 567 by Signetics, the XR 2567 by EXAR, and the Mostek MK 5102 simplified the hardware required to construct tone decoders. Now you can replace the NE 567 and XR 2567 combos with a single chip—the CRC 8030 made by Rockwell-Collins. The chip costs more than the MK 5102, but then it does more and has more output functions.

When coupled with a suitable front end section, you can make a dual-tone multi-frequency receiver (DTMFR) that has fast lock-up time, practically no false outputs, and a few other features that will be discussed later. Pin connections for the CRC 8030 are shown in Fig. 1.

Fig. 3 shows the block diagram of the unit. I built three filters for use with the CRC 8030, but the one shown here seems to be the easiest to adjust and maintain. This circuit also produced some circuit tips that can be added to the decoder circuit described by Buffington (*73 Magazine*, April, 1977), to decrease the lock-in time.

A single-stage agc amplifier drives XR 2567 dual-tone decoders. The decoders form bandpass tracking filters for the two tone groups. A simplified diagram of the filter circuit

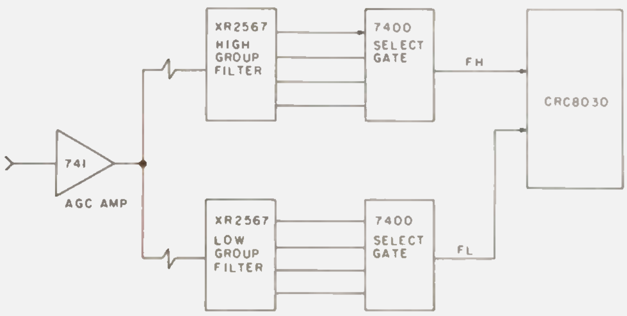


Fig. 3. Block diagram of the DTMFR.

$$F_o = \sqrt{F_1 + F_2}$$

	Freq. (Hz)			
Cap. (uF)	732	895	1270	1553
C1	0.1	0.1	.047	.047
C2	.22	.22	.10	.10
C3'	2.2	2.2	2.2	2.2
C2'	1.0	1.0	1.0	1.0
C3'	10.0	10.0	10.0	10.0

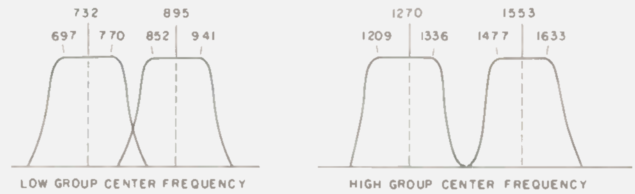


Fig. 4. Free-running frequency settings.

	1209				1336				1477				1633			
	D1	D2	D4	D8	D1	D2	D4	D8	D1	D2	D4	D8	D1	D2	D4	D8
697	1	0	0	0	0	1	0	0	1	1	0	0	1	0	1	1
770	0	0	1	0	1	0	1	0	0	1	1	0	0	1	1	1
852	1	1	1	0	0	0	0	1	1	0	0	1	1	1	1	1
941	1	1	0	1	0	1	0	1	0	0	1	1	0	0	0	0

Fig. 5. Touchtone matrix: binary outputs.

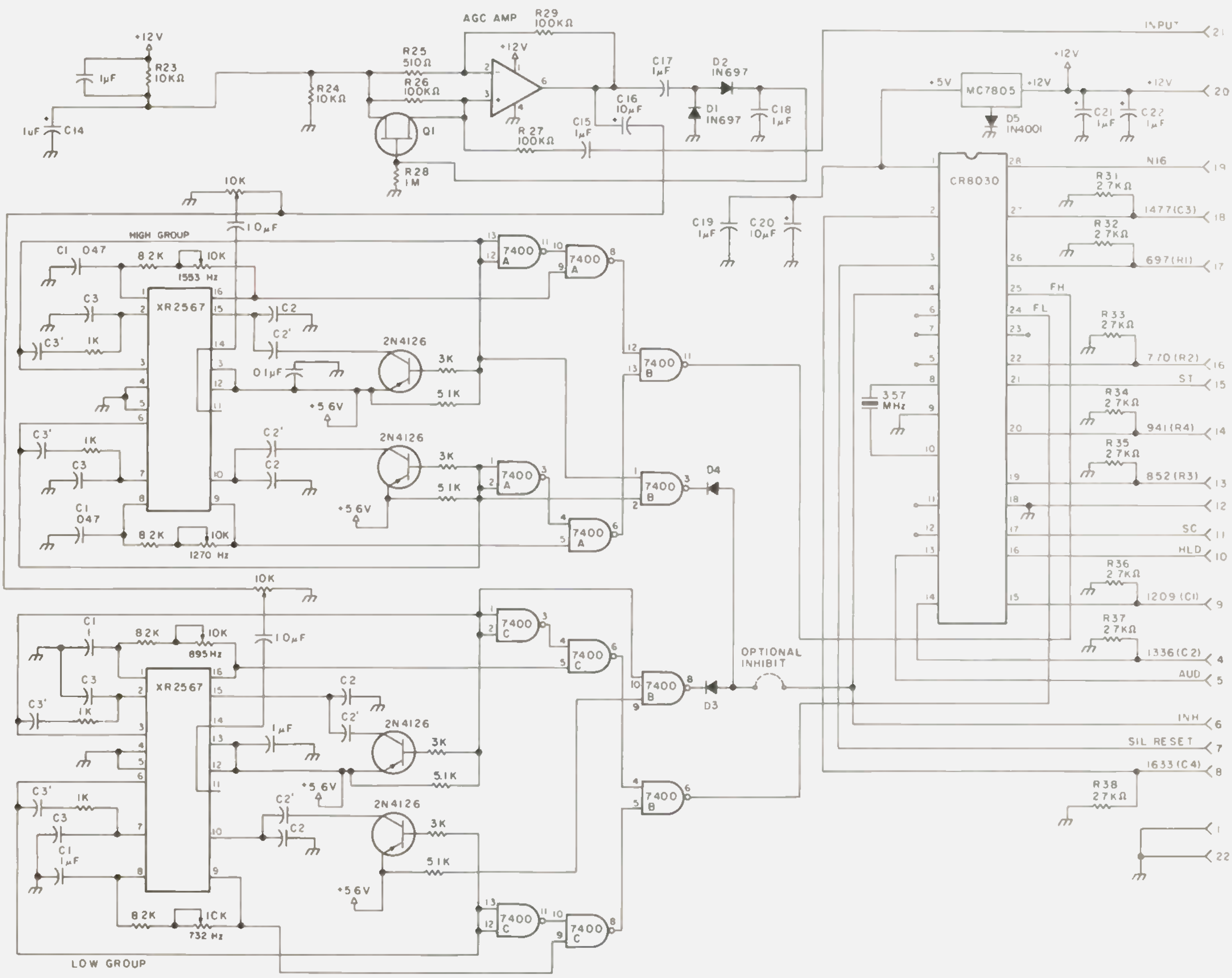


Fig. 6. Schematic of DTMFR. Values for C2, C3, C2', and C3' are found in Fig. 4.

is shown in Fig. 2. Each decoder has two control loops. When no signal is being received, the decoders are free-running at the center frequencies shown in Fig. 4. The smaller value for the loop filter capacitor allows the unit to lock faster. When a tone appears within the passband and the first lock occurs, pin 3 or 6 goes low and the second loop takes over, reducing the bandwidth and over shoot. It's like driving at 90 miles per hour and stopping immediately, if not sooner. In other words, the bounce is gone! After this occurs, the output of the locked decoder is then gated to the CRC 8030.

The CRC 8030 examines the input signal and, if it likes what it sees, generates a strobe pulse to indicate valid data, and all within 40 ms! Whenever a signal is present, AUD (pin 13) goes low to indicate a tone is present. The SIL (pin 3) stops sending out 10 millisecond pulses. Output can be 2-out-of-8 or binary if the BIN (pin 23) is held low. Binary output format is shown in Fig. 5. The output can be stored in the output register if HLD (pin 16) is held low.

I decided to use the INH (pin 4) to inhibit decoding of any tones unless a tone from each group is present. Neat, huh?

Adjustments

Adjust the four decoders to the free-running frequencies shown on the chart of Fig. 4 by first grounding pin 3 or 6 of the respective decoder. Next, apply a single tone of approximately 1 volt to the agc amplifier and adjust the low-tone group control for 1 volt at the input to the decoder for that tone group. Repeat this procedure with the high-tone group.

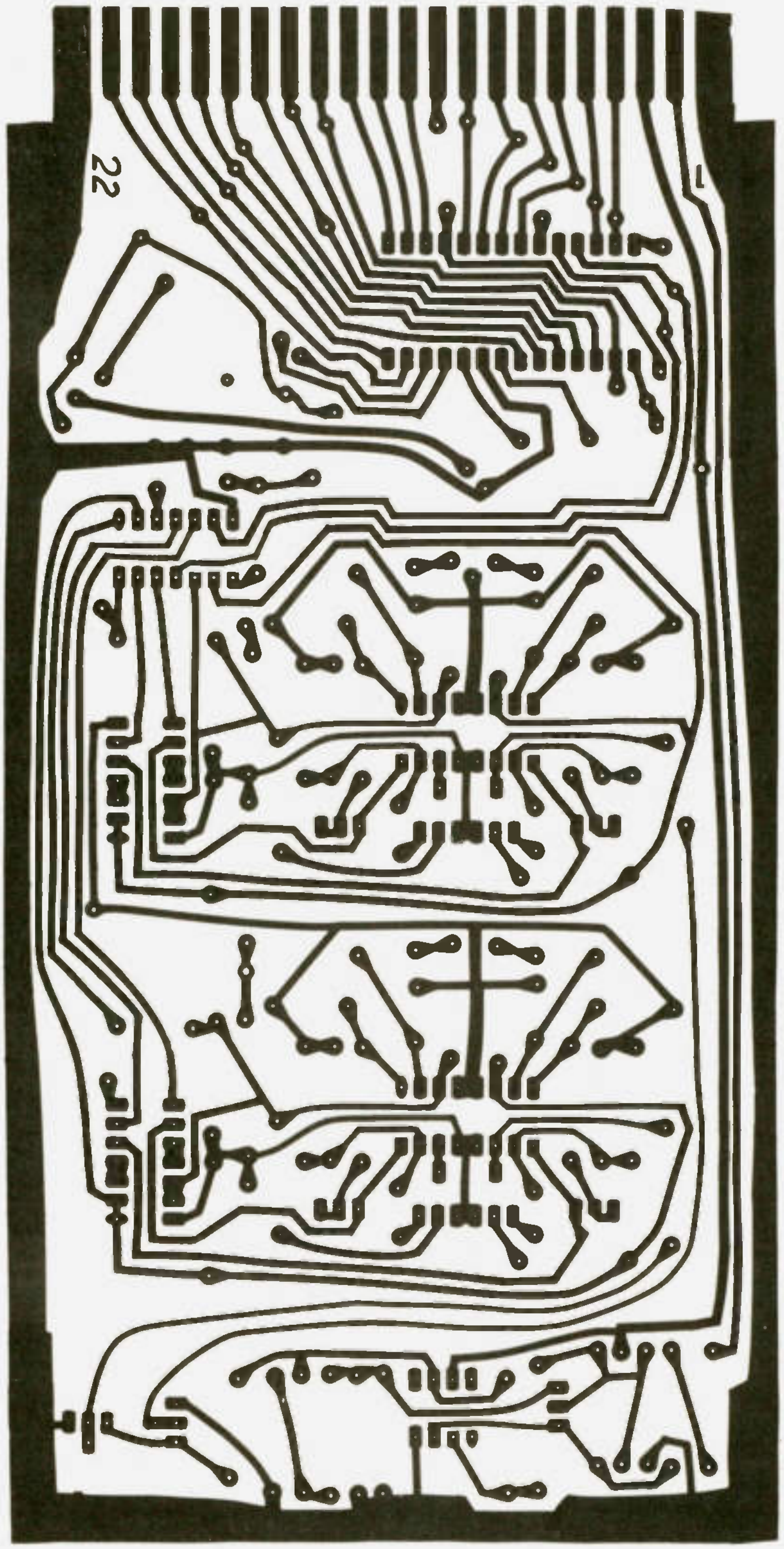
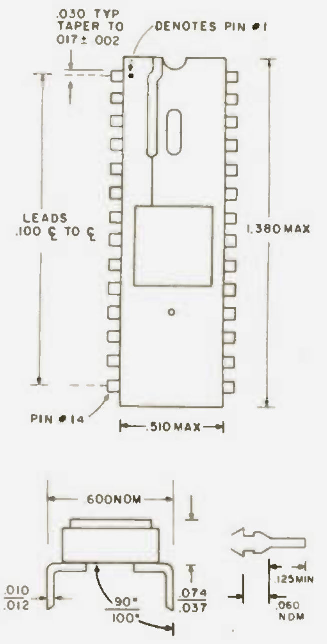


Fig. 7. PC board.



PIN NO.	FUNCTION	PIN NO	FUNCTION
1	VSS	15	1209 Hz
2	1633 Hz	16	HLD
3	SIL	17	SC
4	INH	18	VDD
5	C2	19	D4/852 Hz
6	C16	20	D8/941 Hz
7	C32	21	ST
8	X2	22	D2/770 Hz
9	VGG	23	BIN
10	X1	24	FL
11	TE	25	FH
12	XO	26	D1/697 Hz
13	AUD	27	1477 Hz
14	1336 Hz	28	N16

Fig. 8. DTMF detector (CRC 8030).

The agc amplifier should handle signals from 50 millivolts to 5 volts while holding the output constant.

The dual-lock circuit for the XR 2567 can be incorporated in existing systems without too much trouble and cost. With this circuit, it is possible to use a standard card dialer which would make autopatching a lot easier and safer while mobile in motion.

Further improvements can be made to the front end by using separate agc amplifiers with suitable filters for each group. I would appreciate any and all comments on this circuit. ■

References

1. XR 2567 Data Sheet, EXAR Integrated Systems.
2. CRC 8030 Data Sheet and Application Note, Rockwell-Collins.
3. "Toward a More Perfect Touchtone Decoder," J. H. Everhart, *73 Magazine*, November, 1976.
4. "Autocall '76," C. W. Andreasen, *73 Magazine*, June, 1976.
5. "More Repeater Control Devices," Bill Hosking, *73 Magazine*, December, 1977.
6. "Low Cost Tone Deocder," Chris Winters, *73 Magazine*, November, 1977.
8. "Digital Autopatch," Buffington, *73 Magazine*, April, 1977.
9. "Complete Repeater Control," Buffington, *73 Magazine*, June, 1977.
10. "Fake 'Em Out," Buffington, *73 Magazine*, May 1978.
11. "Single IC Touch-Tone Decoder," Larry Nickel, *Ham Radio*, June, 1978.

Parts List

ICs, Transistors, and Diodes

1 741 op amp
1 MC 7805
1 CRC 8030
4 2N4126
3 7400
1 1N4001
2 1N697
1 MPF 111
2 XR 2567

Resistors

11 2.7k, ¼-Watt, 5%
2 10k, ¼-Watt, 5%
1 1 meg, ¼-Watt, 5%
1 510 Ohm, ¼-Watt, 5%
2 100k, ¼-Watt, 5%
4 8.2k, ¼-Watt, 5%
4 5.1k, ¼-Watt, 5%
8 1k, ¼-Watt, 5%
4 10k, ¼-Watt, 5%
2 10k single-turn pots

Capacitors

3 .1-uF disc ceramic
4 1-uF tan., 35 V
4 10-uF tan., 35 V
2 .047-uF tan., 35 V
1 100-uF elec., 35 V
4 .22-uF tan., 35 V
2 .47-uF tan., 35 V
4 .1-uF tan., 35 V

Other

90 Molex pins
1 22-pin, .156"-spacing card edge connector
1 3.57-MHz xtal

Circuit boards and parts can be obtained from:

O.C. Stafford Electronic S. and D.
427 S. Benbow Road
Greensboro NC 27401

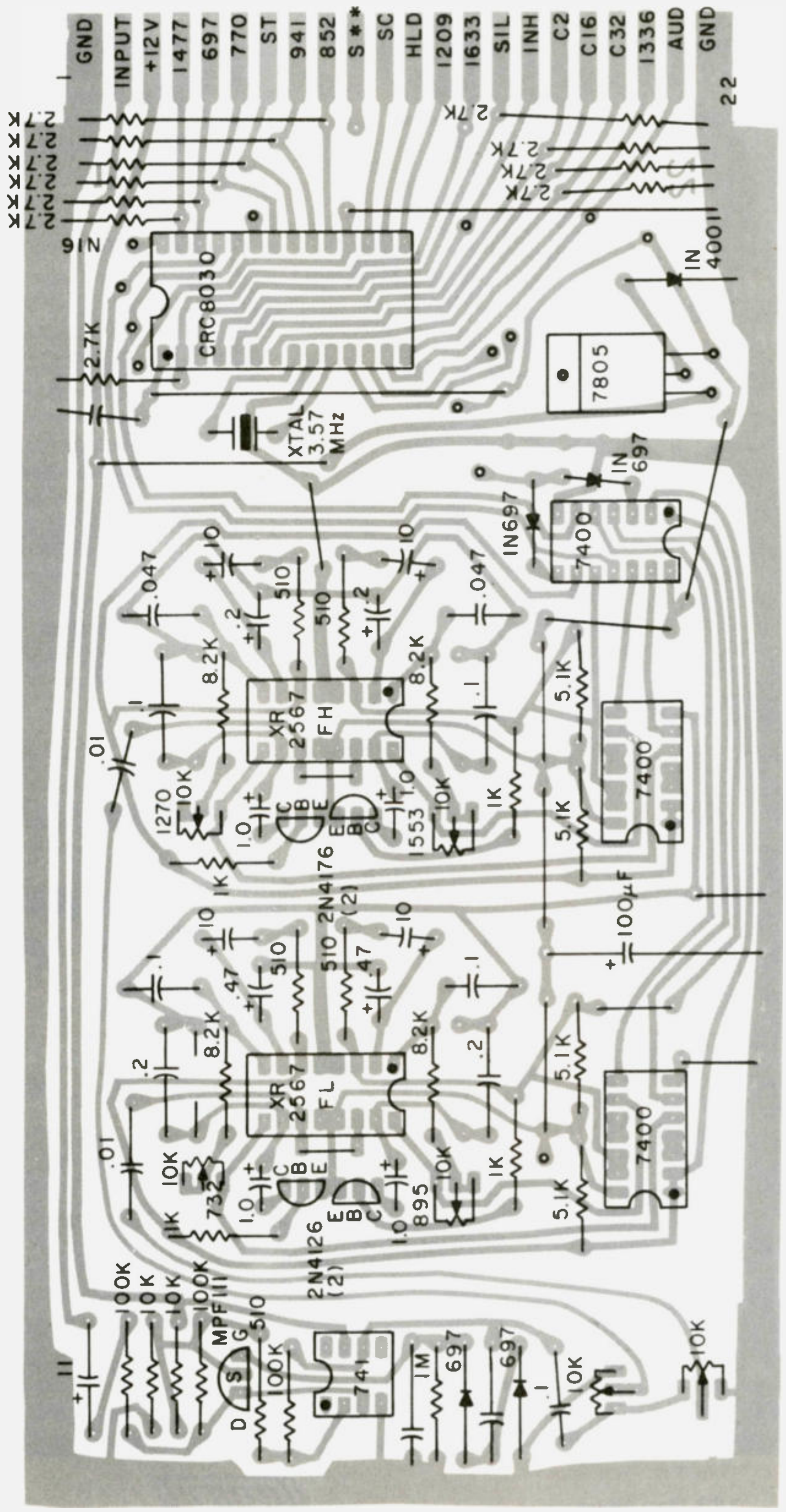


Fig. 9. Component layout.

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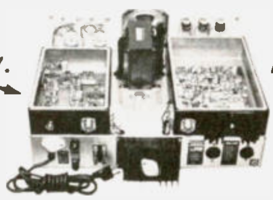
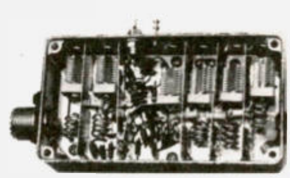
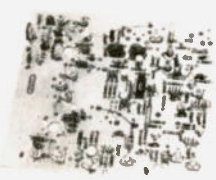




FL-6

SCT 110 BOARD



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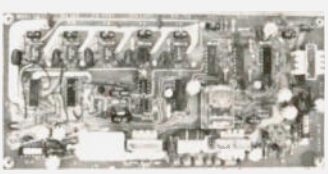

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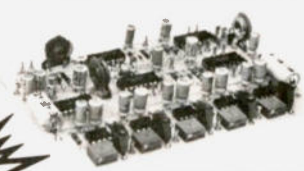

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Freedom Fighters on Forty

—SWLing the anti-Castro clandestines

Harry L. Helms, Jr. KA5M
3002 Valley Meadow, Apt. 144
Dallas TX 75220

Hams by their very nature are "talkers," whether by SSB, FM, CW, or RTTY. I love to yak, too, and that desire to talk is one of the main reasons I wound up with my ticket. But there are times when listening is far more rewarding than speaking, and I can't help but wonder how many hams are aware of some of the remarkable things which could be heard on 40 meters during the first six months of 1978.

My mike and key gathered dust for several weeks as I spent my operating time searching the 7070-7100 kHz range for a Spanish-speaking OM who identified himself as "El Comandante David." His station used no call letters, only the slogan "Radio Rebelde." David did not engage in the usual ham QSOs; rather, he used his station to deliver impassioned and moving speeches against the regime of Fidel Castro in Cuba. As I listened to Radio Rebelde's broadcasts, I found myself becoming emotionally involved with David's situation, hoping desperately that he would manage to avoid detection by the authorities for another night.

David was a Cuban radio amateur. Radio Rebelde was a Cuban ham station pressed into service as a broadcasting station. David faced the death penalty for treason if caught by the Cuban government.

I entered the ranks of ham radio after several years as an SWL (shortwave listener). Unlike many hams who get their start in SWLing, I have never lost interest in the hobby and still belong to a number of SWL clubs. Thus, I was aware that interesting things do pop up from time to time in the 40 meter band. Almost yearly, some teenagers get ahold of an AM phone transmitter like the DX-60 or Johnson Ranger and set up a bootleg broadcasting station for a few days (one I particularly remember took to the air in 1973 under the callsign "WTIT, The Sound of Young America!"). During the first few years following Castro's rise to power in Cuba, 40 meters was the site for several low-powered freedom stations operating from various locations inside and outside Cuba (SWLs refer to such hidden stations as "clandestines"). But such activity decreased during the 1970s, with the last activity I can recall having taken place in 1975.

But recently Castro has become much more venturesome. Despite the continuing stagnation of the Cuban economy and hardships suffered by the Cuban people, Castro decided to launch large-scale involvement of Cuban troops in Africa. American sources estimate that over one-quarter of Cuba's armed forces are currently involved in Africa and the strain upon the homefront is reportedly severe. Goods and services, which have long been in short supply, have in some cases become virtually unobtainable by the average citizen. Moreover, certain portions of Africa, particularly Angola, are becoming as difficult for Cuba to extricate itself from as Vietnam was for the United States. Casualties are high, especially among black troops in the Cuban army, and this has resulted in smoldering racial tensions within Cuba.

Given such a backdrop, it was perhaps inevitable that some form of new anti-Castro clandestine radio activity would spring up. The first inkling came in the pages of *FRENDX*, the monthly bulletin of the North American Shortwave Association (PO Box 13, Liberty, Indiana 47353). During November of 1977, several SWLs reported hearing a station identifying as "Radio Abdala" operating in the AM mode on frequencies centered around 7085 kHz. All broadcasts were in Spanish, using male and female announcers reading scathing critiques of Castro and communism in general. Its theme music played at sign-on and during station breaks was from "2001, A Space Odyssey." It claimed to be operating from within Cuba itself, but most listeners doubted this, if for no other reason than its elaborate and professional production. A better guess placed the transmitter either in southern Florida or somewhere in Central America. "Abdala" turned out to be the title of a well-known Cuban exile group.

Yet another anti-Castro clandestine was heard by a Miami SWL during December, 1977, operating in the 7000-7025 kHz range. The Miami SWL, Timothy Hendel, recorded one of his receptions and forwarded the tape to well-known SWL Glenn Hauser, editor of the "Listener's Notebook" section of the *FRENDX* bulletin. Glenn was able to glean from the tapes such tidbits as the announcer claiming to be operating from the Oriente Province of Cuba "especially for the Revolutionary Armed Forces." The station indentified itself as "Radio Rebelde, unida a Radio Libertad Cubana" and the announcer referred to himself simply as "El Comandante David."

I noted such reports with interest, but was unable to find either Radio Abdala or Radio Rebelde during checks during January of 1978. The two stations gradually began to fade from my memory until the evening of May 5, 1978. I was tuning 7080 kHz around 0300 GMT when I ran across an AM station badly QRMing the Europeans trying to work the states on SSB. Despite my best efforts to tune out the pest, his strong signals continued to obliterate 7080. I flipped the mode selector on my rig to AM and decided to see if I could identify the lid.

Something about the announcer's voice immediately caught my attention. It was strident, urgent, emotional. I found myself struggling to remember the Spanish I took as a college freshman. Certain words kept popping up clearly in his speech: "Cuba," "Angola," "Sovietica," and "la tirania de Fidel Castro." I now realized what I must be hearing, and it was soon confirmed with the identification as "Esta es Radio Rebelde, unida a Radio Libertad Cubana."

I heard Radio Rebelde again on May 9, and on May 10 I heard both Rebelde and Radio Abdala. By this time I was hooked on listening for these two stations. I caught Radio Abdala on May 10 at 0135 GMT on 7080 kHz. Both male and female speakers were heard, and talks were interspersed between musical breaks. Signal strength was excellent, yet modulation was quite crummy. I kept listening until they signed off at 0210. At 0253 on 7088 kHz, I again caught Radio Rebelde and David at the mike. He seemed to be having some sort of transmitter trouble this night, as the carrier left the air several times while he was speaking. Once it returned on 7089.5 kHz. David left the air promptly at 0300 and was heard no more that night.

I tuned for both without success on May 11, but again caught both on May 12. This quickly developed into a pattern; if one station was on, the other was sure to be on later that night. Radio Abdala was caught at a 0122 GMT tune-in on 7082 kHz while Radio Rebelde and David were heard beginning at 0201 GMT on 7089 kHz. David was rapidly proving the more interesting of the two stations. His voice delivery was seemingly extemporaneous, and frequently there were moments of dead air while he seemed to collect his thoughts. He claimed to be broadcasting from a hidden location in the mountains of Oriente Province and that there was a large underground in Cuba ready to rise up against Castro. He attacked the shortages of goods in Cuba and accused the Cuban government of falsifying casualty reports for its African operations.

I couldn't help but wonder if David was a radio amateur like myself. On May 12, I found out. At 0325 David paused and his carrier left the air for a few moments. Another Spanish-speaking voice came on frequency, mocking David and asking, in effect, "Why don't you give up? No one is listening to you anyway!" Immediately David's voice returned to the air, angrily challenging the unidentified intruder. No, no, that's not the case, claimed David. Radio Rebelde had "muchos, muchos oyentes" (many, many listeners). Thus wound up, David once again tore into the Cuban government and Castro until 0400 GMT, when he signed off and thanked his listeners.

David had to be listening to his transmit frequency in order to hear his heckler, indicating that he was operating transceive. That little incident convinced me that Radio Rebelde was actually a CM/CO amateur station in disguise.

As May wore on, I could hear both Radio Abdala and Radio Rebelde two to four times per week. I began to note that David was being subjected to "jamming" of a sort, such as swishing vfos and rough ac-modulated tones almost zero beat with his signal. At the time, I merely chalked these up to noodle-brained stateside hams.

On May 24, I caught a new voice on 7090 kHz from 0152 to 0159 GMT. This speaker was definitely not David, but another Spanish-speaking OM attacking Castro. At sign-off, I caught a clear identification as "Radio Libertad Cubana," the station supposedly "united" with Radio Rebelde. I felt exhilaration as I realized that David was not alone, that there were others inside Cuba who were working with him. And the very next night, May 25, David and Radio Rebelde were back on 7090 kHz until 0300 GMT.

About this time, I was seized with an almost irresistable urge to communicate somehow with David, to let him know that his message was being heard outside the boundaries of Cuba. From several sources, I was able to form what I feel to be a reasonably accurate guess as to the true identity of David and his amateur callsign. Writing a letter was obviously out, due to the chance it could be intercepted by Cuban authorities. I toyed with the idea of ignoring several FCC rules and using AM phone on David's frequency, sending him greetings in Spanish. I decided, however, to stay within the rules.

In retrospect, I wish I hadn't.

Things came to an abrupt head on June 2. At 0235, I caught David and Radio Rebelde on 7080 kHz, 10 kHz lower in frequency than normal. His subject, as near as I could determine with my limited Spanish, was the growing influence of Castro in Venezuela and his designs on that nation's large oil supplies. But, at 0238, he was suddenly QRMed by an English-speaking OM using the call CM2HB, calling CQ for stations in Europe. CM2HB was using SSB, but his signal was so perfectly placed atop the AM signal of Radio Rebelde that he could be copied without using a product detector. CM2HB and Radio Rebelde were identical in strength, and CM2HB continued to call CQ for several minutes. The operator of CM2HB had to be aware of Radio Rebelde on the same frequency, and I knew his choice of frequency could not have been purely accidental.

At 0253, CM2HB got tired of CQing and left the frequency. In his place popped up someone swishing his vfo across the frequency. Through the QRM, I could hear David's voice thanking listeners for their letters. I couldn't help but wonder if this wasn't just some wishful thinking on the part of David, since if the listeners could figure out how to get a letter to Radio Rebelde, the Cuban authorities surely must also have had some inkling as to the identity of David. David exchanged bits of conversation with another Spanish-speaking station, but the talk was too fast for me to follow. Abruptly, at 0258, Radio Rebelde left the air.

I tuned the 7080-7090 kHz range for several minutes before I caught an open carrier on 7080. At 0315, Radio Libertad Cubana came on the air, picking up Radio Rebelde's theme of Cuban influence in Venezuela. I was never able to catch the name of the announcer for Radio Libertad Cubana, but it was not David's voice that I heard. I didn't get the chance to listen to much of Radio Libertad Cubana this night, for, at 0317, several stations suddenly came on the frequency, all using CW. There were four or five stations, all neatly spaced in the bandwidth of the AM signal so as to completely destroy the intelligibility of Radio Libertad Cubana. I switched my receiver into the CW with a narrow bandpass filter and found that each of these CW stations merely sent CQ over and over without signing any call. At 0325, Radio Libertad Cubana left the air and the mystery CW stations likewise ceased operations.

The rest of the evening was a confusion of jumbled activity on 7080 kHz. At 0330, I caught David's voice again, engaging in a brief QSO with another Spanish-speaking amateur using the AM mode. At 0335, Radio Rebelde again took to the air, with David this time sharing the mike with another male announcer. As soon as he began his transmission, David was jammed by a couple of other stations which began sweeping their vfos across his frequency. At 0345, Radio Rebelde left the air as David wished all his listeners a good night and thanked them for listening.

To date, I have not heard Radio Rebelde, Radio Libertad Cubana, or Radio Abdala since.

I have carefully searched 40 meters in the months since June 2, 1978, many nights, but have failed to hear David's distinctive voice once. Nor have any receptions of the three stations appeared in the bulletins of any of the SWL clubs that I belong to.

It could have been that David and his compatriots simply got tired of their activity. Or the jamming activity of June 2 could have indicated to them that it would be best to lie low for a while. A much more ominous possibility is that some of them are currently in a Cuban prison or even dead.

But if David or some of his friends should somehow read these words, I hope that someday he'll return to the air to let his listeners know that he's still all right. And if you should come across an AM station in the CW portion of 40 meters some evening, stop and listen. It could well be David. ■

✓ Reader Service—see page 211

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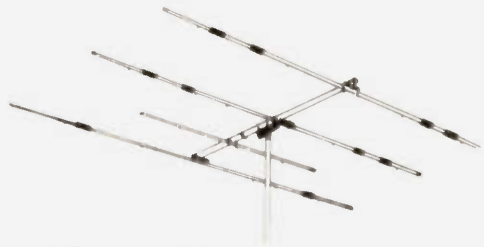

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Reader Service—see page 211

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Take a piece of RG-59/U coax, long enough for your feedline plus about ten feet. Trim the outer cover back about two feet. Carefully expand the braid by pushing from the free end to enlarge the diameter to about twice its normal size (but don't unravel the braid). Now, work the braid down over the top of the outer covering of the coax, so that the braid is folded back over itself over the outer covering. When it is all smoothed down, trim the length of the braid to one-quarter wavelength for the frequency you want (19.25 inches for 146 MHz). Tie or tape the braid in place.

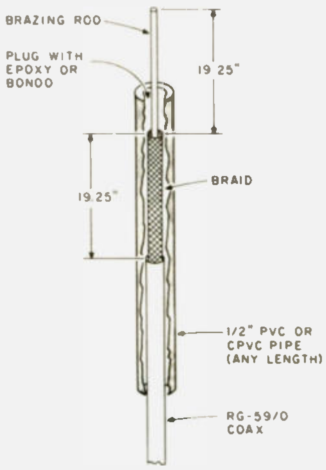

Fig. 1.

Next, cut the exposed center conductor and insulation about two inches from the folded-over end of the braid. Remove the insulation except for about an eighth of an inch. Now cut a piece of brazing rod (or #10 copper wire) to a quarter wavelength and solder it to the free end of the center conductor of the coax, with the rod butting against the insulation. Tape, or use heat-shrink tubing on the joint.

See what you have now? A half-wave antenna fed at the center, and matched to the coax it's made from.

Now take a quick trip to the hardware store and get a piece of ½" PVC or CPVC pipe. Cut it to the length you want for your finished antenna. Insert the end of the antenna through the pipe so that the rod protrudes about twelve to fourteen inches. Plug the end of the pipe around the rod with auto body filler (such as "Bondo") or epoxy. After this sets up, you can pour the rest of the pipe full of fiberglass resin if you want, but it isn't necessary if you've put a good plug in the rod end. (CPVC material seems to slow the setting of fiberglass resin, but it will set up in time.) All you need now is the appropriate fitting for the other end of the coax, and you're on the air.

The swr on my antenna is practically the same across the entire band, about 1.3:1. I have it in a six-foot piece of pipe which gets me well above the car body, so its pattern is not distorted by the metal of the car. And it is much more effective than the quarter wave I used to have on the roof. The CPVC pipe is flexible enough to bend almost double if I forget to take it down before going into the carport (but the noise is terrifying!).

The same approach works well for an antenna for the home rig, but if you're going to have a very long feedline (over about 25 feet), you should use RG-11/U coax. It's next to impossible to pull the braid on this coax back over itself, so the trick is to cut off a couple of feet of coax, take the braid completely out, expand it, and slide it over the piece you're going to use as a feedline. You can then solder the braids together, and I find it protects the outer covering of the RG-11/U if you work a small piece of fiberglass cloth under the place you're going to solder. The braid will easily expand enough to pull it over the top of a couple of layers of cloth.

This is a good project for a rainy Saturday. The antenna works well, is cheap, and, with a little care, can be made good-looking. Try it! ■

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One of the many attractive features of the Kenwood TS-820S transceiver is the fact that circuitry for FSK (frequency shift keying) is already built in, so that the owner who wants to operate radioteletype has no need to start digging around in the vfo or local oscillator. Additionally, when in the FSK mode, one can use the very sharp 500-Hz CW filter and get really remarkable selectivity. When transmitting FSK, the rig even automatically cuts down the power to a level safe for continuous service.

There is, however, one slight difficulty. To key the transceiver, you have to arrange matters so that the FSK input is grounded on mark and open on space. This is a little different from what you may have been used to. If you own the ST-5 terminal unit made by HAL, for example, or its big brother, the ST-6, you can't just connect its FSK output to the FSK input on the TS-820S. The reason is that the HAL units provide negative and positive voltages at the FSK output—about −12 volts on mark and +12 on space. This is an excellent method for keying most transmitters, but don't try it on the TS-820S. Such voltages will confuse the diode circuits Kenwood uses to shift frequencies.

The obvious solution is to insert a sensitive relay in your RTTY closed-loop circuit and use its contacts to key the transceiver. This is what I did, at first, using a small encapsulated relay I had bought from Poly Paks. It worked fine, except that it didn't seem quite "state of the art," and also it made the required CW identification a little awkward. (Since I was no longer using my ST-5 to provide keying voltages, I couldn't use its CW ID capability.) What you end up doing is inserting a hand key in series with the relay contacts. Just remember to close the shorting lever on the key after you've completed your ID. I forgot several times and ended up transmitting a fine unmodulated carrier, but no RTTY.

There had to be a better way, and there was. If I have learned anything in fifteen years of ham radio, it's that the best way to get help with a problem is to "talk it up"—preferably on the air. That's what I did. My solution came from Gordy WB9TGB, who had had the same problem. He passed along a simple two-transistor circuit which he, in turn, had gotten from Mel WØRV.

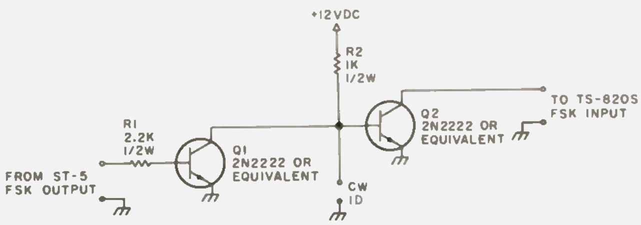

Fig. 1. An FSK relay for the TS-820S.

Fig. 1 shows what is involved. You need two NPN switching transistors (2N2222 or equivalent), a couple of resistors, and a scrap of perfboard. The 12 volts dc can easily be "stolen" from your terminal unit. Note that you get your CW identification by grounding the base of the second transistor—and you don't have to remember to close any shorting lever! I built my unit outboard, but it shouldn't be too hard to squeeze it into the cabinet of your terminal unit, unless you are very cramped for space.

If you use audio frequency shift keying (AFSK), of course, none of this applies to you. All you have to do is feed your audio tones into the phone patch "in" jack on the rear wall of the cabinet. Your problem then will be quite different. Since you will be transmitting lower sideband (LSB), you won't be able to use that beautiful sharp CW filter. There is a modification to get around this problem, made available by the Dovetron Corporation, but it involves several internal wiring changes in the TS-820S, and you may not want to do that. There's no reason why you should. With this solid state relay, going the FSK route is easy. ■

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Bands: 32-50, 118-136 AM, 144-174, 420-512 MHz.
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Frequency range: 30-50, 146-174, 416-512 MHz.
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✓ Reader Service—see page 211

Richard Phenix
c/o 73 Magazine

Einstein Was Wrong!

—this story has a Mobius twist

To quote the inspiring words of that highly-placed military official in 1776, "You can't make an omelet without you break eggs."

True. Remember that near-total blackout of the East Coast in 1965? And power-outages all over New England in February, 1978? And then there were those electrical failures around Peterborough, N.H. (home of *73 Magazine*), early this year.

Well, I'm sorry! Honest. I didn't *mean* to cause them. They were just by-products of a revolution—they happened because I was working on a revolutionary step forward in the field of ham radio which now can be revealed for the first time.

I'm not going to tell you who I am, yet. (That name, above, is a phoney, as must be obvious.) There are still too many soreheads around, and I will not risk exposing myself to the mobs until my Mobius-twist, All-purpose, Synergistic, Lumped-constant circuit, Hanger-hung, Folded dipole, Phase-velocity Transcalent-Transceive System (MASLHFPTS™) is bringing happiness into the average American home.

Background

Those blackouts were simply normal side effects of my genius. They were only because of little slips of memory, actually, for I am far from inexperienced in using electrical stuff.

Electrical stuff has always fascinated me. I remember my introduction to the field, in 1934, in Brooklyn, N.Y., when I was only 14. I hooked a crystal or something up to a radiator—I forget exactly how—and heard voices! And I couldn't have been older than 20 when I was able, most of the time, to find WJZ, WEAF, WOR, and some other stations on the family wireless!

As it happened, most of the years between those early triumphs in the thirties and the Big Blackout of the sixties were devoted to other hobbies in which I also excelled—I was Brooklyn basket-weaving champion in 1939—but I kept in touch with electrical stuff through the science section of *Time* and articles in *Reader's Digest*. (Not much of importance was going on in the radio field in those 30 years, anyway.)

But then, a few years before the East Coast incident, I ran across a book which has been guiding my research in sixteen areas ever since. With regard to science, a single little-known fact published in that book brought my interest in electrical stuff flooding back. I started work on my MASLHFPTS™ at once and went all out.

East Coast lights went all out, too! Joke! (Sorry.) What I had done was to hook up my Mark I transceiver (which utilized that little-known fact) to an antenna system consisting of all of the overhead lines in Greater New York with trackage of the N.Y. Central, Pennsylvania, and Boston and Maine railroads as the ground system. I was so eager to start operating that I didn't check out the circuits, but plugged in the power supply (the main generator of Con Edison) and blooey!

I had forgotten to fuse it!

Now look, I've already said I'm sorry. And please note: Each of the other outages, in 1978 and 1979, affected fewer people than the one before. If that's not progress, I don't know what you *want*!

Oh, yes, the little-known fact. I shall quote it exactly as it appears in the book—and you can check it out yourself.

*. . . electricity will pass through copper wire at the rate of two hundred and eighty-eight thousand miles in a second of time—a velocity greater than that of light.**

And on the very next page (p. 910), that vital information is augmented by reference to the "electric fluid" which gives rise to the

***The Circle Of Knowledge*, "Essential Facts of Everyday Interest in Nature, Geography, History, Travel, Government, Science, Invention, Education, Language, Literature, Fine Arts, Philosophy, Religion, Industry, Biography, Human Culture, and Universal Progress," Henry W. Ruoff, M.A., Litt.D., D.C.L., Editor-In-Chief. The Standard Publication Company, 1919.

appearance of lightning, and its velocity, which

. . . is not less than two hundred and fifty thousand miles per second.

Well, I ask you! With this knowledge of more rapid electricity than was recognized anywhere and of the existence of a fluid form of the stuff, what couldn't I do?

I won't bore you with all the difficulties of those early years of the development and microminiaturization of the Mark I MASLHFPTS™. I had to revise all of Einstein's formulas, too, of course, and gradually build up my knowledge of ether (which obviously does exist, after all; I have renamed it GLOP—for Global Lubrication Of Power), but I will share with you one discovery which will help you over any difficulties you may have in accepting the fact that relativity is a lot of bunk.

Einstein was secretly an associate of Bitten, Batten, Button, Distribution, and Ozymandias, that Madison Avenue firm which had the Waltham, Transworld, and Ivory accounts! He dreamed up his concepts of time, velocity, and size simply in order to sell watches, plane tickets, and the Large Family Size!

(Yeah, I thought that would shake you. I found out because I'm also an expert in advertising, mention of which leads me to the next phase of my research, the development of the Mark II MASLHFPTS™, the heart of which was my 1954, 18", black and white Philco TV set. I selected it because of that advertising slogan. You know, "You can be sure—if it's Philco.")

By early 1978, I had charted the lines of flux of the electric fluid at my QTH and had developed the Mobius-twist™ component of my antenna. This produced the well-known single-sided band which, naturally, provides constant resonance at all frequencies. I wanted to watch the Bruins playing hockey on Channel 38, but my Philco wasn't VHF—just UHF. (Or vice versa; I always get those two mixed up.) Anyway, in my mulling over this problem I suddenly remembered that 8 plus 9 plus 10 plus 11 adds up to 38! There was my answer!

Eagerly, I hooked up Channels 8, 9, 10, and 11 in series, attached my antenna, and plugged in. Blooey! I had barely glimpsed Yastrzemski, I think it was, poised for a slapshot, when the lights went out in Connecticut, Rhode Island, Massachusetts, Maine, New Hampshire, and Vermont.

I had forgotten to hook in my Adjustment Circuit Box!

Back to the drawing board, so to speak.

But good comes from everything, and as I rebuilt the blown parts, I was able to perfect a modification, the NN™ (No-Noise) attachment, which provides 100% effective rf suppression—no non-ionizing radiation on any band.

And so it was that by February of this year my Mark III MASLHFPTS™ was an almost-fully-tested QRN-free, all-mode transceiver, covering all bands from 12 Hertz (VVLF) to 300,000 GHz (Ultra SEHF). (It was possible to go below and above these frequencies, but under 12 Hertz I kept falling asleep for some reason, and over 300k GHz something kept happening to my eyeballs.)

Only one last step remained to prove the value and reliability of my Mobius twist and the Adjustment Circuit Box: turning it on. I flipped the GPMT switch (giga-pole, mega-throw) to Channel 4271 and powered it . . .

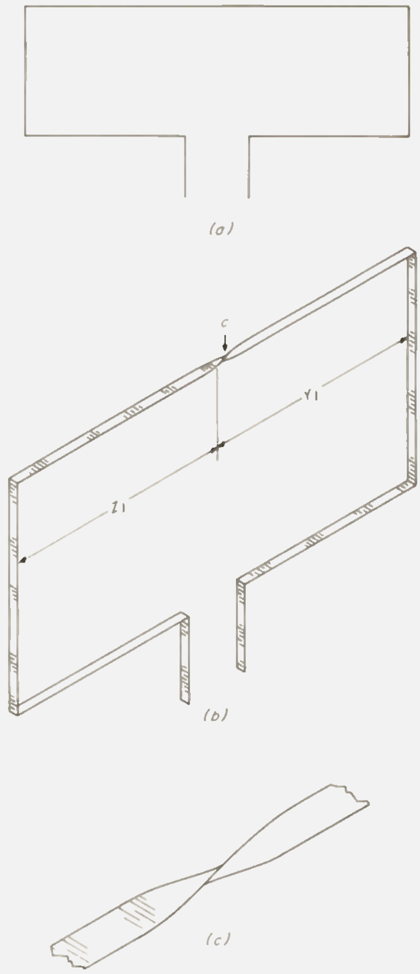

Fig. 1. (a) Schematic of Mobius-twist™, folded dipole, hanger-hung receive system. (b) Isometric presentation showing the location of the twist, with Z_1:Z: :Y_1:Y (see equation in text). (c) Detail of the twist.

Well, the blackout in Peterborough is hardly worth mentioning (no newspapers outside of some in N.H. and Boston did), but in the midst of some strange vibrations which made vision difficult, for about 72 seconds I watched the most incredible sight: The pictures coming in on my tube from the studios of the MGBC (Mars Galaxy Broadcasting Company) were in *color*! Yes, in *color*! I reached for the PTT unit to ask how come and blooey!

The blackout was nothing; the tragedy was the fire in my shack, for I had been forgetful again.

Construction

Nobody is perfect; there is this one component with which I am having difficulty and with the rebuilding of which I am going to ask your help. We'll get to it. But first, let's cover the *obvious* construction—the OB construction, I call it. (The other is the $\overline{\text{OB}}$ construction.)

Fig. 1 shows the basic receive system. So long as the total length of the Mobius strip is exactly L as in the following formula, it is not critical whether the unit of measure is the inch, chain, furlong, hand, or fathom. L can be made up of ells, even. Joke! (Sorry.) But L must = (300,000 GHz − 12 Hertz)/X(Z − Y), where X is the altitude of your QTH and Z and Y are its latitude and longitude, respectively. (If your shack is in Death Valley or elsewhere below sea level, it is

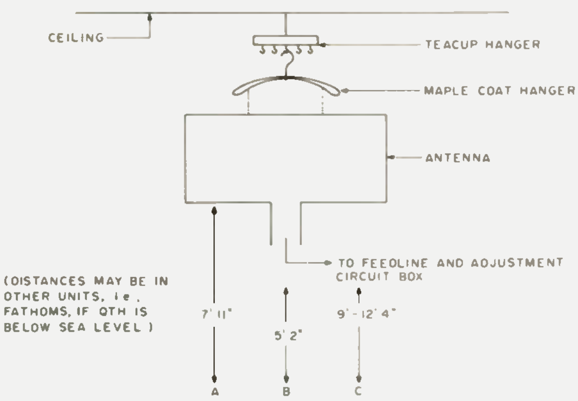

Fig. 2. Parts placement for the antenna array, and linear relationships to ambient resistances, resonances, and other wave influences. A—walnut bookcase; B—steel file drawers; C—bathroom pipes (find mean distance).

recommended that you use fathoms.)

Fig. 2 shows the critical distances between the Mobius twist and those elements which my experiments have shown provide the most favorable reception. Substitution of some materials is OK. The bookcase, for example, may be made of ebony, balsa, Hawaiian monkey pod, or Guamanian ifil instead of walnut, but the steel file drawers *must* contain from 36 to 42 back issues of *73 Magazine*; back issues of *Ham Radio* produce QRM, QRN, QSB, QSD, QTA, and 1-1 conditions.

The other important item is the Adjustment Circuit Box. It must measure exactly 2′ x 2′ x 8′ inside dimensions, with all six interior surfaces covered with perfboard. Consult Fig. 3 and assemble all parts as shown.

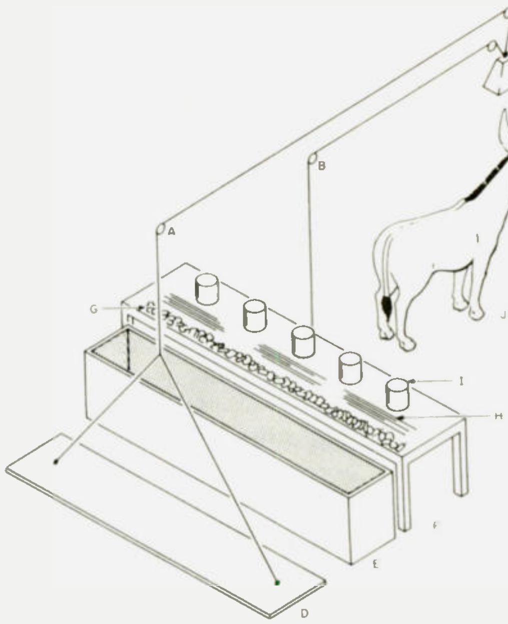

Fig. 3. Setup for the three steps. A—pulley system to jerk up cover (D) of Adjustment Circuit Box (E) when B, pulley system to weight (C) drops weight when mule (J) kicks over table (F) sending flying G—all components from your junk box, H—copper wires of assorted lengths, and I—pots of molten solder, into the perfboard-lined Box and onto the cover as it flies up and over. (Note: Weight C should be positioned to hit mule J on head to keep him calm until ready for the next setup.)

Well, here is where your help is needed. You see, I was so anxious to get my transceiver operable that I plumb forgot to diagram or list, as I installed them, the diodes, triodes, tetrodes, pentodes, octodes, pigeontodes, resistors, transformers, inductors, solenoids, thyristors, shields, spark gaps, fuses, piezoelectric crystals, and switches!

Silly me!

But if you will do as I shall do, complete a setup as in Fig. 3, and follow the three simple steps listed below, one of us will *have* to come up with the internal electrical stuff for the Adjustment Circuit Box just as I had it arranged before the fire last February.

Step 1. Back a mule up to the setup and then annoy him.

2. Let the solder harden, plug in the circuit, and see if it works.

Step 3. Set everything back up again, and go back to Step 1.

Conclusion

There is one at every hamfest, and, Buster, I can hear you now, saying, "It won't work!" OM, you have forgotten the well-known fact that if a few thousand monkeys are provided with typewriters, sooner or later they will write the complete works of William Shakespeare.

All we have to do is to make monkeys out of ourselves by following the steps, and after some unknown number of mule-kicks in the future, that one last, essential component for the MASLHFPTS™ will be recreated.

And *then*, by golly, I'll be able to figure out why that MGBC program came in in color. ■

✓ Reader Service—see page 211

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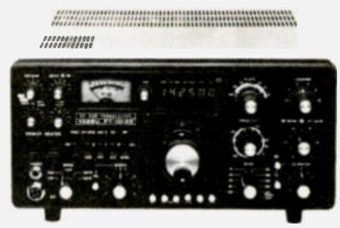

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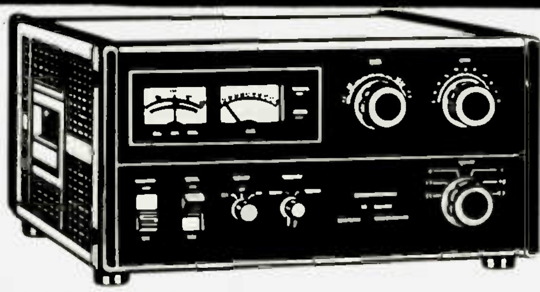

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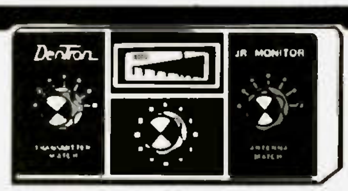

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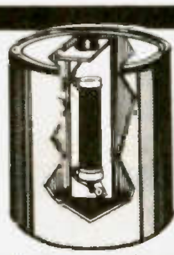

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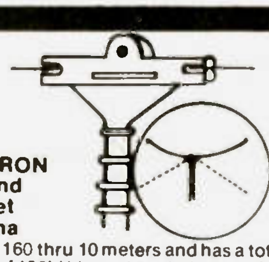

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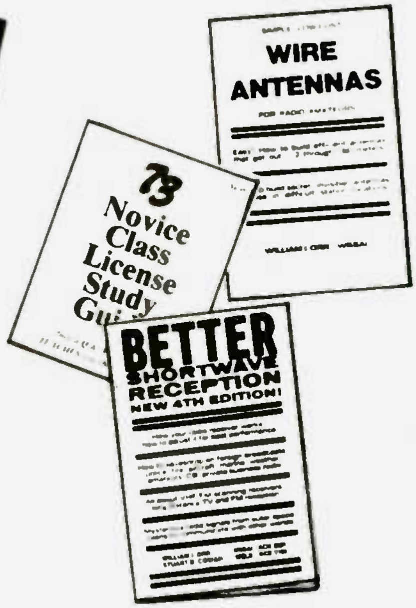

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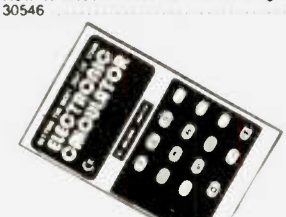

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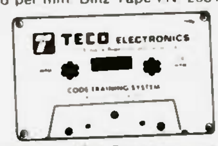

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A couple of projects requiring the eight-bit output from an ASCII keyboard have been completed at W1SNN. These are an ASCII-to-Morse converter and an ASCII-to-Baudot translator.

A Southwest Technical Products KBD5 keyboard was purchased for the first of these two units, and later, when a television display and microcomputer from the same source were added to the station, the keyboard was included in the display framework. It is a considerable task to disconnect the keyboard each time the other units are used. Some might say why not use the microprocessor in the computer to eliminate these two peripherals. I thought of that, but also remembered the time and effort spent on them and decided that some means of switching the eight-bit output wouldn't be too much of a task.

By using tristate quadruple bus buffer gates with three-state outputs, as is often done in the microprocessor data input and output streams, it is very easy to reroute the eight-bit output from the keyboard to either of the aforementioned peripherals and to use the TV display to read what is being sent.

The bus buffers are 74125 and 74126 chips. The inputs of these devices are paralleled and fed into the eight-bit inputs of each of the external units. The ASCII-to-Morse unit does not require the full eight bits, and two of the buffers are unused in this requirement; however, they are all used in the other unit. Additional buffering was added to the bit stream output of the keyboard to reduce the load to the keyboard translator chip, which requires only one TTL load per bit.

Tristate buffers operate so that when the control input of each of the 74125 gates is high, the output is disabled; simultaneously, the 74126 outputs are low. The switch action therefore is completed. Control of the logic is from switch S1 which can be mounted near or on the keyboard.

As shown in the flow diagram, the data from the keyboard is directed into one or the other peripheral devices and into the television display. It may also be fed into the parallel input of the SWTP 6800. This operation provides "canned" sentences for retransmission recalled from the memory of the microprocessor.

There are many types of tristate chips available. I am sure that, by the time this is printed, it will be possible to find one LSI that will do all of the functions described. The ones used in this circuit are inexpensive and readily available from dealers found in the ads of this magazine.■

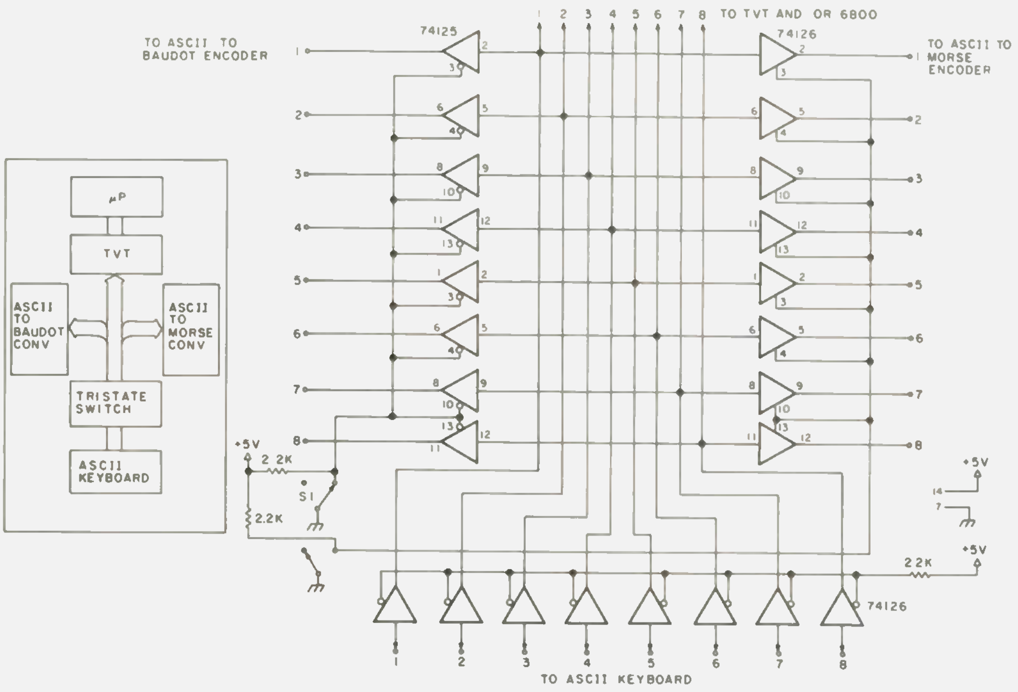
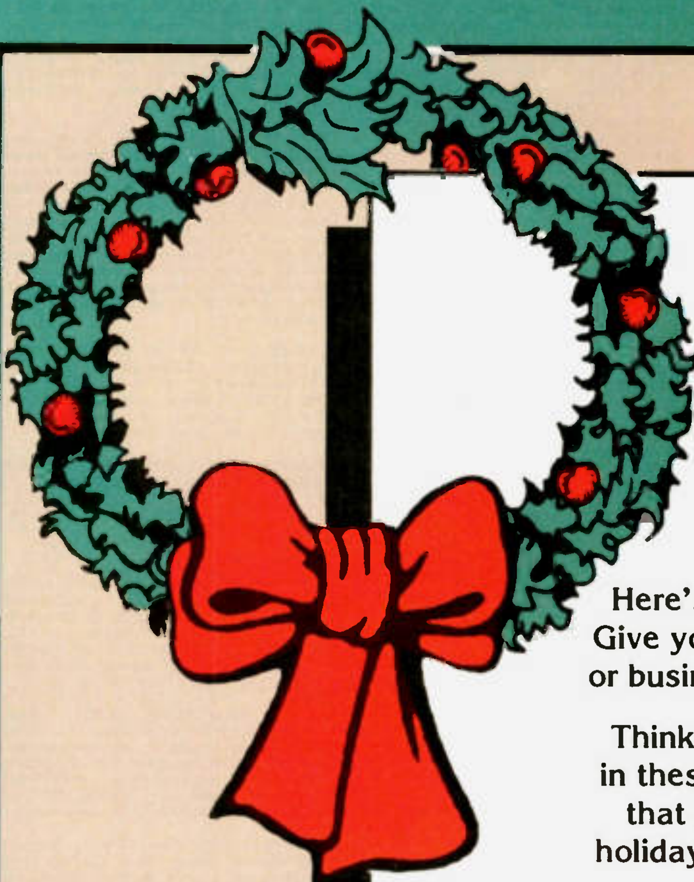


Fig. 1.



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OCT 63. WBFM transceiver ideas HF propagation; cheap phone patch; remote-tuned yagi; construction hints; antenna coupler; $5 vertical; filament transformer construction; 2m nuvistor converter. Lafayette HE-35 mods; buyer's guide to RX & TX; product detector; novel converter; compact mike amplifier.

Available issues published from 1960-1963 are listed at the end of this catalogue.

64

FEB 64. 2m multichannel exciter; RF design ideas; magic t/r switch; loudspeaker enclosures; 40m 2 W TX; look at test equipment; radio grounds; 40m ZL special antenna; neutralization.

Available issues published from 1964 are listed at the end of this catalogue.

65

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66

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67

MAY 67. Quad Issue! 432 quad-quad-quad; expanded HF quad; two el quad; mini-quad; 40m quad; quad experiments; half-quad; three-el quad; quad bibliography; FET vfo; tube troubleshooting; HF dummy load; understanding "dB"; HF SSB/CW RX; geometric circuit design; GSB-201 transceive; FET converter for 10-20m; hi-pass RX filters.

JULY 67. VE ham radio; VE0 hams; DSB adaptor; home-brew tower; transistor design; '39 World's Fair; ground plane antenna; G4ZU beam; SSTV monitor; UHF FET preamps; IC "i-f" strip; vertical antenna; VHF/UHF dipper; tower hints; scope monitoring; operating desk; S-line cross-band; hi-school ham club; Heath HR-10 mods.

OCT 67. HF solid-state RX; rugged rotator; designing slug-tuned coils, FET converter; SSTV pix generator; VHF log-periodics; rotatable dipole; gamma-match cap; old-time DXing; modern DXing.

Available issues published from 1967 are listed at the end of this catalogue.

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JUNE 68. Surplus Issue! transformer tricks; BC-1206 RX; APS-13 ATV TX; low-voltage dc supply; surplus scopes; FM rig commercial xtal types; Wilcox F-3 RX; restoring old equipment; 75A-1 RX mods; TRA 19 on 432; frequency counter uses; transceiver power supply; uses for cheap tape recorders; surplus conversion bibliography; RT-209 walkie on 2m; ARC-1 guard RX; RTTY TX TU.

JULY 68. Wooden tower construction; tilt-over towers; erecting a telephone pole; IC AF oscillator; "dB" explained; ham club tips (part 1).

SEPT 68. Mobile VHF; 432 FET preamps; converting TV tuners; xtal oscillation stability; parallel-tee design; moonbounce rhombic; 6m exciter (corrections Jan. 69), 6m transceiver (corrections Jan. 69); 2m DSB amp; ham club tips (part 3).

NOV 68. SSB xtal filters; solid-state troubleshooting; IC frequency counter (many errors & omissions); "CV" transformers; space communications odyssey pulsar info; thin-wire antennas; 40m transistor CW TX/RX; BC 348M double conversion; multifunction tester; copper wire specs; thermistor applications; hi-voltage transistor list; ham club tips (part 5).

Available issues published from 1968 are listed at the end of this catalogue.

69

JAN 69. Suppressor compressor; HW 12 on 160; beam tuning; ac voltage control 2m transistor TX; LC power reducer; spectrum analysis info; 6m transistor RX; operating console; RTTY autostart; calculating oscillation stability; low-power 40 CW TX; sequential relay switching; sightless operator's bridge; ham club tips (part 7).

FEB 69. SSTV camera mod for fast scan; tri-band linear; selective AF filter; unijunction transistor info; Nikola Tesla biography; mobile installation hints; Extra class license study (part 1).

MAR 69. Surplus Issue: TCS TX mods; cheap compressor/amp; RXZ calculations; transistor keyer; better balanced modulator; transistor oscillators; using blowers; half-wave feedline info; surplus conversion bibliography; Extra class license study (part 2).

APR 69. 2-channel scope amp; RX preamp; Two-er PTT; variable dc load; swr bridge; 100 kHz marker gen.; some transistor specs; SB-610 monitorscope mods; portable 6m AM TX; 2m converter; Extra class license study (part 3).

MAY 69. 2m turnstile; 2m slot; RX attenuator; generator filter; short vee; quad tuning; using antennascope; measuring antenna gain; phone patch regs; swr indicator; 160m short verticals 15m antenna; HF propagation angles; FSK exciter; kW dummy load; hi-power linear; Extra class license study (part 4); all-band curtain array.

JUNE 69. Microwave power generation; 6m SSB TX; 432-er TX/RX; 6m converter; 2m 5/8 wave whip; UHF TV tuners ATV video modulator; UHF FET preamps; RTTY monitorscope; Extra class license study (part 5); building UHF cavities; mini-vee for 10-20m; VHF vfo.

JULY 69. AM modulator; SSTV signal generator; 6m kW linear; 432 kW amp; 432-34 TX/RX; 6m IC converter; radio-controlled models; RTTY IC TU; audio notch filter; VRC-19 conversion; tube substitution; 2m transistor exciter; Extra class license study (part 6); HF FET vfo.

AUG 69. FET regen for 3.5 MHz up; FM crystal switching; 5/8-wave vertical; introduction to ICs; RTTY tone generator; good/bad transistor checker; 2m AM TX; measure transistor Ft; 160m propagation; triac applications; simple i-f sweep generator; transistor keyer; SB-100 on 6m; xtal frequency measurement; Extra class license study (part 7); FM deviation meter; QRP AM 6m TX; circular quads; FM noise figure; transistor parameter tracer.

SEPT 69. Tunnel diode theory; magic tee; soldering techniques; wave-travel theory; cable shielding; transistor theory; AM noise limiter; AFSK generator transistor amp debugging; measure meter resistance; diode-stack power supply; transistor testing; 2½ W 6m TX; HX-10 neutralizing; capacitor usage; radio propagation; AM mod percentage; Extra class license study (part 8); 3-400Z linear; ATV vidicon camera; 2 transistor testers; FET compressor; rf plate choke.

OCT 69. Super-gain 40m antenna; FET chirper; telephone info; scope calibrator; thyrector surge protector; slower tuning rates; identify calibrator harmonics. FM adapter for AM TX; CB sets on 6m; proportional control xtal oven; xtal filter installation; Q-multiplier; transceiver power supply; Extra class study (part 9).

NOV 69. NCX-3 on 6m; i-f notch filters; dial calibration; HW-32A external vfo; 6m converter; feedline info; rf Z-bridge; FM mobile hints; umbrella antenna 432-34 TX (part 1); power supply tricks with diodes; transistor keyer; transistor bias design; xtal VHF signal generation; electronic variac; SB-33 mods; Extra class study (part 10); SB-34 linear improvements.

DEC 69. Transistor-diode checker; dummy load/attenuator; tuned filter chokes; band-switching Swan 250 & TV-2; 88 mH selectivity; math exercises; RTL xtal calibrator; transistor PA design; HV mobile p.s.; 1-10 GHz freqmeter; CB rig on 6m; Extra class license study (part 11); 1970 buyer's guide.

70

JAN 70. Transceiver accessory unit; bench power supply; SSTV color method; base-tuned center-loaded antenna; 6m bandpass filter; Extra class license study (part 12); rectifier diode usage; facsimile info.

FEB 70. 18-inch 15m dipole; 6m converter; high-density PC board; camper-mobile hints; 2m frequency synthesizer; encoding/decoding for repeaters; DX-35 mods; panoramic VHF RX; variable-Z HF mobile mount; Extra class license study (part 13); linear IC info; QRP 40m TX; IC Q-multiplier.

MAR 70. Gdo applications; charger for dry cells; FM frequency meter; PC board construction; ham FM standards; cheap rf wattmeter; multifreq FM oscillation; "I-f" system modules (part 1); Six-er mods; gdo dip lite; Motorola 41 V conversion; CW monitor; buying surplus logic; SSQ-23A sonobuoy conversion; GRC-9 RX/TX conversion; Extra class study (part 14); intro to VHF FM.

APR 70. Noise blanker; 2m hot carrier diode converter; repeater controller; understanding COR repeater; 7/8-wave 2m antenna; Extra class study (part 15); inexpensive semiconductors; renovating surplus meters; linear amp bias regulator; hi-performance I-f amp & agc system; SSB bfo for shortwave radio; vacuum-tube load box; general FM dope & repeater guide; meggering your antenna.

MAY 70. comments on "FM docket" #18803; future of CW; FM-AM RX aligner; 5/8-wave verticals; using 2m intelligently; auto burglar alarms; power supplies from surplus components; "I-f" system modules (part 2); VHF FET preamps; educated "idiot" lights; postage-stamp 6m TX; Extra class study (part 16); Bishop IFNL; low-band police monitor; mobile CW TX; Wichita autopatch.

JUNE 70. DDRR antenna; vfo circuit; remote swr indicator; indoor HF vertical; two RX on one antenna; environment & coax loss; 2-el trap verticals; buying surplus; two 40m QRP TX; 21 dB 2m beam; Extra class study (part 17).

JULY 70. Improved Color Slow-Scan Television; How to Build a Keyer; 450-MHz Mighty Mite—one-transistor superregenerative receiver; Cheapie 6-Meter Half-Gallon—use 811-As and be heard; A High-Performance Power Supply—using an IC voltage regulator; Latham Island DXpedition; Db to Power; Protection for Grid-Dipper Coil's; Mobile CW Receiver; QSL-ing . . . Ham Radio's Own Con Game.

SEPT 70. Integrated Circuit CW ID Generator; The Indication Oscillator—another dipper circuit, 1-400 MHz; Tuning VHF Receivers—clever infinite attenuator and oscillator unit; Repeater Antenna Separation; Diode Stacks; Deluxe Receiver Gain Control—using one transistor and a zener; Reed Relays for Coaxial Switching; Beer-Can Two Meter Coaxial Antenna; Converting 24 V Relays to 115 V ac. Versatile 2m MOSFET Converter—low noise, high gain, ultra stable.

NOV 70. Differential J-FET preamplifier; Remote Quad Tuning; Two-Watt Six Meter Transmitter—using the crystal-heterodyne vfo; Semiautomatic FM channel Scanning; Low-cost Automatic Keyer—an excellent "first project"; Ac Switching with Self-Powered ICs—clever zero voltage switch; Pioneer Radio on the Prairies—what it was like 45 years ago; SST-I Solid-State Transceiver for 40 Meters; A Low-Cost RF Wattmeter; Calibrate That Calibrator.

DEC 70. Solid-state VHF exciter; delta frequency control for SSB; 2m transistor FM TX; HW-100 offset tuning; "little gate" dipper; 3-500Z HF linear; General class study (part 5); "transi-test" (no good errors!); transistor p.s. current limiter.

Available issues published from 1970 are listed at the end of this catalogue.

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JAN 71. Split phones for DXing; Heath Ten-er mods; CW duty cycle; repeater zero beater; HEP IC projects; 10-15-20m parabolic ideas; lightning protection, IC RX accessory; attic antennas; double-balanced mixers; permanent marker tool; ham license study questions.

FEB 71. metal locator; varactor theory; AFSK unit; SSTV patch box; ATV hints; RTTY tuning indicator; tone encoder/decoder; 220-MHz converter; SSTV magnetic deflection; IC code oscillator; 6m TX beeper; General class study (part 6); RTTY intro; perfboard terminal; low ohmmeter.

MAR 71. IC audio filter; IC 6m converter; trap vertical ideas; digital counter info; surplus equipment identification; HF linear; simple phone patch; repeater audio mixer; digital RTTY accessories; coat-hanger ground plane; General class study (part 7).

MAY 71. 75m mobile whip; 2m preamp; transistor amp design; 10m DSB TX; portable FM transceiver directory; audio compressor-clipper; transistor LM freqmeter; 450-MHz link TX; simple Af filter; 1-tube 2m transceiver; surplus 2m power amp; General class study (part 8).

JUNE 71. 2m beam experiments; 3-el 2m quad; multi-band dipole patterns; weather balloon vertical; pocket-pager squelch; Two-er vfo; tuning mobile whips; transistor power supply; capacity decade box; 40m gain antennas; General class study (part 9).

JULY 71. IC audio processor; audio signal generator; CW filter; 2m FM oscillator; 2m collinear vertical; FM supplier directory; Motorola G-strip conversion; transistor beta tester; General class study (part 10).

AUG 71. Ham facsimile (part 1); 500-Watt linear; dimensions for July collinear; 4-tube 80/40 station; vfo digital readout; Jupiter on 15m; General class study (part 11); pink ticket wave-meter.

SEPT 71. Transformerless power supplies; solid-state TV camera; IC substitution; two rf wattmeters; IC compressor-agc; multichannel HT-200; ham facsimile (part 2); causes of man-made noise; vfo with tracking mixer; General class study (part 12); transistor heatsinking; IC pulse generator; phone patch isolation; hcd wattmeters.

OCT 71. Emergency repeater COR; transceiver power supply; predicting meteor showers; digital switching; reverse-current battery charger; passive repeaters; earth grounds; audio "tailoring" filters; Swan 350 mods.

NOV 71. 3-el 75m beam; motor-tuned ground plane; 2m gain vertical; transistor biasing; split-site repeater; fox-hunting; audio filter; transistor/diode tester; xtal tester; 6m kW amp; 10-15-20m quad; transistor pi-net final; antenna feedline; communications dBs; 2300-MHz exciter.

DEC 71. Convert Your 7-MHz Cubical Quad to All Bands; The Indoor Quad; Getting to Know Tee Squared Ell; More Power From 6146s; Radio Direction/Range Finder; Morse Memory—30-letter memory for ident, contests, etc.; SCR Mobile Theft Alarm; DX QSOs or contacts; Code Shorthand; VHF Double Sideband.

72

FEB 72. A Solid-State High Frequency Regenerative Receiver—el cheapo using one IC; Tips for Raising Your Code Speed to 20 WPM; Why Not Try QRP? VHF Dummy Load Wattmeter; CW DX On ½ Watt—enjoy QRP with this 1-Watt rig; 20-60 W 1-4 Band TX— two-tube CW transmitter; Quick and Easy PNP/NPN Transistor Sorter; Self-Contained Reflected Power and CW Monitor; Circuits, Circuits, Circuits; The Automatic Transmission Line Tuner.

MAY 72. Quick Band Change Mobile Antenna—with output indicator; How to Get the Stuff into the House; Anti-CW RTTY Autostart; A Modern VHF Frequency Counter—can be built for under $100; TV Sync Generator—using ICs; Radio Astronomy; Noise and Receiving Antennas; The Sewerpipe Antenna—2m FM, of course; Circuits, Circuits, Circuits; Simple Car Ammeter—all solid state.

JUNE 72. Six Elements on Twenty Meters—eliminate QRM; Slow Scan Television—basics; Active Filter Design and Use—all kinds of filters . . . Part I; Radio Astronomy for Amateurs (Part II); 20 dB Beams—design and construction of VHF antennas; Phasing Multiband Verticals—ten thru eighty meters; 300-MHz Frequency Scaler—extends frequency counters to VHF; Circuits Circuits, Circuits; RTTY Filters—elliptic function filters; Troubleshooting for the Novice.

JULY 72. Solid-State VHF Amplifier; The Phase-Locked Loop; VHF Converters; Add $15 T-Power; 1296-MHz Mixer; The VHF Specialists FM Amplifier; Meteor Shower DXing; Tone Decoder and Carrier Relay Circuits—using the 741 op amp; Flying Spot Scanner for SSTV—solid-state unit, simple, relatively; Active Filter Design, Part II.

AUG 72. SSTV intro; speech processor; FM repeater info; test probe construction; GE Progline ac supply; 432 rf testing; preamp compressor; Six-er mods; phone patch; Two-er info; solar info; SCR regulator for HVPS; "ideal" xtal oscillator; FM RX adapter; auto theft alarm.

SEPT 72. Plumbicon TV camera; WWVB 60-kHz RX; cigar tube signal generator; CW active filter; rf testing at 1296-3500 GHz; balun antenna feed; transistor power supply; IC 6m RX; IC FM/AM detector (part 2); active filter design (part 3); K2OAW frequency counter (part 3); 2m frequency synthesizer (part 1).

OCT 72. Corrections for Aug. FM RX adapter; 2m frequency synthesizer (part 2); 6m transistor vfo; nano-ampere meter; time-frequency measurement (part 1); active filter design (part 4); repeater timer; Extra class Q&A (part 3); balloon vertical; ID generator; time-delay relay; 432 filter ideas; dc-ac inverter; hc-diode converter; RTL decade and nixie driver; plus-minus supply for ICs.

NOV 72. HF transistor power amps; RTTY Selcal; IC trf RX transistor keyer; emergency power; 220-MHz preamp; double-delta antenna; simple converter using modules; HF rf tester; "lumped line" oscillator; 2m frequency synthesizer (part 3); K2OAW counter errata; 2m preamp; Extra class Q&A (part 4); hi-Z voltmeter; Nikola Tesla story; VHF swr meter; transistor regen RX; 432 SSB transverter; ac arc welder; intro to computers; hybrid AM modulator; HR-10 RX mods; 10m transistor AM TX; 40m ground plane; IC logic demonstrator; overload protection; i-f/rf sweep generator; digital frequency counter; aural TX tuning.

DEC 72. SSTV scope analyzer; 2m FM RX; tone burst encoder and decoder; universal i-f amp; autopatch hookup; LM380N info; voltage variable cap info; 2m 18-Watt amp; SSB modulation monitor; xtal freq/activity meter; 10 A var. dc supply; transmission line uses; radio astronomy; inductance meter; 75 to 20m transverter; LED info; 40m preamp; transistor vfo; 1972 index; 2m preamp.

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JAN 73. HT-220 touchtone; 3-el 20m yagi; 50-MHz frequency counter; speech processor; 2-tone generator; FM test set; tilt-over tower; 2m converter using modules; tunable AF filter; six-band linear; 10m i-f tuner; diode noise limiter; CW/SSB agc; HW-22A transceiver 40m mod; HAL ID-1 mod.

MAR 73. A Fast-Scan Facsimile System—use it with SSTV; Six and Two Meter High Power—using a $25 surplus amplifier; A Digital Tape Distributor for RTTY; The Ample Amplifier—all band, 1200 Watts; Popular SSTV Circuits (Part II); Improving the Indoor Antenna System—using copper foil; FM Deviation Meters, Time Frequency Measuring System (Part III); Another Use for 400-Cycle Transformers; Bandpass Filter Design.

APR 73. FM deviation meter; 2m FET preamp; two 2m power amps; repeater control (part 1); repeater licensing; European 2m FM; FM scanner adapter; RCA CMU15 mods; lightning detector; CB alignment gadget; transistor rf power amps (part 2); repeater economics.

JUNE 73. 220-MHz signal generator; UHF power meter; repeater licensing info; RTTY autoswitch; 40m hybrid vfo TX; antenna polar mount; 10-15-20m quad; K2OAW counter mods; double coax antenna; ham summer job; tone decoder; field strength meter; nicad battery pack; ohmmeter; FCC regs (part 1).

JULY 73. Tuneable Oscillators for 2m FM Receivers; Basic ATV System—a T-44 transmitter strip does most of the work; Multiple Output Frequency Standard—lets you calibrate your receiver in .0625-Hz increments; Digital Identification Unit; 450-MHz Power Divider—easily-constructed matching system for stacked arrays; CW Filters, Bared and Compared—complete with scope traces and bandwidth specs; 85 dB Gain 2m Antenna; Compromise Multiband Antennas; Grid-Dip Tuning the Quad Antenna.

AUG 73. Log-periodics (part 1); tone burst generator; rf power amp design; transistor radio intercom; 160m antenna; SSTV monitor; low-cost frequency counter; VOM design; QRP 40m TX; 432-MHz exciter; FM audio processing; FCC regs (part 3).

SEPT 73. Repeater control system; log periodics (part 2); 2m RX calibrator; PLL IC applications; TT pad hookup; Heath HW-7 "S" meter; OSCAR-6 Doppler; 2m coaxial antenna; 2m converter; IC keyer; measure antenna Z; FCC regs (part 4)

NOV 73. 450-MHz exciter; intro to ATV circuits; nicad voltage monitor; autopatch connections; IC meter amplifier; TR-22 ac supply; indoor vertical; IC AF filter; momentary power failure protection; 160m antenna coupler; Motorola HT info; SSTV-ISB, Class B AF amp; FCC regs (part 6).

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FEB 74. SSTV monitor info! IC audio amps; scope sweep generator; 15/20m vertical; telephone line control system; PC board construction; var-Q AF filter; blown-fuse indicator; 40m CW station with Ten-Tec modules; simple preamp compressor; single-IC RX; "432-34" final assembly; transistor keying circuit; 7-segment readout with nixie driver.

APR 74. VOX for repeaters; tone-operated relay; HF transverter; 10 to 2m TX converter; remote control panel for scanner; RCA FM TX tuning; subaudible tone generator; FCC regs (part 9); repeater atlas.

MAY 74. CD car ignition; audio compressor info; interference suppression for boats; auto burglar alarms; 2m IC preamp; 10m FET converter.

JUNE 74. Poor Man's Quad; Reconciling the Long Squared Quad—developing a new type antenna; Antenna Load Indicator; Matching; Remotely tunable Antenna Coupler; A Practical Ground System for 160; Wide-Range Antenna Tuner; Old Antennas and New Baluns—build a double zepp; A Multiband Ground Plane—10-40 meters; Mod Quad for Frustrated Cliff Dwellers.

JULY 74. 4-1000A linear; universal frequency generator; universal AFSK generator; 555 IC timer; 80m phased array; 135-kHz-432-MHz preamps; 10m QRP AM TX; 3000 V dc supply; how to read diagrams.

AUG 74. Toroidal directional wattmeters; 450-HMz FET preamp; use gdo to find "C"; Trimline TT pad hookup; R390 & R392 RX mods; tracking CW filter; aural voltmeter; universal regulated supply, SSTV scan converter; TTL logic problems; ID timer.

SEPT 74. MOSKEY electronic keyer (part 1); WX warning system; Heath IO-103 scope mods; QRP 6m AM TX; rf speech clipper; audio noise limiter; WX satellite on SSTV monitor; universal IC tester; miniature rig construction; tower construction; infinite rf attenuator; electronic photo flash ideas; IC "select-o-ject."

OCT 74. Microtransistor circuits; synthesized HT-220 (part 1); repeater government; regulated 5 V dc supply; FM Selcal; removable mobile antennas; Motorola metering; 2m vertical collinear; Motorola model code; 2m coaxial dipole; 1.6-MHz i-f strip; MOSKEY electronic keyer (part 2); carbon mike circuit; hi-power lo-pass filter; 6m preamp; 3-wire dipole; ATV sync generator; NCX-5 mods; mobile whip for apartment dwellers; SSTV automatic vertical trigger.

NOV 74. K2OAW counter update; regulated 5 V dc supply; wind direction indicator; synthesized HT-220 (part 2); 20m 3-el beam; autopatch pad hookups; double-stub antenna match; Novice class instruction; digital swr meter (part 1); 6m converter (1.6-MHz i-f); "C-bridge"; MOSKEY electronic keyer (part 3); Aug. SSTV scan converter errata; repeater off-frequency indicator.

DEC 74. Care of nicads; wind speed/direction indicator; WX satellite video converter; electronic keyer; hints for Novices; unknown meter scales; SSTV tape ideas; TTL logic probe; public service band converter; tuned-diode test receivers; digital swr meter (part 2); telephone pole beam support; rhombic antennas; 1974 index.

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FEB 75. Heath HO-10 scope mod for SSTV; electronic keyer; digital satellite orbital timer; OSCAR-7 operation; satellite orbital prediction; Heath SB-102 mods; comparing FM & AM; repeater engineering; Robot 80-A SSTV camera mod; neutralizing Heath SB-110A; "Bounceless" IC switch; tape keyer for CW TX.

MAY 75. IC Callsign Generator; Playing with Power on 432; Does Ether Cause Gravity?; OSCARing Your FM Rig; In Pursuit of the Perfect SSTV Picture; Ac Power for the HW-202; You Can Work 75m DX; The Postage Stamp Squelcher; disaster in Honduras.

JUNE 75. Home Brew this SSTV Monitor; El Cheapo Superbeam; The Smart Alarm; RF Power at 432; Dirt Cheap Tunable I-F for Converters; All Band Frequency Marker; Front Burner for Six; Three on Fifteen; Presto! Transistor Checker from VOM; How to Put on a Professional Slide Show.

JULY 75. OSCAR Special! Antennas for OSCAR—What Really Works?; How You Can Take OSCAR's Temperature; FM Alignment Oscillator; The Audio Synthesizer for RTTY, SSTV and Whatever; Ham Radio in the Arctic—1925; Gee, What's a Zepp?; Vertical Antennas for the Novice; Preventing Regulator Carnage; The Ultimate in Variable Selectivity; Phone Patching—A Public Service.

AUG 75. 146/432-MHz helical antennas (part 2); 20 minute ID timer; digital swr computer (part 1); debugging rf feedback; DVM buyer's guide; WX satellite monitor; CMOS "accu-keyer"; PC board methods; sweep-tube final precautions; compact multiband dipoles; small digital clock; accessory vfo for HF transceiver; modern non-Morse codes; multi-function generator; 2m scanning synthesizer errata; KP-202 walky charger; 10m multi-element beam.

SEPT 75. Calculating frequency counter; WX satellite FAX system (part 1); IC millivoltmeter; three-button TT decoder; troubleshooting SSTV pix, 40m DX antennas; 146/432-MHz helical antennas (conclusion); digital swr computer (conclusion); reed relay for CW bk-in; NE555 preset timer; power-failure alarm; portable QRP rig power unit; precision 10 V dc reference standard; 135-kHz i-f strip; telephone handsets with FM transceivers; Motorola T-44 TX mod for ATV; 0-60-MHz synthesizer (part 1), ham radio PR.

OCT 75. A deluxe TTY keyboard (part 1); op amps: a basic primer; an introduction to microprocessors; 2m synthesizer (conclusion); satellite FAX system (conclusion); regulated supplies (dispelling the mystery); digital logic made simple; FCC interview; a contest uP system; digital clock timebases; the operating desk; QRP 432; ham PR.

NOV-DEC 75. Blockbuster double issue! Flip-flops exposed; breakthrough in fast scan ATV; strobing displays is cool; the tuned lunch box (antenna tuner for HF transceivers); a deluxe TTY keyboard (part 2); the 127' rotating mast; less than $100 multi-purpose scope for your shack (part 1); predicting third-order intermod; feedline primer; QRMing the Third Reich; why tubes haven't died; instant circuits—build your own IC test rig; the K2OAW synthesizer PROM-oted; a ham's intro to microprocessing; ground fault interrupter (a keep-alive circuit for yourself); a $1 strip chart recorder; an even simpler clock oscillator; the Fun City surplus scene; updating the Heath IB-1101 counter; 256 pages!

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FEB 76. Build a Starfleet Communicator—Trekkies special; Synthesized IC Frequency Standard! You Can Make Photo PC Boards; How's Your Speech Quality?; ASCII-to-Baudot converter; RTTY Autocall—the Digital Way; Improving the FT-101; Night DXing on 10 and 15m; Really Soup Up Your 2m Receiver; Put Your SB-10 on 160m.

MAY 76. Special Antenna Issue! The Magnificent Sevens Microhelix; An Allband Inverted Vee; Closed Loop Antenna Tuning; The 75-80m Broadbander; The Magic of a Matchmaker; How to Coax Your Antenna; 40m DXing—City Style; The Secret 2m Mobile Antenna; An Inverted Vee for 160/80m; The Dipole Dangler; Amateur Weather Satellite Reception; Scan Your HR-212; A Very Cheap I/O—the Model 15; Code Converter Using PROMs; A Nifty Cassette-Computer Systems; The Ins and Outs of TTL; Build a CW Memory; 5/8-Wave Power for Your HT; 555 Timer Sweep Circuit for SSTV; AM Is Not Dead—It Never Existed at All; Computer Languages—Simplified.

JUNE 76. VHF Special! Super COR—Digital, of course!; Touchtone Decoder—using a calculator readout; Simple Amateur TV Transmitter; Amateur TV Receiving System; Mobile Autodialer; Autocall '76—using a touchtone decoder; Build This Lab Type Bridge—and measure transformer impedances; How Those Triangle Things Work—a sort of op amp handbook; Those Exciting Memory Chips—RAMs, ROMs, PROMs, etc; ASCII/Baudot with a PROM—for ribbonless RTTY on computers; Aim Your Beam Right—with a programmable calculator.

JULY 76. Perfect CW—drive 'em crazy with the keycoder I; The Mini-Mite Allband QRP Rig—a mighty 7 Watts; A Fun Counter Project—under $50; Build a FAX from Scratch—then get satellite pictures and other things; Der Repeatermeister—repeater control with ID; The Giant Nixie clock; Creative SSTV Programming; CW Regenerator/Process; What's Up on 156 MHz?; TT Pad for the Wilson HT; Power Supply Testing—to save your digital circuits; A RTTY/Computer Display Unit; Your Computer Can Talk Morse; Gain for Your HT—a half-wave whip; The Super Transmatch; Simple VHF Monitor.

SEPT 76. The Surprising DDRR Low Noise Antenna (part II); Ultrasimple Regulation with New IC—power supply design greatly simplified; Can an Indoor Antenna Work?—making the best out of a bad bargain; Inexpensive 12 Volts for Your Base Station; A Test Lab Bonanza—using a transistor radio; Protect Your VHF Converter—novel antenna relay; ridiculously Simple RTTY System; How to Catch a CBer; A 450-MHz Transceiver for Under $130; Space Age Junque II; PROM Memory Revisited; Eight Trace Scope Adapter;

The PROM Zapper; Sneaky Baudot—with an ASCII keyboard!; Simple Graphics Terminal—using surplus; Counters Are Not Magic—they're simple.

OCT 76. Build a Weird 2 Band Mobile Antenna; Build a Counter for Your Receiver; How Do You Use ICs? (part II); QRP Fun on 40 and 80—have a real ball with just 5 Watts; The Hybrid Quad—low windload, expense, hassle!; Frequency Detector for Your Counter; Programmable CW ID Unit—for RTTY, repeaters, mobile, etc.; New ICs for the Counter Culture—simpler counters with less used power; Is My Rig Working or Not?—build an effective radiated field meter and know!' Quickie Collinears for 15 and 10—satisfaction guaranteed; Build a Super Standard—goes right down to 1 Hz; The Incredible Lambda Diode; Mechanical RTTY Buffer; Have You Used a Triac Yet?; How To Interface a Clock Chip—Baudot, BCD, or ASCII conversion; A TTL Tester—great for unmarked bargain ICs; The New Ham Programmer—making those confounded uPs work; BASIC? What's That—the basics of BASIC; The Soft Art of Programming (part I).

NOV 76. Blockbuster 288-pg. Issue! Cordless Iron Tips; Bicycle Mobile; Build a Simple Lab Scope—costs less than $70!; Get on Six with Surplus—the el cheapo RT-70 is a natural; The Beam Saver—rotor memory system; Updated Universal Frequency Generator; The Shirt-Pocket Touchtone Liquid Crystal Display Guide; Self-Powered Mike Preamp; The Wind Counter; The S38 Is Not Dead!' The Amazing Inverted L—antenna for 20, 40, and 80m; Battery Chargers Exposed; How Do You Use ICs (part III); Thirty Years of Ham RTTY; Big Noise Burglar Alarm; Dandy Digital Dial Decoder; Weather Satellite Display Control; Ham Time-Sharing Is Here for You!; The Soft Art of Programming (part III); OSCAR Smoke Tester—power supply tester; The Man Who Invented AC—Tesla, the greatest pioneer of them all; Baudot to ASCII—you want to learn programming?; Baudot and BASIC—an interpreter for a Baudot computer; Toward a More Perfect Touchtone Decoder; Using a Wireless Broadcaster; The Quiet Spy—amateur uncovers spy ring in the US!; The Benefits of Sidetone Monitoring—and how to do it.

DEC 76. Go Tone for Ten—simple subaudible encoder; World's Simplest Five Band Receiver?; How Do You Use ICs? (part IV); A Super Cheapo CW IDer; The ZF Special Antenna; CT7001 Clockbuster; Saving a CBer; A Ham's Computer; What's All This LSI Bunk?—an ostrich's eye view of the microprocessor; The Soft Art of Programming (part III); Put Snap Into Your SSTV Pictures—using a $20 frequency standard; What's All This Wire-Wrap Stuff?—talk about cold solder joints! Exploding the Power Myth; Exploding the SWR Myth; The IC-22 Walkie—portablization with nicads; Watch DX with a Spectrum Analyzer; DXing with a Weather Map.

HOLIDAY 76. 55-article Issue! An Inexpensive 400-Watt HF Amplifier; How Do You Use ICs? (part V); Mobile Smokey Detector—10.5 GHz; use it or lose it!; Add RIT to Your Transceiver; DXpedition: Memories for a Lifetime—reflections of HK1TL; Design Your Own QRP Dummy Load; Fail-safe Super Charger—multi-rate, too!; The Amazing 18" Antenna for 160m; Replacing the Knife Switch—simple TR system for the Novice; Now You Can Synthesize—the VHF Engineering approach to 2m happiness; Hutchinson's Remedy—the chirpless CW machine; The Mod Squad Does the Pocket Scanner—Radio Shack Pro-4 update; TR-22 Mod Squad; What Computers Can and Can't Do; A Ham Shack File Handler—program in BASIC for QSLs, repeaters, etc.; Print Your Own Logbook—on your nearest computer; Shoeing Your HT; Cash In on the CB—installation for fun and profit; Tuning Those Big Antenna Coils; The 2m Mod Squad Tackles the Weather Radio—and wins!; Hamming by laser; A 60-Foot Antenna on a 20-Foot Lot—solving a 40m Novice problem; Dual-Voltage Power Supply; An Autopatch Busy Signal; Inside the GLB—a gutsy look at a synthesizer! How to Bug an Automatic Keyer; A 450 Duplexer—that fits in your car; Will Silver-Zinc Replace the Nicad?

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JAN 77. SSTV Test Generator—invaluable diagnostic tool; How Does Your Rig Perform?—an example using the HW-7; What's The Best Antenna for 160?—the inverted vee compromise; 200 lb. Cookie—microwave repeater control; A Super Log—a program for the ham shack computer; Practical Solar Cell Power—great for remote repeaters; A Simple RC substitution Box—using a matrix; Double Sideband: Something New?—one for voice, one for SSTV; A Vest Pocket QRP Rig—if you have a big one; Antenna Magic—good advice on antenna fundamentals. Plus 40 more.

FEB 77. Give That Professional Look To Your Home-Brew Equipment—win prizes; Give the Hamburglar Heart Failure—car alarm system; Contest Special Keyer—has short but adequate memory; You Can sound better With Speech Pre-emphasis—a simple circuit which will work wonders; Getting a Patent—Is It Really Worth It?—how to do it, if you really want to; SSB: The Third Method—bet you cant' even name the first two; The TTL One Shot—another digital building block; Computerized Satellite Tracking—the needed software; Drive More Safely With A Mobile Dialer—hold 4 or 8 phone numbers in a PROM; Tune Up A Random Wire—world's simplest antenna for 80-15. Plus 10 more.

MAR 77. Pitcairn Island—an inside look at VR6TC; How Do You Use ICs?—part VI; PROM Message Generator For RTTY—keyboards are obsolete; Inexpensive Variable DC Supply—easy and quick; The History of Ham Radio—part I; Versatility Plus For the HW-202—external channel mod; Making Your Own PC Boards—part I; Announcing the PCF—legal aid for ham problems; Build Your Own Car Regulator—solid state; The Happy Flyers—fun and public service. Plus 15 more.

APR 77. RTTY? What's That?—how to get started with teletype; Making Your Own PC Boards—part II; 80 CW for the 6800—it works; The Super Clock—what'll they think of next?; The Final Feeder—driving a high power amplifier; What About Surplus Nicads?—how to test and repair them; The History of Ham Radio—part II; Retire to a Ham Heaven—how to go on a permanent DXpedition; The Carbon Marvel—best mobile mike yet?; The Minicom Receiver—finally, a QRP allbander. Plus 25 more.

MAY 77. Build The World's Simplest Keyer—uses 555 timers; Predict the Weather!—a complete satellite receiver; The History of Ham Radio—part III; Let BASIC Control Your Next Contest!—with Extended Tiny BASIC language; Understand Your Pet Rock—tips on crystal oscillators; TTL Techniques—bypass those glitches; Stop Timeouts!—build this 10-minute ID timer; Quick Vertical—for 20 and 40; Try Power Saver Logic—a guide to CMOS applications; All-Electronic Selcal—uses a UART for versatility. Plus 24 more.

JUNE 77. Build This CW Filter—darned good; The W1BB Story—a visit with the king of 160; Ten Watts on 2—it's possible with this rock crusher!; At Last! A 10m Band Plan—requires a CB radio; Sheet Metal Bazooka—build microwave components; Practical P.S. Design—do it right this time; Regulated Nicad Charger—don't cook 'em! Current-Saver Counter Display—multiplex those LEDs!; New PC Techniques Unveiled!—dig out your old chemicals; How Do You Use ICs—part VII. Plus 22 more.

JULY 77. A Battery Voltage Monitor—how simple can an IC project get?; Hunting Noise—with a grid dipper; Hams Profit From CB—how to set up a service center; Patch Up Your 101—simple mod for the HW-101; Dipole Designer Program—calculates coils and length; CB to 10—parts III, IV, and V; World's Smallest Continuity Tester—it's almost minute; Digital Synthesizer—revitalize old xmtr strips; Phone Patch Tips—a lost art?; Digital Clock Fail-Safe—so you won't miss the train. Plus 18 more.

AUG 77. Antenna Special! Centerfed Specials—for the small city lot; Build a Double Bazooka—give your signal a blast; Dirt Cheap Directional Array—for the serious DX hound; Instant PS Regulation—a quickie; The Zeppy Vertical—a perfect 2m antenna; The 8JK Array Revisited—Inexpensive and effective; Build a Brute Power Supply—completely regulated and protected; Computer Logger—for those who keep logbooks; build a kW Linear—a 4-1000 provides the punch; PC Layout Tips—next time, do it right! Plus 44 more.

SEPT 77. RTTY Special! A FAAR-OUT DXpedition—airborne VHF and OSCAR!; So You Want to Get Into RTTY?—"Call For Papers" winner; Design an Active RTTY Filter—eliminate CW QRM and noise; Build a RTTY Message Generator—it's programmable!; FSK for the Drake—easy; Baudot To ASCII Converter—use it for OSCAR RTTY; RTTY With the KIM—features built-in display!; FSK for the FT-101—a simple mod for RTTY; Noise Rejector—great for CW or phone receivers; A Practical 2m Synthesizer—who said it can't be built? Plus 17 more.

OCT 77. W.A.S—Easily!—catching the last few; Try Your KIM-1 on RTTY—CUL on your computer; Try a Trapped Dipole—save copper and coax!; Novice Antenna Specials—tips for that first antenna; Traffic Handling Explained—a lost art?; One Cent Channels For the IC-22S—inflation fighter!; Sensitive Meters Saved; Add Jazz to Your Tempo—with a few simple mods; Interested In Television?—how to get started; Digital To Audio Decoder—for the blind operator. Plus 26 more.

DEC 77. The History of Ham Radio—part V; How Do You Use ICs?—part VIII; A Kilowatt Alternative—try a gain antenna; The DA4FB Story—American repeater in Germany; Computerized Global Calculations—finding the best way to Pago Pago; Run, Sheila, Run!—real-life radio control; CB to 10—parts VI and VII; amplitude vs. Frequency—poor man's spectrum analyzer; Regenerated CW—CW as you like it. Plus 41 more.

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JAN 78. Build a Better Phone Patch—hybrid-op amps—the works; Build a 3½ Digit DVM—replaces old meters!; QRP Hints—for low-power freaks; Custom-Made Thermistors—for precise values; UHF Propagation—believe it; Put an ELF In Your Keyer—sneaky computer strikes again; CB to 10—part VIII; The Extreme Basics of Antennas—for pre-Novices; Versatile Transistor Tester—save expensive devices; How to dissipate 200,000 Megawatts—fool Mother Nature. Plus 36 more.

MAR 78. Old Rigs Can Live Again!—a guide to their resurrection; Novices, Paddle Your Way to Happiness—super deluxe Novice keyer; 1220 MHz—Use It or Lose It!—simple gear you can build and enjoy; New Protection For Your Car—simple force field system; The World of Tone Control—a virtual encyclopedia on the subject; Another Approach to the ASCII/Baudot Headache—a Model 15 and an SWTP system; Surprisingly Low-Cost Lab Supply—an IC regulator does it!; The Solar-Powered Ham Station—one hundred Watts, yet!; Are You Afraid To Build?—how to get organized and started; How to Use a Varactor—And Why—semi-exhaustive article. Plus 33 more.

APR 78. How to Succeed on 1296—cat-food can 50-Watt amplifier; How Do You Use ICs?—part IX; The Challenge of 10.5 GHz—use it or lose it to Smokey; Now Anyone Can Afford a Keyboard—surplus keyboard, KIM, and software; Is TTL Already Obsolete?—CMOS vs. TTL; Improve Your HW-2021—more flexibility, etc.; Simple CW Interference "Filter"—diode code regeneration; How Sunspots Work—basics for the Novice; Use Noise to Tune Your Station—build this simple noise generator; Danger! Microwave Radiation!—just how much is dangerous? Plus 19 more.

MAY 78. Official FCC RFI Report—curing radio and TVI; Fake 'Em Out With Remote Control—TT-operated control unit; Now—A Digital Capacity Meter!—simple construction project; DMM Survival Course—"all" about using digital multimeters; Build This Excitingly Simple Receiver; Diary of a Survivor—cyberosis victim tells all; The Super Select-o-Ject—kill rotten QRM with this filter system; The Miser's Delight Repeater Controller—the very ID!; Make Antenna Tuning A Joy—Instant swr bridge; The COR Goes Solid State—turning two Midland rigs into a repeater. Plus 18 more.

JUNE 78. Antenna Special! Wait Till You Try 16 Elements!—15 dB gain on 2m is a real kick; Working 15m with a 20m Beam—by adding three more elements; Resurrecting the Beverage Antenna—try this 55-year old, low-noise, low-band antenna; Better Than a Quad?—try a delta loop; Towering Low-Band Antennas—berserk mathematician figures impedance; Modernize the Matchbox—increased capability for a classic coupler; The 75m DX Chaser Antenna—the 5/8λ works on 75m as well as 2m; Computerized Loop Antenna Design—in BASIC; Novice Guide To Phased Antennas—part I; The 21-Element Brown Bomber—2m beam with sadistically strong signal. Plus 29 more.

JULY 78. Reincarnating Old Test Equipment—a 1942 capacitance meter is born again; Novice Guide to Phased Antennas—part II; Build Your Own Digital Dial—great update for your receiver; Your 'Scope Can Be Improved—simple calibrator; The $5 Memory Keyer—for lazy cheapskates; RAMmed By Morrow—ECONRAM III lauded; VHF Notch Filter—rejection can be beautiful; Yes, You Can Build A Synthesizer!—220-MHz synthesizer for under $50; A Darn Good IDer—repeaters get smarter every day; VHF Transverters and the FT-101—quickie FM conversion. Plus 34 more.

AUG 78. Radio Row Revisited—It's alive and well in Tokyo; A Complete X-Band Transmitter—easy to build; Power Line DX—(almost) wireless remote control; The End of RF Feedback—here's how the pros do it; CB to 10—part IX; A WWV Primer—become a calibration freak; Super Charger—keeps nicads up to snuff; HW-101 Owners, Check This!—RIT mod for the good old HW-101; Ham Radio Is NOT a Rich Man's Hobby—another myth exploded; New Life for Double Sideband?—awake, ye pioneers, and get cracking. Plus 34 more.

SEPT 78. Another IC-22S Scheme—for oddball repeaters; Tracking the Wild Turkey—DF tips; DVM Scrapbook—the basics; How Do You Use ICs?—part X; Computerized QSO Records—who needs a logbook?; CB to 10—parts X & XI; Build the Triple Threat Keyer—great Novice project; The Ten Meter AM Antenna Special—$5 vertical also works on SSB or FM; Build the IC Experimenter—getting started with TTL and CMOS; Two Meters at the Summit—a backpackers delight. Plus 37 more.

OCT 78. DXpeditioning—a "how to" guide; The History of Ham Radio—part VI; Building From Magazine Articles—the breadboard/wire-wrap way; High Seas Adventure—Ham Style—part I; Use a Computer? Who, Me?—yes, you!; Bird Watching in BASIC Land—another use for your micro; World's Cheapest QSLs—BASIC program keeps your log, too; Happiness Is a Smart Scanner—mods for the PBM/AWE FMSC-1; A Perfect Power Supply?—well . . . almost; Antenna Design: Something New!—controlled-current distribution. Plus 37 more.

NOV 78. Murphy's Masterpiece—the lost weekend; How About Some Ham Shack Safety?—don't be a statistic; The History of Ham Radio—part VII, CB to 10—part XIV; a Realistic PLL rig; High Seas Adventure—Ham Style—part II; Squelchifying Cheap Receivers—junk-box project; Build the Brute—unique heavy-duty power supply; The Circuit Board Aquarium—no fish story; Who Needs Transistors?—you do!; Ham Help!—a telephone aid for the blind. Plus 47 more.

DEC 78. A DXer's Dream Vacation—try sunny Montserrat; Close Encounters—the eyes of Texans are upon them; Receiver Diseases—and how to cure them; Confessions of a Stripper—confirmed junkor tells all; Whither Microcomputers?—a pro looks ahead; "This Is Your Computer Speaking"—how to dial up your micro; Big Max Attacks—It's W2DU vs. K4KI, in the battle of the bazooka; WARC '79 Preview—showdown in Geneva; Build the Flexi-Filter—a very active device; Code Practice Oscillators—an exhaustive report. Plus 29 more.

Also Available: December, 1960; June, July, August, September, October, December, 1961; January, February, November, 1962; January, April, May, July, September, November, 1963; January, March, April, July, September, October, November, December, 1964; May, June, July, August, December, 1965; August, September, December, 1966; January, February, March, April, June, August, September, December, 1967; January, March, April, May, August, October, December, 1968; October, 1970.

TS-180S DUAL SSB FILTER

What advantages are provided by the dual SSB filter system in the TS-180S?

The dual SSB filter system in the TS-180S provides the following advantages:

- Improves receiver signal-to-noise ratio (S/N).
- Improves receiver selectivity.
- Allows greater RF speech-processor compression level.

Which filters are supplied as standard features?

The TS-180S operates with these filters:

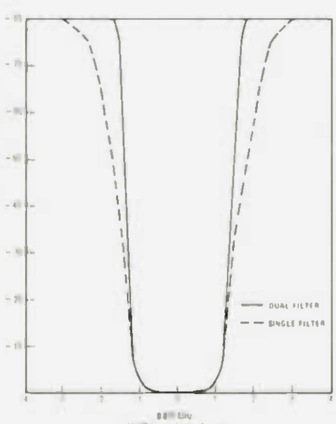
YK-88SSB IF SSB Filter #1	Standard, Built-in
YK-88SSB IF SSB Filter #2 (for dual filter system)	Optional
YK-88CW 500-Hz CW Filter	Optional

How much is selectivity improved by adding the second SSB filter?

Even with just the one standard SSB filter, the TS-180S is very selective. Passband widths with the single and dual filters, as well as with the CW filter, are shown below:

RESPONSE	SINGLE SSB FILTER	DUAL SSB FILTER	CW FILTER
-6 dB	2.4 kHz	2.2 kHz	0.5 kHz
-60 dB	4.2 kHz	3.0 kHz	1.5 kHz

The newly developed MCF type filter, including both the YK-88SSB and YK-88CW, has sharp response characteristics. The newer filters are notable in their lack of response "humps" away from the main portion of the passband curve.



How much does the second SSB filter improve S/N?

Adding a second crystal SSB filter between the IF amplifier and the detector reduces wideband noise from the IF amplifier by 3 dB, thus giving a certain improvement in overall receiver S/N.

How does the dual SSB filter system also improve RF speech-processor compression level?

The following maximum compression levels are available with the TS-180S RF speech processor:

	SINGLE SSB FILTER	DUAL SSB FILTER
MAXIMUM COMPRESSION LEVEL	15 dB	30 dB

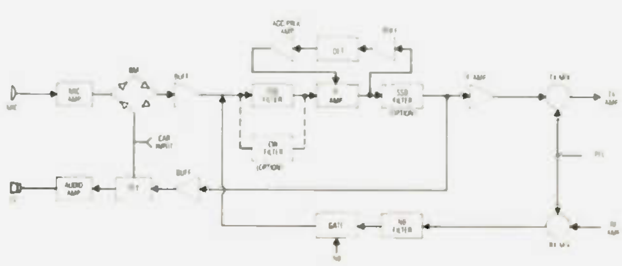
The dual filter system functions in the IF stage, which is common to both the transmitter and receiver. The RF compressor speech processor in the TS-180S is always on, with selectable time constants of SLOW (natural sounding audio) and FAST (more audio punch for the pile-ups). Up to 15 dB of compression in the FAST mode may be achieved without sideband expansion (splatter), using a single filter. With the dual filters, the sideband is filtered again and a high-quality SSB signal of high talk power is obtained, with a maximum compression level of 30 dB without splatter.

Can both the optional second SSB filter and optional CW filter be used for receiving at the same time?

Yes.

Where is the dual SSB filter system located in the TS-180S?

The dual SSB filter system is in the TS-180S IF unit, and the second filter may be installed easily by the user. The general circuit configuration is shown below.



PC-1 PHONE PATCH

Is a matching phone patch available for Kenwood equipment?

After many requests, Trio-Kenwood is introducing the PC-1 phone patch, which may be connected between a transceiver and the telephone-line. (We recommend obtaining a voice connecting arrangement from the telephone company for legal attachment to the telephone line.)

Does the PC-1 use a hybrid circuit for VOX operation?

The PC-1 is able to interconnect the transmitter, receiver, and telephone line voice coupler while accommodating a great difference in voice levels to and from the telephone line, and cancelling the audio level from the receiver at the input to the transmitter's VOX circuit.

Is the PC-1 easy to adjust?

Three easy adjustments are made after a phone call is established:

- NULL control, with a clear, continuous signal tuned in on the transceiver, for minimum deflection of the PC-1 meter.
- RX GAIN control, to about 0 VU on the PC-1 meter, for hearing the signal clearly through the telephone receiver.
- TX GAIN control, for proper VOX operation while the party on the telephone speaks.

Ronald C. Williams W9JVF/ZB2CS
1147 N. Emerson
Indianapolis IN 46219

Get a Piece of The Rock

—a DXpedition to Gibraltar

Slow careful CW, calling CQ, "de WDØEDX."

"This must be a fairly new ham," I thought. "I'll give him a new country." I called at 10 wpm, and back he came and said, "Where is Gibraltar?"

There I was, sitting in the shack of Jimmy Bruzon ZB2BL, which he very kindly loaned to me for a few days for my '78 ZB2CS expedition. In '73, I had operated from the Caleta Hotel on the east side of The Rock. In '75, I was on the west side of The Rock at the Montarik Hotel, and in '78, I was lucky enough to have Jimmy's quad to help things along.

Twenty meters was in fine shape in late July and the USA was roaring in. I slid up to 14.285 for some SSB operation. This time I was going to work a lot of Generals that I had not picked up before. One of the first was WA2PYI, who had just received his General and reported that I was his first SSB contact, his first ZB2, and his first DX. At the other extreme, W1HZV confided that in 46 years on the air, I was his first ZB2.

SSB signals from the USA are fantastic in Gibraltar. US hams are excellent operators. On a stand-by, the QRM was fierce, but when I went back to one station, everyone else was silent. The only times there were any problems with several talking at once were when conditions were marginal and some probably were not hearing me well enough to know who I was trying to work. A number of 6s and 7s came through well, and even KL7HRN was readable through the east coast curtain. It is possible, with a little concentration, to pick up 4 or 5 calls in a pileup and then work all of those before picking up more. This was not during a contest, but I was trying to work contest-style to contact as many as possible. About 50% of the people I worked said I was a new country for them. This is a real pleasure for one who is accustomed to being a run-of-the-mill W9 on the other end of the pileups.

This view shows the town of Gibraltar, left, the airstrip, center, and the town of La Linea, Spain, beyond the airstrip.

Gibraltar is probably best known through the efforts of The Prudential Insurance Company and its slogan, "Get a Piece of The Rock." The model that Prudential uses in TV advertising is only about one-tenth of The Rock. The Rock actually extends about 3 miles to the right of the model as shown and the airstrip is at the foot of the model just to the left. The concrete runway has one end in the Bay of Gibraltar and the other end in the Mediterranean. After considerable air travel, this is the only place where I ever saw a jet airliner put the jets in reverse while still 100 feet off the runway. I found out that the British Trident is one of the few airliners to be able to handle this condition.

On one trip to The Rock I made the mistake of taking in three cardboard cartons of radio gear. This was impounded by customs, and I had to wait 24 hours while officialdom made a ruling that I could get it back. If your gear is in a suitcase, there is no problem.

A license is not hard to get. The postmaster is in charge of such things, and a letter in advance with a copy of your personal license is enough. The fee is about $2. Almost 200 ZB2 calls have been issued, but most of them are British servicemen long gone to other duties, and a scattering of occasional visitors like myself who show up once every few years. The most recent visitor, a few months ahead of me, was Ken Palmer K2FJ/ZB2G, who ran a Gibraltar expedition in February '78. An important consideration to remember is that Gibraltar power is 50 Hz and 250 volts only.

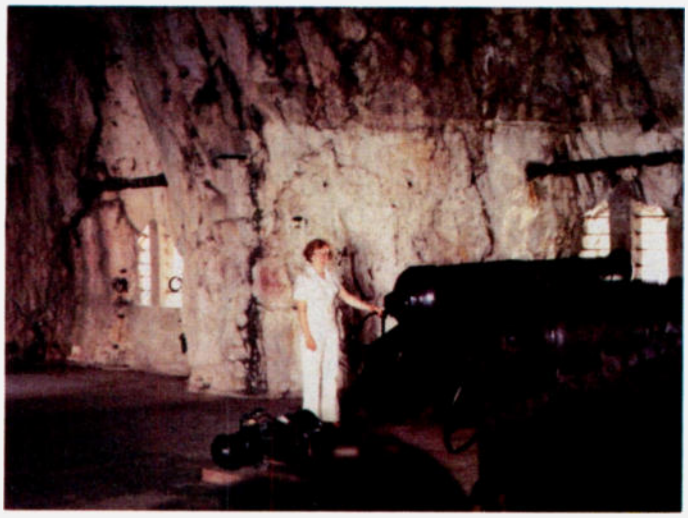
Parts and accessories are hard to come by. Almost everything must be ordered and shipped in; duty, plus the shipping costs, all add to the expense. Jimmy ZB2BL is a TV service man and is able to get ahold of some electronic parts, but there are needed items which normally are not in TV stock. There is a hi-fi store on Main Street across from the Montarik Hotel which has Kenwood 520 and 820 transceivers for sale at considerably higher prices than here in the USA. If one didn't mind the extra expense, it would be possible to fly in and buy equipment locally to get on the air.

Gibraltar's people are bilingual. The schools and all public business are officially conducted in English. Everyone speaks Spanish most of the time, however. The well-educated people speak both quite well. With American or British visitors, they speak English all the time. They switch back and forth when speaking to each other. The reason, they told me, is that some ideas are expressed better in one language and other ideas better in the other.

Gibraltar is isolated; it is a peninsula connected to Spain. There is a road, but the gates were closed by the Spanish government ten years ago and no one is allowed to pass through.

This is the ZB2BL triband quad with its owner.

Many residents of The Rock have relatives and friends in Spain. In order to visit they must take the boat across to Tangier and then back to Algeciras. This means a considerable cost in money and time to make what should be a simple, inexpensive, short trip. Spain wants control of The Rock. The closing of the gates is part of a move to get the British to leave. The citizens of Gibraltar much prefer English rule, and many of them are of British descent.



W9PBT examines an 18th century cannon.

The Rock was known in Roman times as "Mons Calpe."

The eastern face of The Rock.

The only time the gates are opened is on the rare occasion when a critically-sick person is taken through to the Gibraltar hospital. There is no commercial or tourist traffic allowed.

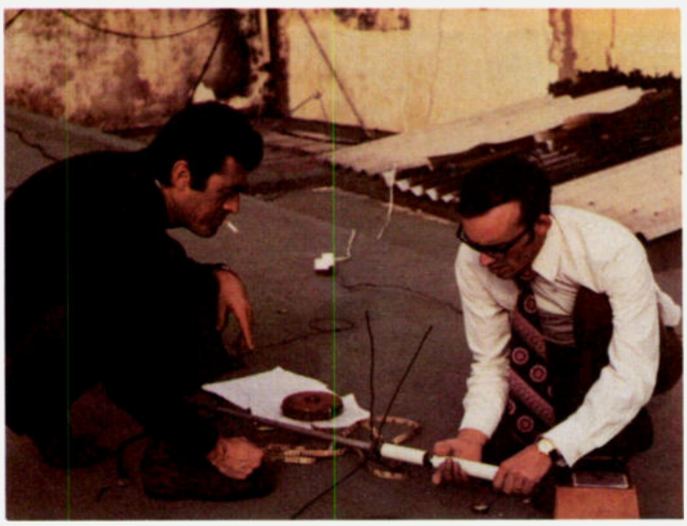
The Rock apes are known far and wide. These are really monkeys in terms of size, but since they naturally do not have tails, they are classified as apes. With the rise of human population, they are concentrated in one area known as the apes' den. The British Army looks after them and supplies food and medical attention. They can be tricky rascals, stealing cameras and purses, and at times they bite. It is best to be careful when around them!

There are plenty of good hotels and restaurants available. The population is about 18,000 and there are stores, bars, banks, and all the normal activities of any medium-sized town. Ham radio from Gibraltar is quite interesting, as one is in demand and a pileup starts in a hurry. About half the people I worked wanted a card for a new country. A transceiver and a dipole are plenty. There are several places to set up—in hotels, up on The Rock, or even in a rented car for mobile operation. From the south end of The Rock at Europa Point one has a clear shot in all directions.

One place which might look good is the top of The Rock, but it is no good for HF work. Apparently due to the almost vertical cliffs falling away on two sides, the angle of radiation is not useful for DX. It has been tried with very poor results, while at lower levels, signals were strong both coming and going. The top is good for VHF. As a matter of fact, the Gibraltar Amateur Radio Club was planning a 50.3 MHz beacon to be placed in operation from the top of The Rock before the end of 1978. An earlier beacon on 50 MHz was heard over much of the eastern part of the USA in early 1978, and all the reports from this success have encouraged a better effort.

My wife, Milly, had a good time shopping in the Gibraltar stores for things to bring home to our four daughters and two grandsons. After three trips to Gibraltar, I have two very good friends there, and this time we had even more social get-togethers as my wife came, too, and we saw more of the Gibraltar wives. We had dinner with Jimmy ZB2BL and Tere Bruzon, and Cecil ZB2CF and Lourdis McEwen. On my earlier visits I had met both of these ladies and formed the opinion that they did not speak much English. It turned out that they were a little shy, and I very much admire their bilingual abilities. If I could speak Spanish half as well as all of them speak English, I would be quite pleased. As it was, I managed to add a few more words to my Spanish vocabulary.

Milly Williams W9PBT/ZB2 and a French tourist watch a British Army keeper of The Rock apes.



Cecil McEwen ZB2CF and Jimmy Bruzon ZB2BL are hunting for a defect in a loading coil.

Jimmy Bruzon ZB2BL is without a doubt the leading amateur on The Rock. He operates the DX bands and OSCAR. He also is in charge of ZB2VHF, the beacon operation, and a real pusher behind ZB2BU, the Gibraltar Amateur Radio Club. The club has several members who are working towards licenses and a very neat new club meeting room with a Kenwood 520 about to be installed. Jimmy earns his money as a TV service man, and several people told me he is the best.

Cecil "Mac" McEwen ZB2CF has given many happy 5BDXCC hunters a contact on 75. He also works various other bands at times. He recently moved into better living quarters, but has some antenna restrictions. He hopes to get something better than his present vertical and loading coil in the air.

This is the proposed site for the new 50.3 MHz beacon, atop The Rock in abandoned fortifications.

I now have 46 countries and 35 states worked from ZB2, so I will be going again in the next couple of years to finish off a DXCC and WAS from The Rock.

For those who would like to give it a try from Gibraltar, I will be glad to offer suggestions and advice and answer questions. It's an easy place to get to and to become the center of a real pileup. Now I'm planning Gibraltar IV. ■

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QUIK-KIT II®
INCLUDES PROPORTIONAL OVEN TIME BASE

- DC-BATT-AC (W-AC9)
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- 9 Digits .5 Inch LED's
- 0.1 HZ Resolution
- Auto Zero Blanking

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5600A-K 5600A-W	$149.95 $179.95	50Hz-600MHz	Proportional Oven .2 PPM 10° - 40° C	10MV	10MV	50MV	9	.5 Inch	*115 VAC or 8.2-14.5 VDC	3¼" x 9½" x 9"
3550	99.95	50Hz-550MHz	TCXO 1 PPM 17° - 40° C	25MV	25MV	75MV	8	.5 Inch	*115 VAC or 8.2-14.5 VDC	2⅛" x 8" x 5"
500HH	$149.95	50Hz-550MHz	TCXO 1 PPM 17° - 40° C	25MV	20MV	75MV	8	.4 Inch	*115 VAC or 8.2-14.5 VDC or NICAD PAK.	1" x 3½" x 5¾"

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FREQUENCY COUNTER CONSUMER DATA COMPARISON CHART

MANUFACTURER	MODEL	SUG'STD. LIST PRICE	FREQUENCY RANGE	TYPE OF TIME BASE	ACCURACY OVER TEMPERATURE		SENSITIVITY			DIGITS		PRE-SCALE INPUT RESOLUTION	
					17° - 40°C	0° - 40°C	100 Hz - 25 MHz	50 MHz - 250 MHz	250 MHz - 450 MHz	No.	SIZE IN INCHES	.1 SEC	1 SEC
DSI INSTRUMENTS	100 HH	$ 99.95	50Hz-100MHz	TCXO	1 PPM	2 PPM	25 MV	NA	NA	8	.4	100 Hz	10 Hz
DSI INSTRUMENTS	500 HH	$149.95	50Hz-550MHz	TCXO	1 PPM	2 PPM	25 MV	20 MV	30 MV	8	.4	100 Hz	10 Hz
CSC‡	MAX-550	$149.95	1kHz-550MHz	Non-Compensated	3 PPM @ 25°C	8 PPM	500 MV*	250 MV	250 MV	6	.1	NA	1 kHz
OPTOELECTRONICS	OPT-7000	$139.95	10Hz-600MHz	TCXO	1.8 PPM	3.2 PPM	NS	NS	NS	7	.4	1 kHz	100 Hz

* 1 KHz - 50 MHz ‡ Continental Specialties Corp.

The specifications and prices included in the above chart are as published in manufacturer's literature and advertisements appearing in early 1979. DSI INSTRUMENTS only assumes responsibility for their own specifications.

100 HH . . . $ 99.95 W/Battery Pack . . . $119.95
500 HH . . . $149.95 W/Battery Pack . . . $169.95

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T-500 Ant. . . . . $ 7.95
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Easy-to-Build 220 Transverter

—simple hookup to any synthesized 2m rig

Frank Kalmus WA7SPR
President, R.F. Power Labs, Inc.
11013—118th Place N.E.
Kirkland WA 98033

One day I took a good look at my 2-meter gear and found that I had an unusual amount of 2-meter equipment but only one Midland 13-509 for 220 MHz. This disturbed me somewhat, because 220 MHz is coming up strong in this country. Having only one piece of 220-MHz equipment to choose from made me wish that there was some way I could convert my excess 2-meter gear to 220 MHz, so that I could go on all of the channels without having to buy additional, expensive, synthesized 220 equipment.

Well, it did not take me very long before I came up with a block diagram showing how I could get around the purchase of a 220-MHz synthesizer by using my 2-meter synthesizer instead, and making it receive and transmit on 220 without the external LO inputs required by many transverters. No connections are needed from the transverter to the 2-meter transceiver except for a piece of 50-Ohm coaxial cable from the transceiver antenna connector to the transverter input connector. See Fig. 1. The transverter runs off +12 volts at about 300 mA for the 1-Watt model, and about 2 Amps for the 10-Watt version.

I connected my prototype to the accessory socket of the Multi-2700. The antenna connects to the output of the transverter. That's it! All of the switching and converting is done automatically by the transverter. The decimal readout remains as is, and the MHz are converted as follows: 145 MHz is 222 MHz, 146 MHz is 223 MHz, and 147 MHz is 224 MHz. It's as simple as that!

If you want to go to 223.500-MHz simplex, you set your radio to 146.500 simplex and let the transverter do the rest. If you want to go to some repeater frequency, let's say 222.500 in, 224.100 MHz out, you simply set your 2-meter radio to the repeater output frequency (147.100 = 224.100), flick the transverter mode switch to Repeater, and bingo! You have an instant 1.6-MHz offset putting you on a repeater mode for all 220 repeaters.

You can work simplex, duplex, reverse, and listen at any repeater input frequency to find those hard-to-locate secret machines.

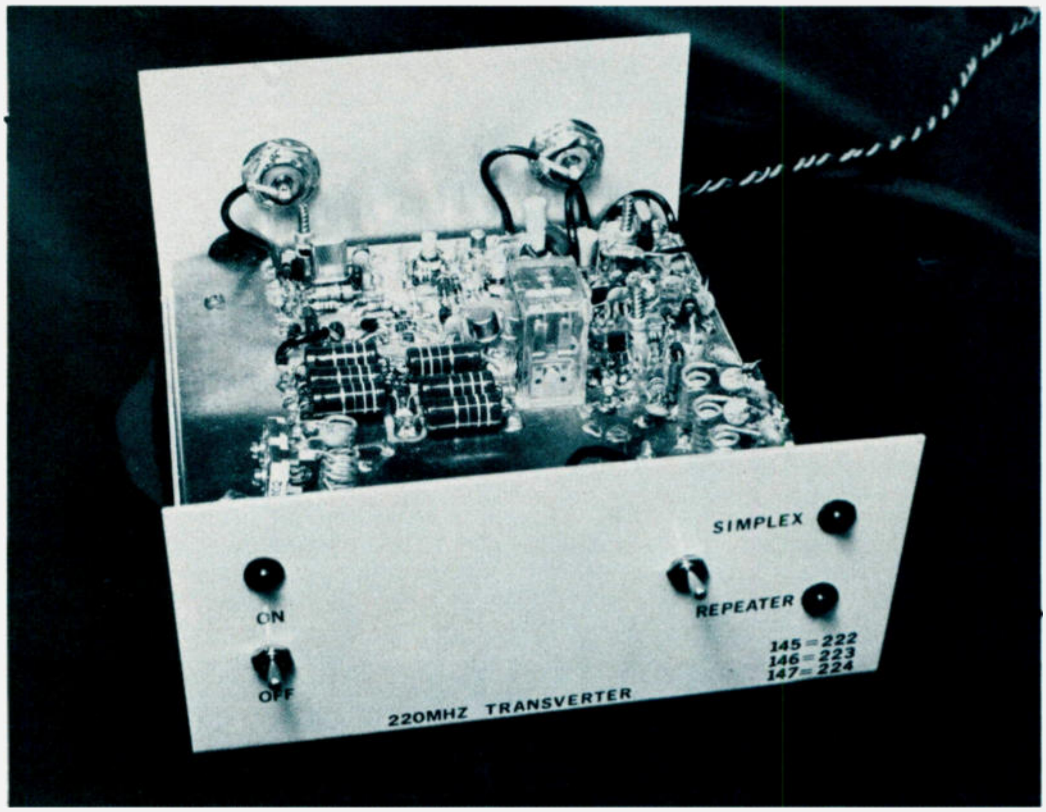

Photo A.

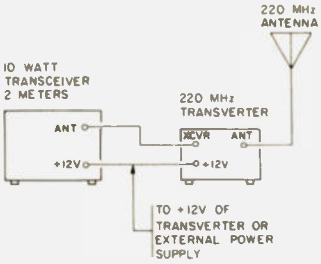

Fig. 1. Transverter connections.

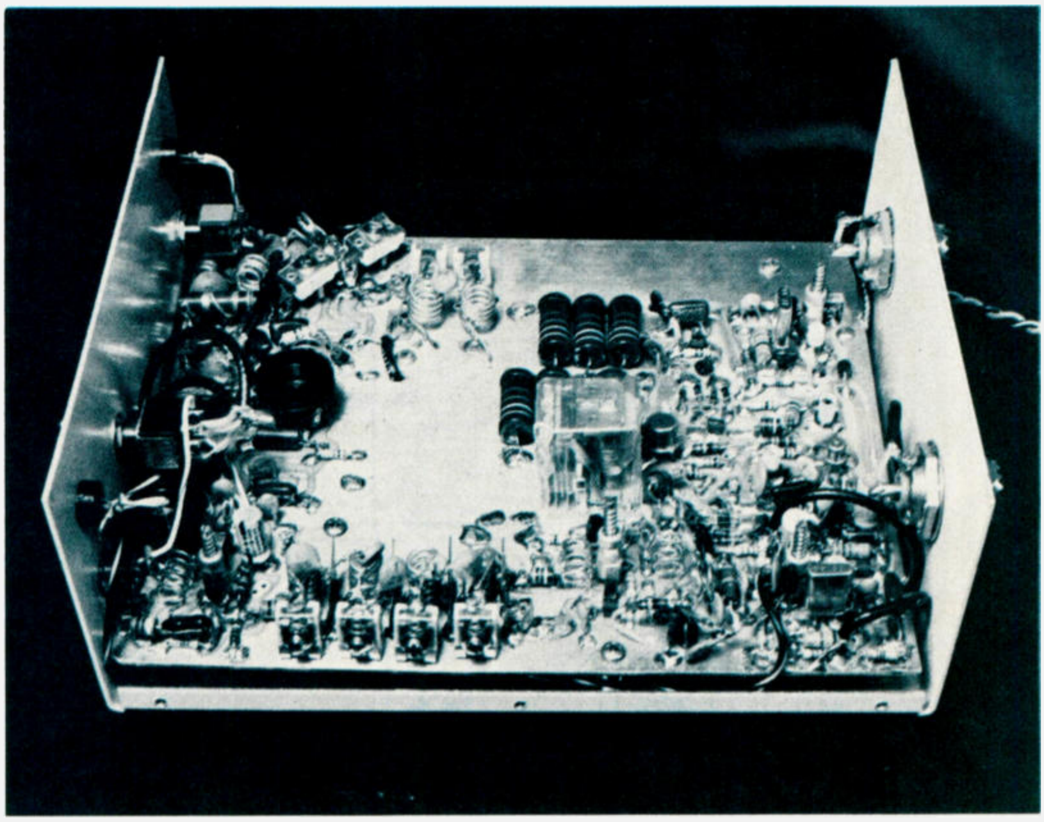

Photo B.

Theory—How It Works

Fig. 2 shows in simple blocks the signal flow from and back into the antenna, and also from and back into the 2-meter transceiver. Fig. 3 is a complete schematic. The system is divided into two parts: the receiver and the transmitter.

Receiver: The 220-MHz signal received by your antenna is fed to a narrow bandpass filter with very low loss at 220 MHz, but high rejection at 146 MHz and all other frequencies located outside the 220-MHz band. This is required to keep strong 2-meter stations such as local repeaters from getting through the transverter and into the very sensitive 2-meter receiver. Also, the filter keeps local FM broadcast stations out of the front end of your transverter, which could cause possible intermodulation distortion.

The filtered 220-MHz signal goes through pins 6 and 5 of the T-R relay to the FET preamplifier stage. This extra stage of amplification was needed to reduce the noise figure of the transverter to about 2.5 dB instead of the 6-7 dB offered by the double-balanced mixer following it. Note that both the input and the output of Q11 (FET preamp) are tuned for good rejection and best noise figure. The gain of the preamp is about 12 to 15 dB, depending on the mood of the transistor that you happen to have in the circuit. The output is coupled directly to a double-balanced mixer consisting of D5 through D8 and T8-T9. Our 220-MHz amplified signal is now mixed with a 77.000-MHz LO from crystal oscillator Q8 through power-splitter T7, with the i-f fed to pin 9 of T-R relay K1. From here it travels to the transceiver connector, already converted to a new frequency of 223 − 77 = 146 MHz. The 2-meter transceiver connected to this terminal will eat this newly converted 223-MHz signal right up, just as if it had been 146 MHz!

Transmitter: This part proved to be much more difficult than the receiver because of the fact that we have a 10-Watt signal feeding a mixer capable of only 1 milliwatt of power conversion. Also, the signal needed to be re-amplified to a point where it was again usable for reasonably distant communications; in this case, 1 Watt, or 10 Watts, as you prefer. You may decide that 1 Watt is sufficient to

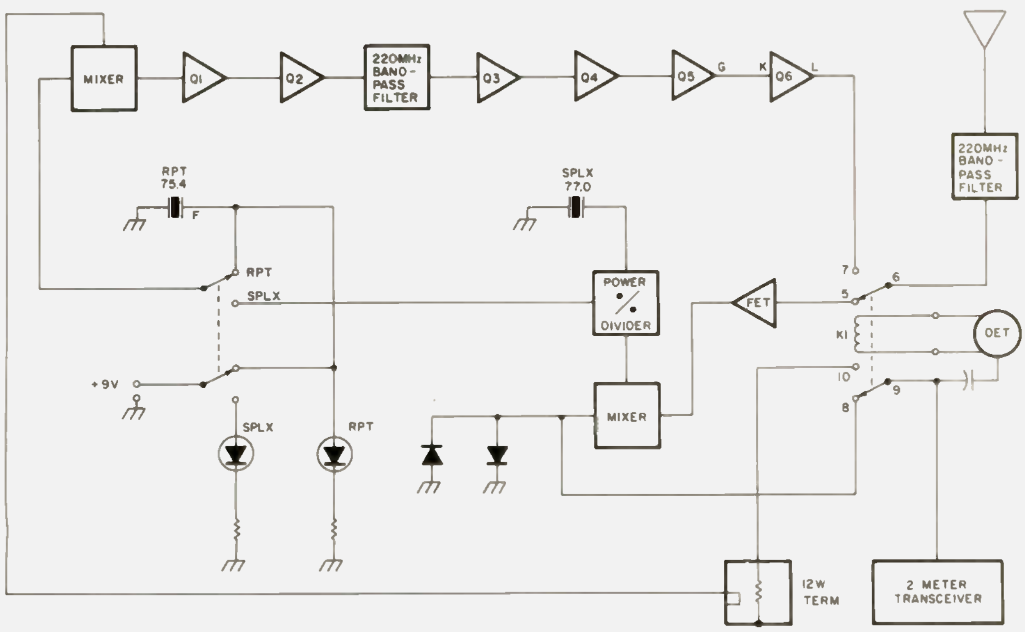

Fig. 2.

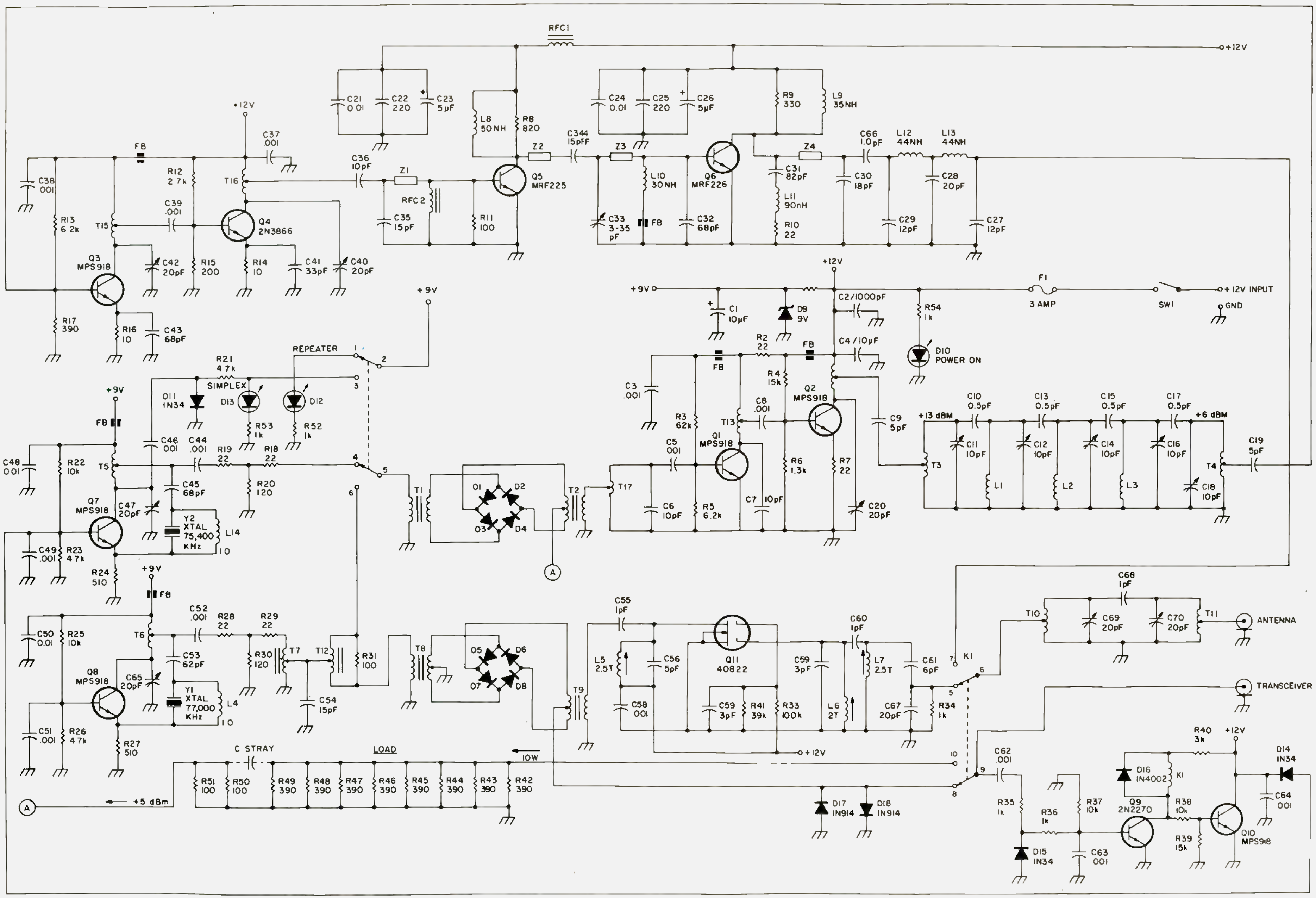

Fig. 3. Shielding beads are indicated by FB. Unless otherwise specified, resistors are in Ohms, capacitors in picofarads, and inductors in microhenrys.

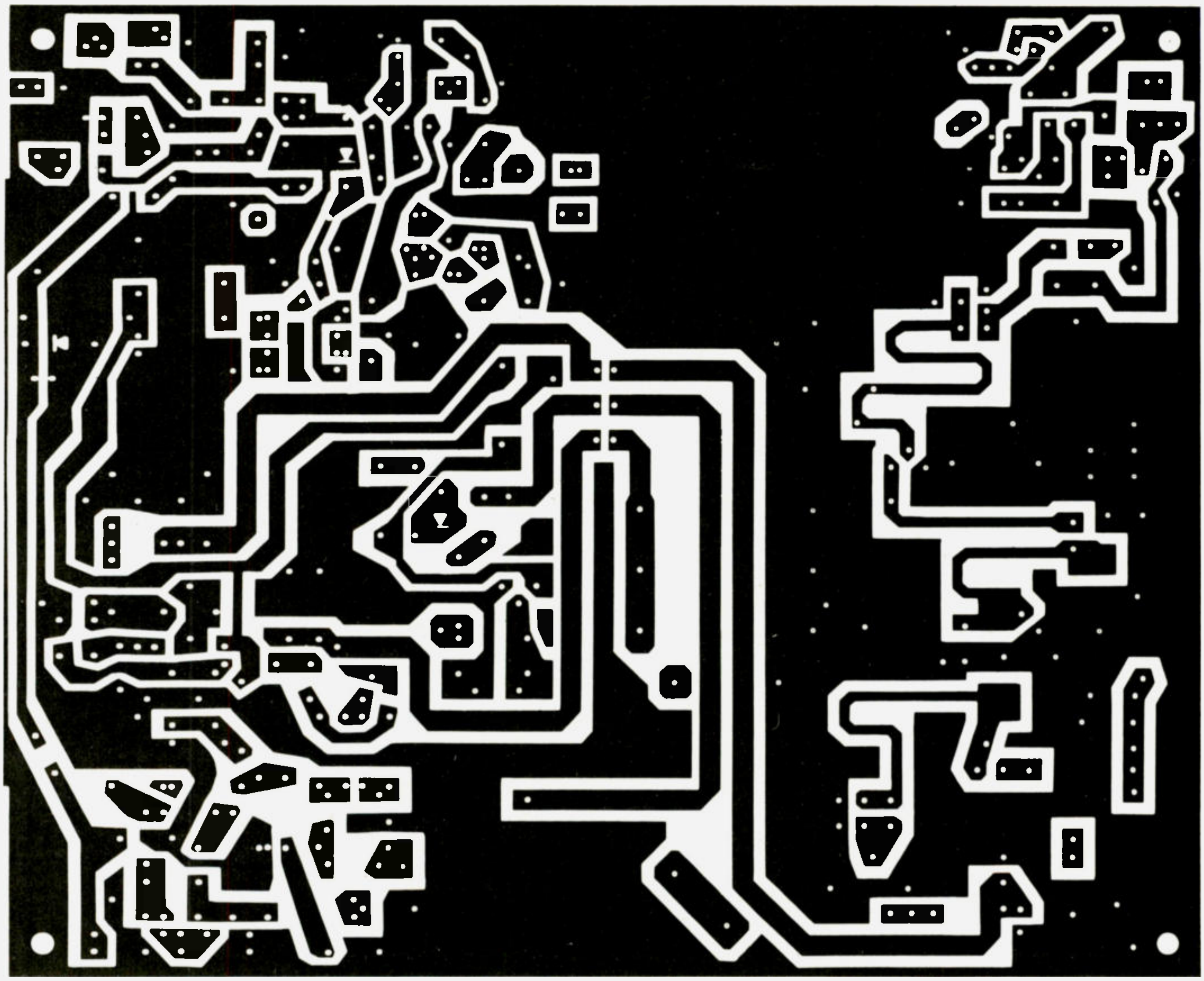

Fig. 4. Top of PC board.

get you where you want to go, or you may want to go all the way and stuff the PC board with all of the parts needed for a full 10-Watt output.

The board has been designed to make it a 10-Watt unit. For the 1-Watt selection, the last stage, Q6, is omitted and the C34 capacitor connects to pin 7 of K1 instead of to C27 and L13, as is shown in the schematic.

When transmitting, let's say on 223.500-MHz simplex, your transceiver is set to 146.500-MHz simplex and produces anywhere from 2-12 Watts. The rf power is received through the transverter input connector and is routed to pin 9 of K1. The signal is fed through the relay (pin 10) to a dummy load capable of absorbing the energy. The rf detector, D15, connected to the transceiver input signal, causes Q9 to conduct, thus pulling in K1 and consequently feeding the signal to pin 10 of K1.

Two 100-Ohm resistors in parallel give us 50 Ohms, creating sufficient stray coupling to sample about 1 milliwatt of rf energy from the dummy load. This small, 1 mW at 146.500 MHz, is fed to T2 of a double-balanced mixer (D1 through D4). With the mode switch in the simplex position on the transverter, we have selected the 77.000-MHz oscillator fed from the T8 power-splitter. The mixer upconverts the signal to 223.500 MHz at the base of Q1. Two stages of selective frequency amplification boost the small signal (about 200 microwatts) back up to about 20 mW at the input of our highly selective bandpass filter, starting with C9 and ending with C19.

This filter was necessary, not to make the transverter work, but merely to satisfy the FCC spurious-radiation specification requirement. Tuning is very delicate and could mean the difference between getting the system to work or not getting it to work. Power output of the filter should be around 1 to 5 milliwatts. The output of the filter drives Q3 and then Q4. Both stages boost the newly-converted signal up to 100 milliwatts before entering a two-stage microstrip-designed 1- or 10-Watt amplifier board. Tuning is not very critical, but care must be exercised when installing the parts. Make sure all leads are as short as possible, and that only non-inductive parts are used. Remember, this project is to be used on 220 MHz, not on 80 or 20 meters. It may sound picky, but it's not; 220 MHz is a far cry from HF, and what may work at 20 MHz will not work on 220 MHz—take my word for it. You may wind up settling for ½ Watt instead of 10 Watts, and you will be wondering why.

The output of the final

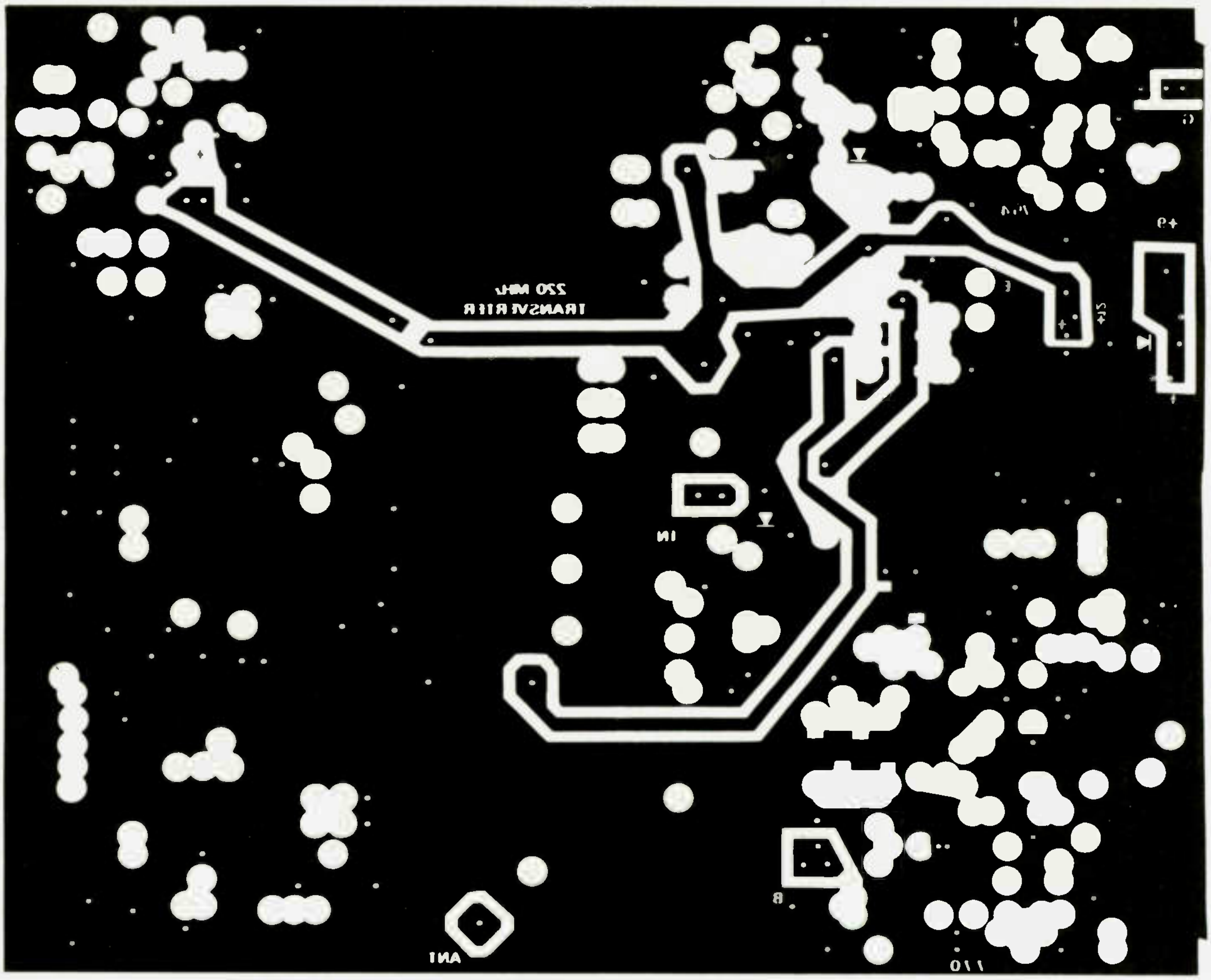

Fig. 5. Bottom of PC board.

power amplifier feeds pin 7 of K1 through pin 6 to the bandpass antenna filter and out to the coax, in the form of a very clean and respectable 223.500-MHz signal. How about that!

Should you want to work the 220 repeaters, all you have to do is to put your transverter mode switch to repeater, and forget it. The transverter automatically will select the 75.400-MHz oscillator, Q7, and connect it to the T1 mixer as before, except that the output frequency will now be 1.6 MHz lower than for simplex. The receive frequency will not be affected by this offset. It will still receive on the 77-MHz oscillator. While receiving on simplex, the 75.400-MHz LO is disabled through Q10 and D14, eliminating possible spurious responses created by the two oscillators beating. While transmitting, the 75.400-MHz LO is disabled only if the mode switch is in the simplex position. Both oscillators are powered by a 9-volt zener reference diode for good frequency stability. For extra precaution, one may want to put a diode in series with the 12-V lead for reverse-polarity protection.

One more note about the narrow bandpass filter. If properly tuned, the filter should be 4-MHz wide and pretty flat, because of later stages following the filter going into saturation amplification.

Construction

If you are going to make do with 1 Watt of power out, you will be making things a bit easier on yourself than does the ham who may want to go all the way up to the last stage of 10 Watts. The 10-Watt stage requires a little extra drilling and fitting to get the studded final power transistor in place. We will get into this a bit later.

The transverter was designed in such a way as to make it possible to assemble the entire unit on one PC board (double-sided) with only the LED lights, power switch, mode switch, and connectors to be wired after completion of the board. Foil patterns for the top and bottom of the board are shown in Figs. 4 and 5. Fig. 6 shows parts placement. I did, in fact, test and align the first unit outside the box, and later installed it into the box and completed the wiring of the final box within 20 minutes, including drilling the holes. An LMB box, no. CO-3, measuring 6″ × 7½″ × 2.75″ high, was found to be just the right size to fit the PC board with only 1/8″ of room left all around the box interior. No more extra room was needed because all of the wiring was located on the PC board. The panel LEDs, switches, and rear panel connectors did not require more than 1/8″ all around to sneak a wire through. The box also lends itself to

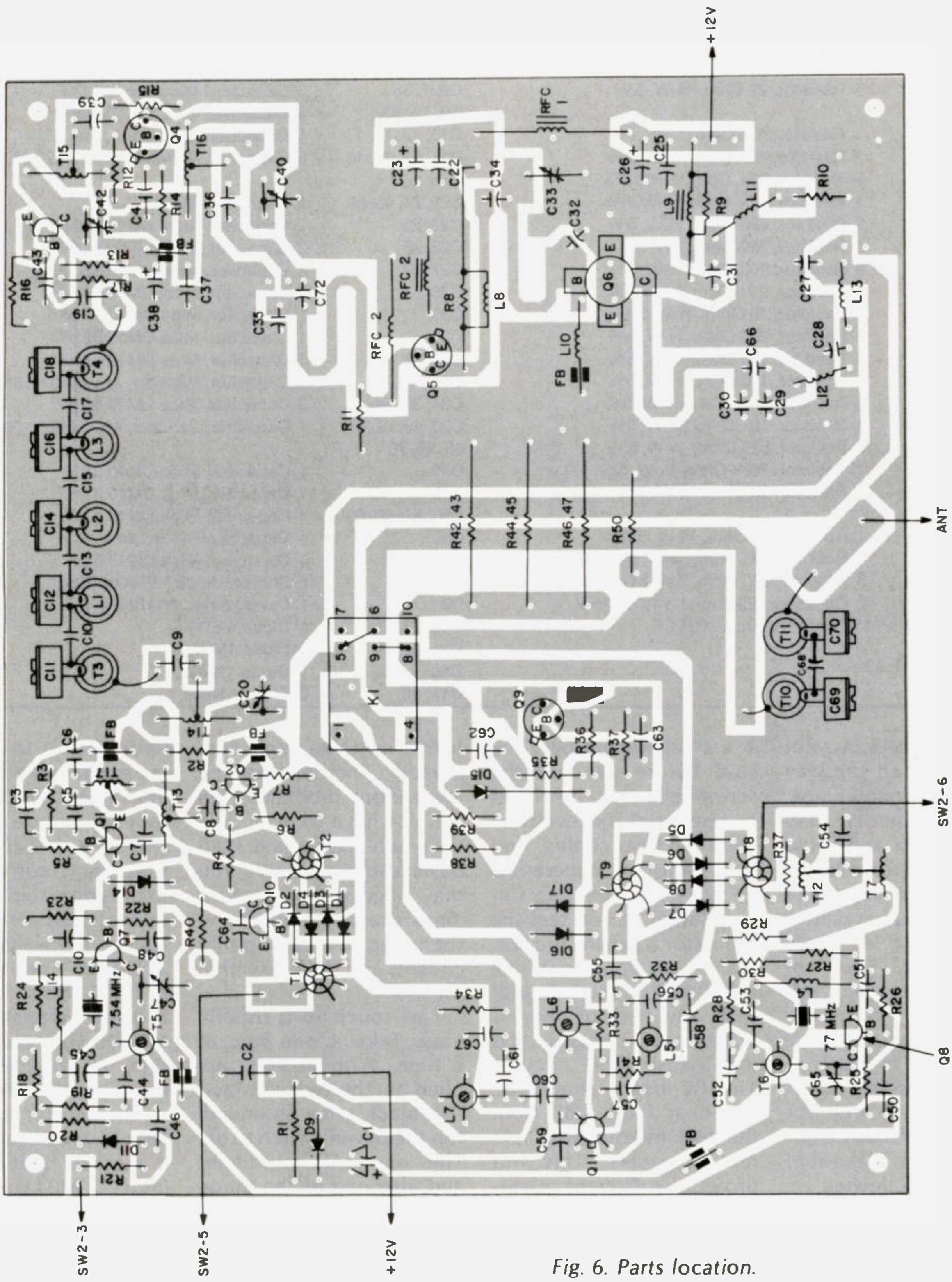

Fig. 6. Parts location.

this project very well because it has a removable top cover, enabling you to finish the wiring completely with all sides exposed. Tuning and testing will be made easy because of this. See Photo B.

The two switches and three LEDs located in the front panel take 1/4" holes, and the two UHF connectors in the rear panel can be the 5/8"-diameter type or the 4/40 mounting-screw type. They are spaced about 3½" apart and are set up about 1½" from the bottom of the cabinet, to clear the PC board. When mounting the connectors and the front-panel lights and switches, be careful to locate them in a place where they do not interfere with the components protruding from the PC board. RG-174/U minicoax is used for input and output connectors and also for the mode switch, SW2, controlling the two oscillators.

The ground braids of the three cables are connected together at the switch and are left free-hanging. The cables will be quite secure because all the connections make them very rigid. The three 1k resistors for the LEDs are connected directly to the LED terminals, and the other ends of the resistors are soldered straight to the PC ground. When soldering your components to the PC

Parts List

R1, 50, 51	3	Resistor, 100 Ohm, ½-W, 5%
R2, 7, 10, 18, 19, 28, 29	7	Resistor, 22 Ohm, ¼-W, 5%
R3	1	Resistor, 62k Ohm, ¼-W, 5%
R4, 39	2	Resistor, 15k Ohm, ¼-W, 5%
R5, 13	2	Resistor, 6.2k Ohm, ¼-W, 5%
R6	1	Resistor, 1.3k Ohm, ¼-W, 5%
R8	1	Resistor, 820 Ohm, ½-W, 5%
R9	1	Resistor, 330 Ohm, 1-W, 5%
R11, 31, 32	3	Resistor, 100 Ohm, ¼-W, 5%
R12	1	Resistor, 2.7k Ohm, ¼-W 5%
R14, 16	2	Resistor, 10 Ohm, ¼-W 5%
R15	1	Resistor, 200 Ohm, ¼-W, 5%
R17	1	Resistor, 390 Ohm, ¼-W, 5%
R20, 30	2	Resistor, 120 Ohm, ¼-W, 5%
R21, 23, 26	3	Resistor, 4.7k Ohm, ¼-W, 5%
R22, 25, 37, 38	4	Resistor, 10k Ohm, ¼-W, 5%
R24, 27	2	Resistor, 510 Ohm, ¼-W, 5%
R33	1	Resistor, 100k Ohm, ¼-W, 5%
R34, 35, 36, 52, 53, 54	6	Resistor, 1k Ohm, ¼-W, 5%
R40	1	Resistor, 3k Ohm, ¼-W, 5%
R41	1	Resistor, 39k Ohm, ¼-W, 5%
R42—R49	8	Resistor, 390 Ohm, 2 W, 5%
C1, 4	2	Capacitor, Electrolytic 10 uF/35 V
C2, 3, 5, 8, 37, 38, 39, 44, 46, 49, 51, 52, 57, 58, 62, 63, 64	17	Capacitor, Disc. .001 uF
C6, 7, 36	3	Capacitor, Mica DM10 10 pF
C9, 19, 56	3	Capacitor, Mica DM10 5 pF
C10, 13, 15, 17	4	Capacitor, Stackpole .5 pF
C11, 12, 14, 16, 18	5	Capacitor, Variable R-Triko 120-05, 1.2-10 pF
C21, 24, 48, 50	4	Capacitor, Disc. .01 uF
C22, 25	2	Capacitor, Mica DM10 220 pF
C23, 26	2	Capacitor, Electrolytic 5 uF/35 V
C27, 29	2	Capacitor, Mica DM10 12 pF
C28, 67	2	Capacitor, Mica DM10 20 pF
C30	1	Capacitor, Mica DM10 18 pF
C31	1	Capacitor, Mica DM10 82 pF
C32, 43, 45	3	Capacitor, Mica DM10 68 pF
C33	1	Capacitor, Variable, Arco #403 3-35 pF
C34, 35, 54	3	Capacitor, Mica DM10 15 pF
C20, 40, 42, 47, 65, 69, 70	7	Capacitor, Variable, Arco #402 1-20 pF
C41	1	Capacitor, Mica DM10 33 pF
C53	1	Capacitor, Mica DM10 62 pF
C55, 60, 66, 68	4	Capacitor, Mica DM10 1 pF
C59	1	Capacitor, Stackpole 3 pF
C61	1	Capacitor, Mica DM10 6 pF
D1—D8	8	Shottky diode, HP-5082-2080
D9	1	Diode, zener, 1N4739, 9 V
D10, 12, 13	3	Diode, LED
D11, 14, 15	3	Diode 1N34
D16	1	Diode 1N4002
D17, 18	2	Diode 1N914

board, take a little care not to push them all the way down to the ground plane; some components may have bare spots and could cause shorts across the top side of the PC board. Make sure your solder connections are good, and free from splashes. This will save you time when you get ready to fire it up. Details of filter construction are shown in Fig. 7.

The transparent rub-off lettering worked well for the marking of both front and rear panels. Make sure you put the following reminder on the front panel, as is shown in Photo A: 145 = 222 MHz; 146 = 223 MHz, and 147 = 224 MHz. This will keep you from guessing the new frequency after the project novelty has worn off and you can't remember the conversion formula.

If you are planning to put in the last amplifier stage for a full 10 W of output power, you will have to drill a 3/8" hole directly underneath the stud of the transistor. Place a piece of 1"x 2" aluminum over the stud before you put the screw back on it. It will act as a heat sink, necessary to keep the final cooled. You may want to add more fins to make the radiating surface larger, if you feel the transistor is getting too hot. Make sure your heat sink does not make contact with any part of the PC board that is not ground; it may cause short circuits. The PC board should be raised at least 1/4" from the deck by using four 1/4" metal spacers. This will provide sufficient clearance, and furnish a good solid ground to the chassis. The MRF225 driver transistor must also be equipped with a top-hat heat dissipator.

Alignment and Adjustment

After careful inspection to make sure that all of the correct parts have been installed in the proper places, you may proceed with the first step of the checkout procedure. All of the wires should be connected, including the lights, switches, and connectors. Should there be any serious problems, you will not have to dismantle the whole thing again. If all basic tests are positive, you may align the transverter "into the ball park," and then remove the panel gadgets and final-assemble the unit.

Last touch-up is usually easy. Take it one step at a time. With 12 volts applied to the red wire and the black wire grounded, flip the power switch to on. The "on" LED should light and also one of the mode lights, depending upon which position the mode switch is in. Flip the mode switch to the other position and the other LED should light. The total current drawn from your 12-volt supply is between 150-220 mA if all is normal.

Receiver and Antenna Filter

Tune in a known repeater on 220 MHz and hook up the transverter as in Fig. 1. Set the power switch to on and the mode switch either to simplex or repeater operation—it does not matter in the receive mode. Set the 2-meter transceiver to the frequency corresponding to the converted frequency as described earlier. For instance, if you have a busy 220-MHz repeater on 224.100 MHz, set your 2-meter transceiver to 147.100 MHz and tune C69, C70, L5, L6, and L7 for maximum S-meter reading on the 2-meter transceiver. Should you have problems, it may be that the oscillator (77,000 kHz) is not doing its thing. Usually, a few turns in either direction with the variable capacitor, C65, will get it going. All you need to do then is to put it on frequency by tuning C65 to a point that will show zero or midscale on a 2-meter discriminator meter. One more time, tune all of the previously-mentioned tuning elements for maximum signal strength. This completes the alignment of the antenna bandpass filter and also the FET preamp. Your sen-

T1, 2, 8, 9	4	Transformer, mixer, trifilar (see kit)
T3	1	Transformer, filter input, 5½T #16, .191 i.d.
T4	1	Transformer, filter output, 5½T #16, .191 i.d., tapped ½-turn cold end
T5, 6	2	Transformer, oscillator, 10T #32 on Gowanda .158, tapped 2T cold end
T7	1	Transformer, splitter, trifilar (See Kit)
T12	1	Transformer, splitter, bifilar (See Kit)
T10, 11	2	Transformer, matching antenna, 4½T #16 on ¼" i.d. tap 2T cold end
T13	1	Transformer, matching, 3T #20, .180 i.d., c-t
T17	1	Transformer, matching, 2T #20, .180 i.d., c-t
T14	1	Transformer, matching, 5T #20, .180 i.d., tapped 2T cold end
T15	1	Transformer, matching, 5T #20, .180 i.d., tapped 3T cold end
T16	1	Transformer, matching, 4T #20, .180 i.d., c-t
L1, 2, 3,	3	Coil, 5½T #16, .191 i.d.
L4, 14	2	Inductor, 1 uH, molded
L5, 6, 7	3	Inductor, variable, Gowanda #7 (.158)
L8	1	Inductor, 50 nanohenry, 5T #20 AWG on R2
L9	1	Inductor, 35 nanohenry, 2T #20 AWG on R3
L10	1	Inductor, 30 nanohenry, 1.5T #20 AWG on 0.25" i.d.
L11	1	Inductor, 90 nanohenry, 3.5T #18 AWG on .25" i.d.
L12, 13	2	Inductor, 44 nanohenry, 2T #18 AWG .25" i.d.
RFC-1, 2	2	Choke, VK200 19/4B
Z1	1	Transformer, microstrip, 2200 x 62 mils
Z2	1	Transformer, microstrip, 1200 x 62 mils
Z3	1	Transformer, microstrip, 1000 x 62 mils
Z4	1	Transformer, microstrip, 1600 x 62 mils
B	6	Bead, Ferroxcube 5659065/3B
Y1	1	Crystal, 77,000 kHz
Y2	1	Crystal, 75,400 kHz
K1	1	Relay, R10-E1-X2-V185
SW1	1	Switch, power, JBT, SPDT
SW2	1	Switch, mode, Alco MST 215
Q1, 2, 3, 4, 7, 8, 10	7	Transistor, MPS918
Q5	1	Transistor, MRF225
Q6	1	Transistor, MRF226
Q9	1	Transistor, 2N2270
Q11	1	Transistor FET, 3N202 or 40822
	1	Cabinet, LMB, #CO-3
IN/OUT	2	Connector, SO-238
	1	PC board (see kit)
	4	Spacer, ¼" brass

(For parts, PC board, etc., contact Frank Kalmus WA7SPR, 7016 NE 138th Street, Kirkland WA 98033.)

sitivity should be good—in the neighborhood of .15 uV, or so, even if your 2-meter radio is not that great. Remember, the transverter FET preamplifier is now your front end, and will set the noise figure and sensitivity unless your 2-meter radio is really bad.

Transmitter

If you possibly can do it, get ahold of any power meter capable of measuring a few milliwatts, like an H-P 430 (real cheap), and disconnect the center tap of T2. Connect a 50-Ohm resistor to ground from the end of the wire connecting to the T2 c-t. You now can fire up your transceiver in the low-power position. You should measure no more than 1 milliwatt, or so. In the 10-Watt position, you will measure 7-10 milliwatts. This is fine. If you do not get these readings, it may be necessary to change the coupling of the two 100-Ohm resistors, R50 and R51, to get more or less power sampled from the dummy load.

Once you satisfy yourself that you have sufficient drive for the mixer (consisting of T1 and T2 with the quad diode), you can proceed to the LO circuit, Q7. With the mode switch in the repeater position, the 75.400-MHz oscillator is selected. We must make sure the oscillator is working properly before we can continue. A frequency counter will help a lot—or a spectrum analyzer. (The latter is mentioned for reference only, realizing that the average ham can't afford that luxury.)

Connect the counter to R18 or pin 4 of the mode switch. Adjust C47 for a frequency reading of 75.400 kHz. You may now reconnect the c-t wire of T2 previously disconnected. Disconnect the 5-pF capacitor, C19, from T4 and measure power into an rf meter connected to this point, or into a spectrum analyzer. Tune C20, C11, C12, C14, C16, and C18 until you get some power output from the narrow bandpass filter. This is the hardest part of the tuning, and it may take several repeated efforts to get the filter to pass some rf. It is a very touchy filter, and although all other circuits are working, it might appear as if nothing was working at all. The filter can block all signals if not tuned correctly. If in doubt, disconnect the filter and bypass it to see if the 220-MHz signal is present after all of the mixing and amplification from the previous stages. If so, connect all back as before, and continue tuning the filter until you get some response. It should be possible to get 5-MHz bandpass from the filter, with very steep skirts.

The reason for the sharp filter is to reject the closely-located spurious frequencies caused by the mixer third harmonic ($3 \times 75.4 = 226.2$ MHz) and the frequency we want to process. Careful tuning will get the spurs down 60 dB. A spectrum analyzer is again the ideal toy to do it with. If all is done right, you should measure +6 dBm of 220-MHz signal at the output of the filter. Reconnect R19 and tune C42, C40, and C33 for maximum power output at the antenna terminal of your transverter. It should be about 1 Watt. If you want to go to 10 Watts and you have installed all of the necessary parts, no tuning is required. The final amplifier is somewhat broadbanded (about 10 MHz wide) and should produce about 60% efficiency when driven with 1 Watt and 12.5 volts. The output transistor is open- and short-circuit-protected for all load phase angles up to 15 V of dc input. Total current drawn by the transverter is 300-400 mA for 1-Watt output models, and 1.8 to 2 Amps for 10-Watt models. Harmonics and spurs on the prototype and first production unit were greater than 60 dB down.

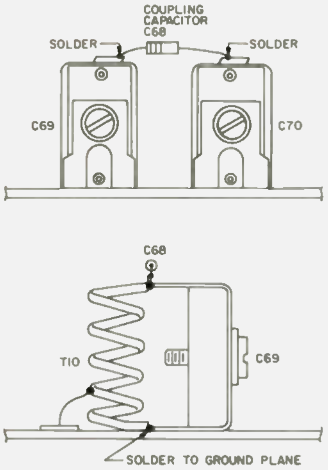

Fig. 7. Construction technique—2-section antenna filter and 5-section spurious filter.

After all checks out OK, you may proceed with the final assembly into the cabinet. Remove all lights, switches, and connectors and set the PC board inside the chassis with the crystal oscillators toward the rear of the cabinet. Mark the four mounting holes and drill them. Mount the PC board and string all of the cables through the cracks between the cabinet and the board for final wiring. You should not have to do much touching up after the final mounting process.

Putting the Transverter On The Air

After all circuits have been checked out and are working, the best way to tell what kind of a job you have done is to actually put the monster on the air and let the critical ears of your fellow hams judge you. Do not tell them what you are testing—they may be biased one way or another. If you are experiencing problems with noise or funny squeals in your 2-meter radio, it is your transverter doing it. It can be eliminated by slowly tuning one or the other oscillator slug until it stops. It will be caused by one of your oscillators putting out spurs if its tuning is not right. All you need to do now is to tune your 2-meter transceiver to simplex and let the transverter do the rest. It will put you on simplex receive and transmit if your mode switch is in the simplex position. If you want to go on a 220 repeater, leave your 2-meter radio on simplex on the repeater output frequency, but put the mode switch to repeater, and you are instantly in repeater-mode operation. You are now capable of tuning in to as many possible combinations as your 2-meter rig permits. If you have a 12-channel radio, you will have 12 channels on 220. If you are lucky and own a synthesized 2-meter radio, you will be able to play with 800 or 1000 channels on 220 MHz. Have fun, friends! I am sure having me a ball with this transverter!

The parts list is complete. All parts are easily obtainable from any local electronics shop. Most parts should be junk-box items, except for the high quality caps and Schottky diodes. A PC board is available for $14.00 from WA7SPR if you do not want to tackle your own layout. The hard-to-find toroidal transformers also are available in a small kit for $4.50 (T1-T2-T7-T8-T9 and T12). All other parts are available from the same source, should you have difficulties finding them in your area.

Total cost for the 1-Watt unit, assuming you have to buy everything, came out to about 65 bucks; it is $16 more for 10 Watts. If you have an average junk box, and wind your own coils, the 1-Watter should cost you no more than about $40.■

✓ Reader Service—see page 211

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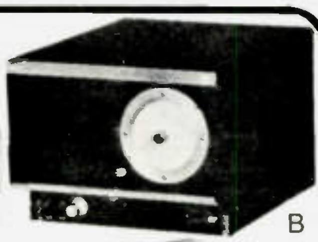

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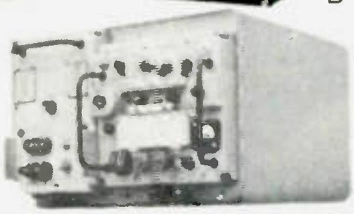

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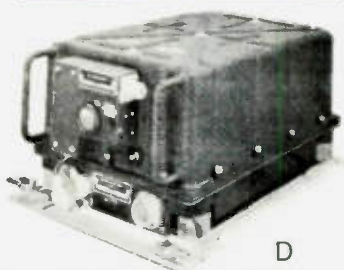

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130	1 95	190	1 85	241	1 71	313	1 00
131	1 98	191	2 07	242	1 90	314	7 85
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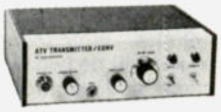

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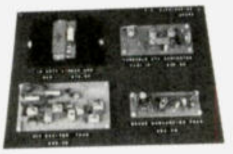

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Social Events

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 two months prior to the month in which the event takes place.

BLACKSBURG VA
OCT 1-6

Two expanded workshops on 8080/8085/Z80 microcomputer design, microcomputer interfacing, software design, and digital electronics are being given by the editors of the popular Blacksburg books. Participants have the option of retaining the equipment used in these courses. Dates are October 1-6, 1979. For more information, contact Dr. Linda Leffel, C.E.C., VPI and SU, Blacksburg VA 24061, or phone (703)-961-5241).

HOUSTON TX
OCT 5-7

The Houston Area Amateurs will host the ARRL West Gulf Division Convention on October 5-7, 1979, in Houston, Texas. For further information, contact Houston Ham Conventions, Inc., PO Box 79252, Houston TX 77024, or phone (713)-466-0518 or (713)-223-3161.

SIOUX FALLS SD
OCT 5-7

The '79 ARRL Dakota Division Convention will be held from October 5-7, 1979, at the Sioux Falls Airport Ramada Inn, located off Exit 81 on I-29, Sioux Falls, South Dakota. Featured will be technical and operating forums, a ladies' program, an ARRL forum, a large exhibit area, and a banquet. Prizes include an advance-registration prize of a DenTron GLA-1000 amplifier, a grand prize of a Kenwood TS-820S and a second grand prize of a Wilson System One™ antenna and WR-500 rotor. Registration is $15.00 ($16.00 after September 1) or $6.00 for the convention only ($7.00 after September 1). Talk-in on 146.16/.76. For further information and convention-rate hotel accommodations, write Sioux Falls Amateur Radio Club, Box 91, Sioux Falls SD 57101.

WARRINGTON PA
OCT 6

The Mt. Airy VHF Radio Club Inc., will hold its Hamarama '79 and Mid-Atlantic States VHF Conference on Saturday and Sunday, October 6-7, 1979. The conference will be held on Saturday, October 6, from 9:00 am to 5:00 pm at the Warrington Motor Lodge, Rte. 611, Warrington, Pennsylvania. Featured will be an all-day VHF program, a cocktail hour and get-together, and a buffet dinner. Registration is $3.00 in advance, or $4.00 at the door, which includes the flea market. The buffet dinner is $9.00. The flea market will be held on Sunday, October 7, from 8:00 am to 4:00 pm, rain or shine, at the Bucks County Drive-In Theatre, also on Rte. 611. Registration is $2.00 with tailgating $2.00 per space (bring your own table). Featured will be amateur radio equipment, electronic parts, surplus, and door prizes. Talk-in on 146.52 W3CCX. For information, write Ron Whitsee WA3AXV, Chairman, PO Box 353, Southampton PA 18966, or phone (215)-355-5730.

CORNWALL NY
OCT 6

The Orange County Amateur Radio Club will hold its annual auction on Saturday, October 6, 1979, at Munger Cottage, Cornwall, New York. Admission is $1.00 and includes a chance on a door prize. The auction begins at 1:00 pm and sellers should arrive at noon. Talk-in on .52. For further information, contact Bill Lazzaro N2CF, 11 Jefferson St., Highland Mills NY 10930.

TAYLOR MI
OCT 7

The third annual RADAR Hamfest and Swap 'n Shop will be held on Sunday, October 7, 1979, from 9:00 am until 3:00 pm at Kennedy High School, Northline Rd., Taylor, Michigan. Admission is $2.00. Featured will be computer displays, ham gear displays, door prizes, and food. Talk-in on .93/.33, .52/.52, and .99/.39. For information, write RADAR, Inc., PO Box 1023, Southgate MI 48195.

ROME GA
OCT 7

The Northwest Georgia Amateur Radio Club will hold its annual Rome Hamfest on October 7, 1979, at the Coosa Valley Fairgrounds, Rome, Georgia. Gates will open at 9:00 am. Talk-in on 146.34/.94 and 146.085/.685. For further information, contact WB4AEG, Box 274, Adairsville GA 30103.

BERRIEN SPRINGS MI
OCT 7

The Blossomland Amateur Radio Association will hold its fall Swap Shop on Sunday, October 7, 1979, at the Berrien County Youth Fairgrounds, north of Berrien Springs, Michigan, on US 31, beginning at 8:00 am. There will be commercial exhibits, prizes, refreshments, plenty of free parking, and display space. Space for self-contained campers, at $3.50 including electricity, is on the grounds. Talk-in on 146.22/.82. Advance tickets are $1.50; $2.00 at the gate. Eight-foot tables are $2.00 and are restricted to electronic items. For advance tickets and information, write Charles White, 1940 Union Ave., Benton Harbor MI 49022.

ROCK HILL SC
OCT 7

The York County Amateur Radio Society will hold its 28th annual hamfest on Sunday, October 7, 1979, starting at 8:00 am, at Joslin Park, Rock Hill, South Carolina. Registration is $2.75 each or 2 for $5.00 in advance, or $3.00 at the gate. The main prize is a Yaesu FT-901DM. A barbecue dinner is available at the park. Talk-in on 146.43/147.03 and 146.52. For more information, write York County Amateur Radio Society, Inc., PO Box 4141 CRS, Rock Hill SC 29730.

OTTAWA ONT CAN
OCT 12-14

The Radio Society of Ontario will hold its 11th annual convention at the Skyline Hotel, Ottawa, Ontario, Canada. On Friday evening, there will be a buffet and dance. On Saturday, there will be demonstrations, forums, technical sessions, a women's program, and a banquet and dance. On Sunday, there will be a flea market and delegates' meeting. For information, write PO Box 5076, Station F, Ottawa, Ontario, CAN K2C 3H3.

SYRACUSE NY
OCT 13

The Radio Amateurs of Greater Syracuse will hold their annual hamfest on October 13, 1979, from 9:00 am until 6:00 pm at the New York State Fairgrounds, located adjacent to I-690, 3 miles southeast of the New York State Thruway, Exit 39, one mile northwest of Syracuse, New York. For commercial exhibitors, a fee of $15.00 will include a booth with a display counter ten to fifteen feet in length or a table and two chairs. Included in the $15.00 fee will be two tickets to the hamfest. Accommodations are available at nearby motels or travel trailer and motor home space will be available on the grounds. Commercial exhibitors will be able to set up their displays Friday night from 7:30 to 10:00 pm or on Saturday morning from 7:30 to 9:00 am. For more information, contact Bob Edgett or Paul Dunn, exhibitor chairmen, c/o Radio Amateurs of Greater Syracuse, PO Box 88, Liverpool NY 13088.

ASHEVILLE NC
OCT 13

The Western Carolina Amateur Radio Society will hold its Asheville Autumnfest on Saturday, October 13, 1979, at the Asheville Civic Center, Asheville, North Carolina. There will be ample space for manufacturers, dealers, and the flea market, which will be in another part of the arena. A concession stand will be operated by the Civic Center. All manufacturers and dealers will have separate booths. And it will be possible to drive directly to your booth for unloading.

MEMPHIS TN
OCT 13-14

The Mid-South Amateur Radio Association and participating Memphis-area clubs will sponsor the Memphis Hamfest and Tennessee State ARRL Convention on October 13-14, 1979, at the Youth Building at the Mid-South Fairgrounds, Memphis, Tennessee. Featured will be forums, exhibits, a giant flea market, FCC exams, a hospitality party, and commercial and manufacturer exhibits. The display area will be open from 9:00 am to 4:00 pm on Saturday, and from 9:00 am to 2:30 pm on Sunday. Fifty trailer hookups are on the premises, which the Memphis Park Commission will rent for $5.00 per night. For further information, contact the Memphis Hamfest, PO Box 3845, Memphis TN 38103, or phone Clayton K4FZJ at (901)-274-4418.

BEAVER OK
OCT 14

The Beaver Hamfest will be held on October 14, 1979, at the Fairgrounds Building in Beaver

OK. Doors open at 8:00 am, with registration at 10:00 am. Tickets are $2.50 each. There will be a covered-dish luncheon, a short program at 1:30 pm, swap tables, and door prizes. Camper hookups are nearby and the event is airport-close. Talk-in on .01/.61 and .52. For details, contact Stella Shaw WB5VUN, Box 310, Beaver OK 73932, (405)-625-3368.

LIMA OH
OCT 14

The Northwest Ohio Amateur Radio Club will hold its annual hamfest on October 14, 1979, at the Allen County Fairgrounds, Lima, Ohio. Two large heated buildings will house the hamfest where tables will be available for $3.00 each. A flea market will be held outside for free. Advance tickets are $2.00 each. For information, send an SASE to NOARC, PO Box 211, Lima OH 45802.

WEST GHENT NY
OCT 14

The Northeastern States 160-Meter Amateur Radio Association will hold its annual election and banquet on Sunday, October 14, 1979, at Kozel's Restaurant, Rte. 9H, West Ghent, New York. There will be a flea market in the rear parking lot at 1:00 pm and a roast beef dinner at 5:00 pm. All hams and XYLs are welcome. For reservations and details, contact William Derby WA5IOD, Secretary/Treasurer, 14 Plain St., Medfield MA 02052.

ISLIP LI NY
OCT 14

The Long Island Mobile Amateur Radio Club, Inc., will hold its Hamfair '79 on Sunday, October 14, 1979, from 9:00 am until 4:00 pm at the Islip Speedway, Rte. 111 (Islip Ave.), one block south of Southern State Pkwy., Exit 43, or come south from the Long Island Expressway, Exit 56, Islip, Long Island, New York. There will be free parking, door prizes, and several contests. Admission is $1.50 (non-hams are free) and $3.00 per seller's space, which permits one person to enter. For information, call Hank Wener WB2ALW, nights, at (516)-484-4322, or Sid Grossman N2AOI, nights, at (516)-681-2194.

ANAHEIM CA
OCT 19-21

The ARRL Southwestern Division Convention will be held on October 19-21, 1979, at the Sheraton-Anaheim Hotel, located at Ball Rd. and I-5, Anaheim, California. The convention will begin on Friday evening with registration and exhibits from 4:00 pm until 9:00 pm. On Saturday, registration will begin at 8:00 am and exhibits and technical sessions will run from 9:00 am until 3:30 pm. FCC testing will continue until 3:30 pm also. The ARRL Forum will be held from 4:00 pm until 5:30 pm, with a no-host cocktail party being held until the 7:30 pm banquet. The Wouff Hong pageant will be held at 00:01 am PST on Sunday morning. At 9:00 am Sunday morning the various breakfasts will be held and the exhibits will again be open until noon. The pre-registration deadline is September 15, 1979. Advanced registration price, which includes complete program, banquet, exhibits, and technical sessions, is $17.00, and $19.00 at the door. The charge for the banquet only is $12.00, and for exhibits and technical sessions, the charge is $5.00, pre-registration; $6.00 at the door. The ladies' program and luncheon is $6.00, pre-registration only. For more information and pre-registration, contact Hamcon, PO Box 1227, Placentia CA, or phone (714)-993-7140.

CEDAR RAPIDS IA
OCT 19-21

The 1979 ARRL Midwest Division Convention and CVARC Hamfest will be held on October 19-21, 1979, at the Five Seasons Center, Cedar Rapids, Iowa. Tickets are $4.00 in advance or $5.00 at the door. Forums will include FCC, ARRL, DX, antenna, AMSAT/OSCAR, FM and repeaters, microprocessors, modern CW, and more. A flea market will be held at $5.00 per table with 150 tables available. Reservations are good for Saturday and Sunday and must be paid in advance. Pre-registrations will be taken through October 1, 1979. Setup begins at 6:00 am Saturday. FCC exams also will be given on Saturday. (Send Form 610 and copy of license two weeks in advance.) There will be many prizes, including a grand prize of a deluxe HF transceiver, a TH6DXX antenna, a HAM III rotor, and a 60-ft Rohn 25G tower. There will be a Saturday-evening banquet, with Senator Barry Goldwater K7UGA as guest speaker. There are many hotels and motels available. Talk-in on 146.34/.94. For information, write Convention, Cedar Valley Amateur Radio Club, Box 994, Cedar Rapids IA 52406.

READING MA
OCT 20

The Quannapowitt Radio Association will hold its annual auction on October 20, 1979, at the Knights of Columbus Hall in Reading, Massachusetts. Doors will open at 10:00 am and the auction will start at 11:00 am. Food and refreshments will be available. Talk-in on 146.52. For information, call Bob Reiser AA1M at (617)-272-6219.

SAVANNAH GA
OCT 20-21

The first annual Hostess City Hamfest will be held on October 20-21, 1979, at the National Guard Armory, Eisenhower Dr., Savannah, Georgia. Admission will be $2.50 in advance and $3.00 at the gate, with tables for $5.00. Featured will be a flea market, ladies' programs, awards, and FCC exams. Talk-in on .37/.97, .10/.70, .28/.88, .63/.03, and 3,975 kHz. For additional information and advance tickets, write the Hostess City Hamfest Committee, PO Box 1237, Pooler GA 31322, or phone (912)-748-6125.

BILOXI MS
OCT 20-21

The Gulf Coast Ham/Swap Fest will be held on Saturday and Sunday, October 20 and 21, 1979, located at the west end of the Biloxi-Ocean Springs bridge on Highway 90 in Biloxi MS. Tables are $3 per day or $5 per weekend. Talk-in on 146.13/73 and 146.52. For information, advance tickets, and tables, contact Al Williams WD5GNR, 311½ DeMontluzin Ave., Bay St. Louis MS 39520.

NORFOLK VA
OCT 20-21

The fourth annual Tidewater Hamfest-Computer Show-Flea Market will be held on October 20-21, 1979, starting at 9:00 am at the Norfolk, Virginia, Cultural and Convention Center SCOPE, Norfolk, Virginia. There will be 60,000 square feet of air-conditioned exhibit and flea market tailgating space available. Featured will be ARRL meetings, DX and traffic forums, and a CW contest. FCC exams are planned for amateur upgrading on Saturday from 9:00 to 12:00 am. A special feature will be a dinner cruise and banquet on the *Spirit of Norfolk* cruise ship on Saturday night for $16 per person, or $30 per couple. Advance registrations are $2.50 (include an SASE) or $3.50 at the door. Flea market tailgate spaces are $3.00 per day. For tickets and information, write TRC, PO Box 7101, Portsmouth VA 23707.

KALAMAZOO MI
OCT 27

The 25th annual VHF Conference in honor of Walter Marburger W8CVQ, founder, will be held on Saturday, October 27, 1979, at Western Michigan University, Department of Electrical Engineering, Industrial Engineering & Technology Building, Room 3034, Kalamazoo, Michigan. At 10:00 am, there will be a morning registration; a final registration will commence at 2:00 pm. At 2:30 pm, Dr. Larry Oppliger will give a welcome. This will be followed by three speakers. At 6:30 pm, there will be a dinner at the University Student Center (by reservation only). For reservations, write Electrical Engineering Dept., Western Michigan University, Kalamazoo MI 49008.

CHATTANOOGA TN
OCT 27-28

Hamfest Chattanooga will be held on October 27-28, 1979, at the Chattanooga State Technical Community College, Chattanooga, Tennessee. Events include FCC exams, prizes, contests, exhibits, forums, and ladies' programs. The indoor dealer area is $15.00 per table and the outdoor paved flea market area is $2.00 per space each day. Talk-in on .19/.79 and 3980. For pre-registration, with prize ticket and information, send $1.00 to Hamfest, PO Box 95, Chattanooga TN 37401.

LONDON ONT CAN
OCT 28

The London Amateur Radio Club will hold its 2nd annual Swap and Shop on October 28, 1979, from 8:00 am until 4:00 pm at Lord Dorchester High School in Dorchester, just off 401. Admission and tables are both $2.00. Featured will be displays and prizes. Talk-in on .78/.18. For more information, write VE3CSK, RR #1, Ailsa Craig, Ontario, Canada N0M 1A0.

MARION OH
OCT 28

The 4th annual Heart of Ohio Ham Fiesta will be held on October 28, 1979, at the National Guard Armory, Marion, Ohio. Featured will be a flea market, prizes, and forums. Dealer space will be available. Talk-in on .90/.30 and .52. For more information, contact Paul Kilzer W8GAX, 393 Pole Lane Road, Marion OH 43302.

FT. MYERS FL
NOV 3-4

The Fort Myers Amateur Radio Club and the ARRL will hold their Hamarama '79 on November 3-4, 1979, from 9:00 am to 5:00 pm on Saturday and from 9:00 am to 3:00 pm on Sunday at the Ramada Inn, on the Caloosahatchee River, Ft. Myers, Florida. A hospitality welcome center will be held on Friday, November 2nd, from 7:00 to 10:00 pm. Featured will be dealer displays, forums, YL and XYL awards, computer displays, and a gigantic flea market. Registration is $2.00 each in advance or $3.00 each at the door. Talk-in on .28/.88, .19/.79, .52, and .94. For information, send an SASE to Bob Sloat K4VGN, PO Box 05-37, Tice FL 33905, (813)-334-6190, or Don Redd WD4ERQ, 1857 Sunset Place, Ft. Myers FL 33901, (813)-332-1825.

WEST MONROE LA
NOV 11

The Twin City Ham Club will sponsor North Louisiana's annual "Hamfest" on Sunday, November 11, 1979, from 8:00 am until 3:00 pm at the West Monroe Civic Center, North 7th Street and Ridge Avenue, West Monroe, Louisiana. Tickets may be purchased at the door or in advance for admission and for the prize drawings. Featured will be swap tables for buying, selling, or trading amateur and related equipment, displays of new radio and electronic equipment, information on becoming an amateur operator, and prizes. Everyone is invited. The building is heated and cooled for your comfort. Talk-in on .25/.85, .52/.52, and 3910.

FRAMINGHAM MA
NOV 11

The Framingham Area Radio Association will hold its indoor electronic flea market on Sunday, November 11, 1979, from 10:00 am until 2:00 pm at the Framingham Police drill shed behind the police station, Framingham, Massachusetts. From Rte. 9, take Rte. 126 south to the center of Framingham. Sellers' setup time is from 9:00 am to 10:00 am. Advance table reservations will be $5.00, with tables available at the door for $7.50. Refreshments will be served outside the flea market area. Talk-in on .75/.15 and .52. For information or reservations, write Framingham Area Radio Association, PO Box 3005, Framingham MA 01701.

CLEARWATER FL
NOV 17-18

The Florida State ARRL convention will take place on November 17-18, at the Sheraton Sand Key Hotel on Clearwater Beach, Clearwater, Florida. An Icom 701 HF station is the main door prize. The latest update on WARC proceedings is just one of the interesting forums we have scheduled. FCC exams will be given on Saturday at 9:00 am. Please send 610s to the Tampa office by November 9. There will be ladies' events both days, with a luncheon and style show on Sunday. Tickets are $5, which includes a Tappan microwave oven as first prize. The QCWA Gator Chapter will host the Saturday luncheon, with all hams and guests welcome, too; tickets are $6. Saturday evening banquet tickets are $9. Swap tables are $10 for both days—no one-day tables, all advance sold. There should be plenty of parking with courtesy buses running on demand for the duration of the hamfest. We have arranged for special room rates at $30 double, per day, with each extra person $4 and kids under 18 free. Hamfest donation is $3; each advance ticket includes two free prize tickets. Talk-in on .37/.97 and 223.34/224.94. Please make all reservations through and checks payable to: FGCARC (Florida Gulf Coast Amateur Radio Council, Inc.), PO Box 157, Clearwater FL 33517. For ham convention and hotel reservations, phone (813)-461-HAMS.

MASSILLON OH
NOV 18

The 22nd annual auction, Auctionfest '79, sponsored by the Massillon ARC, will be held on November 18, 1979, from 8:00 am until 5:00 pm at the Massillon Knights of Columbus Hall, Massillon, Ohio. The flea market opens at 8:00 am, with auction action at 11:00 am. There will be prizes and displays. Talk-in on 146.52 simplex. Tickets are $2.00 in advance; table reservations are $1.00 per table. For further info, write to Joe Turkal K8EKG, 1234 Concord NW, Massillon OH 44646.

FORT WAYNE IN
NOV 18

The Allen County Amateur Radio Technical Society is sponsoring the seventh annual Fort Wayne Hamfest on November 18, 1979, from 8:00 am to 4:30 pm in the Allen County Indiana Memorial Coliseum, Fort Wayne, Indiana. For more information, write Victor M. Locke, Reservation Chairman, 1415 Edenton Drive, Fort Wayne IN 46804, or phone (219)-432-8047.

OAK PARK MI
NOV 25

The Oak Park High School Electronics Club will present a Swap 'n Shop on Sunday, November 25, 1979, at Oak Park High School, 13701 Oak Park Blvd., Oak Park, Michigan. Donation is $1.50 and tables are $2.50. There will be refreshments and door prizes available.

Ham Help

I was recently sent a General Electric 40-channel mobile Citizens Band AM transceiver by a relative in the USA. I would like to convert this rig to the 10-meter band. A friend lent me some copies of *73 Magazine* and I see you've been running articles on this conversion, but I didn't see any covering my set. It's a model 3-5801.

Could any of your readers help me with this conversion? I promise to try to work you with this rig once it's on ten!

Incidentally, 27-MHz CB from the USA can be heard over here quite well when the skip is right.

My own equipment at present is Sommerkamf FLDX500 and FRDX500 and I operate all bands 80-10 at 100 Watts output, although I have an FL1000 amplifier which can go up to 600 Watts.

I hope some of your readers might be able to help me. The full name of the village QTH here is LLANFAIRPWLLGWYNGYLLGOGERYCHWYRNDROBWLLANTYSILIOGOGOGOCH. So if anyone wants a QSL from the (I believe) second largest place name on earth, just let me know.

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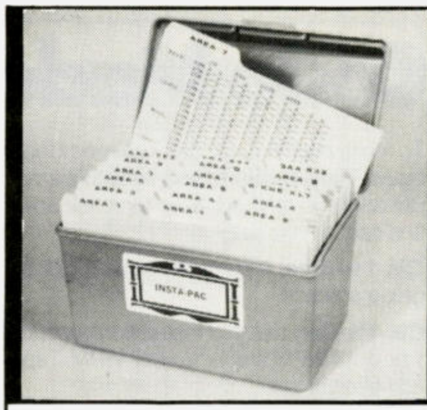

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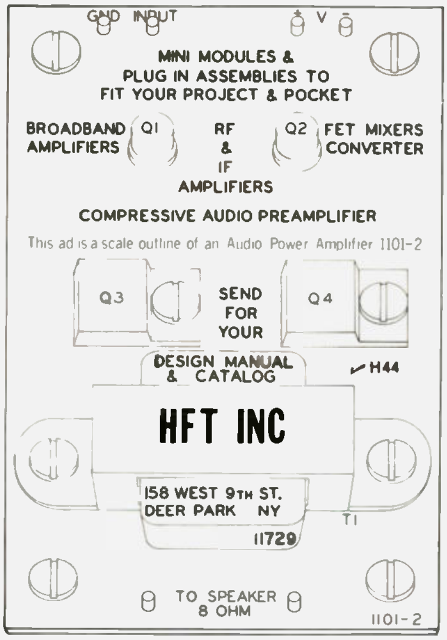

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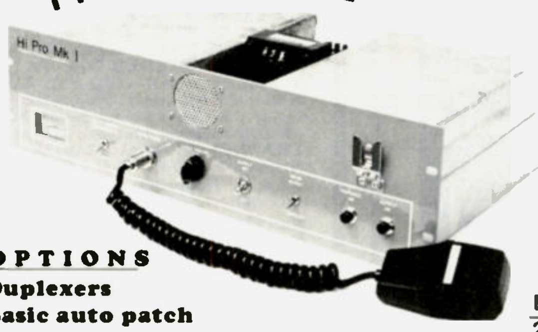

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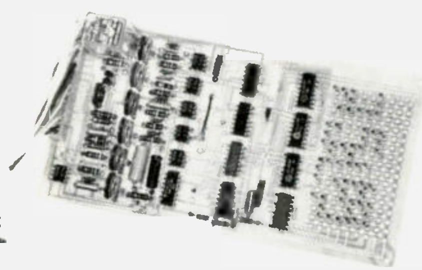

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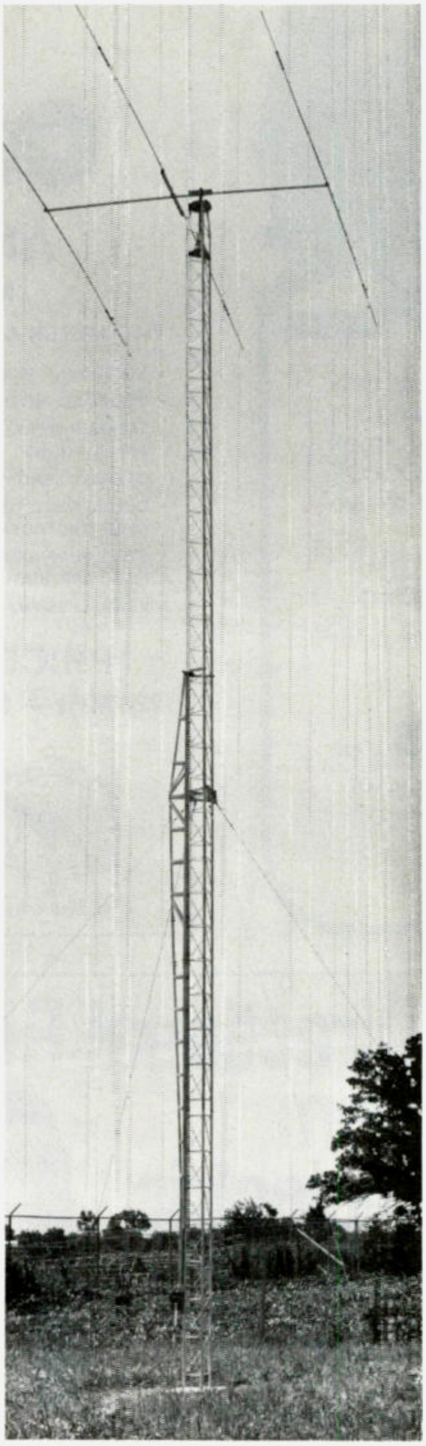
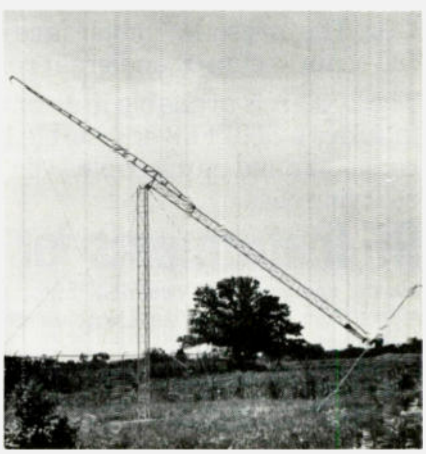




✓ *Reader Service—see page 211*

New Products

from page 32

with pre-cut and pre-bent leads. You won't be pushing diodes with plier-nicked leads or the wrong spread into the sockets, damaging the contacts. For this reason, if the 50 diodes supplied aren't enough (unlikely), I recommend ordering the extras from Drake. Since the extra offsets beyond the standard ones are set up on a diode board, elimination of diodes would require the oddball offsets to be set up with switches on the front panel. That wouldn't be a bad idea, anyway.

The power connector is a 2-pin Jones with the pins exposed on the back panel. There ought to be a guard around it to protect the pins from damage if the unit is dropped. Recessing would be better, but there isn't room inside. Also, there should be some kind of locking feature to keep this connector from vibrating off in mobile operation.

The accessory connector is very well thought out as to the functions provided on it, but it needs to be relocated to the back panel and changed to a type that permits a strain relief on the cable.

Because of heat sink limitations, the transmitter cannot run continuously at 25 Watts. This should never be a problem in two-way voice operation, but continuous RTTY or data transmission would require either reduced power or additional cooling.

Like almost all other transceivers, the UV-3 puts the encoder, if present, on the back of the mike. That makes safe phoning while in motion a rather uncertain proposition. The encoder keyboard for any mobile rig should be mounted on something that is secured to the vehicle, such as the control panel, to allow operation with one hand on the wheel and both eyes on the road. The oft-proposed solution of stopping to phone is no answer if the problem involves reporting a drunk driver and keeping him in sight until the police come up.

The UV-3 represents a big step forward in fitting a VHF transceiver to the needs of the amateur service. On the other hand, the fit isn't quite perfect yet, and a little more tailoring would be in order either on the next product or after they take another look at the placement of the controls on the panel. We hope Drake won't be seduced in the direction of copying any of the more spectacular but irrelevant features of competing products.

We are unlikely to see a transceiver of higher basic quality, especially at ham prices. In many of the most important performance specifications, though, quality is as high as ham applications require, so that improvement is probably not even definable. Various added features could be conceived to fit the unit to specific operating situations, but the accessory jack provides plenty of hooks for doing such things outboard.

I, for one, won't hold my breath waiting for a better transceiver to come along. *R. L. Drake Company, 540 Richard St., Miamisburg OH 45342; (513)-866-2421.* Reader Service number D11.

John A. Carroll AB1Z
Bedford MA

USER REPORT: THE DATONG FL1 AUDIO FILTER

The audio filter has become an increasingly popular add-on device in the amateur station. The reasons are clear. Today's amateur bands are becoming more crowded as more and more amateurs are licensed in the US and abroad, and more broadcasters and intruders sneak onto our frequencies. With the tremendous increase in QRM, amateurs have had to search for ways to improve reception ability. To some extent, recent developments in receiver design and construction have helped, but unfortunately there is a trade-off for the improvement: It is expensive!

Audio filtering has become popular because it helps to reduce the increased QRM, is relatively inexpensive, is simple to install in a receiver audio line, and is an effective filtering technique for everything except front-end overload and intermodulation.

The current state of the art in audio filters can best be seen in the Datong FL1 "Frequency-Agile" filter. It is manufactured in England and is truly the Rolls Royce of the current filter market. The FL1 has all of the most advanced features available in audio filtering, plus a couple that are unique.

By far the most unusual feature of the FL1 is its remarkable automatic notch system. With this system in operation, the filter automatically seeks out carriers and heterodyne whistles and suppresses them. If, for example, someone plops a big carrier near a frequency one is operating on, he will hear the carrier for about a second, and then it will practically disappear, totally automatically. The S-meter reading, of course, will not change, but the operator will not hear the carrier any more and will hear the signal he wants to hear. This feature is especially effective on 40 meters, where it serves well to combat all of the broadcast carriers. I have had QSOs on 40 that would have been impossible without the FL1, and it works well on other bands, too. Tuner-uppers and carriers are no longer a problem.

The filter accomplishes this feat through a highly ingenious phase-locked loop system. Not only does the phase-locked loop system allow for automatic notch tuning during SSB operation but it also provides another feature, a limited automatic frequency-control system which allows for easy receiver tuning with even the narrowest of bandwidths. The filter will crank down to a bandwidth of 25 Hz rather smoothly and with no ringing, although it is easy to tell that it is right on the verge of ringing, especially with high-speed CW.

In typical SSB operation, the automatic notch system is left operable. SSB signals can be either peaked or notched, although I have found that peaking generally works best. When adjacent QRM and splatter are severe, the automatic notch system can be defeated to allow for manual tuning of both the bandpass width and the center frequency of the filter. Here the FL1 has advantages over many of the audio filters now available. First, the gain of the filter is independent of bandwidth. This means that the bandwidth can be narrowed without affecting the gain of the audio, whereas on many filters it is necessary to readjust the volume whenever the bandpass is narrowed. When the FL1 bandpass is set on an extremely narrow setting, there is a slight reduction in gain, but not nearly so pronounced as with most other filters.

Second, and more important, the bandwidth of the filter is independent of its center frequency. In some filters of the constant-Q type, it is necessary to alter the bandwidth whenever the center frequency is changed. This is not so with the FL1, and the result is a smooth "feel" to the filter frequency tuning which approximates receiver tuning itself.

The FL1 is more effective for SSB work than other audio filters I have tried. Normally, I leave the filter in the automatic mode when I am on SSB and it does all the work. It knocks out any nearby carriers, CW or RTTY, that show up. When QRM gets tough, though, I switch to manual control and adjust the bandpass and center frequency for maximum intelligibility with minimum bandwidth.

On CW, the automatic notching system is normally left off because it will tend to notch out the signal one wants to listen to. The FL1 is very smooth on CW, even at extremely narrow bandwidths. This is due to the fact that it contains a limited afc function with a bandpass width of about ±50 Hz, making the filter tune smoothly across a wide range of center frequencies. On filters without this afc feature, it is difficult to tune in (or notch out) desired signals at extremely narrow bandwidths due to drift and varying frequencies in a net or roundtable. On the FL1, however, the afc action keeps the filter on the received signal.

Should you wish to operate without the afc feature, all you have to do is push in a button labeled -afc and the function is disabled. Normally, for CW work, I use the filter in the peak

The Datong FL1 audio filter.

position with fairly narrow bandwidth. It is then possible to vary the center frequency and tune across several CW signals, even though they may be practically on the same frequency. One ends up with a narrow window which can be moved up and down a number of signals, letting in only the one wanted. The filter works so well on CW, even in heavy contest operation, that I have decided not to purchase the optional CW crystal filters for my new solid-state transceiver.

The filter has its own audio amplifier circuit which will deliver about 2 Watts into an 8-Ohm load. This is sufficient to drive headphones easily and speakers at all but the loudest levels. Even with the volume turned up high, the audio is smooth and distortion-free. It sounds very good in a pair of 8-Ohm stereo headphones.

The FL1 has a comprehensive switching and control arrangement with three variable knobs and five push-buttons on the front panel. The knobs and buttons are large and easily accessible, which, in this age of ever-increasing miniaturization, is a pleasant change. One of the knobs controls the bandwidth and varies it from 25-1000 Hz in the peak mode and from 20-800 Hz in the notch mode. A second knob controls the center frequency, varying it from 280-3000 Hz. The third knob controls the volume and is ganged with an adjustable pot on the back of the unit which allows the input level from the receiver to be preset at any desired level. This gives considerable flexibility in the type of headphones and speakers which can be used with the FL1, and it also ensures that the audio level coming out of the speaker will be constant whether the FL1 is on or not.

The five push-button switches turn the unit on and off, turn the afc function on and off, turn the automatic notching feature on and off, control whether the filter is in the peak or notch position, and allow the filter to be left on but bypassed. One front-panel LED indicates when the unit is on and another one, labeled "lock," indicates when the automatic notch has captured a carrier on SSB or when a signal has been correctly tuned in and peaked on CW. The headphone jack is also on the front panel.

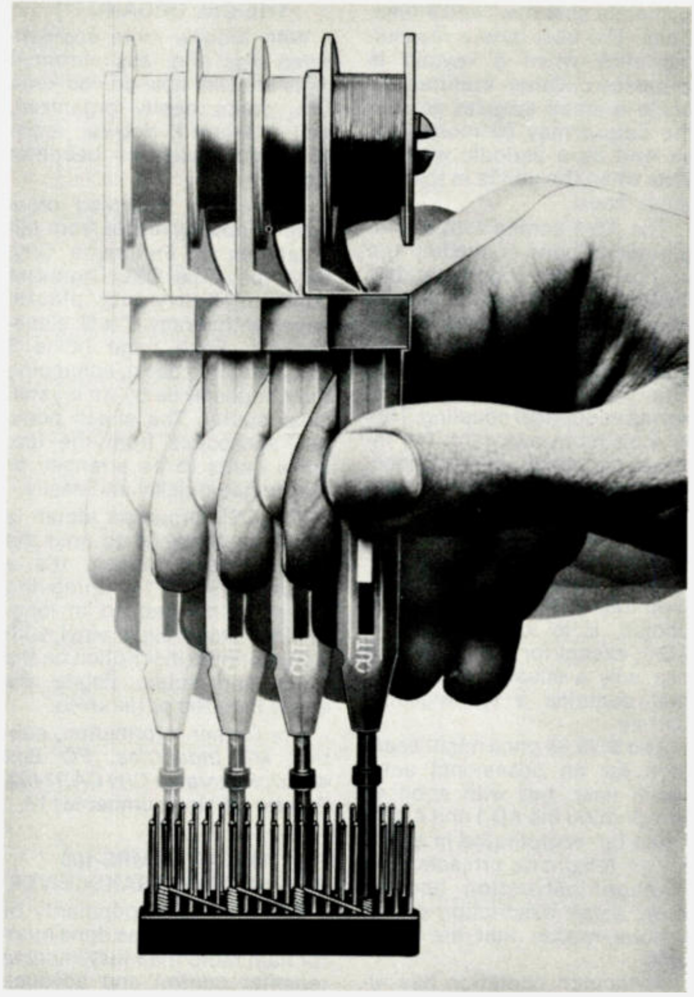
The unit is obviously of high quality construction, with two printed circuit boards and quality components packed into an attractive, high-impact plastic case. The unit is bypassed against rf, and I have noticed no rf getting into it except on a couple of occasions when I have operated the amplifier into extremely high swrs. The FL1 is a complex filter with numerous functions, and it therefore is packed with parts, including eight ICs, six transistors, and eleven diodes. It requires power of between 6.0 and 16 volts at about 100-300 mA, depending upon how much audio is needed. I use a little 12-V dc supply which works quite well. Provision is made internally to plug in a standard nine-volt battery.

The FL1 is a super filter, but no piece of gear is perfect, and this one does have some minor problems. First, it uses identical DIN jacks for the speaker/headphone output and for the power supply input. The filter itself is protected against improper plug-ins, but it might be possible to destroy a power supply if one accidentally plugged it into the wrong jack. Second, the unit is very lightweight (a little more than 1½ pounds), and it will slide across the table when one tries to push in one of the push-buttons. I have had to weigh mine down to get it to stay still. Third, the price for the unit is somewhat steep at $179.95 (although lately several other filters have come out in the same price range).

The FL1 is, however, worth the price. I have used both home-brew and commercial audio filters in the past, but I have never used one that even begins to compare to the FL1. I have found that most audio filters work well on CW but are virtually worthless on SSB, and this is where the FL1 shines. It is far and away the best filter for SSB work I've used, not only when it is in the automatic mode and doing the work itself, but also when it is in the manual mode and one controls the bandwidth and center frequency. And on CW, the FL1 compares to any other filter I've used until it gets down to extremely narrow bandwidths. There, because of its afc function, it performs better than the others. Since I have decided not to purchase any of the optional crystal filters for my new solid-state transceiver, the filter has practically paid for itself already.

Audio filtering has been proven to be effective, and with all of the filters coming out on the market, obviously it is becoming more popular. It is somewhat surprising that more of the manufacturers have not included audio filtering in their transceivers and receivers. Until they do, we shall have to continue using add-on devices, and, of those on the market today, the Datong FL1 appears to be the leader. *Datong Electronics Limited, Spence Mills, Mill Lane, Bramley, Leeds LS13 3HE, England, UK.* Reader Service number D62.

R. Stanley Dicks W8YA
Wheeling WV



OK's "Just Wrap"™ tool.

OK INTRODUCES REVOLUTIONARY WIRING TOOL

OK Machine and Tool Corporation has announced "Just Wrap"™, a revolutionary wiring process and series of tools that produce wire-wrapped connections without prior stripping or slitting of the wire insulation. Designed to wrap on .025-inch square posts, each tool carries a 50-foot spool of 30 AWG wire. The tool will wire continuously through any number of pins (daisy chain). It is equipped with a handy built-in wire cutoff and is equally suited for point-to-point wiring. Wire is available in 4 colors: blue, white, red, and yellow.

For further information, contact *OK Machine and Tool Corporation, 3455 Conner Street, Bronx NY 10475.* Reader Service number O5.

THE AD-1 AUTODIALER

You are fighting bumper-to-bumper traffic during the drive home after a hard day at the office. Suddenly, a car in the opposite lane swerves out of control and causes a serious accident. The confusion that results does not allow you to take your hands off the wheel for more than a second or two. Luckily, you recently installed an autodialer on your two-meter rig. Only two buttons are pushed (one to access the patch, another to dial the number) and you are in touch with the nearest police station. Not only does the Advanced Electronics Applications (AEA) AD-1 autodialer make autopatch operation easy, but it also makes it safer for you and your fellow motorists.

The AD-1 resembles a normal touchtone pad, except that it is slightly thicker and heavier. The tough black plastic case contains the circuitry necessary to store and recall ten seven-digit numbers, provide easy callback, and act as a conventional touchtone pad. An additional eight numbers may be stored in a special factory-programmed chip. The design makes hookup to most amateur FM transceivers a simple task.

The heart of the AD-1 is four integrated circuits which provide tones that will satisfy even the most stringent repeater. The keyboard contains the ten numerals plus the * and # functions. The user gets a reassuring click when a keypad is depressed. Other features include a small speaker so that the output may be monitored, as well as a periodic warning tone when the unit is in the program mode.

The AD-1 comes with a four-pin microphone connector and a short length of coiled cable. Depending on the rig, it may be interfaced between the microphone and transceiver or hooked to an accessory socket. The push-to-talk method involves acoustical coupling. This is a bit more awkward, but involves no permanent connections other than a 12-volt supply. An internal potentiometer allows user adjustment of the output level. If you are only interested in acoustical coupling, then the AD-1P might be a good choice. It is identical to the AD-1, except for the fact that it has only a speaker for output and contains a rechargeable battery.

The $129.95 price might seem high for an occasional autopatch user, but with a bit of imagination the AD-1 and AD-1P could be incorporated in a variety of telephone projects. The 26-page instruction booklet gives a fair description of the various modes that are available.

Autopatch operation has always been a great way to show off the utility of ham radio. Now, you can make it safer and more fun with the AEA autodialer. *Advanced Electronic Applications, Inc., PO Box 2160, Lynnwood WA 98036; (206)-775-7373.* Reader Service number A94.

Tim Daniel N8RK
Peterborough NH

THE QSL ORGANIZER

With today's more sophisticated rigs and less cluttered radio shacks, how do you keep QSL cards neatly organized, well preserved, dog-ear resistant, and always on beautiful display?

A specially designed organizer is now available from Mil Industries of Panorama City, California. The QSL Organizer contains heavy-duty plastic pages with roomy 4" x 6" slip-in pockets. Each page holds 6 QSLs (back to back), enhancing their appearance by its crystal-clear clarity. The slip-in pockets, accessible from the top, allow cards to be arranged or rearranged quickly and easily.

The QSL Organizer album is specially designed to hold the slip-in pocket pages. It's a beautiful 9" x 14" three-ring binder, richly padded in long-lasting "Brown-Hide" vinyl, with a gold-printed inscription on the cover and spine. Pages are easily inserted or removed.

For further information, contact *Mil Industries, PO Box 44457, Panorama City CA 91402.* Reader Service number M117.

The QSL Organizer.

THE XITEX MRS-100 MORSE CODE TRANSCEIVER

The increasing popularity of microcomputers has done more for ham radio than just improve repeater control and advance RTTY operation. The Xitex MRS-100 Morse code transceiver will be of interest to the newest Novice as well as the old-time CW operator. When used with a standard ASCII or Baudot terminal, it becomes possible to generate and receive Morse code at any speed between one and 150 words per minute.

The heart of the MRS-100 is a 3870 microcomputer. It contains 2048 bytes of ROM which hold the programming necessary to generate and copy code. The result is a single MOS integrated circuit which will convert a Morse input (dc levels) on one pin to a serial ASCII or Baudot output on another pin, and convert a serial ASCII or Baudot input on a third pin to a Morse output on a fourth pin. By adding a power supply, 80-Hz filter, and the necessary switching and interfacing, a complete transceiver is created.

The success of a dedicated microcomputer lies in the quality of the internal program. A MRS-100 owner doesn't need to worry about being at the mercy of the ROM's contents. Xitex spent several years developing the most versatile approach possible. The copy algorithm is compensated to accept a wide range of fists at speeds that will meet anyone's needs. Most code receiver systems assume arbitrary values for the relationship between code element spaces, character spaces, and the dot/dash ratio. The MRS-100 does not. It continually evaluates the received signal, allowing speed shifts from 150 to 1 wpm, or vice versa, missing only about five characters before locking in on the new rate or style.

The problem of generating Morse characters is somewhat more straightforward. The MRS-100 goes beyond the usual Morse keyboard utility since it contains a 32-character FIFO (First In, First Out) buffer. This allows the operator to type faster than the transmitted code and results in a smooth, clean signal. If an ASCII keyboard is used, it may be possible to RUBOUT mistakes so that the ham on the other end hears perfect CW.

The MRS-100 tested at *73* came assembled, in an attractive 7-inch by 8-inch by 3½-inch black and grey cabinet. The 43-page instruction manual includes guidelines for the assembly of the kit version as well as information on hookup and use. Ideally, the Xitex SCT-100 video terminal should be used as the display device. However, a Model 33 Teletype® was pressed into service for our tests. The hookup directions left something to be desired if you were not using an SCT-100 or an older Baudot machine. The addition of a reed relay and diode were necessary to get the system up and running. The frustration of interfacing was soon offset by several hours of enjoyable use.

The Extra class portion of 40 meters was the first testing ground. The headphone jack on a Kenwood TS-820 provided a source of audio for the MRS-100, and soon I was "copying" code at twice the speed I am accustomed to. It was apparent that other fellows were using a computer, too, since the teletype was spitting out flawless text at 40 words per minute. I guess I was disappointed that this previously uncopyable code did not contain secret messages, so I soon found myself tuning across the Novice band. Needless to say, most of the signals did not sound like they were machine generated, but the MRS-100 easily slid down to the five-word-per-minute range, copying the mistakes in addition to the correct characters.

The Search-Track-Lock switch provides the operator with three distinct copy modes. The search mode allows the unit to synchronize and track the received audio while outputting the corresponding ASCII or Baudot characters. If no instantaneous large shifts in speed are anticipated, the track mode may provide a more stable output. The reduced capture window allows a more accurate determination of the dot/dash and spacing decision points. The third mode is a lock type which is useful when there are frequent noise spikes that may be interpreted as false dots. When the operator switches from the track to the lock mode, the capture window and all internal decision points are locked to their current values.

The threshold control, like the search-track-lock modes, is best understood after several hours of practice. I found that the MRS-100 would occasionally get locked at too high a speed. By adjusting the threshold and the level of the input signal, I was able to overcome these troublesome quirks. The input circuitry for the receiver portion of the MRS-100 is relatively simple, yet the unit is able to compensate for fading, even when the signal is seemingly overcome by noise. There is, however, very little tolerance for an adjacent signal. An active filter circuit with an 80-Hz bandpass provides slightly more immunity to QRM, but I doubt if the MRS-100 would function well under contest-like conditions. In addition to the filtered CW, a completely regenerated Morse signal is available from the local sidetone oscillator. This provides a useful way to set the threshold and input levels.

A two-digit LED display shows the speed of the received signal. This does not have the versatility of the conversion algorithm since there are a number of ways that code spacing can be set. When I used a 6 wpm *73* code tape as an input, the display read approximately 16 wpm. This is not too surprising when you remember that the *73* tapes use a character speed that is much faster than the word speed. The display provides a good relative indication of speed, but I don't think it can be interpreted literally in most cases.

The sending portion of the transceiver performed well. The code speed may be set from the keyboard or external BCD switches can be wired to do the job. The biggest problem is in keeping up; luckily, the RUBOUT key on an ASCII keyboard lets you fix errors that are bound to occur if you are not used to high speed typing. Another deficiency involves Transmit/Receive switching. An addendum to the instruction manual shows that a single-pole single-throw switch must be put in series with the rig's keying line. This is in addition to the Send/Receive switch on the front of the MRS-100. One switch is bad enough, but two are cumbersome. This problem could be overcome with a bit of custom wiring and a relay; unfortunately, Xitex gives no suggestions.

Old-timers may scoff at the idea of using a computer to send and receive Morse code, but there are several advantages to the MRS-100 that shouldn't be overlooked. It enables amateurs to transmit CW messages and data at speeds comparable to or better than most amateur teletype operation without the numerous FCC RTTY restrictions to contend with. A "RTTY emulate" function allows the MRS-100 to transmit and receive predetermined code characters for the TTY or ASCII keyboard characters not normally used in Morse operation. Two stations using MRS-100s could thus exchange automated, high-speed transmissions that could replace the need for legalized ASCII. Just hook the unit to your computer and start transmitting.

If you're just a beginner in the world of ham radio, the MRS-100 can help to improve your fist. It's amazing how much difference it can make when you see the results of your sending printed on the TTY. Finally, a code computer can allow non-hams to share in the excitement of CW operating.

The MRS-100 is available in three forms. An assembled version costs $295, while a complete kit goes for $225. A partial kit consisting of the microcomputer components and circuit board can be had for $95. Approximately $70 worth of additional parts are needed to complete the partial kit. As computers become commonplace in the ham shack, we are bound to hear a lot more comments like "Keyer here is a computer; it copies the code, too." With the MRS-100, you can brag about your automated station at any speed between 1 and 150 wpm! *Xitex Corporation, 9861 Chartwell Drive, Dallas TX 75243; (214)-349-2490.* Reader Service number X3.

Tim Daniel N8RK
Peterborough NH

HUSTLER INTRODUCES NEW TEN-METER YAGI ANTENNA

A new beam, designated the 10-MB-4, is the conclusion of extensive design refinements of previous beam technology. The result is a four-element yagi optimized for best directivity, excellent front-to-back ratio, and maximum gain through selective element spacing and precisely resonated element length.

The 10-MB-4 employs a gamma match feed system and is fully adjustable for a 1.2:1 or better swr at resonance.

The mechanical structure of the Hustler 10-MB-4 is ruggedly designed to withstand severe weather yet light enough to be accommodated by a TV antenna rotor. The entire antenna is constructed from high-strength aluminum tubing and can be easily grounded for lightning protection.

For further information, contact *Hustler, Inc., 3275 North B Avenue, Kissimmee FL 32741.* Reader Service number H36.

THE HEATHKIT DEVIATION METER

Have you ever had someone tell you that you were overmodulating on your two-meter FM rig? One solution to overmodulation is the new Heathkit™ Deviation Meter Kit (IM-4180) from the Heath Company. This deviation meter can be a useful addition for anyone who operates FM equipment. At a cost of $149.95 it is not for everyone, but it will permit more amateurs to check their equipment's deviation levels accurately.

Construction

The kit can be constructed in two or three nights. Only two printed circuit boards are used, a main circuit board and a converter one. All components (except the front-panel controls, the front-panel jacks, and the meter itself) are mounted on these two circuit boards. The front push-button switch assembly solders directly to the circuit board and simplifies assembly. The kit uses eight integrated circuits which are mounted using IC sockets. Six of these are RCA COS/MOS operational amplifiers which help minimize current drain but require cautious handling.

The main circuit board holds all of the circuitry except for the converter circuitry and the front-panel mounted items. The converter circuitry is mounted on a separate circuit board which is mounted in a shielded enclosure on the rear of the front panel.

Calibration

The alignment and calibration requires only one piece of external equipment. The deviation meter's local oscillator can be aligned using a frequency counter or a standard FM broadcast receiver. The front-panel meter is used for alignment and calibration metering.

Operation

The deviation meter requires ten AA cells for operation. The manual indicates an operating life of about eighty hours for either zinc-carbon or alkaline cells. A battery charger/eliminator for use with nickel-cadmium batteries is an optional accessory. Battery voltage can be checked by the use of the front-panel BATT pushbutton.

A tune switch allows you to peak the meter indication using the main- and fine-tuning controls. The fine-tuning control is a potentiometer which controls a varactor diode in the local oscillator. The fine-tuning control simplifies tuning at VHF and UHF frequencies. Operation from 25 to 50 MHz uses the local oscillator fundamental output, but operation from 50 to 1000 MHz uses the local oscillator harmonic outputs. A dual-gate MOSFET is used as a variable frequency oscillator. This is a diode-protected device, and while no precautions are given in the manual, I advise caution when installing this transistor, since the one I installed failed to operate. A replacement was installed with no problem. A hot-carrier diode is used as a frequency-converting mixer. An i-f gain control is provided on the front panel to control sensitivity. Between 50 and 500 MHz, the deviation meter has a minimum sensitivity of 35 mV. Accuracy (full scale) is specified as plus or minus three percent.

Meter ranges of 0-2, 0-7.5, 0-20, and 0-75 kHz peak are selected by front-panel pushbuttons. The 0-7.5-kHz range is useful for setting the FM deviation of amateur equipment. The 0-2-kHz range uses a low-pass filter and is most useful for adjusting continuous tone-coded squelch systems. The deviation meter uses a pulse-counting detector operating at a 200-kHz i-f.

A speaker output jack is provided for an external speaker (no internal speaker is provided). The audio amplifier provides 100 mW minimum into an 8-Ohm speaker. A front-panel switch selects a de-emphasis of 750 us for two-way radio, or 75 us for standard FM broadcast. This de-emphasis switch affects only the speaker output.

A scope output is provided on the front panel. This output provides a nominal 13-mV/kHz peak superimposed on a dc voltage of about 2.7 volts. This output permits you to monitor the input for clipping which would not be apparent from the meter reading.

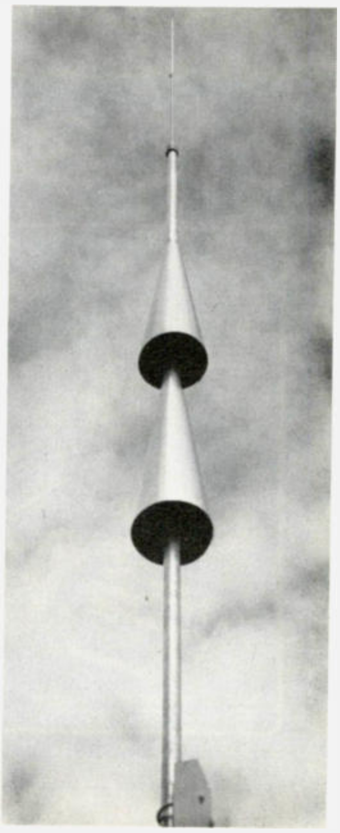
Conclusion

I enjoyed constructing my Heathkit deviation meter and find it simple to operate. Its portability makes it ideal for checking the local repeater or your friends' equipment. I particularly like the ease with which subaudible tone levels can be checked. *Heath Company, Benton Harbor MI 49022.* Reader Service number H5.

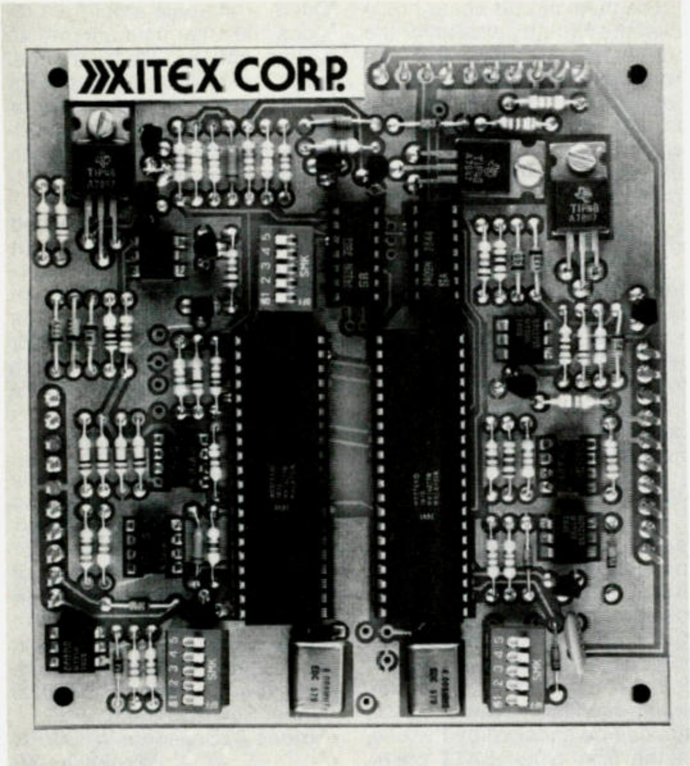
Bruce A. Beyerlein WB9WFH
Waukesha WI

THE ISOPOLE™

AEA (Advanced Electronic Applications, Inc.) has developed the ISOPOLE™, a new vertically-polarized, omnidirectional, gain-type base station antenna which provides truly superior performance over any other low-cost antennas now in the marketplace. ISOPOLE's



AEA's ISOPOLE™.



Xitex's ABM-100 code converter.

revolutionary double-cone design results in virtual elimination of the major problem plaguing other base-driven vertical antennas. This problem is the inadvertent and unwanted coupling of rf currents onto the supporting structure and the shield of the feedline, seriously degrading the radiation patterns of most competitive antennas. On-the-air field tests have shown a substantial signal improvement in favor of the ISOPOLE when switching between the other competitive antennas and the ISOPOLE.

The ISOPOLE's unique new design features a double-decoupled, center-driven, 1¼-wavelength antenna to provide maximum theoretically obtainable gain for a dipole. All rf connections are protected from the weather. The ISOPOLE is pre-tuned at the factory so that the user can obtain an 8-MHz bandwidth by following the simple assembly instructions. The ISOPOLE is intended for installation atop a standard TV mast (not supplied) and is packaged in a 7" x 7" x 29" shipping container.

For further information, contact *Advanced Electronic Applications, Inc., PO Box 2160, Lynnwood WA 98036; (206)-775-7373.* Reader Service number A94.

Heathkit's new catalog.

MICROCOMPUTER-BASED CONVERTER TRANSLATES ASCII/BAUDOT/MORSE

A new single-board code converter, designated the ABM-100, is now available from Xitex Corporation for translating between ASCII and Baudot or Baudot and ASCII. Utilizing a pair of MK-3870 single-chip microcomputers, the board provides two independently programmable serial data ports which are internally connected. Programming is accomplished using on-board DIP switches for selecting the baud rate, line length, and data format for each of the two ports.

Eight different baud rates are provided, from 110- to 1200-baud ASCII and from 45.45- to 74.2-baud Baudot. Output line lengths of either 40, 64, 72, or 80 characters are also selectable.

Other features include a built-in FIFO buffer, interfaces for both RS-232 and 20/60-mA current loop operations, and speed conversion capability.

A third port is provided for translation between Morse code and either ASCII or Baudot. This permits the generation and decoding of Morse signals (dc levels) using conventional ASCII or Baudot equipment.

For further information, contact *Xitex Corporation, 9861 Chartwell Drive, Dallas TX 75243; (214)-349-2490.* Reader Service number X3.

NEW HEATHKIT CATALOG AVAILABLE FREE

A completely new 96-page catalog, describing nearly 400 electronic kits designed for the do-it-yourselfer, is now available from Heath.

Product categories offered include electronics learning programs, test instruments, convenience and security products for the home, stereo components, color television, auto, marine, and aircraft accessories, personal computer systems, and much more.

New products in this catalog include the All-In-One H89 computer with floppy disk storage, a five-antenna remote coax switch for use in amateur radio, a 3½-digit autoranging multimeter, a low-priced dc-to-5-MHz single-trace oscilloscope, a portable solid-state VOM for the hobbyist, and professional quality audio equipment.

For further information, contact *Heath Company, Department 350-880, Benton Harbor MI 49022.* Reader Service number H5.

TEN-TEC'S MODEL 232 SWITCHER/25

Within recent years, transistor switching power supplies have come into wide use for sophisticated electronic equipment. They are characterized by the use of high frequency transformers and transistor switching to produce the regulated output voltage.

Switching power supplies are more complicated than the conventional pass-transistor types and are more expensive. However, they offer many advantages over conventional types. Some of these are greater efficiency, cooler operation, lighter weight, excellent regulation, protection against overvoltage, better reliability, and the capability of being powered by 117 to 230 volts, either ac or dc.

Ten-Tec has announced a state-of-the-art switching power supply, the Model 232. It can be used to power any Ten-Tec transceiver or any other 12 V dc system, with current requirements up to 25 Amperes.

In operation, the 117- or 230-V ac input is first rectified to approximately 160 V dc, plus and minus, using a doubler for 117 V ac and a bridge configuration for 230 V ac. This high dc voltage is applied to a switching circuit to produce pulses at 25 kHz. The internal oscillator that applies the switching signal to the transistors also adjusts the pulsewidth in accordance with a feedback circuit from the output line, so that the average value of the pulse train is 13.5 volts, plus a small amount of loss. The pulsewidth-controlled signal is then rectified and filtered to the 13.5-volt output. No heavy 60-Hz power transformers are needed with this system, and should the switcher stop oscillating, the output voltage drops to zero instead of a high dc value.

The Model 232 complements the OMNI transceiver series in cabinetry and cable and connector compatibility. For further information, contact *Ten-Tec, Inc., Sevierville TN 37862.*

SCANNERS:
KDK 2015R, KDK 2016A
MIDLAND 13-510, 13-513, CLEGG FM-28
YAESU FT227R, ICOM IC22S, KENWOOD TR7400A

- AED continues to expand its line of quality scanners. All of the above scanners are custom designed for their respective rigs.
- All scanners install completely inside the rig. No obtrusive external connections.
- All are easy to assemble and come complete with a detailed instruction manual.
- Scanned frequency displayed on digital readout (except IC22S).
- In the scanner OFF mode the rig operates normally. In the scanner ON mode the scanner locks on an occupied frequency, pauses for a preset time (about 5 secs.) and then resumes scanning.
- This gives you the ability to eavesdrop all over the band without lifting a finger. When you hear something interesting, you flip the switch to the LOCK mode and the rig is ready to transmit.

AED SCANNER SPECIFICATIONS

	KDK 2015R	KDK 2016A	KENWOOD TR7400A	YAESU FT227R	MIDLAND 13-510 13-513	CLEGG FM-28	ICOM IC22S
SCAN RATE	Adjustable 100kHz/sec-1mHz/sec		50kHz/sec	200kHz/sec	100kHz/sec	100kHz/sec	100kHz/sec
SWEEP WIDTH	144-148 or only the mHz segment you select on mHz switch	142-149.995	complete band or mHz you want	adjustable eg. 146-148 144-146 146-147	scans the mHz seg. selected by the mHz switch	same as Midland	145.35-147.99
SCAN CONTROLS	2 mini toggle switches mounted on rig — LOCK switch may be mounted on mic.		2 mini toggle switches mounted on rig.	1 mini toggle switch mounted on mic or rig.	2 mini toggle switches mounted on rig.	same as Midland	1 mini toggle switch mounted on mic or rig.
PRICE FOR KIT	$39.95		$39.95	$34.95	$39.95	$39.95	$34.95
PRICE PRE-ASSEMBLED	$59.95		$59.95	$54.95	$59.95	$59.95	$54.95

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Kantronics' Field Day™

Morse/radioteletype reader & speed display

only
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W2NSD/1
NEVER SAY DIE
editorial by Wayne Green

from page 20

just encourage them to waste more . . . like the government.

The League can make money so they will be able to do the jobs we expect them to . . . such as get amateur radio established on a good footing in most of the Third World countries . . . and put up a more intelligent battle against FCC rules which are harmful. To do this, they need someone running the place with some business background and, as far as I can see, they don't have it.

The ads in *QST* should bring in about $3 million per year . . . and so should the memberships. Books should bring in another $1.5 million, at least. With expenses around $5 million, that should leave a good supply of money for ARRL activities and lobbying.

220—USE IT OR ELSE

The makers of marine radio equipment certainly showed up the CB manufacturers for a bunch of yokels when it came to grabbing off a chunk of a ham band for commercial use. You can put me down as paranoid for thinking of the job as an accomplished fact, but we'll see what the bottom line is when all is said and done.

The CBers, led by the ex-Hy-Gain people, got the idea that they could sell everyone on CB rigs again if they got a new CB band opened up. And this one would be bigger and better than the 23 channels that were then making them rich. Quite a bundle of money was poured into the effort, and it looked as though it might just make it. It would be interesting if an investigative reporter could spare the time to try to find out where a whole bunch of lobby money was spent on this project. It went first to the EIA, as I understand it. Then I noticed that a chairman of the FCC started acting very strange, being totally convinced of the need for a CB 220-MHz band despite the contrary advice from his technical staff. Was this a coincidence?

In my younger days, I used to think well of everyone and be very surprised when I discovered that things were not always what they appeared. Then, as I looked more carefully, I found that things are seldom what they appear. And I think this holds in spades for politics and our beloved government.

And why, if this chap were not in the lobbyists' pocket, did a major equipment manufacturer at the time want to bet with me that 220 would soon be a CB band . . . as he was bringing out a new 220-MHz transceiver? And why did the FCC chairman, who then went on to the White House staff, keep the pressure on for the CB 220 band? Why would he care any more about that once he was out of the FCC?

The maritime equipment manufacturers have long wanted to get the ham 220-MHz band for marine use. Think of the radios some four million pleasure-boat owners would be buying! Now, I don't know how they managed to get their way with the US WARC preparatory group, but they pulled the sleeper of the decade on amateur radio when their plan suddenly appeared in the finished report.

Amateur groups have been furious about this, pointing out that the whole thing was totally illegal. The final report was made on matters which had not been through the legal hurdles prescribed by the Administrative Procedures Act—with no Notice of Inquiry and the usual fact-gathering and discussion stages. No, this crafty (pardon that!) bunch kept the whole thing under wraps and never gave any opportunity for opposition.

The 220-MHz amateur groups are pretty upset over this coup. They've tried to get some satisfaction from the FCC, but have been thoroughly put down. My contacts with the FCC tell me that we lost a lot more than we ever thought when the ham manufacturers refused to cooperate with each other in the linear opposition hearing . . . and then the ARRL's counsel Booth harangued the Commissioners at length, putting them down.

The League is acting as though it is part of the conspiracy, telling the 220 groups not to worry—everything will be all okay. Yes, I'm aware that some of the ARRL directors are going around to clubs saying that I don't know what I'm talking about . . . but you notice that they never challenge me face to face. I have in my files copies of letters from ARRL officials to 220 clubs which say not to worry . . . that the FCC has assured them that all is okay for the ham band at WARC.

My gradually-developed paranoia suggests a rather different story. It tells me to be careful of news like that and to look for the gimmick. In this case, let's look at a scenario. Let's suppose that there is a group that wants more frequencies for a new maritime band. Let's suppose that this group knows damned well that even without any lobby hams can be difficult to put down, so their best approach is not to go the CB route, but to slip something through the back door. We've already seen that they are pretty shrewd at this. I don't think anyone has even figured out who managed the sneak play with the WARC position or how it was done.

Next, let's assume that this group is not stupid enough to think that a lot of other countries thousands of miles away from us and with no substantial pleasure-boating population are going to jump at this proposition. In other words, anyone above the grade of moron is going to know that this proposition is not going to stand the ghost of a chance of becoming international law as a result of WARC. The band involved is a television band in some countries and is not even a ham band in much of the world.

Okay. Now we see that some group spent a lot of time and effort (that means money) getting this into the US WARC position. Knowing that it would be defeated at WARC, why did they invest so much? Well, there is a kicker known as a footnote. The US delegation at WARC can say, shucks fellows, we're sure sorry you didn't go for this fantastic band which we need desperately for our four million pleasure boats, but we agree with your right to decide these things on a one-country, one-vote basis. We also ask that a footnote be appended to the allocations table reserving the right for the US to do as we proposed. A bunch of boats in the US on 220 MHz with low-powered equipment is no hair off anyone in Lesotho, so we get our footnote . . . and we also get a new maritime band . . . and lose a nice ham band.

It is going to be more difficult for the maritime equipment manufacturers to keep this one moving if we get busy and populate the band. But we've been sporting "220, USE IT OR LOSE IT" buttons for several years, and the action is still scanty. Slogans and guilt are not people movers. We'll have action on 220 MHz when enough amateurs are convinced that they should spend the time and money to buy or build equipment for that band . . . and not before.

You get people to do things when they think it is to their benefit. This is why I was so opposed to the very concept of what was jokingly called Incentive Licensing . . . which was anything but that in its original concept. You get people to do what you think best only when they agree that it is going to benefit them. I think this holds for using 220 MHz, and thus I propose that we do something about this.

The 220-MHz groups have been particularly derelict in their approach to the situation, and if the consequences were not so severe for amateur radio, I could almost enjoy their discomfort now that they see the band slipping away from them. For the most part, these groups have been smug and cliquish. They've found a band where they are not much bothered with the rising tide of idiots and kooks who have been making life miserable for some of the 2m repeater owners. They've felt that secrecy is the best answer in order to protect their private preserve. So we see little written for magazine publication and little in the way of reported accomplishments from these groups.

The result of this snobbery is that there are but a few hundred repeaters on 220 MHz and a very few thousand users. When you talk with these people, you find that their reaction is almost universal . . . they think 220 MHz is fantastic, but please don't tell anyone. They like it as it is and don't want the screwballs from two meters to come up and get their kicks.

Well, fellows, you have to make a choice. You have to decide whether it is worthwhile to keep the band for your little group and keep it a secret . . . and possibly lose it completely . . . or whether it is getting time to open up 220 to everyone and perhaps be able to save it.

I think that we should be able to work out some practical solution to the fruitcakes who mess up repeaters. Little has been written of a constructive nature about this, and it is a situation that really needs to be tackled. I get tapes from southern California of some of these goings on, and it's almost enough to get the Ku Klux Klan out recruiting. I don't know how those fellows are able to put up with that crap without wringing a few necks.

220-MHz repeater groups do find some substantial benefits to the band. Their repeaters are generally able to coexist with most commercial band repeaters without anywhere near the severe intermod problems from which 450-MHz repeaters often suffer. There are still a lot of repeater channels available on this band . . . so perhaps this might be the place to put some of the needed experimental repeaters which will give us access to the lower bands.

I'm still enthusiastic about developing cross-band repeaters which will let us remotely access repeaters hundreds of miles away. I'd like to see repeaters which could double as remote base stations cross-banded to the other ham bands, including the DX bands. With the remote tuning system built into the Icom 701, we have a big start in this direction. We'd need some scheme for indicating the frequency used via the repeater . . . and some way to turn the beam . . . let's see some articles.

When you come down to it, articles in the ham magazines are the answer. *You* do the inventing and the pioneering—then *write* about it, pointing out the fun and things which can be done. These articles will get the action we need. Where would two-meter FM be today if *73* had not published hundreds of articles, several books, and gotten the word to everyone about the fun they were missing? Oldtimers will remember that the first reaction of most hams was that they didn't want to read about it—didn't want to be bothered. But they eventually did read, and then began to read more, and eventually they tried it.

With articles on what is going on, with articles on new ideas and circuits, with articles on new equipment which is available . . . with all this, we will spark interest in hundreds . . . then thousands . . . tens of thousands . . . and we just might make it. It's in the hands of the 220 groups. Write about it or write it off. I guarantee that *73* will try to publish as much good information about 220 as possible.

WARC REPORT

Senator Goldwater, apparently concerned over the conflicting reports about WARC, requested the Library of Congress to prepare a report on the matter. The Library's Congressional Research Service (CRS) did some looking into the situation and reported, "The official US approach to the . . . conference could be characterized as one of cautious apprehension. There has been a change in public stance since early May; until that time, Department of State officials, especially US WARC delegation members, had been expressing a degree of optimism."

The study went on to say that Third World opposition to the US proposals "may prove a considerable challenge to US policymakers and representatives." The problem here is that politics is involved rather than technical considerations. The report said that "the US delegation is not totally pessimistic about the conference's outcome."

Several past ITU meetings turned fruitless because the Third World nations refused to enter technical discussions, but insisted on using the ITU to express their political views and frustrations.

No one can say how this conference may work out, obviously. But the preponderance of evidence and projections of past actions are certainly not comforting.

MORE FAKE HAM GEAR BEING SOLD

Last year, an outfit in Houston, Texas, came out with a police radar jammer, calling it amateur equipment because it had a transmitter built in. The only purpose of this equipment was to jam radar. We surely don't need more illegal equipment being sold under the false pretense that it is for hams when the fact is that it is in no way intended for ham use.

Now this firm, Microwave Devices, Inc., has a new and improved model which is being promoted as a ham transceiver for either X or K band. The dial, which used to be calibrated in mph (the speed it would indicate on the police radar unit), is now calibrated in audio frequency. What a rip-off of amateur radio!

It isn't even necessary to use a transmitter to give police radar units a false indication of speed. We ran an article a couple of years ago showing how to build a completely passive unit which would both indicate the presence of radar and return a reflected modulated signal to it showing the speed of your choice. I presume that most of the people who built this fiendish device are put away safely now in various prisons around the country after discovering that police have no sense of humor. Eventually, every user just *has* to give the fuzz an indication of 200 mph while driving along at 25 mph. The radar is right, and the court believes it, no matter how ridiculous. Any driver going 200 mph should be put away.

The recent cases where police radar units were able to clock a house at 80 mph has hurt the reputation of radar a bit. And not a few hams have been hauled before judges who have had no knowledge of or even interest in discussing the question of false readings on radar units, even when attempts are made to offer proof that a mobile ham rig can throw radar readings almost anywhere.

I'm no fan of police radar. Going slower than normal, namely 55 mph, may save gas, but it sure wastes a lot of my time, which is far more valuable than the cost of the gas involved.

The car magazines have exploded the gas-saving myth anyway, by pointing out that the amount of gas saved by driving at 55 mph instead of 65 mph is far less than we would save if we increased the pressure in our tires by one pound! And as far as saving lives, when you look closely at the actual statistics, you find that we are losing more as a result of the inattention brought on by driving 55 mph on 100-mph roads. They have not put any speed limits at all on roads in most European countries.

POLICE RADAR HELD ILLEGAL!

A Washington DC court recently heard a case against a chap who had been arrested for having a radar detector unit in his car. The court spoke out against this quite clearly. The judge drew the parallel of a driver who kept a pair of binoculars on the seat beside him to look ahead and spot speed traps. Can the law be interpreted so that the citizen can be prohibited from carrying binoculars in the car?

But that was only a small part of the judge's comments. He went on to point out that police use of radar is an intrusion by the government without a search warrant issued on probable cause describing the place to be searched and the persons or things to be seized. He felt that this was clearly an unwarranted search since there is no consent to such a search. The judge said that a citizen using the highways in a vehicle has a right to know whether or not the government is monitoring his actions.

Thus, with no positive evidence that a crime is being committed (speeding), the police have no right to search you with their radar to get evidence against you of this crime.

The court felt that the police infringed upon the citizen's rights under the First Amendment, the Fourth Amendment, the Fifth Amendment, the Ninth Amendment, and the Tenth Amendment to the Constitution, and that the infringement constituted an invasion of a citizen's privacy, a denial of a citizen's right to know what officials of the government are doing, an illegal search and seizure of the citizen's property in an electronic sense, and a violation of the citizen's rights as retained by the people.

Lawyers may want to reference *The Daily Washington Law Reporter,* July 19, 1979, page 1257.

MICROPROCESSORS AT WORK

Well, when I started running microcomputer articles in *73*, I warned you that these fiendish little contraptions would find their way into our radios . . . and they have.

Recently, when I finally managed to con Icom out of a 701 for a test, we plugged it into the ETO 374 linear and a Wilson tribander beam up on a Rohn tower and had at the DX. Mercy me, as the CBers say, what a difference!

It took hardly any time at all to get used to being able to tap out the desired frequency on the remote control unit. I'd hit 14.2000 and *zap*, the radio would be right on 14.2000 MHz. To tune up the band, all I had to do was push the UP button and it would advance 100 Hz at a time . . . or if I held my finger down, it would skip on up the band. I soon got used to stopping on the next voice tuned in almost right on channel. If it was some choice DX, but in a contact, I just would touch the MEMORY, WRITE, and #1 buttons . . . and tune on up the band. Then, every now and then, I would check the DX channel by touching MEMORY, READ, #1 and the rig would pop back on the desired channel.

Hey, maybe ten meters is open! 28.5000 and click-click, I'm listening to ten. Hmmm, I must not forget to switch the band on the linear. To cover the band quickly, looking for signals, I'd switch to the 1-kHz scan position and let 'er rip. Nope, dead . . . so let's go to 21.2500 and check fifteen. After working my way up the band, checking out a few Gs and DLs, I'd run into a JY and a J6, both rare enough to warrant some patience. At the first break of either of these stations, I gave a short call . . . and no answer. Damn, I forgot to switch the linear! More waiting for a break, buttoning back and forth between memory 1 and 2, checking both channels . . . then tuning on up the band, listening for more DX . . . back to the two channels again. I finally got both of 'em.

A PUBLISHING CAREER?

You could do worse. In fact, most people do a lot worse. Despite the cutbacks in employment at the ARRL, amateur radio publishing is doing well as an industry and is both fun and profitable . . . an excellent combination. The staff at 73 has grown from about five ten years ago to 110 at present, though this includes *Kilobaud MICROCOMPUTING* and Instant Software. Sometimes it is difficult to know who is working how much for what.

We've openings for some people in several departments, and being an active ham is not going to hurt one bit.

We need a ham editor to help Jeff DeTray WB8BTH with editing articles, selecting material to be published, and following up on an endless number of special projects. There just might be some investigative reporting, too.

If we're going to get involved with any kind of a national organization, we'll need a ham or two to coordinate these matters. This might be something a retired military ham could get his teeth into.

Then there is the need for a ham who can both read and write to help Jim Perry in the book department. We'd like to step up our book production to five or six new books a month in the ham and computer fields. A knowledge of microcomputing will help a bit here.

Instant Software has about 30 full-time employees and we're looking for double to triple that in the next few months, which means there are openings for people with experience in marketing, advertising, production, accounting, packaging, data processing, and management. Some computer hobby background won't hurt here, either.

The Peterborough area is completely smog-free . . . you couldn't ask for cleaner air. We ask that all applicants be non-smokers and not smokers who think they can give it up for a good position.

In additon to the usual dry resumé, I'd like to have a letter telling me what particular qualities you might have for working here. I would prefer people who are anxious to learn a lot and who will be working toward the development of their skills.

Ten years ago, it never even occurred to me that my publishing firm might one day grow larger than the ARRL, but we seem to have arrived at that point this year!

BEEFS

We've received a couple of beefs about a firm called HMR. These people are *not* advertisers in *73*, by the way.

INSTRUCTIONS FOR MAKING SUPERB APPLESAUCE

First, cut up apples, removing the cores and any blemishes . . . spots, bruises . . . but leave on the skins. Cut apples into bite-size chunks.

Put in a large pot, perhaps four to eight quarts at a time, fill one-third to two-thirds full with water (depending on your consistency preference), cover, and bring to a boil. Boil about five minutes at most, and stir the apples now and then to make sure all are cooked about the same amount.

When the apples are fairly soft, turn off the heat and add about ½ cup of sugar for each quart of apples. This will vary some depending on the tartness of the apples. It is difficult to get an apple which is too tart for applesauce . . . I've never found one. Stir in the sugar well and let it cool just a bit.

Spoon the 'sauce into plastic freezer containers, mark with the type of apple and the date, and let them cool. Later you can freeze them with no loss of flavor.

I prefer Transparent apples by far, with the second choice being Duchess . . . then Wealthy. Macintosh and McCowen are okay, but not nearly as great as the first. I had to plant my own trees just to get the type of applesauce I like.

Milder apples may need some lemon juice to add tart . . . use it sparingly and taste as you go. Truly tame apples may even need some cinnamon.

This process of making applesauce is so infinitely better than anything available canned that you will never go back to store applesauce again. Even old, soft apples of the most bland type will make better 'sauce than the best canned stuff.

I often keep a lot of apples in the refrigerator so that I can cut up one or two to have for lunch with some Havarti or Jarlsberg cheese. Eventually these apples get a bit withered and soft . . . so I then 'sauce them . . . you can cut up a remarkable lot of apples while watching TV and not waste your time so totally. I save some videocassette movies for this process.

If you prefer canning yourself, this works fine, too. I like freezing because it is a lot simpler for applesauce and even for jams, too.

Hey, don't strain the 'sauce. The peels of the apples soften up when you cook them and have some of the best flavor. Some peels will give the 'sauce a nice red color.

You have to have your own tree for Transparent or Duchess, both very early apples. They don't last but a day or two when they ripen, so they are not useful for selling. When your Transparents start to get ripe, start shaking the tree every day and don't let 'em ripen all the way on the tree. My first apples this year were ready to eat in mid-July, which is incredible for New Hampshire. I think the Transparent and the Duchess are the finest apples in the world.

JUNE WINNER

"The Voice of Wolf Creek" apparently reached quite a few of our readers, since they voted Dr. William C. Hess W6CK's article of the same name the best in our June issue. Enrich the author of your favorite article by $100 by using your Reader Service card ballot!

PETERBOROUGH FLEA MARKET

As if Sherry doesn't have enough to do, she decided to run a flea market in the parking lot of the 73 West building, in June. That's Sherry in the middle, with Ross, our full-time plumber, on her left, going in to see what he can do with the air conditioning system.

Aline Coutu, our advertising manager, brought over some of the ponies from her stables so there would be pony rides for the kids. One of the nice aspects of living in New Hampshire is that you can have your own stable if you like. Aline has quite a spread, complete with an indoor riding ring, and she and her family board about 30 horses and ponies.

Here are some of the pony rides . . . note the country background! Peterborough is a small town, and just one-half mile from the center of town you start getting into the forested areas. Though only an hour from Route 128 around Boston, Peterborough is a rural area.

Contests

from page 28

may be worked once on each band. The general call will be "CQ ARAC 50."

EXCHANGE:

Arrowhead amateurs send RS(T), county, and state. All others send RS(T) and ARRL section or country.

FREQUENCIES:

CW—3535, 3725, 7035, 7125, 14035, 21035, 21125, 28035, 28125.

Phone—3980, 7280, 14280, 21360, 28560.

SCORING:

Each CW contact with a Novice or Technician counts 5 points; all others count 1 point. Multipliers are: 5 for Novices/Technicans, 5 for 5 Watts or less, 2 for 6 Watts to 200 Watts, 1 for 201 Watts to legal limit. Arrowhead amateurs take the number of points times the sections/countries worked times the multiplier to get the total score. All others take number of points times 5 times the number of counties worked times the multiplier.

AWARDS:

Plaques to top-scoring Arrowhead amateur and top-scoring amateur outside area. Certificates for second and third place and to top-scoring amateur in each ARRL section and country.

ENTRIES:

Logs must show band, mode, date/time in GMT, station worked, exchange sent and received. If more than 100 contacts are made, dupe sheets must be included for each band used. Send entries to: ARAC-50, 123 E. 1st Street, Duluth MN 55802, with an SASE for awards and results. Entries must be postmarked by November 21.

CRAZY EIGHT NET QSO PARTY

The Crazy Eight Net of Pittsburgh PA will hold its first annual QSO party on October 28 and all stations are welcome to participate. Only certificate holders, however, may submit logs! All contacts must be made on 10 meters. Operating period will be the full 24 hours beginning at 0000 GMT October 28. Scoring as follows: Each contact is one point with an additional point for each contact having a 10-X number, and another additional point for each contact having a Crazy Eight number. Maximum point value per contact is 3 points. Awards will be issued to the top-scoring DX station. Submit logs with call, name, QTH, time, frequency of contact, 10-X number, and Crazy Eight number to contest manager no later than November 28. Contest manager is Jim Lundberg WB3ICC, 571 Washington St., McKeesport PA 15132. Enclose an SASE for a copy of the results.

CLUB STATION WD4KOW

Members of the Colquitt County Ham Radio Society will be operating club station WD4KOW from the site of the second annual Sunbelt Agricultural Exposition on October 9, 10, 11, 1979. The hours of operation will be 0900 to 1600 EDST each day.

This annual Sunbelt Expo is the largest agricultural show in the south. The first Expo last year drew 140,000 visitors from all over the United States and Canada during the three-day period, and this year attendance is expected to hit 200,000.

Operations will be mostly on 40 and 20 meters around 7.250 and 14.300 MHz with some operations in the other HF bands. The members will also be listening for visiting hams on the local repeater, 146.19/79. Visiting hams are invited to visit the amateur booth at the Expo and operate the amateur station.

This year, special QSL cards are being printed for this event and will be available for those making a contact and desiring one. For more information, contact the Colquitt County Ham Radio Society, PO Box 813, Moultrie GA 31768.

W3LWW CELEBRATES 20TH ANNIVERSARY

The Foothills ARC of Greensburg PA will be celebrating its 20th anniversary by holding a mini field day from 1400 UTC, Saturday, October 20, through 1400 UTC, Sunday, October 21, 1979.

Phone and CW operation will take place on 10 through 80 meters, 5-10 kHz up from the bottom of the General class portion of each band.

Certificates will be awarded to anyone working W3LWW (SASE required).

AIRSHO '79

An aeronautical mobile operation aboard a Boeing B-29, using the call W5DX, is scheduled to take place during the Confederate Air Force Ghost Squadron's Airsho '79, October 4th to 7th, in Harlingen, Texas. Communications will be available on 14.285 MHz and 21.385 MHz (as propagation permits) during the hours from 12:00 pm to 5:00 pm CDT. Local fixed stations will act as liaison for interested amateurs wishing to make contact with the B-29. A commemorative photo QSL card is planned.

Results

1979 BARTG RTTY CONTEST RESULTS

SINGLE OPERATOR

Call	Points	Total QSOs	Countries
F9XY	445720	290	37
W3EKT	428610	298	34
W7BV	408292	290	36
IT9ZWS	400656	287	36
I5GZS	392274	252	35
W3FV	372204	260	33
SM6ASD	356544	265	34
K8NN	346632	229	36
I5FZI	321816	242	33
C5AAN	319510	241	34

MULTI OPERATOR

Call	Points	Total QSOs	Countries
I5MYL	525332	373	44
W1MX	384116	238	36
G3ZRS	306816	211	37
SM5HEV	286704	235	32
G3UUP	263256	227	31
DK0OW	225342	167	30
OK3RMW	174848	164	32
YO3KAA	160430	163	27
LZ1KDP	149760	192	31
UK4FAD	119520	149	25

SHORTWAVE LISTENERS

Call	Points	QSOs	Countries
I1-50071	568764	381	37
IV3-13018	420912	292	45
OK1-11857	389546	263	45
P. Menadier (USA)	354760	250	37
H. Ballenberger	326890	233	33
Kurt Wustner	237440	175	32
Terry Musson (GB)	130744	152	29
DM8987/K	120628	114	26
Barry Niendorf (GB)	112394	62	32
Anton Muench (DL)	95616	108	28

Ham Help

I'm interested in learning about all the modifications which can be made to the Clegg Venus 6m transceiver. I'm particularly interested in reducing the receiver internal noise level.

I have been told that replacement of the 12BE6 converter with a dfferent tube and some wiring changes reduces the noise level. If anyone has any info on this or other changes, I would appreciate hearing from them.

Leon A. Savidge WA3EFE
Box 268, RD #2, Park Ave.
Binghamton NY 13903

I have been contacted by a local Civil Air Patrol (CAP) unit in need of radio equipment. If anyone can donate equipment, operating or not, I am willing to donate my time and parts to repair the equipment and pay shipping charges, if needed. An IRS donation form can be made available to donors for tax use for some equipment.

CAP operates on 4.4-MHz SSB, 28.8-MHz AM, and 143.90- and 148.90-MHz FM. CAP is a volunteer air search and rescue group that has saved several lives of victims of downed aircraft.

If you have any equipment available, or would like more information, please contact me at the address below. Thank you.

Peter J. St. Arnaud
PO Box 695
Lowell MA 01853

I have a Cosmos Industries Cosmophone 35 transceiver that I would like to obtain a manual for. Can anyone lend me a manual or a copy of same? Of course, copying costs would be covered.

Mel Stoller K2AOQ
51 Allandale Avenue
Rochester NY 14610

Awards

from page 24

123 E. 1st Street, Duluth, Minnesota 55802, before December 1, 1979, to receive this free award.

As time goes on, be sure to continually check this column for announcements of any new awards we may have added to our program. A month doesn't go by that I scratch out another set of Ideas and consider them for submission to headquarters staff. Perhaps you have some ideas of your own. Use your creativity, put your ideas down on paper, and forward them to me.

In the meantime, continue to work those new contacts whether it's for a new state, city, or DX country; they're all important to you, so don't waste another minute! You work the stations and we'll issue the awards; the *73* Awards Program offers something for everyone!

Next month we will travel overseas and review the various awards being offered by our foreign friends. Additionally, we will look at a couple programs offered by stateside organizations.

LETTERS

from page 14

this may be old news to you. However, I heard the Russians playing with twenty for 45 minutes last night and it hacked me off so much I had to let out anxiety somehow. . .so I wrote you.

Steve Baumrucker WD4MKQ
Chapel Hill NC

P.S. Went back to my rig and the Russians reverted to the old radar system and things were business as usual! Can't figure this one out. . .

2M BEACON

A two-meter beacon station has been put on the air by the Marissa Amateur Radio Club, Inc., on July 1, 1979. This beacon will be to plot propagation and signal paths in the two-meter amateur radio band. The beacon will prove very useful to all who work the VHF spectrum.

The beacon is a project of the teenage group of the 100-member club which is located 50 miles southeast of St. Louis MO. The group will need to make a full report to the FCC at the end of December so all receiving stations are kindly asked to send their reports and weather conditions at the time to the club station, WD9GOE, PO Box 68, Marissa, Illinois 62257, attn: beacon committee.

Technical information:

Frequency—144.050.

Emission—A1 and F1 (a slightly deviated 1-kHz signal is on top of the A1 CW signal so that FM receivers are capable of detecting it).

Power—one Watt output from a VHF Eng. rf strip.

Control—220-MHz link.

Emission control—VHF Eng. CW-ID board with solid-state keying circuits added.

Power supply—12-V auto-type sealed battery with charging circuit.

Antenna—4 stacked dipoles, 2 vertical, 2 horizontal.

Height—250'.

Location—Baldwin, Illinois, 4 miles southwest of Marissa, Illinois, 55 miles southeast of St. Louis MO.

Times of operation are continuous, 24 hours per day.

Bob Heil K9EID
Marissa IL

THE QUEEN

Many thanks for the terrific coverage you gave the Associated Radio Amateurs of Long Beach and me in Bill Pasternak's story about W6RO in the wireless room aboard the *Queen Mary*.

This operation is not just a single PR stunt. With few exceptions, the station operates seven days a week with volunteer hams from throughout the area. I believe this is the only time any public display of amateur radio on a continuing basis has ever been established. So interested are the tourists in the operation that answering questions about ham radio occupies a great deal of our operator's time. As the station is part of the tour, it is estimated that about 80,000 people will see the station in operation during a year.

Again, many thanks for all your interest, from all of us in the Associated Radio Amateurs of Long Beach.

Nate Brightman K6OSC
Long Beach CA

FIRED

In your August editorial, under the subcolumn "WARC," you write that if the ARRL doesn't shape up, you'll do something about it. We both know that the League won't do anything, so it's time you went into action. The winds have been changing for a long time, and the boys in Newington still can't tell from which direction it blows.

I think you can get enough support from progressive and concerned amateurs to make a new organization successful. This is to (pardon me) light a fire under your ass and get you moving so that there'll still be amateur radio in the years ahead.

Keep up the good work with *73*. You may not have all the answers, but you raise the right questions. The League's LRPC is a hollow toothless group set up to quell the increasing dissatisfaction brewing in the amateur ranks. The time has come to stop talking and take positive action, and you're the man to lead the way. Best wishes for your continued success.

Scott Liebling WA3OXG
Baltimore MD

NEUTRAL

I have often felt that *73* lacked a rallying cry, a slogan if you will, an eye-catching, rousing phrase with an impact—words that would instantaneously impart to anyone picking up a copy of *73* the thrust and dynamic spirit of the magazine and its editor/publisher.

CQ states, on its cover, *"Serving Amateur Radio Since 1945"*—not much there!

QST says, *"Devoted Entirely To Amateur Radio"*—pretty bland!

How fitting it would be to see the cover of *73*, alternatively the vacant topside space of your editorial page, reflect the credo which I believe best exemplifies *73* and Wayne's personal stance in the field of ham radio: *"Neutral in nothing affecting the destiny of amateur radio."*

If that doesn't say it all, I don't know what does, Wayne! It would be interesting to determine how it strikes your staff.

Anyway, it's yours to do with as you wish. . .you may even desire to have it inscribed on your headstone when and if you ever depart this mortal sphere!

All the very best, Wayne, and please continue to be non-neutral (actually, I have no fear that you will ever change). I do enjoy receiving *73* over here and have a ready recollection of your visit to Frankfurt several years ago.

Burt Hubbs DJ0KQ
Frankfurt, Germany

LONELY

I got a brand-new CB rig and converted it to ten meters, using the "*73* band plan," just as suggested in the magazine.

Three weeks have passed and I have spent hours in consultation with this little box and its attendant power supply. My fingers are worn to the bone, going back and forth, up and down the forty positions, seeking a signal . . . some kind of noise . . . a voice from the past, perhaps . . . even an old, much-used cuss-word from the CB band would delight me! I can report nothing! Though the job checks out perfectly with the meter, I'm wondering if I'm even within the ten-meter band.

Considering the fact that there must be hundreds of amateurs who are suffering from the same malady, would you try to scare about two or three dozen down our way so that we might achieve just one contact and make our efforts worthwhile? You have no idea how lonely it's been these last weeks!

Dean Sturm K8CYW
Huntington WV

NIGERIA

Amateur operation here in Nigeria is now picking up and more stations are getting on each month, including even some activity on SSTV, so before long Nigeria should be one of the not-so-rare countries on the bands. Some calls heard on the bands have other prefixes than the old 5N2; now you might hear anything from 5N0 through 5N9, depending on which zone the station is in; the zones are divided among the 19 states that comprise the Federal Republic of Nigeria.

Richard Fitzgerald
WA5UTF/5N4
Lagos, Nigeria

Looking *West*

from page 10

gave the trade name Betamax. The first Betamax units (SL-7200 series) were also one-hour time limit machines like their big brother the U-Matic, but tape cost was less than half as much. Slowly but surely the Betamax caught on and began to spread into many American homes.

The one-hour time limit was still a drawback, however, until in late 1977 RCA and a number of other manufacturers announced that they also would be entering the home video recording market with machines utilizing the VHS recording format. VHS, which stands for Video Home System, is also cartridge format, but it has the added advantage of up to four hours record-play time. Unfortunately, Beta and VHS cartridges differ in size and are not interchangeable. Most VHS machines are two-speed affairs that record two hours at full speed or four hours at half speed, with some reduction in overall resolution at the reduced speed.

Not to be left out in the cold, manufacturers committed to the Beta format countered by introducing dual-speed and half-speed machines that gave up to two hours record-play on a one-hour tape cassette and then introduced a 1½-hour tape that would give up to three hours at half speed (or "X2" as it is called). Again, the Beta vs. VHS race was on with VHS appearing to be the eventual winner.

(A few weeks ago I read in one of the trade journals that Toshiba has developed an "Up To 6-Hour Beta Format Machine," and with this occurrence, the outcome of the race for the consumer dollar is anyone's guess. However, this should not keep you from obtaining a machine of your choice if you desire one.)

Regardless of which system is the eventual winner in the race to become the national standard—if, indeed, there ever is a winner or a national standard established—it's safe to say that both the Beta and VHS formats will be with us for a long, long time. Tapes, both blank and prerecorded, are in abundance for both formats, and both systems perform admirably. I went with Beta because I happen to like the machine and the results I get, but you should not judge by this. Judge for yourself, based upon your personal tastes and needs. I will tell you that having a home videocassette recorder is well within the pocketbook of most people these days. Even *73* writers.

Suppose you, yourself, have what you feel to be a good amateur-radio-related presentation. You have given it locally and now other clubs or conventions far distant want you but cannot afford to pay for transportation and/or lodging. You want to go, but with gasoline now over a dollar a gallon, you are forced to decline. If only there were some other way!

And indeed there is, if you or someone you know happens to own a home videocassette recorder and a camera. Even if not, they can be rented. Add a few lights and a friend to act as cameraperson and you literally have your own mini-production company. If you have the equipment or can get your hands on it, your cost for the raw tape will be between $14 and $20.

You do not have to be an expert at producing your own "educational spectacular." Suppose you make a mistake halfway through. If the machine you are using has good lockup, you might be able to rewind back past your boo-boo and pick up the presentation from that point. Or, you could simply rewind all the way and begin again. It's up to you and depends upon the level of perfection you are seeking. That's the nice thing about tape. Mistakes cost only time.

Video recording is here to stay and what can be done with it will amaze you once you get into it. Each day new ideas pop up in which a videocassette recorder can play an important part. Who knows; someday in the future this magazine may come to you in the form of a videocassette. Imagine having Wayne Green in your living room reading his famous editorials to you!

THE TEXAS REPORT

Walt Wiederhold W5OGZ is the Texas State Coordination Chairman for the Texas VHF-FM Society. In the current issue of that organization's newsletter, Walt relates the following:

"This quarter has seen a net increase of eight repeaters in the state. Of course, this is a gradual change and not something that takes place overnight. Many of the new repeaters have been in the planning stage for some time and have just been put on the air.

"We are always glad to see more repeaters since they serve such a good purpose in the amateur world today. But don't forget that other forms of communication work very well in the amateur bands and they should be used where possible. Working DX through a repeater doesn't really prove your rig as much as working the other station direct would. So you have a good antenna and you find that you can work across the state line into a repeater over there which is 200 feet in the air with quite a bit of power. Wouldn't it be better to use your ingenuity to talk to a station like your own without the use of the repeater?

"Every band from six meters through 1296 MHz can be used for repeaters and also for these other forms of communications. It would be most gratifying to see a big increase in activity in the 220 and 450 MHz bands and also in the higher frequency bands. We are not saying that 1296 is the top . . . just that it seems like the top right now just as six and two meters did at one time. Greater things are coming, so how about getting in on the ground floor by using your talents to explore the uses of the higher frequency bands? Didn't mean to leave out ten meters either, but it's a special band in itself.

"Wichita Falls, on April 10th, proved the need for emergency-powered repeaters. We hope a lot of operators will try to provide such power for their repeaters so they will be more likely to stay in operation when the need arises. Several repeaters in the state already have emergency power. Tornadoes can strike anywhere. Does your repeater have auxiliary power? Even the club generator, usually used on field day, can be used for that purpose. Think about it a bit and make some needed improvements in your setup."

TO THE FUTURE DEPARTMENT

I wish to close this month with the following thought from Jean AJ6Y which appeared in the June, 1979, issue of *Key-Klix*, the newsletter of the Santa Barbara Amateur Radio Club. With the World Administrative Radio Conference now upon us, I feel that the following is truly apropos.

"Many things have happened since Samuel F. B. Morse on Friday, May 24th, 1844, at 8:45 am sent the first telegraph message to Alfred Vail over the wires for a distance of forty miles. If each one of you will look back over your experience with radio and Morse code, you will see what I mean. The technology of this event was far beyond the scope of most people of the time and the event itself was probably viewed in the same way that you and I react to pictures from Jupiter. I keep wondering about the future of amateur radio and what the communication picture will look like in the year 2000 . . ."

As we remember the achievements of Samuel F. B. Morse, Thomas Edison, and others, so should we remember the foregoing from AJ6Y. In a very few words, Jean has said it all.

Review

INDEX TO HOW TO DO IT INFORMATION

(1978 edition, Mary Lou Lathrop and Norman M. Lathrop, Norman Lathrop Enterprises, PO Box 198, Wooster OH 44691; 161pages; $10.00 + $1.16 shipping)

How many hobbies do you have? Mine number at least seven at the moment: microcomputing, photography, electronics, astronomy, scale modeling, camping, and (of course) amateur radio. These diverse avocations have one thing in common. They are do-it-yourself hobbies—active, rather than passive, ways of using leisure time.

Recently, I discovered a very useful book for us do-it-yourself types. It's called the *Index to How To Do It Information*. This book indexes magazine articles from 52 different publications, ranging from *McCall's* to *Scientific American*, and *National Carvers Review* to *Kilobaud Microcomputing*. That's quite a range.

More than 1,000 subject areas have been used to catalog the magazine articles, making it easy to zero in on specific items of interest. Subject areas are liberally cross-referenced, so you'll often find yourself looking for more information under headings you might otherwise have missed. When you look up "Radio," for instance, you are advised to check no less than 13 other subject headings for further information.

The *Index* is very strong on electronics, photography, and all types of crafts. At present, articles from the ham magazines are not included, but new publications are being added to the *Index* every year. Naturally, this book is useless unless you have access to the publications it references. However, if your local library has a good periodicals collection, ten dollars invested in the *Index to How To Do It Information* would be money well spent.

Jeff DeTray WB8BTH
Assistant Publisher

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Reader Service—see page 211

DX

from page 12

the last to operate there several years ago) is talking about maybe trying again next summer, and a G-land group has high hopes for an operation in the immediate future. Work 'em first . . . etc.

Hans ST0RK has a new linear and TH3 beam courtesy of the W7PHO group. Look for Hans on Sundays around 21320 or 28600 kHz and during the week on 14225 kHz between 1500Z and 1600Z.

Bob T2AAA is on 14225 kHz almost daily from 1200Z.

A group of UA0 types will be signing U0Y from Tana Tuva in rare zone 23 from now through November 20th.

Congratulations to Dan WD6CDU/KH9 for a first-rate performance from Wake Island. Dan's debut into DXpeditioning was a model of good operating practices.

OH2BH had to cancel his Mt. Athos plans due to a prior commitment with the stork.

DJ9ZB's *QSL Managers Directory* is updated quarterly and presently contains some 3900 listings. Price is $5.00 and it is available directly from DJ9ZB.

Lou 3A2HB keeps regular Tuesday skeds with N1ACW and W4LRI on 14240 kHz at 2000Z.

Father Moran 9N1MM is down to 100 Watts since his linear died. Someone advised him to tune for maximum smoke. That's what he did and that's what he got.

During the period October 10 to November 10, Dutch amateurs will be allowed to add a "5" to their callsign, signifying 50 years of amateur radio in the Netherlands. PA0s will become PA50s, PA1s become PA51s, etc.

Slim was back at his original QTH recently again signing 8X8A from Cray Island. Some may remember when Slim signed 1Z4NG, lined up a QSL manager, and then actually forwarded his logs and a stack of QSL cards to the manager. Everything was going fine until the ARRL bounced all the cards back.

Jim Walter WA4GWD, who recently signed VP2VFD, dropped us a note to let everyone know that the correct QSL route is 249 Clearlake Drive W., Nashville TN 37217.

New officers of the Northern California DX Club are President—Ted Davis W6BJS, VP—Ron Rasmussen K6OP, Secretary—Joe Dillow W6UR, and Treasurer—Dave Palmer W6PHF. Directors are Charles Kump W6ZYC, Hal Godfrey N6AN, and Merle Parten K6DC.

Gordon Orelli K1OR has worked WAZ from five different QTHs. Working 3B8DA finished his latest one off from Brazil. Wonder if anyone else has worked WAZ from more than two locations.

ZS4MG reports never receiving any H5AA logs, so he can't fill the many QSL requests.

Has anyone received a bona fide card from LU3ZY or 5R8AL?

ARRL membership at the end of May totaled 167,541, up from 165,163 at the end of January. Total amateur licenses came to 363,820, including 66,363 Novices, 69,162 Technicians, 120,903 Generals, 84,181 Advanceds, and 23,211 Extras.

For the last couple of years, there has been a persistent jamming of DX activities in Europe. Finally fed up with the constant interference, a group of irate European DXers set out with RDFs and soon identified the culprit as an EI type. Swedish authorities have forwarded complaints through official channels and some Swedish amateurs have openly identified the EI station in on-the-air QSOs in a vain attempt at clearing up the problem. SM5BBC was recently discussing the problem on the air and a few days later ZA2BC showed up giving SM5BBC as the QSL route. Slim seems to be not only persistent, but vindictive as well.

The correct QSL address for all of K5VT's operations including K5VT/5T5, /6W8, /5H3, SV5, and XT2AE, 9G1LM, and TY9ER is c/o W2TK, 366 Rutherford Avenue, Lyndhurst NJ 07071.

Although it may all be straightened out by the time this column appears in print, as of early August the TH8JM problem was still very much up in the air with those holding QSLs wondering if they would ever be accepted by the DXCC desk. The origin of the TH8 prefix dates back some ten years when the American Ambassador there was issued a TH8 license with the stipulation that the Ambassador could issue TH8 licenses to any members of the Embassy delegation, but not to visitors. Since this privilege was never rescinded and since TH8JM is an Embassy communications officer and therefore a member of the Embassy delegation, it would seem on the surface that everything is on the up and up and there would be no problems in getting the confirmations accepted for DXCC credit. Of course, life for the deserving is never easy and problems have developed somewhere along the line. Fortunately, another license, TL8JM, has been issued and the necessary documentation forwarded to those hard-to-please guardians of the eternal DX flame in Newington. The Delta DX Association has forwarded a new Yaesu rig, and, if everything works out, before long TL8 will probably be just more garden-variety DX.

NOVICE CORNER

Never, but never, go to your local post office and purchase IRCs. The best source for IRCs at a reasonable price is one of the more active QSL managers. They receive IRCs from overseas stations and are usually quite happy to unload them in bundles of 25 or so for something in the neighborhood of a quarter each. An especially good source is the QSL manager or managers of a recent DXpedition to some exotic location. They receive literally thousands of IRCs and generally announce their availability once the QSLing has been taken care of. Once the announcement has been made, they disappear in short order, so it is important to plan ahead and get your request in early.

OKINO TORISHIMA

We just received two photo QSLs from the recent JF1IST/7JI DXpedition to Okino Torishima and they are fantastic! One shows a wide view of the island(?) with the operating platform jutting up from the sea. The other one has a close-up shot of the tent on top of the operating platform. Hopefully, we will have some color shots of this one-man operation for next month's column.

WEST COAST DX BULLETIN

With honest regret, we report that the weekly *West Coast DX Bulletin* ceased publication with the July 18th issue. The *Bulletin* was a one-man effort by Hugh Cassidy WA6AUD. During the all-too-short eleven-year life of the *Bulletin*, Cass somehow managed to never miss a week in bringing us all the latest DX news. Much of what you read in this column came straight from the *Bulletin*'s multi-colored, hand-typed pages. Thanks a lot, Cass; it was fun.

DX RIDDLE

Someone finally sent in the correct answer to our DX Riddle—which three DXCC countries share the same prefix but are located within separate continental boundaries? Actually, there turned out to be more than one correct answer. Will Roberts AA4NC and Tim Fanus WB3DNA guessed KA1 USA, KA1 Ogasawara, and KA1 Minami Torishima. Rick Cole WD4CTA was the only one to come up with the answer we had in mind: HK0 Mal Pelo, HK0 Bajo Nuevo, and HK0 Serrana Bank. Congratulations, guys, and thanks to everyone who took the time to send in an answer.

That's about all there is for this month. Remember, pictures and DX news are always welcome.

Thanks for much of the preceding to JA1NRH, WD4CTA, AA4NC, WB3DNA, WD9COA, WA4PRU, WA1ZXF, N8AJA, VE2FIT, the LIDXA *Bulletin*, *Worldradio News*, and, for the last time, the *West Coast DX Bulletin*.

Ham Help

I wish to purchase, in any condition, a BC-314. I will pay a fair price plus shipping costs.

Kenneth Hunt
6519 Valhalla Ave.
Klamath Falls OR 97601

I need operating manuals with schematics for a Hallicrafters SX-40B receiver and an Eico 720 transmitter. I will pay in advance by money order for originals or good copies.

George E. Davidson KA4FNB
5290 Joan of Arc Place
College Park GA 30349

An Icom 701 international users club is now operational. Send an SASE for details.

Rob Pohorence N8RT
9600 Kickapoo Pass
Streetsboro OH 44240

I'm looking for information on how to combine my Superboard II from OSI with ham radio for RTTY, Morse, and ASCII send and receive functions. Can anyone help?

C. B. Smith VE3IEN
33 Todd Road
Agincourt, Ontario
Canada M1S 2K2

I have a Midland model 13-895 SSB Citizens Band radio, and wish to convert it to 10 meters. I have not as yet seen an article on this particular rig. Can anyone help? I recently picked up my General ticket and I am curious as to what is happening on 10.

Larry Starkweather
5731 Desert View Dr.
La Jolla CA 92037

P.O. Box 4430M Santa Clara, CA 95054
For will call only: (408) 988-1640
2322 Walsh Ave. Q3

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INTEGRATED CIRCUITS

7400TTL	
7400N	17
7402N	17
7404N	19
7409N	23
7410N	17
7414N	63
7420N	17
7422N	1 39
7430N	20
7442N	50
7445N	69
7447N	60
7448N	69
7450N	17
7474N	29
7475N	49
7485N	88
7489N	2 00
7490N	43
7492N	43
74[illegible]N	43
7495N	69
74100N	90
74107N	29
74121N	34
741[illegible]N	59
74125N	39
74145N	69
74150N	95
74151N	69
74154N	1 00
74157N	69
74161N	87
741[illegible]N	87
741[illegible]N	87
74174N	96
74175N	90
74190N	1 15
74192N	87
74193N	85
74221N	1 55
74298N	1 65
74365N	66
74366N	66
74367N	66

74LS00 TTL	
74LS00N	25
74LS02N	25
74LS04N	25
74LS05N	25
74LS08N	25
74LS10N	25
74LS13N	40
74LS14N	90
74LS20N	25
74LS22N	25
74LS28N	41
74LS30N	25
74LS33N	39
74LS38N	30
74LS74N	70
74LS75N	47
74LS90N	51
74LS93N	51
74LS95N	1 89
74LS107N	35
74LS112N	[illegible]
74LS11[illegible]N	[illegible]
74LS1[illegible]N	72
74LS1[illegible]N	35
74LS151N	67
74LS155N	67
74LS157N	67
74LS16[illegible]N	91
74LS1[illegible]N	91
74LS174N	95
74LS19[illegible]N	1 06
74LS2[illegible]1N	1 95
74LS258N	67
74LS367N	1 35

LINEAR	
CA3045	90
CA3046	67
CA3081	1 80
CA3082	1 90
CA3089	2 95
LM301 AN/AH	35
LM305H	87
LM307N	35
LM308N	89
LM309H	1 15
LM309K	1 50
LM311H/N	90
LM317T/K	2 92
LM318	1 35
LM320K-5	1 20
LM323K 5	6 95
LM320K 12	1 35
LM320K 15	1 35
LM320T 5	1 60
LM320T 8	1 60
LM320T 12	1 50
LM320T 15	1 60
LM324N	1 15
LM339N	1 55
LM340K 5	1 35
LM340K 8	1 35
LM340K 12	1 35
LM340K 15	1 35
LM340K 24	1 35
LM340T 5	1 25
LM340T 8	1 25
LM340T 12	1 25
LM340T 15	1 25
LM340T 18	1 25
LM340T 24	1 25
LM343H	4 50
LM350	7 50
LM370	1 15
LM377	3 00
LM379	5 00
LM380N	1 00
LM381	1 60
LM382	1 60
LM703H	40
LM709H	28
LM723H/N	50
LM733N	67
LM741CH	35
LM741N	25
LM747H/N	62
LM748N	35
LM130[illegible]N	82
LM1304	1 10
LM1305	1 27
LM1307	2 00
LM1310	2 75
LM1458	47
LM1800	1 75
LM1812	7 50
LM1889	3 00
LM2111	1 75
LM2902	1 50
LM3900N	60
LM3905	1 75
LM3909N	61
MC1458V	50
NE540L	2 89
NE550N	65
NE555V	43
NE556A	79
NE565A	1 00
NE566V	1 50
NE567V	1 20
NE570B	5 00
NE571B	5 00
78L05	60
78L08	60
78M05	85
75108	1 75
75491CN	50
75492CN	55
75494CN	89

A to D CONVERTER	
8038B	4 50
8700CJ	13 95
8701CN	22 00
8750CJ	13 95
LD130	9 95
9400CJV/F	7 40
ICL7103	9 50
ICL7107	14 25

CMOS	
CD34001 Fair	50
CD4000	18
CD4001	28
CD4002	28
CD4006	1 10
CD4007	28
CD4008	28
CD4009	39
CD4010	39
CD4011	28
CD4012	28
CD4013	36
CD4014	86
CD4015	86
CD4016	36
CD4017	94
CD4018	94
CD4019	28
CD4020	1 02
CD4021	1 02
CD4022	86
CD4023	28
CD4024	75
CD4025	28
CD4026	1 51
CD4027	36
CD4028	79
CD4029	1 02
CD4030	28
CD4035	1 02
CD4040	1 02
CD4042	71
CD4043	63
CD4044	63
CD4046	1 67
CD4049	36
CD4050	36
CD4051	1 13
CD4060	1 42
CD4066	71
CD4068	40
CD4069	40
CD4070	[illegible]
CD4071	28
CD4072	28
CD4073	28
CD4075	28
CD4076	1 75
CD4078	40
CD4081	28
CD4082	28
CD4116	47
CD4490	5 50
CD4507	1 00
CD4508	4 25
CD4510	1 02
CD4511	94
CD4515	2 52
CD4516	1 10
CD4518	1 02
CD4520	1 02
CD4527	1 51
CD4528	79
CD4553	3 50
CD4566	2 25
CD4583	4 50
CD4585	1 10
CD40192	3 00
74C00	28
74C04	33
74C10	28
74C14	2 10
74C20	28
74C30	28
74C48	1 95
74C74	75
74C76	1 40
74C90	1 15
74C93	1 40
74C154	3 00
74C160	1 44
74C175	1 35
74C192	1 65
74C221	2 00
74C905	3 00
74C906	75
74C914	1 95
74C922	5 50
74C923	5 50
74C925	6 95
74C926	6 95
74C927	6 95

INTERFACE	
8095	65
8096	65
8097	65
8098	65
8T09	1 25
8T10	4 50
8T13	3 00
8T20	5 50
8T23	3 10
8T24	3 50
8T25	3 20
8T26	1 69
8T28	2 75
8T97	1 69
8T98	1 69

MOS MEMORY RAM	
2101 1	3 95
2102 1	95
2102AL 4	1 60
21L02 1	1 18
21F02	1 25
2104A 4	4 95
2107B 4	3 75
2111 1	3 75
2112 2	3 95
2114L 3	7 90
4116	10 95
2513B	6 30
MM5262	40
MM5280	3 00
MM5320	9 95
MM5330	5 94
PD411D 3	4 00
PD411D 4	5 00
P5101L	13 95
4200A	9 95
82S25	2 90
91L02A	1 50
HD[illegible]	6 95
MM5[illegible]	4 50
[illegible]	9 95
MCM[illegible]	9 95
93[illegible]	3 50
4100	10 00
416	16 00

CLOCKS	
MM5314	3 90
MM5315	4 00
MM5369	2 10
MM5841	14 45
MM5865	7 95
CT[illegible]	5 80
CT[illegible]	8 95
CT7015	[illegible]
MM5375AA/N	3 90
MM5375AG/N	4 90
[illegible]	16 50
7207	7 50
7208	15 95
7209	4 95
DS0026CN	3 75
DS0056CN	3 75
MM53104	2 50

MICROPROCESSOR	
6800	17 50
6802	[illegible]
8080A	[illegible]
with data	8 95
8085	27 00
Z80A	19 75
8212	2 90
8214	8 00
8216	2 90
8224	2 90
8228	5 35
8251	8 50
8253	10 00
8255	9 25
8257	19 50
8259	19 50
1802CP plus	13 95
1802DP plus	[illegible]
1861P	11 50
CDP1802CD	19 95
CDP1802D	25 00
CDP1861	12 95
6820	9 95
6850	12 95
6502	12 50
6504	16 50
6522	13 60

UART/FIFO	
AY5-1013	5 50
AY5-1014	7 50
3341	6 95

PROM	
1702A	3 95
N82S23	2 95
N82S123	3 50
N82S126	3 75
N82S129	3 75
N82S131	3 75
N82S136	8 75
N82S137	8 75
2708	10 50
DM8577	2 90
8223	2 90
2716T1	29 50
2716 Intel	48 00

CONNECTORS	
44 pin edge	2 75
100 pin edge	4 50
100 pin edge WW	5 25

IC SOCKETS
Solder Tin Low Profile

PIN	1UP	PIN	1UP
8	15	22	30
14	[illegible]	24	35
16	16	28	42
18	27	36	58
20	29	40	57

WIRE WRAP LEVEL 3

PIN		PIN	
14	25	24	86
16	33	28	1 00
18	57	40	1 23

CRYSTALS	
1 MHz	4 50
2 MHz	4 50
4 MHz	4 25
5 MHz	4 25
10 MHz	4 25
18 MHz	3 90
[illegible] MHz	3 90
[illegible] MHz	3 90
[illegible]	4 00
1 8432 MHz	4 50
3 5795 MHz	1 20
2 0100 MHz	1 95
2 097152 MHz	4 50
2 4576 MHz	4 50
3 2768 MHz	4 50
5 0688 MHz	4 50
5 185 MHz	4 50
5 7143 MHz	4 50
6 5536 MHz	4 50
14 31818 MHz	4 25
18 432 MHz	4 50
22 1184 MHz	4 50

KEYBOARD ENCODERS	
AY5 2376	$12 50
AY5 3600	17 95
74C922	5 50
74C923	5 50
HD0165-5	6 95

D Connectors RS232	
DB25P	2 95
DB25S	3 95
Cover	1 50
RS232 Complete Set	6 50
DE9S	1 95
DA15P	2 10
DA15S	3 10

TRANSISTORS	
[illegible]	40
[illegible]	18
[illegible]	30
[illegible]	20
[illegible]	25
[illegible]	40
[illegible]	25
[illegible]	25
[illegible]	18
[illegible]	18
[illegible]	69
[illegible]	25
[illegible]	25
[illegible]	20
[illegible]	60
TIP33A	1 00

RESISTORS ¼ watt 5%			
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25 per type	025	350 piece pack	
100 per type	015	5 per type	6 75

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56 key ASCII keyboard kit	$67 50
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LEDS	
Red T018	15
Green Yellow T018	20
Jumbo Red	20
Green Orange Yellow Jumbo	25
Cliplite LED Mounting Clips 8/$1 25 (specify red amber green yellow clear)	

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PC board	7 50
Switches Mom Pushbutton	27
3 pos slide	25
Encoder HD0165-5	6 95
3 Digit Universal Counter Board Kit Operates 5-18 Volt DC to 5 MHz typ 125" LED display	10 50
Paratronics 100A Logic Analyzer Kit	$224 00
Model 10 Trigger Expander Kit	$229 00
Model 150 Bus Grabber Kit	$369 00
Sinclair 3½ Digit Multimeter	$59 95
Clock Calendar Kit	$23 95
2.5 MHz Frequency Counter Kit	$37.50
30 MHz Frequency Counter Kit	$47 75

TRANSFORMERS	
6V 300 ma	3 25
12 Volt 300 ma transformer	1 25
12 6V CT 600 ma	3 75
12V 250 ma wall plug	2 95
12V CT 250 ma wall plug	3 50
24V CT 400 ma	3 95
10V 1 2 amp wall plug	4 85
12V 6 amp	12 95

DISPLAY LEDS			
MAN1	CA	270	2 90
MAN3	CC	125	39
MAN72 74	CA CA	300	1 00
DL704	CC	300	1 25
DL707 DL707R	CA	300	1 00
DL727 728	CA CC	500	1 90
DL747 750	CA CC	600	1 95
DL750	CC	600	1 95
FND359	CC	357	70
FND500 507	CC CA	500	1 35
FND503 510	CC CA	500	90
FND800 807	CC CA	800	2 20
3 digit Bubble			60
4 digit Bubble			80
DG8 Fluorescent			1 75
DG10 Fluorescent			1 75
5 digit 14 pin display			1 00
NSN69 9 digit display			60
7520 Clairex photocells			39
TIL311 Hex			9 50

MA1002A	8.95
MA1012A	8.95
102P3 transformer	2 25

North Star Floppy Disk Kit $665 00
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RCA Cosmac Super Elf Computer $106.95

Compare features before you decide to buy any other computer. There is no other computer on the market today that has all the desirable benefits of the **Super Elf** for so little money. The Super Elf is a small single board computer that does many **big** things. It is an excellent computer for training and for learning programming with its machine language and yet it is easily **expanded with additional memory, Full Basic, ASCII Keyboards, video character generation, etc.**

Before you buy another small computer, see if it includes the following features: ROM monitor; State and Mode displays; Single step; Optional address displays; Power Supply; Audio Amplifier and Speaker; Fully socketed for all IC's; Real cost of in warranty repairs; Full documentation.

The **Super Elf** includes a **ROM** monitor for program loading, editing and execution with **SINGLE STEP for program debugging** which is not included in others at the same price. With **SINGLE STEP** you can see the microprocessor chip operating with the **unique Quest** address and data bus displays **before, during and after executing** instructions. Also, CPU mode and instruction cycle are decoded and displayed on 8 LED indicators.

An RCA 1861 **video graphics** chip allows you to connect to your own TV with an inexpensive video modulator to do graphics and games. There is a **speaker system** included for writing your own music or using many music programs already written. The speaker amplifier may also be used to drive relays for control purposes.

A 24 key **HEX keyboard** includes 16 HEX keys plus **load, reset, run, wait, input, memory protect, monitor select** and **single step**. Large, on board displays provide output and optional **high and low address**. There is a 44 pin standard connector slot for PC cards and a 50 pin connector slot for the Quest Super Expansion Board. Power supply and sockets for all IC's are included in the price plus a detailed 127 pg. instruction manual which now includes over 40 pgs. of software info. including a series of lessons to help get you started and a music program and graphics target game.

Many schools and universities are using the Super Elf as a course of study. OEM's use it for training and research and development.

Remember, other computers only offer Super Elf features at additional cost or not at all. **Compare before you buy. Super Elf Kit $106.95, High address option $8.95, Low address option $9.95. Custom Cabinet** with drilled and labelled plexiglass front panel **$24.95. Expansion Cabinet** with room for 4 S-100 boards **$41.00. NiCad Battery Memory Saver Kit $6.95.** All kits and options also come completely assembled and tested.

Questdata, a 12 page monthly software publication for 1802 computer users is available by subscription for $12.00 per year.

Tiny Basic Cassette **$10.00,** on ROM **$38.00,** original Elf kit board **$14.95.**

Super Expansion Board with Cassette Interface $89.95

This is truly an astounding value! This board has been designed to allow you to decide how you want it optioned. **The Super Expansion Board comes with 4K of low power RAM** fully addressable anywhere in 64K with built-in memory protect and a **cassette interface**. Provisions have been made for all other options on the same board and it fits neatly into the hardwood cabinet alongside the **Super Elf**. The board includes slots for up to 6K of **EPROM** (2708, 2758, 2716 or TI 2716) and is **fully socketed**. EPROM can be used for the monitor and Tiny Basic or other purposes.

A 1K Super ROM Monitor $19.95 is available as an on board option in 2708 EPROM which has been preprogrammed with a program loader/editor and error checking multi file cassette read/write software, (relocatible cassette file) another exclusive from Quest. It includes register save and readout, block move capability and video graphics driver with blinking cursor. Break points can be used with the register save feature to isolate program bugs quickly, then follow with single step. The Super Monitor is written with subroutines allowing users to take advantage of monitor functions simply by calling them up. Improvements and revisions are easily done with the monitor. If you have the **Super Expansion Board** and **Super Monitor** the monitor is up and running at the push of a button.

Other on board options include **Parallel Input and Output Ports with full handshake**. They allow easy connection of an ASCII keyboard to the input port. **RS 232 and 20 ma Current Loop** for teletype or other device are on board and if you need more memory there are two **S-100** slots for static RAM or video boards. A Godbout 8K RAM board is available for $135.00. Also a 1K Super Monitor version 2 with video driver for full capability display with Tiny Basic and a video interface board. **Parallel I/O Ports $9.85, RS 232 $4.50, TTY 20 ma I/F $1.95, S-100 $4.50. A 50 pin connector set** with ribbon cable is available at $12.50 for easy connection between the **Super Elf** and the **Super Expansion Board.**

The **Power Supply Kit** for the Super Expansion Board is a 5 amp supply with multiple positive and negative voltages $29.95. Add $4.00 for shipping. Prepunched frame $7.50. Case $10.00. Add $1.50 for shipping.

Multi-volt Computer Power Supply

8v 5 amp, ±18v .5 amp, 5v 1.5 amp, −5v .5 amp, 12v .5 amp, −12 option. ±5v, ±12v are regulated. Kit $29.95. Kit with punched frame $37.45. Woodgrain case $10.00.

60 Hz Crystal Time Base Kit $4.40

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Rockwell AIM 65 Computer

6502 based single board with full ASCII keyboard and 20 column thermal printer. 20 char. alphanumeric display, ROM monitor, fully expandable. $375.00. 4K version $450.00. 4K Assembler $85.00, 8K Basic Interpreter $100.00. Power supply assy. in case $60.00. AIM 65 in thin briefcase with power supply $485.00.

Not a Cheap Clock Kit $14.95

Includes everything except case. 2-PC boards. 6-.50" LED Displays. 5314 clock chip, transformer, all components and full instructions. Orange displays also avail. **Same kit w/.80" displays.** Red only. **$21.95 Case $11.75**

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S-100 Computer Boards

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64K Dynamic RAM Kit	470.00
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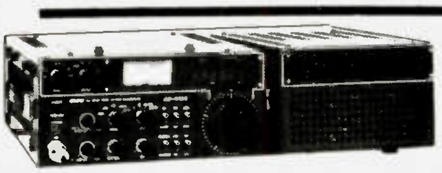

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51	$2.15	63	$1.85
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2716TI	29.95	TMS4024	13.90
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Prices are subject to change. Some items are in limited quantity.

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19.2 kHz	2.3525MHz	2 987MHz	5.426636MHz	8.871MHz	26.66667 MHz
31.5	2.35256	2.9989	5.436636	8.879500	26.8965
37 35	2.368	3.001	5.456	8.888	26.9
49 710	2.374	3.0235	5.4675	8.905	26.958
70	2.375	3.045	5.4990	8.9305	27.70
81.9	2.38725	3.049	5.5065	8 939	27.77778
96	2.395	3.053	5.515	8.956	27.845
225	2.396875	3.062	5.5215	9.0265	27.9
250	2.42	3.067	5.544	9.545	28.728
285.714	2.4375	3.074	5.5515	9.555	28.88889
576	2.44275	3 1125	5.559	9.565	28.9
720	2.4495	3.126	5.5665	9.585	28.93888
1.0000MHz	2.45	3.137	5.574	9.65	29 896
1.2288	2.4585	3 13975	5.5815	9.7	29.9
1.3047	2.46125	3.1435	5.589	9.75	30.0000
1.4	2.482	3.144	5.604	9.8	30.9
1.455	2.486	3.145	5.619	9.85	31.0000
1.689600	2.5	3.151	5.6115	9.9	31 11111
1 7	2.51375	3.1545	5.6265	9.95	31 66667
1.76375	2.56	3.158	5.6415	9.999	31.9
1 77125	2.581	3.1585	5.6715	10.0000	32 0000
1 773125	2.604	3.1615	5.675	10.010	32.22222
1.78675	2.6245	3.1625	5.680	10.020	32.6
1.80224	2.618	3.166	5.695	10.021	32.9
1.81875	2.62825	3.16975	5.7	10.040	33.0000
1.845125	2.633125	3.177	5.7105	10.20833	33.33333
1.84375	2.639	3.181	5.733333	10.80375	33.9
1.845625	2.63575	3.1825	6.00	11.	34.0000
1.84575	2.64325	3.18475	6.210	11.13	34.4444
1.846	2.646	3.1885	6.321458	11.1805	34.44444
1.8425	2.647	3.2035	6.380416	11.228	35.0000
1.84975	2.650750	3.20725	6.380833	11.2375	35.55555
1.8575	2.6545	3.2105	6.381041	11.27	36.0000
1.908125	2.65825	3.2165	6.381666	11.2995	36.21750
1.925	2.660	3.2175	6.382291	11.3565	36.66667
1 927	2.662	3.2315	6.382916	11.535	37.00000
1 932	2.66575	3.23275	6.384166	11.705	37.2175
1 982	2.6695	3.2365	6.384791	11 750	37 385
1 985	2.677	3.23775	6.383541	11.755	37.460
1 9942	2.68075	3.2385	6.385416	11.805	37.77777
1 995975	2.681	3.238875	6 427083	11.855	38 00000
1 964750	2.6845	3.23925	6.45	11.905	38.33333
2.0000	2.68825	3.24	6.47	11.955	38.77777
2.0285	2.69575	3.24025	6.4711	11.96125	38.77778
2.05975	2.7	3.2405	6.510	11.965	38.88888
2.126175	2.702	3.241	6.537	12.70666	38.88889
2 12795	2 704	3.2425	6.567	12.8666	39.00000
2.1315	2.71075	3.244	6.582	12.925	39.160
2 133275	2 715	3 248875	6.612	12.93	40 00000
2.13505	2.716	3.24975	6.6645	12.95	41.11111
2 136825	2.723	3.2515	6.673	12.99	41.66666
2 1425	2.730	3.255	6.693	13.09	43.33333
2.144625	2.7315	3.256125	6.7	13 102	45.
2 14675	2 73225	3.258625	6.705	13.2155	47.48
2.148875	2.732625	3.261	6.723	13.2455	48.50000
2 151	2.733	3.261125	6.7305	13 2745	49 84166
2 153125	2.737	3.268625	6.738	13.2845	49 95
2 15375	2.73975	3.271125	6.75125	13.2945	53 45
2.155	2.742125	3.273625	6.753	13.3045	57 45
2 15525	2.7425	3.276125	6.7562	13.3145	59 45
2 157375	2.744	3.3	6.7605	13.3245	60 45
2 1595	2.7445	3.3345	6.7712	13.3345	61 95
2 16375	2.74475	3.4045	6.77625	13.3445	63.80833
2 165875	2.746875	3.4115	6.880000	13.3545	66 66667
2 170125	2 751	3.4325	6.910	13.395	72.855
2 17225	2.754	3.4535	6.940	14.315	75.185
2 174375	2.75525	3.4675	7.0057	15.016	76 66667
2 1765	2.762375	3.4815	7.15	15.020	82.75
2 17925	2.7735	3.4975	7 17333	15.036	83
2 18475	2.776625	3.5	7.186666	16.39074	84
2 18575	2.78	3.579545	7.193333	16.39166	85 833330
2 194125	2 814	3.64	7 34350	16.51111	90.833
2 207063	2.817	3.7735	7.35	16.75185	93.1346
2 208313	2.8225	3.80	7.390	16.965	93.535
2 209563	2.835	3.803	7.443	17.00925	93.9353
2.210812	2.85	3.805	7.45850	17.01018	94.3
2.210813	2.854	3.901	7.4615	17 015	95.35
2.212063	2.854285	3.908	7.4685	17.065	106.850
2 214562	2.865	3.9168	7 4715	17.115	146.64
2.214563	2.868	4.0000	7.473	17.165	147.09
2.215625	2.8725	4.011	7.47850	17.215	165.5
2.217938	2.876875	4.126666	7 4815	17.8710	
2.21975	2.887	4.26	7 49850	17.9065	
2.222125	2.889	4.3	7.5	17.9165	
2 22325	2.894	4.57	7 5015	17.9265	
2.22675	2.910	4.6895	7.79850	17.9365	
2 22875	2.920	4.6965	7.80150	17.9465	
2.23725	2.925450	4.7	7.81	17.9665	
2.2395	2.92545	4.7175	7.926667	17.975	
2.24075	2.931	4.7245	8.00764	17.9735	
2.241	2.94375	4.7315	8.075	18.290	
2.246	2.945	4.765	8 15571	18.330	
2.2475	2.94675	4.89	8.364	19.100	
2.2925	2.952	5.0000	8.820	20.1	
2.2975	2.966	5.13125	8.8285	23.25	
2.320	2.973	5.139585	8.837	23.575	
2.326	2.980	5.147917	8.8455	25.47667	
2.32625	2.981	5.164583	8.854	25.9	
2.32885	2.98325	5.348400	8.8625	25.99961	

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2N2927	7.00
2N2947	17.25
2N2948	15.50
2N2949	3.90
2N2950	5.00
2N3287	4.30
2N3294	1.15
2N3301	.75
2N3302	1.05
2N3304	1.48
2N3307	10.50
2N3309	3.90
2N3553	1.45
2N3818	6.00
2N3866	1.09
2N3666JAN	2.70
2N3866JANTX	4.43
2N3924	3.20
2N3925	6.00
2N3927	11.50
2N3950	26.25
2N4072	1.70
2N4135	2.00
2N4261	14.60
2N4427	1.09
2N4429	7.50
2N4430	20.00
2N4957	3.50
2N4958	2.80
2N4959	2.12
2N4976	19.00
2N5090	6.90
2N5108	3.90
2N5109	1.55
2N5160	3.34
2N5179	.49

2N5184	2.00
2N5216	47.50
2N5583	4.43
2N5589	4.60
2N5590	6.30
2N5591	10.35
2N5637	20.70
2N5641	4.90
2N5643	14.38
2N5645	11.00
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2N6083	11.80
2N6084	13.20
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CMOS Tone Generator uses 1MHZ crystal to produce standard dual frequency dialing signal. Directly compatible with 12 key Chomeric Touch Tone Pads. Kit includes the following:

1 Motorola MC14410CP Chip
1 PC Board

And all other parts for assembly — **NOW ONLY $15.70**
with 1 MHz crystal — $20.65

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Fairchild 95H90DC Prescaler 350MHZ.
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1 2N5179 Transistor
2 UG-88/U BNC Connectors
1 PC Board

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Order a DM-700, examine it for 10 days, and if you're not satisifed in every way, return it in original form for a prompt refund.

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DC and AC volts:	100 µV to 1000 Volts, 5 ranges
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Resistance:	0.1Ω to 20 megohms, 6 ranges
Input protection:	1250 volts AC/DC all ranges fuse protected for overcurrent
Input impedance:	10 megohms, DC/AC volts
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Accuracy:	0.1% basic DC volts
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Display:	7 digits, LED, 0.4 inch height
Input protection:	50 VAC to 60 mHz, 10 VAC to 600 mHz
Input impedance:	1 megohm, 6 and 60 mHz ranges 50 ohms, 600 mHz range
Power:	4 'AA' cells, 12 V AC/DC
Gate:	0.1 sec and 1.0 sec LED gate light
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Weight:	1 lb with batteries

Prices

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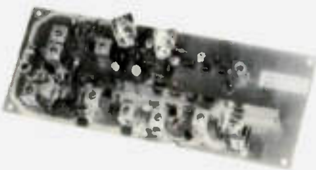

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XV2-4	28-30	144-146
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C50	50-52	28-30
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C144	144-146	28-30
C145	145-147	28-30
C146	146-148	28-30
C146	144-146	26-28
C220	220-222	28-30
C220-2	220-222	144-146
C110	Any 2 MHz of Aircraft Band	26-28 or 28-30
C110-ELT	121.5 (121.6)	CB Chan 9 (17)

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MODEL	RF RANGE	OUTPUT RANGE
C432-2	432-434	28-30
C432-5	435-437	28-30
C432-4	432-436	144-148
C432-7	427.25	61.25
C432-9	439.25	61.25

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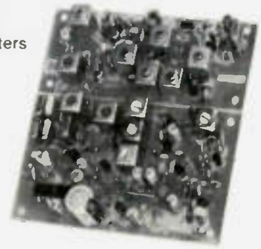
- Smaller
- Easy to align



R75A Kit for monitor or weather satellite service. -60dB at ± 30 KHz $69.95

R75B Kit for normal nbfm service. -60dB at ±17KHz, -80dB at ± 25 KHz $74.95

R75C Kit for repeater service. -60dB at ± 14 KHz, -80dB at ± 22 KHz $84.95

R75D Kit for split channel operation. Uses 8 pole crystal filter! -60dB at ± 9 KHz, -100dB at± 15 KHz ... $99.95

Specify band: 10M, 6M, 2M, or 220 MHz. May also be used on adjacent commercial bands. Use 2M version for 137MHz WX satellite.

HAMTRONICS SIX CHANNEL VHF & UHF FM RECEIVERS

In use by the hundreds throughout the world. Unlimited applications.

- Commercial grade design
- Easy to build & align
- 70 or 100dB selectivity options
- Low system cost
- Compartmentized shielding

R70 VHF Receiver kit for 10M, 6M, 2M, 220 MHz or adjacent commercial bands $74.95
Optional xtal filter for 100dB adjacent channel ... $10.00

R90 UHF Receiver kit for any 2MHz segment of 380 to 520 MHz band $89.95

IT'S EASY TO ORDER!

- Write or phone 716-392-9430 (Electronic answering service evenings & weekends)
- Use Credit Card, UPS COD, Check, Money Order
- Add $2.00 shipping & handling per order

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FREE 1979 CATALOG
With Complete Details
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(312) 848-6777

DIPOLES, ROTORS, ACCESSORIES

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KLM

KLM 144-148-11 2 meter beam...... $47.95 c
KLM 144-148-14 2 meter beam....... 65.95 d
KLM 144-148-16 2 meter beam....... 72.95 d
KLM 219-226-7 220 MHz beam....... 28.95 b
KLM 219-226-9 220 MHz beam....... 29.95 b
KLM 219-226-11 220 MHz beam...... 32.95 c
KLM 219-226-14 220 MHz beam...... 49.95 d
KLM 420-470-6 UHF beam.......... 19.95 b
KLM 420-470-14-UHF beam.......... 31.95 c
STANDARD BALUNS for abv beams. 24.95 b

Larsen

LM150K 2M 3db, mob ant w/cable.. $31.95 c
NM0150 2M adapt ant TAD/TAE mt.. 27.10 b
NLA150K ³/₈" hole, 3db mob w/cable 33.75 c
LMQ-K ¼ wave w/cable 136-512 MHz. 9.55 b
LM220K 220 MHz, 3db mob w/cable. 32.00 c
LM440K UHF 5db mob w/cable...... 30.00 c
MMLM150 2M Mag mt 3db gain ant.. 40.75 d
PQ ¼ wave port and w/PL259 conn... 5.25 a

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HALF-SIZE FULL PERFORMANCE
Multi-Band HF Communications Antennas

MOR-GAIN HD Dipoles
* One half the length of convent onal half wave dipoles
* Multi band Mult frequency
* Maximum effic ency no traps load ng co ls or stubs
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* All weather rated 1 KW AM 2 5 KW CW or PEP SSB
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40-10HD/A 40/20/15/10 Mtrs (36).... $63.25 c
80-40HD/A 80/40 Mtr bands (69)..... 61.25 c
75/40HD/A 75/40 Mtr bands (66)..... 58.75 c
75-10HD/A 75/40/20/15/10 Mtr (66).... 78.25 c
80-10HD/A 80/40/20/15/10 Mtr (69).... 80.25 c

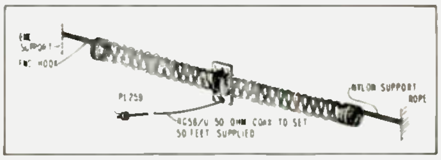
B&W

MODEL
595
$21⁵⁰

Our most popular switch. 6 position, grounds all except selected output circuit. Can be mounted on wall, on desk, or almost anywhere. Good to 150MHz. Wt. 2 lbs.

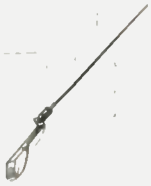
375 6 position, axial lead, gnd...... $19.75 a
376 5 pos, PROTAX, gnd pos........ 19.75 a
550A 5 pos, Radial, no gnding....... 17.50 a
550A2 2 pos, Radial, economy sw... 14.95 a
590 5 pos, axial, panel mtg.......... 18.50 a
590G same as above w/gnd unused. 18.50 a
592 2 pos axial, panel mtg.......... 17.25 a

"SLINKY" Dipole Antenna



A lot of performance in a little space, on 80/75, 40 and 20 meters. Only one setting needed for full band coverage—low VSWR throughout. Can be set at any length from 24-40 an 80/75 meters, 12 35 on 40, 6 18 on 20. Band change takes less than a minute. Handles 1000 watts CW, 2000 PEP on SSB. With 50 RG 58/U coax
$43.95

NEW! B&W PORTABLE WHIP ANTENNA



Simple dependable whip is designed especially for apartment dwellers and renters who cannot install a permanent antenna. Tunes the 2 6 10 15 20 and 40 meter Amateur bands. Offers VSWR of 1 1 1 when properly adjusted to operating frequency. Ideal for use as a portable emergency antenna too. Amounts to almost any horizontal support with a simple clamp bracket.

Weighs less than 2 pounds including five base loading coils (not used for 6 2 meters) coax line and counterpoise. Whip s 22'₂ long disassembled extends to 57 Mount is 14 long. Power rating 360 watts SSB or CW

Quick Mounting
$32⁵⁰

Model 370-10 $32.50

SOUTH RIVER

HDT TRIPODS

- **Galvanized steel.**
- **Lag Screws incl.**
- **UPS Shippable.**

HDT-10KD 10' tripod, hvy duty..... $49.95 g
HDT-5 5' tripod, galvanized.......... 24.95 f
HDT-3 3' tripod, galvanized.......... 15.95 c
ST-SN Stainless chimney mt (pair).. 17.50 c
PFM71 Hvy duty self sup roof mt..... 8.95 c
2791 Guy wire wood screw hooks (3).. 1.54 a
2751 "thread x 7⁷/₈" turnbuckle (3).... 3.46 b
2871 50' #8 alum ground wire......... 4.35 b
2876 100' #8 alum ground wire........ 8.19 c
GND-4CP 4' copper plated grnd rod... 3.39 c
S-1625P 2½ ft. x 1¼" mast.......... 3.95 c
A-125-5P 5 ft. x 1¼" alum mast...... 11.50 c

WHEN ORDERING FROM SPECTRONICS, REMEMBER:

ALL PRICES are subject to change without notice. When any item carries a special sale price lower than shown in the catalog, you will automatically receive a refund if you overpaid with your order.

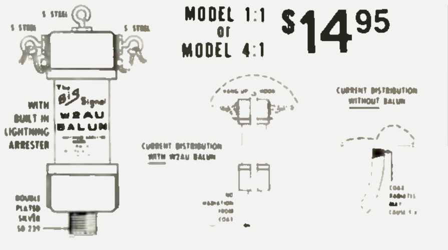
C.O.D. ORDERS require payment to be made by cash, certified check, or money order only. We will gladly quote you the exact amount that the delivery-man will ask for.

SHIPPING CHARGES must be added to your order. Please refer to the chart on the order blank page and add to your total.

ALL ORDERS sent F.O.B. Oak Park, Illinois.

Famous "W2AU" Balun

MODEL 1:1 or MODEL 4:1 **$14⁹⁵**



1. **HANDLES FULL 2 KW PEP AND THEN SOME.** Broad Banded 3 to 40 Mc
2. **HELPS TVI PROBLEMS** By Reducing Coax Line Radiation
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6. **BUILT-IN LIGHTNING ARRESTER** Helps Protect Balun — Could Also Save Your Valuable Gear
7. **BUILT-IN HANG-UP HOOK** Ideal For Inverted Vees Multi Band Antennas, Dipoles Beam and Quads

NOW BEING USED BY ALL BRANCHES OF THE U.S. ARMED FORCES, FAA, RCA, CIA, CANADIAN DEFENSE DEPT PLUS THOUSANDS OF HAMS THE WORLD OVER

Comes in 2 models 1 1 matches 50 or 75 ohm unbalanced (coax line) to 50 or 75 ohm balanced load 4 1 model matches 50 or 75 ohm unbalanced (coax line) to 200 or 300 ohm balanced load

Model 1:1.........$14.95   Model 4:1.........$14.95

DIPOLE HEADQUARTERS

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8U FOAM, hi dens braid 50 ft....... $11.95 c
8U FOAM, hi dens braid 100 ft....... 22.00 e
RG58A/U stranded center 50 ft....... 6.95 c
RG58A/U stranded center 100 ft...... 9.95 d
RG58 3 ft w/PL259 each end.......... 3.35 b
RG58 5 ft w/PL259 each end.......... 4.39 b
RG58 50 ft w/PL259 each end......... 9.95 c

COPPER WIRE

#14 stranded, 100 ft spool............ 5.95 c
#14 solidcopper enameled 100'....... 5.95 c

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Egg Ins, porcelain per pair.............99 a
DOG BONE, porcelain set of 3....... 1.25 a
HY GAIN #155 center insulator....... 5.95 b
HY GAIN Cycolac end ins per pair.... 3.95 b
MOSLEY dipole center insulator..... 5.75 a

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PL259 UHF male, 2 per pkg.......... 1.59 a
SO239 UHF female chassis mt.........69 a
UG175 Adapts RG58 to PL259, pkg 2....59 a
UG176 Adapts RG59 to PL259, pkg 2....59 a
PL258 UHF double female.............99 a
DM-SP UHF double male............ 1.69 a
M359 90 deg UHF elbow conn........ 2.10 a
UG88U BNC male for RG58.......... 1.49 a
1094 BNC female.................. 1.10 a
M358 UHF "T" connector............ 2.95 a
UG255 UHF female to BNC male..... 3.49 a
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After the price of each item you will find a letter, i.e., 19.95 a. To make it easier to figure shipping costs, these letters indicate the approximate weight of the item as follows:

a. Less than 1 lb.		f. 20-30 lbs.
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2 MTR DUCKIES

Model HM-4. Has 5/16"-32 thread. Fits Motorola HT's ICOM IC215 and Standard 146A — $7.00

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Model HM-227. Same, but with BNC connector termination — $12.00

Model HM-228. With F connector for Wilson 1402 & Tempo — $11.50

HM-4 HM-5

HM180 2mtr, 3db trunk lip ant ...... $33.50 b
HM179 2mtr, 3db hole mount ant .... 29.00 b
HM20 2mtr, 3db for marine use ...... 39.00 b
HM176 440MHz 5db trunk lip ant .... 33.00 b
HM175 440MHz 5db hole mount ant . 29.00 b
HM224 220MHz 4db trunk lip ant .... 33.50 b

NEW! ASP-694 ¼-Wave Magnetic Antenna

Low profile magnetic antenna with cable and connector. Tunable 108-512 MHz. Can be converted to gain antenna later. Wt.: 3 lbs.

Model ASP-694 .... $21.00

cushcraft

AR2 2meter Ringo base ant .... $24.95 b
ARX2 2mtr Ringo Ranger base ant .. 39.95 c
AR220 220MHz Ringo base ant ...... 24.95 b
ARX220 220MHz Ringo Ranger ...... 39.95 c
AR450 UHF Ringo base ant .... 24.95 b
ARX450 UHF Ringo Ranger bse ant . 39.95 c
AR6 6 meter Ringo base ant .... 36.95 c
ARX2K Adapts 2M Ringo to Ranger . 16.95 b
A147-4 4 ele 2M FM beam ant .... 24.95 b
A147-11 11 ele 2M FM beam .... 36.95 c
A147-20T 10 ele 2M vert/horz twist ... 62.95 d
A144-7 7 ele 2M CW/SSB beam ...... 26.95 c
A144-11 11 ele 2M CW/SSB beam .... 36.95 d
A144-10T 10 ele Twist OSCAR ant ... 42.95 c
A144-20T 20 ele Twist OSCAR ant ... 62.95 d
A220-7 7 ele 220MHz beam .... 26.95 c
A220-11 11 ele 220MHz beam .... 34.95 c
A449-6 6 ele UHF FM beam .... 24.95 c
A449-11 11 ele UHF beam .... 34.95 c
A432-11 11el 432MHz SSB/CW beam 34.95 c
AFM4D 144-148MHz Four Pole ...... 69.95 c
AFM24D 220MHz Four Pole .... 64.95 c
AFM44D 435-450MHz Four Pole ..... 64.95 c
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LAC-1 Coax lightning arrester .... 4.95 a
LAC2- Coax lightning arrester .... 4.95 a
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ATV3 20-10mtr trap vertical .... 49.95 e
ATV4 40-10mtr trap vertical .... 69.95 e
ATV5 80-10mtr trap vertical .... 89.95 e
A50-3 3 element 6 meter beam ...... 39.95 d
A50-5 5 element 6 meter beam ...... 59.95 e
A28-3 ★ 3 element 10 meter beam .. 69.95 ★
A432-20T 432MHz 20 ele twist .... 59.95 d

2M BASE ANT. PACKAGE

Here's what you get:

- Cushcraft AR2 Ringo South River.
- PFM71 Roof mount.
- A125-5P 5' alum mast.
- Lag bolts.
- 50' 8U foam coax.
- PL259 coax conn.

$59.95

Wt. 16 lbs.

FINCO

The most rugged 6 & 2 meter beams we've seen yet!!

A 2-10 10 ele, 2M beam .... $44.95 d
A 2-5 5 ele, 2M beam, 9.5db gain ..... 27.95 c
A 2-2 10 ele, 2M dual polarization .... 46.50 e
A62 6&2M antenna on one boom ..... 74.95 e
A6-5 5 element 6M beam, 11db ...... 46.50 e
A6-3 3 ele 6M beam, 7db gain .... 30.00 d
A 1¼ 220MHz 10 ele, 13.8db .... 32.95 d

HUSTLER

$9.95 "BUCK-BUSTER" SF-2 ANTENNA

Fits all Hustler deluxe mobile mounts 3/8"x24 base 5/8" wave two meters, 3.4 db gain SWR at resonance adj. to 1.5:1 or better. Bandwidth: 6 MHz, 2:1 or better SWR 100 watts max

$79.95 NEW 4-BTV VERTICAL

One setting covers 10, 15, 20, 40M. Space restricted or unlimited, you get top signal reports, consistent contacts and complete coverage. Add 5th band with a 75M resonator. Use one feedline, any length. Requires no switching or matching devices. 15 lbs.

SF-2 4-BTV

MO1 Mobile mast .... $22.95 c
MO2 Mobile mast .... 22.95 c
RM10 10 Meter resonator .... 6.95 b
RM15 15 meter resonator .... 7.95 b
RM20 20 Meter resonator .... 8.95 b
RM40 40 Meter resonator .... 14.95 b
RM75 75 Meter resonator .... 16.95 b
RM80 80 Meter resonator .... 17.95 b
RM10S 10M resonator 2KW PEP .... 11.95 b
RM15S 15M resonator 2KW PEP .... 12.95 b
RM20S 20M resonator 2KW PEP .... 13.95 b
RM40S 40M resonator 2KW PEP .... 16.95 b
RM75S 75M resonator 2KW PEP .... 31.95 b
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SF2 3db 2mtr ant ³/₈ x 24 stud .... 9.95 b
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QD1 Quick disconnect ³/₈ x 24 .... 16.95 a

hy-gain

VERTICAL ANTENNAS

Model 14AVQ/WB
- **40 thru 10 meters**
- **Wide band performance**
- **New Hy-Q traps**

Self-supporting, automatic band switching vertical antenna. Omni-directional performance. Favorable L/C ratio. High Q. True ¼ wave resonance on all bands. Low angle radiation pattern. Taper swagged seamless aluminum construction. 12" double-grip mast bracket. Full circumference compression clamps at tubing joints. Weight 8.2 lbs.

Model 14AVQ/WB — **$57.00**

Model 18AVT/WB
- **Automatic band switching**
- **Completely Self-Supporting**
- **Omni-Directional Performance**

Three beefed-up Hy-Q traps permit automatic switching. 5 band capability. Favorable L/C ratio. Top loading coil. Across the band performance with one furnished setting for each band (10 thru 40). True ¼ wave resonance on all bands. SWR of 2:1 or less at band edges. Low angle radiation pattern. Extra heavy duty tapered swaged seamless aluminum tubing with full circumference, corrosion resistant compression clamps at tubing joints. Antenna can be mounted without guide wires. 25' high. Weight 10.7 lbs.

Model 18 AVT/WB — **$79.95**

BN86 Ferrite balun for 80-10mtrs ... $15.95 a
155 Center insulator for doublet ...... 5.95 a
156 End insul. for doublet (pair) ...... 3.95 a
18HT ★ HyTower 80-10M vertical .. 239.95 ★
18V Economy 80 tru 10M vertical .... 24.95 c
12AVQ 20-10mtr trap vertical .... 39.95 c
14AVQ 40-10mtr trap vertical .... 57.00 d
18AVT/WB 80-10mtr trap vertical .... 79.95 d
2BDQ Trap doublet for 80 & 40mtr ... 39.95 d
5BDQ Trap doublet for 80-10mtrs .... 69.95 e
TH3 MkIII ★ 3 ele 20-10 tribander ... 179.95 ★
TH6DXX ★ 6 ele 20-10M tribander .. 239.95 ★
TH3 Jr 3 ele tribander (750W PEP) .. 129.95 e
HY QUAD ★ 2 ele quad 20-10 mtrs . 189.95 ★
103BA 3 element 10Mtr beam .... 54.95 e
153BA ★ 3 element 15mtr beam 79.95
204BA ★ 4 element 20mtr beam ... 179.95 ★
402BA ★ 2 element 40 mtr beam ... 169.95 ★
64B ★ 4 element 6 meter beam 39.95
270 6db fiberglass 2M antenna ...... 39.95 e
203 3 element 2 meter yagi .... 15.95 b
205 5 element 2 meter yagi .... 17.95 c
208 8 element 2 meter yagi .... 25.95 c
214 14 element 2 meter yagi .... 31.95 d

Mosley

TA33 ★ 3 el triband beam 2KW PEP . $189.95
TA33Jr ★ 3ele triband 1KW PEP ... 149.95 ★
TA36 ★ 6ele triband 2KW PEP .... 269.95 ★
CL33 ★ 3 ele Classic .... 209.95 ★
CL36 ★ 6 ele Classic .... 269.95 ★
TA40KR 40mtr adpt for TA33/36 ..... 92.95 e
MPK3 2KW conv kit for TA33Jr ...... 67.65 e

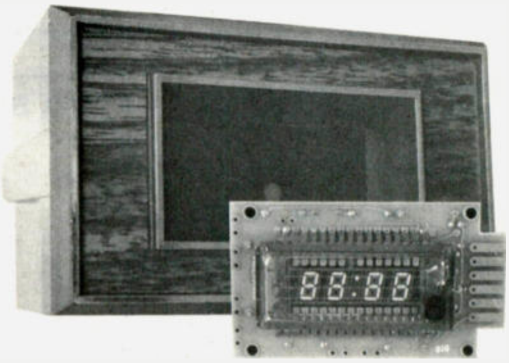
CDE

HAM IV Rotor with control box .... $149.95 f
T2X Tailtwister xtra hvy dty .... 219.95 f
CD45 Medium duty rotor .... 119.95 f
AR22XL Light duty rotor .... 59.95 e
Mast adaptor for Ham II/T2X .... 29.95 d
South Center meter kit .... 3.00 a

HIGH TECHNOLOGY AT LOW PRICES

MA1003 CLOCK MODULE $16.50

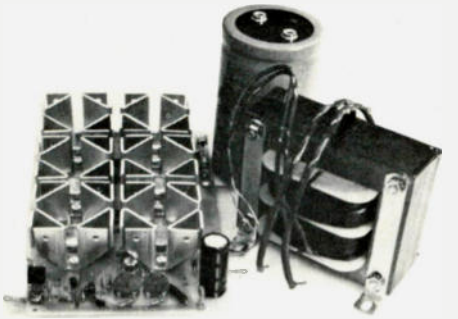
Here is a clock module designed **specifically** for mobile applications. No external timebase necessary; a built-in timebase, accurate to .01%, provides the timing accuracy you need. We don't use wash-out prone LED displays, either; instead, you get blue/green flourescent readouts that are as beautiful as they are readable. No time consuming, tedious assembly; just add two time setting switches, attach 12V DC, and you're ready to go (order our matching case mentioned below for a truly professional look). Additionally, our applications sheet tells you how to take maximum advantage of this module in mobile situations, including how to hook up the display so that it dims at night, and blanks to conserve power when the ignition is off.



Also available: Matching case with mounting hardware, and an optical filter that brings out the best in the clock readouts, for $5.95.

This clock is not only an excellent addition to your car, van, boat, or home, but also makes an excellent gift. Order now, and you'll have it ready to go in plenty of time for Christmas giving.

12 VOLT, 8 AMP POWER SUPPLY KIT $44.50



The original hefty 12V supply, and still going strong ... one look at the specs will tell you why this has been our longest-running kit. Handles 8A **continuous**, and **12A** (!) with a 50% duty cycle. Features foldback current limiting, crowbar overvoltage protection, RF suppression, adjustable output 11-14V, heavy-duty custom wound transformer, and much more.

Applications? This supply powers mobile transceivers (ham or CB) in the home, as well as other automotive/mobile home accessories (tape players, radios, TVs, etc.). It also makes an excellent bench supply, or can power bunches of floppy disc drives.

Assembly is about as simple as we can make it: All parts, except for transformer/power diodes/filter capacitors mount directly on the circuit board — including power transistors and heat sinks.

This supply is available from stock. Please include extra postage for this kit, as the transformer adds quite a bit of shipping weight.

16K MEMORY EXPANSION CHIP SET

regularly $109, now $87.20

We're keeping our competitive edge on this very popular product by continuing our 20% off sale. Expands memory in **Radio Shack-80, Apple,** and **Exidy Sorcerer** computers. Compare with similar kts: 250 ns access time, low power parts, DIP shunts included, 1 year limited warranty, and easy-to-follow instructions that make memory expansion a snap. We don't give you fancy packaging; we prefer instead to give you the best possible parts at the lowest possible price.

RF POWER TRANSISTORS

We've been offering these for a long, long time ... and frankly, we were puzzled why these super parts were taking so long to sell. But it seems like the word is getting around, because more and more hams and ordering these prime, high frequency transistors. **So, it looks like we won't be offering these all that much longer; if you want to take advantage of great parts at low prices, act now to avoid disappointment.** Just thought you ought to know ...

- **2NRF-1** 2 GHz RF power transistor. Pd max (@ 25 degrees C) 3.5W, Pout min @ 2 GNz 1.0W, Pin 310 mW, efficiency @ 2 GHz 30%, round shape, similar to RCA 2N5470. **$4.95**
- **2NRF-2** 2 GHz RF power transistor. Pd 8.7W, Pout 2.5W, Pin 300 mW, efficiency 33%, cross shape, similar to RCA TA8407. **$5.95**
- **2NRF-3** 2 GHz RF power transistor. Pd 21W, Pout 5.5W, Pin 1.25W, efficiency 33%, cross shape. Similar to RCA 2N6269. **$6.95**
- **2NRF-4** 2 GHz RF power transistor. Pd 29W, Pout 7.5W, Pin 1.5W, efficiency 33%, cross shape. Factory selected, prime 2N6269. **$7.95**

NEW FOR THE HEATH H8:

ECONORAM™XV MEMORIES!!

We're announcing two new, fully static, high density/low power Econorams designed from the ground up for electrical and mechanical compatibility with the Heath H8 computer. Econoram XV-16 has 16K×8 of memory, organized as a single 16K block; **Econoram XV-32** has 32K×8 of memory, organized as two 16K blocks. In addition to the standard goodies that are a part of every **Econoram™** — socketing for all ICs, high quality board, excellent thermal design, full buffering, etc. — these boards include a bank select option for implementing memory systems greater than 64K.

Econoram XV-16 costs **$329** in **"unkit"** form (sockets, bypass capacitors pre-soldered in place to make assembly a simple, one evening project), and **$395 assembled and tested. Econoram XV-32 unkit** price is **$599**, and **$729 assembled and tested.** If you're an H8 owner, we're sure you'll be very pleased with the latest addition to our family of fine static memories.

TERMS: Add $1 handling to orders under $15. Allow up to 5% shipping, more for the 12V 8A supply (excess refunded). Give street address for UPS delivery. VISA®/Mastercharge® call our 24 hour order desk at **(415) 562-0636.** CODs OK with street address for UPS. Cal res add sales tax. **Thank you for your business!**

GODBOUT

GODBOUT ELECTRONICS
Bldg. 725, Oakland Airport, CA 94614

FREE FLYER: Whether you're a computer user, experimenter, ham, electronic musician, or mad scientist, we have bargains for you ... and they're all listed in our flyer (including lots of specials that are too provocative to put in family magazines such as this). Send us your name and address; if you wish 1st class delivery, include 41¢ in stamps.

✓G4

Transistor Checker

— Completely Assembled —
— Battery Operated —

The ASI Transistor Checker is capable of checking a wide range of transistor types, either "in circuit" or out of circuit. To operate simply plug the transistor to be checked into the front panel socket, or connect it with the alligator clip test leads provided. The unit safely and automatically identifies low, medium and high power PNP and NPN transistors. Size: 3⅜" x 6¼" x 2"

"C" cell battery not included.

ON SALE!

Trans-Check $19.95 ea.

Custom Cables & Jumpers

NEW NEW

DB 25 Series Cables

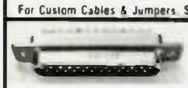
Part No.	Cable Length	Connectors	Price
DB25P-4-P	4 Ft	2-DP25P	$15.95 ea
DB25P-4-S	4 Ft	1-DP25P 1-25S	$16.95 ea
DB25S-4-S	4 ft	2-DP25S	$17.95 ea

Dip Jumpers

DJ14-1	1 ft	1-14 Pin	$1.59 ea
DJ16-1	1 ft	1-16 Pin	1.79 ea
DJ24-1	1 ft	1-24 Pin	2.79 ea
DJ14-1-14	1 ft	2-14 Pin	2.79 ea
DJ16-1-16	1 ft	2-16 Pin	3.19 ea
DJ24-1-24	1 ft	2-24 Pin	4.95 ea

For Custom Cables & Jumpers. See JAMECO 1979 Catalog for Pricing

CONNECTORS



25 Pin-D Subminiature

DB25P (as pictured)	PLUG (Meets RS232)	$2.95
DB25S	SOCKET (Meets RS232)	$3.50
DB51226-1	Cable Cover for DB25P or DB25S	$1.75

PRINTED CIRCUIT EDGE-CARD

156 Spacing-Tin-Double Read Out — Bifurcated Contacts — Fits .054 to .070 P.C. Cards

15/30	PINS (Solder Eyelet)	$1.95
18/36	PINS (Solder Eyelet)	$2.49
22/44	PINS (Solder Eyelet)	$2.95
50/100 (.100 Spacing)	PINS (Wire Wrap)	$6.95
50/100 (.125 Spacing)	PINS (Wire Wrap) R681-1	$6.95

4-Digit Clock Kit

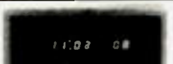
- Bright .357" ht. red display
- Sequential flashing colon
- 12 or 24 hour operation
- Extruded aluminum case (black)
- Pressure switches for hours, minutes & hold functions
- Includes all components, case and wall transformer
- Size: 3¼ x 1¾ x 1¼

JE730 .... $14.95

Jumbo 6-Digit Clock Kit

- Four .630"ht. and two .300"ht. common anode displays
- Uses MM5314 clock chip
- Switches for hours, minutes and hold functions
- Hours easily viewable to 30 feet
- Simulated walnut case
- 115VAC operation
- 12 or 24 hour operation
- Includes all components, case and wall transformer
- Size: 6¾ x 3⅛ x 1¾

JE747 .... $29.95



- Bright .300 ht. comm. cathode display
- Uses MM5314 clock chip
- Switches for hours, minutes and hold modes
- Hrs. easily viewable to 20 ft.
- Simulated walnut case
- 115 VAC operation
- 12 or 24 hr. operation
- Incl. all components, case & wall transformer
- Size: 6¾" x 3-1/8" x 1¾"

JE701

6-Digit Clock Kit $19.95

REMOTE CONTROL TRANSMITTER & RECEIVER

$19.95

Digital Stopwatch Kit

- Use Intersil 7205 Chip
- Plated thru double-sided P.C. Board
- LED display (red)
- Times to 59 min. 59.59 sec. with auto reset
- Quartz crystal controlled
- Three stopwatches in one: single event, split (cummulative) & taylor (sequential timing)
- Uses 3 penlite batteries
- Size: 4.5" x 2.15" x .90"

JE900 $39.95

MICROPROCESSOR COMPONENTS

8080A 8080A SUPPORT DEVICES		
8080A	CPU	$9.95
8212	8-Bit Input/Output	3.25
8214	Priority Interrupt Control	5.95
8216	Bi-Directional Bus Driver	3.49
8224	Clock Generator/Driver	3.95
8226	Bus Driver	3.49
8228	System Controller/Bus Driver	5.95
8238	System Controller	5.95
8251	Prog. Comm. I/O (USART)	7.95
8253	Prog. Interval Timer	14.95
8255	Prog. Periph. I/O (PPI)	9.95
8257	Prog. DMA Control	19.95
8259	Prog. Interrupt Control	19.95
6800 6800 SUPPORT DEVICES		
MC6800	MPU	$14.95
MC6802CP	MPU with Clock and Ram	24.95
MC6810API	128X8 Static Ram	5.95
MC6821	Periph. Inter. Adapt (MC6820)	7.49
MC6828	Priority Interrupt Controller	12.95
MC6830L8	1024X8 Bit ROM (MC68A30-8)	14.95
MC6850	Asynchronous Comm. Adapter	7.95
MC6852	Synchronous Serial Data Adapt	9.95
MC6860	0-600 bps Digital MODEM	12.95
MC6862	2400 bps Modulator	14.95
MC6880A	Quad 3-State Bus. Trans. (MC8T26)	2.25
MICROPROCESSOR CHIPS—MISCELLANEOUS		
Z80(780C)	CPU	$19.95
Z80A(780-1)	CPU	24.95
CDP1802	CPU	19.95
2650	MPU	19.95
6502	CPU	11.95
8035	8-Bit MPU w/clock, RAM, I/O lines	19.95
P8085	CPU	19.95
TMS9900JL	16-Bit MPU w/hardware, multiply & divide	49.95
SHIFT REGISTERS		
MM500H	Dual 25 Bit Dynamic	$.50
MM503H	Dual 50 Bit Dynamic	.50
MM504H	Dual 16 Bit Static	.50
MM506H	Dual 100 Bit Static	.50
MM510H	Dual 64 Bit Accumulator	.50
MM5016H	500/512 Bit Dynamic	.89
2504T	1024 Dynamic	3.95
2518	Hex 32 Bit Static	4.95
2522	Dual 132 Bit Static	2.95
2524	512 Static	.99
2525	1024 Dynamic	2.95
2527	Dual 256 Bit Static	2.95
2528	Dual 250 Static	4.00
2529	Dual 240 Bit Static	4.00
2532	Quad 80 Bit Static	2.95
2533	1024 Static	2.95
3341	Fifo	6.95
74LS670	4X4 Register File (TriState)	2.49
UART'S		
A-Y-5-1013	30K BAUD	5.95

MICROPROCESSOR MANUALS			
M-Z80	User Manual		$7.50
M-CDP1802	User Manual		7.50
M-2650	User Manual		5.00
ROM'S			
2513(2140)	Character Generator(upper case)		$9.95
2513(3021)	Character Generator(lower case)		9.95
2516	Character Generator		10.95
MM5230N	2048-Bit Read Only Memory		1.95
RAM'S			
1101	256X1	Static	$1.49
1103	1024X1	Dynamic	.99
2101(8101)	256X4	Static	3.95
2102	1024X1	Static	1.75
21L02	1024X1	Static	1.95
2111(8111)	256X4	Static	3.95
2112	256X4	Static MOS	4.95
2114	1024X4	Static 450ns	9.95
2114L	1024X4	Static 450ns low power	10.95
2114-3	1024X4	Static 300ns	10.95
2114L-3	1024X4	Static 300ns low power	11.95
5101	256X4	Static	7.95
5280/2107	4096X1	Dynamic	4.95
7489	16X4	Static	1.75
74S200	256X1	Static Tristate	4.95
93421	256X1	Static	2.95
UPD414 (MK4027)	4K	Dynamic 16 pin	4.95
UPD416 (MK4116)	16K	Dynamic 16 pin	9.95
TMS4044-45NL	4K	Static	14.95
TMS4045	1024X4	Static	14.95
2117	16,384X1	Dynamic 350ns (house marked)	9.95
MM5262	2KX1	Dynamic	4/1.00
PROM'S			
1702A	2048	FAMOS	$5.95
2716INTEL	16K*	EPROM	59.95
TMS2516	16K*	EPROM	49.95
(2716)	*Requires single +5V power supply		
TMS2532	4KX8	EPROM	89.95
2708	8K	EPROM	10.95
2716 T.I.	16K**	EPROM	29.95
	**Requires 3 voltages, −5V, +5V, +12V		
5203	2048	FAMOS	14.95
6301-1(7611)	1024	Tristate Bipolar	3.49
6330-1(7602)	256	Open C Bipolar	2.95
82S23	32X8	Open Collector	3.95
82S115	4096	Bipolar	19.95
82S123	32X8	Tristate	3.95
74186	512	TTL Open Collector	9.95
74188	256	TTL Open Collector	3.95
74S287	1024	Static	2.95

CSC CONTINENTAL SPECIALTIES

Proto Board 203

A total ready-to-use power breadboard prototest device with a built in regulated short proof power supply. Just plug in and start building! 2 extra floating 5-way binding posts for external signals. Self contained with power switch indicator lamp and power fuse. 24-14 pin DIP capacity. Attractive two tone quality case. All metal construction.

PB 203 $75.00

Proto Board 203A

All the features of the PB 203 plus additional power supply flexibility, provides 1% Regulated 5VDC supply (same specifications as PB 203). Regulated separate +15VDC and −15 VDC 0.5A supplies, each with internally and independently adjustable output voltage. Ripple and noise of + and −15V supplies 10mV at 0.25A.

PB 203A $124.95

Model Number	L x W x H (Inches)	Price
PB-6	6.0 x 4.5 x 1.4	$15.95
PB-100	6.0 x 4.5 x 1.4	$19.95
PB-101	6.0 x 4.5 x 1.4	$22.95

Model Number	L x W x H (Inches)	Price
PB-102	7.0 x 4.5 x 1.4	$26.95
PB-103	9.0 x 6.0 x 1.4	$44.95
PB-104	9.8 x 8.0 x 1.4	$54.95

62-Key ASCII Encoder Keyboard Kit

The JE610 62-Key ASCII Encoder Keyboard Kit can be interfaced into most any computer system. The JE610 Kit comes complete with an Industrial grade keyboard switch assembly (62 keys), IC's, sockets, connector, electronic components and a double-sided printed wiring board. The keyboard assembly requires +5V @ 150mA and −12V @ 10mA for operation.

FEATURES:

- 60 Keys generate the full 128 characters, upper and lower case ASCII set
- Fully buffered
- 2 user define keys provided for custom applications
- Caps lock for upper case only alpha characters
- Utilizes a 2376 (40 pin) encoder read only memory chip
- Outputs directly compatible with TTL/DTL or MOS logic arrays
- Easy Interfacing with a 16-pin dip or 18-pin edge connector

JE610 ..... $79.95

62-Key Keyboard only . . $34.95

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NEW

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- Uses LM309K
- Heat sink provided
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- Provides a solid 1 amp @ 5 volts
- Can supply up to ±5V, ±9V and ±12V with JE205 Adapter
- Includes components, hardware & instructions
- Size: 3½"x5"x2"H

JE200 $14.95

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- DC/DC converter w/ +5V input
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- Piggy-back to JE200 board
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The Pennywhistle 103 is capable of recording data to and from audio tape without critical speed requirements for the recorder and it is able to communicate directly with another modem and terminal for telephone "hamming" and communications. In addition, it is free of critical adjustments and is built with non-precision, readily available parts.

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Maximum Data Rate	300 Baud
Data Format	Asynchronous Serial (return to mark level required between each character)
Receive Channel Frequencies	2025 Hz for space, 2225 Hz for mark
Transmit Channel Frequencies	Switch selectable: Low (normal) — 1070 space, 1270 mark. High — 025 space, 2225 mark
Receive Sensitivity	−46 dbm accoustically coupled
Transmit Level	−15 dbm nominal. Adjustable from −6 dbm to −20 dbm
Receive Frequency Tolerance	Frequency reference automatically adjusts to allow for operation between 1800 Hz and 2400 Hz
Digital Data Interface	EIA RS-232C or 20 mA current loop (receiver is optoisolated and non-polar)
Power Requirements	120 VAC, single phase, 10 Watts
Physical	All components mount on a single 5" by 9" printed circuit board. All components included

Requires a VOM, Audio Oscillator, Frequency Counter and/or Oscilloscope to align

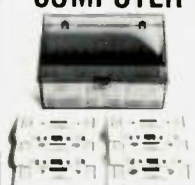
TRS-80 16K Conversion Kit

Expand your 4K TRS-80 System to 16K. Kit comes complete with:

- 8 each UPD416-1 (16K Dynamic Rams) 250NS
- Documentation for conversion

TRS-16K $75.00

COMPUTER CASSETTES



- 6 EACH 15 MINUTE HIGH QUALITY C-15 CASSETTES
- PLASTIC CASE INCLUDED 12 CASSETTE CAPACITY
- ADDITIONAL CASSETTES AVAILABLE #C-15-$2.95 ea

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(Case and 6 Cassettes)

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- ★ Includes coaxial cable and antenna transformer.

MOD II $29.95 Kit

Function Generator Kit

- Provides 3 basic waveforms: sine, triangle & square wave
- Frequency range from 1 Hz to 100K Hz
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- Uses a 12V supply or a ±6V split supply
- Incl. chip, P.C. board, components and Instructions.

JE2206B $19.95

IDEAL FOR TRS 80 — CASSETTE CONTROLLER

"Plug/Jack Interface to any computer system requiring remote control of cassette functions"

The CC100 controls cassette motor functions, monitors tape location with its internal speaker and requires no power. Eliminates the plugging and unplugging of cables during computer loading operation from cassette.

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- Size: 1" x 1-3/16" x 1-3/16"

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Reader Service—see page 211

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6 pins	$1.10 ea	10/$ 9.00
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7108	ON/NONE/(ON)	SPST
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3 for $1.25

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30,000	@	15V	3"	x	4½"	4.00 ea
63,000	@	15V	3"	x	5½"	4.00 ea
10,000	@	20V	1½"	x	53/4"	3.00 ea
2,700	@	25V	1¼"	x	2¼"	2.00 ea
2,900	@	25V	1¼"	x	2"	2.00 ea
3,000	@	25V	1½"	x	4½"	2.00 ea
18,000	@	25V	2"	x	4"	3.00 ea
21,000	@	25V	2½"	x	3"	3.00 ea
39,000	@	45V	3"	x	53/4"	3.00 ea
1,000	@	50V	1¼"	x	3¼"	2.50 ea
34,800	@	50V	3"	x	5½"	3.00 ea
450	@	75V	1¼"	x	2¼"	2.00 ea
500	@	100V	1½"	x	3½"	2.00 ea
240	@	300V	1¼"	x	3¼"	2.00 ea
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EQUIPMENT / COMPONENTS / WIRE & CABLE / ACCESSORIES

DIODES/ZENERS

QTY.				
	1N914	100v	10mA	.05
	1N4005	600v	1A	.08
	1N4007	1000v	1A	.15
	1N4148	75v	10mA	.05
	1N4733	5.1v	1 W Zenner	.25
	1N4749	24v	1W	.25
	1N753A	6.2v	500 mW Zener	.25
	1N758A	10v	"	.25
	1N759A	12v	"	.25
	1N5243	13v	"	.25
	1N5244B	14v	"	.25
	1N5245B	15v	"	.25
	1N5349	12v	3W	.25

SOCKETS/BRIDGES

QTY.					
	8-pin	pcb	.16	ww	.35
	14-pin	pcb	.20	ww	.40
	16-pin	pcb	.25	ww	.45
	18-pin	pcb	.30	ww	.95
	20-pin	pcb	.35	ww	1.05
	22-pin	pcb	.40	ww	1.15
	24-pin	pcb	.45	ww	1.25
	28-pin	pcb	.50	ww	1.35
	40-pin	pcb	.55	ww	1.45
	Molex pins	.01	To-3 Sockets		.35
	2 Amp Bridge		100-prv		.95
	25 Amp Bridge		200-prv		1.50

TRANSISTORS, LEDS, etc.

QTY.			
	2N2222M	(2N2222 Plastic .10)	.15
	2N2222A		.19
	2N2907A	PNP	.19
	2N3906	PNP (Plastic)	.19
	2N3904	NPN (Plastic)	.19
	2N3054	NPN	.55
	2N3055	NPN 15A 60v	.60
	T1P125	PNP Darlington	1.95
	LED Green,	Red, Clear, Yellow	.19
	D.L.747	7 seg 5/8" High com-anode	1.95
	MAN72	7 seg com-anode (Red)	1.25
	MAN3610	7 seg com-anode (Orange)	1.25
	MAN82A	7 seg com-anode (Yellow)	1.25
	MAN74	7 seg com-cathode (Red)	1.50
	FND359	7 seg com-cathode (Red)	1.25

9000 SERIES

QTY.			QTY.		
	9301	.85		9322	.65
	9309	.50		9601	.30
	9316	1.25		9602	.45

MICRO's, RAMS, CPU's, E-PROMS

QTY.		
	8T13	2.50
	8T23	2.50
	8T24	3.00
	8T97	1.75
	74S188	3.00
	1488	1.25
	1489	1.25
	1702A	6.50
	AM 9050	5.00
	ICM 7207	6.95
	ICM 7208	13.95
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	MM 5316	4.50
	MM 5387	3.50
	MM 5369	2.95
	TR 1602B	3.95
	UPD 414	4.95
	Z 80 A	19.50
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	2102	1.45
	2102L	1.75
	2107B-4	4.95
	2114	9.50
	2513 Upper or Lower	7.25
	2708	12.50
	2716 D.S.	29.00
	2716 (5v)	69.00
	2758 (5v)	32.95
	3242	10.50
	4116	13.50
	6800	13.95
	6850	7.95
	8080	9.50
	8085	22.50
	8212	3.75
	8214	4.95
	8216	4.50
	8224	5.25
	8228	6.00
	8251	8.50
	8253	18.50
	8255	9.50
	TMS 4044	10.95

– T T L –

8-1-79

QTY.			QTY.			QTY.			QTY.		
	7400	.20		7492	.45		74H10	.35		74LS51	.75
	7401	.20		7493	.35		74H11	.25		74LS74	1.50
	7402	.20		7494	.75		74H15	.45		74LS75	1.20
	7403	.20		7495	.60		74H20	.25		74LS76	.70
	7404	.45		7496	.80		74H21	.25		74LS86	.95
	7405	.35		74100	1.15		74H22	.40		74LS90	.85
	7406	.35		74107	.35		74H30	.30		74LS93	.85
	7407	.55		74121	.45		74H40	.35		74LS96	2.00
	7408	.40		74122	.55		74H50	.30		74LS107	.90
	7409	.25		74123	.55		74H51	.30		74LS109	1.50
	7410	.20		74125	.45		74H52	.20		74LS123	1.95
	7411	.25		74126	.45		74H53	.25		74LS138	2.00
	7412	.25		74132	.75		74H55	.25		74LS151	.95
	7413	.45		74141	.90		74H72	.35		74LS153	1.15
	7414	.95		74145	1.35		74H74	.35		74LS157	1.15
	7416	.25		74150	.85		74H101	.95		74LS160	1.15
	7417	.40		74151	1.15		74H103	.55		74LS164	2.90
	7420	.25		74153	1.15		74H106	1.15		74LS193	2.00
	7426	.25		74154	1.15		74L00	.30		74LS195	1.15
	7427	.25		74156	.70		74L02	.30		74LS244	2.90
	7430	.20		74157	.65		74L03	.35		74LS259	1.50
	7432	.50		74161	.95		74L04	.40		74LS298	1.50
	7437	.20		74163	.85		74L10	.30		74LS367	2.50
	7438	.30		74164	.75		74L20	.45		74LS368	1.25
	7440	.20		74165	1.10		74L30	.55		74LS373	2.50
	7441	1.15		74166	2.25		74L47	1.95		74S00	.60
	7442	.55		74175	.90		74L51	.65		74S02	.45
	7443	.45		74176	.95		74L55	.85		74S03	.35
	7444	.45		74177	1.10		74L72	.65		74S04	.65
	7445	.75		74180	.95		74L73	.70		74S05	.45
	7446	.70		74181	2.25		74L74	.75		74S08	.65
	7447	.70		74182	.75		74L75	1.05		74S10	.45
	7448	.50		74190	1.25		74L85	2.00		74S11	.45
	7450	.25		74191	1.25		74L93	.75		74S20	.35
	7451	.25		74192	.75		74L123	1.95		74S22	.55
	7453	.20		74193	.85		74LS00	.60		74S40	.30
	7454	.25		74194	.95		74LS01	.40		74S50	.30
	7460	.40		74195	.95		74LS02	.55		74S51	.35
	7470	.45		74196	.95		74LS03	.45		74S64	.15
	7472	.40		74197	.95		74LS04	.65		74S74	1.50
	7473	.25		74198	1.45		74LS05	.45		74S112	.60
	7474	.50		74221	2.25		74LS08	.65		74S114	.85
	7475	.35		74298	1.50		74LS09	.45		74S133	.85
	7476	.40		74367	1.35		74LS10	.45		74S140	.75
	7480	.75		75451	.65		74LS11	.45		74S151	.95
	7481	.85		75452	.65		74LS20	.45		74S153	.95
	7482	.95		75491	.65		74LS21	.45		74S157	.98
	7483	.95		75492	.65		74LS22	.45		74S158	.80
	7485	.75		74H00	.20		74LS32	.60		74S194	2.25
	7486	.55		74H01	.30		74LS37	.45		74S196	2.00
	7489	1.05		74H04	.30		74LS38	.65		74S257 (8123)	2.95
	7490	.55		74H05	.25		74LS40	.70		8131	2.75
	7491	.70		74H08	.35		74LS42	1.25			

C MOS

QTY.			QTY.			QTY.			QTY.		
	4000	.20		4018	.75		4037	1.80		4071	.25
	4001	.30		4019	.35		4040	.75		4072	.60
	4002	.25		4020	.85		4041	.69		4081	.30
	4004	3.95		4021	.75		4042	.65		4082	.30
	4006	1.50		4022	.75		4043	.50		4507	.95
	4007	.25		4023	.25		4044	.65		4511	.95
	4008	.75		4024	.75		4046	1.25		4512	1.25
	4009	.35		4025	.25		4047	2.50		4515	2.95
	4010	.35		4026	1.95		4048	1.75		4519	.85
	4011	.35		4027	.35		4049	.65		4522	1.10
	4012	.25		4028	.75		4050	.45		4526	.95
	4013	.40		4029	1.15		4052	.75		4528	1.10
	4014	.75		4030	.30		4053	.95		4529	.95
	4015	.75		4033	1.50		4066	.75		MC14409	14.50
	4016	.35		4034	2.45		4069/74C04	.45		MC14419	4.85
	4017	.75		4035	.75		4070	1.00		74C151	2.50

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QTY.			QTY.			QTY.		
	MCT2	.95		LM320K24	1.65		LM373	3.95
	8038	3.95		LM320T5(7905)	1.65		LM377	3.95
	LM201	.75		LM320T12	1.65		78L05	.75
	LM301	.45		LM320T15	1.65		78L12	.75
	LM308	.65		LM323K	5.95		78L15	.75
	LM309H	.85		LM324	1.25		78M05	.75
	LM309 (340K-5)	1.50		LM339	.75		LM380 (8-14 Pin)	1.19
	LM310	.85		7805 (340T5)	1.15		LM709 (8-14 Pin)	.45
	LM311 (8-14 Pin)	.75		LM340T12	.95		LM711	.45
	LM318	1.50		LM340T15	.95		LM723	.40
	LM320H6	.79		LM340T18	.95		LM725	3.50
	LM320H15	.79		LM340T24	.95		LM739	1.50
	LM320H24	.79		LM340K12	1.25		LM741 (8-14)	.45
	LM320K5	1.65		LM340K15	1.25		LM747	1.10
	LM320K12	1.65		LM340K18	1.25		LM1307	1.75
	LM320K15	1.65		LM340K24	1.25		LM1458	.65
							LM3900	1.50
							NE555	.45
							NE556	.85
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							NE566	1.25
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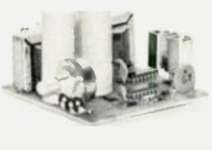

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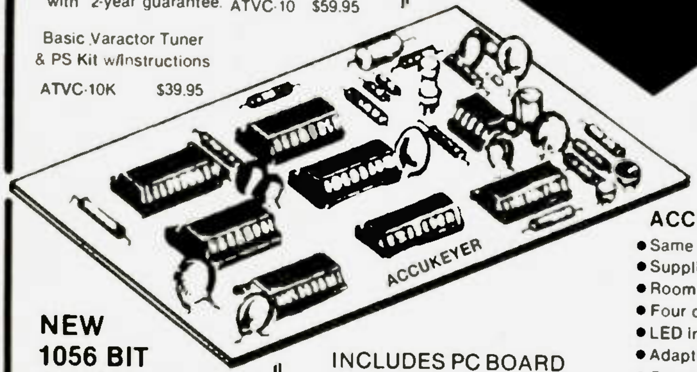

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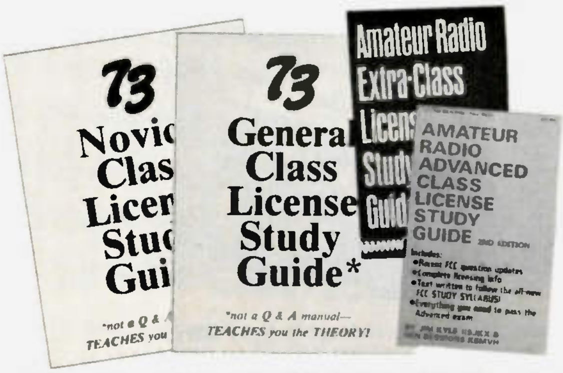

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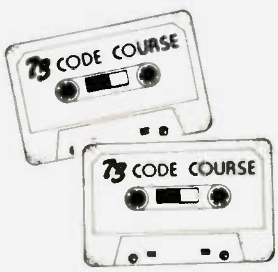

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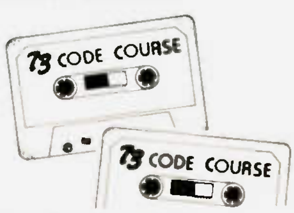

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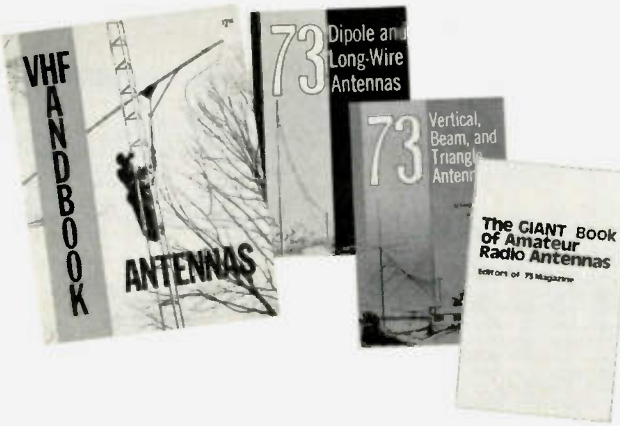

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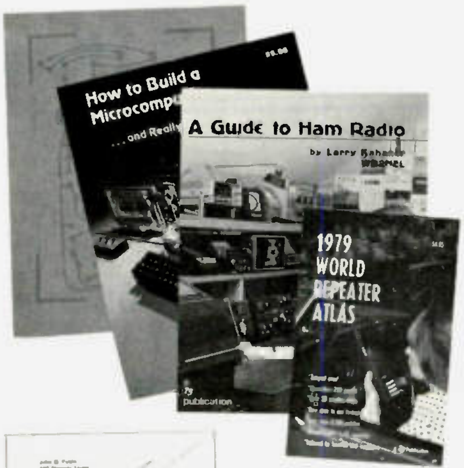

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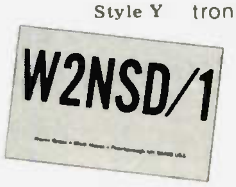

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propagation

by
J. H. Nelson

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14A	14	14	7	7	7	7	7	14	14A	21A	21A
ARGENTINA	21	14	14	14	7	7	14	21A	21A	21A	21A	21
AUSTRALIA	21A	14	7A	7B	7B	7B	7B	14	14	14A	21A	21A
CANAL ZONE	21	14	7A	7	7	7	14	21A	21A	21A	21A	21A
ENGLAND	7A	7	7	7	7	7A	14A	21A	21A	21A	21	14
HAWAII	21A	14	14B	7B	7	7	7	7B	14	21	21A	21A
INDIA	14B	14B	7B	7B	7B	7B	14	21	14	14	14	7B
JAPAN	21	14	14B	7B	7B	7	7	7	7B	7B	14	14A
MEXICO	21	14	7A	7	7	7	14	21	21	21A	21A	21A
PHILIPPINES	14A	14	14B	7B	7B	7B	7B	14	14	14	14B	21
PUERTO RICO	14	14	7	7	7	7	14	21A	21A	21A	21	21
SOUTH AFRICA	14	14	14B	7B	7B	14	21A	21A	21A	21A	21A	21
U.S.S.R.	7	7	7	7	7B	7B	14	21A	21A	14	14B	7B
WEST COAST	21A	14	7	7	7	7	7	14	21	21A	21A	21A

CENTRAL UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21	14	14	7	7	7	7	7	14	21	21A	21A
ARGENTINA	21	14	14	14	7	7	14	21	21A	21A	21A	21A
AUSTRALIA	21A	21	14	7A	7B	7B	7B	14	14	14A	21A	21A
CANAL ZONE	21	14	14	7	7	7	14	21	21A	21A	21A	21A
ENGLAND	7A	7	7	7	7	7B	14	21	21A	21A	21	14
HAWAII	21A	21	14	14B	7	7	7	7	14	21A	28	21A
INDIA	14	14	7B	7B	7B	7B	7B	14	14	14	14	7B
JAPAN	21A	14	14B	7B	7B	7	7	7	7B	7B	14	21A
MEXICO	21	14	7	7	7	7	7	14	21	21	21A	21A
PHILIPPINES	21A	14	14B	7B	7B	7B	7B	14	14	14	14	21
PUERTO RICO	21	14	14	7	7	7	14	21	21A	21A	21A	21A
SOUTH AFRICA	14	14	14B	7B	7B	7B	14	21A	21A	21A	21A	21
U.S.S.R.	7B	7	7	7	7B	7B	7B	14A	21	14	14B	7B

WESTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	21A	14A	14	7	7	7	7	7	7A	14	21	21A
ARGENTINA	21A	21	14	14	14	14	7B	14	21A	21A	21A	21A
AUSTRALIA	28	28	21	14	14	7B	7B	7B	14	14A	21A	21A
CANAL ZONE	21A	14	14	7	7	7	7A	21	21A	21A	21A	21A
ENGLAND	7B	7	7	7	7	7	7B	14	21A	21A	21	14
HAWAII	28	21A	21	14	7	7	7	7	14	21A	28	28
INDIA	14	14	14	7B	7B	7B	7B	7B	14	14	14	7B
JAPAN	21A	21	14	7B	7B	7	7	7	7	7B	14	21A
MEXICO	21A	14	14	7	7	7	7	14	21	21	21A	21A
PHILIPPINES	21A	21A	21	7B	7B	7B	7B	7A	14	14	14	21A
PUERTO RICO	21A	14	14	7	7	7	7	14	21	21A	21A	21A
SOUTH AFRICA	14	14	7B	7B	7B	7B	7B	14	21	21A	21A	21
U.S.S.R.	7B	7B	7	7	7B	7B	7B	7A	14	14	14B	7B
EAST COAST	21A	14	7	7	7	7	7	14	21	21A	21A	21A

A = Next higher frequency may also be useful
B = Difficult circuit this period
F = Fair
G = Good
P = Poor
SF = Chance of solar flares

october

sun	mon	tue	wed	thu	fri	sat
	1 G	2 F	3 G	4 G	5 G	6 G
7 G	8 G	9 G	10 G	11 F	12 F	13 F
14 F	15 G	16 G	17 G	18 G	19 G	20 G
21 F	22 F	23 G	24 G	25 G	26 G	27 G
28 G	29 G	30 G	31 P			

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***Reader Service inquiries not honored. Please contact advertiser directly.**

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ST0500	73 BACK ISSUES—5 YOUR CHOICE	$ 8.50
ST1000	73 BACK ISSUES—10 YOUR CHOICE	$14.00
ST2501	73 BACK ISSUES—25 YOUR CHOICE	$25.00
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BN1002	BINDER—73—2 AND UP	$ 6.00
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CT7306	CODE TAPE—6 + WPM	$ 4.95
CT7310	CODE TAPE—10 + WPM	$ 4.95
CT7313	CODE TAPE—13 + WPM	$ 4.95
CT7320	CODE TAPE—20 + WPM	$ 4.95
CT7325	CODE TAPE—25 + WPM	$ 4.95
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CT7300	NOVICE THEORY TAPES	$15.95
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BX1000	SHELF BOX—1	$ 2.00
BX1001	SHELF BOXES—2	$1.50 each
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BK7354	SSTV HANDBOOK (HARDCOVER)	$ 7.00
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A2	A100	C58	F5	H24	K14	M76	P44	S33	T55	X3
A6	A106	C105	G4	H36	L9	M95	P64	S43	U2	Y1
A21	A107	C106	G12	H44	L10	M100	Q3	S44	U8	
A24	B8	C115	G22	I9	L5	M109	R1	S63	U9	73
A26	B23	C124	G26	I27	M8	N22	R8	S81	U10	MICROCOMPUTING
A40	B42	D6	G27	I32	M35	O3	R27	S117	U13	
A46	B54	D11	H2	I43	M36	O	S3	T3	V24	
A60	C3	D23	H3	I45	M48	P2	S7	T18	W2	
A80	C5	D25	H5	J1	M52	P20	S8	T34	W15	
A92	C6	D29	H8	J2	M57	P31	S10	T48	W18	

This month's ARTICLE WINNER (title page number): ______

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radio bookshop order form

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S10A

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73 magazine

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73 magazine
Peterborough NH 03458

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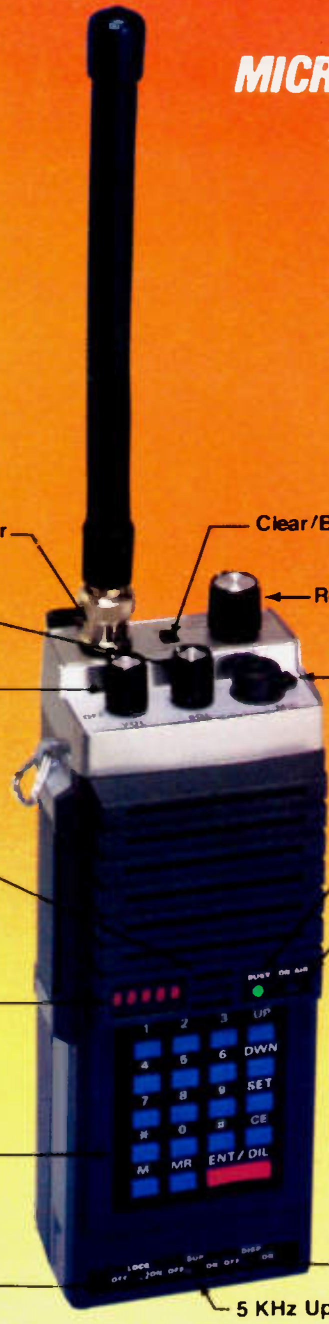
A Breakthrough In Technology!

THE YAESU FT-207R

MICROPROCESSOR CONTROLLED SYNTHESIZED HANDIE



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